Forest Fragmentation and the Conservation of Native Arthropods

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Forest arthropods are important members of the forest ecosystem as they perform tasks such as decomposition and recycling of nutrients from dead plant and animal matter, pollination and seed dispersal, as well as provide non-essential services such as increasing human enjoyment of forests (Schowalter 1995). Over the past 8000 years, human activities have disturbed forests as they are utilized for wood products or cleared to make way for urbanization and agriculture (Ozanne et al. 2000). Degradation of arthropod habitat world-wide is caused by deforestation that results in either altered habitat in the form of forest fragments or remnants; or complete loss of habitat (Scudder 1996; Abensperg-Traun and Smith 1999). Many forest arthropods, such as Collembola and other flightless insects, are poor dispersers and may not be able to adapt quickly to rapid, large scale habitat alterations and therefore must be protected to minimize risk of extinction after deforestation events (Winchester and Ring 1999).

Beyond broad generalities, we do not yet know the significance of the functional role of forest arthropods. Protection of habitat in the form of old-growth, second-growth, or forest remnants is essential for effective conservation measures to ensure forest arthropod populations are maintained (Winchester 1997). The development of plantations is not an adequate protective measure for native forest arthropods. Arthropods are more abundant than all eukaryotes combined but are often overlooked in conservation efforts (Schowalter 1995; Scudder 1996). These efforts do not focus on arthropods for many reasons, including lack of information about specific arthropod groups such as Acari or Collembola (Winchester and Ring 1999; Ozanne et al. 2000; Basset 2001). In particular, there is little information on arthropods of British Columbia, with only a few published works covering a couple of families of Diptera and Lepidoptera (Scudder 1996).

Many forest arthropod species are currently at risk of localized or total extinction because of anthropogenic alterations to their habitats (Scudder 1996; Winchester and Ring 1999). Centinelan extinctions, the extinction of species before they are discovered, are also a concern as little is known about the number of arthropod species actually present in forests (Winchester and Ring 1996). Numerous studies have shown that habitat fragmentation resulting from forestry or agriculture has negative effects on native arthropod communities such as increasing susceptibility of small populations to stochastic extinction events, loss of dispersion ability with increased distance between remnants and lowered habitat quality for reproduction, shelter and food availability (Buse and Good 1993; Bedford and Usher 1994; Greenberg and McGrane 1996; Watt et al. 1997; Winchester 1997; Abensperg-Traun and Smith 1999; Oliver et al. 2000; Davis et al. 2001). For example, fragmentation has been demonstrated to reduce the number of large prey items available for certain spiders in forests in the Tokyo area, resulting in decreases in number of spider species and individuals (Miyashita et al. 1998). Many of these forest arthropod species do not disperse effectively, and therefore the risk of extinction may be quite high (Hoekstra et al. 1995).

Arthropods with strong dispersal mechanisms may make use of forest remnants as stepping stones, or they may function as a metapopulation which effectively increases their population size. Movement between fragments depends on the distance between fragments and the nature of the matrix in which they are embedded. For species that do not have good dispersal abilities, dispersal might not be possible if the fragment is isolated. Other species, such as ants and termites which disperse aerially, may be able to colonize distant fragments if intervening spaces are not overly large. In agricultural settings, the distance between fragments is often substantial and the intervening area hostile, limiting the chances of colonization and the development of a metapopulation dynamic (Abensperg-Traun and Smith 1999). The conservation of forest remnants is therefore essential. McWilliam and Death (1998) support the conservation of forest fragments to minimize losses of arthropod diversity. In a harvested forest, larger remnants result in higher probabilities that endemic populations of arthropods will remain extant and that population density and species richness will be higher (Ozanne et al. 2000).

Deforestation and the replacement of the forest with a plantation does not allow for the conservation of the original arthropods. Forest arthropod species richness and diversity in old-growth forests and mature second-growth forests have been shown to differ greatly from that of plantations. Plantations, which are often forest monocultures, are especially susceptible to pest outbreaks and disease, and support lower abundance and fewer species of the native fauna (Schowalter 1989; Schowalter 1995).

To effectively conserve forest arthropods, focus must be placed on conservation of habitat. The control of forest harvesting and the expansion of cities and agriculture is vital, as is the education of the public on the importance of arthropods to the forest. Selective logging, which will decrease the need for plantations, is one possible option to diminish the damage done to arthropod habitat during deforestation. To understand the processes

by which arthropods interact with the forest environment, in-depth studies of arthropod species must be undertaken by universities, governments and private researchers. This will lead to more enlightened and effective conservation methods (Wilson 1999). Without these steps, the loss of arthropods and changes in species composition may be detrimental to forest processes as a whole (Winchester 1997).

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