THE UNIVERSITY of EDINBURGH
Global Academy of Agriculture and Food Security

Newsletter 02

SPRING 2020

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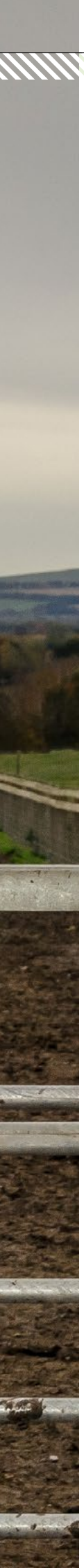
Welcome

A very warm welcome to our second newsletter. As you may be aware, we are one of five Global Academies in the University of Edinburgh that stimulate interdisciplinary education, research and partnership, across Schools and Colleges and with external partners, to help address some of the world's most pressing challenges. Our focus is on supporting transformation of food systems to meet the nutritional needs of the growing human population, while protecting the natural systems on which we depend. There's a strong emphasis on data-driven innovation (DDI), both as part of the University's role in the Edinburgh and South East Scotland City Region Deal (**https://ddi.ac.uk/**), and the wider role of data in driving the 4th Agricultural Revolution globally. There is more on our main themes of activity later in the newsletter.

> “Our focus is on supporting transformation of food systems to meet the nutritional needs of the growing human population, while protecting the natural systems on which we depend.

Professor Geoff Simm
Director, Global Academy of Agriculture and Food Security



The articles here were penned prior to the coronavirus pandemic. As we go to press, the pandemic is unfolding with alarming consequences. In the UK, apart from the direct human impact of the disease, one of the manifestations has been shortages of some food products – the first time most of us have witnessed this in our lifetimes, and a small glimpse of the challenge – though partial and transient for most of us – that is a daily reality for many millions in the Global South, and those living in poverty in the Global North. The causes are very different though, with the recent UK scenario more to do with panic buying and 'tightly geared' supply chains than overall supply. The Global Academy's Dr Peter Alexander and colleagues comment further on resilience in the retail sector in their blog at: **www.edin.ac/SupermarketsInCrisis.**
No doubt there will be many more analyses of local and global impacts on food security in months to come, and we will have more on the topic in our blogs and social media posts.

It's been a very busy few months since our last newsletter. In September we welcomed our second cohort of students to the suite of BSc programmes we offer in partnership with Scotland's Rural College (SRUC). These programmes are designed to help develop the next generation of leaders and scientists who can deliver Global Food Security and contribute to the wider United Nations' Sustainable Development Goals (see more at: **www.edin.ac/GlobalAgricultureUG**.

Our second year BSc students are enthusiastic about their recent study trip to India, to follow the social, cultural and agricultural dimensions of tea production, from 'crop to cup' (see more on this and our students' achievements inside).
We are delighted to see strong growth in enrolment on our online postgraduate degree programmes in Global Food Security and Nutrition – with students from many countries, often already working in the field, inspiring classmates and teachers alike with their rich experience. We also welcome many new PhD students, who we are profiling in this edition.

We are excited to be leading delivery of training from the Easter Bush campus in DDI for the AgriTech sector. Watch this space and our social media accounts for new formal and informal education opportunities with a DDI flavour over the coming months.
We have approaching 50 staff members, research fellows and PhD students now, and 21 PhD students, with a wide range of expertise relevant to food security and a shared commitment to making a real, positive impact in the world. We have a further group of 35 associate members from across the University, from many different disciplines and with shared interests in the global challenges around developing sustainable food systems that support food security and healthy diets.

Global Academy staff have had a very successful year in winning external grant funding, with major new programmes of research underway. These include sustainable intensification and soil health in sub-Saharan Africa, intervention points in agri-food systems to reduce the risk of antimicrobial resistance in India and South America, developing new approaches to food security in fragile and conflict-affected states and resolving ecosystem trade-offs in post-conflict spaces. You can find out more about our research projects later in this newsletter and on our website (**www.edin.ac/GlobalAgricultureResearch**).

We welcome feedback and partnership opportunities. Please do follow our activities via our website, Facebook, Twitter and Instagram accounts at:

www.ed.ac.uk/agrifood
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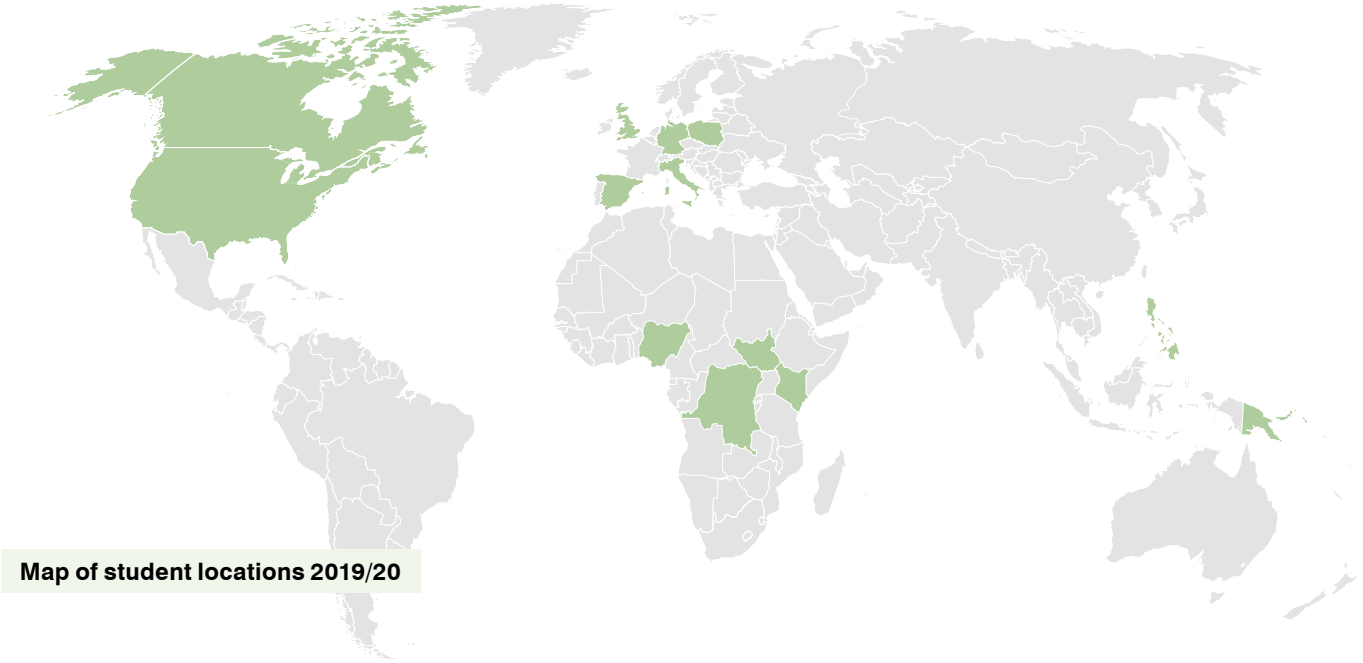
Global Academy Welcomes New Taught Postgraduate Cohort



Map of student locations 2019/20

In September, we welcomed the 2019/20 postgraduate students into the Global Food Security and Nutrition MSc programme. This is the second intake of students to this programme and the Global Academy is excited to see the truly international spread, as shown on the map above.

We are pleased to have been able to provide a number of scholarships to students who come from countries facing significant food insecurity. By providing this kind of support, we reinforce the aim of the programme, which is to train professionals who have the skills required to make a real difference in tackling global food insecurity.

Programme Director Dr Fiona Borthwick praised the student's interest in the subject matter. "The students on course have engaged well, delving into issues such as local food insecurity trends, minority groups, food security, and comparative food choices across different countries."

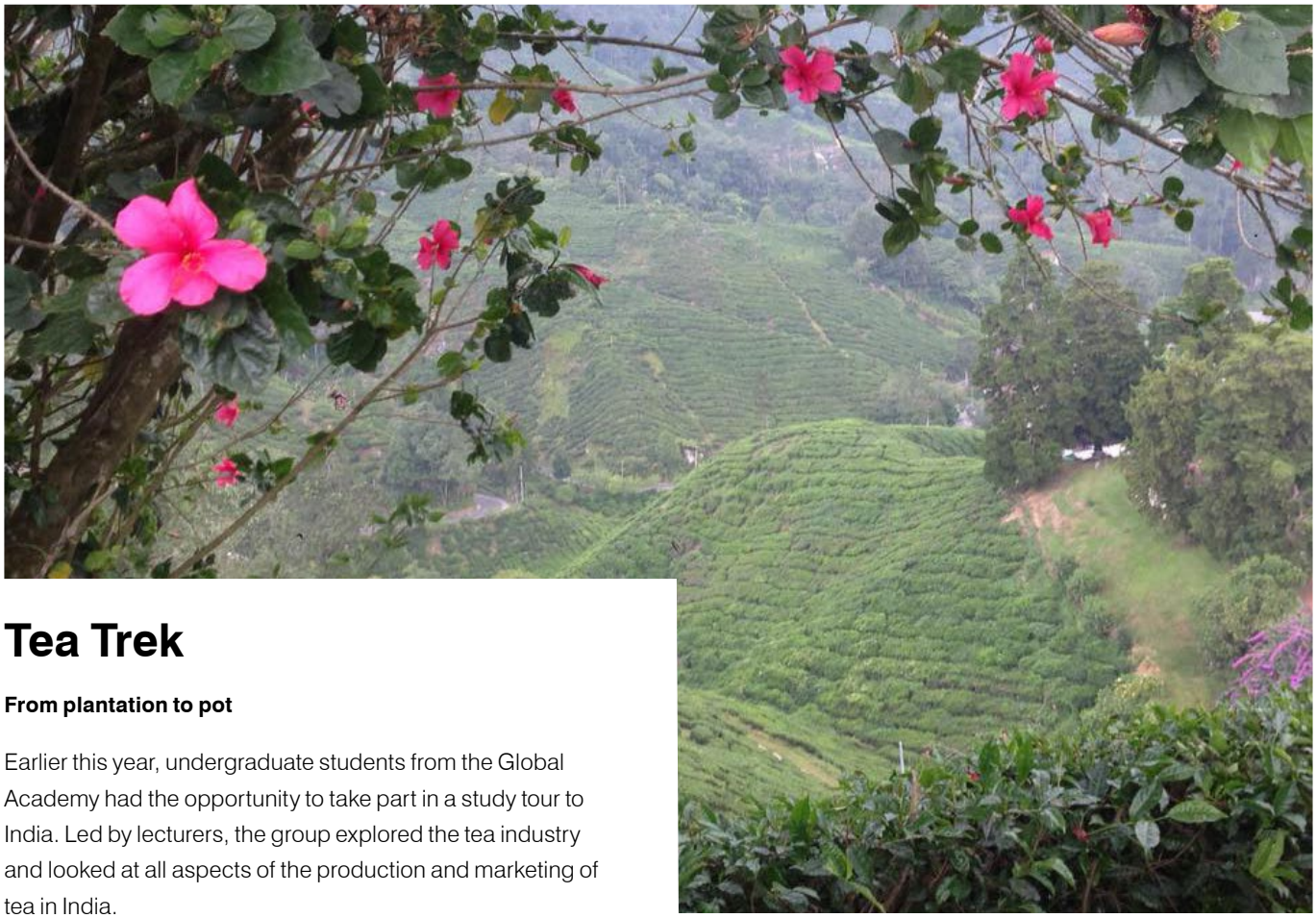
The MSc has attracted students from a diverse range of professional areas, such as teaching, nutrition, communications and agricultural support. We look forward to seeing our students' progression and the career paths that will follow.

HEA Award

Congratulations to Professor Geoff Simm who was awarded Senior Fellowship of the Higher Education Academy (HEA). The HEA promotes excellence in higher education teaching, and the Fellowship demonstrates a personal and institutional commitment to professionalism in learning and teaching in higher education.

Front cover image – *Dr Fiona Borthwick*

The Maramures region of Transylvania (North West Romania) has been through a great deal of political and economic upheaval in the past century and its land use and agriculture reflect this. As in many regions, rural areas are depopulating and this is impacting agricultural production, but Maramures is particularly important for its cultural landscapes, which support a wide range of biodiversity. This image illustrates the landscape of this region, patterns of land use and traditional practices in agriculture, as well as how they impact on biodiversity and rural economies.



Tea Trek

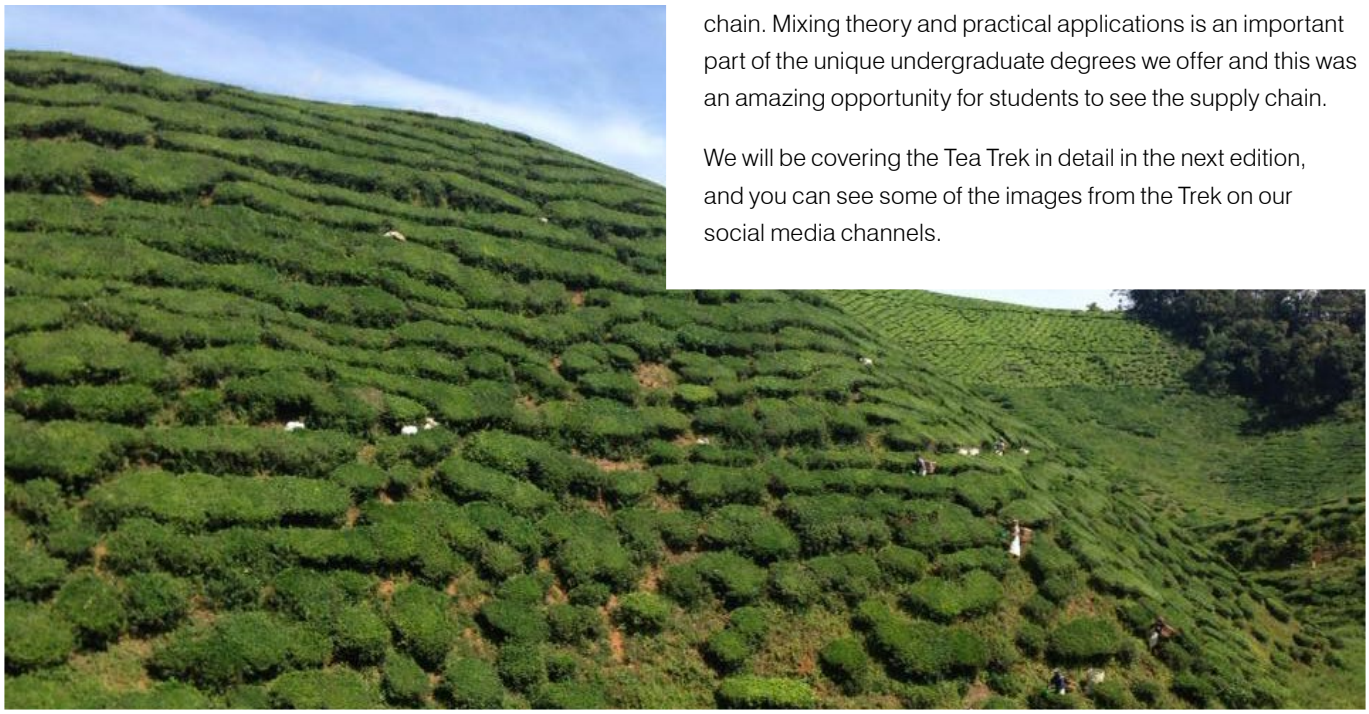
From plantation to pot

Earlier this year, undergraduate students from the Global Academy had the opportunity to take part in a study tour to India. Led by lecturers, the group explored the tea industry and looked at all aspects of the production and marketing of tea in India.

The Trek incorporated a stay at a sustainably certified tea plantation in Kerala, Southern India, as well as visiting a variety of key organisations in Mumbai, including the Indian Tea Board.

Before the Trek, students explored the role of the UK in the tea trade. The Tea Trek offered Global Academy students an opportunity to learn about the practicalities of tea production, as well as the role of sustainable labels in the entire tea supply chain. Mixing theory and practical applications is an important part of the unique undergraduate degrees we offer and this was an amazing opportunity for students to see the supply chain.

We will be covering the Tea Trek in detail in the next edition, and you can see some of the images from the Trek on our social media channels.



MEET THE NEW PHDS

We're delighted to welcome our next cohort of PhD students to the Global Academy. This group is involved in a wide range of valuable new research areas.

Lina González Gordon

There is a growing interest, and need, for a fluid dialogue between science and policy-making to ensure that policy is evidence-based. Although this has been the case for many years in areas such as agriculture, climate change and healthcare, creating efficient and effective science-policy engagement is still very challenging. Lina's PhD focuses on the science-policy interface around animal health and infectious disease control. This involves assessing the preparedness of a society for an animal disease outbreak, and strategies to prevent and control the spread of infection to animals, and in some cases, humans.

The preparedness, prevention and control of infectious diseases in animals provide the perfect scenario to study the science-policy dynamic and its associated contextual factors because infectious diseases create a negative externality for animal producers and human populations. In addition, both populations are constantly vulnerable to several infections despite the advancements made from the public health perspective. During her PhD, she intends to study the science-policy interaction and to propose strategies to improve it.

Yasmin Abdalla

Yasmin graduated as a veterinarian and after practising as a farm animal vet in Alberta, Canada, developed a deep interest in Antimicrobial Resistance (AMR) and Herd Health practices in animal agriculture.

Her research at the Global Academy is looking at AMR global/national action plans and farmer behaviours towards antimicrobial use. She aims to investigate how the different levels of AMR control (global, national and local, or on farm) influence antimicrobial use in agriculture in developed and developing countries.

Laura Higham

Laura's research interests focus on antibiotic usage and sustainable agriculture. With the current lack of evidence-based guidance for farmers and other food chain stakeholders on strategies for reducing antimicrobial usage, Laura's PhD research is utilising commercial supply chain data to identify how antibiotic use can be mitigated in a cost-effective way, whilst protecting animal welfare.

In an era of increased public scrutiny of the sustainability of animal agriculture, selecting effective and ethical antibiotic stewardship strategies will be critical in shaping the future of food animal production. Laura is also a consultant at FAI and is the founder and coordinator of the online veterinary platform Vet Sustain.

MEET THE PHDS

Helen Hughes

Helen's research is on soil carbon changes under different land management practices. Soil carbon supports ecosystem health and resilience as well as crop productivity, but is being lost from many agricultural soils worldwide. Some land management practices can restore carbon to soils, supporting food security, protecting ecosystems and mitigating climate change by removing carbon from the atmosphere.

A mathematician and climate scientist by training, Helen aims to develop a new model to estimate changes in agricultural soil carbon depending on the land management practices used. Helen previously worked as a Sustainability and Climate Change consultant at PricewaterhouseCoopers. She will now be working with the Cool Farm Alliance, aiming to develop her research into a decision support tool for producers and supply chain managers.

Gabriel Marques

Cattle are one of the few species that can digest structural carbohydrates, i.e. plant cell walls. The drawback is that this process generates methane, contributing to climate change. One possible way of overcoming this issue is by feeding the animals more energy-rich rations, including sugarcane or corn, that require less fermentation and thus reduces emissions. However, those feedstuffs are considerably more expensive and their byproducts are extensively used.

Gabriel's research focuses on evaluating optimal diet formulation for cattle and the trade-offs between greenhouse gas emissions and profitability. Ideally, the use of local byproducts may increase productivity and reduce methane emissions without compromising the system's profitability. His research also includes analysing variability in the systems due to stochastic (variable) elements e.g. price, animal efficiency, and feedstuff properties.

Alex Merrington

Alex's PhD focuses on using remote sensing, that is satellite data, and the use of Unmanned Aerial Systems (drones) to investigate how biodiversity can be detected and quantified, in arable and grazed landscapes.
The challenge is to use the spectral information (the specific way different plants reflect light from the sun) and structural information, such as how connected plants are in a landscape, from remote sensing to characterise biodiversity on the ground.

Biodiversity is a key driver of important ecosystem functions in agricultural landscapes. These functions, such as nutrient and water regulation as well as pollination for crops, ultimately provide tangible benefits to us as humans. These are ecosystem services, and Alex's PhD will hopefully aid farmers and land managers in keeping these services flowing within diverse, healthy and prosperous ecosystems, aiding efforts to ensure food security in the future.

Amy McGoohan

Amy is working on a project to investigate the sustainability of the aquaculture industry within Scotland. The project has a One Health focus and will be looking at the interactions between fish, human and environmental health.

Amy aims to engage with industry to collect data from Scottish producers and feed companies to perform life cycle assessments on the welfare, environmental and human health impacts of three Scottish aquaculture species: salmon, trout and mussels. Using the results from these assessments, she intends to develop a decision support tool in consultation with industry, and conduct case studies. This tool will allow aquaculture companies to assess the impacts of their farming practices and decisions, promote best practice and a community of knowledge sharing within industry, and facilitate the communication of this research to a wider, non-academic audience.

LINDA

Safe Sex Education in Kenya

Students at the Global Academy have many interests and make important contributions to society outside of their studies. Undergraduate student Grace Kiruja is the co-founder of a platform called Linda, which provides sexual health education to teenagers in Kenya.

Statistics show that around 15% of Kenyan teenagers will have sexual intercourse or take part in sexual activities before the age of eighteen. Currently, there is little to no sexual education provided in the Kenyan school system and that which is available tends to promote abstinence.

To counter this lack of education, Linda has created outreach partnerships, where qualified individuals speak to schools and social gatherings, providing information and reducing the stigma around sexual health.

Linda also provides a text-messaging platform that allows Kenyan youths to ask sexual education questions, report sexual abuse and receive information on what to do next. A team of social work and health services professionals answer all queries and provide the relevant information.

Linda is an excellent example of how dedicated individuals can make a real and lasting difference to their community.

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AgriPALS
Students Helping Students

AgriPALS is a new scheme that started this year on the Global Academy's undergraduate degree programmes. Run by students, for students, this Peer Assisted Learning Scheme aims to support students' learning by running sessions on various topics.

The three AgriPALS this year are second-year student Dylan Edgar and PhD students Yasmin Abdalla and Gabriel Marques.

In semester one, AgriPALS ran sessions on study techniques and using the statistical technique 'R' as well as how to revise for exams.

In the upcoming semesters, they are excited to run an even bigger variety of events, on topics ranging from professional skills and CV writing to how to reference and find papers.

It has been an exciting and productive start to the year and there is great hope that AgriPALS will continue to grow and be a useful resource for our undergraduate students.

SMARTER

The first annual meeting of a major EU-funded project on sheep and goats was held in the Roslin Institute on 26-27 November 2019. Scotland's Rural College (SRUC) and the University of Edinburgh are two of twenty-seven partners in the collaborative project.

SMARTER will use new and collaborative strategies to improve resilience and efficiency (R&E) of the sheep and goat sectors at the animal, population/breed and system/farm levels.

The overall goal of SMARTER is to phenotypically and genetically characterise and understand novel R&E-related traits, to improve and develop new genomic prediction techniques and to establish new breeding and management strategies. These include novel traits, according to their importance and relevance to various systems, breeds and environments. The project will promote optimised resilience of small ruminant farming systems, which are key pillars of socio-economic sustainability and ecosystem services in rural communities throughout Europe and beyond.

Global Academy visits UC Davis and Stanford

Professors Geoff Simm and Dominic Moran, and Drs Lisa Boden and Susan Jarvis, along with Professor Liz Grant from the Global Health Academy, spent two days at the University of California Davis in September, followed by a visit to Stanford University for the Planetary Health Alliance conference.

While at UC Davis, the group was hosted by Professor Pat Conrad from the School of Veterinary Medicine and Professor Will Horwath, College of Agriculture and Environmental Sciences. The visit gave the group the opportunity to learn about the research and education programmes that are ongoing in the area of Planetary Health, Agriculture and Environmental Sciences. They also explored overlap and opportunities for collaboration. We look forward to working with UC Davis in the future.

Stanford University was the site of the Planetary Health Alliance conference. The opening sessions covered topics such as cities and urban ecosystems, whether the private sector can lead change and the impacts of climate change on mental health. 'Food Connects Land and Sea' was the opening session on the second day, and was dominated by the integration of increased production from aquaculture and fisheries into the sustainable and equitable future of food.

Chinese Agricultural University Summer School

The Global Academy's Drs Fiona Borthwick and Susan Jarvis helped to host a Summer School for Veterinary Students from the Chinese Agricultural University, a partner of the Royal (Dick) School of Veterinary Studies. The group of twelve students and two staff members spent two weeks here in Edinburgh.

Fiona delivered an inspiring seminar on challenges around Sustainable Agriculture and Food Security. To take this into the applied context, Susan took the veterinary students and staff to the local SRUC pig unit to discuss the differences and similarities between pig production in the UK and China. The group explored topics such as the welfare of pigs, future challenges and the sustainability of pig production.

Street Markets and Fieldwork in Assam

In May 2019, Research Fellow Dr Abin Thomas visited the state of Assam in India as part of an interdisciplinary research project on antimicrobial resistance. Alongside a hectic fieldwork schedule, one of the objectives of the trip was to become familiar with the region's agricultural and biomedical settings. Abin sent back this report on the region's markets.

> While choosing the fresh vegetables and fruits, my friend told me: "These are the local ones." I thought about why I shop at a large supermarket in the UK instead of the local market.

In street markets, mangoes, oranges, guava, jackfruits, pineapples, lemons, and lychees are just some of fruits one would commonly come across. The local markets would also sell vegetables like aubergine, cabbage, cauliflower, okra, onion, papaya, sweet potato and tomato. While choosing the fresh vegetables and fruits, my friend told me: "These are the local ones." I thought about why I shop at a large supermarket in the UK instead of the local market. On the following day after work, in hot and humid conditions, I decided to go to the streetmarket and bought some bananas. They were really good - they tasted better than the ones I am used to!

When walking in these crowded marketplaces, one cannot avoid admiring these locally produced crops and fruits. These spaces are not air-conditioned, and the vendors are at the mercy of rain and sun. There are no price tags or special offers and instead the streets echo with shouts of bargaining and the noises of a bustling crowd. Every day, after my work on antibiotic use, I kept returning to these markets even if I did not have anything to buy.

After a few months, I have come back to Assam for a brief period, and found a similar market in another part of the state that I have begun to frequent daily. The routine has become part of my ethnographic study of the place and its people, and is a great way to connect to the country.

Professional Skills Conference Offers Undergraduate Advice

Steph Smith

This November, our Global Academy first year undergraduate students attended the 'Professional Skills second Annual Conference' in which an expert panel discussed their experiences and offered advice on a wide range of topics.

The panel consisted of guests Dulce Mendes, a software engineer manager from IceRobotics, James Deverill, the Commercial Director for Cargill Aqua Nutrition and Professor Alan Raybould, Chair in Innovation in the Life Sciences at the University of Edinburgh.

This was an opportunity for students at the end of their first year 'Professional skills for global agri-food scientists' course to ask questions of those working and recruiting in industry about current issues, sustainability and essential skillsets for successful careers.

Key questions such as: "What skills do you think you'll be looking for in the graduate marketplace in the next 3.5 years' time?" provoked insightful, honest and pragmatic responses from the panel.

Alan, from his experience working at Syngenta, advocated adopting systems-thinking; trying to step back and look at the whole picture, and not lose sight of this when focusing on individual components. James talked about an exciting future of exploring farming our seas as one of the most efficient ways of producing protein. Dulce mentioned open-source data and the range of programming languages which are being used to improve sustainability and animal welfare. She also highlighted the importance of spending time on real farms.

A clear message that came out of discussions was that science is only part of the solution! When tackling real-life problems, broader considerations (social, economic, mechanical) and an interdisciplinary point of view are required. We must acknowledge that science alone can have limits in tackling complex issues.

The panel concluded with each guest offering a single word or phrase that they considered the most important skill going forward: 'problem solving' (Alan), 'approachable' (Dulce) and 'positivity' (James). For those who attended, the discussions proved a valuable reminder of what we are all trying to achieve.

"When tackling real-life problems, broader considerations (social, economic, mechanical) and an interdisciplinary point of view are required.

The Global Academy Takes a Stand at New Scientist Live

The Global Academy had a busy year in 2019, attending events both nationally and internationally, including New Scientist Live at the Excel Venue in London. The event was a celebration of science, featuring talks and display stands from many leading organisations. The Global Academy was pleased to be a part of both of these activities.

Professor Geoff Simm took to the Earth Stage on the Friday and delivered a presentation on 'Sustainable solutions to feed 11 billion' to a wide and varied audience. Sharing his vision with the crowd, he was able to put across the key concepts at the heart of the Global Academy.

On the stand, academics and admissions staff fielded many questions from curious children and adults alike. There was genuine interest in the origins and impact of the food they ate, and a willingness to look again at what and how they consumed.

Among a host of other activities and science celebrities, such as Astronaut Tim Peake and Professor Alice Roberts, the Global Academy was grateful to be able to share its research and speak to many prospective students. We look forward to making a return trip in the future.

Plans for the Global Academy

The Global Academy has exciting plans for new offices and teaching spaces. Below and right we showcase current office plans, which would see us move into the Charnock Bradley Building at the heart of the Easter Bush Campus.

Global Academy key in new City Region Deal

The Edinburgh and South-East Scotland City Region has been awarded a City Region Deal to accelerate growth, by pulling in around £1.3 billion of government investment over the next 15 years.

The University of Edinburgh's Data Driven Innovation component of the City Deal involves working with ten key sectors. These are: Public Sector, Financial Services, FinTech (essentially technology for the finance industry), Health and Social Care, Creative Tech, Tourism and Festivals, AgriTech, Space and Satellite, Robotic and Autonomous Systems, and DigiTech. More detail on these can be found online: **https://ddi.ac.uk/data-talent-for-industry/ten-target-sectors/**.

The University's Royal (Dick) School of Veterinary Studies, which includes the Global Academy of Agriculture and Food Security, is responsible for delivering initiatives targeting the AgriTech sector, and will do so by creating a Data Innovation Hub.

Digital Agriculture involves the use of data technologies to enable farmers, and both upstream and downstream industries, to improve food production while accelerating the path to zero carbon in the agri-food sector. Intersecting artificial intelligence, digitalisation, robotics and biotechnology – in real time – with a multitude of local and global data (in terms of food species genetics, disease state, soil condition, weather and market drivers) means current productivity levels can be increased, by having the right food species and products in the right field at the right time.

The step change in connectivity, creativity and training through collocated-enabled coproduction of teaching, research and commercial activities in Agritech will enable the Easter Bush Campus to achieve the vision of being the Agritech innovation destination of choice for the public, private and third sectors. We are aiming to provide the skills, capabilities and strategies to empower citizens both locally and internationally to benefit from the opportunities afforded by the '4th Agricultural Revolution'.

A lot of this work is at the planning stages just now, but we will keep the Academy newsletter regularly updated over the coming months and years as to how we are delivering, and continually adapting, future City Deal-inspired plans in the agri-tech space.

The One Health challenge of antimicrobial resistance

Dominic Moran

Since their discovery, antibiotic medicines have saved countless human lives through the containment of routine infections that would have previously been fatal, but these medicines and related antimicrobial compounds are becoming a victim of their own success. Mass produced and widely available in the world without a prescription, antibiotics are often used indiscriminately to treat ailments that sometimes have no bacterial origin.

This success is not confined to humans and a large part of the growth of animal agriculture globally is attributable to the widespread use of antibiotics, to promote growth in poultry and ruminant animals and as a lower cost alternative to farmers investing in the biosecurity of their farms. While this has been beneficial for rich and poor farmers alike, the unforeseen consequence has been an increase in microbial resistance to the currently available medicines.

Put another way, the effectiveness of medically-important compounds is compromised by more bugs being exposed to more antibiotics, thereby developing resistance to the currently available compounds. This is happening all around us as antibiotics leak into the environment through water and soil and in the air. It is happening so fast that some experts predict that routine medical interventions for surgeries, childbirth and cancer treatment (chemotherapy) may already be less effective.

The problem gets worse. Soaring demand is not matched by innovation of new drugs to replace those that are no longer effective. A peculiar problem is that pharmaceutical companies do not see a gain in entering a market where there may not be the reward for innovation of new drugs which cannot easily be protected by patent, or distributed in a controlled way.

This potentially post-antibiotic era means we face several dilemmas about how we safeguard effective drugs and how to target their use where the need is greatest. This inevitably leads to debate about the priority given to use in animal agriculture, the ways we might moderate or replace antimicrobials with other medicinal and dietary additives to protect animals, and how we might restructure production systems to reduce exposure to infection.

Managing antibiotic resistance implies behavioural, economic, environmental and ethical challenges. Researchers from the Global Academy are exploring these challenges with projects in the UK, India and Argentina, focussing on the reduction in antibiotic use in human, animal and environmental settings.

In the animal setting, our work involves restructuring animal production systems in ways that are acceptable to producers without compromising national food security.

The challenge is as significant as tackling global climate change, and there is much to be learned from that sphere in terms of global co-operation to translate science into effective policy.

Emissions Intensity in Modelling Brazilian Livestock Systems

By Rafael De Oliveira Silva
Beef cattle emissions in Brazil

The question of whether consuming beef or plant-based protein will have less impact on the environment is more subtle than often assumed. A common way to attribute environmental impacts to the food you eat is based on the so called 'emissions intensity - EI', defined as the amount of CO2 emitted to produce 1kg of a product. EIs for soybeans produced in Brazil will usually be around one tonne of CO2 per tonne of product (t CO2/t-product).

Ruminant meat is usually associated with higher EI, mainly because of the digestion processes i.e. the enteric fermentation process of plants cells in the rumen that produces methane (CH4) as a coproduct. CH4 is a powerful greenhouse gas (GHG) and each kg of CH4 is equivalent to around 30 kg of CO2 in terms of contribution to global warming. EIs for beef produced in Brazil can range from values as low as zero to more than 100 tonnes of CO2/kg of product. Sometimes, it can even be negative, meaning that it is possible to produce meat while sequestering more CO2 from the atmosphere than the amount emitted by the animals and other sources in involved in the production chain.

The reason why EIs can vary so much for beef is because it depends on where it is produced, which system, and which sources and sinks of emissions are included in the calculations of EIs.

For example, beef based on feedlot systems will have a different EI to grass-fed beef. The former will include associated emissions from crops used in the ration, plus enteric fermentation emissions. The latter will benefit from soil organic carbon sequestration by deep-rooted grasses, as well-managed pastures are able to sequester huge amounts of CO2 from the atmosphere and store it in the soil in the form of stable organic matter up to 100cm, or more, below ground.
Depending on how much can be sequestered, it can counter-balance the enteric fermentation emissions. However, studies that incorporate soil organic carbon in beef cattle EIs are still scarce, and there is currently a lot of uncertainly on its potential.

Our work on Brazilian livestock systems involves developing mathematical models to represent grazing beef systems and the role soil organic carbon in improved pasture management plays in reducing EIs.

Some of the questions the models are used to respond to are:

- What are the costs of reducing GHG emissions and adapting to climate change?
- How do we reconcile deforestation reduction targets with a growing demand for food?
- What are the trade-offs between emissions mitigation/ adaptation and the socioeconomic role of agriculture?
- How can food systems adapt to deliver food at lower EIs?

On Rebounds, Boomerangs, and the Road to Hell

Dominic Moran - Professor of Agricultural and Resource Economic

In a familiar comedy trope, the impetuously discarded item invariably ricochets back to the hapless protagonist's head or posterior. The sketch reminds us to beware of unintended consequences of our actions and that systems can effectively push back in surprising and often uncomfortable ways.

Disciplines including physics (Newton's Third), economics (Keynes' Paradox of Thrift), psychology (behavioural rebound effects) offer variants on the theme relevant to public policy. The point is that the systematic or secondary impacts need to be understood. However, as much as we try to capture these multiple rounds of effects, our models are at best typically a partial representation of the complexity of the world around us.

This has relevance to our thinking on contemporary Agrifood challenges. Food systems are socio-ecological constructs. The most ingenious technologies are essentially adjuncts to complex biological systems that can be unstable and unpredictable. When we add the vagaries of human behaviour, it should not be surprising that policy and decision-making are less than deterministic in their outcome.

Consider recent debates around livestock and meat consumption. Livestock production is a major contributor to land use change and global greenhouse gases, and this alone is a good reason to scrutinise the management of production systems. Evidence of detrimental health impacts of diets high in processed and red meats makes the case for policy intervention even more compelling. As debate has become more strident, arguments have suggested the need to move beyond voluntary dietary advice to target reduction in subsidy, or taxation on either producers or consumers of livestock products. Putting aside questions of consumer versus producer liability and property rights, the prima facia economic case seems robust: tax the externality and make the polluter (whoever that is) pay.

But this probably isn't the end of the story. In the first instance, we should be wary about where modified consumption (i.e. demand) ends up. That is, substitution effects may have their own consequences, and these need to be part of the calculus. Millennial crazes for avocados and quinoa spring to mind. On the production side, we should be mindful that there is diversity in livestock systems, and that reducing production in intensive and extensive systems can plausibly lead to different outcomes.

In other words, there is nothing axiomatic in the generic prescription that reduced production will deliver environmental benefits. In Brazil for example (see Rafael De Oliveira Silva's piece earlier in this newsletter), extensive grassland production systems are a major contribution of the country's agricultural sector. When pastures degrade, extensive producers are implicated in ecosystem damage when ranchers often compensate by moving into primary grasslands or forests. However, as observed in the Cerrado, intensively managed pastures can avoid such damages and sequester carbon as an offset to cattle emissions. These managed systems are in a delicate socio-ecological balance that can be destabilised by an abrupt shift in demand that reduces farmers' incentives to invest in pasture management. In this case, a reduction in demand can plausibly result in increased emissions.

Another tale of the unexpected, or perhaps the rational, emerges in the context of antimicrobial resistance, a latent crisis driven by uncontrolled drug use by humans. Antimicrobial compounds used in animal and crop production have been highly successful in managing bacterial infections, but liberal and unsupervised use of antibiotics in agriculture contributes to the diminishing effectiveness of medically important antibiotics. Use in livestock production can be therapeutic, prophylactic and, more controversially, for growth promotion; the latter being purely to accelerate finishing times for animals. As the sector has come under scrutiny for its role in antibiotic stewardship, use for growth promotion has been subject to increased restriction or even bans in some countries including the European Union. However, evidence suggests that this is offset by increased administration under the guise

> “
> This global health emergency is akin to diffuse pollution problems with both technological and often unobservable behavioural factors at play.

of therapeutic or prophylactic treatments. In other words, producers are potentially not adjusting their overall use.

This global health emergency is akin to diffuse pollution problems with both technological and often unobservable behavioural factors at play. Solely focussing on new or as yet-to-be invented drugs, diagnostics and command and control regulations (e.g. bans), does not address some of the more subtle behavioural dimensions of the problem. Indeed, a technological fixation on the supply side may simply put us on a treadmill against nature, which history suggests we will lose.

The bottom line is to be more discriminating about our understanding of systemic effects of apparently good intentions, especially where human behaviours and incentives play a role. The road to hell is paved with good intentions, but as the sayings go, there is nothing as queer as folk and hell is other people…

Global by Name, Global by Nature!

Undergraduate admissions tour to Malaysia and Singapore

We are committed to raising the profile of the Global Academy across the world. The 14 nationalities represented in our student cohort, reflect our ambition to be a centre for international study.

Our staff recently paid a visit to Malaysia and Singapore, to strengthen our partnerships within South East Asia. The travelling team was Dr Fiona Borthwick, Programme Director for the MSc in Global Food Security and Nutrition, and Ailidh Mackay, Senior Recruitment and Admissions Officer. They met up with University of Edinburgh's Regional Director, Audrey Kon, in Kuala Lumpur.

The itinerary included meeting with leading providers of aligned degree programmes, with a view to establishing formal partnerships at undergraduate level; providing workshops to school groups to promote awareness of the global challenges we face relating to sustainable food production and food security, and briefing sessions for recruitment agents who support our work internationally.

Fiona lives on a sustainable palm oil plantation in Papua New Guinea, and was based in Kuala Lumpur before that. She is well-placed to offer a region-specific context on how the impact of our study paths can reach and benefit local communities.

2019 also saw recruitment trips to India, China, Brunei and Thailand. We look forward to building on these relationships.

Past Events

The Global Academy hosts a series of exciting and thought-provoking seminars and events throughout the year. We recently hosted experts on a diverse range of topics – see below for details. For upcoming seminars and events, see our website.

05 JUNE

Good Enough to Eat – Prof Ian Godwin
Professor Goodwin talked about genetically modified crops, their benefits and the activism against AgTech.
He focussed on the benefits and risks of these crops, as well as the exciting new developments ahead.

Healthy and environmentally sustainable diets; how easy are they to define and to achieve?
Prof Nicole Darmon and Prof Jennie Macdiarmid
Presented in partnership with The Food Research in Edinburgh (FRiED) network, Professors Darmon and Macdiarmid presented on environmental and sustainable diets, then took questions and engaged in a lively panel discussion.

19 SEPTEMBER

Can we feed the planet, and stay within planetary boundaries?
Prof Mario Herrero
Professor Herrero was a contributor to the EAT–Lancet Commission report which addressed how to feed a growing global population a healthy diet, while defining sustainable food systems. He delivered a seminar on how to navigate these issues.

You can watch this lecture here -
www.edin.ac/Mario-Herrero

08 OCTOBER

Joined up thinking in agriculture and development: Can humanity survive without agriculture? Can agriculture survive humanity?
Mark Davis
Feeding a growing global population as climate changes and natural resources dwindle seems an impossible task. Mark Davis explored agroecolgical approaches, climate smart agriculture and whether there is a technological innovation solution. He also explored who is looking for the answers and where.

27 NOVEMBER

Prof Maggie Gill
Professor Gill talked about how we can improve the discussion between scientists and policy makers. She defined policy and talked about how the uptake of scientific evidence could be accelerated, why it was important and the challenges faced.

Future Events

To find out about upcoming events at the Academy, visit our website:
www.ed.ac.uk/global-agriculture-food-security/events

If you wish to contribute to our newsletter or want to find out more about the degree programmes and how to apply, please get in touch:

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