Urban edge effects in the Blue Mountains, New South Wales: implications for design of buffers to protect significant habitats

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Urban edge effects can have an adverse impact on native flora and fauna in the adjoining bushland. We surveyed edge effects at sites in the Blue Mountains where the urban area is separated from bushland by a perimeter road. Common edge effects included weed invasion, physical disturbance of the vegetation and soil, incidental rubbish, dumped rubbish, dumped plant material, tree felling/lopping/ringbarking and visits from domestic dogs. Uncommon edge effects included recent hazard reduction burns, bushrock collection, and poor tree health (dieback not associated with fires). The maximum extent of obvious edge effects (all types combined) varied between sites, from 9 m to 60 m from the edge of the road. At most sites (77%), edge effects were restricted to distances of 40 m or less into the bushland, but a significant number of sites (23%) had more extensive edge effects. Sites with extensive weed invasion were associated with older housing, suggesting that weed invasion will increase over time at sites adjacent to younger housing. Weed invasion frequently extended further than 60 m into the bushland along drainage lines and tracks, especially the former, but these were not included in the measurements. Edge effects were more extensive on flatter topography than downslope of housing, apparently because the former is subject to more intensive use by local residents. The actions of local residents have a major influence on edge effects, and are responsible for much of the variability observed between sites. The findings of this study are consistent with previous studies of edge effects around Sydney and elsewhere. Based on the results of the study, we recommend that a buffer of native vegetation at least 60 m wide should be retained around significant flora and fauna habitats to protect them from edge effects. Additional management actions are required to control vegetation degradation along drainage lines.

Key words: Urban edge effects, Buffers, Urban bushland, Significant habitats, Weeds.

INTRODUCTION

NATIVE forest and woodland vegetation (bushland) bordering urban areas is subject to edge effects that can have an adverse impact on the composition and condition of the vegetation. A major example is invasion and degradation of the bushland by exotic weeds (Kirkpatrick 1974; Hester and Hobbs 1992; Fox *et al.* 1997; King and Buckney 2002). Increased physical disturbance of the bushland from human activities on urban fringes (Matlack 1993a), and increased soil nutrient levels from urban runoff (Lambert and Turner 1987; Leishman 1990), provide conditions favourable to weed invasion, with soil nutrient enrichment a particularly important factor on the infertile sandstone soils of Sydney and the Blue Mountains (Leishman *et al.* 2004; Lake and Leishman 2004; Leishman and Thomson 2005). Gardens, lawns and weedy areas adjacent to the bushland provide a source of weed species.

Other edge effects may involve changes in the microclimate on bushland edges adjacent to cleared areas. During the day, the edges typically have higher air temperatures, higher solar radiation, higher wind speeds and lower humidity than the interior of the bushland (Matlack 1993b; Chen *et al.* 1995; Davies-Colley *et al.* 2000; Gelhausen *et al.* 2000; Heithecker and Halpern 2007). At night, by contrast, the edges have lower air temperatures than the interior (Chen *et al.* 1995). Changes in plant species composition and community structure occur in response to the changes in microclimate (Fraver 1994; Young and Mitchell 1994; Gehlhausen *et al.* 2000). Tree mortality may increase as a result of increased exposure on bushland edges (Williams-Linera 1990; Chen *et al.* 1992).

Changes in plant species composition and community structure may also result from changes in the fire regime (increased fire frequency, reduced fire intensity and a change in fire season from the hotter to the cooler months) due to regular burning of the bushland edges to reduce fire hazard (Benson 1985, Clark 1988, Keith 1996). The overall impact of edge effects on Australian urban bushland can be dramatic (Kirkpatrick 1974, 1975; Clements 1983).

Native fauna are also subject to urban edge effects. Examples are: declining species diversity in urban bushland (Tait *et al.* 2005; Chace and Walsh 2006; Garden *et al.* 2006); invasion or increasing abundance of some species, both native and introduced (Jones 1981; Catterall 2004); predation and disease transmission from domestic cats and dogs (Smith and Smith 1990; Potter 1991; Dickman 1996); increased fauna mortality from collisions with vehicles (Smith and Smith 1990; Harris *et al.* 2008); heavy metal pollution from urban traffic (Quarles *et al.* 1974;

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