A Method for assessing the potential Biodiversity Benefits of past and proposed Vegetation Enhancements in the Holbrook Landcare area, NSW

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Summary

The award winning Holbrook Landcare group dates back to 1988 and has been instrumental in the implementation of 57 Landcare projects totalling $1,272,404 (to November 1999). Most of the on-ground works funded externally, as well as many privately funded works, and proposed activities have been mapped by the Group. This is the only case study assessed where all on-ground works have or are being mapped. The Group encompasses the Upper Billabong Creek catchment, which is a focus catchment for the CSIRO led Heartlands Initiative.

A method for appraising the potential biodiversity benefits of vegetation carried out by Holbrook Landcare was conducted using the four-step assessment process proposed by Freudenberger and Harvey (2003a).

Step 1: Status, threats & actions.

The Landcare Group area follows the boundaries of the Upper Billabong Creek catchment. Large blocks of native vegetation dominate the upper slopes, the lower slopes have been heavily cleared. Estimates of total woody cover vary between 12.7% (UBLWMP 1999) and 21% based on NSW DLWC mapping that included widely scattered trees. Both mapping sources show that the cover of riparian woodlands is relictual (<0.5%) and the majority of remnants are dry open forests on the upper slopes and ridges. The majority of remnant patches are less than 10 ha in size. Six species of plants found in the area are listed as endangered, vulnerable or threatened by NSW National Parks and Wildlife. Nine percent of fauna once common within the catchment are now endangered (UBLWMP 1999). Major threats to biodiversity include further degradation of remnants by weed invasion and overgrazing, tree dieback and increasing soil acidity and erosion. A wide range of on-ground works have been implemented or are planned including fencing of remnants, enlargement of remnants, establishment of shelter belts, agroforestry blocks and habitat plantings

Step 2: Expected changes resulting from actions.

Holbrook Landcare has developed detailed and locally explicit predictions regarding the biodiversity benefits expected from fencing remnants and revegetation (UBLWMP 1999, Collard 2000). The expected benefits of vegetation enhancements are an increased probability of occurrence of woodland birds, improved tree health and reduced risk of dryland salinity. Fencing remnants should enhance the natural regeneration of plants and improve habitat for animals. Revegetation should increase habitat availability and reduce habitat isolation. Revegetation should improve water quality and reduce the risk of dryland salinity.

The analysis of potential biodiversity benefits was based on 944 enhancement sites totalling 4354 ha. The classification of sites with unknown objectives was derived from a visual assessment of the orthophoto image and an intersection with the mapped vegetation (remnants). A total of 921 ha of remnants at 335 sites was or is proposed to be fenced. Of these, 58% were dry foothill forest, 36% grassy box woodland and 6% riverine forest. Patch size analysis revealed

that 12.5 % of the fenced remnants were greater than 6 ha and 7% were greater than 10 ha in size.

We estimated a total of 756 blocks totalling over 2500 ha of revegetation with a median patch size of 1.4 ha and average size of 3.3 ha. Twelve percent of sites are over 6 ha. Including enlarged sites, we estimated that a total of 3,460 ha of land should in time have an increased cover of vegetation. This would be a 1.7 percentage point increase in native vegetation cover in the study area.

The mean distance from the centre of any mapped patch of vegetation to the nearest centre of a 10 ha or larger patch increased from 0.6 km to 0.7 km. However this small increase in isolation due to many small plantings distant from large remnants is well below an isolation 'threshold' value of about 1.5 km identified by Freudenberger (2001) for predicting the presence of isolation sensitive woodland birds.

The potential biodiversity benefits of this targeted remnant protection and enhancement is modest at the landscape scale and substantial at the patch scale. Various studies have shown that a greater diversity of birds and a higher probability of occurrence of threatened bird species will occur in remnant patches larger than about 10 ha. Nearly 36% of remnant fencing was over vegetation communities classed as critical conservation value and priority. The benefits of fencing these highly depleted and disturbed vegetation types are not known.

Step 3. Monitoring methods.

Most of the on-ground works mapped by each case study have only been implemented in the past 2-3 years, or will be established in the next year or so. Hence, we applied a monitoring method that quantified detectable structural changes to biodiversity at the landscape scale. That is, we used the data of mapped on-ground works to calculate the following broad landscape attributes of biodiversity: increases in total woody cover, changes in vegetation patch size, changes in isolation of patches, the proportion of remnant vegetation protected by fencing and where possible, the type of vegetation protected by fencing. We then linked these changes in landscape configuration and management to likely benefits to flora and fauna and possible functional improvements such as improved water quality.

We recommend that a monitoring program be established that focuses on the benefits of fencing and enhancing remnants, particularly the benefits to threatened plant species. There is very little data anywhere in Australia that documents the on-going effects of fencing off remnant vegetation, particularly vegetation in poor condition. The Holbrook area is well suited for monitoring benefits of fencing as much of this fencing protected sections of larger remnants that appear to have remained unfenced and grazed. These unfenced sections of remnants could act as 'controls' for the fenced areas. The benefits of riparian protection and restoration should also be monitored in terms of improved habitat values for terrestrial and aquatic species as well as the benefits to water

Step 4. Monitor changes against predicted expectations.

A monitoring program should be established in order to assess whether Holbrook Landcare on-ground works are improving the following broad biodiversity benefits:

- Greater structural complexity of fenced remnants, particularly the re-establishment of a diverse understory.
- Increase in the abundance of threatened species, particularly plants as well as the persistence of small woodland birds and mammals.
- Improvement in riparian vegetation diversity, structure and habitat values for threatened flora and fauna.
- Improvements in water quality flowing through rehabilitated riparian zones.
- Improvement in tree health in fenced remnants and revegetated sites.

CSIRO and the Earthwatch Institute are commencing a project to monitor the long term biodiversity benefits of revegetation and how these values change as the plantings mature.

In conclusion, the activities in the Holbrook area are significant and apparently well-targeted vegetation enhancement projects. We have been able to provide some examples of the likely biodiversity benefits of Holbrook activities by analysing the mapped on-ground works. The quality of this mapping could be improved by providing more detail in the fields (attributes) describing each mapped polygon of on-ground works. This Landcare Group warrants substantial and prolonged investment in monitoring due to its extensive nature and the availability of mapped on-ground works.

Background

The Holbrook Landcare Group covers a 172,000 ha area of the Upper Billabong Creek catchment, which is situated in the eastern division of the Murray Riverina region of NSW. The town of Holbrook is located in the centre of the catchment, about 50 km north west of Albury. This well established Landcare group have been involved in vegetation enhancement activities since its inception in 1988 as a "Trees on Farms Group". Holbrook Landcare has developed numerous innovative initiatives including developing a dryland Land and Water Management Plan (UBLWMP 1999). As of late 1999, 58 Holbrook Landcare projects totalling $1,272,000 has been undertaken with over $2 million for on-ground works since including their innovative "Rebirding" project to protect remnant vegetation and support strategic revegetation with diverse plantings. (Andrew Lawson, pers. comm.) The many different projects include Corridors of Green, Rivercare, Greening Australia projects, DLWC funded activities, individual creek and gully projects, plus many privately funded works. The Group has received numerous awards including two National Landcare Awards for catchment management. The Upper Billabong Catchments is one of the four focus catchments of the CSIRO Heartlands Initiative (http://www.clw.csiro.au/heartlands/). The Heartlands Initiative aims to improve land use in the Murray-Darling Basin thereby preserving land and water resources and sustaining agricultural productivity.

Upper Billabong Land and Water Management Plan (UBLWMP 1999) has objectives focusing on improving the community's knowledge about, understanding of and responsibility for land management. Major issues include tree decline, biodiversity decline soil erosion, soil acidity, soil salinity weeds and water quality. The highest priorities are:

1. Revegetation of predominately cleared country with emphasis on the use of local natives;
2. Enhancement of remnant native vegetation areas.

Specific objectives of the Re-birding Project (Collard 2000) include:

1. Protect and enhance existing patches of remnant vegetation and use these remnants as a basis for revegetation in surrounding areas.

2. Undertake active management of protected areas (e.g. weed control and enhancement plantings of native shrubs and grasses).

3. Give priority to remnant enhancement and *revegetation* in the more fertile and low altitude areas particularly in riparian and woodland environments.

4. Restore the landscape according to defined focal species criteria i.e.:
    - Minimum patch size of $\geq$ 6 hectares (blocks)
    - Isolation of < 1 km, and habitat complexity score $\geq$ 6

5. Commence monitoring of existing and newly planted corridors to determine effectiveness of 20 m wide corridors as dispersal habitat for woodland birds.

Holbrook Landcare is in the process of mapping all on-ground works that involve vegetation enhancement. This case study report is one of seven that examines the usefulness of applying a four step assessment framework (Freudenberger and Harvey 2003b) to predict the potential biodiversity benefits of these mapped on-ground works. Since the associated database is incomplete, this report is not an assessment of the Holbrook activities, but rather illustrates how the framework can be used with such mapped data.

Assessment Framework

CSIRO conducted this assessment using Freudenberger and Harvey's *Framework and preliminary Assessment of Biodiversity Benefits of vegetation Activities* (2003a) developed for Environment Australia and the Biodiversity Benefits Task Group under the auspices of the Natural Resources Ministerial Council. A detailed description of the Framework is provided in Appendix 1. This framework has the following four steps:

Step 1. Describe the status of key attributes of biodiversity, identify the broad threats affecting these attributes and describe the management actions aimed at reducing these threats.

Step 2. Identify the benefits to biodiversity that can be expected to follow the planned actions.

Step 3. Choose methods for monitoring the changes that are expected.

Step 4. Monitor the actual changes that followed the actions, and compare them to the benefits that were expected.

Most of Holbrook Landcare vegetation enhancements are simply too recent to measure any direct changes in any attribute of biodiversity. At this early stage, all that can be done is to predict potential changes and benefits for biodiversity. Step 2 is based on predicting changes from some 'Undesired State' to some 'Transitional State" and then to a 'Preferred State' (Fig. 1). The 'Undesired State' is broadly described by the application of Step 1 as reported in the RESULTS section below. The 'Transitional State' is the current conditions of young revegetation and recently fenced remnants and riparian strips. The 'Preferred State', as broadly articulated by the Upper Billabong Land and Water Management Plan (UBLWMP 1999) as a landscape that has adequate cover of native vegetation that conserves existing species, improves water quality and maintains sustainable agriculture.

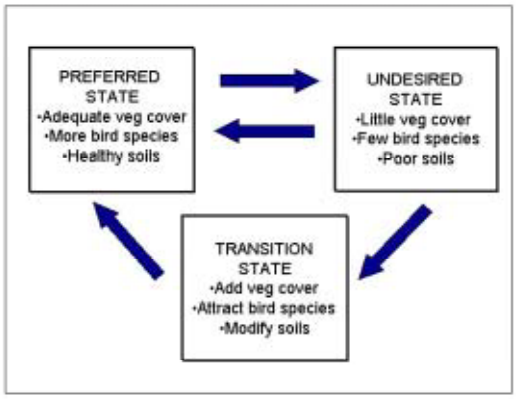

Figure 1. A conceptual model for broadly predicting the benefits of a vegetation enhancement project (adapted from Westoby *et al.* 1989).

The assessment framework (Appendix 1) is based on assessing the actual or potential impacts of on-ground works against predicted responses or expectations, which need to be clearly articulated. The following questions can be asked: What are the expected benefits of the Holbrook vegetation enhancements? At what scale should assessment be carried out and benefits for what attributes of biodiversity? The answers are addressed in the RESULTS section of this report.

This report is not a definitive assessment of the potential biodiversity benefits of the vegetation enhancements in the Holbrook Landcare area. Rather it demonstrates one means of conducting such an assessment at the landscape scale. Our preliminary assessment is limited by the available data (incomplete) and suffers from our lack of local knowledge.

Assessment methods

It is possible to assess the potential benefits of vegetation enhancement with a well-constructed GIS that includes detailed mapped vegetation enhancement activities. The Holbrook Landcare is one of the few projects we reviewed across Australia (Freudenberger and Harvey 2003b) that is mapping, in fine detail, all on-ground works. It is one of the few projects that has attempted to map past works, proposed works (to 2020) and privately funded activities. Andrew Lawson, Implementation Officer for the Holbrook Landcare Group and Jen Howard, provided this critical mapping layer. As of August 2003, not all the blocks of vegetation enhancement were described in terms of objectives, actions performed or date of establishment. Some idea of objectives and actions carried out were obtained from individual project details. The data collection and clarification by Holbrook Landcare is ongoing. The data given to us by Holbrook Landcare did not include many individual farm forestry ventures (single species trials). Within the GIS available at the time, there were 1145 sites or blocks of mapped vegetation enhancement, 782 were dated, and 125 of these were proposed or potential enhancement sites.

We obtained a vegetation classification layer prepared by NSW Department of Land and Water Conservation (DLWC) completed in 2001 for the Heartlands Project. A digital orthophoto image derived from aerial photography flown May 1998, captured at 1:60,000, was also used to clarify classification of on-ground works.

With these GIS layers, and using commonly available GIS software (Appendix 2) we were able to assess the potential of the Holbrook on-ground works in terms of:

- *Remnant fencing*. The size of protected remnants is important for wildlife. The size distribution of vegetation enhancement that overlayed mapped remnant vegetation was analysed. The total remnant areas fenced as a proportion of the total remnant cover was also calculated.

- *Complementarity*. The present distribution of vegetation in the upper Billabong catchment is biased towards the Dry Foothill Eucalypt Forest on the upper slopes of the catchment with fragmented areas of Grassy Box Woodland on the lower slopes and Riverine Forest and Woodland along the drainage lines. The existing vegetation has been prioritised in terms of conservation status and the adequacy of Holbrook vegetation enhancement to protect threatened communities was assessed.

- *Revegetation.* The overall increase in native vegetation cover was calculated before and after the overall vegetation enhancement. The patch size of revegetation (classified using available data and orthophoto image) was also assessed.

- *Connectivity*. We assessed the extent to which Holbrook Landcare supported revegetation has reduced isolation. The distance to the nearest neighbouring patch of vegetation was calculated before and after the on-ground works. The distance to the nearest 10 ha patch was also calculated (Appendix 2).

- *Riparian enhancement.* Vegetation enhancement activities occurring along drainage lines could be identified but it was not always possible to determine whether these were fenced remnants, revegetation of both.

Study area

The Holbrook Landcare Group covers the area known as the Upper Billabong Creek Catchment which is situated in the eastern division of the Murray Riverina region of NSW (Figure 2). It comprises about 172,000 ha of fertile; undulating agricultural lands predominately in the valleys with large open forest remnants on the higher hills and ridges. The town of Holbrook is located in the centre of the catchment about 50 km north west of Albury. Altitude ranges from 220 to 889 m above sea level (Collard 2000). Holbrook receives an annual average rainfall of 695 mm, though annual rainfall increases rapidly with elevation (UBLWMP 1999).

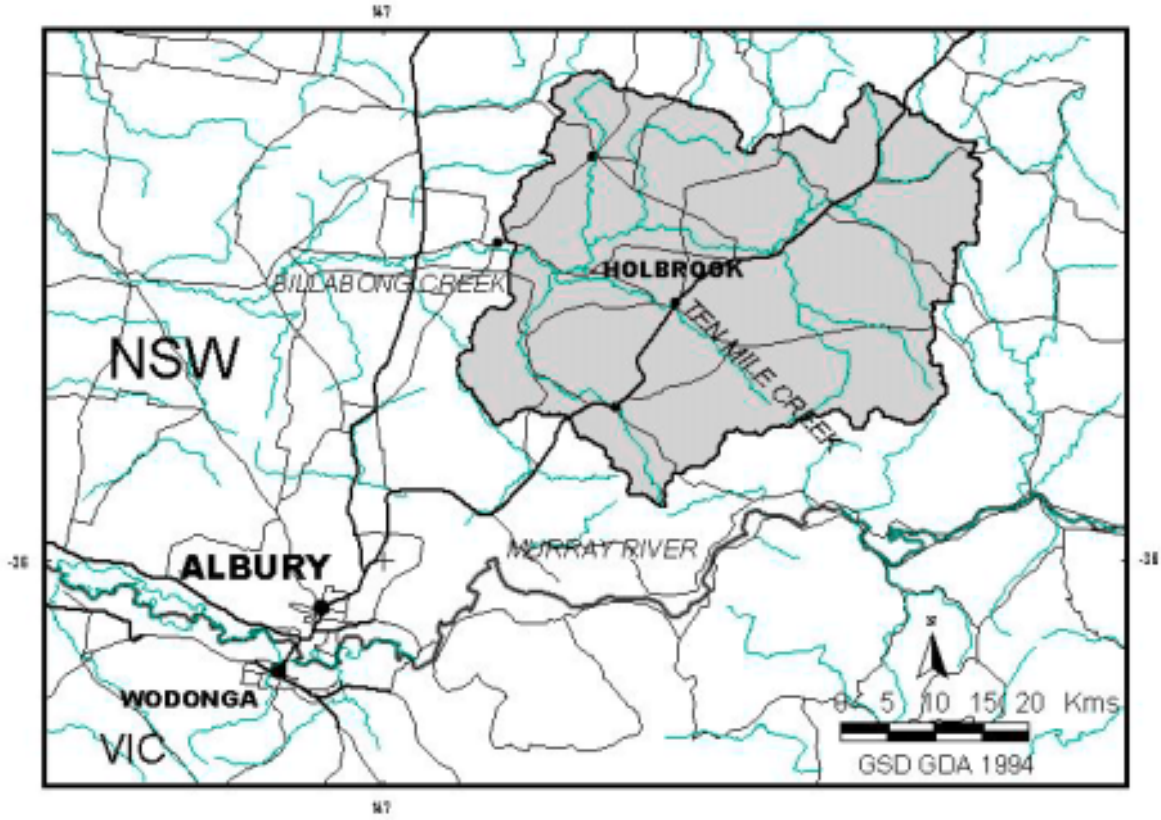

Figure 2. The Holbrook Landcare area in the Upper Billabong catchment, south eastern NSW

The vegetation consists of dry sclerophyll forest and woodlands containing Red Box (*Eucalyptus polyanthymus)*, Red Strinybark (*E. macrorhyncha),* Broad-leafed peppermint (*E. dives)* Brittlegum *(E. manifera),* Long-leaf Box (*E. goniocalyx)* and Black Cypress (*Callitris endlicheri*) on the hills and ridges, with mainly Yellow Box (*E. melliodora)*, Blakely's Red Gum (*E. blakely*) and White Box *(E. albens*) on lower slopes and flats with an understory of native grasses and forbs. Major drainage lines are fringed by mostly River Red Gum (*E. camaldulensis)*.

A detailed survey of fauna in the Billabong catchment by Mathew Herring (2003) observed 23 native mammal species (including 13 species of bat) and 8 feral mammal, 170 bird and 24 reptile and 7 frog species. This list includes 59 species that are predicted to occur in this region but were not recorded in recent surveys.

The main land use in the catchment is cattle and sheep grazing on introduced pastures and dryland crops. Cropping activities increase at lower elevations and within the western portion of the catchment. Additional biophysical information on the Upper Billabong Catchment has been compiled by the Heartlands Initiative and is available on the web at: http://www.clw.csiro.au/heartlands/BLIS1.3/introduction.html