

## INFLUENCE OF LANDSCAPE STRUCTURE ON MOSQUITOES (DIPTERA: CULICIDAE) AND DYTISCIDS (COLEOPTERA: DYTISCIDAE) AT FIVE SPATIAL SCALES IN SWEDISH WETLANDS

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**Abstract:** Patterns of species diversity and community structure depend on scales larger than just a single habitat and might be influenced by the surrounding landscape. We studied the response of two insect families, mosquitoes (Diptera: Culicidae) and dytiscids (Coleoptera: Dytiscidae), to landscape variables at five spatial scales. We studied adult mosquito and dytiscid abundance, diversity, and species assemblages in relation to water permanence (area of permanent water bodies versus temporary wetlands) and forest cover (area covered by forest versus open land) within nested circles of 100 to 3000 m around trap sites in four wetlands in southern Sweden and in five wetlands in central Sweden. We found that mosquito abundance was greatest in areas with plentiful forest cover and a high proportion of temporary water, while most dytiscids favored open areas with a high proportion of permanent wetlands. However, diversity of both mosquitoes and dytiscids was positively correlated with high permanence and little forest cover. Mosquito species assemblages were mainly influenced by forest cover at a large spatial scale, whereas permanence was more important at local scales. Dytiscid species assemblages were mainly influenced by water permanence, especially at intermediate spatial scales. These results can be explained by the flight capability and dispersal behavior of mosquito and dytiscid species. The observed landscape associations of mosquitoes and dytiscids could be useful when creating new wetlands. Mosquito colonization could be reduced by creating permanent wetlands in an open landscape, which would favor colonization by dytiscids, a potential predator of mosquito larvae, while also supporting the diversity of both taxa.

**Key Words:** mosquitoes, dytiscids, diversity, permanence, forest cover, spatial scale, landscape

### INTRODUCTION

Understanding patterns of species diversity and community structure may depend on scales larger than just a single habitat and may require a landscape perspective (e.g., Kareiva and Wennergren 1995, Pickett and Cadenasso 1995, Miller et al. 1997). However, landscape structure does not influence all species equally, and different species perceive landscape structures at different spatial scales (Wiens 1989, Wiens and Milne 1989, Haslett 2001). Thus, there is not just a single landscape mosaic within an area but an almost infinite series of nested mosaics at different spatial scales (Haslett 2001). Accordingly, we have to consid-

er which environmental components might be relevant for our study organisms (Thies et al. 2003). This problem is particularly important when working with insects, since many insects have complex life cycles and use aquatic habitats as larvae but terrestrial habitats as adults. In many cases, the adults are extremely mobile and use landscapes at a variety of scales, while the larvae are less agile and confined to a specific habitat (Haslett 2001). In this study, the local scale is the habitat or trap site (e.g., marsh, swamp, bog) where an insect was collected. The size of this area was represented by a circle around the trap sites with a 100-m diameter.

In our study, we included two insect families rep-