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EVALUATION OF CONSERVATION STATUS OF ROADSIDE VERGES AND THEIR VEGETATION IN NORTH ENGLAND

ABSTRACT: The roadside verges and their vegetation in selected counties of north England were evaluated for their conservation status. Thirty five different road sections each 50 m long along different A and B class roads were surveyed and the criteria selected for conservation evaluation included verge area, plant diversity, species richness, disturbance, presence of rare species and structure of hedges. A field assessment sheet was prepared in which, for each factor, a numerical rating system was used. For each factor, information was recorded to help the surveyor in choosing the appropriate score for that site. The rarity of recorded species was determined from the published sources. Most of the surveyed verges (54%) are of low conservation value, 40% are of medium conservation value and only 6% have high conservation status. Despite the unsatisfactory situation, there is considerable potential for using roadside verges for nature conservation because medium class verges could be improved by adopting sound management techniques.

KEY WORDS: roadside vegetation, conservation evaluation, conservation status, management of verges

1. INTRODUCTION

Conservation of vegetation diversity is a very important issue in today's natural resource management and it has received considerable public attention and support. Harper (1971) mentioned the following four aims of vegetation management for conservation:

- management for species diversity,
- management to maintain some specific vegetational status quo (e.g. maintenance of hedgerow),
- management to preserve or increase specific plant species owing to their rarity or beauty, and
- management for preservation of natural plant assemblages as a museum of vegetation types.

Roadside verges provide a habitat that can meet all the four requirements. Roadside verges are useful sites for a variety of plants and vegetation types. Though roadside verges can not provide a substitute for properly managed nature reserves, yet their large area and wide variety of associated habitats make them a potential source for nature conservation. For example, according to the relatively old survey of Way (1977), out of nearly 2000 native British plant species, 870 have been recorded on roadside verges and these species include 35 of the 275
nationally rare species. Because of their potential contribution to the conservation of nature, Young (1991) described the roadside verges as “Britain’s largest nature reserve”.

Roadside verges belong to a group of habitats termed as corridors (Forman and Gordon 1986) and boundary habitats (Carr and Bell 1986). These habitats are generally linear in nature, separated from the surrounding areas by a physical barrier (fence, hedge, stone wall etc) and their ecology, up to a certain extent, depends upon human activity. Carr and Bell (1986) described naturalness, species diversity, area and rarity as main criteria for assessing the boundary habitats for their conservation value. Grieves and Lloyd (1984) categorized the factors affecting roadside conservation value into two groups. The first group includes the ‘contributing factors’ such as presence of native flora and fauna, rare species, landscape quality and regeneration of vegetation. The second group includes ‘detracting factors’ such as weeds, disturbance, farming pressures and use of verge area by utility services. Jackson (2002) suggested presence and abundance of native plants, weed infestation and adjoining land use as the main parameters for conservation evaluation of roadside vegetation.

There is a growing interest in the ‘conservation aspect’ of roadside verges and their vegetation (Munguira and Thomas 1992, Gerrell 1997, Singleton and Lehmkuhl 1999, Tanghe and Godefroid 2000, Riess et al. 2001, Sykura et al. 2002, Dean and Milton 2003, Forman et al. 2003, Croxton et al. 2005, Wrobel 2006, Santos et al. 2007). Some detailed reviews analyzing the role of roadside vegetation in nature conservation have been published in the recent past (Thompson 1983, Bennett 1991, Spellerberg 1998, Bellamy et al. 2000, Tikka et al. 2000, Rea 2003, Huijser and Clevenger 2006) reflecting an increasing interest of the public and scientific community in roadside vegetation. This study which is a part of a broader project about the ecology and conservation of roadside vegetation in north England (Akbar et al. 2003, 2006a, b and Akbar et al. 2009) was designed and carried out to evaluate the roadside verges in the study area for their conservation status. For this purpose, rapidly assessable variables affecting the long-term survival and richness of roadside flora (width of verge, adjacent land use, plant diversity, level of disturbance, presence of rare plants, value for fauna and condition/composition of hedges) were selected.

The main questions addressed in this study were:
1. What is the conservation status of roadside verges and their vegetation in the study area?
2. What are the main factors of the roadside environment affecting the conservation status of roadside verges?

2. STUDY AREA

To assess the conservation value of roadside verges, thirty five roadside sites (that makes 70 verge sections) along different A-class and B-class roads were selected, mostly in north and west Yorkshire. The study area has two major geological formations, Carboniferous Rocks and Permian Trias (Rayner and Hemingway 1974). The main soil types are lithomorphic soils, brown earths, podzols, gleyes and peat soils (Avery 1990). The roadside vegetation of the study area is primarily composed of mesotrophic grasslands dominated by grasses (Arrhenatheretum elatius (L.) P.B., Festuca rubra L., Dactylis glomerata L., Lolium perenne L., Poa trivialis L. and Holcus lanatus L.) and their associated herbs (Cirsium arvense (L). Scop., Heracleum sphondylium L., and Urtica dioica L.).

According to the British National Vegetation Classification (NVC) (Roddwell 1992), the area is occupied by five NVC mesotrophic grassland communities (Arrhenatheretum elatioris community MG1, Lolium perenne-Cynosurus cristatus grassland MG6, Lolium perenne leys MG7, Holcus lanatus-Deschampsia cespitosa grassland MG9, Festuca rubra-Agrostis stolonifera-Potentilla anserina grassland MG11) and an upland Festuca ovina-Agrostis capillaris-Galium saxatile grassland, U4 (Akbar et al. 2009).

3. METHODS

A field data sheet was prepared for the assessment of conservation value of verges. In this sheet, for each variable, a numerical
rating system was used based on the allocation of ordinal ranking for each applicable factor to indicate its contribution to overall conservation value of the site (Grieves and Lloyd 1984). For each variable, information was given to help the surveyor in choosing the appropriate score for that site.

The rarity of species (at local, regional and national level) was determined from the published sources. No nationally rare plant species was found among the plant species recorded during the survey. At each site, fifty meters length of the road verge was used as a sampling unit. Each side of the road was assessed separately and in this way, seventy roadside sections were assessed. After noting scores for each variable, these were added together to give each site a cumulative ‘conservation score’. These scores were then assessed on a conservation rating index for four conservation classes with class 1 representing the lowest, class 2 – moderate, class 3 – medium and class four – the high conservation status.

<table>
<thead>
<tr>
<th>Total Conservation Score</th>
<th>Class 1 Low</th>
<th>Class 2 Moderate</th>
<th>Class 3 Medium</th>
<th>Class 3 High</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–12</td>
<td>13–19</td>
<td>20–26</td>
<td>≥27</td>
<td></td>
</tr>
</tbody>
</table>

This system of assigning ordinal scores and classes for conservation evaluation has been used in different conservation evaluation studies (Scott 1981, Grieves and Lloyd 1984, Hussey 1991, RCC 2005).

To assess the relationships between conservation status and habitat factors, Principal Component Analysis (PCA) was used (performed in SPSS version 10). Before analysis, the sampling adequacy was measured by the Kaiser-Meyer-Olkin criterion (KMO). The KMO value ranges from 0 to 1 and the KMO measure should be 0.5 or higher to proceed with the PCA. Two other criteria for sampling adequacy adopted in the study were the use of determinant and the Bartlett Test of sphericity which should be significant. In the present study, the overall KMO value was greater than 0.5 and the other two criteria were also significant.

4. RESULTS

The majority of the road verges were 5–10 meters in width with 60% of the verges falling in this category. There were 18 sites (27%) with more than 10 meters in width whereas nine verges had width less than 2 meters. It shows that in the study area, the majority of the roadside verges are of considerable width which can serve as habitat for conservation of plants.

Since the study area has a predominantly agrarian character, most of the roadside verges were neighbored by cultivated fields (62%) and pastures (16%). The remaining sites were in urbanized areas 19% whereas only two sites had woodlands near them.

The number of different plant groups (bryophytes, ferns, grasses, herbs, shrubs, trees) present at a site contributes positively to its plant diversity. The sites with 3–4 types of plant groups were most abundant (26), seven had five types of plant groups and only two sites had six plant groups.

Hedges of trees and shrubs provide habitat for different animals and their presence increases the conservation value of verges (Carr and Bell 1986). Due to extensive urbanization and cropping in the area, it was expected that hedges along roads would be reduced. In the area, one third of the sites were without hedges whereas 40% had heavily disturbed, sparse hedges. Only 25% of the verges had well developed and protected hedges.

Roadside verges are disturbed by different factors such as off-road vehicles, vehicle parking, mowing, laying of utilities such as cables, pipes and mowing etc. All these factors reduce their habitat potential. Nearly 54% of the verges were heavy to moderately disturbed whereas 46% verges were slightly disturbed.

The value of roadside verges for fauna is dependent upon density and diversity of vegetation of an area. Due to dominance of grasses and weeds in the roadside flora, most
of the roadside verges (67%) exhibited poor value for fauna. There were 25% sites with herbs and shrubs whereas only 9% had trees.

Conservation value scores were calculated for each site. The scores ranged from 12 to 36 (Fig. 1). The most frequently occurring conservation scores were 17, 20 and 16. The scores of 19 and 21 were the next most frequent scores followed by 22 and 18. It shows that most of the roadside verges (50) had conservation scores between 16 and 22.

An analysis of the conservation classes of 35 sites (Fig. 2) shows that the majority of the sites (54%) fall into the two lower ranks. Only four sites had high conservation value. But there are many verges (40%) which are of medium conservation status and these could be improved by adopting sound management techniques.

The application of Principal Component Analysis to explore the influence of seven roadside habitat features on its conservation status revealed that four roadside variables (verge area, adjoining land use, number of plant groups and species richness) emerged as the main factors influencing the conservation status of roadside vegetation (Table 1). These four components explained 78% of the total variance (verge area 29.1%; adjoining land use 19.8%; plant groups 16.9% and species richness 12.3%).

5. DISCUSSION

Different criteria have been suggested by different workers for the evaluation and ranking of habitats for their conservation value

Table 1. Eigen values of road verge variables, individual and cumulative variance obtained from Principal Component Analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Eigen value</th>
<th>% variance</th>
<th>Cumulative variance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verge width</td>
<td>2.039</td>
<td>29.1</td>
<td>29.1</td>
</tr>
<tr>
<td>Adjoining land use</td>
<td>1.388</td>
<td>19.8</td>
<td>48.9</td>
</tr>
<tr>
<td>Plant groups</td>
<td>1.182</td>
<td>16.9</td>
<td>65.8</td>
</tr>
<tr>
<td>Number of plant species</td>
<td>0.859</td>
<td>12.2</td>
<td>78.1</td>
</tr>
<tr>
<td>Structure of hedges</td>
<td>0.671</td>
<td>9.6</td>
<td>87.7</td>
</tr>
<tr>
<td>Disturbance</td>
<td>0.489</td>
<td>6.9</td>
<td>94.7</td>
</tr>
<tr>
<td>Value for fauna</td>
<td>0.371</td>
<td>5.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>
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(Ratcliffe 1977, Margules and Usher 1981, Usher 1986). There are differences in the selection and relative weighing of different characteristics in conservation evaluation studies and usually a combination of different habitat factors is used. Vegetation is usually the easiest identifier of natural communities because it is a good indicator of many environmental gradients and faunistic richness is also related to vegetation (Elton and Miller 1954).

One reason for the low conservation status of road verges in the study area may be the dominance of the verges by a small number of grass species (Arrhenatherum elatius, Festuca rubra, Dactylis glomerata, Lolium perenne, Poa trivialis, Elymus repens, Holcus lanatus) which inhibit the increase in abundance or establishment of other species. Absence of grazing and irregular mowing also contribute to the dominance of a uniform and dull grass sward because grazing and regular cutting favour the development of floristically rich grasslands with higher conservation interest. In addition, disturbance, fertilizer input, damage to hedges and de-icing salts are among the other possible agents for the low conservation value of these verges.

With the large scale destruction of natural grasslands, roadside verges are assuming a greater importance as refugia for semi-natural grasslands because a substantial amount of land is occupied by these habitats. Some of these verges even may include rare grassland species. These plant assemblages are of obvious conservation importance and yet were rated low during the conservation assessment. Many verges contain just a few dominant grass species because these grass swards have been established by humans using specific seed mixtures and management practices. Only a few verges have high species richness, usually because they have become established over a long time, or in close proximity to woodland. However, the low rating accorded to most verges by this method seems justifiable. Unlike natural grasslands, they are a manageable and renewable resource and are populated mainly by common, widespread and resilient species which may survive without the need for special conservation measures.

Although the current situation of roadside verges in the area is not satisfactory in terms of conservation value, the current conservation assessment indicated a number of roadsides with a medium conservation class that have the potential to be improved as high conservation sites. The improvement of the conservation value of existing roadside vegetation demands an integrated and continuous planning and management effort with the following aims:

![Fig. 2. Conservation status of roadside verges according to conservation classes (total number of studied sites = 70 verge sections).](image-url)
protection and enhancement of native vegetation and other valuable communities;

- optimization of road verges system, to make habitats for nature conservation without creating any problems for traffic;
- reduction of hazards for nature conservation in the roadside environment;
- selection and propagation of plants helping stabilization of roadside soils which are also visually attractive and useful for wildlife;
- promotion of other values of diverse vegetation on roadside verges such as recreational and educational values.

A review of literature shows that careful selection of species for re-vegetation, increase in native plant species, control of weeds, management of roadside soils for salinity and fertility control and protection of roadside hedges are the main factors that need consideration in improving the conservation status of roadside vegetation (Snowball 1985, Melman et al. 1988, Gough and Marrs 1990, Ramsay 1993, Ausden and Treweek 1995). However, the roadside verges need vegetation that must be compatible with their use as a traffic facility. These include control of soil erosion, clear visibility at bends, glare control and clear areas for off-road vehicles. From the conservation point of view, diversity of both species and life forms are desired features.

The achievement of these objectives is a difficult task because there are different departments and organizations interested in roadside verges. Each of these groups with some legislative control over roadside verges has different powers, responsibilities and interests. In Great Britain, various authorities (e.g. highway, county and metropolitan councils, environment) manage roadside verges. To develop and use roadside verges and their vegetation up to their maximum potential for nature conservation, a coordinated policy recognizing the interests and responsibilities of all stakeholders should be formulated.

The present conservation evaluation exercise proved to be useful in that features related to conservation status of road verges were recognized and evaluated. This study also highlighted the usefulness of different habitat features (area, plant diversity, species richness, adjoining land use) as evaluating and ranking criteria for ecological site evaluation.

Preston (1962) showed that the number of species tends to increase with increasing area. On wider road verges, the plants and animals are less affected by the neighbouring land use (Dowdeswell 1987) and traffic-induced disturbances. On narrow verges, the chances of successful establishment of stable vegetation are limited and such verges are unable to provide useful habitats for wildlife.

The nature and type of surrounding habitats influence the roadside vegetation in many ways. A road verge neighbored by areas of natural or semi-natural vegetation has a greater chance of increased input of genetic material. The adjoining natural vegetation also widens the extent of the verge and protects it from invasion by exotics (Grieves and Lloyd 1984). Road verges surrounded by intensively farmed land, urban areas or industrial units which are less stable in time will be less diverse than those surrounded by more permanent habitats such as woodlands or wetlands. Different plant species (diversity) support or are associated with different animal species (Duffey et al. 1974). Elton and Miller (1954) showed that the faunistic value of a habitat is indicated by the number of vegetational layers and vertical diversity or structure.

Road building and repairing activities, vehicles and adjoining land use may cause disturbance to the soils and plants of road verges. In addition, the use of verges for different utility services such as laying of cables and pipes may affect their ecological characteristics. Once a verge is used for this purpose, its chances of being disrupted are increased because maintenance works are carried out regularly. Hence, the presence of utility services on road verges has an adverse effect on their vegetation.

Hedges are often a prominent feature of roadside boundaries in the UK. Structure, age and species composition of the hedges are important attributes of hedgerows. Hedges are of increasing significance as a refuge for plant and animal life. They also increase the diversity of species on the road verges. Hedges provide habitats for many bird species including...
yellowhammer, robin, hedge sparrow, common whitethroat, willow warbler, pheasant and partridge (Ratcliffe 1977). Diversity in the hedge structure, therefore, is expected to increase the habitat value of roadside verges.

Some workers (Gehlbach 1975, van der Ploeg and Vlijim 1978, Nilsson 1986) have criticized the use of plant diversity, area, rarity of species and naturalness as evaluating criteria in conservation assessment of natural habitats as being “non-ecological characteristics” resulting in arbitrary assessments. Nilsson (1986) suggested classification of the composition of plant communities as a method for conservation evaluation. Since roadside verges are anthropogenic habitats encompassing various positive and negative factors and are linear in form, their evaluation on the basis of one single feature will not yield correct assessment. Their conservation evaluation therefore needs multiple criteria that can represent the roadside environment in its totality and are relatively easy and quick in application.

6. REFERENCES


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