

Functional biodiversity

understanding how forest ecosystems work



compare the diversity associated with native and non-native tree species, and in conifer and broadleaf forests.

Growth and decay, the primary functions of all ecosystems, are entirely due to the presence of organisms, and without them ecosystems would not exist. Plants account for all of the primary growth within ecosystems, while microorganisms and soil animals are the main drivers of decomposition.

The sustainable growth of the plants is affected by organisms which feed on them or affect the population sizes of herbivores

and by the availability of nutrients for growth. This project will concentrate on animals and fungi which carry out these roles.

Soil arthropods play a major role in decomposition and nutrient cycling within forests and are also believed to help inoculate roots with mutualist fungi, called mycorrhizae. The associations between the roots and the fungi are important because they

Top left: trees benefit from their association with mycorrhizal fungi.

Below: one of the species previously unreported from Ireland, Malaconothrus egregius, a mite inhabiting the crowns of Sitka spruce.

assist in the assimilation of nutrients. Within the forest system, there is far greater biodiversity below ground than above ground, for example, there are approximately 1,000 species of soil invertebrates in a single metre square in a German beech forest.

Apart from soil fauna and fungi, some above-ground arthropods which serve important functions will also be studied. These include bugs, aphids and parasitoid wasps. Ecological theory suggests that communities with more complex food web structures and high numbers of predatory and parasitic species have greater inherent population stability and are less prone to pest outbreak. Parasitoid wasps, which display great feeding specificity, are among the most species rich and biologically diverse groups and are particularly important natural enemies making them effective agents of biological control. The Hemiptera contain a mixture of herbivorous and carnivorous species. They include the aphids, many of which are important pests, such as the spruce aphid, and important predators such as the anthocorids. They are an abundant group of insects in forests and therefore will be an important component of the diet of other arthropods such as spiders and parasitic Hymenoptera as well as larger carnivores such as insectivorous birds.

Both the Hemiptera and the mites, which are to be studied in this project, are relatively poorly known in Ireland and recent small scale work by members of the research team has resulted in the discovery of a large number of species previously unrecorded in Ireland.

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The most important driver of change in biodiversity in most temperate regions is habitat change. Currently, afforestation is one of the main forms of land use change in Western Europe. This is of particular interest in Ireland where much of the afforestation has involved planting non-native species, such as Sitka spruce. However, this is changing gradually as greater emphasis is placed on the use of native tree species in afforestation programmes.

Changes in biodiversity are often considered from aesthetic or ethical stand points. Reduction in the population sizes and distributional ranges of well-known and loved species raises public concern and are reported widely in the media. However, an aspect which is often not reported is that these organisms are integral parts of the ecosystems to which they belong. They serve functional roles in those systems and thus contribute to the sustainability of ecosystems and to the services which they deliver.

It is with this awareness in mind that a new COFORD funded project to be carried out by teams from University College Dublin and the University of Limerick will examine functionally important components of biodiversity in a range of Irish forests, and