Amy M Brunner

OECD Theme: Managing Natural Capital for the Future

Project Title: Integrative approach for improving forest tree productivity, climatic adaptation and stress tolerance

Host Institution: Universidad de Concepción

Host Collaborator: Sofia Valenzuela

Dates: 27 October 2022 to 16 December 2022

Consent to your report being posted on the Co-operative Research Programme's website, or alternatively, a short paragraph about your fellowship which could be used anonymously: yes

What were the objectives of the research project? Why is the research project important?

In Chile and many regions in the southern hemisphere, *Eucalyptus* is the principle angiosperm taxa in forest plantations, whereas *Populus* is widely planted in the northern hemisphere. A central challenge to achieving sustainable forest productivity goals is optimizing tree responses to seasonally recurring and episodic abiotic stress events that are being altered by climate change. *Populus* and *Eucalyptus* are at the forefront of forest tree genomics and biotechnology research, and greater cooperative and comparative research that leverages work in both taxa could accelerate identification of genes and mechanisms that control responses to different abiotic conditions. By sharing and analysis of ongoing work in these two tree taxa as well as socioeconomic and research challenges, the project aims to produce a synthesis and review paper that presents a new paradigm for comparative and functional genomics of forest tree climatic adaptation and abiotic stress tolerance to advance development of new strategies for genetic improvement of these traits.

1. **Were the objectives of the fellowship achieved?**

The objectives of this research are on their way to being achieved. We identified commonalties in research efforts in the two tree taxa that will serve as examples in the review paper. In regards to building stronger international collaborations beyond individual researchers in the next generation, we are exploring ways to facilitate postgraduate research internships.

2. **What were the major achievements of the fellowship? (up to three)**
    - Improved networking, communication and collaborations with host country institutions.
    - Greater understanding of research results, goals and challenges related to genetic mechanisms and applied goals for climatic and abiotic stress resilience in Eucalyptus compared to Populus.

3. **Will there be any follow-up work?**

A peer-review journal synthesis/review publication is planned with co-authors from both collaborating institutions. This will likely not be ready for publication until 2024 because we would like to first publish primary research articles that will provide examples for the review paper and also due to co-author commitments and family leave. We are exploring other ways to establish collaborations between institutions.

4. **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?**

In addition to being major sources of pulp and wood, considerable research effort has been focused on improving the efficiency of converting lignocellulosic biomass from these fast-

growing taxa to biofuels and bioproducts, potentially increasing their already sizeable contribution to national economies and the growth of renewables. Central to reaching these goals is maximizing productivity under sub-optimal conditions (e.g., marginal agricultural lands, increasing abiotic stress events, reduced fertilization). This can also increase social acceptance of bioenergy crops and acceptance of gene-edited trees. Both tree breeding and genetic modification are likely needed to reach the potential of sustainable woody biomass production.

5. How was this research relevant to:

This project addresses the CRP goal of increasing scientific knowledge to inform decisions that promote sustainable forestry. The research is charting a course to a holistic understanding of genetic interactions with climate variables and abiotic stress involving two major plantation hardwood taxa that collectively are grown on all continents except Antarctica This will inform new tree improvement strategies to produce trees adapted to different climates and resilient to episodic stresses. Achieving this goal would increase the economic vitality of the forestry sector and allow preservation of more native forests. By increasing forest productivity on marginal lands, it would also reduce competition with food crops.

6. Satisfaction

Yes, I think the Fellowship was a success. The host institution, particular the faculty of the Centro de Biotecnologia, facilitated development of collaborations and revealed similar research interests and challenges with my home institution's Translational Plant Science Center. The only challenge was due to the COVID pandemic disrupting the original plan and reducing the time I could spend in residence at my host institution and that during the fellowship period, I was not on Sabbatical as was originally planned.

7. Advertising the Co-operative Research Programme

I learned about the Research Programme from a colleague who previously had an OECD fellowship and I had not known about the program before that. To increase visibility, I suggest finding listservs or other ways that reach research or international offices at universities so that they alert their employees to this opportunity annually. Also, make it easy to find out about the Research Programme from the main OECD page.