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## Roles of plants in an ecosystem

1 It is useful to distinguish between the immediate impact of species' wealth on ecosystems and those that occur over a longer period of time, which is described here as the influence of the filter and the founders. (2) The relationship between plant diversity and ecosystem characteristics can be investigated by classifying component species into three categories – dominant, subordinate and transitioned. Dominant people are recurrent, particularly for plant tea species, are relatively large, have coarse food searchers for resources and, as individual species, make an important contribution to plant biomass. Subordinates also have great fidelity regarding certain vegetation types, but they have smaller growth, feed on a limited scale and tend to occupy micro habitats with finite architecture and phenology associated with their dominance. Passers-by shall consist of a heterogeneous selection of species with a low abundance and persistence; a large proportion are juveniles of species that are dominant or subordinate in neighbouring ecosystems. (3) The theory of mass ratio suggests that the immediate control is proportional to the inputs of the initial production, is largely determined by the characteristics and functional diversity of the dominant power plants and is relatively insensitive to the wealth of subordinates and passers-by. Recent experiments support the mass relationship hypothesis and Huston's (1997) conclusion that claims that a high wealth of species for ecosystem functions directly benefit from misinterpretation of the data. 4 The attribution of direct control to dominant positions does not preclude subordinate and transient participation in the determination of the function and sustainability of the ecosystem. Both are suspected of significant role in influencing recruitment dominators. Some subordinates may act as a filter that affects regeneration by the dominant side after major disturbances. 5 Transient products come from seed rain and seed banks and contain a collection of potential dominant and subordinates in specific locations. If the landscape carousel works, given the dwindling diversity of colonising passers-by reservoirs, we can predict that the gradual loss of ecosystem functions will result from a reduction in the accuracy that can be dominated by the reassembly and relocation of ecosystems. When ecosystems degrade due to pollution or overuse to the point where previously dominant organisms are eliminated or drained, it is often possible to demonstrate a causal link between biodiversity loss and loss of ecosystem function and benefits for humans (Smith 1968; LeCren et al. 1972; Pearson && Rosenberg in 1976; Vitousek && Melillo in 1979). A more complex analysis theme arises in a situation where poor ecosystems (e.g. boreal forests, bogs, (e.g. limestone grassland, tropical forests and coral reefs) remain stable, but have a gradual loss or genetic diversity (Thomas 1960; Bobbink & Willems 1987; under the 1993 Treaty. Does such misery, especially when it affects species with little relative abundance in communities, have a significant impact on the function and viability of the ecosystem? To solve this issue, it is useful to identify two separate problems. Firstly, we need to know whether the loss of species' wealth has an immediate (pro-excel) impact on ecosystem function. Secondly, the possibility of less obvious long-term consequences must be considered. This document briefly addresses both issues. The evidence is derived mainly from studies of herbaceous plantstosis, but it seems that some of the principles apply more broadly. In order to assess the consequences of species destruction for its host ecosystem, it is necessary to know the role (if any) of the organism concerned (if any) (Grime 1973; Whittaker in 1975; McNaughton in 1978; The 1994 Act. In his pioneering experiments to define the functional roles of species in the plant and animal communities, Whittaker (1965, 1975) acknowledged that the first step is to outsource component species according to their relative abundance or productivity. Once a large number of the resulting dominant diversity profiles are produced, it is possible to start looking for consistent links between the characteristics of species and their abundance in ecosystems and communities. In the case of European herbaceous plants, there is a huge collection of information on the abundance and characteristics of ingredients in relatively small (c. 1 m2) plant samples. Discussions on the functional significance of these data are available in Grime(1973, 1987), Grubb et al. (1982) and Mitchley & Grubb (1986). Many ecological factors and plant characteristics deserve to be considered as potential factors for dominant diversity profiles, and it is clear that the controlling effects are sometimes detailed. However, generalisation tests can be attempted and summarised in Figure 1 in the form of a designated dominance diversity curve (sensuWhittaker 1965). This suggests that most herbaceous samples can be recognized as three elements can be identified, each of which is able to vary between species wealth and taxonomic identity, and the dominant, subordinate and transition described here. Dominant conditions are usually few, longer and more expansive in morphology and account for a large part of biomass (as shown in the grassland example in Figure 2). Many subordinates are constantly present with special dominant parties, and although they are usually more than individuals than dominant individuals, they are smaller than growth (Figure 2) and make up a smaller proportion Unlike subordinates, transient heterogeneous and lack of fidelity to specific dominations. They make a very small total contribution to the plantstoma and vary greatly in both abundance and functional properties. Most of them are represented only by seedlings or juveniles, and a large proportion are species that occur dominant or subordinate in other ecological situations (Table 1) often located nearby. In passing, it is interesting to note that the official procedures used to collect and analyse data on the species composition of plant communities (e.g. Clements 1905; Braun-Blanquet 1932; Bray & Curtis 1957; Kent & Coker 1992) is often involved in the under-recording or discarding of information about passers-by, which is often considered inappropriate from the point of view of the classification. Table 1 shows that such excursions by species are frequent when detailed and exhaustive sampling procedures are applied: the data of all three sampled habitats cover a wide range of species normally related to other habitats. The idea-based diversity curve (sensuWhittaker 1965) for a small herbaceous sample. The distinction between dominant and subordinates is based on relative abundance and is set at an arbitrary value (10%). Transfers are distinguished from subordinates due to their inability to restore and survive in controlled vegetation. Vertical distribution of the leaf canopy (a) four selected dominant and (b) four selected subspecies of ancient limestone pasture in Buxton, North Derbyshire, United Kingdom. The distribution of the canopy in June was assessed by measuring contacts with 375 randomly distributed vertical tehvli (S. H. Hillier, unpublished data), table 1. The ecological classification of species recorded in three distinctive and highly contrasting habitats, of which a 2400 km2 area around Sheffield in the United Kingdom has been widely taken. All species that were selected in a specific habitat were classified according to their primary habitat (columns 3 to 6). Details of sampling, registration and habitat classification procedures are given in the sample habitat Number of forest species Grassland Species Arable species Other \* Total wooded wooded area 51 65 23 1 5 94 Meadows 40 7 64 8 0 79 Grain crop 55 5 38 69 2 114 \* Includes species mainly related to wet habitats (cliffs, walls and bare walls). Can we generalise the relative importance of dominant, subordinates and passers-by as factors of ecosystem characteristics, such as productivity, carbon sequestration, water ratios, nutrient cycling and storage, the quality and durability of litter, and resilience to disruptive properties? Both theory & Post 1986; Huston & Smith 1987; Grime 1987; Sala et al. 1996; Huston 1997) and is dictated by physics and chemistry laws that require that the major influence of autotrophs in ecosystems involves a high participation in syntheses and inputs of resource flows and decaying processes. It follows that ecosystem characteristics should be largely determined on the basis of the characteristics of dominant conditions and are relatively sensitive to changes in the wealth of species in a situation where this is due to a change in the number of subordinate and transient employees. It is important to specify that the mass relationship hypothesis is limited when autotrophs are used in ecosystem processes. When attention is paid to other trophic elements, such as parasites, herbivores, predators and symbiotes, there is a chance of an ecosystem effect less predictably related to abundance. A growing body of experimental evidence supports the hypothesis that ecosystem characteristics are strongly influenced by the characteristics of dominant plants. A comparative study of the durability and durability of five herbaceous plants for drought, late cold and fire (MacGillivray et al. 1995) found that, using the characteristics measured in the laboratory, the forecasts were accurate if the calculations were based on the means weighted on the basis of the relative abundance of each plant species at each test site. A similar conclusion was drawn from two recent investigations (Wardle et al. 1997; The Hooper & Vitousek 1997), which found that different ecosystem characteristics were strongly linked to the functional characteristics of biomass-dominated supporters. There is also strong evidence that functional differences between existing dominant conditions can have a profound effect on ecosystems, especially in the maintenance of yields during periods when climate or plant management has fluctuated. Both monitoring studies and experiments (Willis 1963; Mellinger & McNaughton 1975; Kemp & Williams 1980; Grime et al. 1985) there is a great deal of evidence that differences are related to dominant, phenology, photosynthetic mechanism, root depth and reproductive biology. In some reported cases (Spedding & Diekmahns 1972; The Armstrong & Eadie in 1973; The Hooper & Vitousek 1997), it has been demonstrated that such additional use benefits productivity. If the immediate effect of planttooria on the characteristics of ecosystems depends mainly on dominant characteristics, consideration should be given to the additional effects of subordinate and transitioning effects. Firstly, it may be noted that there is no reason to suspect that such small respondents must have an impact on the functioning of the ecosystem; their presence may simply reflect the fact that past or present conditions have enabled them to be accepted. However, a number of sources of evidence suggest that some subordinate members of plant communities (different transitions) perform tasks that go beyond mere adventist roles. We may suspect that the consistent connections between certain dominant and their subordinates (e.g. Figure 2) reflect the additional use of habitat, resulting in more full capture of resources and the spread of productivity. In some axes paired with dominant, spatial and time-blocking finds accurate morphological expression, such as the case bryophyte Brachythecium rutabulum which in winter colonized each fallen stem litter with a long herb Urtica dioica (Furness & Grime 1982). More often, complementarity between incumbents and subordinates involves situations where they use relatively unfavourable micro-habitats. They can be expressed spatially, as in the case of fearsome herbs and bryophytes, which occupy the shaded lower layers of herbaceous plants (Al-Mufti et al. 1977; Figure 2) or in time, as shown by the small winter of isas and spring geophytes, which make little contribution to the biomass of the species-rich lime-rich grasslands Ratcliffe (1961; Grime et al. 1985). Further evidence of the mechanisms of complementarity of habitat use between the dominant and subservient members of the plant community is available from a test (Campbell et al. 1991), where the abundance of eight plant species in the test mixture was accurately predicted on the basis of independent measurements of isolated plants growing in standard uneven environments. This investigation concluded that the dominant position was achieved through the development of coarse architecture, where the main roots and shoots quickly spread through a large number of habitats with rather inaccurate concentrations in the resource-rich sectors. Additional food-seeking mechanism was recognised in subordinates; Here, the capture of resources was achieved with an accurate but local concentration of roots and shoots in resource-rich places, specialisation which can impose a penalty of subordination and, ultimately, (in the context of unlimited growth and consolidation of dominant conditions) the risk of competition exclusion. Therefore, we can conclude that functional and dominant and perhaps also subordinate functional diversity can immediately affect the characteristics of ecosystems. However, it may be a mistake to limit the search for beneficial effects of biodiversity by studying the immediate effects; the role of smaller plant components may be in the long term. The remainder of this document lists two hypothetical mechanisms where the benefits of biodiversity may be due to the intermittent effects of the biomass contributors of the installation. The first hypothesis involves subordinates, the second transient. Until now, this document has been comfortable in regarding the plant community as a stable hierarchy that includes dominant, subordinate and transferable. In reality, communities naturally experience compositional fluctuations due to seasonal and longer-term changes in climate, herbivory and plant management, and the internal dynamics of component plant populations. In addition, field surveys and experiments provide strong circumstantial evidence that the survival of subordinates in the vegetation probe of both grassland and woodland often depends on periodic events (e.g. droughts, floods, wind shedding, grazing, burning, coppicing) which temporarily limit the vitality of the dominant plants and the competitive impact. The literature contains many references to the circumstances in which the reduction of such harmful events has led to the expansion of the dominant authorities, the loss of subordinates and the rapid decline of the richness of the species (Tansley & Adamson 1925; Thomas in 1960; 1971. There is therefore no doubt that plant species, which are normally dominated by certain plant communities, usually exert control over the suitability of their subordinates. However, since it is suspected that direct control of ecosystem characteristics is largely determined by dominant dominants, it is much more appropriate to ask the objectives of this document: Do subordinate members of plant communities control the identity, functional diversity and relative abundance of dominant conditions? In order to verify the control of dominant conditions, it is necessary to take into account the long-term dynamics of plant vegetation and the regenerative stages of the life cycles of dominant conditions. Studies of the succession of vegetation (e.g. Watt 1925, 1947) have established that the continued dominance of certain species often depends on the success of sowing or vegetative re-establishment after disturbances that cause the mortality of dominant conditions, either locally or on a catastrophic scale. It may be important to recognise that the early course of post-distraction events has often been temporarily expanded in the coverage and robustness of subordinates. This phenomenon is most evident in forest clearings, where dense coating of shrubs, herbs and bryophytes can be a context for tree regeneration (Watt 1925; Skutch 1929; Characters 1974; Bormann & Likens 1979), but similar phenomena have been described in grasslands and heathlands (Oosting 1942; Keever 1950; Hillier in 1990). The habits of the seedling and vegetative company after the disruption have not only with regenerative properties such as the size and number of propagules and their dispersion, dormancy, morphology and physiology. They also arise from complex interactions with the conditions of the underlayers, where it can be assumed that the contribution of subordinate plants to the land cover will have both a positive and negative impact (Cavers & Harper 1967; Ross & Harper in 1972; Grubb in 1977; Connell & Slatyer in 1977; Noble & Slatyer in 1979; Pickett & White 1985; Bazzaz in 1986; Maguire & Forman in 1983; Burke & Grime 1996). The benefits of the company are described in a situation where seedlings survive in a shed provided by low-growth shrubs, herbs and bryophytes (Lawrence & Hulbert 1960; 1990 department; Hillier in 1990). The negative impact of shrub, herbaceous and bryophyte cover on the path of grassland and forest domination has been observed (Wardle 1959; Niering & Goodwin in 1962; Webb et al. 1972; Pons 1989) and it is generally accepted (Fenner 1992) that many small seeded herbs, trees and shrubs are not able to be located where there is sealed vegetation. There is some evidence that the rather inconspicuous subordinate members of the plant community can have a selective effect on seedling populations regenerating dominates. For example, in a microcosm test reported in Grime (1987), algae film inhibited the development of small-seeded species on the soil, but allowed larger seed ings to be created. Thus, the importance of subordinates in plant communities can go beyond any direct contribution to carbon economy and nutrient dynamics. In the long term, there seems to be a possibility that sub-members of the plant community will act as a filter that selects different potential dominants in the early stages of recolonisation after the event of disruption. Such a choice could be based on the variation in the seed stocks of the dominant countries and the related differences in the ability of their seedlings to penetrate the shallow grid (Grime & Jeffrey in 1965; Westoby et al. 1992). Alternatively, according to the characteristics of the filter cover, there may be discriminatory dominant conditions which depend on rapid formation and those which persist by juveniles (Marshall 1927; Bisli surface in 1932; 1974 scores). The control of the influence of subordinates in the restoration of dominant conditions may also be carried out through more indirect mechanisms, such as the creation of areas where seed ownership is reduced (Thompson 1987; van Tooren 1988). In this review, it was considered reasonable to limit the discussion of the potential filtering role of subordinates rather directly to the recruitment of dominant conditions. However, it would be possible to include cases where the effects of subordinates are due to more complex phenomena such as critical pests, pathogens, herbivores or (e.g. Gilbert in 1977; Huston & Gilbert in 1996). Evidence of the role of the lower filter during ecosystem reassembly remains anecdotal. Careful long-term tests (e.g. 1990) are urgently needed to assess this phenomenon. The transient ecosystem function is not relevant for the first inspection. They occur in scattered individuals and many appear only briefly in seedlings that fail to survive. Familiar examples of European grasslands include, for example, years such as papaver and polygoum species, which are present as heritage of former cultivation materials or wind-blown or bird-flavoured herbs, shrubs and tree seeds. Could such small and controversial plant-based ingredients affect the functioning and viability of ecosystems? To explore the ecological importance of passers-by, it is useful to identify the origin of these individuals and to consider why some communities contain wider diversity than others. This review focuses on the potential importance of passers-by, which shows how effective the dominant position can be across the landscape and recruiting into suitable ecosystems. However, it is worth noting that transients represent a neglected subject of plant ecology and deserve studies that are not covered by this review. In particular, it is necessary to test the hypothesis that the accumulation and persistence of transient substances in a species-rich plant is a sign that there is a low level of competition in such conditions. The sources of passing substances appear to be soil seed banks and seed rain from the surrounding landscape. This indicates that transients can provide useful information on a possible cluster of colonising species at any location. We can predict that the diversity of passers-by will mean a rich range of colonizers and a high probability that, in the event of habitat disturbance or management change, there will be a rapid influx of different plant functional types, some of which may be able to take advantage of the new conditions. Here would be a concrete example of the development of woodland, where abandoned grassland already contains a diverse selection of treeemics. Efforts to preserve biodiversity in Europe and many other parts of the world are being made in the fragmentation of landscape mosquitoes, which are constantly disrupted by natural events and urbanisation, cultivation, forestry and various forms of grassland management. Successful protection therefore depends in part on the continuous movement of populations and the reassembly of plant types and ecosystems. The extent of rapid reconstitution of communities and ecosystems is likely to be linked to the colonizer tank, many of which should be detectable as transient before being disturbed plant in the existing plant. After Egler (1954), we can suspect that the speed and completeness of the reassembly of ecosystems depends on early colonisation by relevant dominant and subordinates; Late arrival can be expected to delay the establishment of the species and may even exclude some completely (Keever 1950; Niering & Goodwin in 1962; Holt in 1972; 1975. It follows that the loss of diversity in many modern landscapes is not simply the result of local losses within communities. Impoverishment can also be caused by the gradual failure of plant dispersion and ecosystem reassembly processes; this failure should be detectable as the density of temporary plant communities and the wealth of species over time. This document sought to combine recent studies on plant diversity and ecosystem function (e.g. Lawton 1994; Naeem et al. 1994; Tilman & Downing 1994) another literature related to the mechanisms for controlling diversity itself. Referring to studies such as Whittaker (1975), McNaughton (1978) and Grime (1973), it appears that even in species-rich vegetation, the majority of plant biomass can be found in a small number of dominant species whose properties may outweigh the effects of more sub- or temporary components as ecosystem controllers. As Huston (1997) discussed, this suggests the need for caution in studies (Naeem et al. 1994; Tilman & Downing in 1994; Tilman et al. 1996; Tilman et al. 1997), which identifies links between species' richness and ecosystem characteristics, but no data are

provided on the relative abundance of constituents species. Extreme maintenance seems necessary when differences in the richness of species are not only related to differences in ecosystem functions, but also related to conflicting life history and resource dynamics (e.g. Tilman &amp; Downing 1994). As long-term experiments are available to measure the functional characteristics of the natural and synthesized ecosystems of the richness and functional composition of opposing species, the potential immediate effects of the richness of species cannot in itself be excluded. Even if the balance of evidence (Huston 1997; Grime's 1997) continues to move towards the hypothesis of mass relationship and against the suggestion that the richness of species controls the immediate functioning of ecosystems does not mean that the decline in plant diversity should be seen as equanimity. Declining diversity may be associated with less obvious effects, which are due to filter and founding influence failures. In particular, we suspect that there may be a gradual loss of functions in a situation where the dynamics and ecosystem re-assembly of vegetation rail sites continue to be colonising propagule. According to this hypothesis, the importance of plant diversity in the deterioration of ecosystem functions may be due mainly to its impact on the recruitment of dominant workers, not to the immediate impact of the species' wealth. I am grateful for Sue Hillier, John Hodgson and Ken Thompson's permission to use the data received for collaborative projects and Sarah Buckland, Andrew Askew and Suzanne Hubbard for help in preparing the manuscript. It is a pleasure to congratulate the perceptive and constructive comments made by Sandra Lovell and Michael Huston in an earlier draft of this document. 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