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The application of focal species knowledge to landscape design in agricultural lands using the ecological neighbourhood as a template

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Abstract

The focal species approach to nature conservation provides a method for identifying management actions required to meet the needs of the most vulnerable species in a landscape with respect to the threatening processes responsible for their decline. For each threat, a focal species is identified as the one with the most critical requirement pertaining to the threat. With multiple threats, the resulting suite of focal species can be regarded as a "focal community", whose combined needs are used to address a range of management actions. In this paper, the critical requirements of a focal community of resident land birds are identified with respect to the threats arising from the loss, fragmentation and degradation of habitat in the central wheat-belt of Western Australia. This knowledge of their critical requirements is then used to guide a landscape design procedure for the enhancement of bird habitat in the Gabbi Quoi Quoi sub-catchment of Western Australia. The landscape design procedure is framed against the concept of the ecological neighbourhood, where the necessary size, spatial arrangement, area of influence and connectivity of existing landscape elements are used as a starting point for habitat restoration and re-vegetation.

Keywords: Connectivity; Ecological neighbourhood; Focal species; Focal community; Fragmentation; Isolation; Landscape design; Patch size

1. Introduction

Lambeck (1997) proposed a multi-species approach for defining the attributes required to meet the needs of the biota in a landscape. "The approach builds on the concept of umbrella species, whose requirements are believed to encapsulate the needs of other species. It identifies a suite of focal species, each of which is used to define different spatial and compositional attributes that must be present in a landscape together with their appropriate management regimes. All species considered at risk are grouped according to the processes that threaten their persistence. These threats may include habitat loss, habitat fragmentation, weed invasion and fire" (Lambeck, 1997). Within each group, those species most sensitive to the threat are used to define the critical level beyond which persistence is compromised. Previously, Robert Lambeck (personal communication) has applied the approach in the Western Australian wheat-belt to define minimum remnant sizes in the Wallatin Creek sub-catchment and the Dongolocking area and to define minimum remnant sizes and the need for increased connectivity in the South Tammin and Dowerin sub-catchments. In southeastern Australia, David Freudenberger (personal communication) has used a similar methodology to provide guidelines

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for the re-vegetation of remnant grassy woodlands in the variegated landscapes (MacIntyre and Barrett, 1992) of the southern tablelands of the Australian Capital Territory and New South Wales and remnant woodlands of the southwestern slopes of New South Wales.

In this paper, the focal species approach is used to identify a suite of resident land birds, each of which is identified by some critical habitat requirement in terms of the size, isolation or condition of habitat fragments. The resulting suite of focal species, comprising one or more species for each threat, I term a "focal community". This focal species analysis improves on previous catchment-based assessments, in that data from seven sub-catchments are combined to provide more robust models for determining critical threshold values. Knowledge gained from the analysis is used to guide a landscape design procedure for the enhancement of bird habitat, using as an example the Gabbi Quoi Quoi sub-catchment in the central wheat-belt of Western Australia. The landscape design procedure is framed against the concept of the ecological neighbourhood, where the necessary size, spatial arrangement, area of influence and connectivity of existing landscape elements is used as a starting point for habitat restoration and re-vegetation.

2. Focal community approach

Elsewhere, Lambeck (1997) has described a methodology for the focal species planning procedure, involving: (1) the identification of threats, and (2) the identification of focal species and description of their critical requirements relative to those threats.

2.1. Identification of threats

In agricultural landscapes of Western Australia the major threats to the persistence of the biota have been identified as the loss and fragmentation of habitat, the loss of critical resources and inappropriate rates and intensities of ecosystem processes such as fire, nutrient cycling and predation (Lambeck, 1997). For this study, I have grouped the threats into those requiring habitat reconstruction (i.e. threats related to the loss and fragmentation of habitat), which constitute the main focus of this paper, and those requiring habitat management (i.e. threats related to the degradation or alteration of habitat or to altered processes).

Limiting factors (threats) for which the solution is a habitat reconstruction may include the following.

2.1.1. Insufficient habitat size

Each breeding unit of animals requires some minimum area of habitat from which to obtain resources. For some species, such as invertebrates, this minimum area may be quite small. For others, such as large mammals, although their total area requirements are large, fragmentation of this habitat may not be a problem if they are able to move easily between remnants and so obtain their resources from a number of scattered remnants. Most affected will be medium-sized sedentary species whose daily needs must be obtained from within a single remnant. Therefore, focal species limited by habitat size will be those with an insufficient area of unfragmented habitat for their daily requirements.

2.1.2. Isolation of habitat and lack of habitat connectivity

Some species may have sufficient habitat for their daily requirements, but if that habitat is beyond the distance over which an incoming disperser can move easily, then the population within the remnant will not be viable in the long-term. Focal species limited by isolation will be those with the least ability to travel long distances. Other species may be able to travel long distances between remnants only if those remnants that are not separated by a matrix that is too hostile to permit movement. Such species require increased connectivity between habitat patches by the provision of corridors.

2.1.3. Insufficient total habitat area

An adequate landscape is one which contains all of the resources required to meet the immediate needs of individuals of each species in the area to be managed. However, these resources (habitat patches in particular) may not be available in sufficient quantities to support populations that are large enough to be viable in the long-term (Lambeck, 1997). As this study deals only with landscape-scale issues, the problem of population viability is not considered further here. However, it needs to be acknowledged that such landscape-scale plans would need to be adopted