Brownfield or Greenfield? An Ecological Assessment of a Vulnerable Greenfield Site

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Introduction

Government guidance now rightly prioritises the use of brownfield sites for development, but the designation of some sites is fairly liberal with even vacant playing fields being considered for development. This investigation compared three such sites with regard to species composition, abiotic conditions and seed bank potential to determine if any met County Wildlife criteria (5 notable species, or >10sps/m^2) or had similar biodiversity value to an adjacent County Wildlife Site.

Location

The 20.2 ha site under investigation is situated at Ernesettle, Plymouth (SX448593) and offers an iconic vista of the Tamar AONB (Plate 1). The sample area comprises an abandoned playing field which has been landraised by infill (site A), a second playing field (site B) and a neutral unimproved grassland County Wildlife Site (site C). Sites A and B have been considered brownfield sites and a target for waste management development, including a waste to energy incinerator. Site C is situated adjacent to site B, with a species-rich hedgerow dividing the two sites. Site A is divided from sites B and C by the entrance road to an military armaments depot.

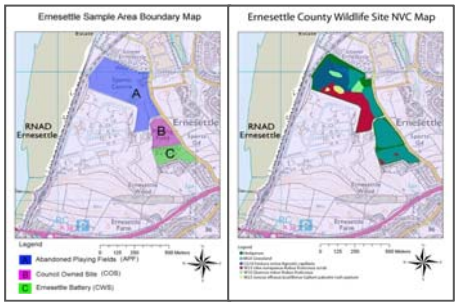

Fig 1. (left) Ernesettle sample area boundary map; (right) NVC map

Current Ecological Management

Mowing of site B takes place in the last week of June, once the sward reaches a height of approximately 30cm. Site C is subject to intensive horse grazing equating to 4.6AU (Agricultural Units) per annum[1]

Methodology

To assess the biodiversity of all three sites, floral species composition was assessed over 33 quadrats using random stratified sampling to identify 1m^2 x 1m^2 quadrat locations. Within each quadrat vegetative species composition, microclimate, habitat and soil[6] variables were recorded.

Several variables were chosen as measures of small-scale variation in the environment which could limit the availability of certain habitats for plant community development. Environmental variables measured included the ratio of red to far-red light, aspect, slope, bare ground microtopography, soil structure, bulk density, nutrient analysis, pH, organic matter and drainage[2].

Seed bank samples were taken from the upper 5cm of a 40cm soil core from each quadrat and transferred to seedling trays for propagation under glasshouse conditions[4]. Species occurring were allowed to grow until positive identification could be established and results recorded on a presence/absence basis.

Results

Species richness and Shannon-Weiner diversity indices were calculated for the vegetation and seed bank results for each site. This enabled comparison between sites to determine whether any could achieve CWS criteria, whether perceived 'brownfield' has a lower diversity than accepted 'greenfield' and whether the seedbank has sufficient potential to restore the area to a more characteristic species composition.

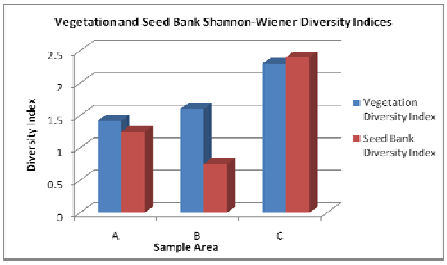

Fig 2. Shannon-Wiener Diversity Indices of vegetation and seedbank samples taken from 33 quadrats

Detrended Conical Correspondence Analysis[6] (DCA) was used to evaluate the influence of environmental variables on vegetation composition; DCA group quadrats by similarity of vegetation and overlaid the environmental variables influence.

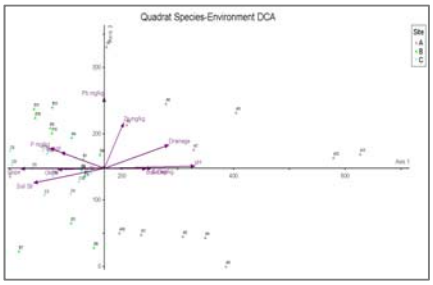

Fig 3. Graph showing Detrended Conical Correspondence Analysis of vegetation with environmental variables overlaid

Discussion

Site A has the lowest biodiversity value but has the second highest seedbank diversity value. Although only one vegetation sample achieved the CWS species richness criteria, the high seedbank diversity suggests that if this area undergoes appropriate management it might be able to achieve CWS criteria. The site contained many pea species and two orchid species providing a colourful ground flora. It is strongly influenced by soil pH, drainage, soil bulk density and calcium levels (Fig 3) and reflects the differences from the other sites in underlying geology.

Site B showed strong species assemblage similarity to the CWS (site C), comprising an unimproved MG5 *Cynosurus cristatus-Centaurea nigra*[5] grassland (Fig 1). Two quadrats surveyed showed a species richness >10. Site B is primarily influenced by soil nitrate concentrations, with availability being the limiting factor on the ability of species-rich communities to establish[1].

Site C had the highest proportion of quadrats with species richness >10 and also contained a number of Devon notable species. This site was influenced by grazing intensity – four horses all year round.

Plate 1. Aspect from site C facing north, showing sites A,B,C and the sample area in relation to adjacent SSSI, SAC, SPA and AONB sites.

Conclusion

- The sample area should be considered for reclassification as a CWS; although some areas do not achieve the desired species richness, it does fulfil a number of other criteria
- Seedbank potential should be assessed before development of this (and other) sites as although the area may not contain established characteristic species, the seedbank may allow future re-establishment.
- Every area requires specific management plans to increase biodiversity and conservation potential – in this instance rotational grazing would be beneficial as it could alleviate intensity and reduce sward height gradually.
- Shallow ploughing to restore seedbank potential could also benefit the biodiversity value of some sites.
- Such Brownfield and Greenfield areas are of high biodiversity value and have a strong position in an ecological unit; any development of the areas surveyed here should be avoided as it would lower biodiversity value and the restoration potential of significant sites.

References

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