

100 INFLUENTIAL PAPERS – LONGER COMMENTARY

42 Cornelissen, J. H. C. (1996)

An experimental comparison of leaf decomposition rates in a wide range of temperate plant species and types. *Journal of Ecology*, **84**, 573-582.

There has been a long-standing interest by ecosystem and soil ecologists in understanding the factors that influence litter decomposition rates. Historically this work recognized the importance of three interacting drivers: the chemical or physical properties of the litter itself (i.e., 'litter quality'), the decomposer organisms, and the abiotic environment, notably climate. However, much of the historical work on this topic has been conducted without much consideration of the ecology of the plants actually producing the litter, or how differences in ecological attributes among plant species may drive differences in the decomposability of their litters. This is due to a disconnection between those working on the ecology of plants and those studying the decomposer subsystem at that time. More generally, although a small minority of ecologists has historically recognized that plant species exhibit important differences in their effects on the decomposer subsystem (e.g., Handley 1961), this topic has only attracted widespread attention over the past 20 years.

The study by Cornelissen (1996) broke new ground, through being the first major study to link across-species variation in litter decomposability to the ecological attributes of these species. This work was conceptually based on the comparative approach to plant ecology which was rapidly gaining traction at that time (e.g., Grime, Hunt & Hodgson 1988). Specifically, it involved placing leaf litters of 125 highly contrasting British plant species including trees, shrubs, grasses and forbs in a common soil environment or 'litter bed' (see photo by Hans Cornelissen below) and measuring their mass loss through decomposition over time. It showed that variability among species in litter decomposability could be explained in part by several ecological and taxonomic characteristics. These included plant life form, deciduous versus evergreen habit, leaf colour at litter-fall, taxonomic status, and Sporne's index of evolutionary advancement. As such, this work provided compelling evidence that key aspects of a plant's ecology could have considerable predictive power for determining litter decomposition rates. It also highlighted that key plant traits that underpin ecological differences among species may have important afterlife effects in driving interspecific variation in the decomposition of their litter, and ultimately carbon and nutrient cycling processes known to be driven by decomposition.

This work, as well as the 'litter bed' approach for simultaneously measuring the decomposition rates of multiple species, has underpinned considerable subsequent activity aimed at understanding the comparative ecology of plant litter decomposition. As such, there has been much activity in determining the importance of plant traits in driving plant litter decomposition, including those traits that underpin the 'leaf economics spectrum' (Santiago 2007). A combined analysis of several studies around the world utilizing this approach revealed that small-scale variation in plant traits may be more important than macroclimate in directly influencing litter decomposability (Cornwell *et al.* 2008). Further, the so-called 'meeting of litter' experiment that used litters from a range of global change experiments in common litter beds was able to unravel the mechanisms through which global change may affect decomposition (Cornelissen *et al.* 2007). Other studies have used this type of approach to explore whether decomposability of different plant tissue types (e.g., leaves, stems and roots) are coordinated across species (Freschet *et al.* 2012), and whether there is coordination among species of decomposability of litter and palatability of foliage (Wardle *et al.* 2002). As such, the approach to studying decomposition instigated by Cornelissen (1996) has firmly established variation among plant species, and the traits that drive this variation, as a fundamental driver of litter decomposability and therefore potentially the cycling of carbon and nutrients in the decomposer subsystem.

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Cornwell, W. K. *et al.* (2008) Plant species traits are the predominant control on litter decomposition rates within biomes worldwide. *Ecology Letters*, **11**, 1065-1071.

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