Chapter 46

THE FUNCTION AND MANAGEMENT OF ROADSIDE VEGETATION

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SUMMARY

The structure and composition of roadside vegetation vary from frequently mown grass to shrubs and trees and from artificial landscaping to natural plant communities. Roadside vegetation can perform many important functions, including the provision of habitat for rare plants and animals, a source of seeds for adjacent landscapes, a buffer to reduce the penetration of traffic noise and light, carbon sinks and enhanced aesthetics for road users. In certain situations, roadside vegetation can have negative effects, such as attracting wildlife and increasing rates of wildlife-vehicle collisions (WVC), creating movement corridors for weeds and invasive species, obscuring road signs and damaging road surfaces.

46.1 Roadsides can support rare and threatened species of plants and animals, and these should be managed for conservation.

46.2 Vegetation that reduces visibility or poses a traffic hazard should be managed to achieve a compromise between safety and biodiversity conservation.

46.3 Roadside habitats may act as ecological traps: It is preferable to recreate offset or compensation habitats away from roadsides.

46.4 The drainage of roads and roadsides must be designed to minimise impacts on adjacent vegetation and habitats.

46.5 Never plant invasive species (environmental weeds) along roads: Use plants native to the region for roadside soil stabilisation, shade, ornamental planting and control of noise and light pollution.

46.6 Perennial vegetation cover and ongoing management of roadside vegetation are required to control the continuous threat of weed invasion.

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46.7 The reduction of fuel loads on roadsides should be compatible with biodiversity management objectives.

The challenge for management is to comprehensively quantify and understand the role and values of roadside vegetation and manage roadsides to enhance their positive impacts and reduce their negative effects.

INTRODUCTION

Most roads, especially those designed and built in recent years, include a strip of land on one or both sides of the road that remains undeveloped. These strips of land (i.e. roadsides or verges) are usually owned and managed by the government or department of transportation. The width of the roadside depends on the tenure, land use and competing demands (and hence purchase price) of the land at the time it was acquired for the road, the predicted growth in traffic volume (and hence need for future expansion) and the terrain (mountainous vs. flat). The uses and functions of roadsides are diverse, and they usually support natural or planted vegetation, footpaths or bicycle paths, utility infrastructure (e.g. power lines and pipelines) and safe places for vehicles to pull off the road. Roadside vegetation may play numerous other roles, including the provision of habitat for plants and animals; intercepting and buffering adjacent landscapes from noise, dust, light and other pollutants; controlling soil erosion; and improving aesthetics.

Roadside management is challenging because of the diversity of uses and often competing goals. For example, the provision of habitat for biodiversity along roads by maximising the amount of habitat (e.g. large trees) is often at odds with driver safety due to the risk of collision. Consequently, vegetation that remains, re-establishes itself or is planted on roadsides will always be influenced by the primary function of the road – that is, safe and rapid traffic flow. The aim of this chapter is to highlight ways in which roadside vegetation may influence the integrity of the road; the safety and comfort of motorists and adjacent settlements; the conservation of plants, wildlife and genetic resources; and the spread of fires and invasive weeds. We present general guidelines for roadside vegetation management that consider issues of road integrity, road user safety, biodiversity conservation and aesthetics.

LESSONS

46.1 Roadsides can support rare and threatened species of plants and animals, and these should be managed for conservation

Large areas of natural and semi-natural vegetation and wetlands occur in road reserves, potentially providing habitat or movement corridors for a wide range of plants and animals (Saunders & Hobbs 1991; Lamont & Atkins 2000). In highly cleared landscapes, roadsides can provide the majority of available habitat (e.g. van der Ree 2002). Fragments of natural vegetation along roadsides also have the potential to protect rare species, habitats and ecosystem functions (e.g. pollinators) that have been lost from crop monocultures (Figs. 46.1, 46.2 and 46.3) or that are threatened by urban development, mining, overgrazing and other forms of land transformation. In some situations, the quality of the habitat in roadside fragments may exceed that which is remaining in larger patches (e.g. van der Ree & Bennett 2001).

Roadside conservation requires identification and mapping of plant populations or communities of significant conservation value and integration of such maps with the infrastructure maps used for road planning and maintenance (Connor & Ralph 2006; Johnson 2008; Chapter 17). Depending on the vulnerability of the target plants to theft or vandalism, the sensitive section of the roadside could be demarcated with signs that provide information to the road user or

Figure 46.1 Contrast between density of flowering plants in the grazed rangeland (to the left of the fence) and ungrazed roadside (to the right of the fence) in the South African Karoo. Source: Photograph by S. J. Milton.

Figure 46.2 Fragment of threatened Renosterveld vegetation lies between cropland and the weedy mowed shoulder of the road near Wellington, South Africa. Source: Photograph by and reproduced with permission of Clement Cupido.

Figure 46.3 Woodland along roads and streams in this agricultural area in south-east Australia accounts for over 85% of the remaining woodland cover in this district. Source: Photograph by R. van der Ree.

marked only on maps used by road authorities. Conservation of rare plants and habitat on roadsides may require special management, for example, plant species that require fire for regeneration may need to be burned periodically (Johnson 2008).

46.2 Vegetation that reduces visibility or poses a traffic hazard should be managed to achieve a compromise between safety and biodiversity conservation

Tall or dense vegetation adjacent to roads can pose a traffic hazard by obscuring traffic, road signs, wildlife and pedestrians. This vegetation may need to be pruned or mowed to improve driver visibility (Forman & Alexander 1998; Johnson 2008) or to give drivers more time to observe and respond to animals that cross the road (see also Lesson 53.3). Non-frangible vegetation may be a safety hazard for out-of-control vehicles and can either be removed or safety barriers (e.g. guard rail or wire rope fencing) installed to prevent collisions. Guard rail is effective at preventing vehicle–tree collisions; however, it is expensive and doesn't solve the issue of driver visibility. Unfortunately, cutting of shrubs and herbaceous vegetation can result in a flush of new growth that may attract herbivores (e.g. bears; Textbox 46.1; Chapter 42) which increases the probability of WVC. Although the provision of diversionary feeding, forage repellents, establishment of unpalatable species or vegetation clearing along roads could reduce this problem (Rea 2003), these interventions are costly, with unproven effectiveness, and may have negative effects on rare plant communities or adjacent vegetation (e.g. facilitating the spread of invasive species). Vegetation in the median can improve safety by reducing headlight glare (Forman & Alexander 1998), but if vegetation is non-frangible, the median will need to be sufficiently wide and include safety barriers to protect motorists on high-speed roads.

Roadside vegetation must be managed to achieve both safety and conservation requirements; therefore, we recommend the use of parallel management zones. This means the priority for management of vegetation immediately adjacent to the road should be on driver safety, while areas outside the clear zone should focus on conservation (e.g. Fig. 39.4). Furthermore, where high-conservation-value vegetation exists close to the road, the use of safety barriers should be used to protect motorists and conserve plants. The amount of effort invested in conserving and managing rare or threatened species in roadside habitats should increase in proportion to its rarity and value.

46.3 Roadside habitats may act as ecological traps: It is preferable to recreate offset or compensation habitats away from roadsides

Roadside habitats may function as ecological traps that attract animals and increase rates of WVC and mortality. Wetlands are often built adjacent to new and

existing roads to provide fill for the road construction and to receive and treat storm-water run-off before it enters waterways or groundwater recharge areas. In some instances, road agencies intentionally build wetlands immediately adjacent to the road as an offset for wetlands that were destroyed during construction (Textbox 31.2). These attract amphibians and birds and are likely to contribute to the millions of such animals killed on roads (Forman & Alexander 1998). As a rule of thumb, it is probably better to provide offset habitats away from the road to reduce the rate of mortality and avoid the road-effect zone (Chapter 7). However, it is essential to clearly understand the specific impact of the road on the species of concern and not just assume that roadside habitats are either good or bad for all species. For example, some species of wildlife that occupy roadside habitats may suffer low rates of WVC and mortality because they avoid the road surface or avoid traffic.

46.4 The drainage of roads and roadsides must be designed to minimise impacts on adjacent vegetation and habitats

Roads alter the flow of water by bisecting and damming waterways and by collecting and discharging surface water via channels or pipes (Chapters 44, 45 and 47). Roads that intersect streams and wetlands are often elevated on bridges or contain culverts and pipes to protect the road from flooding and damage. These roads have the potential to alter rates and patterns of water flow, depths and chemistry (Coffin 2007; Chapter 44), and adequate provision for water flow is essential to ensure that downstream wetlands do not dry out, resulting in habitat degradation or loss.

Culverts that drain water away from the road surface should discharge run-off into natural waterways or wetlands but only via treatment or retention ponds to filter out pollutants and sediment loads. Foreign liquids spilt on the road (e.g. oil, fuel, milk, sewerage), and seeds transported on vehicles find their way via natural waterways or overland flow to rivers, wetlands and groundwater. Drainage infrastructure can cause soil erosion or development of artificial wetlands where natural waterways are absent or unable to cope with peak water flows (Coffin 2007). Erosion can be reduced by installing drainage systems that mimic natural flows and facilitate absorption of water into the ground and by the strategic planting of vegetation to bind the soil (Chapter 44). Modifications of the physical and chemical properties of soil and hydrology caused by roads and drainage works can change the structure, composition and nutritional value of natural vegetation and promote weed growth, particularly in arid and semi-arid regions (Martinez & Wood 2006; Chapter 47).

46.5 Never plant invasive species (environmental weeds) along roads: Use plants native to the region for roadside soil stabilisation, shade, ornamental planting and control of noise and light pollution

Roadside rest areas, often providing shade and shelter near scenic lookouts, are a feature of national and international highways around the world. Native trees and shrubs adapted to the local conditions should be used for plantings in these areas to reduce maintenance costs and as an opportunity to educate motorists. Species that become environmental weeds when planted outside their natural ranges (e.g. Peruvian pepper, mesquite, black locust, black wattle, sugar gum) should be avoided because of the risk of invasion into adjacent habitats (Forman & Alexander 1998; The University of Queensland 2008; Milton & Dean 2010; Figs. 46.4 and 46.5). Most regions have lists of declared weeds, and these should be consulted to identify which floral species should be avoided.

Near-continuous noise produced by major roads has a negative effect on the quality of life of people, reduces the value of adjacent properties and affects vocal communication in many species of wildlife (Chapters 19, 33 and 34). Trees, hedges or vegetation-covered barriers can reduce high-frequency sound by 40% (Kalansuriya et al. 2009), but this approach may not be practical or ecologically acceptable if the species to be planted is invasive. Similarly, soil embankments of roads in steep topography or shoulders of roads through sand dunes are often stabilised with grasses (e.g. fountain grass, marram), shrubs (bramble) or ground covers (highway iceplant) which must be carefully selected to minimise the risk of invasion into adjacent natural and agricultural ecosystems.

46.6 Perennial vegetation cover and ongoing management of roadside vegetation are required to control the continuous threat of weed invasion

Roadside management that maintains an intact community of native perennial vegetation reduces the risk of weed establishment and slows the rate of its spread. In

contrast, the clearing of natural vegetation and repeated grading to bare soil promote the establishment of weeds due to increased disturbance, creation of open areas for colonisation and availability of water and nutrients via run-off from the road surface (USDA 2003; Figs 46.4 and 46.5). Furthermore, pollutants including salt applied to road surfaces to reduce ice in cold climates contribute to the development of weedy vegetation adjacent to the road surface (Truscott et al. 2005). The constant supply of weed seeds carried by vehicles (Taylor

Figure 46.4 Blue morning glory is an aggressive climber and has smothered this broadleaf–podocarp forest along a roadside near Auckland, New Zealand. Source: Photograph by and reproduced with permission of Margaret Stanley.

Figure 46.5 Pampas grass, originally from South America, has invaded this roadside in the Hunua Ranges near Auckland, New Zealand. Source: Photograph by and reproduced with permission of Margaret Stanley.

Textbox 46.1 Roadside vegetation management to protect black bears in British Columbia, Canada.

The Sea to Sky Highway (Highway 99) in British Columbia, which connects Vancouver to Whistler, passes through the Pacific Ranges of the Coast Mountains of North America. Bears emerging from hibernation in spring 2010 were unable to find sufficient food at higher elevations because the melting of the mountain snowpack was delayed due to an unseasonably late and cold spring. Consequently, a large number of black bears grazed on vegetation in the highway verge where vegetation planted the previous year was emerging (Fig. 46.6). Highway verges typically green up earlier in the spring than adjacent areas because they are exposed to more sunlight.

Over the spring and summer, intense grazing by the bears altered the planned succession of rights-of-way plant species. Clover, one component of the seed mix, was intended to quickly stabilise soil, fix nitrogen, hinder the establishment of invasive plant species and then be outcompeted by the other species in the mix. The clover successfully withstood overgrazing by the bears and flourished, providing a high-quality food source for the bears. A number of bears were injured and killed due to collision with vehicles, and 'bear jams' began occurring on the highway in the District of Squamish when motorists slowed down and stopped near the bears. Motorists unfamiliar with wildlife risked their safety by leaving their vehicles to photograph the bears.

The British Columbia Ministry of Transportation and Infrastructure worked with its maintenance contractors, the Get Bear Smart Society and the District of Squamish to reduce the potential for human/bear conflict along the Sea to Sky Highway. An extensive programme was developed which included new seasonal warning signs, changeable message signs, access restriction and innovative vegetation management. Native plant species known to be unattractive to bears were planted to shade out and displace clover over time and/or provide visual barriers to reduce the number of bear jams.

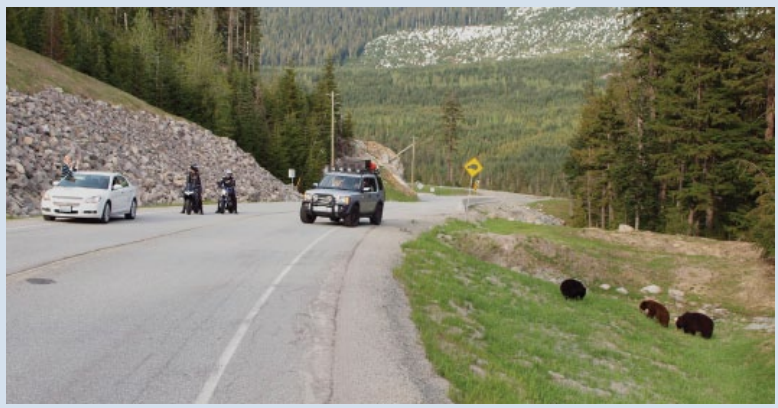

Figure 46.6 Motorists along the Sea to Sky Highway (Highway 99) in British Columbia, Canada, stop to view and photograph black bears grazing on clover on the highway verge. Source: Photograph by and reproduced with permission of Sylvia Dolson.

et al. 2012) or dispersed from adjacent disturbed landscapes (Sullivan et al. 2009) exacerbates the risk of establishment and spread. Generalist birds, such as omnivorous corvids scavenging roadkills, will also disperse seeds of fleshy-fruited plants to roadsides under their roosts on fences, poles and signs. Once established on roadsides, invasive alien plants and agricultural weeds are further spread via overland water flows and culverts to rivers that intersect roads (Rahlao 2010). Through regular monitoring and the use of mechanical and chemical methods, road management authorities should better control weeds of environmental and agricultural significance along roadsides (Johnson 2008).

46.7 The reduction of fuel loads on roadsides should be compatible with biodiversity management objectives

Reduction in woody vegetation cover to improve visibility along roads creates suitable conditions for development of tall grass that can increase the risk of fire

spread and exacerbate fragmentation in forested environments (Coffin 2007). Fires can be caused by ignition of dry roadside vegetation by vehicle accidents, sparks from engines or exhausts, discarded cigarettes and cooking fires at roadside pull-offs, potentially posing a hazard to passing traffic. Managers may plough or poison roadside vegetation to prevent roadside fires from destroying adjacent crops, plantations, rangelands, conservation areas or suburbs. Such practices are often in conflict with roadside conservation goals, especially for threatened but fire-prone vegetation, such as Chaparral, Fynbos and Kwongan.

Best-practice guidelines for roadside fuel reduction include the removal of dead trees and mowing, controlled burning or cutting of grass and brush in areas where fire risk is high; however, environmental authorisation should be required for use of herbicides and grading or for any intervention in high-conservation-value or specially protected vegetation or where it may impact threatened wildlife (Lamont and Atkins 2000; Johnson 2008).

CONCLUSIONS

Roadside vegetation can perform many roles, including pollution reduction, erosion control and aesthetics. Vegetation can pose risks to drivers by obscuring oncoming vehicles, signs and large animals approaching the road. Trees and other non-frangible vegetation can also be a hazard for out of control vehicles that leave the road. Roadsides can also aid in the conservation of plant and animal species and ecological communities in highly cleared or modified landscapes. While human safety is critical, there are viable and cost-effective alternatives to the destruction of vegetation. In many cases, vegetation can be maintained, while road safety is improved through reductions in traffic speed and the installation of crash barriers. In the case of rare or threatened plant communities, the rarity and value of that plant community should trigger a more detailed analysis of management options and a willingness to do more to protect it. Minimising damage to existing roadside vegetation also reduces the effort required to manage the weeds that colonise disturbed ground.

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FURTHER READING

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DECWA (2009): Useful guidelines for roadside vegetation management.

Harper-Lore and Wilson (2000): A useful resource for North America and possible model for other regions on roadside use of native plants.

Milton and Dean (2010): Discusses role of roads in arid areas in facilitating the spread of invasive alien plant species.

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