

UN GLOBAL COMPACT
COMMUNICATION ON ENGAGEMENT (COE)



Period covered by this Communication on Engagement

From: January 2022

To: January 2024

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Part I. Statement of Continued Support

18th January 2024

To our stakeholders:

I am pleased to confirm that the University of Greenwich reaffirms its support to the United Nations Global Compact (UNGC) and its Ten Principles in the areas of Human Rights, Labour, Environment and Anti-Corruption.

In this Communication on Engagement, we describe the actions that our organization has taken to support the UNGC and its Principles as suggested for an organization like ours. We also commit to sharing this information with our stakeholders and welcome feedback on its contents.

Sincerely yours,



Professor Jane Harrington
Vice Chancellor
University of Greenwich

Part II. Description of Actions and Measurement of Outcomes

As part of our commitment to the Global Compact, the University of Greenwich pledged to participate in and engage with the UN Global Compact in the following ways:

- Ensure that the ten principles are central to and incorporated in our teaching offer in our relevant programmes delivered by the University of Greenwich including the Natural Resources Institute (NRI), a research institute based in our Faculty of Engineering and Science;
- Be guided by the ten principles in undertaking our research at the University of Greenwich;
- Engage with the UK Global Compact Network to promote through public engagement and education, the principles of the Global Compact.

This is our time **University of Greenwich** **Strategy 2030**

[Extract]

As we embark on the next phase of developing our strategic plan, we take enormous pride in our 130-year heritage within the higher education sector. This heritage is one of high standards of teaching, learning and research that reflect the needs of our local, regional, national and global communities, and this remains just as important and relevant for us today.

As we move towards 2030, we will continue to act as a positive force for change, using our expertise as educators to curate knowledge, create opportunities and change lives for the better –on a local, regional, national and global stage.

Our strategic priorities are focused on transformational shifts in our work across Learning and Teaching, Research, and Knowledge Exchange. We will focus on four cross-cutting priorities: Student Success, Inclusivity and Culture, Impactful Research and Knowledge Exchange, and Connected and Sustainable Campuses.

These priorities come with a commitment to invest in our students, staff, physical infrastructure and technology as key enablers to deliver against the goals that we set for ourselves over the next few years. They will be underpinned by a strong financial foundation and a sustainable future that will help us to navigate challenges as they emerge.

This is our time to establish ourselves as leaders in the fields that matter most to us. We are ambitious and absolutely committed to the future success of the University of Greenwich and our students.

*Professor Jane Harrington Vice-Chancellor,
University of Greenwich*

*Bronwyn Hill CBE
Chair, University of Greenwich Governing Body*

Our vision and purpose

Our Vision for 2030 is to be the best modern university in the UK. We define 'best modern' as being the best in our peer group (for example, the University Alliance): modern universities who lead the way in student experience, impact-driven research and knowledge exchange that makes a difference in the modern world.

Our university is a community of people from many walks of life. We take pride in the diversity of our subject expertise, the lived experiences of our staff, students and alumni, and the diversity of campus experiences that we offer –in London, Kent and via our international partners across the globe.

This diversity is our strength and enables us to say that we are a university that empowers others to make a difference, locally, regionally, nationally and internationally, with equal intensity.

Making a difference is a core purpose for many universities. What makes the University of Greenwich distinctive is that we proactively support our students and staff to achieve their ambitions because of, rather than despite, their backgrounds.

We call this Education Without Boundaries.

For us, Education

Without Boundaries means:



Widening access to higher education for individuals who may otherwise not aspire to experience and benefit from it



Fighting for improved social mobility and equality, diversity and inclusivity in everything that we do



Empowering our students to use their lived experience to stand out in their chosen vocation in the workplaces of tomorrow



Empowering our staff to innovate in a way that makes a difference academically, commercially and socially



Providing physical and digital campus services that foster a sense of community to build networks, peers, friends and connections that set our students up for life



Breaking down the boundaries that exist within and between academic disciplines, locations and borders



Ensuring an equitable focus on local (civic), regional, national and global agendas.

Locally curated and nationally and internationally recognised, we will demonstrate our success as a leader in our areas of focus by featuring in the Top 30 of the Guardian University League Table by 2030 and by growing to a community of over 40,000 students studying in the UK and overseas.

As our university and income grow, we will invest in a programme of continuous innovation to meet the needs of the future workforce and society.

Principles

During 2021–30, we will align our key areas of Teaching and Student Experience, Research, and Knowledge Exchange by embedding the following principles into how we work. These principles will allow us to be distinctive from other modern universities.



Creating opportunities for individuals and society

We attract, retain and empower our staff and students to act as leaders in advancing equality, diversity and inclusion. We believe that this is key to innovation and results in more opportunities and better outcomes for all.



Building partnerships

We recognise that we cannot go on this journey alone and our future strategy is founded upon working in partnership to make, build and buy innovative solutions that will accelerate our progress across multiple contexts; and



Delivering impact

We will align our priorities and resources to achieve our goals. We will track our progress against agreed milestones and indicators.

Values

Our shared values help us to articulate and demonstrate to our community what we value. They guide us to adopt and embrace the behaviours that will help us to achieve our strategic plan and distinguish us from others. Our values also set clear expectations for our whole university community about the behaviours that inform how we work and are recognised.

Our refreshed values are:



Inclusive

Always inclusive and empowering -being fair, supportive, aware, compassionate, polite, respectful, and determined, and ensuring all people are supported and celebrated.



Collaborative

Embracing collaboration-working together, being open-minded, listening, being adaptable, free-thinking and enterprising, and seeking out new ideas together.



Impactful

Evidence led and outcomes focused - making a difference, demonstrating our contribution to knowledge and society, achieving goals for ourselves, the university community and the wider world.

Strategic Priorities

Following extensive engagement with our students, staff and partners, the following strategic priorities will help us to achieve our goals for growth and to reach our Top 30 status by 2030:



The complete text is available at - [This is our time: University of Greenwich Strategy 2021-2030](#)

Responses to specific commitment in the University of Greenwich Letter of Support.

Ensure that the ten principles are central to and incorporated in our teaching offer in our relevant programmes delivered by the University of Greenwich including the Natural Resources Institute (NRI), a research institute based in our Faculty of Engineering and Science

The University of Greenwich (UoG) is keen to support the ten principles in our teaching offer. In particular the work of NRI is pivotal in this approach, focusing on food, agriculture, environment and sustainable livelihoods. NRI's work in these areas is recognised globally. Our staff work on cutting edge development issues and this is reflected in the teaching programmes offered by the Institute. Our portfolio of undergraduate and postgraduate courses continues to grow and develop, ensuring that **environmental, sustainable and ethical issues** are highlighted. Our commitment to the **Sustainable Development Goals (SDGs)** is also reflected in our teachings, some of which are included here:

Environmental Science, BSc Hons

With its mix of natural and physical sciences and emphasis on sustainability, our BSc Hons Environmental Science degree prepares students for careers that have real impact on the world. Students develop their understanding of the interactions between living systems and the physical landscape and its processes, and how society affects these. **They investigate solutions to environmental issues from scientific, political, legal and philosophical perspectives, documenting the human impact on the landscape and explore environmental conflicts and issues.** Our students go on to have careers in, amongst other areas, management roles in the **environmental, land, conservation and heritage sectors.**

Biology, MBiol

Our MBiol biology degree is a dynamic exploration of the fascinating processes of life. This award combines bachelor's-level modules with advanced study leading to a master's degree. This degree provides a comprehensive, multidisciplinary understanding of biology, with diverse topics including cancer therapeutics, plant ecology and neuroscience. Students will also carry out two research projects, developing the analytical and problem-solving skills sought by employers. The course has an international focus, enabling students to learn from global experts and undertake field trips and work placements abroad. **Students develop skills to address some of mankind's most challenging problems, from how to feed a growing population in a changing climate to treating Alzheimer's and Parkinson's disease.** The MBiol provides an extensive range of career opportunities. These include industrial and medical research in government or commercial laboratories, or consultancy work in areas such as biomedical science, biotechnology or agribusiness.

Agriculture for Sustainable Development, MSc

This course is for graduates and professionals looking for greater knowledge and expertise in **sustainable agricultural development**. It provides students with a strong understanding of the fundamentals of crop production, such as **adaptation to climate and other environmental changes**. Students then explore how this expertise can help to **design effective food production systems without placing unsustainable demands on the environment**. The emphasis is on agriculture in tropical or developing countries, but the approaches can be used globally. **The course integrates natural, social and economic sciences.** It draws on our unrivalled expertise in an array of disciplines, including crop production, pest and disease management, postharvest technologies, climate change adaptation, and agricultural economics and marketing. The course is delivered by world-leading scientists from the award-winning NRI, who are working on **sustainable agriculture projects** around the world. We use real global case studies in our teaching, and students have an opportunity to play a meaningful role in current research projects.

Food Innovation, MSc

This MSc in Food Innovation is aimed at graduates and professionals looking to build careers in

the food science industry (and especially in product development). The course builds their knowledge and understanding of how ingredients are developed and launched, from concept to completion. It is based on the expertise of staff working in areas including human nutrition and public health, food chemistry and microbiology, product development, packaging, food safety, legislation, and **sustainability**. The course prepares students for a career in product development science, with expertise in food and nutrition. They develop insight into the development of healthy and nutritious food and learn how to enhance **sustainability and creativity within food chains**.

Food Safety and Quality Management e-learning, MSc/PGDip/PGCert

For professionals involved in the safe supply of food to consumers, this online Master's in Food Safety and Quality Management provides the knowledge and skills to advance their career. For those working in the food supply chain, our online MSc Food Safety and Quality Management provides an ideal opportunity to consolidate their experience and learn more about their industry. Students study safety and quality management systems following the **'farm-to-fork'** approach, as well as the agents of foodborne illness and the control and enforcement measures **that ensure our food is safe**. This online course is based upon the successful taught course, which has run since 2001. It benefits from the expertise and experience of the NRI food safety and quality management team, which has carried out research for over 40 years.

Applied Food Safety and Quality Management, PGDip/MSc

Our Master's in Applied Food Safety and Quality Management is designed for professionals working in food manufacturing who wish to boost their career with a new qualification. On this course, students learn about the requirements for providing **safe and wholesome food** to consumers with our specialist course in applied food safety and quality management. We follow the **farm-to-fork** approach to address a wide variety of food safety and quality management issues. Topics include good governance and national control systems, food inspection and testing services. Students cover the **management of food safety and quality across the supply chain**, as well as how to design and implement safety and quality management systems to meet **national and international legislation**. The course is research-informed and is taught by staff at the award-winning NRI, with its unique knowledge base and industry experience.

Global Environmental Change, MSc

With our MSc Global Environmental Change, students develop the knowledge and skills to address some of the world's major challenges. Study topics include **climate change, environmental law and policy, meteorology and sustainability**. This wide-ranging programme reflects the strength of unique expertise held within our prizewinning NRI whose recent interdisciplinary research ranges from practical areas with a direct relevance to **climate adaptation** - such as agricultural practices - to issues of **equity and environmental economics**. NRI academics who run modules for the MSc Global Environmental Change have contributed to global initiatives such as the Intergovernmental Panel on Climate Change (IPCC) assessment reports.

Transformative Change for Sustainable Development, MSc

Transformative change is widely advocated by global organisations, such as the United Nations, as a roadmap towards a more sustainable future. Despite progress in many aspects of global development over recent decades, 690 million people experienced hunger in 2020. Degradation of our natural resources – land, water, forests and biodiversity – continues at alarming rates. These challenges are exacerbated by climate change and violent conflicts in many parts of the world. Tackling these challenges and ensuring a sustainable future will require Transformative Change (TC) – change that is disruptive, systemic, occurs at relatively large scales, and involves a reconfiguration of technology, economy, institutions and society. Our Transformative Change for Sustainable Development MSc **provides students with an in-depth understanding of Development Studies theory and practice**, including different conceptions of human, societal and environmental changes. Drawing on real-world lessons from various domains (e.g. economic, environmental, social and institutional), sectors (e.g. agri-food, energy, education, and financial services) and contexts (developing and developed countries), students will develop the capacity to critically discuss, analyse and evaluate TC. **Students will develop hands-on skills in**

sustainable development design and planning, project management, research, and impact evaluation methods, and familiarity with systems modelling and relevant software.

Other courses offered by University of Greenwich include:

Human Resources and Organisational Behaviour, MPhil/PhD

This research degree (MPhil/PhD) allows students to undertake rigorous and critical exploration in the area of work, **employment, human resource management and organisational behaviour** with support from an expert supervisor.

The programme can include:

- **Equality, Diversity and inclusion at work** - multiple inequalities; in-work poverty, income and pay distribution; gender and ethnic pay gaps.
- **Democratic Governance at work** - whistle blowing, business ethics and professionalism. Representation, voice and organisation at work, individual and collective conflict.
- **The quality of work and labour standards** - working time and intensification; technology, digitalisation and robotisation, work-life boundaries and balance, training, coaching, mentoring. Employment rights. Modern slavery.
- **Sustainability and climate change**: green jobs, the role and structure of public services and public finance internationally. The environmental, social, economic and political aspects of privatisation and liberalisation in water, energy, waste management, health care and social care (PSIRU).
- **Health and Safety at work** in the context of Covid-19 and future pandemics, stress and mental health.

Law, LLB Hons

Includes modules in **Human Rights Law and International Human Rights Law**.

International & Commercial Law, LLM

Covers the legal framework governing the international community and the legal issues surrounding global markets. The course includes: **Business Human Rights & the Environment**; Intellectual Property; and **Ocean Law & Policy**.

Water, Waste and Environmental Engineering, MSc

Combines solid waste management, and contaminated land treatment with management of the earth's resources. This MSc course is designed for graduates from a wide range of environmental engineering backgrounds who want to **apply new sustainable strategies to increasingly complex problems. The course covers the technical aspects of natural and engineering environmental systems.** Our broad approach combines science, public health and engineering. Students develop their engineering skills and learn to design, develop and apply concepts for water and waste, **considering environmental sensitivity**. Students will also consider planning, modelling, design, construction, operation, maintenance and control of engineered and natural water and earth resources. Students gain the skills for career progression in areas such as desalination and water reuse, water resource engineering, hydraulics, hydrology, and environmental remediation.

Be guided by the ten principles in undertaking our research at the University of Greenwich

Research Integrity

The University of Greenwich expects the highest standards in the conduct of all research undertaken in its name. This includes research undertaken by staff, students, visiting or emeritus staff, associates, contractors and consultants.

Implementing ethical principles

In order to embed these principles, and recognising its obligations to the wider research community, to the funders of research and to society as a whole to uphold the integrity of academic

research, the University of Greenwich is committed to implementing the principles and commitments of the [UK Concordat to support research integrity](#).

The UUK concordat's five commitments are:

- maintaining the highest standards of rigour and integrity in all aspects of research
- ensuring that research is conducted according to appropriate ethical, legal and professional frameworks, obligations and standards
- supporting a research environment that is underpinned by a culture of integrity and based on good governance, best practice and support for the development of researchers
- using transparent, robust and fair processes to deal with allegations of research misconduct should they arise
- working together to strengthen the integrity of research and to reviewing progress regularly and openly.

Key policies

[Code of Practice for Research](#) – presents the guiding principles and standards of good practice in research across all subject disciplines and fields of study in the university.

- [Procedures for Investigating Research Misconduct](#) - documents the procedures that the university will adhere to when investigating any allegation of research misconduct.
- [Research Ethics Policy](#) - encouraging a high quality research and enterprise culture, with the highest possible standards of integrity and practice.
- [Academic Regulations for Research Awards](#) - the framework and criteria in the assessment, examination and awarding of a university research award.
- [Ethical Research Collaboration Policy](#) - GRE risk assesses projects and funders as part of the bid management process. The Ethical Research Collaboration Policy sets out the process by which an increased risk would be managed.

Annual Statement on Research Integrity

[Annual Statement on Research Integrity 2021/22](#)

[Annual Statement on Research Integrity 2022/23](#)

Engage with the UK Global Compact Network to promote through public engagement and education, the principles of the Global Compact.

The University of Greenwich is a member of the UN Global Compact Network UK, participating in AGMs in June 2022 and June 2023, and the Annual Summit in October 2023. We will work to engage with the UN Global Compact Network UK to promote through public engagement and education, the principles of the Global Compact.

The 10 Principles of the UN Global Compact

Human Rights

[Principle 1](#): Businesses should support and respect the protection of internationally proclaimed human rights; and

[Principle 2](#): make sure that they are not complicit in human rights abuses.

The University's **Business, Human Rights and the Environment Research Group (BHRE)** undertakes research on the impact of commercial activities and business working methods on the enjoyment of **human rights and the environment**.

The BHRE was created by Professor Olga Martin-Ortega in 2013. It brings together researchers from different disciplines, including law, criminology and business. Its core members are based at the University of Greenwich, whilst affiliated members are based all over the world.

The BHRE develops high quality, policy relevant research in a number of research areas. It also provides training and capacity building to public bodies, governments, unions and civil society organisations.

Our Research includes:

Modern Slavery, Human Rights and Public Procurement.

Human Rights Due Diligence in Global Supply Chains.

Research Cluster: Human Rights at Sea.

Centre for Transformative and Global Justice

The Centre for Transformative and Global Justice is an interdisciplinary research centre that conducts research, analysis and activism on **Human Rights** issues, governance practice, environmental challenges and Criminal Justice systems. The Centre builds upon the world-leading expertise, experience and reputation of the BHRE, as well as that of the Criminal Justice Collective.

The Centre addresses global societal challenges and the regulatory initiatives to address them collaboratively. In particular: **Human rights** abuses, international crimes, financial regulation and crime, international global migration and human trafficking, discrimination and inequality in the criminal justice system, environment and climate change and their social impacts.

The Centre brings together researchers from different disciplines, including Law, Criminology, International Relations and Business. The Centre develops high quality, policy relevant research in a number of research areas. It also provides training and capacity building to public bodies, governments, unions and civil society organisations.

Safeguarding

As part of providing a safe environment in which to work and study, and protecting the public, the University has a [Safeguarding Policy](#) and a Safeguarding Officer network. This framework should be used to report concerns that may arise about **children** (anyone under 18), **adults at risk** (those over 18 who are vulnerable to harm or exploitation due to their personal situation and/or social circumstances), and **radicalisation** (the process by which an individual becomes vulnerable to supporting terrorism and the extremist ideologies associated with terrorist groups).

Concerns can relate to students, staff or members of the public, and may relate to an individual's behaviour or how they are being affected by the behaviour of others.

Concerns relating to [bullying and harassment](#), [sexual misconduct](#), [hate crime](#) and [discrimination](#) should normally be reported immediately via the University's [Report + Support](#) portal. Other types of safeguarding concerns (e.g. Prevent-related concerns, child protection concerns, risks to adults who are vulnerable) should normally be reported immediately via the University's [Accident Management System](#). Concerns can also be discussed with the relevant Local Safeguarding Officer or the Lead Safeguarding Officers.

How we respond to a concern will depend very much on the context and situation, and could include referral to another University policy or support service, or (rarely) referral to an outside agency. The [Safeguarding Policy](#) is about ensuring that the right expertise is brought to bear in responding to a concern, including the involvement of the University's two Lead Safeguarding Officers (the Executive Director of Student and Academic Services and the University Secretary).

We encourage all staff to complete the following online courses (which must be completed by all Safeguarding Officers):

- Safeguarding Essentials (covering child protection)
- Safeguarding Against Extremism (covering Prevent and radicalisation)

NRI (www.nri.org) is a specialist institute of the University of Greenwich. Combining the expertise of natural and social scientists, NRI engages in research, teaching, training, and consultancy to address significant challenges and opportunities in the sectors and countries in which we work. Our work supports the Principles of the UN Global Compact and the Sustainable Development Goals which is evidenced in our work focusing on sustainable trade and responsible business. More detail on our recent work to support Human Rights is highlighted later in this COE.

Labour

[Principle 3](#): Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;

[Principle 4](#): the elimination of all forms of forced and compulsory labour;

[Principle 5](#): the effective abolition of child labour; and

[Principle 6](#): the elimination of discrimination in respect of employment and occupation.

CREW | Centre for Research on Employment and Work

CREW is one of the few research units left in the UK who focuses on work and employment. Our areas of expertise cover a wide spectrum of employment-related topics, such as welfare-to-work policy, whistleblowing, trade union renewal, dispute resolution, labour courts, pay systems, equality, and many others.

PSIRU | Public Services International Research Unit

Focusing on the impact of privatisation and liberalisation on public services globally.

Examining the social, economic and political aspects of privatisation and liberalisation in water, energy, waste management, health care and social care as well as role and structure of public services and public finance globally.

The Public Services International Research Unit (PSIRU) was established in 2000 by agreement between Public Services International and the University of Greenwich, to carry out research on the impact of privatisation and liberalisation on public services, globally. PSIRU is based in the

University of Greenwich Business Faculty.

Its staff publish in a wide range of academic journals and books, are invited to present at numerous academic and policy conferences, and to submit evidence to official inquiries.

Institutions which have invited or commissioned presentations for PSIRU: World Bank, United Nations, The European Commission, European Parliament, International Labour Organization (ILO), World Health Organization (WHO), UN Commission on Trade and Development (UNCTAD), Organisation for Economic Cooperation and Development (OECD).

They are also invited to attend and speak at trade union and civil society conferences, in many countries.

DIG | Diversity Interest Group

Focusing on Equality and Diversity

The Diversity Interest Group provides space for collaboration, cross-fertilization of ideas and germination of new ideas to research and improve our understanding of equality and diversity in the workplace. In particular, the group encourages interdisciplinary research and approaches that include intersectionality. The remit of the group is equality and diversity matters arising from any of the 9 protected characteristics covered in the Equality Act 2010: Age; Race; Sex; Disability; Sexual orientation; Pregnancy and maternity; Religion or belief; Gender reassignment; Marriage or civil partnership.

MIG | Management Inquiry Group

The Management Inquiry Group (MIG) is a research group for management research and practice. They are a community of academics and practitioners who are committed to making a difference in the world

The ways they realise their mission include:

- Seminars organised by MIG, where faculty members and students present work-in-progress
- Workshops organised by MIG, where invited speakers communicate and discuss their research or managerial practices.
- Establish relationships with national and international networks who research and practice in the areas which aligned with MiG's
- Joint projects conducted with stakeholders, including employers, consultancy groups, alumni and aligned partners.
- Conferences on a variety of topics consistent with the interests of MIG
- Host visiting scholars whose research and expertise align with those of MIG's.

Equality, Diversity and Inclusion (EDI)

The University takes active steps to provide an inclusive environment for students, staff and visitors as outlined in the Public Sector Equality Duty of the Equality Act 2010. We value EDI and take active steps to provide an inclusive environment for students, staff and visitors irrespective of their age, disability, gender, gender re-assignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief (non-belief) and sexual orientation as outlined in the Public Sector Equality Duty of the Equality Act 2010.

Gender Pay Gap Reporting

Universities, alongside all other employers of more than 250 people must publish and report specific figures about their gender pay gap. The University's Gender Pay Gap report is available

through the following link: <https://docs.gre.ac.uk/rep/human-resources/gender-pay-gap-report>

Equality, Diversity and Inclusion Strategy

The [Equality, Diversity and Inclusion Strategy 2019-2022](#) is a declaration of the University of Greenwich's commitment to place the promotion of equality, diversity and inclusion at the heart of the University. We believe that having a clear [Equality and Diversity Policy Statement](#) for staff and students reinforces our expectations of the values and behaviours that all members of the University community should exhibit. The policy outlines that the University will take steps to encourage staff, students and visitors to the University to:

- Treat others with respect at all times, and promote an environment free of all kinds of bullying and harassment.
- Actively discourage discriminatory behaviours or practices.
- Participate in training and learning opportunities that would enable them to adopt best practice.

EDI Annual Report

[EDI Annual Report 2022-2023](#)

[EDI Annual Report 2021-2022](#)

Inclusion Calendar

Inclusion is a university core value. To support our community, we are proud to have an online calendar which promotes, commemorates, and celebrates the diversity of our staff, students and partners by providing information on faiths, festivals, observances, culture and wellbeing.

Training Resources

We have two online training modules available for University students and staff to complete. These training modules help to build confidence in recognising equality, diversity and inclusion in every day practice.

Equality, Diversity and Inclusion in Practice online training comprises of two courses:

- Equality and Diversity Essentials
- Managing Diversity

Accreditations and Charters

A list of our current accreditations and Charters can be viewed at: <https://www.gre.ac.uk/people-directorate/edi> together with detailed information on:

Diversity and Network Groups:

LGBT+ Staff Community
Disabled Staff Community
Disability Named Contacts (DNC)
BAME Staff Network
Women Staff Network

Union recognition

Staff have a choice of Union representation including UCU, Prospect, UNISON and the GMB who are able to discuss, consult and negotiate on policies, terms and conditions of Employment for collectively bargained staff. Students have a very active Students Union (<https://www.greenwichsu.co.uk/>).

Modern Slavery Act – Annual Statement of Compliance 22-23

[Extract]

The University of Greenwich is committed to preventing acts of modern slavery and human trafficking from occurring within its business and supply chain and imposes these same standards on its suppliers.

This statement is made pursuant to section 54(1) of the Modern Slavery Act 2015 (the “Act”) and constitutes the University of Greenwich’s modern slavery and human trafficking statement for the financial year commencing 1 August 2022 and ending 31 July 2023. It also describes planned actions in 2023/24.

This statement has been approved the University’s Governing Body, which, together with the Audit and Risk Committee, will review and update it as necessary on an annual basis.

The full statement can be viewed through the following link: [University of Greenwich Modern Slavery Statement](#)

Staff Training

The University has a Learning and Development Programme available to all staff which includes mandatory/essential courses in Bribery Prevention; Data Protection; Equality and Diversity Essentials; Managing Diversity and Safeguarding against Extremism

Further information is available through our staff development webpage: <https://www.gre.ac.uk/staff-development> and also through: <https://www.gre.ac.uk/hr/learning-and-development/programme>

Aurora

The University also supports the Aurora Programme which is organised by Advance HE for all people who identify as a woman. It was designed to help address the issue of the reducing numbers of women in senior posts in Higher Education. The Programme aims to enable a wide range of women in academic and professional roles to think of themselves as future leaders and to develop leadership skills and strategies.

We also have a Coaching Network and a Work Shadowing scheme to support staff development.

All of this is underpinned by our **Equality and Diversity Policy Statement:**

The University of Greenwich is committed to promoting equality and diversity, and to providing an inclusive and supportive environment in which all individuals have the opportunity to contribute to their full potential. This is central to our commitment to excellence in all that we do: teaching, research and enterprise.

We believe that having a clear policy on equality for staff and students, as well as meeting our statutory requirements, under the Equality Act 2010, will further demonstrate this commitment, and be consistent with values and behaviours that all members of the greater university community should exhibit.

The University of Greenwich aims to create an environment in which students and staff are selected and treated solely on the basis of their merits, abilities and potential, regardless of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity status, race,

religion or belief, sex, sexual orientation, trade union membership or non- membership, socio-economic background, or on the basis of being a part-time or fixed term worker.

The University has responsibility for adhering to this statement and other University policies which it will inform. The whole University community has a responsibility to apply the principles of this statement in our policies, practice and behaviours. We recognise our responsibility to provide guidance and training on equality and diversity issues to both students and staff.

We welcome our general public sector equality duty to have due regard for the need to:

- Eliminate unlawful discrimination, harassment and victimisation
- Advance equality of opportunity, and
- Foster good relations.

The University will take steps to encourage staff, students and visitors to the University to:

- Treat others with respect at all times, and promote an environment free of all kinds of bullying and harassment
- Actively discourage discriminatory behaviours or practices
- Participate in training and learning opportunities that would enable them to adopt best practice.

The University is committed to taking action to change unfair and discriminatory practices wherever they occur.

The University will:

- Publicise and raise awareness of our equality and diversity policy statement and related policies amongst staff and students
- Operate a fair, open and transparent procedure for the recruitment of staff and students
- Provide fair and accessible opportunities for training and promotion for staff
- Operate fair and transparent procedures for student assessment, progression and attainment of awards
- Promote the use of inclusive language and avoid the use of words or phrases which are discriminatory or exclusive in all University publications and correspondence
- Ensure that any new or updated policies and procedures are analysed for any adverse impact they might have on equalities, and take any necessary action to mitigate this.
- Publish equality information annually, and publish equality objectives which show how we plan to tackle particular inequalities or disadvantages, and reduce or remove them.

This policy statement will apply to all other policies and procedures within the University.

Fairtrade Accreditation

The Fairtrade university and college award gives recognition to institutions that have embedded ethical and sustainable practices through their curriculum, procurement, research, and campaigns. We have been an accredited Fairtrade university for over 10 years.

Every year the university holds an Ethical Food and Fairtrade Fortnight (EFFF) in support of the national Fairtrade Campaign. The event helps to raise awareness of how food choices can make positive impacts, both on the environment and ethically for farmers.

NRI's recent work to support Labour rights in our project work is highlighted later in this COE

Environment

[Principle 7](#): Businesses should support a precautionary approach to environmental challenges;

[Principle 8](#): undertake initiatives to promote greater environmental responsibility; and

[Principle 9](#): encourage the development and diffusion of environmentally friendly technologies.

University of Greenwich Sustainability Policy

The University of Greenwich has over 20,000 students and over 1,500 staff based across three campuses: Avery Hill and Greenwich in London and Medway in Kent. In recent years it has made significant progress in improving its sustainability performance and is recognised, from the awards it has won and is proud to commit to achieving Net Zero Carbon by 2030.

Sustainability can be applied to deliver many outcomes in all four strategic priorities of the new corporate strategy, Strategy 2030, underpinning the vision of 'Education Without Boundaries.' Our role in teaching and research means we should educate future decision-makers and apply academic study to help solve many of the sustainability issues society faces. We also need to operate in ways that ensure we meet our economic and social responsibilities whilst protecting the natural systems upon which the institution ultimately depends. Climate change amongst many other major challenges can only be addressed by organisations such as ours taking the actions needed to reduce and eliminate these impacts.

Our decisions and actions will work to deliver sustainable outcomes. As a result, the university is committed to:

- Maintain or exceed compliance with all relevant UK legislation and regulations, and other relevant internal and external compliance obligations. We will retain our ISO 14001 certification and achieve its objectives and targets.
- Review all of our activities and operations, in order to identify, understand and evaluate all the direct and indirect environmental aspects and impacts. We will then prioritise action to address them.
- Ensure continuous improvement by establishing procedures and associated sustainability performance targets that are reviewed and externally reported annually. We will annually report on our progress in delivering this policy including reporting on key metrics including carbon, water, waste and recycling.
- Protect the environment by reducing resource use and preventing pollution by reducing and eliminating sources of pollution and developing appropriate control mechanisms.
- Work with partners and organisations that can help us achieve more sustainable outcomes ourselves and in collaborations.
- Ensure that sustainable development is fully understood by staff and students and is enshrined within all aspects of strategy, planning and activities with resources available to enable such.
- Continually improve our sustainability management system to enhance environmental performance.

In order to implement this policy the university undertook a baseline review of sustainability and has determined the following set of key sustainability impacts and associated objectives:

- **Education and Research for Sustainable Development:** Actively encourage and support the teaching of and research into sustainable development in the university supporting staff to embed principles of sustainable learning and teaching practice in curriculum development and delivery.
- **Energy and carbon:** Reduce energy use, decarbonize our estate and fleet, purchase zero carbon electricity and seek to increase use of onsite renewables.
- **Waste and natural resources:** Prevent pollution by reducing harmful emissions and discharges and to promote the 'zero waste' principle (rethink, reduce, reuse, recycle) in order to minimise the environmental impact of the use of natural resources and waste disposal.
- **Procurement:** Implement the university's Sustainable Procurement Policy that supports the purchase of more sustainable products and services from responsible contractors and suppliers.
- **Food:** Work with catering contractors to ensure our Sustainable Food Policy is met and the university's Fairtrade accreditation is maintained.
- **Water:** Reduce water use and maintain a utilities monitoring and targeting system.
- **Transport:** Minimise harmful emissions arising from business travel, commuting and deliveries by implementing the university-wide Green Travel Plan.
- **Construction and Refurbishment:** Incorporate the principles of sustainable development into all new build and refurbishment projects, integrate climate mitigation and adaptation measures where appropriate and feasible and ensure we maximise space utility and user needs.
- **Cultural and Natural Heritage:** Protect and conserve the heritage buildings occupied by the university and implement our Ecosystems Services Policy that actively protects and enhances wildlife on campus.
- **Community Involvement:** Build partnerships and take part in networks to share experience and knowledge of sustainability with Greenwich Students' Union broader community and lead the debate on sustainability issues.
- **Staff and Student Wellbeing:** Use sustainable development activities to provide opportunities for positive stakeholder engagement.
- **Training, Awareness and Communication:** Increase the awareness and understanding of sustainable development and its practical application amongst all staff and students, through learning opportunities and training.

The University of Greenwich Sustainability Policy is fully supported by the Vice-Chancellor's Group and has been approved by the Sustainability Management Committee and the University's Health, Safety, Sustainability and Wellbeing Board, which have ultimate responsibility for setting and reviewing sustainability objectives and targets of the university. All staff, students, visitors, contractors and relevant external stakeholders share this responsibility. This policy is reviewed annually.

The support of precautionary approaches to environmental challenges; initiatives to promote greater environmental responsibility; and the development and diffusion of environmentally friendly technologies is at the heart of the development work undertaken by the NRI. In the next section of this COE we will provide details of some of the projects we have undertaken to show how we put our expertise into practice.

Anti-Corruption

Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

The **University of Greenwich Anti-bribery Policy** sets out the university's approach to preventing bribery and corruption, and is designed to comply with UK legislation.

[Extract]

The University has a zero-tolerance policy towards acts of bribery and corruption as described in the Bribery Act 2010. This Policy sets out the University's approach to minimising the risk of Bribery Act offences, and the potential consequences facing any person who breaches the Policy, or the law.

Scope. The Bribery Act 2010 is applicable to an organisation's activities anywhere in the world, and sets out both organisation-level and personal responsibilities. To match the scope of the law, this Policy applies to:

- All locations and geographic functions of the University;
- All partners, offices, and subsidiary companies;
- All the University's staff, including employees, contract, agency and temporary workers, irrespective of location or work, as well as Members of the Governing Body;
- Other parties when they represent or hold themselves out as working or acting for the University, such as agents and students; and
- Persons and organisations with whom the University enters into contracts, who will be expected either to have their own satisfactory anti-bribery policies and processes, or to abide by this one.

Who is responsible for preventing Bribery Act offences? It is everyone's responsibility to help ensure that the University's business is conducted honestly and fairly. Everyone who is listed above is within the scope of the policy, and is responsible for helping the University to comply with the law, the terms of this Policy and associated procedures. They must all identify the risk of bribery and consider the duty to make appropriate disclosures in reporting instances of bribery as necessary. This policy also names specific post holders who have particular responsibilities for Bribery Act compliance.

Further information and a complete copy of our policy is available through the following link: <https://docs.gre.ac.uk/rep/human-resources/anti-bribery-policy>

Our staff receive mandatory training for bribery prevention.

The University of Greenwich Finance Committee has overall responsibility for advising the Governing Body on all issues pertaining to financial and estates management within the University.

The Finance Committee is responsible for overseeing the finances of the University on behalf of the Governing Body.

The Committee advises the Governing Body on the University's financial and estates strategies and monitors their implementation. This includes overseeing the University's financial position, performance and sustainability, and reviewing the budget and financial statements before they are considered by the Governing Body.

Our Accounts are audited annually by external Auditors and are published on our website. Our

latest accounts are available at: https://docs.gre.ac.uk/data/assets/pdf_file/0031/342994/report-and-financial-statements-for-year-ended-31-july-2023.pdf

Public Interest (Whistleblowing) Disclosure Policy and Procedure

This policy sets out the arrangements and obligations that apply when an individual wishes to make a public disclosure about the conduct of the university or colleagues.

[Extract]

The University is committed to the highest standards of openness, probity and accountability and encourages a free and open culture in dealings between its officers, employees and all people with whom it engages in business and has legal relations. In particular, the University recognises that effective and honest communication is essential if concerns about breaches or failures are to be effectively dealt with and the organisation's success ensured. It seeks to conduct its affairs in a responsible manner taking into account the requirements of funding and regulatory bodies, relevant governance codes and standards, and the standards in public life set out in the reports of the Committee on Standards in Public Life (in particular, [the seven principles of public life](#) articulated by the committee, known as the 'Nolan Principles').

The Public Interest Disclosure Act 1998 (the Act) gives legal protection to employees and former employees against being dismissed or suffering detriment as a result of publicly disclosing certain serious concerns. It aims to promote greater openness in the workplace and all University's employees are obliged by their contract of employment to give honest and faithful service to their employer. This includes an obligation not to disclose confidential information about the University's affairs, unless it is in the public interest to do so, and the disclosure is made in line with this policy.

This policy applies to members of the University, meaning employees of the University, workers employed by the University's contractors or agencies, members of the University's Governing Body and students. Where a member of the University discovers information which they believe shows malpractice/wrongdoing within the University then this information should be disclosed without fear of reprisal, and may be made independently of line management. Members of the University are expected to use this procedure rather than air their complaints outside the institution. It would not be a breach of this policy, however, where a disclosure is made to one of the agencies that has been designated as a [prescribed third party](#) to whom public interest disclosures may be made. Wider disclosure, for instance to the media, is not to a prescribed third party and such disclosures, even where made in the public interest, may not be protected under the Act and may be considered a breach of this policy. Advice and guidance are available from [Protect, the whistleblowing charity](#), the University's trade unions, Greenwich Students' Union, or [Citizens Advice](#).

Members who make disclosures under this policy that they reasonably believe are substantially true, and who do not make disclosures for the purpose of personal gain, will not under any circumstances be subjected to any form of detriment or disadvantage as a result of having raised their concerns.

More information is available at: <https://docs.gre.ac.uk/rep/human-resources/public-interest-whistleblowing-disclosure-policy-and-procedure>

Natural Resources Institute, University of Greenwich



The Natural Resources Institute (NRI) (www.nri.org) is a specialist institute of the University of Greenwich. Combining the expertise of natural and social scientists, we engage in research, teaching, training, and consultancy to address significant challenges and opportunities in the sectors and countries in which we work.

Among these challenges are the issues of food and nutrition security, agriculture and sustainable development in the face of **climate change, land and environmental management, markets and responsible business, capacity strengthening, and gender and inequality.**

NRI's work is focused on making a significant contribution to achievement of the UN Sustainable Development Goals. The Institute carries out strategic and applied research that is focused on the food and agricultural sectors of developing countries with broad objectives of contributing to poverty reduction, economic growth, food/nutrition security and sustainable development.

NRI operates a Quality Management System which is certified through the British Standards Institute to ISO 9001:2015. Our registration number is: FS54723. NRI has also been awarded ISO 27001:2013 for its management of information security.

Research Overview

NRI is a leader in natural resources research, promoting efficient management and use of renewable natural resources in support of sustainable livelihoods. Research is primarily focused on developing and emerging economies. NRI's presence and research partnerships in developing countries, and its training and capacity building programmes, provide the platform for the Institute to develop and disseminate key technologies and knowledge. This has resulted in substantial impact at farmer and community level, and has made significant contributions to the international research community. Much of the work also involves interaction with the developed world where it is equally applicable. Our Research and Development work is also organised to address thematic challenges.

Agriculture, Food and Veterinary Sciences

NRI researchers address challenges and opportunities relating to the spectrum of activities from food production to consumption, with a focus on low- and middle-income countries particularly in sub-Saharan Africa but increasingly also on those related to the UK. At the primary production end of the scale this includes a particular emphasis of the vectors of disease of people, livestock and crops. Our work post-harvest concentrates on durable and perishable crops to, reduce losses, enhance financial and/or nutritional crop value, improve storage and preservation, improve food processing technologies, ensuring food safety and quality management and, address food loss and waste – all with the ultimate aim of improving the livelihoods and nutritional status of vulnerable, less advantaged populations.

Chemical Ecology and Plant Biochemistry

The Chemical Ecology Group works on the identification and use of naturally-produced chemicals for control of pests, particularly in the developing countries.

Ecosystem Services

Climate change and biodiversity loss are two of the biggest global challenges in the coming decades, primarily due to their impacts on the provision of ecosystem services.

Food Systems

The Food Systems Research Group addresses challenges and opportunities relating to the spectrum of activities from food production to consumption.

Pest Behaviour

The work of the Pest Behaviour Group ranges from laboratory-based research to analyse the basic physiology and behaviour of pests and vectors through field-based studies of pest behaviour and ecology to translational research where knowledge of pest behaviour is used to develop innovative control technologies.

Plant Health

The Plant Health Group's research focusses on reducing yield losses caused by pests and diseases through application of integrated natural and social science approaches. Fundamental research to understand complex plant-virus-vector interactions are focussed on providing critical components needed to generate impact through improved and sustainable control measures.

Anthropology and Development Studies

NRI social scientists are committed to researching major questions about how households and communities in the global South escape from poverty, how they make themselves more resilient to external trends, and how they can be helped by governments and their policies, civil society, market actors, and international agencies. We research these questions in projects we design and lead ourselves, and in collaboration with colleagues from the biophysical sciences, in NRI and beyond.

Centre for Society, Environment and Development

Our research addresses poverty and vulnerability, and how poor people themselves, governments, the private sector and civil society can help overcome them.

Development Programmes Overview

NRI's Development Programmes address significant developmental challenges and opportunities arising from global trends, emergent policy issues, capacity limitations and problems in the sectors and countries in which we work. We aim to contribute to enhanced livelihoods and poverty reduction in some of the world's poorest countries. We apply our knowledge and experience to bring about improvements in food security and nutrition, sustainable agricultural productivity and natural resource management, market access and income generation. We assist local organisations in strategy and skills development and use the results of our work to inform policy processes and debates. The programmes draw on the interdisciplinary strengths of NRI working in collaboration with a broad range of partners.

Food Loss, Waste Reduction and Value Addition

Improving resource use through value addition, technical solutions for food loss and waste, and providing guidance to researchers and practitioners.

Food Systems for Improved Nutrition

Developing, evaluating and supporting the implementation of sustainable strategies to increase access to nutritious diets for all people.

Sustainable Agricultural Intensification

Increasing food production efficiency to feed a growing global population, while maintaining ecosystem services, conserving biodiversity and promoting social equity.

Climate Change, Agriculture and Natural Resources

Responding to climate change by understanding the challenges posed by climate variability and

developing mitigation and adaptation strategies.

Capacity Strengthening for Agricultural Development and Food Security

Supporting individuals and organizations to strengthen their ability in high-quality demand-led research and learning, leading to developmental impact.

Gender and Social Difference

The Gender and Social Difference programme conducts innovative and high-quality research and practice for demonstrable impact on equality and gender justice.

Land, Rural Institutions and Governance

The programme aims to assist policy and institutional innovation for sustainable, socially inclusive economic development in rural areas.

Sustainable Production, Trade and Consumption

Generating knowledge on the impact of trade and private sector initiatives in support of equitable and environmentally sustainable development.

Root and Tuber Crops in Development

Improving nutrition, food security and incomes through research and development, capacity building and policy advice.

Highlighting some of NRI's work which particularly supports the UN principles and sustainable development goals includes:

FOOD SYSTEMS FOR IMPROVED NUTRITION

Achieving **sustainable, ethical and efficient food systems in support of human health** is among the greatest challenges facing the global community. Improving nutrition is a core priority of the current international development agenda, and an area of increasing attention for many national governments, research institutions and the international development community. **SDG 2** highlights the multi-dimensional nature of food and nutrition security, encompassing the quantity of food available and issues of resilience, nutrient content and food safety, with targets incorporating both agriculture and nutrition, underlining the importance of food-based approaches in addressing nutritional challenges.

Treating severe acute malnutrition using locally available foods in Sierra Leone

UNICEF estimated that approximately 10.4 million children were at risk of suffering from acute malnutrition in 2021 in the Democratic Republic of the Congo, South Sudan, northeast Nigeria, the Central Sahel, and Yemen. Along with Sierra Leone, these countries or regions have experienced humanitarian crises, conflicts, intensifying **food insecurity**, and pandemics, raising the threat of severe acute malnutrition (SAM). The World Health Organization defines SAM as a very low weight for height, visible severe wasting, or the presence of nutritional oedema – swelling caused by the accumulation of fluid in the body tissues. SAM is caused by a significant imbalance between nutritional intake and individual needs, where diets are deficient in both the number of kilocalories/day and in the right vitamins and minerals. The median fatality rate for children under five suffering from SAM ranges from 30%–50%.

An established way of treating severe malnutrition is the use of ready-to-use therapeutic food (RUTF) – a paste made of peanuts, powdered milk, vegetable oil, sugar, and vitamins and minerals. RUTF does not require the addition of water, which could be contaminated, allowing at-home treatment for cases without medical complications. Since its launch 20 years ago, it has shown a high level of success in terms of recovery: in a couple of months, about 90% of children return to a normal weight. However, the majority of this 'food-medicine' is imported from private companies in high-income countries. As a consequence, the delivery of RUTF for malnourished children on the ground depends on foreign aid and its coverage is limited. The powdered milk ingredient contained in the formulation has to be imported, meaning that only 50% of its ingredients are available locally. Formulations have been developed in other

countries which use about 95% local ingredients with the same **health impact** on malnourished children and for half the price.

NRI led a project in collaboration with the Ministry of Health and Sanitation in Sierra Leone with the aim of investigating the feasibility of developing RUTF using local ingredients and by local enterprises. After carrying out a literature review to identify existing examples of successful businesses, potential formulations using local crops, and quality assessment of such products, the team conducted a field trip to interview a range of local stakeholders in Sierra Leone, including the Ministry of Health, UNICEF, WFP, the private sector and NGOs. **NRI's Dr Aurelie Bechoff led the nutrition scope of the study, Dr Louise Abayomi investigated the food safety and product quality aspects and Prof Ben Bennett explored the market and business environments.**

The team found that the range and diversity of locally grown crops and commodities would allow the development of local manufacture – Sierra Leone has a diverse agroecological system potentially enabling the cultivation of various food crops that could be used as ingredients, which are then combined using linear programming to meet nutritional requirements. On the other hand, the infrastructure and local laboratories available in Sierra Leone do not currently meet minimum quality standards. There will be a need to build local capacity in the years to come. These challenges could be overcome with targeted investment/support. Dr Bechoff was recently awarded a grant under the University of Greenwich Innovation Fund to pursue research on the development of suitable formulations. **This research area is of growing urgency, given the increasing challenges of food security and nutrition amplified by the Covid pandemic, climate change, and environmental pressure on food systems.**

Evaluating public attitudes towards the environmental impact of salmon aquaculture in Scotland

Aquaculture, which involves farming aquatic animals and/or plants in the oceans or freshwater, is one of the fastest growing food-producing sectors and currently contributes over 40% of world fish supplies. The benefits of this development are real and visible, both for producing countries and for consumers in the form of lower prices and access to healthy sources of fatty acids. Growing concern over **the environmental impact of aquaculture**, however, has prompted a search for a governance framework that can guarantee **sustainability** – that is, a financially viable aquaculture industry in which **environmental damage** is minimised.

Jointly implemented by the Scottish Association for Marine Science (SAMS), Newcastle University, the Tyndall Centre for Climate Change at the University of Manchester, and NRI, the DIVERSEAFOOD project aimed to evaluate the potential of aquaculture diversification to improve nutrition and **ecosystem sustainability** in the UK. This type of aquaculture diversification is known as 'integrated multi-trophic aquaculture' (IMTA) which uses the by-products (including waste) from one aquatic species as inputs for another, for example as fertilisers or food. **The idea is to create balanced systems that are more environmentally sustainable, economically stable and more socially acceptable.** Using salmon farming in Scotland as a case study, NRI's Dr Pamela Katic and Dr Andrea Gatto developed a suite of research activities to understand a range of **sustainability features of aquaculture.**

In a subsequent phase, the project used a survey-based approach to evaluate public attitudes towards the **environmental performance** of aquaculture, with 1,800 respondents from all regions of Scotland. The survey first sought to shed light on how aware people are of aquaculture development and their opinions regarding **the environmental, socioeconomic and nutritional impacts of aquaculture.** They also investigated whether different types of aquaculture systems were perceived differently, in particular whether respondents supported or opposed the development of IMTA in Scotland.

The results indicate that public attitudes towards the future of the salmon farming industry are influenced by the importance people attach to the beneficial effects of industry expansion (i.e. job creation, etc.) as opposed to the perceived negative effects associated with **environmental degradation**. A further important aspect of the research relates to the observed regional differences in public attitudes towards salmon farming. Knowledge of such differences may be useful for policy purposes, particularly area and site selection, and in research terms it is also important to try to explain why some communities may be more favourably disposed to aquaculture development than others. To this end, the team looked at both attribute variables (i.e. those specific to the respondent) and context variables (principally, the characteristics of the area where people live.) The results broadly show that people in areas with higher levels of income deprivation and unemployment place a relatively higher priority on the benefits that salmon farming could bring in terms of regional development and community cohesion – specifically through its ability to support employment and incomes, compared to those living in areas of relative affluence.

DIVERSEAFOOD was funded through the Global Food Security's 'Resilience of the UK Food System Programme' with support from BBSRC, ESRC, NERC and Scottish Government.

SUSTAINABLE AGRICULTURAL INTENSIFICATION

Increasing agricultural productivity is essential to feeding a fast-growing population and has potential to lift rural families out of poverty. Sustainable Agricultural Intensification (SAI) provides the means to do this with limited resources, while protecting our living **environment** and conserving natural and agricultural biodiversity. **The ambition for SAI is highlighted in SDG 15 – Life on Land, which aims to sustainably manage forests, combat desertification, halt and review land degradation and halt biodiversity loss; and SDG 2 – Zero hunger which seeks to ensure sustainable food production systems and implement resilient agricultural practices.**

Striga smart sorghum solutions for smallholders in East Africa

Walking through a field of sorghum, your vision might be drawn upwards to the plant's impressively tall stalks, its waxy green leaves or its large panicles. You may be unaware of what is happening to the crops under your feet. A cereal species of the grass family (*Poaceae*), sorghum is an important crop worldwide. Its edible starchy seeds are used for food – it is a staple in sub-Saharan Africa, where it is primarily ground into flour and made into a stiff porridge. It can also be used for the production of alcoholic beverages and biofuels, and the stalks and leaves can be used as animal fodder or building materials. Despite its good adaptation to African growing conditions, the crop suffers from multiple production constraints. Underfoot, you will find the two most urgent constraints: poor soils, and infestation by a parasitic weed called *Striga* – also known as 'witchweed' as it causes damage to the host plant when it is still in its invisible underground stages. *Striga* parasitises sorghum through its roots, resulting in severe yield reductions.

A Royal Society-funded project called '*Striga* Smart Sorghum Solutions for Smallholders in East Africa' is running from 2019–2023. The project, led by NRI in close collaboration with Kenyatta University (KU) in Kenya, aims to overcome the above constraints. As *Striga* cannot be controlled sustainably by a stand-alone technique, the project aims to improve and combine two approaches: deploying sorghum cultivars with increased levels of *Striga* resistance, and applying fertilisers.

The team's biomolecular work, mostly carried out at KU, involves confirming the genes that are responsible for different resistance mechanisms by switching them on or off using a novel gene-editing technique called CRISPR/Cas. This technique is also being used to transfer resistance genes to cultivars that are preferred by farmers and adapted to local growing conditions. The team conducted trials in farmers' fields in western Kenya, where problems with *Striga* are severe. A

range of sorghum varieties with previously identified *Striga* resistance were tested, and farmers were invited to evaluate them.

The team has also investigated which nutrients play a role in *Striga* resistance and tolerance and how they can best be delivered as fertiliser in order to enhance the efficacy of these *Striga* defence mechanisms and overall crop performance. The aim is to develop high-effect and low-cost fertiliser technologies, by determining the best composition, the minimum required amount, and best application mode. The team conducted a range of plant experiments under controlled environmental conditions in NRI's new greenhouse facility. In an experimental plant growth set-up called the mini-rhizotron (allowing the study of roots and 'underground' *Striga* infections), the team grew sorghum plants with pre-germinated *Striga* seeds under specific fertiliser regimes. Initial results show that macro-nutrients reduced *Striga* infection levels on sorghum varieties that already have partial resistance. In experiments where sorghum plants were grown in *Striga*-infested soil, the team found a positive effect from fertilisers on both *Striga* resistance and tolerance, in particular when the fertilisers were sprayed on the crop plant leaves, compared to the conventional soil application method. Next steps include farmer participatory testing combinations of sorghum varieties and fertiliser solutions on farms in Kenya. Dissemination of the technologies generated by the project have the potential to enable millions of farmers across Africa to become more food secure.

CLIMATE CHANGE, AGRICULTURE AND NATURAL RESOURCES

Responding to **climate change** is one of the most urgent challenges facing humankind. The most severe impacts are likely to be **suffered by the poorest and most vulnerable in society** who live in more fragile environments and have the least resources to adapt and recover.

The majority of the world's poor continue to live in rural areas and their livelihoods are heavily dependent upon agriculture and natural resources, which will be severely affected by **climate change**. Therefore, there are **serious implications for their food security, health and well-being**. NRI's work in this field aims to understand these challenges better, to build adaptive capacities, and to develop appropriate strategies for sustainable and equitable rural adaptation.

Support on Climate Change for Morocco's National Institute of Agronomic Research

The North African country of Morocco is heavily dependent on agriculture, which employs 40% of its **labour** force and is vital for feeding its growing population. However, it is extremely vulnerable to the impacts of climate change, with overall temperatures projected to increase, and precipitation to decrease sharply, leading to an increase in major droughts. Morocco's National Institute of Agronomic Research (INRA) has identified a need to increase its capacity to carry out agricultural research that addresses the needs of Moroccan farmers, especially smallholders in more marginal areas, to respond to climate change. In 2020, the British Embassy in Morocco, through the North Africa Technical Assistance Facility of the UK Government managed by Tetra Tech International Development, asked NRI to assess their capacity-building needs in this area. NRI Professors Hans Dobson and John Morton visited INRA headquarters and four of its Regional Centres, holding meetings and participatory workshops with INRA staff to identify research needs, seeing INRA research and getting the views of other stakeholders.

As a result of the mission, detailed proposals for capacity building for INRA involving NRI and other UK centres of expertise were drawn up, though their implementation was delayed by COVID-19. Further discussions led to agreement on a focussed programme of capacity building that could be delivered remotely, and three strands of training were delivered by NRI staff.

Prof John Morton delivered training to 34 INRA researchers on climate change, giving them a greater insight into the specific nature of climate change impacts on smallholders and the rural poor, the issues of adaptation and vulnerability that arise from those impacts, and some

implications for the practice of agricultural research and the role of research organisations. The great majority of trainees were researchers in the biophysical sciences, who were introduced to some social-scientific and interdisciplinary perspectives as complementary to their existing expertise. Dr Andrew Armitage delivered training in bioinformatics (science of genome analysis and handling of large-scale sequence data), responding to the specific needs identified by INRA. This training in DNA analysis, genome sequencing and computing, supports researchers to identify and use genetic diversity in crop material within breeding programmes, a key component for breeding new crop varieties that may be more resilient to climate change and tolerant to drought. Researchers at INRA were also interested in applying genome sequencing to develop new diagnostic tests for plant diseases, particularly those whose spread may be subject to climate change. Dr Armitage delivered general training sessions to 34 INRA researchers followed by advanced training, open-forum discussions, and one-to-one engagement on research activities identified by individual trainees. Dr Huiyi Yang delivered training on use of climate and agri-climate models, a key training need identified by INRA, involving general sessions for 16 INRA staff, hands-on workshop sessions on the Linux Operation System and the General Large Area Model (GLAM) for Crops, advanced sessions based on case-studies, and drop-in sessions.

Overall evaluation by trainees was very positive with the training being evaluated as “good” or “very good” in all dimensions. The project allowed the NRI researchers to assist individual INRA staff with research design and the preparation of two peer-reviewed articles (Khayati et al. 2021 in *Mitochondrial DNA Part B*, Snaibi et al. 2021 in *Heliyon*).

Note: NRI would like to thank the management and staff of INRA, and particularly Dr Abderrahime Bentaibi, Dr Slimane Khayati and Dr Tarik Benabdelouahab for assistance with needs assessment and management of the training

Transformative pathways to sustainable peace and equitable prosperity in the age of compound risk

Peace and prosperity underpin the success of the Sustainable Development Goals (SDGs), from reducing extreme poverty and violent conflicts to ensuring peaceful and inclusive societies. But there are now more conflicts worldwide than at any time in the past 20 years, spurring massive displacement of millions of people, intensifying livelihood struggles, and reducing opportunities for social cohesion and economic development. Many conflicts are a result of extreme poverty, especially in the Lake Chad region, spanning a number of countries in West and Central Africa, where over 30 million people live in poverty and almost every family is threatened by violence. Without concerted, collaborative action to promote peace and prosperity across the world, violence could drive 100 million people into poverty by 2030. Dr Uche Okpara's research, as part of a 'Future Leaders Fellowship' run by UKRI, is a direct response to this concern.

The pursuit of peace and prosperity can involve interconnected social, economic, ecological and governance challenges that interweave competing interests, norms, values, priorities and memories. As such, research on peace and prosperity pathways must incorporate a diversity of perspectives, worldviews and knowledge systems. Working with partners across the Lake Chad region (which include the University of Diffa, Niger, University of N'Djamena, Chad and University of Maiduguri, Nigeria), the research will employ a range of interdisciplinary approaches and mixed methods, underpinned by the principles of knowledge co-creation –whereby researchers and all groups of people affected by the problem, jointly contribute to research planning and implementation, for improved and sustainable impact.

As part of this fellowship, Dr Uche Okpara will build an interdisciplinary team of early career and PhD researchers in conflict, peace, environment and development, launch a new 'Lake Chad Conflict and Environment Observatory', and establish local citizens' labs. These will bring together science, society and the state in a reciprocally useful way to explore the foundations of citizens' preferences and strategies for both socio-economic development – 'prosperity' and meaningful and non-violent interactions – 'peace'.

Working in three fragile and conflict-affected Lake Chad territories in Chad, Niger and Nigeria, the project will research and co-create – together with local communities, groups and partners – peace and prosperity pathways that will serve as decision-support tools to foster sustainable and inclusive development planning in fragile environments.

The research aims to generate new knowledge on the dimensions of, and pathways towards sustainable peace and equitable prosperity, enhancing progress towards SDGs 1 (poverty reduction) and 16 (peaceful and inclusive societies) – all leading to improved lives and livelihood opportunities for citizens. Further impact includes capacity building of a new generation of young academics in conflict, peace, environment and development research.

FOOD LOSS, WASTE REDUCTION AND VALUE ADDITION

Food loss and waste, including postharvest losses, represent both a major global challenge and an opportunity for improved resource use through value addition. NRI has been working to reduce losses and waste after harvest since the 1970s. **The importance of food loss and waste reduction is recognised in SDG 12 ‘Responsible, Consumption and Production’, SDG 2 ‘Zero Hunger’, and several others. NRI experts on food losses and waste reduction and technologies for value addition, use their experience, insight and capability to measure food loss and waste, develop technical solutions, assess upgrading opportunities and provide guidance to researchers and practitioners, both in the UK and overseas.**

Reducing food losses: measuring losses and mining data for evidence-based interventions

Producing enough to feed their families is a back-breaking reality for millions in small-scale farming households across sub-Saharan Africa (SSA) and beyond. For example, cereal and legume grain producers have to store sufficient seed from the previous harvest, invest in land clearing, planting, manage pests and diseases, and control weeds using basic tools such as hoes and machetes. After harvesting, farmers transport their crop home, spread it out to dry – guarding it against wildlife and livestock and unexpected rain showers – and then thresh, sort and store, sometimes after mixing with a protectant to deter attack by insects and other pests. Usually, women then process the grains by pounding and/or milling them before cooking for their households. At every stage, losses occur, which can be quite high when added together – a loss of valuable food but also of the resources used to produce the crop, including land, **labour**, and other inputs. Reducing postharvest losses (PHLs) is important for smallholder households and has been prioritised under the African Union’s Malabo Declaration and the Sustainable Development Goal 12.3. However, reducing PHLs requires understanding the scale of losses, where and why they occur, and the loss-reducing interventions which different actors can use.

A team of NRI researchers, including Drs Tanya Stathers, Aditya Parmar and Gideon Onumah, are playing a pivotal role in PHL reduction in Africa. They are collaborating with the University of Zimbabwe, AKM Services, the European Commission’s Joint Research Council, among others, and a network of postharvest and agricultural information experts from across SSA on the African Postharvest Losses Information System (APHLIS) project. The APHLIS team has built a science-based system of PHL estimation for different stages in target value chains. The estimates are computed through screening literature, creating a database of high-quality measured PHL data, combining it with datasets on subnational level crop production, weather conditions, storage duration, pest incidence, marketing systems and PH-technology used. Losses are reported at national and provincial levels across SSA via the APHLIS website – www.aphlis.net – an open-access, user-friendly information system. It covers estimates of volumes lost and as percentages of total output; projections of their financial and nutritional values and impacts – offering a crucial basis for decisions on interventions and investments by policy and investment decision makers.

In the current phase of the project, known as APhLIS+, one of the work packages has involved the NRI team collaborating with researchers in Benin, Togo, Tanzania, Nigeria and Uganda in piloting PHL measuring systems for bean, cowpea, groundnut, cassava and sweetpotato. The work is widening the knowledge base to understand the losses that occur during activities other than storage and for a range of important food crops beyond the cereals. This work is expected to support strategic targeting of PHL reduction investments and to improve capacity to robustly monitor and report on progress in achieving PHL reduction goals.

Future-proofing our food: plant and algae proteins for NetZero

Livestock emit 14.5% of global greenhouse gases (GHGs), including methane (CH₄), nitrous oxide (N₂O) and carbon dioxide (CO₂). In response to the urgent need for a reduction in emissions and a **transition to more sustainable diets, the uptake of livestock-free, alternative plant and algae proteins can play a key role.** This fits well with the recommendation from the independent UK Committee on Climate Change for a 20% reduction in consumption of meat and dairy products to achieve NetZero carbon emissions by 2050. However, the modification of plant and algae proteins to functionally, nutritionally and sensorially mimic meat and dairy products via harnessing clean/green food processing is a key innovation challenge. A team of researchers at NRI is working to understand how to future-proof plant and algal protein supply, identifying the drivers of the plant-based food value chain, and developing solutions to innovation challenges for alternative protein-based food.

Algae are rather underexploited as sustainable sources of alternative protein, and do not compete with food crops for land and natural resources. Seaweed (also known as macroalgae) contains up to 47% protein but there is a lack of eco-innovative, or environmentally friendly, solutions for improved extractability of the proteins. NRI's Dr Parag Acharya has begun work on a project to develop scientific insights on how to improve the yield of seaweed protein extraction, in collaboration with the University of Lincoln, and ISIS Neutron and Muon Source (ISIS-STFC), UK. This project, funded by the Science and Technology Facilities Council (STFC) Food Network+, will involve experts from NRI's Aquatic Biotechnology group led by Professor Patricia Harvey and Dr Birthe Nielsen from the Faculty of Engineering and Science at the University of Greenwich.

Much of the approximately 1.6 billion tonnes of global agri-food loss and waste – responsible for around 8–10% of total GHG emissions – can be upcycled (Prandi et al., 2021) to generate alternative proteins with co-benefits of developing a circular food system and improving its resource efficiency. Dr Acharya is collaborating with Professor Chu-Ky Son from Hanoi University of Science and Technology, Vietnam, to decipher the techno-economics (i.e. the economic performance) of plant proteins from under-utilised rice and maize by-products while complying with food safety. Funded by the Global Challenges Research Fund (GCRF), this project involves NRI scientists Dr Conor Walsh and Dr Marcos Paradelo Perez as co-investigators.

As part of the 'Growing Kent & Medway' (GK&M) project (supported by UKRI's 'Strength in Places' fund and led by NIAB EMR), Dr Acharya, Prof Andy Frost and Dr Deborah Rees are involved in developing a plant-based food accelerator where new food start-ups can grow to regenerate the local economy. The accelerator is part of the state-of-the-art 'Medway Food Innovation Centre (MFIC)' being built at the University of Greenwich, through NRI's Food and Nutrition Security Initiative (FaNSI, supported by the Research England E3 scheme) and GK&M. MFIC is focused on strengthening the regional food and drink industries through research, innovation and enterprise. In this way, NRI's research on alternative proteins aims to accelerate a transition to climate- smart protein, while the concomitant collaborations seek to enable a much-needed ecosystem for alternative protein-based food innovation.

SUSTAINABLE TRADE AND RESPONSIBLE BUSINESS

Making enterprise, trade and consumption **more responsible and sustainable** has the potential

to have a **huge impact on millions of workers and communities** whose lives are directly affected by business and supply chains, and on local and global environments. NRI's Sustainable Trade & Responsible Business programme aims to **generate knowledge and lessons on the sustainability of trade and responsibility in business, in a context of globalization and changing world trade patterns, rising authoritarian governments, growing corporate and elite power, and crises in global social and ecological systems**. It is critically important that **social, environmental and economic dimensions** are appropriately considered in an integrated manner in research, policies and programmes which aim to support **economic development**.

Corporate accountability for human rights and environmental challenges

How can we change corporate behaviour to stop the harm it causes to workers, Indigenous Peoples, local communities and **environments** in low- and middle-income countries? Corporate power has grown through globalisation, and state power to curb corporate impacts has decreased. Voluntary initiatives are widely promoted as a **responsible business** solution to international supply chain challenges. However, given the competitive pressures in global value chains, voluntary initiatives are insufficient. An increased focus on regulatory solutions, such as mandatory due diligence requirements for companies to tackle **business, human rights, and environmental challenges** is occurring in Europe and the United States. These may have more teeth, but their effectiveness requires scrutiny.

Following a study on **human rights** due diligence in 2019 for the Fair Trade Advocacy Office and Brot für die Welt, an NRI team recently evaluated two Dutch Government programmes, the Fund against Child Labour (FBK) and the Fund for Responsible Business (FVO), which subsidise companies to improve their due diligence and tackle local root causes of relevant challenges. Led by Professor Valerie Nelson, a team comprising Professor Adrienne Martin, Professor Vegard Iversen and independent consultants Michael Flint and Hannah Betts, conducted a portfolio review, analysed monitoring data, conducted extensive key informant and stakeholder interviews for 20 projects, and five in-depth project case studies. The evidence was used to assess progress and effectiveness and to generate lessons. 61 projects are supported by both programmes; examples include mica mining in Madagascar, gold mining in Tanzania and Uganda, cocoa in Ghana, Cote d'Ivoire, and Cameroon, digital innovation in Nicaragua, vegetable seed production and garments in India, rice in Pakistan, coffee in Vietnam, granite mining in India, medical waste recycling in Egypt, rice blockchain in Cambodia, timber in Gabon, and leather from China and India.

Overall, the NRI study found that FVO and FBK funds are providing worthwhile support to improve how child labour and other Responsible Business Conduct (RBC) risks are identified and impact assessments conducted, and for Dutch companies to build systems to potentially address them. However, evidence of companies taking concrete action on risk mitigation, monitoring and remedy is less strong (and some projects have only recently begun). General progress of the projects against results has been good, although gaps in monitoring data make an accurate assessment difficult. Knowledge of RBC and **child labour risks** and root causes among project partners has been significantly improved. Some improvement in the earlier and easier stages of due diligence appears to have been achieved, and some innovative approaches have been facilitated, but it is not yet possible to know whether such **initiatives will effectively tackle child labour and RBC risks**. The study points to the limits of projects of this type, scale, and duration, often involving limited coalitions and with measures on enabling conditions being out of scope of the programme. Significant impact at scale is likely to require larger multi-stakeholder initiatives and changes to the 'rules of the game' in both consumer and supplier countries. The Dutch Government is acting on the recommendations to consider demand-side root cause issues, strengthening internal programme capacity and enhancing quality indicators for company due diligence.

CAPACITY STRENGTHENING

NRI recognises that capacity strengthening for agricultural development and food security is fundamental to achieving the Sustainable Development Goals. Researchers and other stakeholders in smallholder agricultural systems require new skills to work together effectively, to engage in high-quality, demand-led research and learning, to embrace interdisciplinary approaches and to deliver innovative solutions to promote sustainable development – especially in the face of climate change. Researchers, policy makers and civil society organisations are working together to build capacity to demand, evaluate and utilise evidence so that impact is achieved.

Understanding what works to promote science, technology and innovation in East Africa

The **sustainable development** agenda is a response to a new class of challenges that call into question current patterns of human activity in relation to production and consumption, access and distribution of resources, and the way these processes and patterns of human activity are governed and directed. Broadly these challenges relate to **environmental sustainability** of the resource base and the planet as a whole and the crisis of unbalanced patterns of growth that are failing to **eradicate poverty, inequity, and food, water and energy resource insecurities**. These are global-scale issues, but have particular poignancy and manifestations in low- and middle-income countries (LMICs) where **poverty is widespread** and where **climate change** is a major threat to already fragile and degraded **environments**.

Science, Technology and Innovation (STI) could form a central pillar in addressing these challenges. But that will require a form of innovation that is much more deeply embedded in society than it has been in the past. This will entail a much closer alignment of STI policy with development priorities in a particular country and will require patterns of governance and participation that give ownership of both the priorities and the outcomes of the innovation process, to a wider set of stakeholders. Building this new form of innovation capacity will need to look beyond traditional science and technology providers – although it is essential to strengthen these too – and will need to embrace the full gamut of knowledge production and use, actors and processes that society has to offer.

The Knowledge Systems Innovation (KSI) project, funded by UK Aid through the East Africa Research Hub, seeks to develop a practical approach to guide capacity development and investment in knowledge systems in Kenya, Rwanda and Tanzania. The project was led by Professor Andy Frost and also included Associate Professor Apurba Shee, who worked on the economics and financial analysis. Working with in-country teams and colleagues from ACTS in Kenya, CSIRO in Australia, and the University of Sussex and UCL in the UK, the team first undertook case studies and quantitative work. They observed diverse STI contexts across the three countries, research investments poorly aligned to the majority of **SDG targets**, interventions tackling recognised innovation system gaps, particularly those aimed at enhancing brokering, without appropriate evaluation. Significant informal-sector knowledge activity was seen in all three countries which was of high relevance to local communities and **SDGs** but these are not mainstreamed and hence overlooked. In order to address this, the team proposed a practical conceptual framework which defines a sufficient set of STI investment and capacities required to drive the transformational change necessary for balanced and sustainable growth. The framework is intended for use by donors, to design projects with a fresh outlook that are fit for purpose.

GENDER AND SOCIAL DIFFERENCE

At NRI, we understand that inequality is a result of powerful social norms, stereotypes and power relations that influence attitudes and behaviour. Over the past three decades working with our Northern and Southern partners, we have extensive experience in development and empowerment pathways that focus on **equitable processes** and outcomes in development.

These approaches place **capabilities, dialogue and accountability at the centre of our**

work. The goal of our work in gender and social difference is to produce innovative and high-quality research and practice for demonstrable impact on reducing inequalities and achieving gender justice in sustainable development. The ultimate aim is to contribute to theory, policy and practice to benefit the lives of women, men, girls and boys, as a matter of human rights, gender justice and good development.

Depleted by debt? Using a ‘gendered lens’ to bring into focus climate resilience, credit and malnutrition

The work of social scientists involves taking an in-depth look at the many, often interlinking aspects of how society works. In order to understand certain facets of social relationships in more detail, it is sometimes necessary to apply a specific ‘lens’ to highlight these, especially where they tend to be neglected. **A ‘gendered lens’ allows us to examine gender bias, gendered power relations and resulting inequalities in economic and social relations and institutions.**

Development Economist, Dr Fiorella Picchioni, Fellow in Gender and Diversity in Food Systems at NRI, is working on a project entitled ‘Depleted by debt? Focusing a Gendered Lens on Climate Resilience, Credit and Malnutrition in Translocal Cambodia and South India’. ‘Translocal’ in this context refers to the interconnected, interpersonal relations and processes that happen through migration flows and networks, beyond geographical boundaries. The initiative uses a feminist political economy lens to guide critical inquiry on financial inclusion, in a context where the market-driven global system has demonstrated disastrous **impacts on the environment** and in the management of the COVID-19 pandemic.

A gendered or feminist lens highlights the risks of individualised solutions, such as microfinance, as key tools to mitigate and adapt to **climate and environmental change**. By taking into account social reproduction, which considers the multitude of everyday ‘invisible’ activities that regenerate life and societies, a feminist reading of financial inclusion highlights the inadequacy of such tools that offer only a temporary and risky solution to the deepening **environmental and climate crisis and its effects on health and food security**.

As with many projects that involved primary data collection in early 2020, this one was also delayed by the COVID-19 pandemic: travelling was impossible and concerns about infection and survival raised by communities took priority over the project’s timeline. However, almost two years into the pandemic, the project has made great progress: Dr Picchioni developed an online training module and provided desk support for the nutrition and physical activity arm of the project in Cambodia. The data from this module is combined with environmental profiling, household surveys, nutrition and physical activity assessments, photovoice and qualitative interviews, where possible, in Cambodia and Tamil Nadu, India.

The analysis is still ongoing, and it is too early to talk about results and outcomes at this stage. Nevertheless, the interviews evoke a picture of vulnerabilities within and outside the households. Families were living on the “edge”, with limited resources and missing the public sector to help them cope with external shocks. This is compounded by: 1) environmental crisis and natural resources mismanagement that has made agriculture an unreliable source of income; 2) debt-related stress and anxiety due to the fears of losing land and other collateral.

Funded by the Global Challenges Research Fund (GCRF), the project brings together a team of 20 interdisciplinary scholars and practitioners from Cambodia, India, the UK, and continental Europe.

RURAL INSTITUTIONS, LAND AND GOVERNANCE

NRI’s work in this field aims to assist policy and institutional innovation **for sustainable, socially inclusive economic development in rural areas**, particularly in Africa, with a focus on improved

governance of land and natural resources, extending market participation by small farmers, strengthening rural advisory services and the **social impact of agricultural and other investments, and responds to several SDGs.**

Assessing orangutan conservation investment considering social and environmental contexts

Like many endangered species worldwide, orangutan populations are facing multiple threats from habitat loss, poaching and illegal trade. Conflicts with humans also arise, as competition between the two species increases due to the shrinking of land and natural resources. In south-east Asia, the rapid shrinking of forests in Indonesia and Malaysia – especially due to the expansion of agriculture, timber, and mining industries – reduces the habitats for orangutans, and affects local people who depend on goods and services provided by the forests and **natural environments** for their **livelihoods and wellbeing**.

Since 2019, NRI's Dr Truly Santika has collaborated with more than fifty research institutes and non- governmental organisations (NGOs) in Indonesia, Malaysia, the UK, Australia, and Europe on a project supported by the US Fish and Wildlife Service (USFWS). The project aims to unravel the state of orangutan conservation and funding across Indonesia and Malaysia. Despite considerable investment that has been put in place every year to conserve the species, detailed knowledge is lacking about these conservation activities. The project seeks to understand orangutan conservation through systematic evaluation of the change in orangutan populations between 2000–2019, **the environmental and social factors** driving this change, the different types of conservation interventions that have been implemented to save the species, the amount of investment spent on these conservation activities, and the relative benefit of these activities.

The team developed a model that links data from surveys on orangutan occurrence, conducted by NGOs, with the **environmental and socioeconomic** variables known to have important effects on orangutan population and their habitats. **Environmental variables** such as forest cover, rainfall, and land degradation were obtained from satellite-based data. Data on socioeconomic variables such as distance to market, poverty, presence of agricultural and forest concessions, and community-based land tenure were obtained from censuses and land records. Given data on investment in orangutan conservation activities, the team estimated the benefit of these activities in reducing the rate of decline of orangutans, per unit of investment.

Findings show that habitat protection, patrolling, and community outreach provided large benefits in slowing the decline in orangutan numbers. However, given the variability in threats, land pressure, and poverty levels in different regions where orangutans occur, the most cost-effective conservation activity was different for each region. Hence, instead of trying to provide a generalised one-size-fits-all recommendation for the most effective conservation approach for orangutans, the project is developing a specific conservation action for each **environmental and social context**.

NRI's full annual review can be seen at: <https://www.nri.org/publications/annual-reviews/75-annual-review-2021-2022/file> and is included in this COE.

Due Diligence

NRI has put in place a Due Diligence process which we can apply to the Project Partners we work with. This process covers requirements such as the recognition of, and effective procedures covering, anti-slavery, anti-fraud, corruption, bribery, financial stability, whistleblowing, safeguarding and ethics.

More information and regular updates on our work are available through our website: www.nri.org

Natural Resources Institute

Annual Review 2021-2022

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Knowledge for a
sustainable world



Annual Review 2021-2022

The Natural Resources Institute (NRI) is a specialist institute of the University of Greenwich. Combining the expertise of natural and social scientists, we engage in research, teaching, training and consultancy to address significant challenges and opportunities in the sectors and countries in which we work.

Among these are the challenges of food and nutrition security, agriculture and sustainable development in the face of climate change, land and environmental management, markets and responsible business, capacity strengthening, and gender and inequality. These global challenges are addressed through our thematic areas of work which are covered in this Annual Review.

www.nri.org

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Front cover photo: Food market in Kampala, Uganda | Photo: Lora Forsythe

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Foreword

Professor Jane Harrington, Vice-Chancellor, University of Greenwich

I am delighted to share with you the Annual Review from our award-winning Natural Resources Institute. NRI's staff and students are consistently pushing boundaries, carrying out research that makes an impact, contributing to the UN's Sustainable Development Goals (SDGs), winning major research grants and prizes, and representing the University on a global stage. Through dedicated teaching and research supervision, NRI's teams are helping to form the next generation of experts equipped with the skills to devise sustainable solutions to some of the world's most significant challenges.

Despite the many challenges in 2021, NRI has continued to deliver through academic excellence and teamwork, as this edition of their Annual Review shows. Among these examples I am pleased to highlight the official opening of three new research and teaching facilities at our Medway campus, which are integral to NRI and the University's ongoing success in the fields of agronomy, climate change and food innovation – read more on page 2.

I was very pleased to announce that NRI's Dr Uche Okpara was awarded a prestigious 'Future Leaders Fellowship' for a programme of work on prosperity and peace in countries facing interrelated risks of conflict and climate change. Dr Uche Okpara is the first of our researchers to become part of this UKRI scheme and we are very proud of his work and achievements in gaining this award – find out more about his work on page 20.

If you get the chance to visit NRI, I'm sure you'll agree that the enthusiasm and passion that our scientists have for their work is palpable – this is something that's felt from the students on undergraduate degrees up to Professors and beyond, and translated into a successful array of prizes, publications and innovations. Enjoy reading and learning more about NRI.

Introduction

Professor Andrew Westby, Director of NRI

NRI's Annual Review for 2021 demonstrates our Institute's dedication to overcoming significant global challenges through our work. NRI began 2021 by hosting a virtual international seminar to share research insights and to discuss the challenges relating to food and nutrition security in sub-Saharan Africa as part of our Food and Nutrition Security Initiative (FaNSI) – find out more on page 2. Linked to FaNSI, NRI has continued its involvement with Growing Kent & Medway, developing food innovations to help regenerate the local economy – read more on page 30.

As the COVID-19 pandemic has continued to alter people's lives, I am enormously proud of how our staff and students have shown resilience and initiative, and continued to deliver world-changing research and teaching, supported by our excellent professional services team.

As much of the world shifted to working online, our teaching staff and students adapted to learning in virtual and hybrid classrooms, with lecturers creatively engaging with students in a variety of ways. Similarly, our PhD students adapted their study programmes and methods to deliver results. I thank you all for your outstanding efforts and wish you luck in your future studies.

In addition to our targeted research in 2021, NRI participated in UKRI's exercise to assess the impact of research outside academia, with seven impact case studies submitted to REF2021, the UK's system for assessing the quality of research in UK higher education institutions. Our academics also responded to global events by producing series of in-depth articles responding to COVID-19 and the UN climate conference, COP26. We hope you enjoy reading about our work. Join us!

Highlights from the year



FaNSI: boosting research capacity to tackle food and nutrition challenges

Andrew Westby

In January 2021, NRI hosted a virtual international seminar to share research insights and to discuss the challenges relating to food and nutrition security in sub-Saharan Africa. This was part of NRI's Food and Nutrition Security Initiative (FaNSI), through which the institute has been expanding its research capacity and partnerships with a specific focus on addressing climate change, food loss and waste, sustainable agricultural intensification and food systems for nutrition. Supported by Research England's 'Expanding Excellence in England' (E3) Fund, NRI's research team has grown through FaNSI, incorporating staff with expertise including biostatistics and bioinformatics, climate security, state fragility and climate change, public health nutrition, economics of food and nutrition, food security, behavioural sciences, agriculture and soil science, gender and diversity in food systems, food safety, and fish and food systems.

Through FaNSI, NRI's work has also benefitted from improvements to research infrastructure. In September 2021, Professor Jane Harrington, Vice Chancellor of the University of Greenwich, opened three new buildings at the University's Medway campus in Chatham. These include the Agronomy Laboratory, a Food Product Development space and the Climate Change Greenhouse.

- The Agronomy lab is equipped with the newest technologies for processing and analysis of crop plants and soils, which are used in cutting-edge research on plant physiology and soil physics. The lab allows the processing and measuring of plant materials and soils derived from greenhouses and from farmers' fields.
- The Food Product Development space provides a large area for food innovation research, where local businesses can work together with academics to create innovative products or improve their existing range. It also serves as a teaching space, where students are taught the process of developing new products as part of degree programmes.
- The Climate Change Greenhouse has five experimental compartments with temperature, humidity and lighting control that can be used to simulate growing conditions from temperate to tropical conditions. It is being used for FaNSI-related work on crops and biotic and abiotic stresses, and is crucial to NRI's research on drought-tolerant plants – of growing importance amidst a warming climate.

NRI also continues to build research collaborations with partners in Africa through FaNSI. NRI has made official visits to Bayero University and Benue State University in Nigeria, Haramaya University in Ethiopia, the International Centre of Insect Physiology and Ecology (icipe) and the University of Eldoret in Kenya, and Sokoine University of Agriculture and the Nelson Mandela African Institution of Science and Technology in Tanzania.

Find out more: www.nri.org/development-programmes/fansi/overview

NRI students and staff present their work to Professor Jane Harrington, Vice Chancellor of the University of Greenwich, who opened three new buildings at the University's Medway campus in Chatham: the Climate Change Greenhouse (bottom left), the Agronomy Laboratory (top) and the Food Product Development space (bottom right).



Food systems for improved nutrition >

Achieving sustainable, ethical and efficient food systems in support of human health is among the greatest challenges facing the global community. Improving nutrition is a core priority of the current international development agenda, and an area of increasing attention for many national governments, research institutions and the international development community. SDG 2 highlights the multi-dimensional nature of food and nutrition security, encompassing the quantity of food available and issues of resilience, nutrient content and food safety, with targets incorporating both agriculture and nutrition, underlining the importance of food-based approaches in addressing nutritional challenges.

Sesame seeds, one of the ingredients that can be used to make RUTF.



Treating severe acute malnutrition using locally available foods in Sierra Leone

Aurelie Bechoff

UNICEF estimated that approximately 10.4 million children were at risk of suffering from acute malnutrition in 2021 in the Democratic Republic of the Congo, South Sudan, northeast Nigeria, the Central Sahel, and Yemen. Along with Sierra Leone, these countries or regions have experienced humanitarian crises, conflicts, intensifying food insecurity, and pandemics, raising the threat of severe acute malnutrition (SAM). The World Health Organization defines SAM as a very low weight for height, visible severe wasting, or the presence of nutritional oedema – swelling caused by the accumulation of fluid in the body tissues. SAM is caused by a significant imbalance between nutritional intake and individual needs, where diets are deficient in both the number of kilocalories/day and in the right vitamins and minerals. The median fatality rate for children under five suffering from SAM ranges from 30%–50%.

An established way of treating severe malnutrition is the use of ready-to-use therapeutic food (RUTF) – a paste made of peanuts, powdered milk, vegetable oil, sugar, and vitamins and minerals. RUTF does not require the addition of water, which could be contaminated, allowing at-home treatment for cases without medical complications. Since its launch 20 years ago, it has shown a high level of success in terms of recovery: in a couple of months, about 90% of children return to a normal weight. However, the majority of this 'food-medicine' is imported from private companies in high-income countries. As a consequence, the delivery of RUTF for malnourished children on the ground depends on foreign aid and its coverage is limited. The powdered milk ingredient contained in the formulation has to be imported, meaning that only 50% of its ingredients are available locally. Formulations have been developed in other countries which use about 95% local ingredients with the same health impact on malnourished children and for half the price.

NRI led a project in collaboration with the Ministry of Health and Sanitation in Sierra Leone with the aim of investigating the feasibility of developing RUTF using local ingredients and by local enterprises. After carrying out a literature review to identify existing examples of successful businesses, potential formulations using local crops, and quality assessment of such products, the team conducted a field trip to interview a range of local stakeholders in Sierra Leone, including the Ministry of Health, UNICEF, WFP, the private sector and NGOs. NRI's Dr Aurelie Bechoff led the nutrition scope of the study, Dr Louise Abayomi investigated the food safety and product quality aspects and Prof Ben Bennett explored the market and business environments.

The team found that the range and diversity of locally grown crops and commodities would allow the development of local manufacture – Sierra Leone has a diverse agroecological system potentially enabling the cultivation of various food crops that could be used as ingredients, which are then combined using linear programming to meet nutritional requirements. On the other hand, the infrastructure and local laboratories available in Sierra Leone do not currently meet minimum quality standards. There will be a need to build local capacity in the years to come. These challenges could be overcome with targeted investment/support. Dr Bechoff was recently awarded a grant under the University of Greenwich Innovation Fund to pursue research on the development of suitable formulations. This research area is of growing urgency, given the increasing challenges of food security and nutrition amplified by the Covid pandemic, climate change, and environmental pressure on food systems.



Evaluating public attitudes towards the environmental impact of salmon aquaculture in Scotland

Pamela Katic

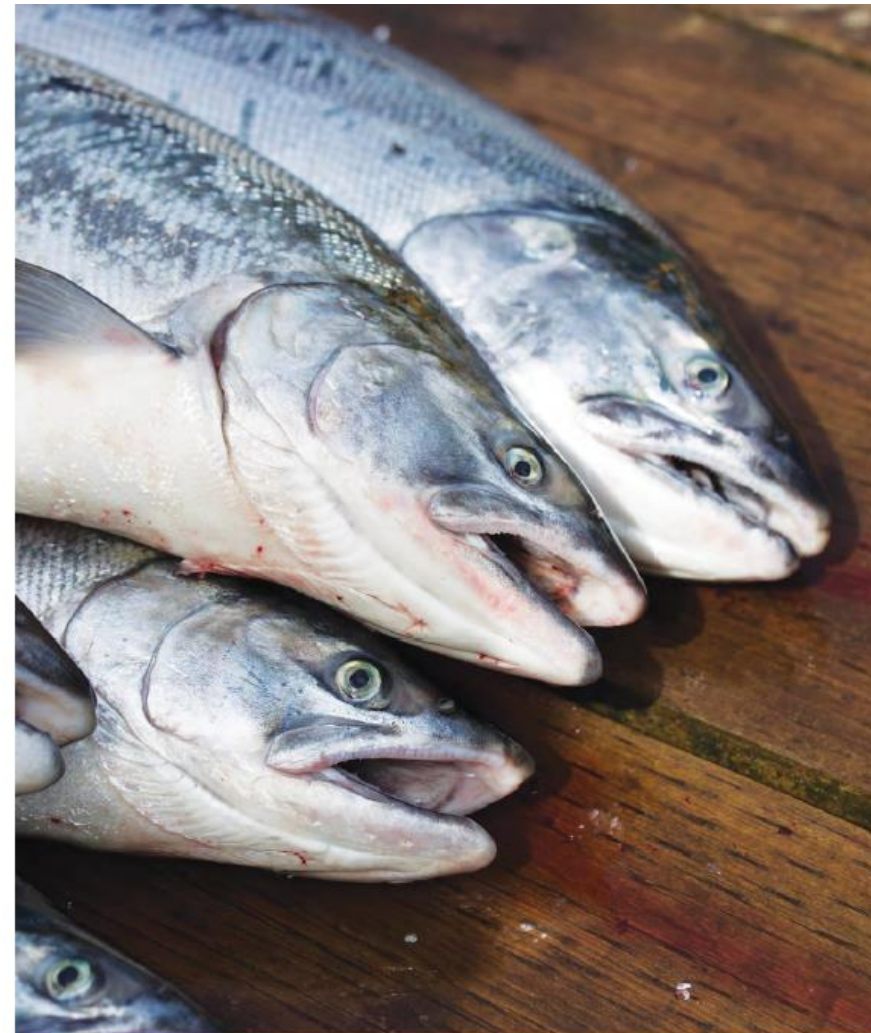
Aquaculture, which involves farming aquatic animals and/or plants in the oceans or freshwater, is one of the fastest growing food-producing sectors and currently contributes over 40% of world fish supplies. The benefits of this development are real and visible, both for producing countries and for consumers in the form of lower prices and access to healthy sources of fatty acids. Growing concern over the environmental impact of aquaculture, however, has prompted a search for a governance framework that can guarantee sustainability – that is, a financially viable aquaculture industry in which environmental damage is minimised.

Jointly implemented by the Scottish Association for Marine Science (SAMS), Newcastle University, the Tyndall Centre for Climate Change at the University of Manchester, and NRI, the DIVERSEAFood project aimed to evaluate the potential of aquaculture diversification to improve nutrition and ecosystem sustainability in the UK. This type of aquaculture diversification is known as 'integrated multi-trophic aquaculture' (IMTA) which uses the by-products (including waste) from one aquatic species as inputs for another, for example as fertilisers or food. The idea is to create balanced systems that are more environmentally sustainable, economically stable and more socially acceptable. Using salmon farming in Scotland as a case study, NRI's Dr Pamela Katic and Dr Andrea Gatto developed a suite of research activities to understand a range of sustainability features of aquaculture.

In a subsequent phase, the project used a survey-based approach to evaluate public attitudes towards the environmental performance of aquaculture, with 1,800 respondents from all regions of Scotland. The survey first sought to shed light on how aware people are of aquaculture development and their opinions regarding the environmental, socioeconomic and nutritional impacts of aquaculture. They also investigated whether different types of aquaculture systems were perceived differently, in particular whether respondents supported or opposed the development of IMTA in Scotland.

The results indicate that public attitudes towards the future of the salmon farming industry are influenced by the importance people attach to the beneficial effects of industry expansion (i.e. job creation, etc.) as opposed to the perceived negative effects associated with environmental degradation. A further important aspect of the research relates to the observed regional differences in public attitudes towards salmon farming. Knowledge of such differences may be useful for policy purposes, particularly area and site selection, and in research terms it is also important to try to explain why some communities may be more favourably disposed to aquaculture development than others. To this end, the team looked at both attribute variables (i.e. those specific to the respondent) and context variables (principally, the characteristics of the area where people live.) The results broadly show that people in areas with higher levels of income deprivation and unemployment place a relatively higher priority on the benefits that salmon farming could bring in terms of regional development and community cohesion – specifically through its ability to support employment and incomes, compared to those living in areas of relative affluence.

DIVERSEAFood was funded through the Global Food Security's 'Resilience of the UK Food System Programme' with support from BBSRC, ESRC, NERC and Scottish Government.



Freshly caught salmon, such as that farmed in aquaculture initiatives in Scotland.



Improving nutrition policies and programmes through concerted monitoring and evaluation

Ravinder Kumar

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients, as defined by the World Health Organization. Undernutrition can be defined as an insufficient intake of energy and nutrients to meet an individual's needs to maintain good health. This form of malnutrition includes underweight (low weight-for-age), wasting (low weight-for-height) and stunting (low height-for-age). Stunting is the result of chronic or recurrent undernutrition which holds children back from reaching their physical and cognitive potential. Globally in 2020, 149 million children under five were estimated to be stunted.

Accelerating progress in the fight against malnutrition requires improvement in the design of nutrition policies and programmes. The European Union's commitment to nutrition is to support partner countries to reduce the number of stunted children under the age of five by at least 7 million by 2025. Effective monitoring and evaluation (M&E) of EU programmes can contribute to achieving this nutrition commitment. NRI is a partner in the 'Knowledge and Research for Nutrition' project of the European Commission which aims to provide improved knowledge and evidence for policy and programme design, management, and M&E in order to reach better nutrition outcomes.

The project has established a Nutrition Research Facility (NRF), implemented by Agrinatura – the European Alliance on Agricultural Knowledge for Development – an association of 35 universities and research institutes in 16 countries in Europe who are committed to supporting agricultural development in a sustainable manner in order to improve people's lives. An NRI team, as part of the NRF, is leading the work package on delivering technical and statistical support to the M&E of the programme's progress and performance at field level. As part of this facility, NRI is engaging at early stages in EU programme designs and is offering flexible, interconnected and demand-oriented support in three areas: planning, implementation and learning. This work will include the development of impact pathways and theories of change; the design of M&E frameworks, systems, assessments and evaluations to track programme impacts on nutrition; performance analysis and process evaluation; capacity building of programme teams; collation of M&E evidence and production of best practice compendiums; and promotion of M&E-related learning across stakeholders through knowledge exchange and peer learning.

The NRF is currently supporting the Indian Ocean Regional Programme on food and nutrition security, managed by the Mauritius and Seychelles European Delegation. The NRF is also providing M&E technical support to the EU programmes in Mauritania, north-west Africa. The NRI support, as part of the NRF, has the potential to contribute to improved knowledge and evidence for better tracking of nutritional benefits of policies and programmes at field level, which can consequently contribute to improved design and management of the EU programmes.



Groundnut farmers in Ghana, where groundnut is predominantly cultivated by women, bringing nutritional benefits for the family.

Transforming food systems and food environments in Nigeria

Louise Abayomi

With over 200 million people, Nigeria has the largest population on the African continent, which is projected to double over the next 30 years. Current crop production is barely keeping up with these rates of population growth. With weak national food controls, and high levels of postharvest physical, nutritional and quality losses due to poor infrastructure, sub-optimal marketing information systems, and increased food consumption outside the home, how might closing the food security gap be achieved? This requires a transformation of national food systems, and of 'food environments' – which encompass social, physical, economic and political factors involving food availability, affordability, accessibility and acceptability. The Global Alliance for Improved Nutrition (GAIN) aims to transform food systems so that they deliver more nutritious foods for all people, especially the most vulnerable. Their aim is to lay the foundations for systemic improvements, which include opportunities for food-related activities of women and youth that address their specific needs and make their livelihoods more resilient.

GAIN has targeted Nigeria's four staple crop value chains – rice, maize, cassava, sweetpotatoes – for research and development. The functioning of these crop value chains is not homogeneous across Nigeria and so prior to project design, GAIN required a better understanding of the food systems in four key states – Benue, Kaduna, Nasarawa and Oyo – involving 16 local government areas. To aid with this preliminary work, NRI supported an appraisal of biofortification (where crops are bred or particular agronomic practices are adopted to increase the crop's nutritional value from a national or global baseline). In 2021, NRI led formative research to help design project implementation. This was coordinated by NRI's Dr Louise Abayomi, a postharvest and food safety specialist, and carried out with NRI colleagues, local partners the Federal University of Agriculture (FUNAAB), Nigeria, Agricultural Development Programmes and nutrition officers.

Key findings relate to emerging trends in consumption habits in the target areas, and more specifically, in contexts where most workers are eating outside the home. This situation has implications for addressing food safety practices during production, processing, marketing and food preparation, as well as access to healthy diets and the need for both general and targeted behavioural change communication strategies to inform consumers and sellers in traditional markets, their suppliers, and influence habits. The team tested key assumptions (e.g. that biofortified maize, orange-fleshed sweetpotatoes and yellow cassava can easily be substituted for the traditional varieties), projected growth trends, explored consumer acceptability of biofortified staple crops, and preferred traits by processors.

The successful outcome from this formative research led to the design of the project's second phase, consisting of strategies for capacity strengthening of micro, small and medium entrepreneurs, and for selected upstream and downstream innovators to act as champions in facilitation, advocacy, 'proof of concept' and 'scaling'. Behavioural change communication will also feature strongly in driving a shift to safer, more diverse, and nutritious diets. Policy coherence across national ministries including finance was identified as an important component within the 'enabling food environment'.



Peeling cassava at a cassava processing station in Nigeria.



Sustainable Agricultural Intensification >

Increasing agricultural productivity is essential to feeding a fast-growing population and has potential to lift rural families out of poverty. Sustainable Agricultural Intensification (SAI) provides the means to do this with limited resources, while protecting our living environment and conserving natural and agricultural biodiversity. The ambition for SAI is highlighted in SDG 15 – Life on Land, which aims to sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss; and SDG 2 – Zero hunger which seeks to ensure sustainable food production systems and implement resilient agricultural practices.

Measuring water infiltration into the soil at the EMR experimental vineyard.



Cultivating a sustainable vintage: healthy soil and terroir in English vineyards

Marcos Paradelo

Wine connoisseurs might describe the taste of a wine as earthy, round, robust, crisp, mellow, oaky, or any number of specialist terms. Much of the taste is attributed to its terroir – a term encompassing the complete natural environment in which a particular crop is produced, including factors such as the soil, topography, and climate. The terroir is the basis for protecting certain regional products – in Europe this is known as ‘protected designation of origin’ (PDO) which guarantees the product’s reputation. Famous examples of wine with a PDO are Champagne, Bordeaux and Beaujolais, to name but a few. England is not yet well-known for its wine-growing regions, though vineyard land in the country has doubled in the last decade amid climate change.

To understand land suitability and better management practices for vineyards, it is crucial to understand the factors that impact soil quality – including soil structure development (such as how particles are assembled and how air and water circulate through them), microbial activity (microbiological processes of soil microorganisms that improve organic nutrients) – and how these link to plant physiology or functioning.

In the case of ‘new’ wine regions like south-east England, the lack of long-term soil and management data makes it even more important to develop experiments and models that help the establishment of new vineyards in the best conditions. A project led by NRI’s Dr Marcos Paradelo, in collaboration with NIAB EMR, a horticultural research organisation in East Malling, Kent, UK, is investigating how soil changes when new vineyards are established, to propose better management practices to improve soil health and maintain terroir characteristics. The project includes measuring the relationship between soil structure, the microbiome (an interacting community of bacteria, viruses, fungi and other organisms) and plant physiology in the NIAB EMR concept vineyard. Established in 2015 over an area of 10,000m², the vineyard makes it possible to deliver randomised and replicated trials to ensure the research is robust and supports viticulturalists. The team is studying the effects on soil properties of the year of planting, the rootstock variety, and weeding control (with herbicides, a mechanical weeder or strimming), using a Chardonnay variety.

The project has been helped by facilities for soils analysis. Officially opened in September 2021, NRI’s new Soils and Agronomy lab is specially equipped for the physical characterization of soil samples. In addition, the project began by winning an open call from the EU initiative Fields4ever (fields4ever.biome.makers.com) which provides microbial analyses for free. Fields4ever will carry out 100 microbiome analyses, sequencing the bacterial and fungal DNA in the soil. This is to understand the microbial diversity in the soil which affects different functions of soil health and terroir. The microbiome data will be merged with a range of physical measurements. The team has also explored the management effects on soil properties, and grape quality. The team will use the results to engage with winegrowers to discuss and plan interventions for sustainable soil management. This project aims to help winegrowers in south-east England to adopt sustainable management practices that protect soil and enhance wine quality; it is hoped this work will be used as a benchmark for soil health in English vineyards.



Keeping the cereal killers at bay: improved detection of viruses to monitor chemical-free plant protection

Sophie Bouvaine

Aphids – the tiny sap-sucking insects that are the scourge of many gardeners and growers – are the main insect vectors that carry and transmit barley yellow dwarf viruses (BYDV) the agents responsible for barley yellow dwarf disease. This is the most widespread viral disease of cereals affecting some of the world's most economically important crops, including wheat, barley and maize. BYDVs are not transmitted mechanically or by seed; rather the spread of the disease is directly dependent on the dynamics of the vector population. Recently, the increase in winter temperatures linked to global warming and the ban on neonicotinoids – systemic insecticides shown to be harmful to a wide array of non-target wildlife – has led to an increase in aphid populations which translates into a higher impact of the disease. To limit the surge of the disease, it has become urgent to develop new methods to curb the aphid vector populations as soon as they arrive on cereal fields in late autumn. Usually during this period, a few winged aphids carrying the virus arrive on cereal fields and produce parthenogenetic offspring – progeny that are the result of asexual reproduction. While the initial flight brings the virus onto the field, the offspring then spread it from plant to plant, ensuring a wide distribution of the virus.

Previous studies have demonstrated that replacing the usual grass field margins with flowering margins could increase the number of beneficial insects such as aphid predators and parasitoid wasps – those that lay eggs inside the aphids which then develop and kill their host – which could contribute to decreasing the aphid populations. In addition to offering food and shelter to beneficial insects, these plants could also have a direct repellent effect on the aphid vectors.

NRI's Dr Sophie Bouvaine, Plant & Insect Molecular Biologist, is leading a component on the 'PlantServ' project, a collaboration between the Université de Rennes and the National Research Institute for Agriculture, Food and Environment (INRAE) in France. The project's overarching aim is to understand how an increase of plant biodiversity around agricultural plots can support biological control by conservation and reduce damage and yield losses caused by BYDV. Dr Bouvaine and NRI's Dr Gonçalo Silva are using their expertise in plant virology to evaluate the effects of flowering cover crops on the joint dynamics of BYDV and pest communities at the plot and landscape scales.

This work includes investigating the prevalence and genetic diversity of viruses causing BYDVs in France and developing specific diagnostic molecular tests to differentiate between the species of viruses present in the field, in order to specifically target the species of interest. They will then use those tests for molecular screening of viruses in plant and aphid samples obtained by project partners in the experimental fields in Western France. Together with the data obtained from the partners on the prevalence of natural enemies and pests, the team is measuring whether the presence of flower field margins helps reduce the virus pressure in wheat and barley fields. If successful, flowering field margins could offer a partial control of viruses and their vectors and could be integrated as an effective tool for chemical-free disease management.



"It has become urgent to develop new methods to curb the aphid vector populations"

A grain aphid (*Sitobion avenae*) on a cereal leaf.



Striga smart sorghum solutions for smallholders in East Africa

Jonne Rodenburg

Walking through a field of sorghum, your vision might be drawn upwards to the plant's impressively tall stalks, its waxy green leaves or its large panicles. You may be unaware of what is happening to the crops under your feet. A cereal species of the grass family (Poaceae), sorghum is an important crop worldwide. Its edible starchy seeds are used for food – it is a staple in sub-Saharan Africa, where it is primarily ground into flour and made into a stiff porridge. It can also be used for the production of alcoholic beverages and biofuels, and the stalks and leaves can be used as animal fodder or building materials. Despite its good adaptation to African growing conditions, the crop suffers from multiple production constraints. Underfoot, you will find the two most urgent constraints: poor soils, and infestation by a parasitic weed called *Striga* – also known as 'witchweed' as it causes damage to the host plant when it is still in its invisible underground stages. *Striga* parasitises sorghum through its roots, resulting in severe yield reductions.

A Royal Society-funded project called 'Striga Smart Sorghum Solutions for Smallholders in East Africa' is running from 2019–2023. The project, led by NRI in close collaboration with Kenyatta University (KU) in Kenya, aims to overcome the above constraints. As *Striga* cannot be controlled sustainably by a stand-alone technique, the project aims to improve and combine two approaches: deploying sorghum cultivars with increased levels of *Striga* resistance, and applying fertilisers.

The team's biomolecular work, mostly carried out at KU, involves confirming the genes that are responsible for different resistance mechanisms by switching them on or off using a novel gene-editing technique called CRISPR/Cas. This technique is also being used to transfer resistance genes to cultivars that are preferred by farmers and adapted to local growing conditions. The team conducted trials in farmers' fields in western Kenya, where problems with *Striga* are severe. A range of sorghum varieties with previously identified *Striga* resistance were tested, and farmers were invited to evaluate them.

The team has also investigated which nutrients play a role in *Striga* resistance and tolerance and how they can best be delivered as fertiliser in order to enhance the efficacy of these *Striga* defence mechanisms and overall crop performance. The aim is to develop high-effect and low-cost fertiliser technologies, by determining the best composition, the minimum required amount, and best application mode. The team conducted a range of plant experiments under controlled environmental conditions in NRI's new greenhouse facility. In an experimental plant growth set-up called the mini-rhizotron (allowing the study of roots and 'underground' *Striga* infections), the team grew sorghum plants with pre-germinated *Striga* seeds under specific fertiliser regimes. Initial results show that macro-nutrients reduced *Striga* infection levels on sorghum varieties that already have partial resistance. In experiments where sorghum plants were grown in *Striga*-infested soil, the team found a positive effect from fertilisers on both *Striga* resistance and tolerance, in particular when the fertilisers were sprayed on the crop plant leaves, compared to the conventional soil application method. Next steps include farmer participatory testing combinations of sorghum varieties and fertiliser solutions on farms in Kenya. Dissemination of the technologies generated by the project have the potential to enable millions of farmers across Africa to become more food secure.



Measuring leaf-level photosynthesis and fluorescence in a greenhouse pot experiment where plant nutrition effects on *Striga*-infected sorghum plants are assessed, from L–R, Students: Yamuna Nuepane Ghimire (MSc) and Immaculate Mwangangi (PhD).

Climate change, agriculture and natural resources >

Responding to climate change is one of the most urgent challenges facing humankind. The most severe impacts are likely to be suffered by the poorest and most vulnerable in society who live in more fragile environments and have the least resources to adapt and recover. The majority of the world's poor continue to live in rural areas and their livelihoods are heavily dependent upon agriculture and natural resources, which will be severely affected by climate change. Therefore, there are serious implications for their food security, health and well-being. NRI's work in this field aims to understand these challenges better, to build adaptive capacities, and to develop appropriate strategies for sustainable and equitable rural adaptation.

Terraced fields on smallholder farms on the southern slopes of the High Atlas, Morocco.



Support on Climate Change for Morocco's National Institute of Agronomic Research

John Morton

The North African country of Morocco is heavily dependent on agriculture, which employs 40% of its labour force and is vital for feeding its growing population. However, it is extremely vulnerable to the impacts of climate change, with overall temperatures projected to increase, and precipitation to decrease sharply, leading to an increase in major droughts. Morocco's National Institute of Agronomic Research (INRA) has identified a need to increase its capacity to carry out agricultural research that addresses the needs of Moroccan farmers, especially smallholders in more marginal areas, to respond to climate change. In 2020, the British Embassy in Morocco, through the North Africa Technical Assistance Facility of the UK Government managed by Tetra Tech International Development, asked NRI to assess their capacity-building needs in this area. NRI Professors Hans Dobson and John Morton visited INRA headquarters and four of its Regional Centres, holding meetings and participatory workshops with INRA staff to identify research needs, seeing INRA research and getting the views of other stakeholders.

As a result of the mission, detailed proposals for capacity building for INRA involving NRI and other UK centres of expertise were drawn up, though their implementation was delayed by COVID-19. Further discussions led to agreement on a focussed programme of capacity building that could be delivered remotely, and three strands of training were delivered by NRI staff.

Prof John Morton delivered training to 34 INRA researchers on climate change, giving them a greater insight into the specific nature of climate change impacts on smallholders and the rural poor, the issues of adaptation and vulnerability that arise from those impacts, and some implications for the practice of agricultural research and the role of research organisations. The great majority of trainees were researchers in the biophysical sciences, who were introduced to some social-scientific and interdisciplinary perspectives as complementary to their existing expertise. Dr Andrew Armitage delivered training in bioinformatics (science of genome analysis and handling of large-scale sequence data), responding to the specific needs identified by INRA. This training in DNA analysis, genome sequencing and computing, supports researchers to identify and use genetic diversity in crop material within breeding programmes, a key component for breeding new crop varieties that may be more resilient to climate change and tolerant to drought. Researchers at INRA were also interested in applying genome sequencing to develop new diagnostic tests for plant diseases, particularly those whose spread may be subject to climate change. Dr Armitage delivered general training sessions to 34 INRA researchers followed by advanced training, open-forum discussions, and one-to-one engagement on research activities identified by individual trainees. Dr Huiyi Yang delivered training on use of climate and agri-climate models, a key training need identified by INRA, involving general sessions for 16 INRA staff, hands-on workshop sessions on the Linux Operation System and the General Large Area Model (GLAM) for Crops, advanced sessions based on case-studies, and drop-in sessions.

Overall evaluation by trainees was very positive with the training being evaluated as "good" or "very good" in all dimensions. The project allowed the NRI researchers to assist individual INRA staff with research design and the preparation of two peer-reviewed articles (Khayri et al. 2021 in *Mitochondrial DNA Part B*, Snalibi et al. 2021 in *Heliyon*).

Note: NRI would like to thank the management and staff of INRA, and particularly Dr Abderrahime Bentaibi, Dr Slimane Khayri and Dr Tarik Benabdelouahab for assistance with needs assessment and management of the training.



Transformative pathways to sustainable peace and equitable prosperity in the age of compound risk

Uche Okpara

Peace and prosperity underpin the success of the Sustainable Development Goals (SDGs), from reducing extreme poverty and violent conflicts to ensuring peaceful and inclusive societies. But there are now more conflicts worldwide than at any time in the past 20 years, spurring massive displacement of millions of people, intensifying livelihood struggles, and reducing opportunities for social cohesion and economic development. Many conflicts are a result of extreme poverty, especially in the Lake Chad region, spanning a number of countries in West and Central Africa, where over 30 million people live in poverty and almost every family is threatened by violence. Without concerted, collaborative action to promote peace and prosperity across the world, violence could drive 100 million people into poverty by 2030. Dr Uche Okpara's research, as part of a 'Future Leaders Fellowship' run by UKRI, is a direct response to this concern.

The pursuit of peace and prosperity can involve interconnected social, economic, ecological and governance challenges that interweave competing interests, norms, values, priorities and memories. As such, research on peace and prosperity pathways must incorporate a diversity of perspectives, worldviews and knowledge systems. Working with partners across the Lake Chad region (which include the University of Diffa, Niger, University of N'Djamena, Chad and University of Maiduguri, Nigeria), the research will employ a range of interdisciplinary approaches and mixed methods, underpinned by the principles of knowledge co-creation – whereby researchers and all groups of people affected by the problem, jointly contribute to research planning and implementation, for improved and sustainable impact.

As part of this fellowship, Dr Uche Okpara will build an interdisciplinary team of early career and PhD researchers in conflict, peace, environment and development, launch a new 'Lake Chad Conflict and Environment Observatory', and establish local citizens' labs. These will bring together science, society and the state in a reciprocally useful way to explore the foundations of citizens' preferences and strategies for both socio-economic development – 'prosperity' and meaningful and non-violent interactions – 'peace'.

Working in three fragile and conflict-affected Lake Chad territories in Chad, Niger and Nigeria, the project will research and co-create – together with local communities, groups and partners – peace and prosperity pathways that will serve as decision-support tools to foster sustainable and inclusive development planning in fragile environments.

The research aims to generate new knowledge on the dimensions of, and pathways towards sustainable peace and equitable prosperity, enhancing progress towards SDGs 1 (poverty reduction) and 16 (peaceful and inclusive societies) – all leading to improved lives and livelihood opportunities for citizens. Further impact includes capacity building of a new generation of young academics in conflict, peace, environment and development research.



Dr Uche Okpara interviewing women fish farmers in the Lake Chad region.

Helping African farmers future-proof against climate change

Laxmi Pant and Andy Frost

Climate change and the prospect of more frequent droughts in Africa are leaving farmers across the region facing an uncertain future and increasing risks of food insecurity. NRI is participating in a new project being implemented by the European Alliance on Agricultural Knowledge for Development (Agrinatura) which is designed to support an EC-funded Initiative – the Development of Smart Innovation through Research in Agriculture (DeSIRA). Together they will contribute to climate-relevant, productive and sustainable transformation of agriculture and food systems in low- and middle-income countries.

The objective of the Agrinatura-led project 'Leveraging the DeSIRA Initiative for Agri-Food Systems Transformation', abbreviated to 'DeSIRA-LIFT', is to support the DeSIRA initiative and its current and future activities in order to optimise its impact. 'DeSIRA-LIFT' is funded by the European Commission's Directorate-General for International Partnerships (DG-INTPA) and led by Wageningen University & Research, the Netherlands. The project will support DG-INTPA to deliver impact in this flagship initiative, including enhancing capacities of country-based implementers of climate-oriented innovation systems, supporting key research organisations to work effectively together in promoting agricultural innovation systems, sharing information and experience and contributing to the policy dialogue on agri-food system transformation.

NRI's Dr Laxmi Pant, an agricultural innovation systems specialist, together with COLEACP (an association of companies and experts committed to sustainable agriculture) is co-leading one of the project's three support service areas, which provides support to the regional and sub-regional research and extension organisations in Africa. NRI's contribution to this project builds on its experience in agricultural innovation systems thinking and practice. This incorporates the recognition that the innovation and development performance of a region depends not only on scientific research excellence, but also on how different actors engage in co-creating and using knowledge and technologies. The innovation systems approach has been widely adopted in building capacity for scientific research and technology development, as well as facilitating effective collaboration of the public, private, and non-profit private actors, such as through the formation of multi-stakeholder innovation platforms.

This is highly relevant to the DeSIRA initiative, which launched in 2018 from a growing recognition that many different people and organisations help bring about agricultural innovation, each playing a crucial role to ensure success, but not necessarily working together efficiently. Knowledge generation is a key part of the innovation process and scientific research is central to this. However, experience has shown that a combination of traditional academic research and participatory research with farmers and other 'innovation actors' is most likely to deliver impact. In other words, fully involving the people on the ground with the results and actions that come from scientific expertise will ensure the best outcome.



Farming on a slope in Colombia illustrates the risks when farmers are forced to grow crops on unsuitable land.



Food loss, waste reduction and value addition >

Food loss and waste, including postharvest losses, represent both a major global challenge and an opportunity for improved resource use through value addition. NRI has been working to reduce losses and waste after harvest since the 1970s. The importance of food loss and waste reduction is recognised in SDG 12 'Responsible Consumption and Production', SDG 2 'Zero Hunger', and several others. NRI experts on food losses and waste reduction and technologies for value addition, use their experience, insight and capability to measure food loss and waste, develop technical solutions, assess upgrading opportunities and provide guidance to researchers and practitioners, both in the UK and overseas.

The glass-covered insulated boxes housing the black tubes and reflectors which heat the water with solar energy, at their final stage of construction at the Intermech Engineering warehouse in Tanzania.



Solar technology casts a bright future for improved cassava processing

Marcelo Precoppe and Aditya Parmar

After harvesting, fresh cassava roots must be consumed or processed within 72 hours, or they become unsuitable for human consumption. For this reason, the roots are usually processed into dried products including flour and gari – a granular, fermented, roasted product – that can be used later as the basis for various dishes. Cassava processing involves numerous stages including peeling, grating, pressing, pulverising, drying, and milling, which in many places, are carried out by hand. In order to make these tasks more efficient and less laborious, some cassava processing centres in Africa are looking to mechanise their operations. However, many of these are small or medium-sized enterprises (SMEs) whose expansion is constrained by a lack of appropriate, affordable and efficient processing equipment. Here we highlight two projects that are harnessing solar power and the latest advances in agricultural engineering design to develop efficient cassava processing technologies suitable for village enterprises. Such improvements can reduce postharvest losses and food insecurity, and improve livelihoods.

Solar-powered pre-heater

Firewood is often associated with deforestation, exposure to pollutants, and CO₂ emissions, though it is still widely used as a heat source in many postharvest operations in developing countries, particularly in drying. Many projects have aimed to develop postharvest technologies that use more sustainable heat sources such as solar energy, biogas, or bioethanol, but in low-income countries, the adoption of those technologies by SMEs has been limited. To reduce fuel consumption, NRI's Dr Marcelo Precoppe, a Crop Postharvest Technologist, led a project funded by GCRF AgriFood Africa Innovation to develop a solar-powered pre-heater for a flatbed dryer used for cassava processing. By pre-heating the drying air, this reduces the amount of energy needed to reach the target temperature of the dryer.

The innovative aspect of this design is that it uses solar power to heat water, which stores more energy than air. The heater consists of a series of 12 black tubes containing water, which are heated by the sun. Surrounding each black tube is a parabolic reflector made of sheet metal which helps to concentrate the sun's rays. Each black tube and reflector is housed in a glass-covered insulated box to increase the heat of the water. Water heaters typically store hot water in a separate insulated tank, but in this project, Dr Precoppe designed an integrated system which acts as both storage tank and solar collector. The heat is then passed through an ordinary car radiator, placed at the heat exchanger air inlet, which transfers the heat from the solar collector to the air used for drying.

The heater is sturdy, durable, and was built and tested with project partners in Tanzania, Intermech Engineering, using locally available materials to reduce costs. It can reduce by up to 80% the fuel consumption used during a drying operation. Because of its low costs, the payback period from investing in its construction is short, and the team hopes this technology will proliferate throughout sub-Saharan Africa.



Solar-powered multipurpose hammermill

During processing, cassava roots must be reduced to a manageable size. A 'hammermill' is one of the most-used pieces of equipment to do this and works by the repeated blows of little hammers. A project led by NRI's Dr Aditya Parmar, a Crop Postharvest Scientist, has developed a solar-powered multipurpose hammermill that can be used to grate the cassava root, pulverise it into mash and mill the dried cassava grits. It is a versatile tool to replace the two or more separate machines currently used for these processes – which could be transformative in terms of costs and benefits to many people in rural Ghana and potentially in other regions.

Hammermills are usually used designed for a single product and a single particle size. In this project, Dr Marcelo Precope used specialist particle simulation software – ESS Rocky – to design a hammermill that can be used for several different products and different particle sizes. To grate the cassava and to pulverise the mash, the hammers rotate in one direction. To mill the dried grits, the hammers rotate in another direction. The hammers have a special design – with one sharp side and one blunt side. The direction of rotation for milling activates the fan; this is necessary to move the product through the machine, because when milling, the product is too small and light and does not move by gravity.

Instead of using diesel, this machine runs purely on solar energy – harnessing the daily average of six to seven hours of sunshine in West Africa, thus reducing production of greenhouse gases. Although the machine cannot store energy and will only power-up when the sun is shining, most processing traditionally takes place during daylight hours. It was carefully designed to run using direct current (DC) motors, which are much less powerful than the motors usually employed on hammermills. Unlike in typical photovoltaic systems with batteries, charge controllers and other additional electronics, the project team reduced costs further by adding a 'direct coupling system' by connecting the photovoltaic panels directly to the DC motors. Recent advancements in technology mean that the cost of solar panels has reduced the overall cost of photovoltaic systems by 90%. The absence of any maintenance or fuel costs will quickly offset the initial cost of buying this machine.

A key objective was to strengthen local capacity, and the team worked closely with two Ghanaian partners, the Food Research Institute, and First Product Enterprise Ltd., who manufactured the hammermill. It is currently being used at a cassava processing centre in Accra. The next steps include scaling up production, collaborating with the local manufacturer, who will play a vital role in disseminating knowledge and creating new jobs in Ghana. If the machine is a success, NRI hopes to facilitate its production more widely across cassava-growing regions in Africa.

This activity was part of a project funded by Agri-Tech Catalyst (Innovate UK).



The solar-powered multipurpose hammermill at the manufacturer's premises, First Product Enterprise Ltd., in Ghana.

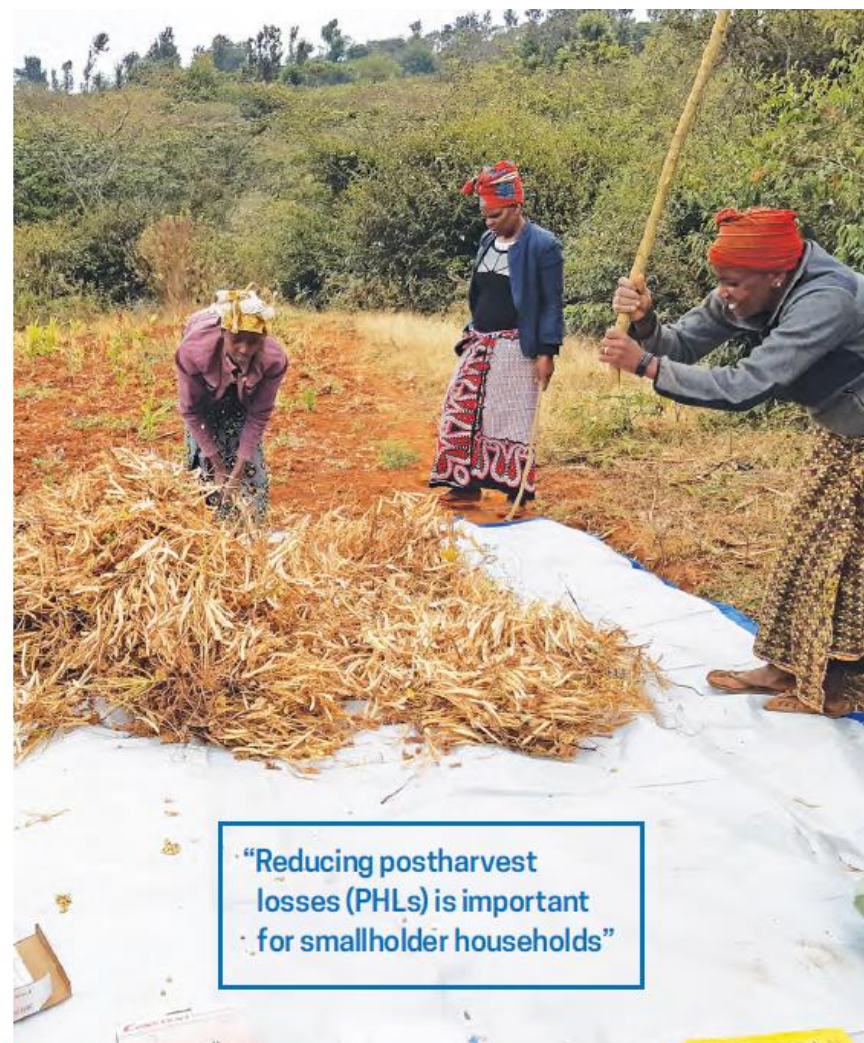
Reducing food losses: measuring losses and mining data for evidence-based interventions

Tanya Stathers, Aditya Parmar, Gideon Onumah

Producing enough to feed their families is a back-breaking reality for millions in small-scale farming households across sub-Saharan Africa (SSA) and beyond. For example, cereal and legume grain producers have to store sufficient seed from the previous harvest, invest in land clearing, planting, manage pests and diseases, and control weeds using basic tools such as hoes and machetes. After harvesting, farmers transport their crop home, spread it out to dry – guarding it against wildlife and livestock and unexpected rain showers – and then thresh, sort and store, sometimes after mixing with a protectant to deter attack by insects and other pests. Usually, women then process the grains by pounding and/or milling them before cooking for their households. At every stage, losses occur, which can be quite high when added together – a loss of valuable food but also of the resources used to produce the crop, including land, labour, and other inputs. Reducing postharvest losses (PHLs) is important for smallholder households and has been prioritised under the African Union's Malabo Declaration and the Sustainable Development Goal 12.3. However, reducing PHLs requires understanding the scale of losses, where and why they occur, and the loss-reducing interventions which different actors can use.

A team of NRI researchers, including Drs Tanya Stathers, Aditya Parmar and Gideon Onumah, are playing a pivotal role in PHL reduction in Africa. They are collaborating with the University of Zimbabwe, AKM Services, the European Commission's Joint Research Council, among others, and a network of postharvest and agricultural information experts from across SSA on the African Postharvest Losses Information System (APHLIS) project. The APHLIS team has built a science-based system of PHL estimation for different stages in target value chains. The estimates are computed through screening literature, creating a database of high-quality measured PHL data, combining it with datasets on subnational level crop production, weather conditions, storage duration, pest incidence, marketing systems and PH-technology used. Losses are reported at national and provincial levels across SSA via the APHLIS website – www.aphlis.net – an open-access, user-friendly information system. It covers estimates of volumes lost and as percentages of total output; projections of their financial and nutritional values and impacts – offering a crucial basis for decisions on interventions and investments by policy and investment decision makers.

In the current phase of the project, known as APHLIS+, one of the work packages has involved the NRI team collaborating with researchers in Benin, Togo, Tanzania, Nigeria and Uganda in piloting PHL measuring systems for bean, cowpea, groundnut, cassava and sweetpotato. The work is widening the knowledge base to understand the losses that occur during activities other than storage and for a range of important food crops beyond the cereals. This work is expected to support strategic targeting of PHL reduction investments and to improve capacity to robustly monitor and report on progress in achieving PHL reduction goals.



“Reducing postharvest losses (PHLs) is important for smallholder households”

Measuring losses during bean threshing, Hanang district, Manyara Province, Tanzania.



Future-proofing our food: plant and algae proteins for NetZero

Parag Acharya

Livestock emit 14.5% of global greenhouse gases (GHGs), including methane (CH₄), nitrous oxide (N₂O) and carbon dioxide (CO₂). In response to the urgent need for a reduction in emissions and a transition to more sustainable diets, the uptake of livestock-free, alternative plant and algae proteins can play a key role. This fits well with the recommendation from the independent UK Committee on Climate Change for a 20% reduction in consumption of meat and dairy products to achieve NetZero carbon emissions by 2050. However, the modification of plant and algae proteins to functionally, nutritionally and sensorially mimic meat and dairy products via harnessing clean/green food processing is a key innovation challenge. A team of researchers at NRI is working to understand how to future-proof plant and algal protein supply, identifying the drivers of the plant-based food value chain, and developing solutions to innovation challenges for alternative protein-based food.

Algae are rather underexploited as sustainable sources of alternative protein, and do not compete with food crops for land and natural resources. Seaweed (also known as macroalgae) contains up to 47% protein but there is a lack of eco-innovative, or environmentally friendly, solutions for improved extractability of the proteins. NRI's Dr Parag Acharya has begun work on a project to develop scientific insights on how to improve the yield of seaweed protein extraction, in collaboration with the University of Lincoln, and ISIS Neutron and Muon Source (ISIS-STFC), UK. This project, funded by the Science and Technology Facilities Council (STFC) Food Network+, will involve experts from NRI's Aquatic Biotechnology group led by Professor Patricia Harvey and Dr Birthe Nielsen from the Faculty of Engineering and Science at the University of Greenwich.

Much of the approximately 1.6 billion tonnes of global agri-food loss and waste – responsible for around 8–10% of total GHG emissions – can be upcycled (Prandi et al., 2021) to generate alternative proteins with co-benefits of developing a circular food system and improving its resource efficiency. Dr Acharya is collaborating with Professor Chu-Ky Son from Hanoi University of Science and Technology, Vietnam, to decipher the techno-economics (i.e. the economic performance) of plant proteins from under-utilised rice and maize by-products while complying with food safety. Funded by the Global Challenges Research Fund (GCRF), this project involves NRI scientists Dr Conor Walsh and Dr Marcos Paradelo Perez as co-investigators.

As part of the 'Growing Kent & Medway' (GK&M) project (supported by UKRI's 'Strength in Places' fund and led by NIAB EMRI), Dr Acharya, Prof Andy Frost and Dr Deborah Rees are involved in developing a plant-based food accelerator where new food start-ups can grow to regenerate the local economy. The accelerator is part of the state-of-the-art 'Medway Food Innovation Centre (MFIC)' being built at the University of Greenwich, through NRI's Food and Nutrition Security Initiative (FaNSI, supported by the Research England E3 scheme) and GK&M. MFIC is focused on strengthening the regional food and drink industries through research, innovation and enterprise. In this way, NRI's research on alternative proteins aims to accelerate a transition to climate-smart protein, while the concomitant collaborations seek to enable a much-needed ecosystem for alternative protein-based food innovation.



A student demonstrates food product preparation at the opening of the New Product Development facility, part of the Medway Food Innovation Centre - officially opened by Professor Jane Harrington (R), Vice-Chancellor of the University of Greenwich.



Sustainable trade and responsible business >

Making enterprise, trade and consumption more responsible and sustainable has the potential to have a huge impact on millions of workers and communities whose lives are directly affected by business and supply chains, and on local and global environments. NRI's Sustainable Trade & Responsible Business programme aims to generate knowledge and lessons on the sustainability of trade and responsibility in business, in a context of globalization and changing world trade patterns, rising authoritarian governments, growing corporate and elite power, and crises in global social and ecological systems. It is critically important that social, environmental and economic dimensions are appropriately considered in an integrated manner in research, policies and programmes which aim to support economic development.

Tropical forest landscape, South Sumatra.



Advancing understanding on protecting and restoring tropical forests for nature, people and climate

Valerie Nelson

Forests are critically important – they encompass vast terrestrial biodiversity, and they are culturally, spiritually and economically significant to millions of local communities, Indigenous Peoples and producers. Because of their role as carbon sinks, the protection and restoration of forests is central to any of humanity's efforts to mitigate and adapt to climate change. But deforestation and forest degradation continue at alarming levels; a particular driver is production of commodities such as beef, soy, palm oil and cocoa. Tackling this land use change and achieving sustainable production, trade and consumption is urgently needed. Researchers from NRI's Sustainable Trade and Responsible Business Development Programme have been exploring tropical forest ecologies, politics, and cultures, engaging on different aspects of forests, land use, land rights and the knowledge, livelihoods and experience of Indigenous Peoples, building on decades of experience in these areas.

During COP26 in November 2021, DEFRA – the UK Government's Department for Environment, Food and Rural Affairs – announced a second phase of the UK Government's flagship climate forestry programme, Partnerships for Forests (P4F). Since 2017, Professor Valerie Nelson has been conducting 'evaluation-for-learning' on this programme, incorporating a series of studies on P4F interventions, which seek to catalyse investments in sustainable land use and forestry, create forest partnerships, market demand measures and influence policies. The evaluation studies, carried out by Prof Nelson and a team led by LTS-NIRAS International in Indonesia, Brazil and Colombia, have generated findings on the effectiveness of P4F interventions. These findings were fed back into the programme during implementation and to inform future programmes.

The research indicates that the strongest potential for transformative change occurs where there is a holistic and shared vision of the desirable future system, root causes of challenges are identified and there is a design that responds to these aspects by integrating all five impact pathways which target 1) the producers, 2) producers' organisations, 3) catalyst companies, 4) forest/landscape actors and governance systems, 5) enabling conditions to support scaling and systemic change; or ensures that other actors are covering areas beyond the scope of the specific programme's interventions.

The studies highlight the need for greater attention in conservation finance and tropical forest landscape approaches to issues of equity, the terms of incorporation of smallholders and harvesters, including informal workers, gender issues, influencing policy through social learning processes, improving monitoring and evaluation systems and ways to assess the potential for transformative change and achievements. The team's report on transformative change, led by Prof Nelson, informed UK government thinking in advance of COP26, highlighting the need for combinations of interventions across production/extraction, trade, investment, governance and consumption aspects of the food and agriculture system.



Corporate accountability for human rights and environmental challenges

Valerie Nelson and Adrienne Martin

How can we change corporate behaviour to stop the harm it causes to workers, Indigenous Peoples, local communities and environments in low- and middle-income countries? Corporate power has grown through globalisation, and state power to curb corporate impacts has decreased. Voluntary initiatives are widely promoted as a responsible business solution to international supply chain challenges. However, given the competitive pressures in global value chains, voluntary initiatives are insufficient. An increased focus on regulatory solutions, such as mandatory due diligence requirements for companies to tackle business, human rights, and environmental challenges is occurring in Europe and the United States. These may have more teeth, but their effectiveness requires scrutiny.

Following a study on human rights due diligence in 2019 for the Fair Trade Advocacy Office and Brot für die Welt, an NRI team recently evaluated two Dutch Government programmes, the Fund against Child Labour (FBK) and the Fund for Responsible Business (FVO), which subsidise companies to improve their due diligence and tackle local root causes of relevant challenges. Led by Professor Valerie Nelson, a team comprising Professor Adrienne Martin, Professor Vegard Iversen and independent consultants Michael Flint and Hannah Betts, conducted a portfolio review, analysed monitoring data, conducted extensive key informant and stakeholder interviews for 20 projects, and five in-depth project case studies. The evidence was used to assess progress and effectiveness and to generate lessons. 61 projects are supported by both programmes; examples include mica mining in Madagascar, gold mining in Tanzania and Uganda, cocoa in Ghana, Côte d'Ivoire, and Cameroon, digital innovation in Nicaragua, vegetable seed production and garments in India, rice in Pakistan, coffee in Vietnam, granite mining in India, medical waste recycling in Egypt, rice blockchain in Cambodia, timber in Gabon, and leather from China and India.

Overall, the NRI study found that FVO and FBK funds are providing worthwhile support to improve how child labour and other Responsible Business Conduct (RBC) risks are identified and impact assessments conducted, and for Dutch companies to build systems to potentially address them. However, evidence of companies taking concrete action on risk mitigation, monitoring and remedy is less strong (and some projects have only recently begun). General progress of the projects against results has been good, although gaps in monitoring data make an accurate assessment difficult. Knowledge of RBC and child labour risks and root causes among project partners has been significantly improved. Some improvement in the earlier and easier stages of due diligence appears to have been achieved, and some innovative approaches have been facilitated, but it is not yet possible to know whether such initiatives will effectively tackle child labour and RBC risks. The study points to the limits of projects of this type, scale, and duration, often involving limited coalitions and with measures on enabling conditions being out of scope of the programme. Significant impact at scale is likely to require larger multi-stakeholder initiatives and changes to the 'rules of the game' in both consumer and supplier countries. The Dutch Government is acting on the recommendations to consider demand-side root cause issues, strengthening internal programme capacity and enhancing quality indicators for company due diligence.



Photographs from the Dutch Government programme, the Fund against Child Labour (FBK)



Plant, animal and human health

At NRI, we deal with both beneficial and harmful insects, and other pests including rodents and birds, which have an impact on human and plant health. Here we highlight examples of our work in this area, which include investigating the role of rodents in spreading diseases on livestock farms and developing strategies to protect farm animals from rodent pest problems, controlling invasive insect pests with environmentally friendly approaches, understanding mosquito behaviour to help develop new control methods, and combatting destructive crop viruses.

At a make-shift field laboratory in a pig farm in Norfolk, UK, Dr Judy Bettridge adds preservative to freshly collected samples, which helps to preserve the quality of DNA for later testing back at NRI.



Developing strategies to protect farm animals from rodent pests and the diseases they carry >

Steve Belmain

On farms, rodents consume and spoil animal feed, damage infrastructure and are a considerable threat to animal health and to achieving optimal health and wellbeing recognising the interconnections between people, animals, plants and their shared environment, an approach known as 'One Health'. Rodents can cause direct stress to pigs and poultry but are mainly important as carriers of pathogens. In pigs, this includes serious diseases like Swine dysentery, Aujeszky's Disease, PCV2 (Porcine circovirus 2) and Encephalomyocarditis. Wild brown rats can carry Influenza A and might act as an intermediate host for the transmission of avian influenza between wild birds and poultry. For other diseases like African Swine Fever, rodents may support ticks that can carry it, or act as mechanical reservoirs – whereby they spread the disease without being infected by it. Rodents also play a role in the epidemiology of leptospirosis (Weil's disease) and salmonellosis, or in spreading antibiotic-resistant bacterial strains such as livestock-associated MRSA. Rodents can pick up infections from pigs or poultry and spread them within and between farms, they can act as a bridge between wild fauna and livestock, and they can maintain the infection locally when a farm is emptied and decontaminated after a disease outbreak or livestock turnover. Some of these diseases can go on to infect humans, for example new strains of influenza, or rodents could facilitate the spill-over of novel diseases or future pandemics.

Thus, there are very good reasons for rodent management on pig and poultry farms. An important approach has always been the use of rodenticides. However, concerns about the environmental safety of the most common rodenticides have led to changes in European and national regulations that restrict their use and pose new challenges for efficient rodent management on farms. There is also the problem of resistance against these poisons.

NRI is part of a European consortium investigating the role of rodents in spreading diseases on livestock farms and developing future strategies to protect farm animals from rodent pest problems, through a research project known as 'RodentGate' (Future rodent management for pig and poultry health). Consortium partners include the University of Antwerp, Belgium, the Dutch Pest & Wildlife Expertise Centre, the Netherlands, Julius Kühn Institute, Germany and the National Veterinary Research Institute, Poland.

Led by Professor Steve Belmain, the NRI team includes Drs Judy Bettridge, Dan Bray, Sophie Bouvaine and Gonçalo Silva, who are looking at how different farm-rearing practices impact on the prevalence of rodent-borne diseases, trying to link farm activities with disease incidence and getting a better understanding of rodent movements and interactions with farm animals. A better understanding of the eco-epidemiological dynamics of rodents and livestock is expected to lead to more sustainable rodent management methods, with reduced reliance on using poisons.

RodentGate is supported by the ERA-NET fund for International Coordination of Research on Infectious Animal Diseases; NRI's funding comes directly through UKRI (BBSRC).



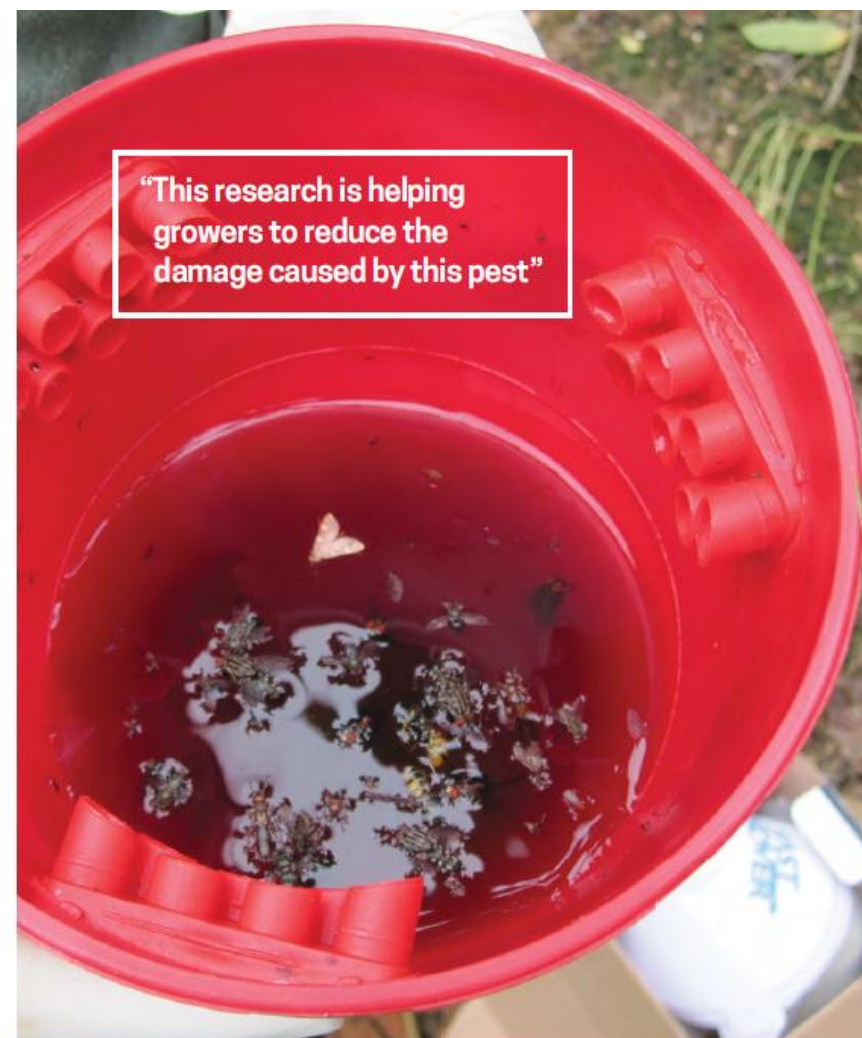
Spotted wing drosophila: controlling the invasive fruit fly with environmentally friendly approaches >

Dan Bray and David Hall

Spotted wing drosophila (SWD) is a fruit fly that lays its eggs in ripening fruit. The larvae cause severe fruit damage and increase production costs. This invasive pest was first detected in the UK in 2012 by NIAB EMR, a horticultural research organisation based in East Malling, Kent. Numbers have increased year-on-year and SWD has become the main pest of concern for UK growers of a wide range of horticultural crops, particularly strawberries, raspberries and cherries. Initially the only method of controlling SWD involved broad-spectrum insecticides, including spinosad and chlorpyrifos, which are designed to kill a wide range of organisms, without targeting a specific species. However, such insecticides can disrupt the integrated pest management (IPM) programmes used by growers against other pests and diseases which are based on more biological, environmentally friendly approaches.

NRI scientists of the Chemical Ecology Group led by Dr Daniel Bray have been involved in several projects in collaboration with NIAB EMR to develop better methods for control of SWD that are compatible with growers' IPM programmes. In projects funded by the Agriculture and Horticulture Development Board (AHDB), NRI has developed and supplied lures for traps used in a National Monitoring Programme to follow spread of the pest in the UK. Repellents for SWD have been discovered and work by NRI/NIAB EMR PhD student Christina Conroy has demonstrated that at least two of these can significantly reduce the numbers of SWD eggs laid in strawberry crops. In work funded by Innovate UK in collaboration with specialist crop-protection firm, Russell IPM, a new lure for SWD adult flies has been produced and marketed. Progress has been made on developing a device that attracts SWD flies and infects them with a fungus that specifically kills flies. The infected flies are released to infect other SWD flies before dying. A third project, funded by the Biotechnology and Biological Sciences Research Council (BBSRC) in collaboration with Berry Gardens, a major supplier of strawberries to the UK supermarkets, aims to discover why SWD doesn't lay eggs in fruit infested with other species of Drosophila. The NRI scientists are working to identify chemical signals which may be responsible for this deterrent effect. If successful, these could be applied to a crop to reduce damage caused by SWD.

SWD has become established on horticultural crops throughout the UK as well as in Europe, North and South America and even now in Africa, and this research is helping growers to reduce the damage caused by this pest. The approaches being developed are sustainable and compatible with IPM programmes on other pests and diseases, and will help growers reduce applications of traditional chemical pesticides. This in turn will help to reduce the risks to pollinators and other beneficial insects essential for maintaining our food supply, and to the wider ecosystem.



Spotted wing drosophila in a trap.



Harmonious matchmaking: understanding how mosquitoes hear and respond to each other >

Gabriella Gibson and Lionel Feugère

Mosquitoes can be loud and annoying – and it is precisely this whiny tone that they use to find a mate. But from how far away can they hear each other and at what level of sensitivity?

NRI's Dr Lionel Feugère and Professor Gabriella Gibson have been working on a research project to find out the answer – the first time this question has been addressed. The objective of the project was to identify visual, sound and chemical stimuli used by virgin females of the *Anopheles gambiae* s.l. complex which includes the most important group of malarial mosquitoes. The aim of this project is to detect, recognise and locate species-specific male swarms at long range, to provide the fundamental knowledge needed to develop new bio-inspired traps for their surveillance and control.

Dr Feugère and Prof Gibson worked on the sound cues that mosquitoes are sensitive to. They recorded the sound of males in mating swarms and assessed the distance over which females can hear this sound. The team used behavioural assays, supported by acoustic theory, to monitor the behaviour of mosquitoes in response to sound stimuli, i.e., how their flight speeds or their flight tones change in response to the sound of a potential mate. They used free-flying mosquitoes and ecologically relevant sound stimuli to test their hypotheses and discovered that inter-mosquito communication occurs only at close proximity to a mate. They also tested the minimum sound level of the female's flight tone that males can respond to, which was found to be significantly lower than previously reported.

Contrary to most studies, the team used free-flying mosquitoes rather than tethered mosquitoes or electrophysiological methods, which provided them with the natural sensory environment they needed to produce natural mating swarms. The mosquitoes were released in a large arena (approximately 4m²) with a visually conspicuous object on the ground that stimulates swarming behaviour, consisting of elliptical flight patterns over the object. Mosquitoes were exposed to a range of natural and synthetic played-back sounds of female flight emanating from a speaker located at the same height as the swarm centre. The team monitored their responses to flight-tone sound by recording the flight-tone and flight-dynamic responses of males using 3D video recording.

The outcome of this basic-research study contributes to a greater understanding of mosquito mating behaviour and can inform the development of more specific and effective sound-based traps to monitor and/or kill mosquitoes.

This research project was carried out by Dr Feugère and Prof Gibson as part of the project entitled 'How *Anopheles* Females seek males', led by Olivier Roux (IRD, France; IRSS, Burkina Faso) and the Human Frontier Science Program led by Rajat Mittal (Johns Hopkins University, USA). It also involved Nicholas Manoukis (USDA ARS, USA).



The antennae fibrillae of a male *Anopheles* mosquito, used to detect airborne sound.

Combatting destructive crop viruses in tomato and cucurbit plants >

Maruthi Gowda

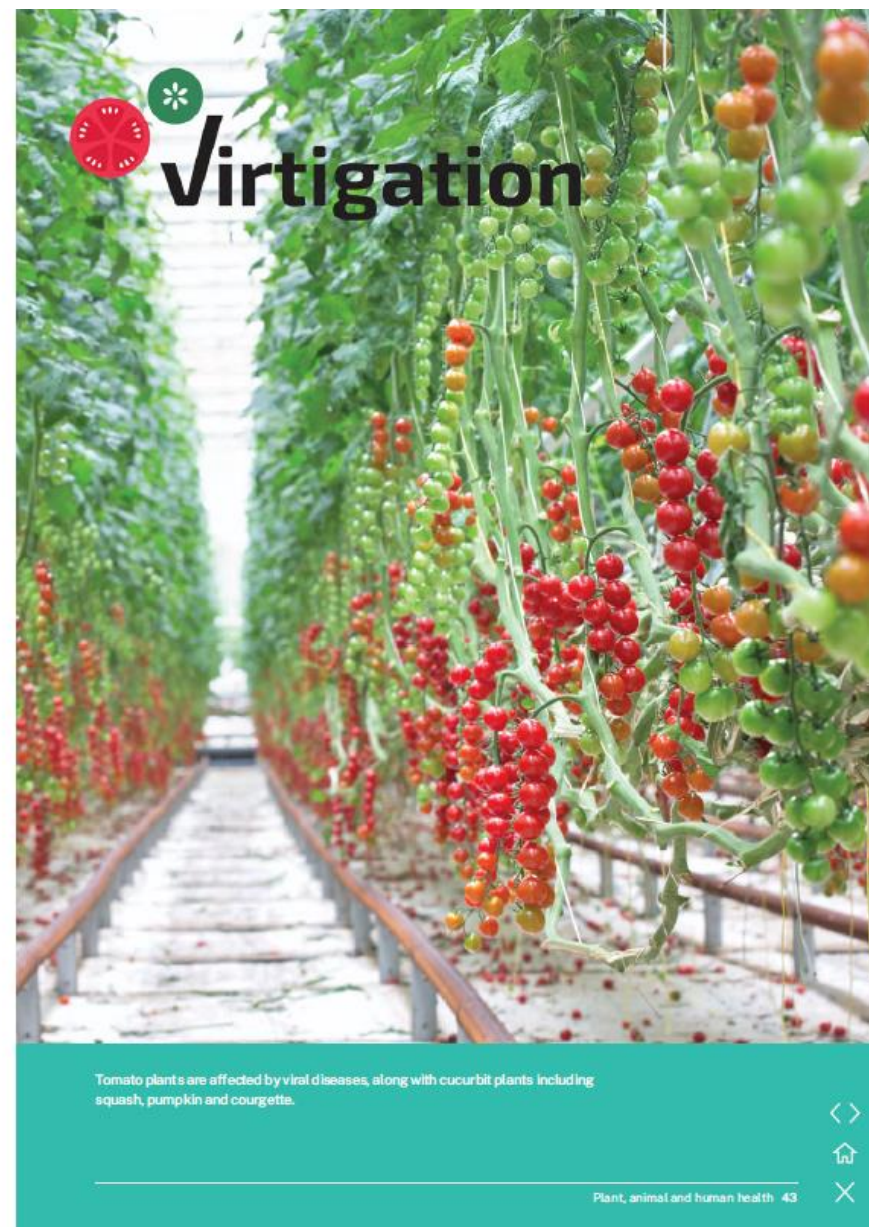
Every year, viral diseases wreak havoc worldwide on tomato and cucurbit crops (squash, pumpkin, courgette), causing huge yield losses ranging from 15% to 100%, accounting for losses of around €3.5 billion in Europe alone. The emergence of new and devastating plant viruses is fuelled by a combination of climate change, rising global trade and more interconnected agricultural sectors. Building on decades of expertise in plant molecular biology and sustainable pest management approaches, NRI is part of the EU-funded VIRTIGATION project, which aims to combat emerging viral diseases in crops, and to help prevent them from spreading around the world.

To date, few viable remedies have been made available to tackle the destruction of crops caused by these plant viruses. The VIRTIGATION project aims to cut tomato and cucurbit crop losses stemming from viral diseases by up to 80%, and it seeks to cut in half, or even eliminate the use of pesticides to control emerging viral diseases. VIRTIGATION will demonstrate several innovative biologically based solutions to safeguard tomato and cucurbit plants. These will include natural plant resistance, plant vaccines, a sustainable and integrated pest management (IPM) approach, and biopesticides – substances used for controlling pests made from natural products or micro-organisms, as opposed to the more conventional synthetic or chemical pesticides. VIRTIGATION will also implement new methods for the early detection and prevention and control of these plant viruses. It will further develop innovative diagnostic tools and online monitoring platforms to identify possible outbreaks to 'test, track and trace' the spread of viruses. With this toolbox, VIRTIGATION aims to assist the entire value chain – from farmers and plant health services, to policymakers and industry – in protecting tomatoes and cucurbits from viral diseases.

NRI's Professor Maruthi Gowda is leading NRI's contribution to VIRTIGATION which focuses on understanding how viruses jump hosts from tomatoes to cucurbits and expand their host range. The team aims to identify virus-resistant varieties from extensive germplasm collections to provide rapid and natural control measures for farmers. In addition to the use of naturally occurring resistance sources, the NRI team is exploring wide-ranging IPM practices such as the use of biopesticides, plant extractions and novel eco-friendly formulations for controlling whiteflies – one of the main insect vectors which transmit viral diseases. These efforts will minimise the use of harmful synthetic pesticides and thus help produce healthier vegetables.

VIRTIGATION is coordinated by the Department of Biosystems at KU Leuven University in Belgium and brings together 25 partners from universities, industries, research and technology organisations, agricultural extension services and small and medium-sized enterprises from 12 countries: Austria, Belgium, France, Germany, India, Israel, Italy, Luxembourg, Morocco, the Netherlands, Spain and the United Kingdom.

The VIRTIGATION project is running from 2021–2025 and is funded with EUR 7 million by the EU Horizon 2020 programme. www.virtigation.eu



Capacity strengthening >

NRI recognises that capacity strengthening for agricultural development and food security is fundamental to achieving the Sustainable Development Goals. Researchers and other stakeholders in smallholder agricultural systems require new skills to work together effectively, to engage in high-quality, demand-led research and learning, to embrace interdisciplinary approaches and to deliver innovative solutions to promote sustainable development – especially in the face of climate change. Researchers, policy makers and civil society organisations are working together to build capacity to demand, evaluate and utilise evidence so that impact is achieved.

Pictured with apple trees during a visit to NIAB-EMR at East Malling in Kent, UK, the first cohort of doctoral students from the UKFS-CDT learn about NIAB-EMR's research and contribution to UK Food Systems.



UK Food Systems – Centre for Doctoral Training: developing the next generation of interdisciplinary food systems transformation leaders

Chris Turner

Food systems are complex networks of people and activities involved in the production, processing, distribution, preparation and consumption of food. There is an urgent need to transform food systems to achieve the 2030 Sustainable Development Goals (SDGs) and promote sustainable diets that are nutritious, healthy and affordable, whilst also recognising the importance of food systems to economic growth and social wellbeing. Such change requires transformation leaders. To that end, the UK Food Systems – Centre for Doctoral Training (UKFS-CDT), led by NRI, aims to train the next generation of UK food system transformation leaders for a healthy and sustainable food future.

The UKFS-CDT is a new programme that provides a unique opportunity for transformative and interdisciplinary food systems research. The UKFS-CDT welcomed its first cohort of fifteen doctoral researchers to NRI in October, 2021. From 2021–2027, the UKFS-CDT will train over 60 interdisciplinary doctoral researchers, who will undertake research linked to the programme's key themes: Healthy People: food environments, consumer behaviour, diets, nutrition and health; Healthy Animals: livestock health and welfare in sustainable food systems; Healthy Environment: environmental sustainability of food systems; Healthy Economy: food production, distribution, manufacturing and waste.

Alongside the programme, UKFS-CDT is building a transformative food systems community in the UK, with the vision of helping to shape a truly resilient, healthy and inclusive food system. This community is being created through the UKFS-CDT Academy – a dynamic learning network which provides a platform for collaboration around transformative food systems research by bringing together doctoral researchers, supervisors and over 130 Associate Partners from across businesses, government, and civil society.

The UKFS-CDT features a unique approach to doctoral training, with students recruited according to their aptitude for interdisciplinary food systems research, rather than on the basis of a PhD proposal. In year one, the students receive bespoke training in food systems at NRI in collaboration with the Innovative Food Systems Teaching and Learning (IFSTAL) programme led by Oxford University's Environmental Change Institute. This is followed by two four-month rotations with UKFS-CDT partners, where the students will undertake short research projects, or 'kernels' (one social science-based, one natural science-based). This unique approach is based on the principle of co-design, with project kernels developed collaboratively between Associate Partners from across businesses, government, and civil society, academics across the UKFS-CDT consortium and the students.

The UKFS-CDT is supported by UKRI's Strategic Priorities Fund 'Transforming the UK Food System for Healthy People and a Healthy Environment Programme' and managed by the Partnership for Sustainable Food Future (PSFF). Led by NRI, the consortium includes University College London, Royal Veterinary College, Institute of Biological, Environmental & Rural Sciences at Aberystwyth University, Centre for Food Policy at City University, University of Sussex, Brunel University London, NIAB EMR and Rothamsted Research.



Keeping CONNECTED: molecular diagnostics training to tackle vector-borne plant diseases

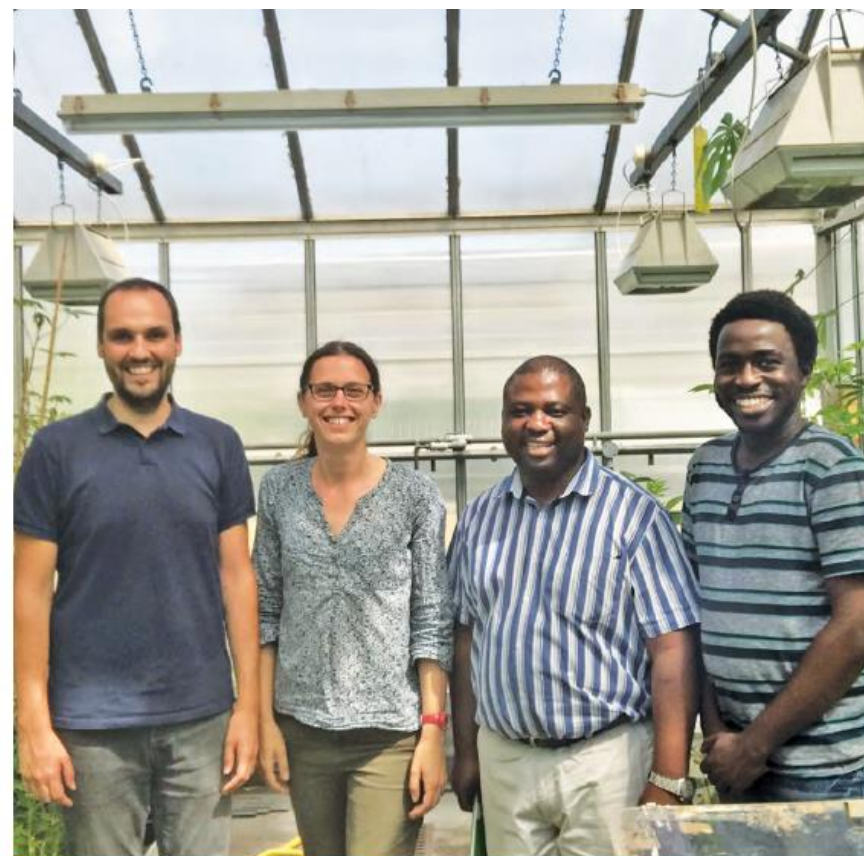
Sophie Bouvaine and Gonçalo Silva

NRI experts in entomology and plant virology have been involved in a suite of capacity-strengthening initiatives, as part of the 'Community Network for African Vector-Borne Plant Viruses' (CONNECTED). Funded by GCRF and directed by Professor Gary Foster, University of Bristol, and Professor Neil Boonham, Newcastle University, CONNECTED endeavours to establish and consolidate collaborations of international researchers to tackle vector-borne plant diseases. In addition to providing funding, the network offers 'training vouchers', workshops and training videos. As part of CONNECTED, NRI members, Dr Gonçalo Silva, Dr Sophie Bouvaine and Prof Susan Seal have contributed to knowledge transfer with members of participating African universities.

One example which demonstrates the urgent need to build capacity in combatting plant virus diseases and their insect vectors is maize streak virus (MSV), which is transmitted by the insect leafhopper *Cicadulina* spp. In maize plants, MSV infection initially manifests as small, round, scattered spots on their leaves, which get larger as the plant grows until the spots resemble broken yellow streaks. Severe infection causes stunting, and plants can produce malformed cobs or no yield at all. Despite a number of control strategies, the ensuing threat to food security and economic impact is significant for smallholder farmers across sub-Saharan Africa, where maize is often the most important crop. By using molecular techniques, scientists can detect viral diseases at an early stage of infection, and identify and differentiate between vectors that appear identical. Accurate and rapid diagnostics are crucial to develop precise and sustainable measures to control these serious diseases and their insect vectors.

From 2019–2020, several recipients of the network's training voucher scheme chose NRI to obtain training on molecular techniques for diagnostics, characterisation and monitoring of viruses causing plant diseases and their insect vectors. Scientists had the opportunity to use NRI's infrastructure and facilities and to interact with virologists and molecular biologists to develop and expand their research on the crop viruses of their choice. In 2021, Drs Bouvaine and Silva developed a series of videos for online demonstrations of several molecular techniques for the identification of insect vectors and detection of plant viruses, including polymerase chain reaction (PCR), recombinase polymerase amplification (RPA) and loop mediated isothermal amplification (LAMP) – alternatives to PCR which use lower-cost equipment that is robust, and can be battery-powered to protect the equipment from fluctuations in energy supply. These videos constitute a step-by-step protocol that will be provided to the network members so they can be replicated in the scientists' own laboratories worldwide.

Drs Bouvaine and Silva have also delivered CONNECTED training courses on plant virus detection, insect vector molecular barcoding, and molecular diagnostics for plant virus surveillance in Kenya, Nigeria, and the UK. Together, the CONNECTED training activities contribute to knowledge transfer and provide scientists from around the world with the necessary technical skills to further their research and to bring sustainable solutions to vector-borne plant viruses.



(L-R) NRI's Dr Gonçalo Silva and Dr Sophie Bouvaine welcome Mathias Tembo from Zambia and Dr Adedapo Adediji from Nigeria to NRI for a training course in diagnostic tools for plant virus detection.



Understanding what works to promote science, technology and innovation in East Africa

Andy Frost

The sustainable development agenda is a response to a new class of challenges that call into question current patterns of human activity in relation to production and consumption, access and distribution of resources, and the way these processes and patterns of human activity are governed and directed. Broadly these challenges relate to environmental sustainability of the resource base and the planet as a whole and the crisis of unbalanced patterns of growth that are failing to eradicate poverty, inequality, and food, water and energy resource insecurities. These are global-scale issues, but have particular poignancy and manifestations in low- and middle-income countries (LMICs) where poverty is widespread and where climate change is a major threat to already fragile and degraded environments.

Science, Technology and Innovation (STI) could form a central pillar in addressing these challenges. But that will require a form of innovation that is much more deeply embedded in society than it has been in the past. This will entail a much closer alignment of STI policy with development priorities in a particular country and will require patterns of governance and participation that give ownership of both the priorities and the outcomes of the innovation process, to a wider set of stakeholders. Building this new form of innovation capacity will need to look beyond traditional science and technology providers – although it is essential to strengthen these too – and will need to embrace the full gamut of knowledge production and use, actors and processes that society has to offer.

The Knowledge Systems Innovation (KSI) project, funded by UK Aid through the East Africa Research Hub, seeks to develop a practical approach to guide capacity development and investment in knowledge systems in Kenya, Rwanda and Tanzania. The project was led by Professor Andy Frost and also included Associate Professor Apurba Shee, who worked on the economics and financial analysis. Working with in-country teams and colleagues from ACTS in Kenya, CSIRO in Australia, and the University of Sussex and UCL in the UK, the team first undertook case studies and quantitative work. They observed diverse STI contexts across the three countries, research investments poorly aligned to the majority of SDG targets, interventions tackling recognised innovation system gaps, particularly those aimed at enhancing brokering, without appropriate evaluation. Significant informal-sector knowledge activity was seen in all three countries which was of high relevance to local communities and SDGs but these are not mainstreamed and hence overlooked. In order to address this, the team proposed a practical conceptual framework which defines a sufficient set of STI investment and capacities required to drive the transformational change necessary for balanced and sustainable growth. The framework is intended for use by donors, to design projects with a fresh outlook that are fit for purpose.



Bottom left: Dr Shemdee of COSTECH presenting on the STI policy environment in Tanzania; Top: Prof Andy Frost introducing the project to the participants; Bottom right: a participant explaining a potential approach to engaging stakeholders in knowledge systems.



Gender and social difference >

At NRI, we understand that inequality is a result of powerful social norms, stereotypes and power relations that influence attitudes and behaviour. Over the past three decades working with our Northern and Southern partners, we have extensive experience in development and empowerment pathways that focus on equitable processes and outcomes in development. These approaches place capabilities, dialogue and accountability at the centre of our work. The goal of our work in gender and social difference is to produce innovative and high-quality research and practice for demonstrable impact on reducing inequalities and achieving gender justice in sustainable development. The ultimate aim is to contribute to theory, policy and practice to benefit the lives of women, men, girls and boys, as a matter of human rights, gender justice and good development.

Selling attieke, a product made from cassava, in Ivory Coast.



Gender in RTB product preferences: developing Food Product Profiles

Lora Forsythe

Gender equity may not immediately come to mind when thinking about crop breeding. However, the influence of gender roles and social relationships on crop breeding is considerable, particularly with root, tuber and banana (RTB) crops which are vital for people's food and income across sub-Saharan Africa. While breeding programmes have been working for decades on developing new varieties to increase yield potential, pest and disease resistance and for new markets, gender issues and post-harvest and consumer preferences, have tended to be overlooked. This has led to significant problems of acceptability of new varieties among farmers, partly due to a tendency for women, and hence women's priorities, to be excluded from varietal development programmes.

Crop breeders can have a significant positive impact on women's lives by breeding for traits in which women in particular have a high interest. For example, any trait that would reduce RTB processing and product preparation time – which involves a significant amount of women's labour in sub-Saharan Africa in general – would reduce women's workloads. RTB products are often sold on 'local' markets by women, and therefore improving product yield or taste may lead to improvements in women's income. To meet this challenge, NRI has been collaborating on the project 'RTBFoods' led by CIRAD, as part of the CGIAR Research Program on RTBs. Now in its fifth year, RTBFoods continues in its aim to link local consumer preferences with breeders' selection criteria, to encourage adoption along the value chains of cassava, yam, sweet potato and cooking banana products; focus countries are Benin, Cameroon, Ivory Coast, Nigeria and Uganda.

NRI's Dr Lora Forsythe leads the project's largest work package on understanding the gender and socioeconomic and cultural drivers of food quality preferences, which is contributing to a growing movement in crop breeding programmes towards promoting gender equality. The project has carried out innovative research that profiles the preferences of women, men and other social groups, from producers to consumers, in 'Gendered Food Product Profiles', FPPs (Forsythe et al., 2021). Lora and the RTBFoods Gender Working Group (GWG) – a collaboration of 18 specialists from 10 institutes in the project – developed an RTBFoods FPP gender assessment, which draws extensively on ground-breaking work of the Gender in Breeding Initiative's (GIB) G+ Product Profile Tool, to assess the gender impact of RTB plant traits listed in the FPP. A team of plant breeders and social scientists will use this tool to identify how a set of proposed traits will be harmful or beneficial to men and women and the trade-offs between different breeding objectives.

These activities are highlighting essential information for breeders about food products at each stage of the food and product development chain. This will contribute to improving the adoption of new RTB varieties, and most importantly, increase their development impact, particularly in terms of the livelihoods of women.



Depleted by debt? Using a 'gendered lens' to bring into focus climate resilience, credit and malnutrition

Fiorella Picchioni

The work of social scientists involves taking an in-depth look at the many, often interlinking aspects of how society works. In order to understand certain facets of social relationships in more detail, it is sometimes necessary to apply a specific 'lens' to highlight these, especially where they tend to be neglected. A 'gendered lens' allows us to examine gender bias, gendered power relations and resulting inequalities in economic and social relations and institutions.

Development Economist, Dr Fiorella Picchioni, Fellow in Gender and Diversity in Food Systems at NRI, is working on a project entitled 'Depleted by debt? Focusing a Gendered Lens on Climate Resilience, Credit and Malnutrition in Translocal Cambodia and South India'. 'Translocal' in this context refers to the interconnected, interpersonal relations and processes that happen through migration flows and networks, beyond geographical boundaries. The initiative uses a feminist political economy lens to guide critical inquiry on financial inclusion, in a context where the market-driven global system has demonstrated disastrous impacts on the environment and in the management of the COVID-19 pandemic.

A gendered or feminist lens highlights the risks of individualised solutions, such as microfinance, as key tools to mitigate and adapt to climate and environmental change. By taking into account social reproduction, which considers the multitude of everyday 'invisible' activities that regenerate life and societies, a feminist reading of financial inclusion highlights the inadequacy of such tools that offer only a temporary and risky solution to the deepening environmental and climate crisis and its effects on health and food security.

As with many projects that involved primary data collection in early 2020, this one was also delayed by the COVID-19 pandemic: travelling was impossible and concerns about infection and survival raised by communities took priority over the project's timeline. However, almost two years into the pandemic, the project has made great progress: Dr Picchioni developed an online training module and provided desk support for the nutrition and physical activity arm of the project in Cambodia. The data from this module is combined with environmental profiling, household surveys, nutrition and physical activity assessments, photovoice and qualitative interviews, where possible, in Cambodia and Tamil Nadu, India.

The analysis is still ongoing, and it is too early to talk about results and outcomes at this stage. Nevertheless, the interviews evoke a picture of vulnerabilities within and outside the households. Families were living on the 'edge', with limited resources and missing the public sector to help them cope with external shocks. This is compounded by: 1) environmental crisis and natural resources mismanagement that has made agriculture an unreliable source of income; 2) debt-related stress and anxiety due to the fears of losing land and other collateral.

Funded by the Global Challenges Research Fund (GCRF), the project brings together a team of 20 interdisciplinary scholars and practitioners from Cambodia, India, the UK, and continental Europe.



Preparing a variety of dishes in Cambodia.



Rural institutions, land and governance >

NRI's work in this field aims to assist policy and institutional innovation for sustainable, socially inclusive economic development in rural areas, particularly in Africa, with a focus on improved governance of land and natural resources, extending market participation by small farmers, strengthening rural advisory services and the social impact of agricultural and other investments, and responds to several SDGs.

Labouring on a sugar plantation – one of the sectors covered for private-sector agricultural investment addressed by the Land Collaborative learning cycle.



Strengthening engagement with the private sector for responsible agricultural investment through social learning

Julian Quan

Over the last 15 years, there has been a significant expansion of private-sector agricultural investments in low- and middle-income countries. Too often, such investments have led to dispossessions, forced resettlements, lost livelihoods and human rights abuses for smallholders and local communities, with few real beneficiaries. In many cases, misguided large-scale investments have trampled over local people's land rights, failed to include them in projects or to generate real economic benefits in developing countries – leading to opposition from civil society – or even failed completely. To promote more inclusive and environmentally sustainable approaches to public and private agricultural investment, international agencies have begun to channel resources to country-level initiatives that bring stakeholders together into multi-stakeholder platforms (MSPs) and alliances for reform.

The Land Collaborative, a partnership of organisations including the International Land Coalition, the German NGO Welthungerhilfe, and the Mekong Region Land Governance Program, have developed a global Community of Practice on MSPs and alliances for progressive change in land governance. In one of its first initiatives, Land Collaborative commissioned an NRI team to design and deliver a participatory 'Learning Cycle' on how to engage with private investors for over 30 platform participants from Burkina Faso, Cambodia, Cameroon, Ethiopia, Laos, Liberia, Mongolia, Myanmar, Philippines, Sierra Leone, Tanzania, and Vietnam. Led by Professor Julian Quan, with Professor Valerie Nelson and Richard Lamboll, the team employed a 'social learning' approach, to facilitate learning through stakeholder interaction.

Participants were supported to conduct country diagnostics of agri-investment issues, and to prioritize their learning needs to engage effectively with the private sector. As a result of the COVID-19 pandemic, interactive and participatory learning has been delivered entirely online, with NRI sharing expert knowledge of practical case experience, relevant international policy, law and sustainability standards to help fill knowledge gaps. Topics include how to build trust and communicate with the private sector, the incentives driving private-sector decision making and how to improve the broader enabling environment for responsible investments. Learners were encouraged to reach out to private-sector and government actors to establish more open dialogue, and to promote practical collaboration and appropriate regulatory reforms. The NRI team is also producing comprehensive guidance notes, supporting country-level MSPs to develop action plans for engaging with the private sector, and developing a set of practical tools, learning materials and case studies for wider future application in Land Collaborative's continuing efforts to promote better, people-centred land governance and necessary stakeholder learning and collaboration globally in multiple countries.



Assessing orangutan conservation investment considering social and environmental contexts

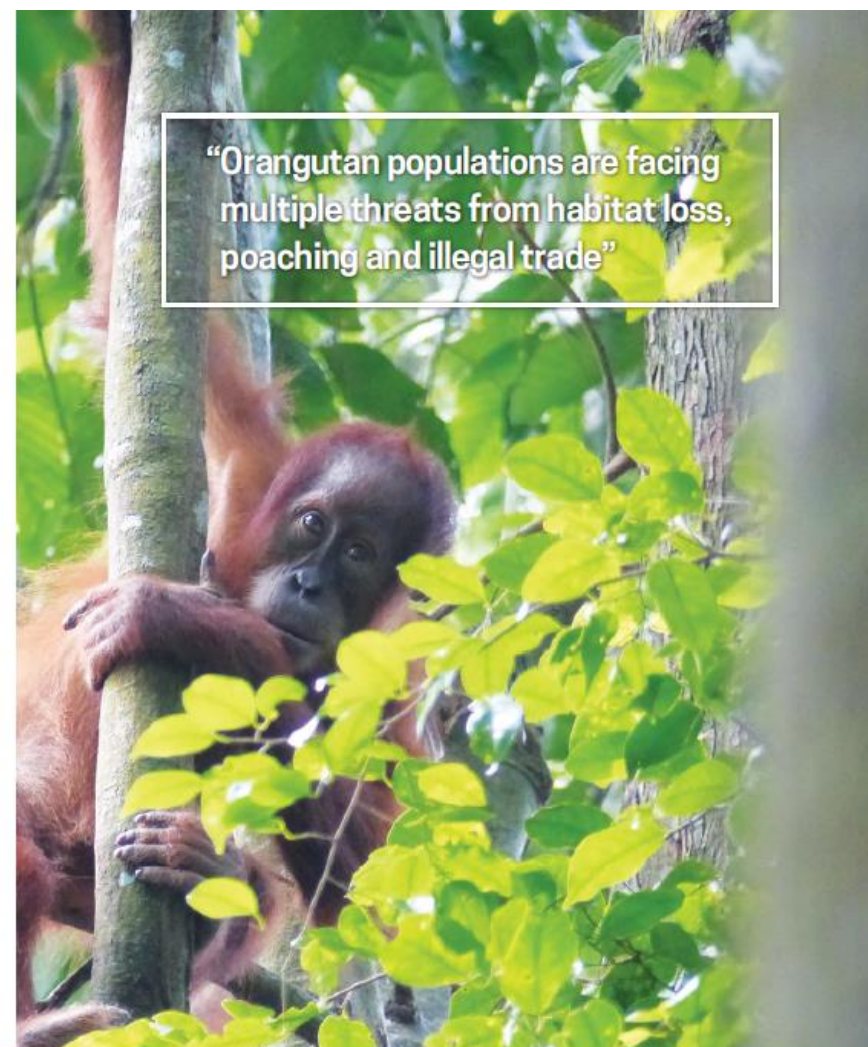
Truly Santika

Like many endangered species worldwide, orangutan populations are facing multiple threats from habitat loss, poaching and illegal trade. Conflicts with humans also arise, as competition between the two species increases due to the shrinking of land and natural resources. In south-east Asia, the rapid shrinking of forests in Indonesia and Malaysia – especially due to the expansion of agriculture, timber, and mining industries – reduces the habitats for orangutans, and affects local people who depend on goods and services provided by the forests and natural environments for their livelihoods and wellbeing.

Since 2019, NRI's Dr Truly Santika has collaborated with more than fifty research institutes and non-governmental organisations (NGOs) in Indonesia, Malaysia, the UK, Australia, and Europe on a project supported by the US Fish and Wildlife Service (USFWS). The project aims to unravel the state of orangutan conservation and funding across Indonesia and Malaysia. Despite considerable investment that has been put in place every year to conserve the species, detailed knowledge is lacking about these conservation activities. The project seeks to understand orangutan conservation through systematic evaluation of the change in orangutan populations between 2000–2019, the environmental and social factors driving this change, the different types of conservation interventions that have been implemented to save the species, the amount of investment spent on these conservation activities, and the relative benefit of these activities.

The team developed a model that links data from surveys on orangutan occurrence, conducted by NGOs, with the environmental and socioeconomic variables known to have important effects on orangutan population and their habitats. Environmental variables such as forest cover, rainfall, and land degradation were obtained from satellite-based data. Data on socioeconomic variables such as distance to market, poverty, presence of agricultural and forest concessions, and community-based land tenure were obtained from censuses and land records. Given data on investment in orangutan conservation activities, the team estimated the benefit of these activities in reducing the rate of decline of orangutans, per unit of investment.

Findings show that habitat protection, patrolling, and community outreach provided large benefits in slowing the decline in orangutan numbers. However, given the variability in threats, land pressure, and poverty levels in different regions where orangutans occur, the most cost-effective conservation activity was different for each region. Hence, instead of trying to provide a generalised one-size-fits-all recommendation for the most effective conservation approach for orangutans, the project is developing a specific conservation action for each environmental and social context.



“Orangutan populations are facing multiple threats from habitat loss, poaching and illegal trade”

Orangutans in their natural habitat is south-east Asia.



Root and tuber crops in development >

Root and tuber crops, including cassava, sweet potato, yams, potato, cocoyams and other minor root crops, are important to agriculture, food security and income for 2.2 billion people in developing countries. Several factors constrain the contribution of root and tuber crops to development; they are often affected by pests and diseases passed on through vegetative propagation and, compared to cereal crops, they are bulky and have a relatively short shelf-life. NRI's team of experts undertakes world-leading research and development activities to address key challenges at all stages of root and tuber crop value chains, from farm to fork. NRI's strategies for root and tuber crop development are economically sound, environmentally, culturally and socially appropriate and gender sensitive, to ensure broad-based beneficial development outcomes.

Blending fortified cassava flour.



Fortified cassava flour: development of an international specification

Louise Abayomi

It is estimated that 10% of the world's population rely on cassava as a staple food. Cassava is one of the world's most versatile crops, with uses for both food and industry – for example, it can be used to make animal feed, ethanol, or adhesives. As a food, although cassava is probably the most energy-dense of all staples, it is lacking in micronutrients. A reason for its popularity is that cassava is a relatively drought-resilient crop, and can stay in the ground, once mature, until harvesting for processing or preparation for consumption. Another of its attractions is that it's affordable, relative to maize and rice. However, where cassava is consumed daily by communities or whole populations with limited dietary diversity, such as in the Republic of Congo, there is an increased risk of micronutrient deficiencies. This has been recognised by the United Nations World Food Programme Republic of Congo Office (WFP-RoC) who are interested in supplying fortified cassava flour within their school feeding programmes – principally for the preparation of a fermented cassava product known as fufu (or fufou), a dough cooked with water and consumed with a variety of stews or sauces.

Blended or composite flours, such as wheat and cassava flour, cassava and rice flour (often used as a weaning cereal for babies), maize and wheat, or banana and maize, are usually created to add nutritional balance or to meet desired organoleptic characteristics, such as flavour, texture and colour. In addition to these, the development and utilization of a fortified cassava flour may be viewed as a complementary strategy for consumers to access and contribute towards their daily recommended nutritional intake, and increase diversity of convenient foods, particularly for countries with high levels of undernutrition.

With technical assistance from NRI, the WFP-RoC has taken the lead in developing a new product – fortified cassava flour – produced with added vitamins and essential micronutrients. There are a number of organoleptic and textural characteristics preferred by different communities across cassava fufu-consuming countries. The aim of the international specification is to set targets and tolerances for these attributes, which include acidity (sourness), and aroma and granulation (finesness), reflecting preferences across a diverse set of consumers, thus making the specification adoptable by a greater number of countries.

The project's technical lead is NRI's Dr Louise Abayomi, who is also undertaking the validation of portable test kits and will provide capacity building of national laboratories in RoC. NRI's Dr Corinne Rumney, microbiologist, is supporting the project with sample analyses and validation with an external accredited laboratory in Italy. Storage trials are under way at NRI, examining the stability of the vitamins within the cassava flour matrix in order to establish optimum vitamin and micronutrient addition rates, packaging specification requirements, and thus, shelf-life under particular conditions.

Building on NRI's commitment to collaborative research with positive impacts for development in this area, this initiative is supporting the development of the industrial cassava flour industry in RoC, which is in its initial stages. The cassava value chain is being supported by the national government more broadly.



Strengthening yam seed systems in sub-Saharan Africa using High-Throughput Sequencing technologies

Gonçalo Silva and Susan Seal

Yams look similar to sweet potatoes – they both grow herbaceous vines and produce edible tubers. Their taste, however, is quite different – yams are starchier and more potato-like whereas sweet potatoes are sweeter with a creamy texture. In West Africa, yam (*Dioscorea* spp.) is a preferred staple food for over 300 million people where the crop is prepared in different ways to make a variety of dishes. However, yam productivity is severely compromised by the impact of viruses and by the lack and high cost of virus-free planting material. Like sweet potato, yam is propagated vegetatively, meaning that edible tubers known as 'seed yams' are planted. Traditionally, farmers save their seed yams from one generation to the next. This system has led to endemic pathogens persisting in the germplasm over generations, and ultimately production in the field is compromised.

Ghana is the second largest producer and leading exporter of yams worldwide. The availability of a ready and reliable source of certified virus-free, premium-quality planting material is critical in Ghana, where farmers obtain their planting material – often of low quality and infected with viruses – either from their own farms, or through any surplus from neighbouring farmers. There is the need to utilize cutting-edge technologies that facilitate the availability of virus-free seed in required quantities to supply industry and other users. However, the lack of a formal seed system and high costs associated with seed yam production are a major constraint to yam productivity in the country. To meet this increasing demand, Ghana's Biotechnology Laboratory of the Council for Scientific and Industrial Research-Crops Research Institute (CSIR-CRI) developed an aeroponics and hydroponics system to boost the production of seed yam. This system has a very high multiplication rate and thousands of plantlets can be generated from a single plant. However, virus titres (quantities) in the generated tissues are generally decreased but not eliminated. This poses an increased challenge for reliable virus detection, which makes it difficult to ensure that planting material is virus-free.

Through a collaborative research project between NRI and CSIR-CRI, funded by the Royal Society in the UK, NRI's Professor Sue Seal and Dr Gonçalo Silva are using High-Throughput Sequencing to strengthen the yam seed systems in Ghana. High-throughput sequencing describes technologies that sequence multiple DNA or RNA targets in parallel, enabling millions of sequences to be generated at a time. This has the advantage that the virus status of germplasm can be obtained for multiple known as well as novel viruses in a rapid and relatively cost-effective manner.

This project will transfer the state-of-the-art diagnostic techniques to Ghana to improve capacity for yam disease diagnostics and seed certification in the country. The project aims to ensure the timely availability of virus-free seed yams at low cost, thereby establishing a sustainable seed system and contributing towards the safe distribution of yam germplasm. CSIR-CRI has accredited a virus-indexing cassava test and through this project the team will set up the facility to accredit the test for yam diagnosis which will subsequently enhance NRI's laboratory quality management system.



Participants from the Yam Virus Diagnostics Training Course at the Council for Scientific and Industrial Research-Crops Research Institute (CSIR-CRI) in Ghana, 2019.

Research-led teaching >

Contact Claire Coote

NRI's research responds to global challenges. Our researchers also supervise the research of our PhD students and teach on our undergraduate and postgraduate programmes, with new elements from their research and enterprise work being rapidly introduced into individual courses and lectures.

Valentine Seymour (right) with samples taken from a river.



My Future in Five: perspectives of life and study at NRI and beyond

Linden Kemkaran

'My Future in Five' is a series of articles created by NRI Communications Officer, Linden Kemkaran, who chats for five minutes with NRI alumni and current students, asking them all about their time studying at NRI and how they've used their degrees to get where they are today or where they hope to get to with an NRI degree. This selection of excerpts introduces former and current students from our undergraduate and postgraduate degree programmes.

Valentine Seymour – Environmental Science BSc

I'd had a passion since childhood to work with the aquatic environment. I was fascinated by freshwater species and coastal sciences, and that's what drew me towards taking a degree in Environmental Science at NRI. When I read the University of Greenwich prospectus, the programme was given a huge double-page layout, dedicated to freshwater research that was going on in the River Medway. I immediately thought 'right, that's where I want to go'.

My passion has always been to understand the different species that live in rivers, how they are interrelated and what processes go on just beneath the surface of that body of water. I wanted to know the different effects that water quality has on these creatures and what improvements we can make to help them flourish. The NRI programme also contained a module on environmental impact assessment where I could learn about water management.

It represented a change in career for me going from the arts to the sciences and I was very excited, but a bit nervous. I began the academic year wondering if everyone else was going to know more than me, but the lecturers explained that the first year of any degree lays the foundation of knowledge and you build on that as you go. Two of my lecturers – Dr Peter Burt and Professor Colin Hills – gave me such a high level of support and encouragement. My first year provided me with a solid understanding of the subject, giving me the basic skills and the necessary reading materials. There was a lot of lab work and field work, which I loved.

After graduating, I went on to complete a Master's degree in freshwater and coastal sciences at Queen Mary's on a scholarship that came about directly from my work at NRI/Greenwich. From there I had the confidence and contacts to complete my PhD at University College London. Now I'm a Research Fellow at the University of Surrey and my work focuses on the interface between human health, policy and the natural environment.

Find out more: www.nri.org/study/undergraduate-taught-programmes



Research-led teaching 63

Babajide Milton Macaulay – Sustainable Environmental Management, MSc

Over a decade ago and fresh out of university, I taught biology as my National Youth Service – mandatory for every Nigerian graduate for one year. After I'd finished, I was retained by the Federal University of Technology Akure (FUTA) in Nigeria, and I realised there were some gaps in the Department of Biology – one of them being in environmental science – we had just one environmental expert. I vowed to study this subject abroad.

I applied for the Commonwealth Shared Scholarship and found that the University of Greenwich offered a funded MSc in Sustainable Environmental Management, taught at NRI. I'd never left Nigeria before, so travelling to the UK was slightly nerve-wracking. It was my first time on a plane; then I remember arriving at the Chatham campus in Medway and being so shocked at how cold it was and it wasn't even winter!

As I began to study, I found the pace really fast and full on – and my weakness was revealed. I knew how to write, but I didn't know how to write academically. When we were assessed in Nigeria, it was strictly by examinations, rather than long-form essays, so I simply didn't have the right skills. I went from being a straight A student in Nigeria, to getting disappointingly low scores in the UK. I joined a writing skills class at the Drill Hall Library on campus and gradually my scores improved as I learnt to drop the emotive words I had been using and write with a purely academic focus; impartial and scientific.

I got a lot of help from my supervisor, Dr Debbie Rees – she was so calm and patient, and she understood the difficulties of coming to study in a foreign country. NRI support staff like Caroline Troy were always happy to lend a hand with practical, emotional and moral support and would just check in with us to make sure everything was going ok; it made us feel like part of the NRI team.

After graduating from NRI, I returned to FUTA, and was promoted to Assistant Lecturer. I was awarded another Commonwealth Scholarship for my PhD, which took me to the University of Manchester to research Environmental Geochemistry and Geomicrobiology. I focused on arsenic in groundwater, using samples from Cambodia, where arsenic flows from the Himalayas and ends up in the drinking water. After my PhD and back at FUTA, I was promoted to full-time lecturer specialising in Environmental Toxicology and Pollution Management.

Every time I'm published as an academic, I have NRI and the Drill Hall Library to thank for teaching me how to do it, and Dr Debbie Rees, Dr Peter Burt and Dave Grzywacz – I'm still in contact with them and I'm so grateful for their continued support. My journey into environmental science began with NRI; they set the firm foundation upon which I built my career.

Find out more: www.nri.org/study/postgraduate-taught-programmes



Babajide Milton Macaulay



Richard Lloyd Mills, PhD student

My PhD is in chemical and molecular ecology, and I research the Poultry Red Mite – a small blood-feeding external parasite that primarily infests chickens. I'm essentially trying to find new ways of controlling it. Previously I've worked on Zebra fish embryos and water-fleas, and I was intrigued that there was not much information on poultry mites at all. People knew they represented a serious threat to the poultry industry, but no one really knew how to contain or control them reliably, so that was my main focus. I felt I could make a real impact in an area that was relatively under researched.

One approach to control is through a classical chemical ecology solution where you identify the chemicals emitted by chickens that are attractive to mites, and design traps based around these chemical formulations. I wanted to try a novel approach focusing on chemosensory genes, identifying exactly what genes the mites use to sense and become attracted to chickens. If I can find the repertoire of genes that the mites are using to locate the chickens, new molecular-based mite control methods can be developed.

As my PhD budget wasn't enough to complete this work, my NRI supervisors, Dr Dan Bray and Professor Richard Hopkins, suggested that I apply for a range of grants. They explained that it was rare to get the first one you apply for, and I knew I'd be up against other established researchers. I applied for a grant from the British Egg Marketing Board – I heard back from them pretty quickly and was awarded the full amount, £11,000. I think my application appealed to them as it's a collaboration with a group at the Moredun Research Institute in Scotland which specialises in promoting livestock health and welfare and is recognised for its research into infectious diseases of farmed livestock.

My research offers a potential long-term solution for mite control and offers an alternative to the over-reliance on pesticides. If we can disrupt this fundamental mechanism that they've relied on for millions of years, it's not going to end well for the mites. I've always been interested in how things work at a fundamental level and I love finding out things that no one else knows. I could have directed that curiosity towards anything really, but my early love of biology just kept on growing.

The key thing about a PhD which a lot of people seem to forget is that it's a training degree or programme, we're being trained for a possible future career. We're not full-blown academics just yet. Studying at NRI is great as there's a good level of integration between students and staff and all my supervisors are top scientists and well-renowned in the scientific world. Getting a grant for my PhD work is quite unusual; I don't think many students receive grants. It's enough money to get me through and I'm really excited to see how my research unfolds.

Find out more about PhDs at NRI: www.nri.org/study/mphil-phd-opportunities



Richard Lloyd Mills



New degrees at NRI: focus on climate change, transformative change, and food safety and innovation

Despite progress in many aspects of global development over recent decades, 690 million people experienced hunger in 2020. Degradation of our natural resources – land, water, forests, and biodiversity – continues at alarming rates. The food supply chain faces a series of global issues concerning sustainability, safety and innovation. These challenges are exacerbated by climate change and violent conflicts in many parts of the world. How will we tackle ongoing global challenges? Join our new study programmes:

Climate Change, BSc: Climate change, together with food security and inequality, is a top concern for many around the world; as climate science is reported more in the media, 'climate literacy' is becoming ever more important too. This cutting-edge degree offers the skills to assess the impact of our changing climate, to develop solutions to mitigate emissions and adapt to a changing world. This new BSc combines a diverse range of subjects, from land use, water use and energy management to topics in the social sciences and economics, such as law, equity and climate justice, business and trade, and explores the interactions between the atmosphere, the biosphere and the economy that underpin the current mitigation gap and emerging adaptation challenges.

www.gre.ac.uk/undergraduate-courses/engsci/climate-change-bsc

Transformative Change for Sustainable Development, MSc (TC4SD): Tackling serious global challenges and ensuring a sustainable future will require Transformative Change (TC) – change that is disruptive, systemic, occurs at relatively large scales, and involves a reconfiguration of technology, economy, institutions, and society. Our TC4SD MSc provides students with an in-depth understanding of Development Studies theory and practice, including different conceptions of human, societal and environmental changes. Drawing on real-world lessons from various domains, sectors and contexts, students will develop the capacity to critically discuss, analyse, and evaluate TC and develop hands-on skills in sustainable development design and planning, project management, research, and impact evaluation methods.

www.gre.ac.uk/postgraduate-courses/engsci/transformative-change-for-sustainable-development-msc

Applied Food Safety and Quality Management, MSc & Food Innovation, MSc – with Industrial Practice: Our two-year food programmes with Industrial Practice will suit graduates and entrepreneurs who are looking for careers developing safe and sustainable food within the supply chain. Students from both programmes look at cross-cutting aspects and will discover the importance of enhancing sustainability and creativity within food supply chains, the design, implementation and management of food safety and quality systems, and developing new ingredients and products. Our popular programmes include a one-year internship with a relevant employer, preparing graduates for a range of managerial roles. Current students are finding the knowledge and skills gained on the MScs highly relevant when they go into the placement, which are then supplemented by practical experience.

www.gre.ac.uk/postgraduate-courses/engsci/food-innovation-with-industrial-practice-msc

www.gre.ac.uk/postgraduate-courses/engsci/applied-food-safety-and-quality-management-with-industrial-practice-msc



New degrees at NRI: Top left: Transformative Change for Sustainable Development, MSc. Top right: Climate Change, BSc. Bottom left: Food Innovation with Industrial Practice, MSc. Bottom right: Applied Food Safety and Quality Management with Industrial Practice, MSc

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Rural institutions, land and governance

- Professor Julian Quan, Professor of Land and Development Practice
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Root and tuber crops in development

- Dr Louise Abayomi, Senior Research Fellow – Postharvest Specialist
- Dr Gonçalo Silva, Research Fellow: Molecular Biologist / Virologist

- Professor Susan Seal, Professor of Molecular Biology; Molecular Plant Pathologist

Research-led teaching

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Page 35:	Dutch Government programme, the Fund against Child Labour (FBK)		

The NRI Team

NRI's team is made up of over 130 members of staff including natural and social scientists, technicians, and specialists in project management and administration, communication, finance, IT and other fields. We are based at the University of Greenwich Medway campus in Chatham, UK, with many of our staff undertaking overseas assignments all over the world, working with international partners to achieve our mission.

To see the full list of staff and their contact details, visit:
www.nri.org/about/organisation-and-staff/all-staff

Senior Management Team, as of 31st March 2022





Professor Andrew Westby, Director of NRI, Faculty Director of Research and Enterprise
 Professor Ben Bennett, Deputy Director of NRI, Deputy Faculty Director of Research and Enterprise
 Professor Adrienne Martin, Director of Programme Development
 Mark Parnell, Commercial Manager
 Dr John Orchard, Director of Postgraduate Research Studies
 Professor Andy Frost, Director of Business Development and Partnerships
 Claire Coote, NRI Teaching and Learning Leader
 Professor Vegard Iversen, Head of Livelihoods and Institutions Department
 Dr Nazanin Zand, Head of Food and Markets Department
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Sustainability Annual Report

2021/22



UNIVERSITY OF
GREENWICH
London | Kent

Foreword

Sustainability is integral at the University of Greenwich and continues to be embedded into our curriculum, operations, and research. I am delighted to present the Seventh Annual Sustainability Report which details what sustainability initiatives and achievements have taken place over the 2021/22 academic year, and how sustainability is having a real impact across the university.

At the close of the previous academic year, we launched our 'This is Our Time' strategy, where our commitment to sustainability was demonstrated throughout the six sub/enabling strategies. At the start of this academic year, the United Nations Climate Change Conference (COP26) was held in the UK and the university further displayed its commitment to sustainability by joining the COP26 Universities Network and presenting our academic work in Glasgow.

Whilst we were still grappling with the challenges brought about by the global pandemic, we adapted to new more flexible ways of teaching and working. Crucially, we launched a Green New Travel Plan which focuses on reducing carbon emissions from commuting and business travel, and this, along with our hybrid working model, has reduced staff commuting emissions by 1,935 CO2e.

Our sustainability efforts have not gone unnoticed with University of Greenwich being ranked 23rd in the United Kingdom by People and Planet's University League for the positive impact the university has had. We also performed well in the Times Higher Impact ranking 19th in the world for its commitment to SDG10: Reduced Inequalities and 60th in the world for SDG17: Partnership for the Goals. These are outstanding achievements, and I am very proud of the continued efforts being made by our students, staff and partners who have contributed to make the university a more sustainable place.

This report highlights the scale of activity and the power of collaboration and collective action. However, to build upon and continue to deliver these strategies, policies, and initiatives we all must continue to take action both within and outside of the university.

Professor Jane Harrington
Vice-Chancellor



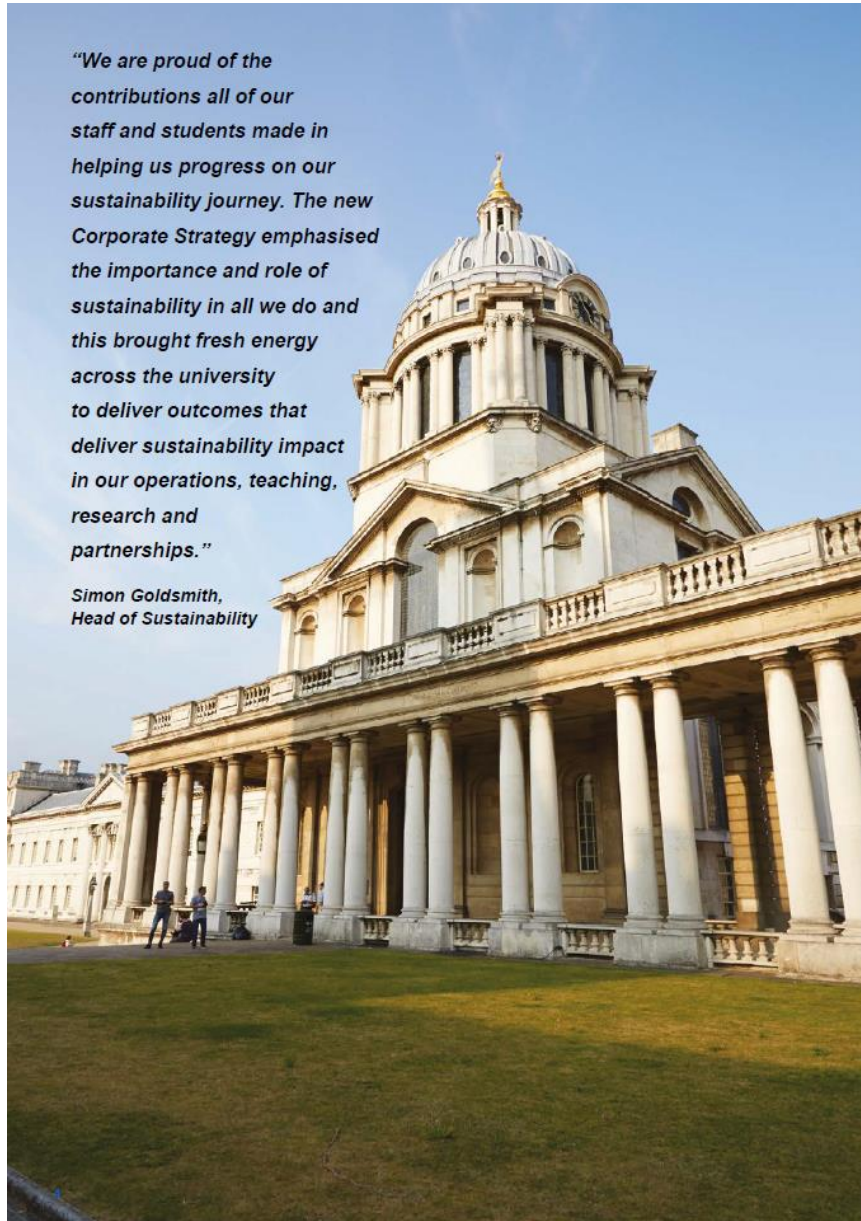
Professor Jane Harrington receiving the Planet Mark Net-Zero verification certificate from Steve Malkin, CEO of Planet Mark. 11th June 2021

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Waste and Recycling	26
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"We are proud of the contributions all of our staff and students made in helping us progress on our sustainability journey. The new Corporate Strategy emphasised the importance and role of sustainability in all we do and this brought fresh energy across the university to deliver outcomes that deliver sustainability impact in our operations, teaching, research and partnerships."

*Simon Goldsmith,
Head of Sustainability*



Introduction

Welcome to the University of Greenwich Sustainability Annual Report 2021-22.

This report provides a summary of the initiatives and efforts made by the entire university community during the 2021-2022 academic year in pushing towards our sustainability targets. From managing our estates and facilities, to world-leading climate research and engaging with our local communities, we have continued to make significant progress in achieving our sustainability ambitions and advancing towards our commitment to reach Net Zero by 2030 (Scope 1 and 2 emissions with reducing business Scope 3 emissions by 50%).

The university is motivated by its ability to empower change and the significant impact of our global contribution when we act together, from the smallest individual action to life-changing research. Our [Sustainability Policy](#) ensures that we are leading by example whilst encouraging the next generation of leaders.

We consider environmental impact throughout our operations; sustainability is an interlinking thread between all six enabling strategies set within our '[This is Our Time](#)' corporate strategy, which launched in 2021. The values of inclusivity, collaboration and impact are crucial to delivering positive change.

Celebrating achievements across all three of our campuses, we combine rich heritage with high-tech learning and research facilities, providing an environment which stimulates enquiry, celebrates scientific endeavours, and promotes well-being.

Whilst this report is only a snapshot, it provides a great overview of what we're up to, how sustainability is embedded across the university, and our ambitions for the future. We hope it inspires you to act on climate and sustainability, no matter your role within or outside of the university.

"Supporting and acting responsibly on the green issues of today and tomorrow is also crucial to the future success of the university. We take our sustainable development responsibilities very seriously and we are focused on working in partnership with others to collaborate on climate change and the green agenda.... We will work to embed sustainability in student experience, university operation and our financial strategy".

This is Our Time Strategy, 2030

Contributing to the Sustainable Development Goals

Greenwich and SDGs

The University of Greenwich recognises its responsibility in playing a central role in delivering sustainability across its work, including teaching, research, and operations. The contributions we make can be clearly identified and reported against using the United Nations (UN) Sustainable Development Goals (SDGs). These are 17 agreed goals covering social, environmental, and economic sustainability objectives that are to be delivered across the world.

Here is a summary of how each of the action areas in this report are most closely linked to the SDGs:

Energy	7, 13, 17
Carbon	13, 17
Travel & Transport	9, 11, 13, 17
Water	6, 13, 17
Waste & Recycling	12, 13, 17
Sustainable Food	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17
Ecosystem Services	14, 15, 17
Construction & Refurbishment	9, 11, 13, 17
Environmental Management System	13, 17
Education & Research	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17

Embedding the SDGs

Each of the impact areas set out in this report highlights how we are contributing to the SDGs. This year has seen many of us coming back to campus after the pandemic, but with a significant difference in working patterns. As we settle into a more hybrid working model, we must learn to adjust how we embed the SDGs into our operations, buildings and teaching.

For a full breakdown of how the university contributes to the SDGs, please see our 2021-22 SDG Report.

Awards and Recognition

Here at Greenwich we work with staff, students and partners to implement sustainability initiatives that make our community a better place. In 2021-22, we were awarded and ranked on our social impact. Below is an overview of these awards and recognitions.



Times Higher Education Impact Rankings

The Times Higher Education Impact Rankings assess universities against the UN SDGs and recognises commitment to positive social and environmental impact. In 2021/22 Greenwich ranked between 101-200 overall.



People and Planet

The People and Planet's University Green League ranks UK Universities by their environmental and ethical performance. In 2021/22 the University of Greenwich was ranked 23rd and maintained its First-Class score.



ISO14001 Accreditation

Our Estates and Facilities Directorate (EFD) has operated to international ISO14001 (Environmental Management) standards since 2012. ISO14001 is a voluntary international standard set through environmental management systems (EMS) to reduce impact and risk. We successfully passed our re-accreditation audit during 2021.



Fairtrade Accreditation

The Fairtrade university and college award gives recognition to institutions that have embedded ethical and sustainable practices through their curriculum, procurement, research, and campaigns. We have been an accredited Fairtrade university for over 10 years.



Hedgehog Friendly Campus

Since May 2020, The University of Greenwich has been signed up to the national Hedgehog Friendly Campus Initiative. In 2022 we were awarded with Silver Accreditation for Hedgehog Friendly Campus.

Snapshot!

An overview of our key findings of this year

23rd
in the
UK

Ranked for its
environmental
and ethical
performance

99%

of Students and Staff
felt that sustainability
is important or
extremely important
for the university to
consider

18%

Reduction in
carbon intensity per
student and staff,
from 0.31tCO₂e to
0.26tCO₂e, despite a
total increase of 2,000
people

Reduced Scope 1 & 2
emissions from
7,021 tCO₂e in 2018/19 to
5,384 tCO₂e in 2021/22



Increased lines of Fairtrade
items at all our outlets



234 Bags of Coffee Grounds
Reused



100% Fish sold is MSC
Certified



73% of Tea, Coffee, Sugar and
Bananas are Fairtrade



Embedded sustainability into our
Curriculum Framework



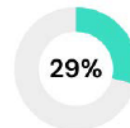
Continued our **Living Lab
Programme** to drive engagement
with sustainability



Improved REF ranking by 25
places, taking it to joint **78th**
place



Launched a new
Green Travel Plan



Decreased
commuting
emissions by **29%**
from the previous
year



Decreased
emissions made by
business air travel
by **69%** from the
previous year



Increased Cycle to
Work Scheme to
£3000



Fitted **Automated Meter
Reading (AMR)** devices
on all utilities meters
supplies of water



Successful creation of
mini meadows at Avery
Hill, paving the way for
similar areas across all
campuses



Artificial habitat (bird
boxes, bat boxes and
hedgehog homes) scheme
to be trialled at Avery Hill

Installed
Smart Heaters
at Avery Hill
Campus

Energy
consumption
reduced by
0.76% (kWh)



Recycling rate of **36%**



Reduced single cup waste in
cafes which saw a **247%**
increase in reusable water
bottle sales



Avoided **42,644 KG CO₂**
through the Furniture Reuse
Scheme since November 2019



Avoided **£87,037** of
procurement costs through
the Furniture Reuse Scheme
since November 2019



£19,012 worth of furniture
donations to local community
groups



1,358 bags (10,800kg) of
items were donated from
students to the British Heart
Foundation

Energy

Target: *To reduce non-residential energy consumption by 14% by 2022 from a 2015/16 baseline.*



Energy

Annual Energy Consumption

The university has seen an increase in electricity consumption (+7.22%), but a decrease in gas consumption (-8.71%) and total energy consumption (-0.76%) compared to 2020/21.

One of the causes in the reduction in gas consumption was the closure of the Mansion site in 2020/21 meaning a significantly large set of buildings were no longer heated and powered.

Electricity consumption was expected to increase with the return to on-campus 'business as usual' following the pandemic, and increased student numbers. Ongoing hybrid working has meant that in many cases, buildings have remained heated, however on site electricity consumption by staff has reduced.

In 2022, the UK has its first readings above 40°C in July. It has also been the joint warmest summer on record according to mean temperature in England. This meant more demand for electricity to drive air handling units and air conditioning systems.

Energy Saving Tip
Change light bulbs to LEDs and you can save **£40 per year**

Upgrades to Lighting Systems

The university has been replacing florescent lamps with LED fittings in student halls, which saves a significant amount of energy as they require less to produce the same amount of light output.

We have also installed Thorlux Smartscan LED lighting into the teaching spaces, which dims or switch off lights according to the room's local environment. This can save up to 80% of energy. It also allows us to monitor the energy performance of different buildings constantly, in addition to capturing the occupancy of rooms which will help us understand more about the situation and further reduce consumption by better targeting room utility.

Smart Heating and Chilling System

In 2021, the university has replaced all of the electric heaters with smart control heaters in the university owned Avery Hill halls. It monitors and manages energy use in each room, making sure that energy is not used when not needed. Compared to pre-Covid times, we have seen a **12.5%** decrease in energy usage.

As planned, we will be upgrading heaters in Cutty Sark (one of the halls in Greenwich campus) to the Prefect system. We are also adding smart controls to Medway Central Services chillers to save energy.

Student Engagement

The university subscribed to the Student Switch Off campaign (SSO), a behavioural change campaign run by Students Organising for Sustainability UK (SOS-UK) which focuses on sustainability through student-led actions. Through quizzes, surveys, trainings, and competitions, SSO promoted energy efficient behaviours to our students living in the university halls. **160,719kwh** was estimated to be saved during the year through student actions; that is equal to saving **37 tonnes** of carbon emissions.

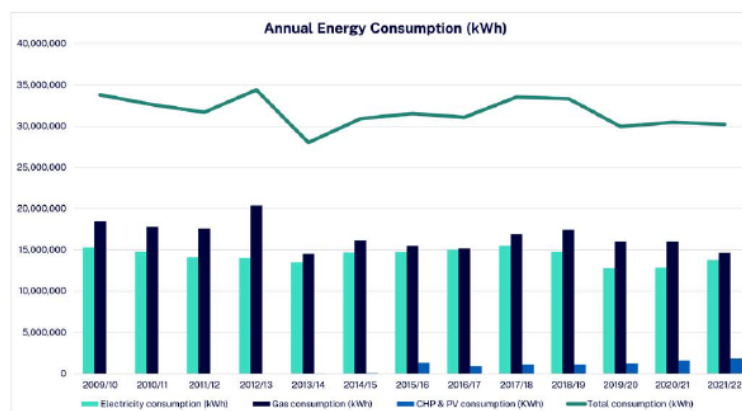


Figure 1: Annual Energy Consumption at the University of Greenwich

"The university has committed to replacing its gas fired heating systems with electrical systems by 2030. By replacing them with electrical will lower amount of emission of carbon dioxide into the atmosphere."

Noel McSweeney,
Building Services Manager



Carbon

Target:

*To achieve Net Zero by 2030
as outlined in the Net Zero Carbon Strategy.*



Carbon

The university is committed to achieving net zero by 2030. In spring 2021 we commissioned external experts to assist in the creation of the university's **Net Zero Action Plan**. The plan includes analysis to fully cost and set timelines for completion to ensure we meet this fundamental target/KPI. The overall target comprises of:

Scope 1 and 2 emissions

Net Zero baseline of **3,234.9 tCO₂e** with 2030 emission of zero (carbon produced directly from sources used and owned including electricity, gas, owned vehicle fleet and other sources of energy). The electricity element has two calculation methods:

- Location method: an average national carbon emission factor
- Market-based method: a more accurate carbon emission factor based on the specific supply of electricity to the organisations.

The university provides both calculations; however, our electricity supply is certified as Blue Business 100% carbon free meaning our market-based emission factor and electricity is 0t CO₂e and this is method included in our Net Zero Plan.

Our total market-based value for 2021/22 is therefore **2,720 tCO₂e** (the location-based value is 5,384tCO₂e), a positive reduction of 16% compared to baseline. More work is required in order to fulfil the net zero target.

Scope 3 emissions

Net Zero baseline of 3,075.9 tCO₂e with 2030 reduction target of 50% (indirect emissions from operations and processes; for the Net Zero Target this includes utilities consumption in the estate relating to third parties occupants in shared buildings, Waste, Water, Business Travel (non-fleet) and Laboratory gases).

It should be noted that other Scope 3 emissions, such as those from procured goods and services, employee, or student commuting, have been excluded at this stage but must be considered as a future second phase for the university to progress to net zero in its full sense.

The footprint for 2021/22 is **1,080 tCO₂e**, a significant 64% reduction; however it has to be mentioned that the baseline was pre-covid and compared to 2020/21 the emissions doubled so a long-term analysis will need to be conducted post-covid to identify any positive trends.



Being accurate is crucial for Greenwich to meet its Net Zero by 2030 commitment. Our carbon calculations are verified externally by Planet Mark's Business Certification every year, meaning our stakeholders can be confident of our progress and our transparency in showcasing the challenges to overcome.

David Jackson,
Sustainability Projects Officer

Total Calculated Emissions

The university does conduct analysis on the Scope 3 emissions not included in the Net Zero Plan; these are less accurate nationally due to methodologies and assumptions required, however it becomes apparent that Scope 3 emissions and our procurement aspects are crucial to consider. Typically, Scope 3 emissions account at least 70% of 'total' emissions and this University is no different with an additional 60,331 tCO₂e attributable to procurement.

Notable Changes 2021-22

The university purchased two fully electric double decker buses that run between Avery Hill and Greenwich campuses. These were in service from the summer of 2021 and join two hybrid coaches that the university runs between Greenwich and Medway campuses.

In 2021/22 the university worked with local authorities to understand the feasibility of partnering in zero carbon district heating systems at Medway and Greenwich campuses. In 2021 the university won £1.1 million of the Public Sector Decarbonisation Scheme fund and has added its own investment to deliver and air source heat pump system that will lead to decarbonisation of 60% of the gas heating system at Avery Hill from December 2023.

Planet Mark

The university has partnered with Planet Mark in helping to reach its commitment of net zero by 2030. The partnership will explore collaboration, in a range of areas including green jobs and engagement in curriculum design. Helping students and graduates become employable after graduation is important for the university and setting the students up with the knowledge and skills to help companies to make the sustainability changes and transformation will drive meaningful change.

Travel and Transport

Target: *To reduce harmful emissions and encourage active travel such as cycling and walking to our campuses and using university-owned electrical vehicles.*



Travel and Transport



New Green Travel Plan

In 2022 the university launched its **New Green Travel Plan** which outlines how the university will reduce its carbon emissions from transport and get us on route to Net Zero by 2030. To achieve this the university:

- Launched Double Decker Electric Vehicles in September 2021 adding to our hybrid coaches bought the previous year.
- Built new bike shelters at Pembroke and Sparrows Farm.
- Termly visits from Dr Bike to help students and staff keep their bikes in good condition.
- Extension of Cycle to Work Scheme from £1000 to £3000

With the lingering effects of the pandemic still in place, students and staff have learned how to embrace technology to replace travel when practical to do so.

Commuting Data

The Annual Travel survey highlighted that more and more students are choosing sustainable modes of travel to commute to the university.

Most students took either public transportation such as the DLR (17.7%), the London Underground (16.7%), the public bus (15.6%), national rail (11.1%) or walked (12.3%). This is in comparison to those that drove (11.4%). However, bicycle levels are still low at 0.7%.

This year has seen a lot of our staff returning to the workplace, whilst still adopting a flexible hybrid working pattern. This has reduced staff commuting and as a result has reduced commuting emissions by **6,661 tCO₂e** pre-covid (2017/18) to **4,726 tCO₂e** post-covid (2021/22).

Business Travel

National and international travel can play a key part in achieving our academic and research objectives. However, the pandemic has highlighted alternative ways of staying connected without the necessity of travel.

With the new Green Travel Plan the university is strongly encouraging staff and students to adopt alternative modes of transport and reducing non-essential travel. Tackling the number of flights and total distance travelled by air is a core focus. In 2018-2019 emissions from air travel made up **2335.19 tCO₂e** of business travel carbon emissions by University Staff. This compares to this year with **733.77 tCO₂e**, showing a reduction from pre-covid and it is hoped a new long-term trend.

Whole University Annual Distance Travelled:

81,447,300km



That is equal to **106** journeys to the moon and back!

Reduce your Emissions
Download apps such as **Betterpoints & Green Rewards** that reward you for avoiding travel by car

Water

Target: *To reduce water consumption by 1% per annum.*



Water

Water Analysis

Water usage rose by **20.2%** compared to 2020/21. With students returning back to campus after the coronavirus pandemic, along with record breaking temperature extremes in the summer (over 40°C heat was recorded for the first time in London) - this put more pressure on water consumption and may help to explain the increase in overall consumption.

Reducing Consumption

We are moving to fit Automated Meter Reading device (AMR) on all metered supplies of water and have started the installation of flow restrictors on water outlets in Avery Hill. We will be piloting the start of a Remote Temperature Monitoring System at the David Fussey building and are looking to install dual flush/water saving devices through the rolling toilet refurbishment programme.

Better monitoring through out of hours alerts and on the metering portal will assist in resolving leaks quickly.

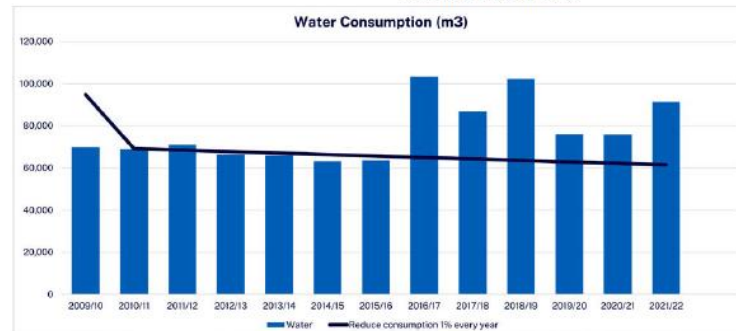


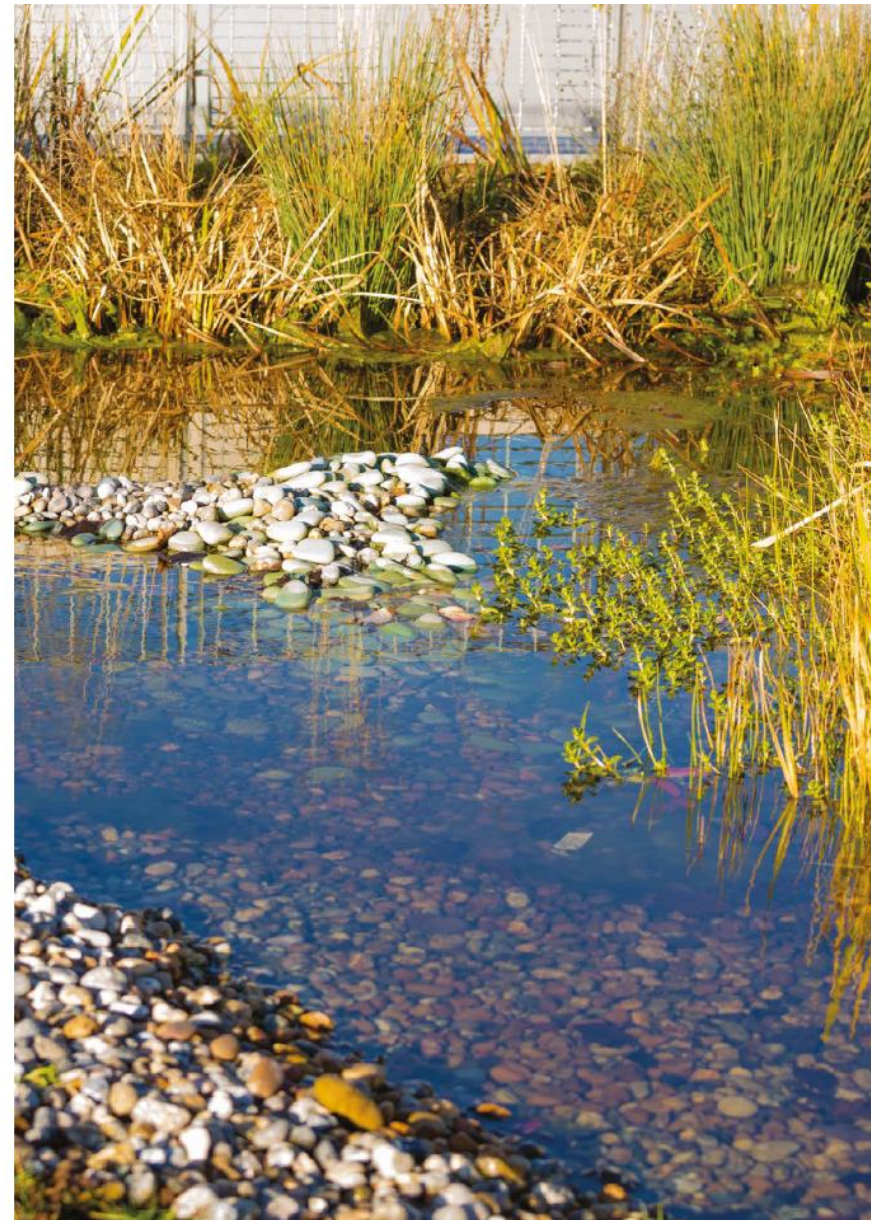
Figure 2: Annual Water Consumption at the University of Greenwich

Water Usage on Campus

We closely manage watering our grounds. We select more drought tolerant plants for our beds and do not water our grass areas even in the hottest and driest of years.

We encourage staff and students to avoid wasting water by not leaving taps running and reporting drips and leaks. Plans for any redevelopment of the estate will investigate the potential for grey water, rainwater harvesting and also look to ensure sustainable drainage systems are designed in to reduce any surface water flooding that could occur downstream of the campuses.

Water Saving Tip
Take a shorter shower! 1 minute shorter can save **21 glasses** of water



Waste and Recycling

Target:

To achieve a 70% recycling rate (by weight) of non-construction waste and reduce total waste of non-construction waste by 5% annually.



Waste and Recycling

This is Our Time Strategy states "we will address pollution by reducing harmful emission and discharges by promoting the 'zero waste' principle (rethink, reduce, reuse, recycle) to minimise the environmental impact of the use of natural resources and waste disposal." (p.56). The university is committed to reducing the harmful impacts associated with waste generation and is continually striving to increase its partnerships with organisations that share this vision.

Total Waste

The total waste has seen an increase from **388 tonnes in 2020/21 to 636.20 tonnes in 2021/22**, however this can be explained through students and staff returning to campus after the pandemic. Pre-covid, the average generation was **700 tonnes** per year and this therefore shows an overall positive reduction when looking at the bigger picture.

Can I be Recycled?
70% of waste can be recycled so double check is it going in the right bin!

Recycling

Recycling rates fell from **39% in 2020/21 to 34% in 2021/22**.

Pre-covid the average recycling rate was around **50%** per year, which demonstrates the ongoing challenges the university faces whilst returning back to normal operations. The success of our Circular Economy schemes such as End of Term and Furniture Reuse highlight our commitment to reaching our waste targets.



Clothes Swap

In 2021, a student group called 'Circular Textiles' launched a sustainable clothes swap. It was a great innovation in which the events included sustainable make-up, repair stations and the clothes swap. The student group inspired the Sustainability Team to investigate developing their own clothes swap for future years.



Furniture Reuse

Procurement is a significant contributor to emissions and environmental impact; with teaching, office and social spaces undergoing frequent change, there is an opportunity in reusing items. The Furniture Reuse Scheme to date has saved: **£87,037, 20 tonnes from waste and 42,644 KG CO2** since its launch in November 2019.

Additionally, when items are no longer required internally, community outreach is conducted for potential donations; the university has donated almost **£20,000** worth of items to local charities, hospitals and schools.



Lost Property

A process is in place to attempt to reunite lost items to individuals, but after a period of time that item may require a new home. Where possible donations are made to reduce unnecessary waste. Internally, items are donated to Bargain Corner - an honesty shop at Medway to help students on a budget. Externally, donations are made to local charities.

Two trolleys donated by Library Services will be used next year for students to takeaway books that have not been claimed through the lost property system, providing free books and stationery to students around our campuses.



End of Term Reuse

The university continues its partnership with the British Heart Foundation to encourage students and staff to donate any unwanted items before leaving at the end of year. This saves on unnecessary waste and helps to raise research funds.

In 2021/2022 academic year, **1,358 bags or 10,800kg of items** were donated, leading to **£19,012** being raised and **64,121 kgCO2** being saved. Since the scheme started in 2010 we have raised **£47,068** for the British Heart Foundation and saved **375,928kg CO2**.

Sustainable Food

Target: *To provide nutritious and sustainably sourced, prepared and served food to students, staff and visitors.*





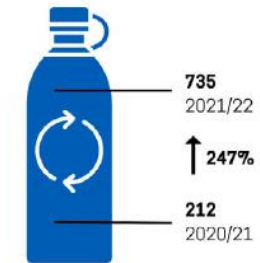
Sustainable Food

The university and its catering partners recognise their responsibilities to provide nutritious and sustainably sourced food to students staff and visitors. Our **Sustainable Food** and **Fairtrade** Policies outline our operational processes and targets.

Reusables

Reusable water bottle sales increased from **212 in 2020/21** to **735 in 2021/22**, alongside an increase in number of hot drinks sold in reusables from **10,892 in 2020/21** to **22,087 in 2021/22**. Challenges were seen however with the hot drink cup reuse rate being at an average of **16%**.

Trials of a 'rent-a-cup' scheme failed to increase the reuse rate, with involvement of student positions and a redesigned campaign due in 2022/23. Lingering concerns over Covid and touch points may have been a contributing factor, but disposables remain a significant issue and an investigation into disposable taxes is underway.



Accreditations

Fairtrade reaccreditation took place between 2020-2022, results came in August 2022 that we gained **Level 1 Fairtrade Accreditation Status**. We retained Food for Life Gold at all our outlets for all our menus. We retained the MSC certification as all seafood comes from MSC certified stocks.

Meat Free Meals

2021/22 have seen an increase in meat free meals sold in our outlets from **4,056 in 2020/21** to **6,717 in 2021/22**. However, the overall percentage of meat free meals has dropped **2%** in the past year. This could be a result of post-covid, students coming back to campus and therefore more meals have been sold, however, more work needs to be done to understand this change and also to increase the percentage.

Fairtrade Fortnight

Every year the university holds an Ethical Food and Fairtrade Fortnight (EFFF) in support of the national Fairtrade Campaign. The event helps to raise awareness of how food choices can make positive impacts, both on the environment and ethically for farmers. This years EFFF was held online.

"As a student leading on the accreditation this year, it has been a great learning experience. I have learnt so much, not only on the importance of Fairtrade but great skills on leadership, communication, and organisations. I look forward to working with everyone to continue encouraging Fairtrade and ethical products in the future."

Sophie Elliott, Student Sustainability Projects Assistant with the Sustainable Development Unit (a paid, Job Shop position)

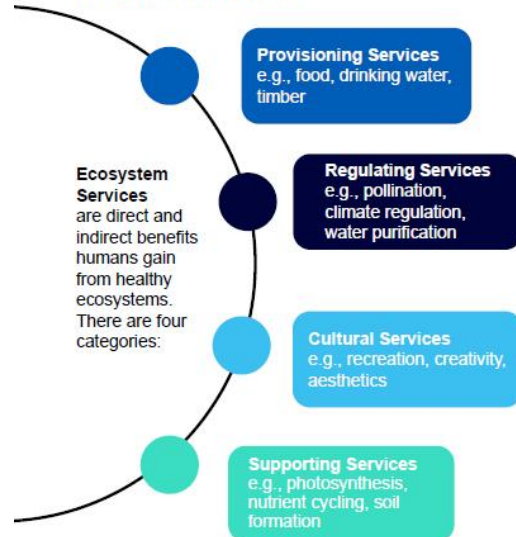
Ecosystem Services

Target: *To maintain and enhance the biological diversity of the campuses natural land whilst balancing the conservation opportunities with amenity needs.*



Ecosystem Services

Moving away from the 'typical' biodiversity evaluations, we have expanded our objectives into wider ecosystem services with assessing organisational impact and opportunity. Our **Biodiversity Action Plan** (BAP) covers the years 2020-2025, split into four objective areas and supports our Ecosystem Services Policy reviewed on a biannual basis.



Hedgehog Friendly Campus

Hedgehogs are biological indicator species, meaning that their presence indicate a healthy ecosystem. However, their population has declined by 50% in rural areas since 2000. The university has been working hard to bring hedgehogs back on our campuses by enhancing the habitat, and in 2021 we had our first reports of them since 2006. We are also awarded with silver accreditation for Hedgehog Friendly Campus in 2022, moving on from last year's Bronze Accreditation.



Habitat Monitoring and Enhancement

We are completing habitat surveys across our campuses to help guide future habitat improvement. 10 bird and bat boxes were installed around the Avery Hill campus with monitoring set in. The first 'mini-meadows' were trialled also at Avery Hill, transforming three small 1x7m sections of amenity lawn into a more diverse habitat. These were highly successful, with a variety of butterfly, moth and bee species identified. Following guidance from Butterfly Conservation, we are looking to expand the scheme at all campuses.

Avery Hill was also subject to a new mowing regime; altering the contracted 'one-size fits all' grass cutting to a more varied programme. The aim was to allow more flowering plants and to increase root strength, which in turn would better support the wider ecosystem. Balancing the conservation with the need for social and teaching amenity lawns was crucial, and following its successful first few months will be expanded to all campuses next year.

Engagement

At Avery Hill we have an organic food and forest garden, both cared for by volunteers. The Edible Garden provides fruits and vegetables for free for any of our staff, students, and community members to harvest.

Beehives are present at all campuses, providing honey for student and staff rewards whilst offering an engaging opportunity to get close and personal with a key invertebrate. Knowing how native bee populations can be outcompeted by honeybees, no more hives will be installed on campus and monitoring will ensure no adverse effects are felt on the native populations.

Nature can be a crucial ally to educational teaching; we welcome Primary Education and Early Years lecturers to the garden every year to learn how natural spaces can be used in the curriculum. We provide training to any academic who is interested to demonstrate how the garden can be used in education and to highlight areas of potential interest.



Construction and Refurbishment

Target:

*To create multi-purpose spaces that drive utilisation and to improve space utilization by 6% per student.
Carbon neutral is central to all investments.*

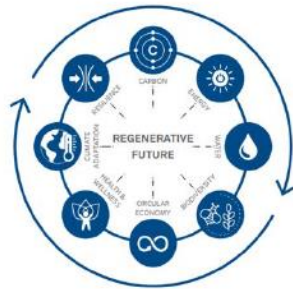


Construction and Refurbishment

Strategy

Our new **Estates Sub Strategy**, launched in March was ratified by the Governing Body. This sub-strategy is intertwined with the Digital and People-enabling sub-strategies help delivery of all.

Supporting our Corporate Strategy to 2030, the Estates Sub Strategy will deliver a modern estate that would be expected at a top modern university. It will support our commitment to be Net Zero by 2030 with sustainability its core embedded theme, with its Campus Masterplans designed to influence behaviour and habits in all our capital projects; the university currently holds position 23 out of 154 universities in the People & Planet University league. We have a target to move and sustain a top 10 position by our investment in estates, carbon reduction and sustainability.



Improving the Space Management and Energy Usage of Existing Buildings

The university has a rich and varied estate, ranging from the historic 17th Century architectural masterpiece of Greenwich Maritime and the Edwardian redbrick of Medway Campus to the parkland mosaic of buildings at Avery Hill and the futuristic BREEAM Excellent rated Stockwell Street building.

To reach Net Zero, particularly with our older and historical buildings, we need to closely reconsider the original building design to understand how we can create the dynamic spaces required whilst reducing their carbon footprints. Furthermore, by taking buildings back to their original design we also increase employability and collaboration with local tradesmen.

Case Study

Digital Twin of Queen Anne

Collaboration with Captivate, the Estates team have managed to use world-class technology to create a digital copy of the Queen Anne Building. By upgrading the Queen Anne building, it removes the need for a new building elsewhere.

Mohammad Sakikhales, a lecturer in Property and Construction Management in the School of Engineering is currently working on a project which involves creating a digital twin on this building. This project aims to understand the most important parameters (e.g., internal/external temperature, occupancy rate) to optimise the overall sustainability performance of an historic building.

By implementing Digital Twin, we will learn about the building and its operational patterns, enabling the development of different scenarios to test the decision making of the building's operation, manage real-time issues and ensure long-term conservation. The Digital Twin would also be able to identify risk and threat scenarios that may arise in the future, e.g., related to climate change, such as the urban heat island effect and flooding.



Environmental Management System

Target: To maintain ISO 14001 certification for Estates and Facilities Directorate.





Environmental Management System

Our Estates and Facilities Directorate (EFD) is proud to operate to international ISO1 4001 (Environmental Management) standards. ISO 14001 is a voluntary international standard set through environmental management systems (EMS) to reduce impact and risk.

An EMS is a set of processes and practices that enable organisations to reduce environmental impacts, increase operating efficiency and integrate sustainability thinking into operations. It requires senior leadership in addition to operational innovation and collaborations to allow developments without overusing limited resources. This includes waste, energy and utilities, transport, construction, training, legal requirements, emergency plans and natural grounds management.

Our EMS allows us to increase cost savings and efficiency, reduce environmental risks and ensure collaboration occurs between staff. Where issues occur, 'non-conformances' are raised that require corrective action to route cause, ensuring the issues do not arise again in the future. We have a team of staff and students who

conduct internal audits to our processes to an annual programme. Externally, surveillance audits occur annually, with a full re-accreditation compliance audit every three years done against strict criteria.

We have been accredited since 2012 and during 2021 we experienced our third full re-accreditation; achieving the standard with no non-conformances to our processes and four observations for areas of improvement.

There are ten clauses in the ISO 14001 standard that follow, and push an EMS to the plan, do, check, act model (Deming cycle refer below), a cyclical system which requires continuous improvement.

Management systems require continual review and evolvement to ensure all processes are to a safe and modern standard. Following this successful re-accreditation the university is looking towards the future in expanding the scope of the EMS to include wider Faculties and environmental processes involved with teaching and research practices.



Figure 3: EMS Cycle

Education and Research

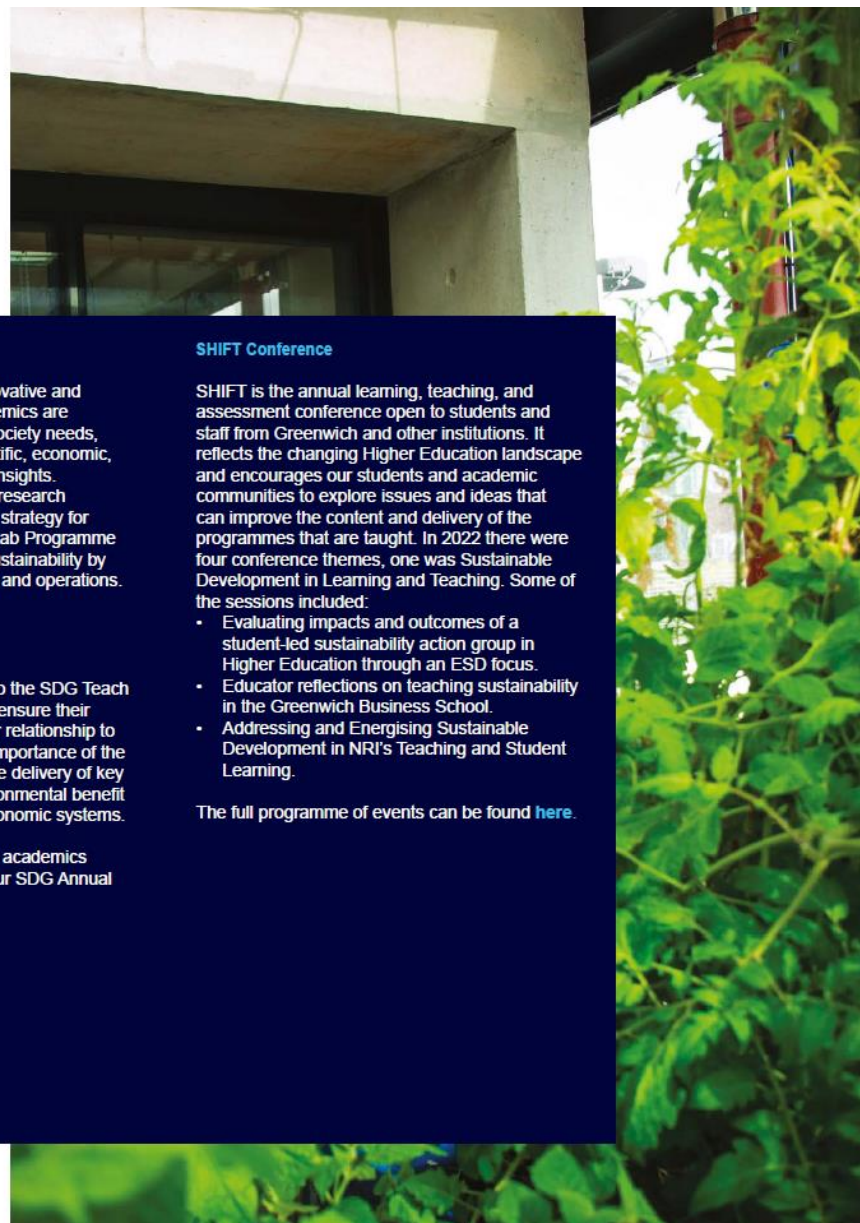
Target:

Actively encourage and support the teaching of and research into sustainable development in the university supporting staff to embed principles of sustainable learning and teaching practice in curriculum development and delivery.



Education and Research

It is increasingly important for teaching institutions to ensure their graduates are equipped with the knowledge and skills required to help deliver a net zero and sustainable world. In order to embed sustainability throughout teaching and research, our [Curriculum Framework](#) was formally launched in 2021 with sustainable development included as one of eight dimensions. To help teaching staff, the Sustainability Team created this useful resource [bank](#).



COP26

In support of the 2021 United Nations Climate Change Conference (COP26) the university joined the COP26 Universities Network, and signed the Global Climate Letter for Universities and Colleges committing to going net-zero.

Deputy Vice Chancellor, Prof. Javier Bonet, chaired a working group meeting fortnightly to ensure that the university was engaged with the COP26 programme in Glasgow, delivering learning opportunities at Greenwich and ensuring that the Conference and some of the solutions were promoted to help individuals and societies help meet carbon targets.

Education for Sustainable Development

Professor Wim Vandekerckhove and Simon Goldsmith (Head of Sustainability) set up an Education for Sustainable Development Community of Practice. This met termly with contributions from staff sharing how they are applying sustainability in their teaching and learning.

One of the sessions focused on how the university is considering sustainability from a corporate strategic level and how to integrate this in the sub strategies, including Student Success and the Sustainability Cross Cutting Strategy. Senior Lecturer, Louise Hewitt from the School of Law and Criminology, presented about how student reflections on an extra-curricular activity helped her realise what learning for sustainability entails, and how she is now bringing this to big student groups as part of the curriculum.

Living Labs

At Greenwich we are proud of the innovative and impactful work our students and academics are doing in helping create the solutions society needs, using engineering, architectural, scientific, economic, political, legal and many other expert insights. Greenwich's Living Lab offers real life research opportunities, that have emerged as a strategy for sustainable development. Our Living Lab Programme continues to drive engagement with sustainability by bringing together research, education, and operations.

SDG Teach In

Every year our academics contribute to the SDG Teach In. We encourage staff to sign up and ensure their teaching highlights the SDGs and their relationship to subject areas. This is to highlight the importance of the SDGs as a framework to help focus the delivery of key outcomes that deliver social and environmental benefit and help support more responsible economic systems.

For a more in-depth review of how our academics contribute to the SDGs, please read our SDG Annual Report 2021/22.

SHIFT Conference

SHIFT is the annual learning, teaching, and assessment conference open to students and staff from Greenwich and other institutions. It reflects the changing Higher Education landscape and encourages our students and academic communities to explore issues and ideas that can improve the content and delivery of the programmes that are taught. In 2022 there were four conference themes, one was Sustainable Development in Learning and Teaching. Some of the sessions included:

- Evaluating impacts and outcomes of a student-led sustainability action group in Higher Education through an ESD focus.
- Educator reflections on teaching sustainability in the Greenwich Business School.
- Addressing and Energising Sustainable Development in NRI's Teaching and Student Learning.

The full programme of events can be found [here](#).

Closing Remarks

The university continues to make progress in sustainability, and this is due to the staff and students. Everyone has a role to play in creating a sustainable university to ensure the longevity of our planet's survival and there is still much more work to do. This is a great opportunity to lead in pushing forward our sustainable development agenda.

We are always looking ahead in considering a more sustainable future. As set out in our Net Zero by 2030 plan, we understand the importance of a long-term view. 2022/2023 looks set to bring out more opportunities as we continue to embed sustainable development in all facets of the university. Furthermore, opportunities to get involved in sustainability will increase as we look to develop new approaches to engage staff and students by developing knowledge and understanding.

We are always looking for information about the great contributions our students and staff are making to helping create a more sustainable university and planet. Please share what you are doing so we can celebrate this more widely. Contact the Sustainable Development Unit team to share your work.

Email: sustainability@gre.ac.uk
Instagram: [@sustainablegre](https://www.instagram.com/sustainablegre)
Twitter: [@SustainableGRE](https://twitter.com/SustainableGRE)
Facebook: facebook.com/UoGSustainability



University of Greenwich Sustainable Development Goals – Annual Report 2021/22



The University of Greenwich is proud to take this opportunity to showcase our activities contributing to the Sustainable Development Goals. The Goals are a focus for our efforts to act as a positive force for change, using our expertise as educators to curate knowledge, create opportunities and change lives for the better – on a local, regional, national and global stage.

Andrew Westby,

Deputy Vice Chancellor (Research and Knowledge Exchange)

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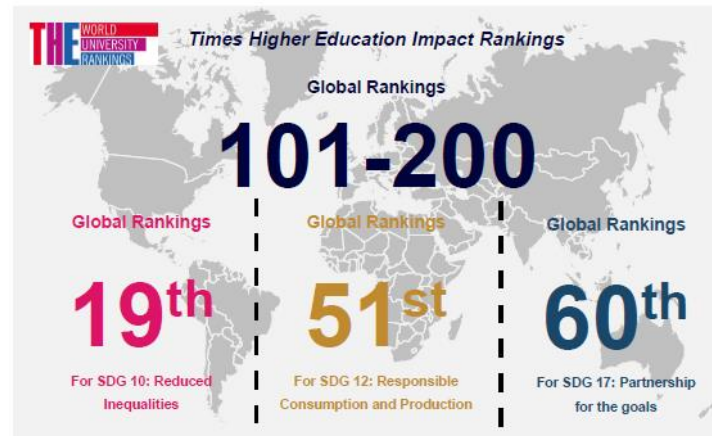


Introduction

The United Nations (UN) published its 2030 Agenda for Sustainable Development with 17 Sustainable Development Goals (SDGs) to be used as a blueprint for prosperity for people and planet. These goals ensure the ongoing economic growth of our planet, the protection of our environment and addressing social inequalities. More than a year into the COVID-19 pandemic, and the human and economic toll can be felt across all three dimensions of sustainable development: economic, social, and environmental. The impact of the pandemic has been unprecedented and efforts to ensure that it does not delay the urgent transition to a greener and more equitable future have been integral. Whilst the pandemic has brought further challenges to meeting these goals, it has also opened up new ways of thinking and opportunities.

The university recognises the importance of the SDGs and our role in contributing to them and this is highlighted in our new corporate strategy. The university has continued its commitment in meeting these goals and this report provides a snapshot of the SDG-related activities taking place across our campuses in the 2021/22 academic year. This has been a collaborative effort across the university, and we are increasingly witnessing the use of SDGs in teaching and research as a means to gauge operational progress.

We are proud to showcase some of our SDG-related activities and are committed to reporting annually.



1: No Poverty

End poverty in all its forms everywhere.

This goal relates to the university's research on poverty and the commitment to support low-income or disadvantaged students and citizens in the local community.

Our Research

Reducing poverty and inequalities in all its forms is a highly topical research topic and some projects in this academic year have included:

Perception and adaptation of pastoralists to climate variability and change in Morocco's arid rangelands

Climate change has massively affected livestock production which has increased poverty and inequality in pastoralists. This [research](#) analyses factors affecting the adoption of different adaption measures in pastoralists.

Rural Electrification and Transition to Clean Cooking

Led by our NRI this piece of [research](#) explores rural electrification and the feasibility of environmental preservation policies within cooking activities. As access to energy is a key indicator of energy poverty, and is required for basic human activities, it is integral to understand the challenges in energy security for all.



77 research papers published in 2021-22

Our Teaching

We are proud that some of our programmes address poverty in several different disciplines:

Development Studies - Research MPhil/ PhD

Led by our Natural Resource Institute (NRI), this research [course](#) in development studies gives our students the opportunity to investigate key global social-scientific areas, such as sustainable development, economic growth and poverty reduction, primarily in developing countries.

In 2022, 2 students completed their PhDs.

Poverty, Inequality and Social Exclusion

This [course](#) explores the links between poverty, inequality, social exclusion and health and wellbeing.

In 2021/22 64 students completed this programme.

Our Operations

Greenwich was recently ranked **67th** in the world for reducing inequalities in the new THE Impact rankings. Our [Access and Participation Plan](#) contains ambitious measures to help reduce poverty and promote social mobility. A significant proportion of our students are from families that fall below the national poverty line. The university offers a

range of anti-poverty support programmes, support services and funding to assist students facing financial hardship including:

- Subsidised transport and food to reduce financial burdens on our student and staff communities.
- Bursaries to cover tuition costs and bursaries to assist students covering transport costs.
- The Greenwich Bursary is a £700 payment for new students who come from low income households. In 2021/2022, this was distributed between 1490 students. This was an increase of 200 students getting financial support from the previous year.
- Greenwich is Fairtrade Accredited which helps at reducing poverty in developing countries.

Cost of Living Crisis

To help tackle the cost-of-living crisis the university has implemented a number of initiatives to support students and staff. Professor Ozlem Onaran has been invited to the advisory board of the Citizen's Economic Council on the cost of living. Furthermore, the university is working closely with Greenwich Students' Union (GSU) to offer support through:

- Free [Community Breakfasts](#) twice a week on all campuses
- [Open Pantry Project](#)
- Emergency Medway [bus vouchers](#) to help students tackle the cost of transport between campuses



Find out all the ways the university is supporting students [here](#).

Furthermore, staff are also being supported, with those on lower grades receiving a [one-off payment](#) to assist with the rising costs.

Our Partnerships

The university has a Bargain Corner at Medway Campus, which offers items at reduced prices. It works by partnering with the Furniture Reuse Scheme and Lost Property to provide items which would have been put in waste if not reused.

Kings College Hospital NHS

For their homelessness programme in 2022 the university donated over **£2450** worth of furniture items from refurbishments of one of our buildings.

Working Towards
Target
1.3

2: Zero Hunger

End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

This goal highlights the multidimensional nature of food and nutrition security, encompassing the quantity of food available and issues of resilience, nutrient content, food safety, as well as incorporating sustainable agriculture. This SDG relates to our research on hunger and food sustainability, as well as our commitment to tackling food waste and addressing hunger in local communities. Read our Sustainable Food Policy [here](#).

Our Research

Examples of our research in this area include:

Future-proofing our food

A team of [researchers](#) at NRI are working to understand how to future-proof plant and algal protein supply, identifying the drivers of the plant-based food value chain, and developing solutions to innovation challenges for alternative protein-based food.

Reducing Food Losses

A team of [researchers](#) at NRI are playing a pivotal role in understanding and researching Post-Harvest Loss (PHL) reduction in Africa. Collaborating with the University of Zimbabwe, among others, and a network of postharvest and agricultural information experts from across SSA on the African Postharvest Losses Information System (APHLIS) project.

Solar-powered hammermill

Two [projects](#) that are harnessing solar power and the latest advances in agricultural engineering design to develop efficient cassava processing technologies suitable for village enterprises, which can reduce postharvest losses and food insecurity, and improve livelihoods.



63 research papers published in 2021-22

Treating severe acute malnutrition using locally available foods in Sierra Leone

NRI led a [project](#) in collaboration with the Ministry of Health and Sanitation in Sierra Leone with the aim of investigating the feasibility of developing Ready-to-use Therapeutic Food (RUTF) using local ingredients and by local enterprises.

Our Teaching

The following two programmes were new this year: [Applied Food Safety and Quality Management, MSc](#) and [Food Innovation, MSc](#). Students from both programmes look at cross-cutting aspects and will discover the importance of enhancing sustainability and creativity within food supply chains, the design, implementation and management of food safety and quality systems, and developing new ingredients and products.

Agriculture for Sustainable Development, MSc

Taught by world-leading scientists from the award winning NRI, students who study on this programme will gain a strong understanding of the fundamentals of crop production, such as adaptation to climate and other environmental changes. Real world case studies are used, giving students an opportunity to gain experience in current global research projects.

Our Operations

Eliminating food insecurity begins on campus and the university have implemented many programmes that support students and staff to combat food insecurity. The university's catering outlets offer a wide range of food options. They also made leftover food available for free on Wednesday and Fridays, 30 minutes before closing. This not only prevents food waste but helps to tackle food poverty and hunger.

The university has tracked total food waste over the last few years, with food waste decreasing from **67.06 tonnes** in 2018/19 to **22.63 tonnes** in 2021/22.

Furthermore, our community Edible Garden continues to be a free grow space that students and staff can volunteer and grow fruit, vegetables, and herbs for themselves.

Our Partnerships

Kent & Medway Partnership for Enterprise, Food and Health

Launched on the 2nd of January 2022, the University of Greenwich is leading a partnership which aims to bring healthy, sustainable food to 25,000 people – around 5% of the population - in Kent and Medway. Worth £530k, the Kent and Medway Partnership for Enterprise, Food and Health



will see the university partner up with councils in Gravesham, Medway and Swale.

The Food & Drink Accelerator Programme

This is a free service provided by Growing Kent & Medway, funded by UKRI's Strength in Places fund. It is being run by the University of Greenwich, with mentoring support provided by University of Kent. Over four months, the start-ups will benefit from direct access to technical research experts across Kent, including the new Medway Food Innovation Centre at the University of Greenwich.

Studentships

The UK Food Systems centre for Doctoral Training is offering 15+ funded studentships for its second cohort (starting in September 2022). The UKFS-CDT consortium brings together the Natural Resources Institute (NRI) of the University of Greenwich (lead institution), University College London, Royal Veterinary College, Institute of Biological, Environmental and Rural Sciences (IBERS) at Aberystwyth University, Centre for Food Policy at City University, University of Sussex, Brunel University London, the National Institute of Agricultural Botany East Malling Research (NIAB EMR) and Rothamsted Research, plus 60 Associate Partners from business, government and civil society.

3: Good Health and Well-Being

Ensure healthy lives and promote well-being for all at all ages.

The world has seen unprecedented global health and wellbeing challenges over the last few years because of the COVID 19 pandemic. The university is committed to improving health and wellbeing and reducing inequalities; locally, nationally and globally.

Our Research

At the University of Greenwich, health and wellbeing are highly researched and taught subjects. The pandemic and its many challenges have highlighted the importance of research and teaching in this subject area. Some of our researchers have been nationally recognised for their work. For example, Greenwich lecturer, research supervisor and mental health specialist Dr John Foster, featured in a BBC Radio Kent interview looking at his work around 'at-risk drinking' and Dry January.

Read more about it [here](#).

Dr Ryan Essex is a Research Fellow with the Institute for Lifecourse Development, he has several interests related to justice and health and his past work has focused on detention in Australia. His [current work](#) is largely focused on activism in health.



123 research papers published in 2021-22

Our Teaching

The university offers a range of outstanding education programmes designed to offer students a pathway to become health professionals to tackle major health and science challenges. The University of Greenwich ranked **77th** for Medicine in the United Kingdom and **183rd** in the World with

4,623 publications made and 99,239 citations received. Main research topics: Pathology, Psychiatry, Public Health, Nursing, Health Science. Check out all our health-related degrees [here](#), including public health, nursing and pharmaceutical degrees.

The university's Institute for Lifecourse Development and Academic & Learning Enhancement Team launched a new seminar series to allow delegates to explore approaches to embed wellbeing into the curriculum. Furthermore an online event for students and staff led by Dr Sue Force, expert in Human and Sports Nutrition and Simon Goldsmith, Head of Sustainability to explore how we can all improve our diets.

2,535 students completed into some form of health science degree in 2022.

Our Operations

The university invests greatly to meet [wellbeing](#) needs, including mental health first aid training for staff and managers, wellbeing days and also the provision of free and subsidised classes and sports facilities for staff and students. The university prohibits smoking in public access, teaching or working areas in any of the university's buildings. Read the university smoking policy [here](#).

Funding

Disabled Students Allowance (DSA) is a

government fund which helps pay for any additional support that you may need due to a disability so that you are able to complete your degree course and is offered at the university.

Medway Buddy Bench

Formerly launched in January 2022, this initiative is for students and staff to use during tougher times or when they need to talk to someone. Helped by STAART ambassador Daniel Crockett and STAART graduate Shona Reid, the bench is ready to go on our Medway Campus.

Sexual Health

The Students Union offers free sexual health advice to students through their advice services. Greenwich Students' Union (GSU) has online resources signposting students to local services, as well as having information on how to access free chlamydia tests and morning after pill. Students can also access free condoms and period products.

University Mental Health Week 2022

The University Mental Health Week included a 5 day agenda of our most wide-reaching programme of activities to-date, with a breadth of online and face-to-face events taking place across the university – including a [keynote](#) session from our Vice Chancellor, Professor Jane Harrington, and Dr Jacqui Dyer MBE, President of the Mental Health Foundation.



Our Partnerships

The university has many collaborations and partnerships in London and Kent with local health and social care organisations that deliver care and promote and support the public's health and well-being. These include NHS Trusts as well as other providers of health and well-being services (see the full list [here](#)). The university has students on placements in these organisations on health-related professional programmes, but staff also deliver a significant amount of continuing professional development courses to partners organisations, as well advising on and providing 'credit for learning' for inhouse courses.

The university was a foundational partner with Mind supporting the [Mentally Healthy Universities Programme](#). This tested a whole-university approach focused on preventative interventions. University staff were also empowered to participate in Mental Health Champions and Peer Supporters schemes.

Professor Karen Cleaver has led a project with the Metropolitan Police and a range of partners across statutory agencies to produce a training package which aims to raise awareness of County Lines. The training helps participants develop an understanding of the relationship between vulnerability and becoming a perpetrator of crime and the potential consequences of this for the young person's mental health.

4: Quality Education

Ensure inclusive and equitable education and promote lifelong learning opportunities for all.

The university is proud of its roots and its continuing role in supporting the local community to access excellent quality teaching and learning at our campuses and continuing our commitment to inclusive education.

Our Research

Educational research at the university aims to address ongoing challenges and promote lifelong learning opportunities for all. Some highlights of this year include:

Real-life research projects improve student engagement and provide reliable data for academics

Student engagement can have a positive impact on student success and this study aims to examine whether real-life research projects act as a motivation tool for engaging students.

Self-efficacy, performance and the role of blended learning

The aim of this paper was to investigate the role of blended learning, both online and face-to-face teaching, on mathematic self-efficacy in students who are non-math specialists.

University-enterprise cooperation for the employability of higher education graduates

This paper addresses the analysis of how the collaboration between HEIs and companies affects the employability of HEIs students.



42 research papers published in 2021-22

Our Teaching

Our School of Education was ranked **48 out of 83** universities in The Guardian Impact Rankings in 2021/22.

We offer access to university staff and students and the public to many of our talks, often with relevance, interest and impact in sustainability, this year they have included:

- **School of Education**
- **GREAt Talks** at Medway – free public talks every Wednesday at 6pm on a range of subjects.
- **Big Picture Seminars** – free public guest seminars, given by industry professionals from a variety of fields every Wednesday at 5pm.
- The University offers a number of ad-hoc lectures and seminars to the public including **Future of Uniformed Services**

The Institute for Lifecourse Development Research Centre

The institution is a key resource where professionals from many fields work closely together with researchers and a variety of stakeholders to develop effective and economically sustainable lifecourse solutions to some of the most significant challenges society faces. This is to reduce inequalities and to promote inclusive quality education.

4,952 graduates with teaching qualification

Our Operations

The university is committed to widening access to higher education for everyone. To ensure that education is accessible to everyone from all backgrounds, Greenwich offers financial scholarships based on both academic and financial need. Details are available in our **Access and Participation Plan**. This plan highlights how we actively target students from disadvantaged backgrounds with our outreach work, ensuring it is fully inclusive for everyone.

Early Years Nursery Room in Dreadnought contains a number of resources, specialised books and equipment that allow for the students to plan and organise activities for young children. The room is used to support theoretical knowledge and students can use it to try out teaching skills.

The university offers a **commuter bursary** to support our students from low-income households who face challenging travel costs to attend university.

Our Edible Garden at Avery Hill offers learning in natural spaces which students and staff can use for all kinds of research and teaching.

Our Partnerships

The university works closely with over **300 schools, colleges and education partners** across London and the South East to support academic attainment and progression to higher education.



Women in Tech

The university held an event on **Women in Tech: London Group Meeting**, in which the session explored how to encourage and support women in the sector.

Mentoring Programme

The university holds a **'Find a Mentor'** programme in which at least 10% of female students participate in. It allows students to make connections and get advice from industry professionals.

Whistling Woods International

Greenwich partners with Whistling Woods International (WWI) in 2021, a prestigious communications and creative arts institute located in Mumbai. WWI strives to set new standards of world-class education in film, communication and creative arts.

Aziz Foundation

The university has become of the Foundations' Preferred Partners, having demonstrated a commitment to making higher education accessible at the postgraduate level to BME students and those from lower socio-economic groups. The university will offer up to three new masters scholarships specifically for British Muslims. Read more [here](#).

5: Gender Equality

Achieve gender equality and empower all women and girls.

This goal relates to our commitment to recruiting and promoting women, reducing gender inequalities within our operations, teaching and research, and our policies on gender equality.

Our Research

Gender equality and gender-related matters are embedded into our teaching and research at Greenwich. Some highlights this year include:

International Mechanisms to Revalue Women's work


2021 saw Greenwich Professor Sian Moore, Heather Wakefield and Dr Laura William from the Centre for Research in Employment and Work produce a report on Women's Work in Scotland. The findings highlighted that despite the Scottish Government's commitment to equal pay, women's work in Scotland remains undervalued and that it is a key driver of the gender pay gap. Read more [here](#).

Depleted by debt? Using a 'gendered lens' to bring into focus climate resilience, credit and malnutrition

This [project](#) uses a feminist policy economy lens to guide critical inquiry on financial inclusion in a context where the market-driven global system has demonstrated disastrous impacts on the environment and the management of the COVID-19 pandemic.

Gender, Deviance and Society Research Group

Drawing together research expertise of its leaders, [this group](#) aims to push forward research innovation in gender-related matters through interdisciplinary approaches, horizontal leadership and mentoring.

 **24 research papers published in 2021-22**

Our Teaching

Gender equality is embedded across our whole curriculum, and we offer several courses and modules that are dedicated to understanding gender, sexuality and inequality such as [Criminology, Gender and Sexualities](#); [Gender, Race and Crime](#); [Sociology of Gender and Sexuality](#).

Gender Based Violence Series

Between March and June 2021, an [event series](#) hosted by the Women's Staff Network was held, highlighting the experiences of marginalised women and non-binary people.

International Women's Day 2022

Throughout the month of March, NRI scientists shared thought pieces on gender equality in agriculture, food and resources. Other events included a panel discussion about women in leadership positions – more information [here](#).

Menopause Awareness Training

During these [sessions](#), colleagues and managers learn what menopause is, how to recognise the symptoms and how someone may be affected by menopause, the options available to manage symptoms and long-term health, what support is available and how to access it, both at work and outside work.

The university also published this [article](#) on menopause.

Female Graduates in STEM: **444/1,068 (42%)**
Female Graduates in Medicine: **562/687 (82%)**
Female Graduates in Arts & Humanities / Social Sciences: **2,054/3,197**

Our Operations

Our Access and Participation Plan provides a framework for ensuring we meet our gender equality responsibility in our recruitment and teaching work. Universities must also publish a [Gender Pay Gap Report](#), which highlights the wider commitment to eliminating pay gaps, including for BAME, Disability and LGBT+ staff. Furthermore, our [Equality, Diversity and Inclusion Annual Report](#) highlights what the university has been doing this year to achieve gender equality.

The university has a [Transgender Inclusion Guidance Document](#) that aims to create an inclusive workplace and learning environment, free from discrimination, harassment or victimisation where all transgender and non-binary people are treated with dignity and respect.

The university has [Maternity Leave Provisions](#) and recognises and values unpaid care and domestic work – which is reflected in our [Shared Parental Leave Policy and Procedures](#) to promote shared caring and domestic responsibility – which often disproportionately fall on women.



Our workforce comprises of 43% male and 57% female and as of 2021/22, women make up 35% of senior position roles at the University.

Aurora Leadership Programme

The university has been part of the [Aurora Leadership Programme](#) for over 7 years, which encourages and supports women to access mentoring to help them become leaders at Greenwich and elsewhere. It can support up to 10 staff members each year.

South East Action Learning Scheme

Greenwich is one of the founding institutions of the [South East Action Learning scheme](#) and has participated in the scheme for the last four years. The scheme is a cross institutional action learning set for women of all grades in Higher Education within London and the South East.

Our Partnerships

Athena Swan Charter

As part of Strategy 2030 and ongoing commitment to addressing gender inequalities and embedding inclusive cultures, the University of Greenwich has pledged its commitment to the principles of the [Athena Swan Charter](#). The Athena Swan Charter is a framework to support and transform gender equality in higher education and research.

6: Clean Water and Sanitation

Ensure availability and sustainable management of water and sanitation for all.

The university has processes and systems in place to help ensure we manage the water we use and consume to drive SDG6 forward. Our Environmental Management System provides our framework to make improvements and we have a water reduction target of 1% per year.



Our Research

One in four people worldwide lack access to safe drinking water. SDG6 aims to ensure universal access to safe and affordable drinking water for all by 2030. Since 2000, researchers at the University of Greenwich's Public Services International Research Unit have catalogued qualitative case studies in the global North and South. This induced a reassessment of the merits of water privatisation and influenced the international diffusion of municipalisation (or reverse privatisation) in 5 countries and has improved sanitation and water services to about 17 million people.

Read more [here](#).



20 research papers published in 2021-22

Our Teaching

Our Engineering School has courses and modules that contribute to SDG 6. These include our postgraduate course **Water, Waste and Environmental Engineering, MSc**. This course is designed for graduates from a wide range of environmental engineering backgrounds who want to apply new sustainable strategies to increasingly complex problems. Furthermore, our engineering courses offer modules such as **Hydraulics, Water Engineering and Water and Wastewater Engineering** modules.

Our Operations

We provide free drinking water across the university which are highlighted on our campus maps and have optimised water consumptions across our campuses through a variety of different means:

BREEAM (Building Research Establishment's Environmental Assessment Method)

Plans were in place by 2021 to meet BREEAM standards in the university planting and roof design that seeks to minimise water use, both in retaining water and using drought tolerant plants.

Automated Meter Reading (AMR) Devices

We are moving to fit AMR devices on all metered supplies of water and have started the installation of flow restrictors on water outlets in Avery Hill.

Rainwater Harvesting

We harvest water at the Edible Garden in Avery Hill Campus to help water the plants.

Resources

The university's Sustainable Development Unit refreshed their '**Being Sustainable at Home, Halls and Work**' documents in 2021/22. The documents include tips to reduce water consumption.

Our Partnerships

Engineers Without Borders UK

Engineers play a fundamental role in designing solutions that will ensure that the planet thrives. The university participates in the Engineers Without Borders annually, encouraging students to submit projects that cover a range of issues impacting developing nations including water availability and sanitation.



7: Affordable and Clean Energy

Ensure access to affordable, reliable, sustainable and modern energy for all

This goal relates to our energy efficiency policies and energy research. Here at the university, we are committed to reducing our carbon footprint from our energy usage and our operations, teaching and research reflect this.

Our Research

Our academics are making headway with their research in renewable and decarbonising technologies. Project DualFlow is developing a new energy conversion and storage concept that combines water electrolysis, battery storage and co-production of decarbonised chemicals into one single hybrid technology. This project was recently awarded £3 million by European Innovation Council. One of our academics, Dr Kevin Lam, Associate Professor/Reader in Medicinal Chemistry at the University of Greenwich has been heavily involved in this project.

Read more [here](#).



39 research papers published in 2021-22

Our Teaching

Greenwich offers many programmes and modules that offer insights into renewable energy from across a number of different disciplines such as engineering, chemistry, environmental science and more. The **Smart Grids and Sustainability** module provides students an in-depth study of the most relevant Smart Grid technologies that are from renewable and sustainable sources.

Our Operations

The university seeks to ensure operationally that it reduces the amount of energy used through the application of its **Carbon Management Plan** (which has since become our Net Zero by 2030 Action Plan). The university knows the importance of reducing energy demand and this is reflected in our Corporate KPI.

Renewable Energy

Investment in renewable energy will be required to reduce our carbon emissions. The university is supportive of these decisions, with several improvements already made, including renewable energy generation technology being installed across our campuses such as photovoltaic solar panels in Stockwell Street and Avery Hill halls. These solar panels have provided **81,982kWh** of electricity in 2021/22.

Furthermore, the university has an Operational CHP (Combined Heat & Power Plant) at our Medway Campus, running on recycled cooking oil. This consumed 253,083 litres of cooking oil, generating **931,650kWh** of electricity with 925,800kWh of heat. Within our Daniel Defoe Halls in Greenwich, a biomass (wood pellets) is in operation, managed by a third party and contributes to the heat utilised throughout the building. In 2021/22 **822,430kWh** of heat was produced.

Smart Heating System

In 2021, the university replaced all of the electric heaters with smart control heaters in the university owned Avery Hill halls. It monitors and manages energy use in each room, making sure that energy is not used when not needed. Compared to pre-Covid times, we have seen a **12.5%** decrease in energy usage.

Investments

The university does not have any direct investments in fossil fuel companies, although as part of investment tracking portfolios at any one time some of our short-term investments may move into and out of oil fossil fuel companies. View our Ethical Investment Policy [here](#).

Our Partnerships

Partnering with Polysolar Ltd and Huge Lowe Farms Ltd., the University was awarded a quarter of a million pounds, to explore if agrivoltaic materials can be retrofitted to existing greenhouses or polytunnels and help UK-protected agriculture to meet net zero-carbon targets. Read more [here](#).

7 AFFORDABLE AND CLEAN ENERGY



Student Switch Off

The university has partnered with Student Switch Off (delivered by the National Union of Students) since 2014. SSO is a not-for-profit international campaign encouraging student action on climate change primarily in halls of residence. A huge 160,000kwh was estimated to be saved during the year through student actions alone; that's a saving of 37 tonnes of carbon emissions, the equivalent to 422 flights from London to Manchester. Read more about it [here](#).

60%

of respondents claimed to practice sustainable behaviour including energy efficiency*

*according to our annual sustainability survey

8: Decent Work and Economic Growth

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

The university is committed to providing decent work for all. This goal relates to our employment practices and how we enable our students to gain work experience and employment after completing studies.

Our Research

Some of our research centres such as The Centre of Political Economy, Governance, Finance and Accountability (PEGFA) have contributed to this SDG. Some highlights below:

A shorter working week as part of a green caring economy

This research [paper](#) argues that a shorter working week, as part of a wider set of policy changes, can promote gender-equal distributions in paid work, unpaid work, and income, while facilitating a green transition.

Is a €10 trillion European climate investment initiative fiscally sustainable?

This [research](#) asks to what extent large-scale public investment could be a viable tool to provide the necessary infrastructure to break Europe's dependency on fossil fuel and carbon emissions more broadly.

Towards a business, Human Rights and the environmental framework

In this [Special Issue](#) of Sustainability on Business, Human Rights, and the Environment, this article seeks to articulate a comprehensive theoretical framework which seeks to protect both human rights and the environment from corporate abuses.



60 research papers published in 2021-22

Our Teaching

We are proud to be able to offer our students exceptional industrial placement and internship opportunities to develop their industry-ready skills. In addition to this, we have a dedicated [Careers Service](#) and the Business School has a dedicated Employability Office to help both undergraduates and postgraduates secure a placement within a leading organisation. From career-focussed degrees, connections with employers, work placements and mentoring schemes, our students can start building skills from day one at the university.

According to our Graduate Outcomes annual survey, in 2020/21 **88%** of our students found full time employment or entered further study within the first 12 months following graduation.

In 2021/22 **190** students completed a placement.

Our Operations

The university is a huge employer, with more than **2,455** permanent members of staff. In 2021/22 the university hired **418** employees. Furthermore, **77%** of our staff who are directly employed by the university had contracts of over 24 months.

Equal and Diverse Workforce

The university recognises unions and labour rights with representation on relevant committees. Our [Equality, Diversity and Inclusion Strategy](#) and Action Plan aims to deliver measurable equality and inclusion outcomes for both students and staff, promote inclusion, fairness and dignity at work and ensure we comply with legislative requirements.

The women's network supports and represents women members of Academic and Professional services staff who feel comfortable in female centred community, including women and non-binary people. We have an Annual Statement of Compliance for the Modern Slavery Act and adhere to our Anti-Slavery and Trafficking Policy, as well as publish our Gender Pay Gap report annually.

Going Beyond Fair Pay

Going beyond fair pay for Greenwich staff and faculty includes pay, benefits, pension, as well as a wide array of work/life wellness programs. The university publishes pay scales and ranges as part of its efforts to promote pay equity and transparency.

8 DECENT WORK AND ECONOMIC GROWTH



Our Partnerships

In the Faculty of Education, Health, and Human Sciences (FEHHS), placements are an integral part of the learning. These placements can range from colleges, secondary schools, primary schools, and nurseries for our education placements, to hospitals, prisons, mental health and learning disability facilities, hospices for end-of-life care, neonatal wards, Accident and Emergency, children's wards, specialist children's services, oncology, cardiology, Intensive Care and community teams. Our strong partnership with these organisations ensures our students get the most out of their placements.

95%

of our students want to learn more about sustainability including having it in embedded in the curriculum to support their future career*

*according to our annual sustainability survey

9: Industry, Innovation and Infrastructure

Make cities and human settlements inclusive, safe, resilient and sustainable.

We are committed to fostering innovation and playing a key role in promoting new sustainable technologies for efficient use of resources.

Our Research

Greenwich is home to award-winning research programmes that make valuable contributions to business, industry and the community.

Analysing Wind Power Penetration in Hybrid Energy Systems Based on Techno-Economic Assessment

In 2022, Greenwich's Yuhani Wimalaratna co-published a [paper](#) on the innovation of wind power penetration in energy systems. It was found that most to all countries have identified the potential for wind power generation.

Electric vehicle battery secondary use under government subsidy: A closed-loop supply chain perspective

This [study](#) looks at closed-loop supply chains with battery secondary use, to enhance supply chain efficiency and further sustainable development in electric vehicle battery industry.

Stockwell Street

Our Architecture and Built Environment departments are utilising our estates to further their sustainability related research. A study conducted by Professor Benz Kotzen, Professor of Landscape Architecture and Nature Based Solutions on biophilic measures was undertaken in an office occupied by Student Union staff. The aim of the project was to better understand how people react to introducing biophilic measures into office spaces.



128 research papers published in 2021-22

Our Teaching

The university's teaching contributes to the provision of graduates with skills that will improve the industries and infrastructure making them more resilient and sustainable. Integrating sustainability thinking into [civil engineering](#), [construction](#), [architecture](#) and [landscape architecture](#) our degrees and courses across multiple disciplines actively encourages improvement and innovation that will deliver sustainability outcomes.

Engineering, Design and Innovation, BEng Hons

Students on this course will become skilled engineers and inventors. They will get an understanding of both engineering essentials and specialist knowledge in product and computer-aided design.

Our Operations

Innovation Fund

The aim of the Innovation Fund is to stimulate activity and support Knowledge Exchange activity. The fund can support projects which result in outcomes for public and community engagement, IP and commercialisation, local growth and regeneration, skills, enterprise and entrepreneurship, working with the public and

voluntary sector, working with business and research partnerships.

Impact Development Fund

This fund supports impact development that is the result of research (or will be seeking funding for co-creation of research projects) undertaken at the University of Greenwich. The fund aims to enable acceleration of potential impacts from research, evidence to be gathered for developed impacts, developing impacts to be scaled out into new environments and an increase in the significance of impacts.

Upgrades to Lighting Systems

The university has been replacing florescent lamps with LED fittings in student halls, which saves a significant amount of energy as they require less to produce the same amount of light output. We have also installed Thorlux Smartscan LED lighting into the teaching spaces, which dims or switch off lights according to the room condition. This can save up to 80% of energy. It also allows us to monitor the energy performance of different buildings constantly, in addition to capturing the occupancy of rooms which will help us understand more about the situation and further reduce consumption by better targeting room utility.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



Research & Enterprise Training Institute

Provides advice, support, development and mentoring along researcher's career journey to develop their skills and achieve their goals.

Generator

[Generator](#) aims to inspire and encourage students and graduates with new ideas. Nurturing entrepreneurship is important to us as entrepreneurs have the ability to drive market change.

Living Labs

Living Labs offer students, external partners, academics and staff to collaborate on projects looking at real-life challenges.

Working Towards
Target
9.4

Our Partnerships

Mayor of London Entrepreneur Prize

This academic year the university had two students employed as paid interns to the Mayor of London Entrepreneur Prize and subsequently we had a strong number of student submissions to the sustainability focused award scheme.

10: Reduced Inequalities

Reduce inequality within and among countries.

This relates to our research, teaching, and policies on addressing disadvantages and reducing social and economic inequalities, ensuring no one is left behind.

Our Research

Prof Jill Jameson's [research](#) on transformative education has led to co-creation of knowledge-sharing processes to nurture improved community-police engagement through dialogic conflict resolution with marginalised BAME young people.

Dr Panagiotis Pentaris is an Associate Professor of Social Work and Thanatology at the School of Human Sciences and Centre for Inequalities at the Institute for Lifecourse Development. Panagiotis' [work](#) addresses inequalities related to culture, religion, gender, LGBTQ+ identities and ageing. He has studied assisted dying and assisted suicide in relation to ageism in social and healthcare students and workers.

Rethinking gender mainstreaming in agricultural innovation policy in Nepal

In 2022, The university's Laxmi Pant co-published a [paper](#) on the failure of gender mainstreaming in Nepal national agriculture. Women in Nepal who are smallholder farmers were found to still be vulnerable.



30 research papers published in 2021-22

Our Teaching

We have many interdisciplinary courses and modules which cover a wide range of topics that address global challenges. These courses help to address existing inequalities and to understand their effects on individuals, communities and populations across the world.

Public Health, BSc Hons

This [degree](#) will allow students to explore strategies that will improve the UK's health, from social change and targeting inequalities, to designing and implementing national campaigns.

Our Operations

At the University of Greenwich we value Equality, Diversity and Inclusion (EDI) and take active steps to provide an inclusive environment for students, staff and visitors irrespective of their age, disability, gender re-assignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief (non-belief), sex and sexual orientation.

EDI Strategy

The [Equality, Diversity and Inclusion Strategy](#) 2019-2022 is a declaration of the University of Greenwich's commitment to place the promotion of equality, diversity and inclusion at the heart of the university. The university is committed to challenging racial inequality in our institution and being proactive

in creating a learning, working and social environment that increases the representation, progression and success of our Black, Asian and Minority Ethnic students and staff. In March 2022, the university published its [Race Action Plan](#), which further reinforces. There is also an annual report published each year highlighting the different strategies in place to promote equality – read [here](#) for the 2021/22 EDI report.

Working Towards
Target
10.2

LGBT+

The university's work towards culture change for LGBT+ inclusion was recognised through Stonewall's celebrations of the university. We are committed to making to make our community a welcoming and inclusive place for everyone. As a long-standing Stonewall Diversity Champion, the university achieved a Gold Award, ranking 75th in [Stonewall's Top 100 Employers](#) list and 11th in the Education Sector.

Furthermore, 2021 saw the relaunch of [The University LGBT+ Staff Community](#) to celebrate diversity, promote inclusion and share the communities' refreshed priorities. The event opened with a welcome message from the Vice Chancellor and discussed its new strategy, ongoing dialogue, intersectionality, and partnership with other equality groups. The Community champions the positive development of LGBT+ related equality & diversity support and representation within the university. The university is a proud member of the Stonewall Diversity Champions



Programme and is also featured in Stonewall's Gay by Degree, a guide for Lesbian, Gay and Bisexual students on higher education institutions.

Disability Confident

The university has been reaccredited with its Disability Confident Employer Level 2 status, after undertaking a self-assessment process against a set of statements and actions issued by the Department for Work and Pensions.

Sanctuary Scholarship

This year saw the continuation of the [Sanctuary Scholarship](#) - a bursary scheme for applicant students that have refugee status or seeking asylum in the United Kingdom. It covers tuition and accommodation costs, plus a maintenance grant.

Our Partnerships

Charlton Athletic

In 2021, The university supported diversity in the community with [Charlton Athletic](#). Charlton Athletic are the only club in UK Professional Football with an EDI department. The university are proud to be partners with them and to have supported their Red, White, and Black day which is an initiative of their CARE team.

11: Sustainable Cities and Communities

Make cities and human settlements inclusive, safe, resilient and sustainable.

The university is committed to ensuring that we continue to make our campuses and communities safe and resilient, and strengthening our relationships with our communities.

Our Research

Transitioning to a more sustainable and green future we have to find innovative solutions to safeguard our cities and natural environment. An example of how our campuses are being used in research is included below:

Digital Twin Project

Mohammad Sakikhales, a lecturer in Property and Construction Management in the School of Design is currently working on a project which involves creating a digital twin on the Grade 1 listed Queen Anne building in the historic Greenwich campus. This project's research aims to understand the most important parameters (e.g., internal/external temperature, occupancy rate) to optimise the overall sustainability performance of the historic buildings and specifically Queen Anne. This initiative allows us to model energy use within our building to further reduce energy and optimise building system efficiencies.

Sustainable Tourism

Professor Alastair Morrison and Professor Andres Coca Stefaniak published the [Routledge Handbook of Tourism Cities](#) in 2021. This book captures the latest thinking and practice on urban tourism and the management of tourism cities drawing on contributions by subject experts from around the world.

Furthermore, both professors published this article, in collaborations with the Greenwich

Business School. This research will result in the first ever global scale for the measurement of socially sustainable tourist behaviours, with the aim of protecting host communities, their heritage, local economy and, ultimately, increasing their resilience.



64 research papers published in 2021-22

Our Teaching

The university applies its teaching and research on making cities and communities sustainable. Work undertaken across our faculties focusing on the built environment, in Faculty of Liberal Arts and Sciences (FLAS), on health and education at Faculty of Education, Health and Human Sciences (FEHHS), science and engineering including the work undertaken by the NRI contributes greatly to our teaching and research output.

Sustainable Transport (Module)

This [module](#), part of the wider course of Business Logistics and Transport Management, BA, helps students understand the issues involved in planning and managing transport systems. To examine the issues surrounding sustainable transport and the relationship of the transport sector with society.

Our Operations

The university is fortunate to have inspiring campuses of historic, architectural and natural value, with our Greenwich campus sitting on a world heritage site with Grade 1 listed buildings dating back from the 17th century. Our grounds and some internal areas are open free of charge to the public to enjoy. Public access to indoor spaces includes Medway library where local people have borrowing rights, in addition to exhibition and cafe spaces available on our campuses.

Green Travel Plan

We continue to encourage sustainable travel, both in business travel and in commuting and in 2022 the university launched its [New Green Travel Plan](#) which outlines how the university will reduce its carbon emissions from transport and get us on route to Net Zero by 2030. To achieve this the university has launched double decker electric vehicles in September 2021 - adding to our hybrid coaches bought in the previous year, built new bike shelters at Pembroke and Sparrows Farm and extended the cycle to work scheme from £1,000 to £3,000.

Biodiversity Plan

Our grounds are managed sensitively; limiting the use of herbicides, protecting habitats and balancing conservation practices. Our [Ecosystems Services Policy](#) sets out our overall vision and aims for how to achieve a balance between natural conservation,



education and wellbeing enjoyment. Our [Biodiversity Action Plan \(BAP\)](#) 2020-2025 outlines how our policy will be transformed into reality. With a wealth of expertise on our doorstep, we aim to lead by example; showing our students and staff how correct management can bring both human and biological improvement.

Building Closure

Helen Pierce, the Head of Estates and Operations trialled a reshuffling of the opening times of our buildings across our Greenwich campus in 2021/22. This was to reduce the amount of energy being used to heat buildings that were not being utilised and to also condense user communities to one place rather than spread across multiple buildings. The closure of these buildings had no affect on people needing to use buildings and there was a cost and energy saving.

Our Partnerships

In July 2022, the university expanded its partnership with Visit Greenwich. The partnership builds on previous agreements already in place between the partner organisations and emphasises the university's commitment to contribute to the local community as set out in its Strategy 2030. This partnership includes funding of five 4-week placements outside term time for students from all years within local businesses. Read more about the partnership [here](#).



Case Studies: The SHARE project

The €1.4 million **SHARE project** (Principal Investigator: Professor J. Andres Coca-Stefaniak) co-funded by the European Regional Development Fund (ERDF) through the Interreg Europe programme urban areas and tourism destinations as testbeds of innovation.

This project encouraged the development of more sustainable communities and town centres by encouraging a more sustainable management approach to cultural heritage in tourism destinations adopting smart(er) approaches, including those used by smart cities and smart tourism destinations.

The findings of this project informed the development of six Action Plans in as many European countries with the aim of delivering a lasting effect on local policy making. This project also explored the impact of the COVID-19 pandemic on tourists' behaviours in and around heritage sites. Its findings helped tourism managers and policy makers to develop recovery strategies beyond the COVID-19 pandemic in Italy, Croatia, Spain, Hungary, Romania, and the United Kingdom.

The GO TRADE project

The **GO TRADE project** (Principal Investigator: Professor Petros Ieromonachou; Co-Investigator: Professor J. Andres Coca-Stefaniak), with a budget of £5.2 million and co-funded by the EU's Interreg IVA France (Chanel) England programme galvanised 16 partner organisations across England and northern France to deliver the largest impact to date at Greenwich Business School.

The project helped improve the social and economic sustainability of town centres in England and France by focusing on the role of **traditional markets** in the visitor economy, encouraging residents and visitors to buy local produce, fostering more sustainable local supply chains, and encouraging people to engage with their town centre's heritage.

The project delivered the largest transnational survey to date (3,776 respondents) of

traditional market traders, market customers and town centre visitors in Europe. It also delivered bespoke business support for new and established market traders, with an additional 327,650 visitors to town centres as a result of the project's interventions. A new tourism brand (GO TRADE) was developed with a business plan for sustainability, an online platform for traditional market traders, 4 click&collect service platforms, and 32 bespoke tourism itineraries that incorporated each location's market.

Work related to this project was also influential in oral evidence submitted by Professor J. Andres Coca-Stefaniak to the UK Government's Housing, Communities and Local Government Parliamentary Select Committee as part of the UK parliamentary inquiry on "High Streets and Town Centres in 2030".

12: Responsible Consumption and Production

Ensure sustainable consumption and production patterns.

The university is committed to sustainably using its resources and researching and teaching responsible consumption practices.

Our Research

In 2022, the university's Professor Colin Allen co-published a [paper](#) on cleaner production in green construction supply chain management. This paper aims to examine whether governmental intervention can act as an effective mechanism with which to foster public-private partnerships among construction companies, thereby promoting ecological modernisation through the adoption of green supply chain management.



48 research papers published in 2021-22

Our Teaching

Circular economy thinking is included in a number of programmes at undergraduate and postgraduate level and focuses on responsibility within economic systems. These include: [Business, Human Rights and the Environment](#), [Managing in a Critical Context](#), and masters courses in Agriculture for Sustainable Development and Global Environmental Change. Marketing, Innovation and Management, Innovations in Food Packaging, Food Systems and Climate Change and Risk Analysis for Agriculture and the Environment are all modules within the [MSc Food Innovation](#).

The University of Greenwich's Sustainable Trade and Responsible Business development programme aims to generate knowledge and lessons on the sustainability of trade and responsibility in business, in a context of globalisation and changing world trade patterns, rising authoritarian governments, growing corporate and elite power, and crises in global social and ecological systems.

Our Operations

The university has policies on [Sustainable Procurement](#) and other more specific policies such as our [Sustainable Food](#) and [Fairtrade policies](#) that help ensure we meet strict goals relating to the food our caterers procure and serve. In 2021/22 we were reaccredited as a Fairtrade University - achieving a Level One Accreditation. As part of this accreditation, in February 2022 the university held its annual [Ethical Food and Fairtrade Fortnight](#) (EFFF). These two week-long event highlights why buying Fairtrade is important but also encouraged students to reduce waste. Outlets offered students and staff a 50p discount on hot drinks when a reusable cup or mug was used.

Furniture Reuse Scheme

Running since November 2019, our Furniture Reuse Scheme (FRS) to date has saved **£87,037** in procurement costs, avoided 20 tonnes of waste and **42,644 KG CO2**. Procurement is a significant contributor to emissions and environmental impact and the furniture reuse scheme works by relocating

items of furniture and stationery that are no longer needed to other part of the university. This ensures that waste is actively reduced.

Reusables and Disposable Free Cafes

Queen Mary Cafe has been disposable cup free since September 2018 and Pilkington Cafe has been since November 2019. This is to help promote students and staff using reusables when purchasing hot drinks.

Our Partnerships

Ellen MacArthur Foundation

The university is proud to be partnered with the [Ellen MacArthur foundation](#). They support circular economy learning across a number of global higher education institutions and schools. The university worked with the team from the Foundation and London Higher to deliver a Circular Food Workshop in June 2022.

Please see SDG 7 in this document to see other examples of where the university is committing to responsible consumption and production in terms of energy generation.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION



59%

of our students and staff mostly chose ethical products such as Fairtrade when buying*

*according to our annual sustainability survey

13: Climate Action

Take urgent action to combat climate change and its impacts.

Our research, teaching and operations to help progress climate action and alleviate the impacts of climate change.

Our Research

Our academics and researchers have been undertaking a wide breadth of research concerning climate action including policies, energy and agriculture. Some highlights are included below:

Assessing climate policies

The authors in this research [paper](#) employ an ecological stock-flow consistent model to provide a systems-based evaluation of certain macroeconomic, financial and sufficiency policies for climate mitigation.

COP26: Mobilise now to counter climate conflict

In 2021 an [article](#) was released around the university NRI's Dr Uche Okpara work to counter climate conflict in Lake Chad. Dr Uche is working with the NRI to advance transformative pathways towards sustainable peace.

Himalayan ecosystem services and climate change driven agricultural frontiers

In 2022, The university Laxmi Pant published a [review](#) on the Himalayan ecosystem services and climate change driven agriculture frontiers.



28 research papers published in 2021-22

Our Teaching

New study programmes at the Natural Resources Institute (NRI) to help tackle ongoing global challenges launched in 2021/22 including:

Climate Change, BSc

This new cutting-edge [degree](#) offers the skills to assess the impact of our changing climate, to develop solutions to mitigate emissions and adapt to a changing world. This degree combines a diverse range of subjects, from land use, water use and energy management to topics in the social sciences and economics, such as law, equity and climate justice, business and trade, and explores the interactions between the atmosphere, the biosphere and the economy that underpin the current mitigation gap and emerging adaptation challenges.

Transformative Change for Sustainable Development, MSc

This [degree](#) provides students with an in-depth understanding of Development Studies theory and practice, including different conceptions of human, societal and environmental changes. Drawing on real-world lessons from various domains, sectors and contexts, students will develop the capacity to critically discuss, analyse, and evaluate Transformative Change and develop hands-on skills in sustainable development design and planning, project management, research, and impact evaluation methods.

In December 2021, GREAt Medway Talks held an [event](#) that was free and open to the public on 'Planning the response for Climate Emergency Events' and online on 'Decarbonising the Bank of England'.

Our Operations

The university continues its collective efforts to address climate change. We are part of several networks and initiatives, including a Cross-University Collaboration with a number of other universities across London.

Living Labs

The university an opportunity for students, academic staff, professional staff and external bodies to collaborate on projects looking at real-life sustainability problems in the form of a 'Living Lab'.

Our Partnerships

The NRI teamed up with Morocco's National Institute of Agronomic Research (NIRA) to help build capacity to carry out agricultural research that addresses the needs of Moroccan farmers. Prof John Morton delivered training to 34 NIRA researchers on climate change, giving them a greater insight into the specific nature of climate change impacts on smallholders and the rural poor, the issues of adaptation and vulnerability that arise from those impacts, and some implications for the



practice of agricultural research and the role of research organisations. Dr Andrew Armitage delivered training in bioinformatics (science of genome analysis and handling of large-scale sequence data), responding to the specific needs identified by INRA. s. Dr Huiyi Yang delivered training on use of climate and agricultural models; a key training need identified by INRA. Read more about this [here](#).

Planet Mark

The university has partnered with Planet Mark in helping to reach its commitment of net zero by 2030. The partnership will focus on two key areas of collaboration, graduate jobs and the development and implementation of sustainable/net zero courses and teaching. Helping students and graduates become employable after graduation is important for the university and setting the students up with the knowledge and skills to help companies to make the sustainability changes and transformation will drive meaningful change.

Royal Borough of Greenwich

Collaborated with Royal Borough of Greenwich to support a local net zero commitment for borough businesses and households.

14: Life Below Water

Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

This goal relates to our commitment to preserving and supporting aquatic ecosystems.



Our Research

The university's NRI [Annual Review 2021/22](#) explored the environmental impact of salmon aquaculture to inform discussions between government and communities on the movement to balance the financial needs of the fishing communities with the avoidance of environmental degradation. Furthermore, in a joint [project](#), NRI evaluated public attitudes towards the environmental impact of salmon aquaculture in Scotland.



9 research papers published in 2021-22

Our Teaching

The university teaches modules and courses in areas focusing on protection and sustainability of aquatic ecosystems.

Environmental Science

This degree provides education relating to water resources management and conservation.

14 people completed this degree in 2022

Aquaculture and Fisheries Management (Final Year Entry) (Hadlow), BSc Hons

This [course](#) helps students to build on practical experiences, gaining insight into the importance of the sport fishery and

aquaculture sectors for food production and sustainability.

Science Internship Course

This [course](#) offered in the Engineering and Science school gives students the opportunity to develop key skills before they graduate and enhance employability.

Our Operations

At our Avery Hill Campus we have two wildlife ponds which are sensitively managed, with frog spawn, dragonflies, butterflies and other wildlife seen each year.

Certifications

We have a Sustainable Food and Agriculture Policy to ensure that food on campus all promote and serve sustainably and responsibly sourced food. Furthermore, all our catering partners (Sodexo, Grayson's and GSU) have the Marine Stewardship Council (MSC) certification.

Strategies

The university has policies and strategies in place to encourage water conservation – please see SDG6: Clean Water and Sanitation of this document for more information. Our Environmental Management System provide us with a clear strategy and the processes needed to reduce any discharges and keep any discharges within set limits. Chemicals

are managed in ways whereby any wastes are taken off-site for specialist and safe disposal.

Check out our [Waste Strategy](#) to find out more about how we ensure our waste does not damage marine and aquatic life.

Our Partnerships

Medway Council is committed to becoming a single-use plastic free council. Plastic pollution has devastating effects on the environment and hinders our ability to address the climate crisis. The University of Greenwich has become a community ally to [Towards Plastic Free Medway](#), a community group tackling single-use plastic pollution in Medway. They encourage local businesses and organisations to switch from single-use plastics to reusable and sustainable alternatives.

15: Life on Land

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Greenwich undertakes many operations to ensure that we protect and manage our natural environment and land ecosystems. .

Our Research

Advancing understanding on protecting and restoring tropical forests for nature, people and climate

Prof. Valerie Nelson **evaluated** the effectiveness of Partnerships for Forests (P4F) interventions, a UK Government's flagship climate forest programme. Findings show the need for greater attention in conservation finance and tropical forest landscape approaches to issues of equity, the terms of incorporation of smallholders and harvesters, including informal workers, gender issues, influencing policy through social learning processes, improving monitoring and evaluation systems and ways to assess the potential for transformative change and achievements.

Assessing Orangutan conservation investment considering social and environmental contexts

Since 2019, Dr Truly Santika from the NRI has **collaborated** with different research institutes and NGOs to understand orangutan conservation. It was found that habitat protection, community outreach and patrolling are beneficial in slowing the decrease of orangutan numbers, but the most cost-effective method depends on the context of each region.

The Triple Challenge: Food Security and Vulnerabilities of Fishing and Farming Households in Situations Characterized

by Increasing Conflict, Climate Shock, and Environmental Degradation

In 2022, Greenwich's Uche Okpara from the NRI co-published a **paper** looking at the 'triple challenge'. It was found that the triple challenge of conflict, climate shocks and land degradation increase the probability of being an insecure food state.

Ecosystem Services Research Group

NRI researchers address challenges and opportunities relating to the spectrum of activities from food production to consumption, with a focus on low-and middle-income countries.



19 research papers published in 2021-22

Our Teaching

The university offers a number of different undergraduate and postgraduate programmes and modules that relate to climate change, sustainability and conservation.

Global Environmental Change, MSc

This interdisciplinary master's **programme** offers students the opportunity to study a range of topics including climate change, sustainability, environmental law and policy and meteorology. NRI academics who run modules for this course have contributed to global initiatives such as the Intergovernmental Panel on Climate Change

(IPCC) assessment reports.

Environmental Science, BSc Hons

This **degree** provides education relating to soil and environmental ecosystems, habitat management and conservation. This degree gives students the chance to take part in funded fieldwork, which have previously taken place in locations such as the Lake District, New Forest and south-east Spain.

Our Operations

The ways we protect and manage our natural environment is covered by our **Ecosystems Services Policy, Biodiversity Action Plan, Environmental Management System** and through the processes and systems we have in place.

The Edible Garden at Avery Hill was restored after Covid-19 in 2021. The garden enables students and staff to grow their own vegetables and offers a wellbeing space for teaching, wellness, and community. The restoration included the garden, meadow, and orchard.

Greenwich achieved Silver Accreditation for Hedgehog Friendly Campus in 2021/2022, the work to achieve the accreditation led to a sighting of a Hedgehog in 2022 at the Avery Hill Campus. The sighting was the first since 2006, suggesting the campus ecosystem has improved over the past few years.

To enhance habitats for different species, the



university has installed 10 bird and bat boxes around the Avery Hill campus with constant monitoring. We have also established a mini meadow in Avery Hill during 2021 Spring as a pilot, and butterflies and bees have been seen feeding in the meadows.

We have created a **diversified mowing regime**, aiming to allow more plants to flower and create suitable habitats for invertebrates, but at the same time balance with amenity and recreational needs.

Our canteen uses locally and sustainably sourced food and maintaining the Gold Soil Association Food for Life Catering Mark across all of our menus.

Our Partnerships

The university partners with a local nursery Crafty Wizards, the nursery uses the University's Edible Garden to bring the children to learn about biodiversity and nature. The university's Sustainable Development Unit have partnered with Crafty Wizards, holding sessions in 2021/22 to teach the children about hedgehogs and why they are important.

Bee Sustainable

Bee Sustainable is a student-led and community-based project by Enactus Greenwich that aims to preserve the declining wild bee and bumblebee populations in London.

16: Peace, Justice and Strong Institutions

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

The university is committed to ensuring academic freedom and has many policies to continue to be an inclusive institution.

Our Research

Greenwich's Professor of Public International Law Steven Haines, spoke in 2021 giving [evidence](#) to the Parliamentary Committee on International Relations and Defence. The committee was conducting an enquiry into the UK and the UN Convention on the Law of the Sea.

In 2022, Uche Okpara at the University's NRI published [research](#) on how gender-based violence is leading to community food security. It was suggested that GBV is not only a human rights issue but a food insecurity issue.

This research illustrates how the university is committed to working with policymakers and public bodies nationally and internationally.



37 research papers published in 2021-22

Our Teaching

We offer a number of different courses and modules that support SDG 16, such as [politics and international relations](#), [law](#), [migration and citizenship](#), [human rights](#) and [international security](#). Furthermore, our [Learning and Teaching Strategy](#) highlights our commitment to making a positive difference to our students, our staff and our communities.

In 2022, **143** of our graduates received law and justice related degrees. This was an increase of 15 graduates compared to the previous year.

In 2022, **58** of our graduates completed an international relations or similar degree.

Our Operations

Greenwich has a Governing Body made up of independent and university representatives including elected student representatives. This and other governance groups such as the Finance Committee and other committees enable the effective management of the university and ensures the objectives of many of the SDGs are met through our operations, procedures, systems and actions.

Student Union

The university publicly recognises its Student Union (Greenwich Student Union) as a democratic union run by students for students, with over 20,000 members. The GSU released their [GSU Plan by 2026](#) in 2021 which details how they will proactively support the 'This is Our Time' strategy and the students in the next five years. Read the [Student Union Code of Practice](#).

Strategy

Our ['This is Our Time' Strategy](#) and our vision of Education without Borders has strong emphasis on four cross-cutting priorities: Student Success, Inclusivity and Culture, Impactful Research and Knowledge Exchange, and Connected and Sustainable Campuses. This strategy underpins all decisions made at every level.

Policies & Statements

The university has clear policies in place on [anti-bribery](#), [socially responsible investment](#) and [freedom of speech](#). We recognise core tenets of education and academic need including a commitment to academic freedom and we publish our [Annual Financial Statement](#) that illustrates our accountability and meets legal requirements.

Our Partnerships

The university engages and works with key stakeholders within the community to form strong local partnerships. This is outlined in the [Partnerships Sub Strategy](#), which outlines the university's vision for partnerships, both locally and internationally.

Innocence Project London

The Innocence Project London (IPL) is a pro bono law clinic based in the School of Law and Criminology. Students work alongside the director (Louise Hewitt) and lawyers offering



their time for free, deconstructing claims of innocence from convicted individuals and who have exhausted the criminal appeals process. Over the years the student numbers have grown consistently and in 2021, all students from other schools in FLAS were invited to participate. In total since 2017, 138 students have worked on 24 cases.

17: Partnerships for the Goals

Strengthen the means of implementation and revitalize the global partnerships for sustainable development.

The university is committed to developing and strengthening partnerships locally and globally to promote collaboration and progress the goals.

Our Research

The university is committed to contributing towards the UN SDGs through its research. Greenwich university is home to internationally recognised researchers that explore a wide range of topics that progress sustainability. The university collaborates with other institutions and organisations to help deliver SDGs.

The NRI collaborated with International Food Policy Research Institute (IFPRI) in the research of Risk-Contingent Credit (RCC), to help agricultural risk management and limited access to credit for smallholder maize farmers in Kenya.

Read about other projects [here](#).



381 research papers published in 2021-22

Our Teaching

The University of Greenwich is rated amongst the best in the world for social impact. The university offers several undergraduate, postgraduate and taught research programmes that incorporate sustainability and progress us forward in delivering social impact. Some examples of courses are:

Transformative Change for Sustainable Development, MSc

Our TC4SD MSc provides students with an in-depth understanding of Development Studies theory and practice, including different conceptions of human, societal and environmental changes. Drawing on real-world lessons from various domains, sectors and contexts, students will develop the capacity to critically discuss, analyse, and evaluate TC and develop hands-on skills in sustainable development design and planning, project management, research, and impact evaluation methods.

Politics and International Relations, BA Hons

This [degree](#) provides courses that give students an introduction to major debates around development.

Our Operations

The university submits extensive data and information to support sustainability benchmarking and improvement. For example we submit complete data sets to the Higher Education Statistical Agency's Estates Management Record, which in turn helps with analysis of the sector in delivering sustainability goals. Many of our professional services teams collaborate with other teams within the university (including our academic communities) and outside to help improve sustainability objectives.

Our Partnerships

Importantly the university participates in international collaboration on gathering and measuring data for SDGs.

London Higher Sustainability Network

Simon Goldsmith, the Head of Sustainability at the university is the chair of the London Higher Sustainability Network, bringing together sustainability leaders to collaborate to deliver large scale sustainability change to the capital and beyond.

University Alliance

Professor Jane Harrington, our current Vice-Chancellor sits on the board of the University Alliance (UA). UA is the voice of professional and technical universities. Alliance Universities partner with industry and the professions to deliver the workforce of today and tomorrow through practical, skills-based learning and applied research.

Cross-University Engagement

The university is part of a wider network of higher education institutions within Greater London

Partnerships with Local Authorities

The university partners with local authorities to foster cooperation between academics and policymakers.

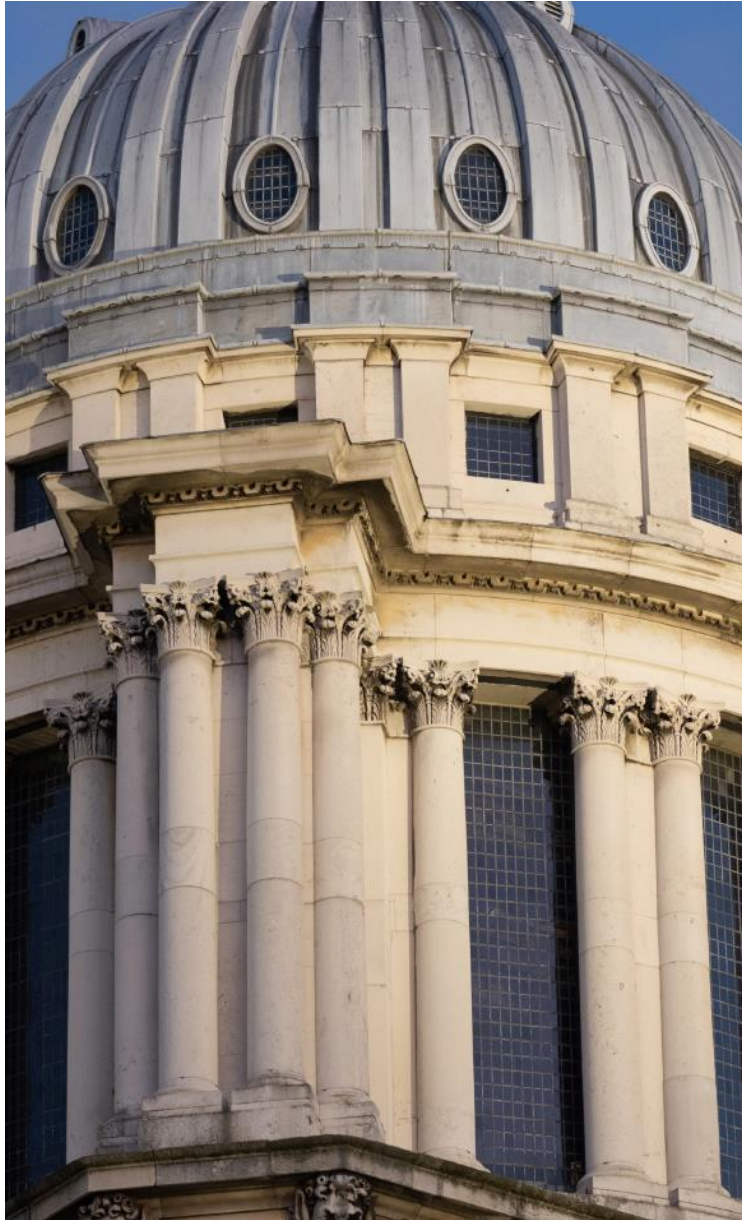
- Greenwich Council (Net Zero Pledges, Greener Greenwich)
- Submission of info to District Heating Networks in Medway Council and Royal Borough of Greenwich

Partnerships with Institutions

The university has approximately over **200** partnerships both locally and globally.

17 PARTNERSHIPS FOR THE GOALS





Looking Ahead

With our ongoing commitment to making a difference to the world we live in, the SDGs are a fundamental framework that enable this commitment to become a reality.

As a leading higher education institution with outstanding research and innovation practices, we will continue to take action and responsibility for becoming more sustainable, as well as shaping a better future for everyone. We will continue to embed our commitment to addressing the SDGs through our strategic plans and policies. The university will continue to forge partnerships with others to advance the role of higher education institutions in addressing the SDGs.

By reporting on how the SDGs are embedded within the university, it helps to formulate a strategic plan on how to improve. We hope that our next report will have even more ambitious achievements and goals.

Email: sustainability@gre.ac.uk
Instagram: [@sustainablegre](https://www.instagram.com/sustainablegre)
Twitter: [@sustainableGRE](https://twitter.com/sustainableGRE)
Facebook: facebook.com/UoGSustainability



UNIVERSITY OF
GREENWICH

Sustainable
Development Unit

Part III. Measurement of Outcomes cont.

University of Greenwich Annual Sustainability Report 2021-22 and
SDG report - <https://docs.gre.ac.uk/rep/ef/sustainability-annual-report-2021-22>

This is our time: University of Greenwich Strategy 2021- 2030
University of Greenwich Strategic Plan - <https://docs.gre.ac.uk/rep/communications-and-recruitment/this-is-our-time-university-of-greenwich-strategy-2030>

NRI Annual Review 2021-2022 - <https://www.nri.org/publications/annual-reviews/75-annual-review-2021-2022/file>

Mandatory training for staff which includes courses in Bribery Prevention; Data Protection; Equality and Diversity Essentials; Managing Diversity and Safeguarding against Extremism
<https://docs.gre.ac.uk/rep/people/mandatory-and-essential-training-courses>

Anti-Slavery and Human trafficking statement - <https://docs.gre.ac.uk/rep/vco/modern-slavery-statement>

Anti-Bribery policy - <https://docs.gre.ac.uk/rep/human-resources/anti-bribery-policy>

Sustainability Policy - <https://docs.gre.ac.uk/rep/ef/sustainability-policy2>

Sustainability strategy including our Sustainability Management Board -
<https://www.gre.ac.uk/sustain/strategy>

Sustainability Blog: [Sustainability: University of Greenwich | University of Greenwich Sustainability Blog](https://www.gre.ac.uk/sustain/strategy)

Sustainability Facebook page: <https://en-gb.facebook.com/UoGSustainability/>

Gender Pay Gap report - <https://docs.gre.ac.uk/rep/human-resources/gender-pay-gap-report>

Work of the BHRE - <http://www.bhre.org/> and <https://www.gre.ac.uk/las/research/bhre>

Work of the CREW - [CREW | University of Greenwich](https://www.gre.ac.uk/las/research/bhre)

Work of the Centre for Transformative and Global Justice - [Centre for Transformative and Global Justice | University of Greenwich](https://www.gre.ac.uk/las/research/bhre)

Work of the NRI – www.nri.org and <https://www.nri.org/publications/annual-reviews/75-annual-review-2021-2022/file>