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 Guelph, 2012)
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## "Understanding and sampling spatial ecological process for biodiversity conservation in heterogeneous landscapes"

School of Environmental Studies

Thursday, April 26, 2018
12:00 P.M.
Clearihue Building
Room B017

Supervisory Committee:
Dr. John Volpe, School of Environmental Studies, University of Victoria (Co-Supervisor)
Dr. Jason Fisher, School of Environmental Studies, UVic (Co-Supervisor)
Dr. John Taylor, Department of Biology, UVic (Outside Member)

External Examiner:
Dr. Angela Fuller, Department of Natural Resources, Cornell University

Chair of Oral Examination:
Dr. Lisa Gould, Department of Anthropology, UVic

Dr. Stephen Evans, Acting Dean, Faculty of Graduate Studies

## Abstract

Anthropogenic landscape change represents a major threat to contemporary biodiversity. Such changes affect the heterogeneity of landscapes, where species occur on the landscape, how and if those species persist, and the efficacy of conservation strategies. Landscape change and biodiversity decline is a global problem and has sparked world-wide initiatives promoting biological conservation techniques such as reintroductions, protected area networks, and both preservation and restoration of landscape connectivity. Despite the increasing abundance of such working landscapes (i.e. “human-modified” landscapes), we know relatively little about their ecological mechanics; these landscapes can be vast, encompassing areas too large to obtain high resolution ecological data to test ecological process. To investigate the ecological mechanics of working landscapes, I use a small, tractable, landscape mesocosm situated in east-central Alberta, Canada – The Cooking Lake Moraine (a.k.a. the Beaver Hills Biosphere). The chapters within this dissertation quantify biodiversity across a hierarchy of measurements (from genes to communities) and investigate consistencies in ecological processes generating patterns in these biodiversity measurements across spatial scales. As a result, I investigate both a depth, and breadth, of spatial ecological processes underlying the efficacy of biodiversity conservation techniques in heterogeneous working landscapes. In Chapter I, I explore between-landscape functional connectivity by investigating the genetic contribution of reintroduced individuals to an ostensibly successfully reintroduced population within the mesocosm. I find that contemporary animals are the result of recolonization from adjacent sources rather than putative reintroduction founding individuals, indicating greater mesocosm functional connectivity to adjacent landscapes than previously thought. In Chapter II, I probe within-landscape functional connectivity by quantifying the contribution of protected areas, natural, and anthropogenic landscape features to animal movement across the mesocosm. I find that natural features had the largest effect on animal movements, despite the presence of protected areas. Chapter III investigates protected area network efficacy on biodiversity conservation by quantifying the contribution of protected areas, natural, and anthropogenic landscape features to mammalian functional diversity across multiple spatial scales within the mesocosm. I find that protected areas rarely predict functional diversity across spatial scales; instead natural features positively predict functional diversity at small spatial scales while anthropogenic features are negatively associated with biodiversity at large spatial scales. Finally, Chapter IV ties the previous three chapters together by testing implicit assumptions of the species occurrence data collected in each. I compare GPS collar data (Chapter II) to species occurrence data collected on wildlife cameras (Chapter III) to demonstrate that the magnitude of animal movements better predict species occurrence than the commonly assumed proximity of animal space use. Across chapters, two central themes emerge from this dissertation. First, the importance of natural features at small spatial scales, and anthropogenic features at large spatial scales, within the landscape matrix is predominant in predicting multiple measures of biodiversity. And second, we cannot assume predictable efficacy of conservation strategies or even the ecological process inferred from the data collected to test these strategies.