

Ecological factors  
influencing terrestrial  
plants and animals  
biology essay



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Ecology was first defined by Ernst Haeckel in 1866 as “ the science of relations between organisms and their environment (Bramwell 1989). The study of ecology has developed over the years from an initial descriptive field of study in the 19th century to a more quantitative, experimental and analytical discipline in the 21st century (Mayorga et al. 2002). The definition has also developed. Krebs (1972) gave the following more defined definition, “ Ecology is the scientific study of the interactions that determine the distribution and abundance of organisms.” He omitted the use of the word environment. It is clear however that the interactions to which he referred are the very factors which create the environment and so a more complete definition which marries the definitions given by Haeckel and Krebs is suggested as follows by Begon et al. (2006): “ Ecology is the scientific study of the distribution and abundance of organisms and the interactions that determine distribution and abundance.”

It is necessary to take a historical aspect and to discuss Island biogeography to understand the present distribution of plants and animals within the United Kingdom. The fauna and flora of islands are determined historically by events that occurred that affect floral and faunal populations. The initial event is generally seen to be the movement of land masses followed by glaciation. Pliocene glaciation is largely the event determining the present day patterns in distribution of Flora and Fauna in the UK (Begon et al 2006). Recolonisation of plants and animals is dependent on distance from other populations and the ability of some animals to disperse and reproduce, grow and survive, once they arrive in a suitable environment. There are two notable contrasts with continental Europe, “ Britain has a relatively

impoverished mammal fauna as several species, such as the garden dormouse *Eliomys quercinus* and the beech marten *Martes foina*, now found on the western edge of the continental mainland, failed to recolonise Britain after the last ice age" (Mitchell-Jones 1996). Reptiles and amphibians species are also more diverse on the continent than in the UK. There are only 6 native species in the United Kingdom, by comparison with a single species in Ireland which is further from Europe and Europe itself boasts over 87 reptilian species (Silva et al. 2009).

Inter actions between organisms and their environment can be viewed at three different levels, the individual, as part of the population and as part of the community. To discuss the factors affecting the distribution of plants and animals in the United Kingdom it is necessary to look at all aspects. The scope of the interactions which will be discussed here are outlined in figure 1.

The term niche is very frequently misunderstood as and often used loosely to describe where an animal lives, this is more correctly it's habitat. A niche is a summary of the organism's tolerances and requirements, how they interact to define the conditions and resources needed by an individual or species in order to practice its way of life (Begon et al 2006), and the time it occurs there (Mackenzie et al 1998). The niche of an animal is generally larger than that it actually inhabits, This is the fundamental niche which is characterised by conditions (temperature, relative humidity amongst others), within the tolerable limits of a species provided that there are enough resources available i. e. food, accommodation and that it is not limited by interactions with other organisms such as predation and competition and that it is not

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prevented from getting to the suitable area (dispersal). Hutchinson (1957) identified the Fundamental niche from the realised niche with the latter being “ the more limited spectrum of conditions and resources that allow an animal to persist even in the presence of competition and predation.

The primary conditions influencing animal distribution are as outlined in figure 1. These are portrayed as one dimensional but clearly the effect of temperature will be affected by the effect of winds and humidity.

Conditions are defined as variable environmental factors which organisms respond to. They are non depletable, the organism cannot use them up (Mackenzie et al. 1998)

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Figure 1. Factors affecting distribution of plants and animals in the United Kingdom

Temperature is a condition which affects the rate of development in organisms, in fact many cold blooded animals incubation and development is given in degree days rather than in actual time. What is really required is a temperature-time continuum also referred to as physiological time. An example of how temperature affects not 1 but ultimately 2 species in their realised niche and distribution is given by Randall (1982) In this case The rush moth (*Coleophora alticolella*) lays its eggs on the flowers of the rush *Juncus squarrosus* and the caterpillar uses the ripe seeds as its food resource. The moths and the larvae are little affected by low temperatures so there is no reason why they can't extend their niche further up in altitude

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however at the lower temperatures above 600m the seed of the rush fails to ripen and so there is no food resource for the caterpillar. The temperature related limit of tolerance has been reached for the rush, which in turn limits the niche of the caterpillar giving us the realised niche.

The pH of soil and water can have a strong influence on plant and animal communities. Plant roots tend to be damaged in soils below pH 3 and above pH 9 due to the pathogenic effect of toxic levels of  $H^+$  or  $OH^-$  ions. Soil pH also has an effect on the uptake of nutrients and the concentration of toxins, tolerance levels vary for pH but only a minority of plants can grow at pH less than 4.5 (Begon et al 2006). Kidd and Proctor (2001) investigated the role of the toxicity of hydrogen ( $H^+$ ) as an explanation of the reduced plant growth observed in the grass *Holcus lanatus* L. (Yorkshire fog) and the tree *Betula pendula* Roth (Silver Birch) in very acid soils. They collected soils and seeds from a range of acidic to more alkaline environments from 4 Scottish sites. It was shown that there was separate adaptation in the various populations to  $H^+$  or  $Al^{3+}$  toxicity which was closely related to the edaphic characteristics of the original site from which they were collected. "The fact of plant adaptation to  $H^+$  toxicity supports the view that this is an important factor in very acid soils (Kidd and Proctor 2001)."

Salinity is another condition which affects the distribution of organisms. The presence of salt in the soil water offers osmotic resistance to water uptake. The main effect of salinity is to cause osmoregulatory problems similar to those encountered in drought and freezing conditions. Salinity mainly affects organisms close to the sea or around inland salt springs/ ponds. The main adaptation of plants is..... . Salt marshes encompass a broad  
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range of saline concentrations from full strength sea water to non saline conditions. And has plants that are halophytic by degrees.

Wind plays a major role in plant dispersal. Only small light seeds with special adaptations can be dispersed by the winds. These adaptations are to facilitate the seeds remaining airborne longer which means they can be carried greater distances. Such adaptations usually involve hairs or outgrowths which increase the surface area to catch the wind

The flower ovary containing the seeds becomes a dry hollow container with one or more openings. The containers are shaken by the wind, scattering the seeds through the openings, dispersing them all around the immediate area.

(Photo: [http://www.countrysideinfo.co.uk/seed\\_dispersal/wind.htm](http://www.countrysideinfo.co.uk/seed_dispersal/wind.htm))

Wing-like outgrowths on the fruit (which contains the seed) make it spin as it falls from the parent plant. This spinning delays its fall so that the wind may carry it some distance away.

(Photo: [http://www.countrysideinfo.co.uk/seed\\_dispersal/wind.htm](http://www.countrysideinfo.co.uk/seed_dispersal/wind.htm))

Wind also has a negative effect on the distribution of organisms in that it has been implicated in the problem of soil erosion of arable lands and of sand dunes., thereby reducing their capacity to sustain plant communities.

We cannot discuss the factors influencing the distribution of organism n the United Kingdom without looking at the effects of the activities of man. Man does have a positive impact in the management of resources and in the study of, collection of and interpretation of information ecology and

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ecosystems. However he also has a negative effect in that man is the perpetrator of the majority of effects leading to environmental pollution. These include the clearing of land for operations totally wiping out local habitats, the leaching of metals into the environment and the dumping of copper, zinc and lead around mines. Many of these metals are present already but at lower concentrations and some are vital nutrients for organisms in the surrounds but the practice of mining can elevate their presence to lethal levels (Begon et al 2006). Power plants and other factories may emit sulphur dioxide and nitrogen oxide which facilitate the problems with acid rain. After much analysis, researchers now know that acid rain causes slower growth, injury, or death of forests. It is practical to assume that if it has this effect in forests it may also retard the growth of other plants which affects a resource required in the energy flow of an ecosystem and will ultimately affect the core of that system. (National Geographic 2010) (<http://environment.nationalgeographic.com/environment/global-warming/acid-rain-overview/>) When pollution occurs, animals often find away to combat the stress and overcome the effects this is evidenced in the well known example of the peppered moth. However while the development is a reaction to industrial pollution there are many other factors at play, such as genetic variability. With the increasing industrialisation in Britain, the peppered moth survived by developing a darker coloured form which was better camouflaged from predators when it landed on the soot darkened trees after the lichens had died off. (Majerus and Stevens 2006)

## CLIMATE

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Furthermore Berry et al (2003) have undertaken a study which shows the vulnerability of terrestrial habitats and species distribution in Britain to climate change which is essentially the temperature increase of 0.6°C over the past century. They contend that with such changes that it is not safe to assume that a species historical range of distribution will remain suitable.

Organisms face hazards in everyday life, they develop ways to combat or counteract these hazards, however occasionally the disturbances are on such a large scale they are to b