Community Structure of Canopy Arthropods Associated with *Abies amabilis* Branches in a Variable Retention Forest Stand on Vancouver Island, British Columbia, Canada

by

Stacey Lee Wilkerson
B.Sc.,University of Victoria, 2001

A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

in the Department of Biology

Supervisor: Dr. Bradley R. Anholt

ABSTRACT

Clearcut harvesting can create conditions unfavourable to forest regeneration. In response, variable retention harvest methods are being investigated in montane forests on Vancouver Island, Canada. The effect of this overstory removal is unknown for canopy microarthropods, especially oribatid mites. As mites contribute significantly to nutrient cycling and decomposition processes in the canopy, changes in community structure and abundance may have dramatic effects on forest productivity. I studied the effects of two variable retention treatments, patch-cut and shelterwood systems, on arthropod communities associated with *Abies amabilis* (amabilis fir) branches and lichens. Changes in community structure were evident among the treatments and an old-growth control site. I also investigated the use of lichen abundance as a surrogate for oribatid mite abundance because it is time consuming and laborious to collect, count and identify microarthropods. Lichen abundance was a good predictor of mites in the old-growth and shelterwood, but not in the patch-cuts. Lichen abundance estimates should not replace biotic inventories, but can be used as an indicator when rapid biodiversity assessments are required.

TABLE OF CONTENTS

page

TABLE OF CONTENTS (continued)

LIST OF TABLES

CHAPTER 2 page

CHAPTER 3

LIST OF TABLES (continued)

LIST OF FIGURES

CHAPTER 2

CHAPTER 3

LIST OF FIGURES (continued)

ACKNOWLEDGEMENTS

Many people have been helpful in various stages of this thesis. I would like to thank Dr. Brad Anholt, to whom I owe an enormous debt of gratitude, for his editorial and statistical assistance, support, and generosity. I would also like to thank Dr. Lee Humble who provided much in the way of support and resources, and Dr. Richard Ring whose passion for entomology and teaching are an inspiration to many young (and old) entomologists. I am also very grateful that Dr. Verena Tunnicliffe graciously agreed to join my committee so late in the game. Thank you to Dr. Valin Marshall for readily agreeing to sit as the External Examiner for this thesis and to Dr. Bill Beese who allowed me access to the MASS site.

Thank you to Dr. Neville Winchester who was instrumental in the design and implementation of this project. I also thank the Biology Department, a major source of funding for this project. As well, thanks to the Chair, Dr. Will Hintz, for support and guidance. I would like to thank Eleanore Floyd for her patience, organization and important reminders. Thanks to Yousuf Ebrahim for words of wisdom and giving me the kick I needed to start this project.

There are a few people who I could not have done this without. A big thanks to Kevin Jordan of Arbornaut Access; without him the samples would still be in the trees. There is simply not a better tree climber in the world and I could not have asked for a better field companion. Another big thanks to Marilyn Clayton of the Pacific Forestry Centre for support, assistance with mite identification and answering many questions. I

would also like to thank Kirk Hockin and Celina Gabriel who risked life, limb and carpel-tunnel syndrome to help me collect and sort samples.

Thank you to Dr. Valerie Behan-Pelletier for being a source of support and information. To Zoë Lindo, who is a bright light for the future of acarology, I am very grateful for all the discussion, commiseration and support.

Lastly, I would like to thank my parents, Brad Wilkerson & Carol Meyer for providing me with the tools I needed to start and complete this project. To Sara, Mandy and Breanne, thanks for keeping me sane. And to Wes, thanks for everything else.

Dedicated to

James Wilkerson

CHAPTER 1

General Introduction

Habitat loss and biodiversity

Decades of research have shown that many genetically distinct populations, species, and ecosystem types have been lost due to human activity (Ehrlich and Wilson 1991, Wilson 1992, Ehrlich and Daily 1993, Vitousek 1994). The significant and accelerating global loss of species is largely due to habitat alteration and fragmentation (Soulé 1991). Not only are we facing an extinction crisis, but also a biome crisis as the rate of habitat conversion greatly exceeds habitat protection (Hoekstra et al. 2005). While we do not fully realize the consequences of a massive biodiversity loss, many ecosystem goods and services have already been altered irreversibly (Hooper et al. 2005). In order to understand human impact on ecosystems, we must first measure the effects of habitat alteration and loss on biodiversity.

Habitat fragmentation occurs when large tracts of land are subdivided resulting in smaller, isolated patches. Habitat fragments are generally smaller, more isolated, and have more edge relative to interior habitat (Saunders et al. 1991, Robinson et al. 1992, Debinski and Holt 2000, Fahrig 2003). Habitat fragmentation typically reduces species richness (Wettstein and Schmid 1999, Bascompte and Rodriguez 2001, Steffan-Dewenter 2003), reduces genetic diversity (Lande 1998, Gibbs 2001, Francisco et al. 2004, Vandewoestijne and Baguette 2004) and changes population distributions and abundances (Lande 1987, Hanski et al. 1995, Hanski et al. 1996, Lande 1998). Fragmentation also affects ecological structure in habitats. Trophic chain lengths are reduced (Komonen et al. 2000), species interactions, such as predation rates, are changed