

FELLOWSHIP SUMMARY REPORT

Evaluating the contributions of birds as pollinators and pest control agents in forest ecosystems

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Co-operative Research Programme Fellowship: Biological Resource Management for Sustainable Agricultural Systems, Directorate for Trade and Agriculture

Theme 1: Simultaneous delivery of provisioning and regulating ecosystem services in forested lands

Host 1: University of Canterbury, Prof. David Kelly, Christchurch, New Zealand;
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Host 2: Scion Crown Research Institute, Dr. Eckehard Brockerhoff, Christchurch, New Zealand;
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Fellowship duration: 10 January – 25 July, 2019

I consent to have my report posted on the Co-operative Research Programme website or the use of a short paragraph about my fellowship.

1. Research Objectives and Importance of Project

The objectives of this research project were to investigate how land cover and habitat type influence bird predation rates on herbivorous caterpillars. Birds can play a major role in controlling populations of insects in agroecosystems and in native ecosystems but their ability to perform this valuable ecosystem service is influenced by how humans manage the surrounding landscape. During any given year, birds often need more than one habitat type to feed, forage and reproduce. Managed forests and agricultural areas are often surrounded by residential areas, pasture, or row crops and this landscape mosaic has been shown to influence bird community structure and abundance. Most songbirds are insectivorous for at least part of the year and in many parts of the temperate world, they focus on consuming lepidopteran larvae which are often the major herbivores on important agricultural crops and economically important trees.

I worked with my New Zealand hosts and their graduate student, Ms. Laureline Rossignaud (LR), to set up several experimental plots with artificial caterpillars made of plasticine clay and attached to vegetation to simulate moth caterpillars. These were left for nine days and checked every three days for signs of attack by birds or other organisms. We found signs of attack on artificial caterpillars from birds, mammals, and insects and preliminary data analyses suggest that exotic pine forest size does influence attack rates on artificial caterpillars. These data are currently being analyzed by myself, Ms. Rossignaud, and Dr. Kelly and will form a major part of Ms. Rossignaud's Ph.D. thesis as well as two future manuscripts.

1b. In the early weeks of my fellowship, we identified another related research project which I briefly summarize below.

New Zealand is arguably the epicenter of global bird extinctions in the last 800 years. Nearly half of the bird species present when Polynesian sailors arrived in New Zealand and its many surrounding islands are now extinct. Many other bird species remain imperiled from diverse causes including habitat change and introduced mammalian predators. About 150 km west of Christchurch are the foothills of the Southern Alps which harbor remnants of the native beech (*Nothofagus* spp.) forest that once covered vast areas on the South Island but which have been greatly reduced by human activities. Populations of native birds in these forests face threats from introduced mammal pests like European rats and stoats. Human efforts to control these pests have been ongoing for decades in the Craigieburn Forest Park area, west of Christchurch. Prof. Dave Kelly, my host was aware of some unpublished songbird population monitoring data from the late 1970s, and suggested that if we could acquire these data and repeat the surveys in 2019, we could look at a very unique 40-plus-year time span and to evaluate how successful some of the pest management has been for native bird populations. This pest management is a huge part of what the New Zealand Department of Conservation (DOC) focuses on in its efforts to conserve native biodiversity. Several endemic New Zealand bird species remain in these forests including the Bellbird (*Anthornis melanura*), Tomtit (*Petroica macrocephala*) and Rifleman (*Acanthisitta chloris*).

2. Were the objectives achieved?

I have achieved or am well on the way to achieving the research objectives described above. A pollination portion of this project was not possible because I was notified of the OECD fellowship some months after my original proposed timeline and thus was unable to get to New Zealand during the flowering period for flax, the target plant. However, I added a height component to the research project I had proposed so that we (myself and Ms. Rossignaud) can now address the question: Within a forest, does caterpillar height above the ground (0m, 2m, 4m, 6m) influence the attack rate on artificial caterpillars? This is an important question because many artificial caterpillar studies are being conducted worldwide with little investigation of the question of height above the ground. Because some bird species focus their foraging attention at different forest strata, it is likely that height influences predation risk for caterpillars.

For the Craigieburn bird population study, we have completed over 250 5-minute point counts, and historical data has been acquired. We are working on data analysis and writing manuscripts stemming from this work. In another project initiated after I arrived in Christchurch, I collaborated with another

Scion soil scientist on a paper documenting for the first time, geophagy by common redpolls (*Carduelis flammea*) (Flaspohler and Smaill, in press, *Notornis*, see below); this was a side project I completed early on during my fellowship.

3. What were the major achievements of the fellowship?

The achievements of this fellowship can be summarized under the following three headings:

a. Scholarship – Working with my hosts and two graduate students (Laureline Rossignaud [LR] & Archie Mcfarlane [AM]), I have collected new bird point count data from native forests with different histories of pest control. I have also worked with LR to refine and carry out the artificial caterpillar field experiment and these data are currently being analyzed. I expect that at least two peer-reviewed publications will result from these studies. Below is one publication already in print in a peer-reviewed New Zealand science journal.

Flaspohler, D.J. and S. Smaill. Common Redpolls (*Carduelis flammea*) consume sodium rich clay soil in the Port Hills, Canterbury, New Zealand. In press: *Notornis* (Ornithological Society of New Zealand). Accepted 3 May, 2019.

I am also working on an essay with Dave Kelly that will discuss the issue of how species extinctions are often discussed in the conservation biology literature. This will be written for the journal *Conservation Biology*.

b. Collaboration – I have worked with my hosts as well as LR, AM and have established new and I hope enduring professional relationships. I invited LR to come to my university in Michigan, USA in August to give a workshop on the use of plasticine caterpillars in ecological research and was able to get funding from my home university to cover her travel and stay (she will be visiting Houghton, MI from 16-23 August, 2019). I collaborated with Dr. Simeon Smaill on the in print paper above; this was a new collaboration which was not part of my original OECD proposal. I have also met and continue to meet with Dr. Dean Anderson, ecologist with LandCare, another Crown Research Institute; he is beginning new work with Adele penguins and we are exploring collaboration possibilities.

c. Broadening – This fellowship has given me the chance to participate in new field work using new methods I was not previously familiar with. I spent at least 2-3 days per week in the field throughout the fellowship and became comfortable with an entirely new ecosystem, new birds, as well as new methods and analytical techniques. I have broadened my skills as a biologist and my professional relationships with new and future collaborators.

4. Follow-up work

Follow-up work – In addition to the visit from LR to the United States in August, 2019, I hope to invite one or both of my two hosts to give talks at my home institution in the next year or two if resources are available. I have also discussed writing targeted proposals with my hosts. Future symposia at IUFRO (International Union of Forest Research Organizations) or other meetings are also likely to result from this fellowship. Dr. Bockerhoff and I are both active IUFRO; he is an officer in the governing board

5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?

This project has produced results that can benefit society in at least two ways: 1) insectivorous birds play an important role in controlling insect pests in natural ecosystems and in agriculture and tree plantations. Understanding the magnitude of this role and the habitat and landscape features that influence it will allow managers to better utilize this ecological service for the benefit of agriculture, forestry, and the

birds themselves; 2) by improving our understanding of the factors that influence bird presence and behavior, we can better manage for the conservation of healthy bird populations. Birds are among the most valued and recognized components of natural ecosystems worldwide, and therefore support not only practical and productive natural resource commodity production systems but also healthy, resilient, and aesthetically rich environments for human life.

6. Relevance to CRP and Research Theme

Relevance to CRP: Biodiversity represents the origin and foundation of all food systems and many other ecosystem processes (e.g., waste recycling, decomposition, soil fertility) that humans rely on. The dynamic balance between different species is mediated by many biological and physical forces. Predation is among the major forces that can control arthropod populations, yet we know very little about how habitat quality, structure and size influence important predators of herbivorous insects, including insects that are pests in agriculture and forestry. This research is relevant to the CRP because it deals directly with improving our understanding of how landscape structure and habitat type influence bird abundance and predation on insect pests. Moreover, additional components of this research involve understanding the effects of forest management and pest management on native and introduced birds. The 40+ years of data on bird population numbers we are working with is nearly unprecedented in its length for New Zealand forest birds.

7. Satisfaction:

This fellowship was extremely satisfying to me on a professional level and on a personal level. It opened up new research opportunities, gave me more and new experience in the field and in an entirely new ecosystem, and allowed me to build new and productive professional relationships. My career opportunities may or may not bring me to New Zealand again but I am sure that the methods and questions explored during this fellowship will return with me to the U.S. where I hope to share them with students in my teaching and with my own graduate students in their research.

One challenge for my fellowship was that I was notified of the award nine months later than I had expected; I was told in Dec. 2017 that I was on a list to be funded if resources were available, then was not told my proposal would be supported in Oct. 2018. I took this as great news but it presented some challenges for my work which was linked to phenological and seasonal processes that had to be adjusted given the new timing. I was able to make these changes by adjusting the foci of my research and by adding new related questions to the project. I also had the good fortune of having creative and flexible hosts in Drs. Kelly and Brockerhoff. In addition, one of my hosts had a serious medical issue just 10 days after I arrived in New Zealand and this made him largely unavailable to me for the first three months of my fellowship. Fortunately, the other host was able to step up and we continue to have a great working relationship.

One minor suggestion would be to allow recipients to submit the payment invoice information electronically rather than the comparatively slow method of mailing hand signed forms from overseas to Paris.

8. Advertising the Co-operative Research Programme

I learned about this programme through one of my hosts, Dr. Eckehard Brockerhoff, who received one of these fellowships to go from New Zealand to the U.S. some years ago. I think you might get more interest if you explicitly advertise this programme as a good opportunity for sabbatical support for academics. That is how I used it and it was perfect to allow me to cover some of the many additional expenses of moving and living abroad. I found Nathalie and all of my communications with OECD to be very professional and punctual.