



**University  
of Victoria**

Graduate Studies

Notice of the Final Oral Examination  
for the Degree of Doctor of Philosophy

of

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MSc (University of New Brunswick, 2012)

BSc (University of New Brunswick, 2010)

BA (University of New Brunswick, 2007)

**“The Effects of Condensed Tannins, Nitrogen and Climate on Decay,  
Nitrogen Mineralisation and Microbial Communities in  
Forest Tree Leaf Litter”**

Department of Biology

Monday, December 19, 2016

10:00 A.M.

David Turpin Building

Room A136

Supervisory Committee:

Dr. Peter Constabel, Department of Biology, University of Victoria (Co-Supervisor)

Dr. John A. Trofymow, Department of Biology, University of Victoria (Co-Supervisor)

Dr. Real Roy, Department of Biology, UVic (Member)

Dr. Douglas Maynard, Department of Geography, UVic (Outside Member)

Dr. Richard Winder, Pacific Forestry Centre, Natural Resources Canada (Additional Member)

External Examiner:

Dr. John Klironomos, Department of Biology, University of British Columbia, Okanagan

Chair of Oral Examination:

Dr. Gordon Fulton, Department of English, UVic

## **Abstract**

Vast amounts of carbon are stored forest soils, a product of decaying organic matter. Increased CO<sub>2</sub> in the atmosphere is predicted to lead to increasing global temperatures, and more extreme moisture regimes. Such increases in mean temperature could accelerate the rate of decay in soils and lead to additional release of CO<sub>2</sub> into the atmosphere, thus exacerbating climate change. However due to its impact on plant metabolism, high atmospheric CO<sub>2</sub> concentrations may also lead to greater condensed tannins and reduced nitrogen content in leaf litter. This reduction in litter quality has the potential to slow decay of organic matter in soil and therefore offset the accelerated decay resulting from a warmer climate. My research aimed to quantify the effects of climate and litter chemistry, specifically CT and N, on litter decay, N mineralization and associated microbes in the field. Strings of litterbags were laid on the forest floor along climate transects of mature Douglas-fir stands of coastal British Columbia rain-shadow forests. *In-situ* climate was monitored alongside carbon and nitrogen loss over 3.58 years of decay along three transects located at different latitudes, each transect spanning the coastal Western Hemlock and Douglas-fir biogeoclimatic zones. Microbial communities in the decaying litter and in forest soils were also analysed using polymerase chain reaction-denaturing gradient gel electrophoresis. Microbial biogeography at field sites was partially influenced by climate, soil characteristics and spatial distance, but did not improve best fit decay models using climate and litter chemistry variables. Litter with greater initial condensed tannin and smaller nitrogen concentration slowed down early decay (0 - 0.58 yr) and net N mineralization, while warmer temperatures accelerated later decay (0.58 - 3.58 yr) and net N mineralization. Water-soluble condensed tannins were rapidly lost during decay, while other forms of condensed tannins were likely responsible for slower decay. The composition of fungal communities on decaying litter was affected by initial concentrations of condensed tannin and nitrogen. On a yearly basis, the slower decay of litter with high condensed tannin and reduced nitrogen content can offset accelerated rates of decay associated with warmer temperatures. Concurrent shifts in microbial communities and net nitrogen mineralisation suggest potential benefits to trees.