

CO-OPERATIVE RESEARCH PROGRAMME FELLOWSHIPS AWARDED FOR 2019

(N.B.: for confidentiality reasons, no names of individuals are given in this list)

Proposed Studies	Research Fellow's Nationality	Home Institution	Destination Country	Host Laboratory	Duration of Fellowship (weeks)
Theme 1 : Managing Natural Capital for the Future					
<p><u>Does exposure to biodiversity protect against childhood leukemia?</u></p> <p>This research project aims to determine whether the exposure of children to biodiverse natural environments can increase microbial exposure to children and thereby increase their immunity, in particular whether such exposure can protect children against acute lymphoblastic leukaemia. This is a long-held view by many that has not really been tested in a controlled and quantitative way. Having such a demonstration would help policy makers design policies to help farmers and forest owners to retain and enhance biodiversity.</p> <p>Manuscript: Donovan G. et al. (2020), "An empirical test of the biodiversity hypothesis: Exposure to plant diversity is associated with a reduced risk of childhood acute lymphoblastic leukemia", <i>Science of the Total Environment</i>, Ed. Elsevier, Vol. 768; https://doi.org/10.1016/j.scitotenv.2020.144627</p>	United States	USDA Forest Service	New Zealand	Center for Public Health Research, Massey University	12
<p><u>Identifying drivers of N₂O emissions in a changing climate</u></p> <p>This fellowship aims to use state-of-the-art regional and global modelling with the Community Atmosphere Land Exchange (CABLE) model to understand and predict major drivers of N₂O fluxes over the coming decades in a changing climate, considering particularly the interactions between drought, warming and land use changes. A comprehensive understanding of N₂O emission processes is important in defining options to reduce the severity of climate change and its impacts on agriculture.</p> <p>Manuscript: Harris E. et al. (2022), "Warming and redistribution of nitrogen inputs drive an increase in terrestrial nitrous oxide emission factor", <i>Nature Communications</i> 13, 4310; https://doi.org/10.1038/s41467-022-32001-z; data: https://doi.org/10.1594/PANGAEA.946948</p>	Australia (Work country: Austria)	University of Innsbruck	Australia	University of Melbourne	16

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<p><u>Long-term effects of forest management on soil carbon: Understanding the mechanisms of soil carbon vulnerability and resilience to harvest</u></p> <p>Soil organic carbon (SOC) is a critical component of soil function to provide ecosystem services (e.g., plant productivity, hydrologic process). Disturbances such as harvesting can remove substantial portions of a forest's aboveground C stores and mineral associated SOC pools can change in response. Few studies have been conducted to examine the mechanisms that lead to reductions in SOC after harvesting or in its resistance or resilience to change. A new paradigm to explain SOC dynamics is currently emerging that can better explain SOC dynamics which will be used along with a widely established global forestry study to study the resistance and resilience of SOC to forest harvesting. The objective of this proposal is to illuminate the mechanisms that result in vulnerability or impart resilience to forest SOC after harvesting.</p>	USA	Oregon State University	New Zealand	New Zealand Forest Research Institute Ltd (trading as Scion research)	9
<p>Minimum tillage sowing techniques for sustainable organic cereal production (<i>Confidential report</i>)</p> <p>Tillage is used extensively for weed control in organic cropping systems but is associated with a decline in soil quality and increases soil erosion potential. While direct-drilling (no tillage) techniques have been developed for summer crops (maize and soybean) in organic systems, tillage is still an essential component of other phases of the cropping system. The project built upon existing organic no-till research at Cornell University to pioneer direct drilling of winter cereals into mulch of summer broadleaf cover-crops. The project demonstrated that summer cover crops could produce up to 7 t biomass over 10 weeks to suppress weeds, and full emergence of wheat seedlings was observed following direct seeding into rolled crimped sunn hemp and buckwheat cover crops. In addition to providing an option for further reductions in tillage in organic systems in the USA, the project opens the door for direct drilling in Australian organic systems that are dominated by winter cereal production.</p>	Australia	Southern Cross University	United States	Cornell University	16

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<p>Molecular mechanisms of induction of systemic resistance to foliar pathogens by disease-suppressive soils</p> <p>This research project will examine how technology can be used to improve soil-induced plant resistance at different locations in different crop plants. Unlike defence mechanisms plants have developed against foliage pathogens, crop plants often lack genetic resistance to some of the most common and destructive soilborne fungal pathogens. As a result, plants rely on microbial-based resistance defence mechanisms initiated and supported by root exudates, which stimulate and enrich populations of antagonistic rhizosphere microorganisms. Disease-suppressive soils are soils in which pathogens cannot establish or persist or cannot cause damage because of microbial-base defence mechanisms present in the soil. The researchers hope to identify the signalling pathways involved in inducing these antagonistic microorganisms in targeted soils to their disease suppressive qualities, which could lead to a significant reduction in the use of pesticides and fumigants.</p>	United States	USDA, Agricultural Research Service	Netherlands	Utrecht University	20
<p>New trait-based approach to integrate soil biodiversity into sustainable land management <i>(Confidential report)</i></p> <p>The new protocol constructed by this project will make it possible to predict soil community composition and diversity from aboveground vegetation composition non-destructively without direct observations through digging the soil. Information of soil biodiversity estimated by this protocol will provide scientific evidence to inform policy decisions not only for soil biodiversity conservation but also for sustainable land management including soil ecosystem functioning as driven by the soil community. Human activities have had tremendous negative effects on soil ecosystems via land degradation (e.g., destruction of rainforests) and land-use change (e.g., urbanisation). In accordance with the serious state of soil degradation, the United Nations (UN) are now focusing global attention on improving soil security, as seen in Goals 2 and 15 of UN Sustainable Development Goals. Our proposed project will provide information to predict changes in the soil community and biodiversity by land transformation, which is necessary and fundamental to decide a policy or management practice among several stakeholders including farmers, foresters, scientists and governments. The protocol developed from this project will be the basis for adjustment and application in many countries including multiple climate zones with different vegetation types.</p> <p>Manuscript: Fujii S., Berg M. P. and J. H. C. Cornelissen (2020), "Living litter: dynamic trait spectra predict fauna composition", <i>Trends in Ecology and Evolution</i>, TREE 2697; doi.org/10.1016/j.tree.2020.05.007</p>	Japan	Forestry and Forest Products Research Institute	Netherlands	VU University Amsterdam	22

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<p><u>Regenerative agriculture – transforming food systems by coupling grassroot innovation with scientific understanding</u></p> <p>This research project will evaluate regenerative agricultural practices which may promote and enhance the sustainability and functionality of top soil and soil microbial diversity. Regenerative agriculture – farming and grazing practices aimed at rebuilding soil organic matter, restoring degraded soil biodiversity, and tightening water and nutrient cycles – is a transformative management approach being implemented by many farmers worldwide. The researchers involved in this project will conduct a comprehensive integrated review analysis of quantitative evidence for improved ecosystem services in regeneratively managed farms</p>	France (Work country: New Zealand)	Manaaki Whenua - Landcare Research	United States	University of California, Merced	9
<p>Simultaneous delivery of provisioning and regulating ecosystem services in forested lands <i>(Confidential report)</i></p> <p>This research fellowship aims to analyse the role of tree diversity in the delivery of forest ecosystem services using forest databases from two contrasting regions of the world in Spain and the US. The increasing demand of simultaneous ecosystem services, for example climate regulation and raw materials, put into question the sustainability of forestry and the mitigation capacity of forests. Many OECD countries are adopting the bio-economy model, but which could be a threat to biodiversity if few species are preferred because of their profitability in one single ecosystem service. The outcomes of this fellowship will inform policy makers about the long-term acquisition of ecosystem services in mixed forests and will help towards such sustainable forest management practices as informed species selection to minimise ecosystem services trade-offs.</p> <p>Manuscript: Bravo-Oviedo et al. (2021), "Similar tree species richness-productivity response but differing effects on carbon stocks and timber production in eastern US and continental Spain", <i>Science of the Total Environment</i>, Ed. Elsevier, Vol. 79; doi.org/10.1016/j.scitotenv.2021.148399</p>	Spain	MNCN-CSIC	United States	USDA Forest Service	12

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<p>Sustainable management of natural resources using multi-source remote sensing data and enhanced software solutions</p> <p>Case study</p> <p>This research project will apply forest inventory methods based on remote sensing to sustainable forest management. Air- and space-borne methods – such as aerial light detection and ranging, satellite images – as well as new algorithms for computational analysis will be applied to provide precise and up-to-date information about forest ecosystems. The algorithm will have a universal potential for estimating the state of forests and changes on various spatial levels with respective spatial resolution in the same time period.</p> <p>Manuscripts: 1. Bucha T., J. Papčo J, I. Sačkov et al. (2021), "Above-ground biomass estimation on abandoned agriculture land using Sentinel-1 and Sentinel-2 data", <i>Remote Sensing</i> 13(13):2488; doi.org/10.3390/rs13132488</p> <p>2. Sačkov I., I. Barka and T. Bucha (2020), "Mapping aboveground woody biomass on abandoned agricultural land based on airborne laser scanning data", <i>Remote Sensing</i> 12(24):4189; doi.org/10.3390/rs12244189</p> <p>3. Sačkov, I., L. Kulla and T. Bucha (2019), "A Comparison of Two Tree Detection Methods for Estimation of Forest Stand and Ecological Variables from Airborne LiDAR Data in Central European Forests", <i>Remote Sens</i>, 11, 1431; doi:10.3390/rs11121431</p> <p>4. Sačkov I, L. Scheer and T. Bucha (2019), "Predicting forest stand variables from airborne LiDAR data using a tree detection method in Central European forests", <i>Central European Forestry Journal</i>, Vol.65, no.3-4, pp.191-197; doi.org/10.2478/forj-2019-0014</p> <p>5. Goga T., I. Sačkov et al. (2019), " A review of the application of remote sensing data for abandoned agricultural land identification with focus on Central and Eastern Europe", <i>Remote Sensing</i> 11, 2759; doi.org/10.3390/rs11232759</p>	Slovak Republic	National Forest Centre	Norway	Norwegian University of Life Sciences	16

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<p><u>Sustainable valorisation of non-edible residues of the aquaculture and fish processing industries: learning from the Australian standard</u></p> <p>This research fellowship will look into how non-edible residues from fish processing industries can be processed through biorefineries to give them economic value and reduce waste. The fellow will look in particular at Australian research projects in the conversion of marine biomass into other products (for example, feed, cosmetics, pharmaceuticals, bioplastics, new materials) to assess if the protocols and technology could be exploited in Europe. Given that 70% of landed fish is processed by the food industry, generating up to 80 wt % of waste which represent sources of potentially valuable molecules including oils, proteins, amino acids and collagen, among others, reusing such waste could have substantial contributions to the blue economy, whilst reducing negative environmental impacts.</p> <p>Manuscript: Hemming E.B., M. Selva et al. (2019), "Single-Step Methylation of Chitosan Using Dimethyl Carbonate as a Green Methylating Agent", <i>Molecules</i> 24(21):3986; doi.org/10.3390/molecules24213986</p>	Italy	Ca' Foscari University of Venice	Australia	University of Sydney	15
<p><u>Towards a targeted agri-environmental policy in Europe: adaptation of a novel payments for ecosystem services framework to Nordic agro-ecosystems</u></p> <p>This fellowship aims to design a novel payment system for ecosystem services (PES) for Nordic countries, taking PES designed for Mediterranean conditions as a base to work on. The research done could help to resolve the conflict between agricultural productivity and nature conservation by identifying critical features of multifunctional agricultural practices which may require support mechanisms. The outcomes could also lead to enhanced public awareness of the value of farmer services in ecosystem maintenance through outreach programmes.</p>	Spain	Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA)	Norway	Norwegian University of Life Sciences	18

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Theme 2: Managing Risks in a Connected World					
<p><u>Genetic studies on fruit trees for adaptability to climate change</u></p> <p>This research project will assess the genetic diversity of peach trees to deliver innovative tools to help breeders choose cultivars best adapted to changing conditions due to climate change. Predicted annual temperature rises due to climate change in fruit producing regions will have a detrimental impact on the development of fruit trees, from their dormancy during winter, through budbreak, flowering to maturation of fruits, impacting crop success. Increased temperatures in the last two decades have already resulted in lower production. Another issue will be water availability and rainfall, including severe precipitation and flooding events. The researchers will use next generation sequencing technology to identify candidate genes which can control the adaptive traits in fruit crops. The results from this fellowship will help to accelerate the breeding process of fruit trees adapted to new climate conditions. Given the importance of fruit in the human diet and current agro-market demands for larger volume or higher nutritional value fruit, breeders need to develop new improved varieties which will withstand new climatic conditions, in order to achieve sustainable and environmental friendly breeding programmes.</p>	Sweden	Swedish University of Agricultural Sciences (SLU)	Spain	Instituto Valenciano de Investigaciones Agrarias	16
<p><u>Sustainable non-chemical control of Russian wheat aphid in cereal crops</u></p> <p>The objective of this fellowship project is to secure social, environmental and economic wellbeing by reducing the risk of yield losses in cereals caused by aphids and the reliance on insecticides for pest control. The researchers will look at the role of labile carbohydrate pools in wheat cultivars and potential resistance to the Russian wheat aphid. Important outcomes from the research should be better informed modelling for crop-pest interactions, particularly under climate change. If the experiments conducted during the fellowship support the hypothesis that high concentration of labile carbohydrates enhances cereal resistance to aphids, phenotyping tools and genetic markers could be developed to improve cereal resistance to key species, thereby lessening the need for chemical pesticides.</p> <p>Manuscript: 1. Sadras V. et al. (2020), "Aphid resistance: an overlooked ecological dimension of</p>	Australia	South Australian R&D Institute	Spain	CSIC	6

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<p>nonstructural carbohydrates in cereals”, <i>Frontiers in Plant Science</i>, Vol. 11, Article 937; doi.org/10.3389/fpls.2020.00937</p> <p>2. Sadras V. et al. (2021), “The role of plant labile carbohydrates and nitrogen on wheat-aphid relations”, <i>Scientific Reports</i> 11, Article number: 12529 ; doi.org/10.1038/s41598-021-91424-8</p>					
Theme 3: Transformational Technologies and Innovation					
<p>Applying genomics resources to oat genetic improvement</p> <p>This fellowship aims to apply recently developed genomic resources to the improvement of durable resistance traits to crown and stem rust in oats. This is a devastating disease of a valuable low-input crop with proven benefits for human health. The project is innovative in being the first to utilise new oat reference genome assembly and other next generation sequencing technologies to identify and characterise economically important genes in oats to lead to plants bred to resist crown and stem rust which constantly threatens to overcome conventional breeding approaches.</p>	Canada	Morden research and development center, Agriculture and Agri-Food Canada	United Kingdom	IBERS, University of Aberystwyth	16
<p>Bioinformatic analysis of RAV gene family in rice: Mining systems genetic datasets</p> <p>Adaptation in crop plants is crucial for ensuring high yields in the face of environmental stress. The proposed research examined adaptation in developmental genes as they relate to stress response and specifically focussed on the RAV (OsRAV) gene family in <i>O. sativa</i> (Asian rice).</p> <p>Understanding the regulatory framework of cereal crop flowering time, specifically under drought conditions, can help in the development of new varieties of climate-ready crops. By providing insights into how flowering time is regulated, particularly under drought, we can use this to breed new drought-escape mechanisms into cereal crops, and help mitigate possible effects of drought stress conditions.</p>	USA	New York University	Spain	Center for Research in Agricultural Genomics	5

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<p>Circular bio-economic strategies for active bio-packaging for food: electrospun nanobiocomposites as high-barrier films</p> <p>This research project is to produce biodegradable nanocomposite films for food packaging from agricultural raw materials using novel processing and chemical modification. Agricultural raw materials represent a huge opportunity for economic development. It is useful then to develop technologies that can exploit these raw materials and upgrade their commercial values. Developing novel processes and products from agro-based materials will increase the market demand and value of agricultural products and by-products, thereby converting waste into wealth.</p> <p>Manuscripts: 1. Cheng H. N., A. Biswas, K. Vermillion, B. Melendez-Rodriguez and J. M. Lagaron (2020), "NMR analysis and triad sequence distributions of poly(3-hydroxybutyrate-co-3-hydroxyvalerate)", <i>Polymer Testing</i>, Ed. Elsevier, Vol. 90; doi.org/10.1016/j.polymertesting.2020.106754</p> <p>2. Vázquez-González Y., C. Prieto, M.F. Filizoglu, J.A. Ragazzo-Sánchez, M. Calderón-Santoyo, R.F. Furtado, A. Biswas and J.M. Lagaron (2021), "Electrosprayed cashew gum microparticles for the encapsulation of highly sensitive bioactive materials", <i>Carbohydrate Polymers</i>, Ed. Elsevier, Vol. 264; doi.org/10.1016/j.carbpol.2021.118060</p>	United States	United States Department of Agriculture	Spain	IATA, Spanish Council for Scientific Research (CSIC)	14
<p>Computational methods for haplotype identification, phasing, and imputation using short-read DNA sequence to enable low-cost genotyping</p> <p>This project is focused on adapting bioinformatics software to produce new computational tools for genetic analysis able to extend beyond plant systems to animal breeding systems as well. There has been a recent rapid improvement in sequencing technologies and this, together with the low costs now involved, makes the use of direct sequencing attractive for plant and animal breeders for breeding selection. However, challenges remain in translating DNA sequence into useable genotypes for easy use by breeders. This project is aiming to develop reliable, relatively easy to use bioinformatics software and pipelines that are also freely available.</p>	United States	USDA-ARS	United Kingdom	University of Edinburgh	10

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<p><u>Considerations for national big data strategy: Big data in agriculture in Canada and Australia</u></p> <p>This research project aims to build a prototype design and network for a national big data strategy in the agricultural sector. The network should strengthen scientific knowledge and provide relevant scientific information and advice to inform future policy decisions related to the resilience and long-term sustainability of agricultural production systems. Given the recent and ongoing advances in big data and artificial intelligence-aided analytics, this project is highly relevant and will provide a platform for providing data access for public sector science, policy and programme analysis.</p>	Canada	Government of Canada (Agriculture and Agri-Food Canada)	Australia	Australian Government, Department of Agriculture and Water Resources, Agricultural and Resource Economics and Sciences (ABARES)	6
<p><u>Developing genomic resources for African nightshade (<i>Solanum scabrum</i>) breeding</u></p> <p>This research project will study the role of hybridisation and genome duplication in the diversification of African nightshades and develop genomic tools for breeding drought tolerant individuals. African nightshades, although best known in OECD countries as poisonous or noxious weeds, are nonetheless part of the same family as potatoes, tomatoes and aubergines, but are emerging as an important food source in many countries, especially in Africa. The leaves and berries are rich in proteins, fibres, iron, vitamins and amino acids, and are also a source of plant based inks and dyes. This group of nightshades is also a valuable genetic resource for plant breeding because its species are resistant to all known races of the late blight <i>Phytophthora infestans</i>, which is the most serious potato disease worldwide. The <i>Solanum scabrum</i> and relatives is a range of plant species whose potential contribution to food security, health, income generation, and environmental services has not yet been fully exploited, but they could play an important role as a cash crop for example in Africa; hence the interest of this fellowship.</p>	Hungary (Work Country: Finland)	University of Helsinki	Netherlands	Department of Plant Science, Radboud University	12

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<p>Manuscripts: 1. Szabo T. and T. Attila (2019), "The emergence of genetics from Festetics' sheep through Mendel's peas to Bateson's chickens", <i>Journal of Genetics</i> 98, 63; doi.org/10.1007/s12041-019-1108-z</p> <p>2. Pour-Aboughadareh, A., M. Yousefian, H. Moradkhani, M. Moghaddam Vahed, P. Poczai, and K. H. M. Siddique (2019), "iPASTIC: An online toolkit to estimate plant abiotic stress indices", <i>Applications in Plant Sciences</i> 7(7): e11278; doi:10.1002/aps3.11278</p> <p>3. Cseh, A., P. Poczai et al. (2021), "Exploring the legacy of Central European historical winter wheat landraces", <i>Scientific Reports</i>, Rep 11, 23915; doi.org/10.1038/s41598-021-03261-4</p> <p>4. Gagnon E., P. Poczai et al. (2022), "Phylogenomic discordance suggests polytomies along the backbone of the large genus <i>Solanum</i>", <i>American Journal of Botany</i> 109(4):580-601; doi.org/10.1002/ajb2.1827</p> <p>5. Poczai P., J.A Santiago-Blay, J. Sekerák et al. (2022), "Mimush sheep and the spectre of inbreeding: historical background for festetics's organic and fenetic Laws Four Decades Before Mendel's Experiments in Peas", <i>Journal of the History of Biology</i>; doi.org/10.1007/s10739-022-09678-5</p> <p>Book: Poczai P. (2022), "Heredity Before Mendel, Festetics and the Question of Sheep's Wool in Central Europe", Ed. RC Press, Boca Raton, USA; ISBN 9781032015088</p>					
<p><u>Earthworm-assisted bioactivation and ecotoxicity for revalorization of biochars produced from co-pyrolyzing plastic with biomass waste streams</u></p> <p>This project will evaluate biochars and their potential usefulness in reducing waste. The aim is to increase the value of biochars made from co-pyrolysing plastic and biomass waste. The researchers will use earthworms to assess the potentially harmful effect of biochar produced by co-pyrolysis of plastics with biomass and to activate the biochar surface with extracellular enzymes derived from the activity of earthworms in soil. Including plastic debris in the co-pyrolysis design will improve the energetics of pyrolysis process, and modify the structural and physiochemical characteristics of the biochar. The researchers expect that the results derived from this project will provide novel knowledge in the field of biochar and (micro) plastic research by providing a fast and eco-friendly alternative to managing plastic residues.</p>	Spain	University of Castilla-La Mancha	United States	United State Department of Agriculture	12

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<p>Manuscripts:</p> <p>1. Sanchez-Hernandez J.C., K. S. Ro and F. J. Díaz (2019), "Biochar and earthworms working in tandem: Research opportunities for soil bioremediation", <i>Science of The Total Environment</i>, Vol. 688, pp. 574-583; doi.org/10.1016/j.scitotenv.2019.06.212</p> <p>2. Sanchez-Hernandez J.C., Y. Capowiez and K. S. Ro (2020), "Potential use of earthworms to enhance decaying of biodegradable plastics", <i>ACS Sustainable Chem. Eng.</i>; doi.org/10.1021/acssuschemeng.9b05450</p>					
<p>Enhanced aquafeed production: improving growth and feed quality of microalgal cultures and biofloc (<i>Confidential report</i>)</p> <p>To date the use of algal biomass has been a promising but not well-funded area of research. Policy decisions have favoured agro-industrial interests in supporting expansion of corn and soy production, and use of these crops in energy production (ethanol addition to fuels) or their inclusion in extruded pellets for fish feed. However, the nutrient value of microbial assemblages or biofloc exceeds that of corn and soy, and is potentially more appropriate in an aquatic/marine context where fish naturally feed on periphyton. The bacterial assemblages in periphyton are also important in gut flora, hence assimilation of nutrients, and other aspects of immunity that we know are extremely important for growth and overall health of target organisms. If we are to manage our natural capital for the future in aquaculture and fisheries, more effort needs to be expended on technologies and practices that put less stress on terrestrial ecosystems and optimise inputs and outputs along the whole aquaculture production and supply chain, starting with feed. There is considerable promise in feeds that depend only on primary producers (i.e. sunlight for energy), or recycled nutrients from biowaste (i.e. using bagasse from copra production) to develop single-cell feeds that are indeed more in keeping with the microbial relationships and evolutionary feed preferences of natural marine/aquatic environments. In this research, we examined specific aspects of microalgal production that recognizes the benefits of organisms' exposure to diverse microbial assemblages in feeds, with the goal of creating better feed supplements.</p>	Sweden	University of Gothenburg	Australia	Government of South Australia, Division of Primary Regions and Industries	16

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<p><u>Establishment of value-adding products from woody biomass toward low carbon emission</u></p> <p>This project is to develop an economically viable and value-added bioeconomy model from woody biomass and waste products. The researchers will look in particular at the advantages of torrefaction of woody biomass, i.e. the mild carbonisation of biomass, similar to roasting coffee or tea, which is known to improve the waterproof properties and durability of woody biomass, avoiding severe decomposition; quality monitoring controls for the torrefaction process will be developed. The researchers will also look at the use of the ash remaining from burned woody biomass as an effective fertiliser. This would give added value in reducing the need to mine resources for fertilisers, thereby decreasing fertiliser costs, and helping increasing agricultural production and incomes.</p>	Japan	National Research and Development Agency Forest Research and Management Organization	Germany	German Biomass Research Center (DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH)	20
<p><u>Natural nano-material derived from spider mite silk: genomics of agricultural pest leads to novel biomaterial</u></p> <p>This research project will be looking at developing novel biological nanomaterial derived from spider mite silk, using combinations of genomics, cell and molecular biology and biotechnology. The nanomaterial developed will be safe environmentally, by being biocompatible and biodegradable, and non-toxic for humans and animals, and will have potential in multiple sectors ranging from agriculture and biomedicine to the food industry (e.g. bio-films). It is expected that upcoming regulation will restrict use of inorganic and synthetic nano products and impose rigorous safety regulations, favouring bio-nanomaterials that are biocompatible and environmentally safe. Spider mite silk nanoparticles have the potential to substitute currently used inorganic (metals, silicate) or chemically-synthesized nanoparticles (plastic, polystyrene) in various applications.</p> <p>Manuscript: Lozano-Pérez A.A. et al. (2020), "The silk of gorse spider mite <i>Tetranychus lintearius</i> represents a novel natural source of nanoparticles and biomaterials", <i>Scientific Reports</i> 10, 18471; https://doi.org/10.1038/s41598-020-74766-7</p>	Canada	University of Western Ontario	Spain	Instituto Murciano de Investigación y Desarrollo Agrario y Alimentario (IMIDA)	16

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(N.B.: for confidentiality reasons, no names of individuals are given in this list)

Proposed Studies	Research Fellow's Nationality	Home Institution	Destination Country	Host Laboratory	Duration of Fellowship (weeks)
<p>Resistance to pests and diseases through modulating emission of volatile organic compounds in citrus varieties using new breeding technologies</p> <p>This research fellowship will look at using new breeding techniques (NBTs) such as cisgenesis or CRISPR-Cas9 on the volatile organic compounds (VOCs) of citrus to generate new varieties of citrus which have improved resistance to pathogens and reduced the attractiveness to pests. In citrus, leaf and fruit VOCs are essential for repellence/resistance to insect herbivores and pathogens while mature fruit VOCs are additionally of a great importance to plant fitness due to their function in attraction of seed dispersers or seed dispersal facilitators. However, specialized pathogens, pests and vectors sharing a long evolutionary history with citrus hosts are fully adapted to their specific bouquets, in such a way that some VOCs are needed for successful infection or infestation. Fruit VOC emissions can be manipulated to provide novel strategies for pest and disease management, without altering important agronomic traits, thereby reducing or minimising the use of toxic synthetic agrochemicals for pest and pathogen control.</p> <p>Manuscript: Shimada T., T. Endo, H. Fujii, A. Rodríguez, T. Yoshioka, L. Peña and M. Omura (2021) "Biological and molecular characterization of linalool-mediated field resistance against <i>Xanthomonas citri</i> subsp. <i>citri</i> in citrus trees", Tree Physiology, 1–18; https://doi.org/10.1093/treephys/tpab063</p>	Spain	CSIC-UPV	Japan	NARO Institute of Fruit tree and Tea Science (NIFTS)	6