Institution: Canterbury Christ Church University

Unit of Assessment: Agriculture, Veterinary and Food Science (6)

a. Overview

This submission is based on the research, knowledge exchange (KE) and consultancy activity of a cross-Departmental Unit of Assessment (UoA) within Canterbury Christ Church University (CCCU). The UoA was formalised in 2010 and developed from the Ecology Research Group (ERG), a research grouping established in 1989. The UoA is housed within the Department of Geographical and Life Science. Of the staff submitted to REF2014 in this UoA, ten are members of the Department of Geographical and Life Sciences and three come from other Departments within the Faculty of Social and Applied Sciences. There are also five visiting research fellows sited within the UoA.

Staff from the ERG were not submitted to RAE2008, although the group was involved in an Environmental Sciences submission to RAE2001. Since 2010, major staffing increases, primarily within the Department of Geographical and Life Sciences, have greatly expanded the UoA, with nine of the thirteen submitted staff appointed at CCCU since 2011. Consistent with this growth in staffing, seven of those submitted are early career researchers (ECRs). These increases in staffing have broadened the scope of the research undertaken within the UoA and, as part of this growth and investment process, the UoA has developed a new strategy and direction. This has involved an on-going coordination of staff research interests, the development of three key research groupings, and the formulation of the UoA's future strategic aims and goals for research. These future strategic aims and goals have been developed in response to national and international research priorities, and to policies that require a focus on research that underpins good agricultural practice and biodiversity. Our strategy is also in agreement with the University's strategic plan, in that we prioritise stewardship of the environment and that our research facilitates social, cultural and economic prosperity, and sustainability.

Research activity within the UoA is supported and funded by a range of commercial, public, private and charitable organisations, and is also supported directly by CCCU. The coordination of research, and the promotion of a research culture, is led by the UoA steering committee, which comprises the UoA Coordinator, the Research and KE Directors for the UoA and the Head of the Department of Geographical and Life Sciences. There is also a Departmental Research and KE Committee that meets termly, which facilitates links between the UoA and research active staff in other parts of the Faculty and University.

b. Research strategy

Over the REF period the strategic aims of the UoA were to build research capacity and infrastructure, to develop the research groupings and to establish a strong research plan for the next five years.

These aims have been achieved by:

1. Recruiting research-active staff. Of the submitted staff within the UoA, only three were employed at CCCU at the start of 2008 (**Bértolo**, **Osthaus** and **Ponsonby**). Since then, appointment of new, research active, academic staff has seen the life sciences area of the Department of Geographical and Life Sciences increase from six academic staff in 2008 to twelve in 2013, with ten of these staff included in this submission. This staffing increase has allowed the creation of coherent and coordinated research groupings (see below), with staff appointments targeted to develop existing expertise and to bring in colleagues with specific skills.

2. Investing in capacity, infrastructure and equipment. Over the REF period, CCCU has supported the development of the UoA by providing new, purpose-built, research laboratory facilities (2009), by increasing access for staff to internal funding, by providing a central allocation to support the coordination of research activity (introduced 2012), and by annual support of *c.*£50,000 for capital equipment purchase (introduced 2012). The REF period has also seen greater support by CCCU for post-graduate study within the UoA and the number of postgraduate research (PGR) students

has increased steadily over the REF period (7 completed in the period 2008-13, 9 currently registered). This support has facilitated and enabled research capacity building, and contributed to a vibrant and developing research culture.

3. Developing research groupings. Three key research groupings have now been defined. These groupings have improved the focus of the UoA on strategically important issues, have allowed the development of future research plans, and are also contributing to building a supportive research environment for the development of ECRs and for PGR students. This active research culture is also facilitated through regular research seminars, with both internal and external speakers, and by presentations from graduate students. Visiting researchers, accredited as Honorary Research Fellows, also enrich the research environment.

The conjunctive effect of these achievements has greatly increased research capacity and focus, and the UoA now represents a coherent, vital and sustainable unit. Given this context, our strategy is to promote and support fundamental and applied research in three key clusters: 'Animal Behaviour, Welfare and Conservation'; 'Pests, Pathogens and Crop Protection'; and 'Applied Ecology and Environmental Management'. Central to these changes has been the explicit aim of developing groupings of staff with the appropriate expertise to undertake integrated research at multiple levels. Hence, all of the research groupings aim to integrate analyses conducted at either the whole organism or ecosystem level with research on the underlying genetics and biochemistry. Collaborative work is therefore a key aspect of our research, with significant internal multi-disciplinary and inter-disciplinary collaborations now either on-going or planned in all of the research groupings. This approach is clearly demonstrated by recent appointments, with **Byrne** (2012), **Bloemink** and **Leslie** (both 2013) appointed to bring specific protein analysis techniques into the UoA and to extend the biochemical and structural biology expertise of **Bértolo** and Dr Lisgarten, a research technician with expertise in protein crystallography. This area of the UoA's expertise will be further strengthened by the appointment of another biochemist (Jan 2014 start date). Similarly, **Vega** (2013) has been appointed to develop population genetic expertise within the UoA, and another on-going appointment is bringing another quantitative geneticist into the group (Jan 2014 start date) to extend the existing expertise of **S Harvey**.

Research strategy and future plans

The research of the UoA aims to support the European Commission's objective to halt biodiversity loss by 2020 (particularly important here is the work of the 'Applied Ecology and Environmental Management' group) and also to address key issues with the control of plant pathogens, a priority given the on-going range of expansions of many plant pests, and on-going changes in the licencing and availability of chemical treatments (particularly important here is the work of the 'Pests, Pathogens and Crop Protection' group). Our research is also targeted at policy makers and special interest groups in order to inform systematic changes in both policy and practice. During 2013-2019 we will continue to build the coherence and academic standing of the UoA.

Specifically, we intend to:

1. focus on delivering the specific identified goals of the research groupings (identified below).
2. continue to expand the numbers of both academic staff and of PGR students within the UoA.
3. increase our external income such that a greater proportion of our research is externally funded.

'Animal Behaviour, Welfare and Conservation'

This group is led by **Osthaus**, an academic based in the Department of Psychology, Politics and Sociology, and research aims to address both welfare and conservation issues. This grouping therefore brings together the cognitive and behavioural work of **Osthaus** and **Hocking** and expertise in biochemical (**Bértolo**) and molecular (**S Harvey**) analyses. Within this research grouping, strategic priorities are principally focused on integrating behavioural and biochemical analyses of stress in captive British wildlife, work undertaken in conjunction with the Wildwood Trust, the Aspinall Foundation and the Kent Mammal Group. This grouping also encompasses elements of the conservation work of **Vega** and research that aims to integrate species conservation with community engagement.

'Pests, Pathogens and Crop Protection'
This group is led by **S Harvey**, and aims to understand, and to develop methods to affect, interactions between host species and a variety of pests, parasites and pathogens. This therefore represents the most diverse of the research groupings, with work spanning multiple levels and encompassing research on fungal and bacterial plant pathogens (**Byrne**), on free-living, plant-parasitic and entomopathogenic nematode species (**Bértolo**, **Byrne**, **C Harvey**, **S Harvey** and **Leslie**), and a number of insect pests (**Bloemink**, **Burman** and **Ponsonby**). Strategic priorities here are focused on understanding the molecular and biochemical bases of signalling that underpin environmental interactions in these species and on the development of new products for their control. Particularly important here are studies using free-living model nematode species to inform work on the control of plant parasitic species such as *Meloidogyne hapla* and to maximise the potential of species such as *Steinernema feltiae* for biological control.

'Applied Ecology and Environmental Management'
This group is led by **Ponsonby** and aims to undertake applied and fundamental research that addresses issues around economically sustainable methods of biodiversity monitoring and of optimum land management and habitat sustainability. Much of this activity is focused on informing and improving agricultural management, particularly in relation to Higher Level Stewardship schemes. Within this research grouping, strategic priorities include pheromone monitoring of insects as a sustainable method of biodiversity monitoring (**Burman**), work underway in collaboration with the Swedish Agricultural University (SLU) and with the Rothamsted Insect Survey. Other work in the group is focused on the monitoring and assessment of managed ecosystems to address issues related to agricultural productivity (**Ponsonby** and **Rintoul**), and work that links to on-going studies in conjunction with Natural England. This grouping also encompasses the work of **Haddock-Fraser** that aims to influence policy with regard to corporate environmental sustainability.

c. People, including:

i. Staffing strategy and staff development

The UoA is committed to providing a fair environment in which everyone is treated with dignity and respect. This commitment is embedded in all the activities of the UoA and of the wider University, evidenced by the fact we have held Investors in People status since 2004, been awarded the two ticks symbol for our commitment to the employment of disabled people and our role as a Stonewall Diversity Champion. Within the UoA, application to join the Athena Swann Charter is also currently underway.

As detailed above, the UoA's staffing strategy has been explicitly directed at building research capacity, and at recruiting staff with particular expertise. Over the REF period, staff numbers within the UoA have increased significantly. This is particularly noteworthy in the life science part of the Department of Geographical and Life Science, in which the UoA is sited. Here, staffing has increased from 6 academic staff in 2008 to 12 academic staff at present and, in alignment with CCCU strategy, research activity is considered at appointment. In total, ten of the thirteen submitted staff are new appointments since 2008, with nine appointed since 2011. Expansion in staffing means that a large proportion of staff within the UoA are ECRs. The research careers of these staff will be supported and developed as outlined below and by focusing resources and staff development activity to support the key research groups and collaborative work that feeds into their objectives.

Staff development is provided both by the University and by the UoA, with CCCU providing a comprehensive range of training and development opportunities and the UoA providing additional support principally to early career researchers. At the University level, staff development is organised via the Researcher Development Programme, which is facilitated by the Research and Enterprise Development Centre (RED) and the Graduate School, and is organised around the four main domains of the Vitae Researcher Development Framework (RDF). As part of this programme there are modules offering specialist training in quantitative research methods, as well as organised sessions and bespoke individual support to facilitate the on-going development of vital skills for successfully undertaking research. These include project management, dissemination,

presentation and publication activity, bid writing, research ethics and governance, and PhD supervision training. All sessions of the Researcher Development Programme are supported by one to one advice and access to mentors drawing on the expertise of staff in the Research and Enterprise Development Centre and the wider academic community. ECRs are specifically supported in the Researcher Development Programme through a series of 'getting started in' sessions covering a range of research related topics. In addition, the faculty Research and Knowledge Exchange Development Manager meets with all new staff in their first semester to discuss their research aspirations and plans, and to introduce and explain the support on offer.

All staff are appraised annually as part of CCCU's standard appraisal system. Within the UoA, this process now specifically integrates research planning and the provision of internal resources to support activity. Staff produce an Individual Research Plan that details their research and knowledge exchange activity, that articulates how this activity contributes to the objectives of the research groups and of the University, and that details the support that they require to achieve these goals. The Individual Research Plans are then reviewed as part of the appraisal process and, in conjunction with the research group leaders, are used to facilitate the allocation of internal resources for research and staff development activity. During the period leading up to REF2014, staff development has allowed targeted buyouts that have relieved staff of teaching and/or administrative responsibilities for defined periods (**Ponsonby** and **S Harvey**) and, for staff appointed since 2012, reduced teaching responsibilities during their first two years in post (**Bloemink**, **Burman**, **Byrne**, **C Harvey**, **Leslie**, **Rintoul** and **Vega**). The UoA also operates a research mentoring system for ECRs that is linked to the appraisal process, with staff allocated a mentor to assist in the development of research and funding plans and the UoA's research seminar series acting as an additional, more informal, sounding board and discussion forum for research plans.

ii. Research students

Across the REF period, the numbers of post-graduate research students within the UoA have increased, with seven PhD students completing between 2008 and 2013, and nine students currently registered. All post-graduate research students are provided with first and second supervisors and a chair. There are regular meetings with the supervisors and there is an annual meeting with the whole supervisory team in order to monitor student progress and to ensure timely completion, with progress reports reviewed by the Graduate School. All supervisors undertake the University's Supervisor Development Programme.

During the period leading to REF2014, the UoA has also initiated a regular programme of Research Seminars, attended by staff and students (typically four seminars per term). These are given by invited scholars, by UoA staff and by post-graduate students. This seminar series is complemented by talks arranged at the University level and by the annual Christmas lecture organised by the Department of Geographical and Life Sciences. PhD students are also given additional support for conference attendance and are expected to present their work at a suitable conference annually.

In addition to this support from within the UoA, all research students at CCCU are members of the University's Graduate School and of the Postgraduate Research Association (PGRA). The Graduate School provides dedicated computing, meeting and social facilities for students, and coordinates and manages the Researcher Development Programme (RDP). This programme, which is organised around the four main domains of the Vitae Researcher Development Framework, provides research skills training and development, including in-depth modules in quantitative and qualitative research methods, generic sessions on research design, methodology and theory, data collection and analysis techniques, project management skills, specialist software training (e.g. SPSS and R), presentation and publication activity and Viva preparation. The PGRA represents the interests of research students at CCCU, arranges a series of seminars where research students can present their work and also organises an annual conference for research students. Research students therefore benefit from academic and pastoral support external to their research unit and are encouraged to interact with their peers from different academic specialisms.

d. Income, infrastructure and facilities

Extensive research funding support is available from the Research and Enterprise Development Centre (RED). This includes the sourcing and identification of funding opportunities, bid development support and advice, facilitation of peer review through to project set-up and ongoing project management support. In addition RED employs a team of Business Development Managers who facilitate engagement with external organisations through the development of a wide range of research, knowledge exchange and impact generating initiatives. Internal funding is used to support new researchers and research areas that aligns with this strategy, with the aim of enabling sufficient progress to attract external funding.

Over the REF period, CCCU has funded the construction of new, purpose-built, research laboratory facilities (2009), which provide dedicated research space for staff. These laboratories contain appropriate constant-temperature rooms to supplement the greenhouse and exterior plant growth facilities available to the UoA. CCCU has also provided annual support of *c.*£50,000 for capital equipment purchase (introduced 2012). This has, to date, allowed the extension of capacity for molecular work within the unit and on-going purchases are targeted at extending capacity for protein extraction and analysis.

Research staff within the UoA have been successful in generating research income from a wide range of funding bodies. Over the period from 2008 this income has however been modest (totalling £113,225), but given the number of recent appointments and the limited staff numbers for the early part of the REF period this is unsurprising. Going forward, a specific aim of the UoA is therefore to increase the levels of external income and the amount of research activity supported by such income.

e. Collaboration or contribution to the discipline or research base

1) Collaboration

Members of the UoA collaborate with various external organisations and communities, and the UoA has strong links to a wide range of organisations and institutions outside of academia. Current external non-academic partners include: The Natural History Museum; Royal Botanic Gardens Kew; Environment Agency; Natural England; Wyebugs; BCP - Certis Europe; FAST Ltd. (Brogdale); Algaecytes; Wildwood Trust; Aspinal Foundation; East Malling Research; and The Prince's, Royal St George's and Royal Cinque Ports Golf Clubs. Links with other UK and overseas universities include: Birkbeck College (Univ. of London); University of Bristol; University of Calgary; University of California; Cardiff University; University of Edinburgh; Imperial College; University of Kent; Liverpool John Moores; University of Maryland; University Natural Resources Institute (Greenwich University); New University of Lisbon; and Wageningen University.

This wide engagement with both academic and non-academic partners is a key part of the responsive and applied nature of the work undertaken by the UoA. Such non-academic and academic links are supported and fostered as they deepen and broaden the range of expertise available to the UoA and extend opportunities for use of infrastructure, equipment and resources. Staff also work closely with other Departments and research centres within CCCU, for example, several staff are members of the Centre for Sport, Physical Education and Activity Research (SPEAR), a cross-departmental and cross-faculty research centre. UoA staff also collaborate with colleagues in the Faculty of Education in work to promote STEM uptake, and with colleagues in the Business School to facilitate KE activity.

2) Contribution to the research base and discipline

UoA members have served and sustained the discipline as members of a wide variety of subject associations and learned societies, through peer-review activity (including both national and international grant reviews, acting as reviewers for a wide range of journals and for the National Ecosystems Assessment), through engagement in institutional consultancies at a number of universities in the UK and abroad, as external assessors, and by acting as external examiners for PhD theses. Staff have also given a range of invited lectures and keynotes.