Decomposition is a process essential to the functioning of an ecosystem. During the breakdown of plant and animal residues (decomposition), nutrients that are essential for plant growth are released into the soil and made available for uptake. Within the soil system, it is the bacteria and fungi that are directly involved in decomposition. Also playing a significant, if indirect, role in the breakdown of organic matter are the soil fauna. The soil invertebrate population is extremely diverse, including such critters as mites, spiders, centipedes, millipedes, earthworms, beetles, nematodes, and springtails.

Springtails are small, wingless organisms that usually possess a distinctive springing organ used for escaping from predators. This study considers these jumping creatures and attempts to determine their biodiversity in the soil on a particular site on Vancouver Island, British Columbia.

An understanding of the biodiversity of soil fauna on a specific site is important to development of a broader understanding of the factors affecting nutrient cycling on that site. This becomes significant on certain sites on the north end of Vancouver Island in the Port McNeill area, where it was discovered that large plantations of Sitka spruce were becoming stagnated. This problem was especially apparent on sites that had been designated as "CH phase" (characterized by large old-growth western red cedar), as opposed to those in the "HA phase" (characterized by hemlock and amabilis fir).

Various researchers are now investigating several hypotheses put forth to account for the processes involved at these sites. Determination of the composition of the major groups of soil fauna in the virgin CH and HA forest phases is an integral part of these investigations, since soil fauna play an important role in cycling of plant nutrients. Jeff Battigelli (M.Sc., University of British Columbia) has recently completed a general survey of the major groups of soil fauna of the virgin CH and HA forest phases. His study, however, limited by time constraints, did not identify any of the faunal groups to the species level; the majority were identified to the family level.

It is the objective of the study to take only one group, the springtails, from those samples collected by Jeff and identify them to species. Because different species of springtails will differ with respect to what they eat, where they live, and their response to changes in the environment, it is believed that identification of these fauna to the lowest taxonomic level (i.e., species) will lead to a much greater understanding of trends observed in their vertical distribution, seasonal fluctuations, and in differences between the HA and CH sites and, subsequently, their effects on nutrient cycling.

A change in the number or types of organisms found within an ecosystem may result in a change in the functioning of that same system, and studies of springtail populations can be used by managers and policymakers as biological indicators of such changes. Such information could, in turn, help in understanding the factors affecting the cycling of nutrients such as carbon, nitrogen, and phosphorus, which are essential to plant growth.

Exotic Aphids in Oregon

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The first step in any effort to understand the biodiversity of an area is to catalog the species present. Accordingly, a concerted effort has been made to update the knowledge about the diversity of Oregon aphids. To date, 241 species have been identified in Oregon alone. Most feed on a specific host plant, whereas some feed on several species of plants. Some species are pests of crop or ornamental plants, but most live on native plants and/or introduced weeds.

Species occurring in Oregon are here by one of three possible routes. First are those species that are indigenous to Oregon; second, those that are introductions from other parts of the North American continent; and third are exotic species originating outside North America. Below is a discussion of some of the exotic species of aphids we have in Oregon, and the reasons that they may threaten the conservation of native aphid species.

Sixty of the 241 species are known to be exotic, originating chiefly from Europe and Asia. Thirty-seven additional species were described originally outside North America, suggesting that they too may be exotic, but available information is not sufficient to determine whether they are naturally distributed throughout much of the northern hemisphere, or are introductions.

The Russian wheat aphid, *Diuraphis noxia* (Mordvilko), is an example of an introduced pest. It is thought to be of west Asian origin (Aalbersberg et al. 1987), and has now spread throughout much of the world. *Diuraphis noxia* was first discovered in the United States in 1986 in a Texas wheat field. Since then it has colonized all of the western states and parts of Canada, where it causes severe economic damage to various cereal crops (Stoetzel 1990). Although some exotic species are major pests and receive media attention as their ranges expand, many others go unnoticed. These species may feed on introduced weeds or economically unimportant native plants. Most of these species usually occur in disturbed habitats, but sometimes they may be found in natural environments. An example is *Macrosiphoniella leucanthemi* (Ferrari), a native of Europe that feeds on the oxeye daisy, *Chrysanthemum leucanthemum* L. During the summer of 1991, this species was recovered from the H. J. Andrews Experimental Forest in the western Oregon Cascade mountains, only the second North American record for this aphid.

Pest species such as the Russian wheat aphid pose an obvious threat: they cause economic losses to farmers whose crops they affect. Non-pest species are more obscure, as is the threat they pose. It is possible that introduced species are capable of displacing native species. Few, if any, cases of this have been documented because of the lack of data about the native species before and after the exotic species arrived. An example of possible displacement concerns the introduction of the pea aphid, *Acyrthosiphon pisum* (Harris). It is a very common aphid, feeding on most native and introduced legumes. The species may be displacing *Macrosiphum creelii* (Davis), which also feeds on many kinds of legumes. Although *M. creelii* is widespread in the western United States, it is uncommon. Since recent collecting efforts began, it has only been collected along ocean beaches, where the pea aphid does not live. It is possible that the pea aphid has displaced *M. creelii,* except for in unusual habitats such as ocean beaches. This type of displacement and the extinction that may result clearly threaten the natural biodiversity. If further introductions can be avoided, the current diversity may continue unchanged. This research provides a data base of the aphids present in particular types of habitats, which can be consulted when decisions need to be made about conservation of native habitats.

The above research was funded by USDA/ARS–State Exp. Station Coop. Res. Program.

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An Examination of Differences in the Accessibility of Habitat for Four Types of Old-growth Dependent Organisms in Fragmented Landscapes

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In the Pacific Northwest, where large blocks of old-growth forest are fragmented by clearcuts, the ability of animals dependent on old growth to move among the remaining patches of old-growth forest is important. Movement from patch to patch (i.e., dispersal) prevents inbreeding of small sub-populations within individual old-growth patches and allows young animals to find currently unoccupied habitat in which to live and reproduce. Factors relevant to dispersal are the distance the animal is capable of moving and the range of habitat types through which it is able to travel.

We developed a model to look at the ability of four different types of old-growth dependent animals to move relative to the landscape patterns provided by three different landscapes in southwestern Washington. We found a lack of good data on the exact relationship of old-growth species to old-growth habitat. Thus, the animals in our model are not real species. We used "pseudo-species" whose dispersal capabilities were modeled in terms of the maximum distance they could move and the types of habitat through which they could travel. Our four pseudo-species were designed to represent a set of old-growth dependent animals with varying abilities to move through fragmented landscapes.

For the model, we assumed a relationship between forest age and the presence or absence of various forest habitat qualities. We also assumed the occurrence of movement wherever old-growth habitat became both available (as forest stands developed over time) and accessible (relative to the dispersal capability of each pseudo-animal). The opportunity for dispersal occurred as the forest aged in yearly increments.

The model was used to explore the ways in which variations in landscape pattern and dispersal capabilities may affect the extent to which one animal may serve as an indicator for the presence of another. In all three landscapes, the "pseudo-owl," by virtue of its ability to disperse long distances, was much more successful at moving among old-growth patches than were the other pseudo-animals.

In the finely dissected landscape, fine-scale differences in maximum dispersal distance were important in determining how much of the available habitat was accessible. In landscapes with bigger habitat fragments, the amount of time since the organism had reached the edge of the fragment was more important to its spread than was its dispersal capability.