Writing outline

### Introduction

Effective wildlife management requires a thorough understanding of the many factors that can affect species’ population demographics, including survival, reproduction, immigration, and emigration. All of these may be influenced by diet. For individuals, abundant food increases adult survival and the number of young produced. For populations, abundant food resources can lead to population growth and the dispersal of individuals to surrounding areas. Fluctuations in the prey base may cause corresponding flucuations in population size or growth, creating instability that must be taken into account in species management plans. However, the severity of such fluctuations depends in turn on several factors, including dietary niche breadth. Species with a narrow, specialized diet are more sensitive to changes in prey abundance than those with a wide, diverse diet, and as a result may be more vulnerable to population declines and even local extinctions.

For a generalist predator, dietary breadth may depend less on which species it is capable of hunting and more on which species are available to be hunted. Within a single species’ range the diversity of available prey species may vary widely, forcing some populations to subsist on a few species while other populations have access to many. A wide prey base reduces the likelihood that prey species will fluctuate synchronously, and increases the predator’s ability to switch from a less abundant prey to a more abundant one. Regional diet diversity can therefore influence population productivity and stability.

In addition to prey diversity, prey species composition may also vary across a species’ range. Factors such as abundance, size, encounter rate, and handling time can make some prey species more desirable than others. The presence of these species can increase population productivity by providing an especially valuable food resource, but also decrease population stability if they are prone to fluctuations in abundance. These two factors—prey diversity and prey composition—combine to make diet a powerful influence on population demographics.

Both factors ultimately depend on landscape characteristics. At larger scales, ecosystem type dictates the distribution of prey species, while at smaller scales, habitat type affects local patterns of abundance. The effects of small- and large-scale landscape patterns, transmitted through prey resources, can influence individual survival and productivity, and population growth and dispersal. For this reason, longstanding management recommendations for the northern goshawk in the American Southwest have called for managing the landscape for goshawk prey as well as for goshawks themselves.

The northern goshawk is a forest-dwelling raptor with a Holarctic distribution and a generalist diet. In North America, the species is associated with mature conifer forest, breeding in closed-canopy stands with large trees and limited understories. Widespread habitat loss, primarily due to timber harvest, raised concerns that the species may be declining. Management guidelines were developed by the U.S. Forest Service (USFS) which identified 14 important prey species and included recommendations to manage forests as a mosaic of differently-aged stands and small openings for their benefit.

The applicability of these guidelines to other portions of the goshawk’s range is unknown. On the Kaibab platueau, where they were developed, goshawks have access to a wide prey base and fluctuations in goshawk productivity are small and driven primarily by the abundance of red squirrel (*Tamiasciurus hudsonicus*). In the Yukon, on the other hand, goshawks have a much narrower prey base and show strong variations in productivity, space use, and dispersal in response to populations of snowshoe hare (*Lepus americanus*), which are their main prey. For such a generalist predator, management guidelines, especially those which incorporate management for prey species, must take local diet into account.

In British Columbia, the coastal population of northern goshawks is the focus of federal and provincial management efforts, which currently do not include recommendations for foraging habitat management or the management of prey species. While goshawks in this region are known to consume a wide range of birds and small mammals, their diet has never been quantified. One objective of this study was therefore to quantify goshawk diet at the nest during the breeding season. Furthermore, there is no information on how goshawk diet changes at small and large scales in response to different habitat types across this ecologically diverse region. A second objective was therefore to identify which landscape characteristics are correlated with variation in breeding season diet. Finally, the consequences of habitat-driven variation in goshawk diet may have a significant–or a negligable–affect on goshawk productivity. The third ovjective was therefore to determine whether occupancy and reproductive success vary with diet and landscape characteristics.

### Study area