

# Greening Western Sydney Project

## Summary

The Greening Western Sydney project focuses on ecological restoration and management of peri-urban open space areas of Cumberland Plain woodland previously managed for livestock grazing. The project aims to restore natural values across an extensive network of public open space on Sydney's periphery – and operates across three large corridors that run north-south amongst Sydney's Western suburbs – and area totalling 7800 ha.

The Cumberland Plain, a broad and shallow clay-soil rain shadow basin which is surrounded by an extensive steep and dissected sandstone plateau, once supported a network of grassy woodlands and alluvial forests. However over the 200 years plus of European settlement the vegetation has been widely cleared to feed and house the populous of Sydney. Cumberland Plain Woodland is listed as an Endangered Ecological Community under both State and Federal legislation.

Associated with this high level of fragmentation has been a comparable decline in ecosystem function. Many species of fauna have become locally extinct including many reptiles, critical-weight range mammals and woodland birds. The flora has proved much more resilient with far less local extinction. The spread of woody weeds, especially African Olive (*Olea europea* subspecies *cuspidata*), is further threatening the ecological function of the few remaining patches.

The Greening Western Sydney project adopted a two-tiered approach to ecological restoration and management. Firstly, remnant patches of bushland are actively managed to restore ecological function and mitigate threatening processes. This involves active weed management being undertaken within the remnants but also increasingly in the surrounding landscapes. Likewise, pest animal control for species such as rabbits and hares is undertaken. Secondly, mass revegetation has been undertaken to buffer riparian zones and improve the landscape context of existing remnants.

## Introductory Information

The easternmost corridor "The Western Sydney Parklands" totals some 5500 hectares and is owned by the newly created Western Sydney Parklands Trust. The central and western most corridors, Ropes Creek Open Space Corridor and South Creek Open Space Corridors, together total 2200 hectares and are owned by the New South Wales Department of Planning. (The NSW Department of Planning is also the former owner of the Western Sydney Parklands).

Over the last forty years the NSW government has been acquiring these corridors primarily to situate infrastructure such as power lines, water and gas pipelines and freeways. Providentially, in seeking to land for such pragmatic purposes, large tracts of bushland riparian zones and creek lines were also reserved.

## **Stakeholders & budget**

The project is operated by Greening Australia, a not-for-profit environmental organisation that has worked in partnership with the NSW Department of Planning, to improve the health and viability of these environmental assets.

Greening Australia has been working with the NSW Department of Planning on the Greening Western Sydney project since 1992. In 2008 the Western Sydney Parklands Trust was established and this new body is currently establishing its own environmental priorities. Greening Australia and the NSW Department of Planning still cooperate in restoration works in the South and Ropes Creek corridors.

Total investment is approaching \$8 million largely from the NSW Department of Planning with additional support from others including the Hawkesbury Nepean and Sydney Metro Catchment Management Authorities, the NSW Environmental Trust, the Natural Heritage Trust, Blacktown Council and Penrith Council.

## **Ecosystem and impacts**

The once widespread Cumberland Plain Woodland has declined in extent by up to 92% from a total of 125,000 ha to 11,000 ha. Typically the community's vegetation structure varies from open forest to woodland and the canopy is dominated by a small number of eucalypt species such as Forest Red Gum (*Eucalyptus tereticornis*) and Coastal Grey Box (*Eucalyptus mollucana*). The shrub density is highly variable depending on the local fire regime but is often dominated by Australian Blackthorn (*Bursaria spinosa*). The ground layer is dominated by native grasses such as Kangaroo Grass (*Themeda australis*) and Weeping Grass (*Microlaena stipoides*) intermixed with a wide variety of other ground flora.

On the more fertile alluvial floodplain Cumberland Plain Woodland makes way for Sydney Coastal Riverflat forest with a denser canopy and shrub layer. Species such as Cabbage Gum (*Eucalyptus amplifolia*) and Rough-barked Apple (*Angophora floribunda*) dominate the canopy up to rivers edge where Swamp Oak (*Casuarina glauca*) is abundant due to the slightly saline stream flow.

The fauna is typical of Australian woodlands although fragmentation and other impacts have particularly reduced the ground-dwelling and arboreal mammals. The Eastern Grey Kangaroo, brush-tailed and ring-tailed possums and sugar gliders are among the surviving species.

Woodland birds have been in steady decline and once common birds such as hooded robins, flame robins and regent honeyeaters are all but extinct from the area.

Tree clearing and livestock grazing have been relatively constant impacts on Cumberland Plain Woodland since settlement. The fragmentation has exacerbated impacts from invasive fauna such as cats, foxes and rabbits. The expansion of the urban footprint has seen further clearing and fragmentation over the last 40-50 years. More recently, African olive (*Olea europea* subspecies *cuspidata*) has outgrown its status as a 200 year 'sleeper weed' and massively expanded its range threatening to convert the remaining Cumberland Plain Woodland into a dense monoculture.

## **Restoration goals and planning**

The broad aims of the Greening Western Sydney project are:

- Restoration of Cumberland Plain Woodland
- Restoration of riparian vegetation to provide fauna habitat, connectivity and ecosystem services to peri-urban river systems
- Engagement of local community in achieving above aims
- Raising awareness of ecological values of local area.

The original ecological underpinnings for the project are laid out in a feature article in EMR (Davies & Christie 2001). The initial focus of the project was to restore degraded plant communities to their original state. Site based restoration plans were developed by Ian Perkins.

Specific benchmarks or goals were not set *per se* for restoration. However, efforts have targeted the re-establishment of presumed pre-existing vegetation composition (especially in the ground layer) and aspects of ecological function such as fauna habitat utilisation and canopy recruitment. Formal studies examined some of these aspects comparing adjacent reference site, restored sites and unrestored degraded sites.

## **Project implementation**

Weed and pest animal control was carried out in the high resilience areas to facilitate regeneration. To achieve reconstruction in the more degraded areas, revegetation of tree and shrub species were used to create a woodland framework with the aim of accelerating ecological recovery. Combining both approaches, the Greening Western Sydney project has achieved the following since 1992 (to the present):

- Undertaken active environmental management of 2000 hectares of native vegetation spanning a range of condition classes
- Established 990,000 native trees and shrubs through mechanical planting, community planting events and direct seeding
- Coordinated approximately 5000 hours per annum of volunteer contribution in a range of activities including a successful community nursery
- Implemented an environmental education program 17 schools (annually)
- Produced regional ecological management best practice guidelines.

The restoration effort initially was heavily dependent on volunteer effort. Over time as the project grew the volunteer effort remained constant whilst the additional work was carried by Greening Australia's professional paid staff. Two contractors have served the project exceptionally. Tractor operator, Leon Parisi, has carried out 1000's of kilometres of slashing to prepare and manage revegetation sites. Phil Burkitt developed and operated specialised mechanical planting device for mass revegetation.

All restoration sites are subject to ongoing management including environmental weed control and pest fauna species control. This work is incorporated into every annual works plan. All revegetation works are maintained to ensure plant survival including watering (although rarely required), pasture suppression and pest control.

The weed control techniques applied varied from hand removal, herbicide application (spot spraying, cut-and-paint and stem injection) and mechanical clearing; depending on the weed species and level of site resilience. The revegetation of degraded sites has predominately been carried out by mechanical planting of nursery produced stock.

The program has been subject to a detailed external audit and review on two occasions. An annual report is produced and made available to the public for comment. Long term involvement of an environmental NGO (like Greening Australia) has allowed retention of intellectual property and local ecological knowledge which has lead to consistent and improving implementation.

## **Progress to date**

Invasive weeds have been removed from 15 remnant bushland sites. The removal of these weeds has allowed some regeneration of native species. However, in many instances, the removal of woody weeds has provided opportunities for annual weeds to establish – although with continuing active management, native species have become dominant. Canopy trees, such as eucalypts and angophoras, are regenerating from seed rain. The native grasses have been slow to return as the invasive woody weeds have shaded out the tussocks and depleted the soil seed bank over time. This has limited the resilience of the restoration sites. Further intervention such as application of native grass seed will be required in some areas to complete restoration.

The level of reinvasion by woody weeds has depended on the proportion of weeds removed from a site. Where a large proportion of woody weeds have been removed (i.e. more weeds removed than remain) the level of reinvasion is low. However, when a smaller proportion was removed (i.e. more weeds remain than were removed) then the level of reinvasion is high. This indicates that reinvasion is likely to be from seed rain or bird-dropped seed rather than from the soil seed bank.

The impact on fauna of weed removal has not been explicitly studied; however, some observations have been noted. There were some concerns that the extensive removal of woody weeds would simplify the overall vegetation structure and lead to a fauna decline. At one site (Mamre Homestead on South Creek) where we have kept long term bird records there has been no decline in bird diversity despite weed removal. It appears that the loss of structure has been offset by the revegetation buffer and also the regeneration of a native understorey.

The reconstruction of degraded sites through revegetation has been studied intensively by several PhD students. They found that there has been recovery of vegetation structure and an increase in floral biodiversity (over and above those species planted). The recovery of species composition is not, however, on a trajectory towards reference communities. It appears that a depauperate soil seed bank, a high level of soil nitrates and a vigorous exotic grass layer all form barriers to full restoration. Removing soil nutrients (through fire or soil carbon amendments) and the application of native grass seed will take restoration to the next level.

The restoration of ecological function has occurred to a greater degree than vegetation composition. Insect diversity is greater in revegetated areas than either adjacent paddocks or remnants. However, not all remnant species have returned. Bird use in revegetated areas is good with some areas supporting more small bird species than remnants. This may be due to a higher level of bipinnate wattles providing cover and potentially limiting the distribution of the hyper-aggressive noisy miner. Whether the revegetation is improving connectivity between or the viability of adjacent remnant has not yet been tested.

## **Monitoring and research links**

The project has had strong links to science including six high quality investigations (4 PhD and 2 honours theses). These investigations, largely through Dr Charles Morris at the University of Western Sydney, examined the restoration of degraded sites.

Greening Australia carried out photopoint monitoring across the majority of sites; although unfortunately this practice was initiated part way into the project. Bird records have been taken over time at a number of sites by the Cumberland Bird Observers Club. Initial observation show that revegetation sites have been well colonised by small insectivorous birds. Volunteers have recorded frog presence at one site over a decade where it appears that frog diversity is in decline. It is difficult to correlate this decline to management actions or broader factors such as continuing drought, pathogenic infection or water pollution arising from outside the site.

## **Lessons learned**

In terms of the science and practice of the restoration we have learned that the restoration of vegetation composition is a very long term process; but restoring elements of ecological function can occur over a shorter time frame.

A long term partnership with government (including significant multi-year financial commitments) has been critical to the success of the project. Furthermore the long term involvement of an environmental NGO (like Greening Australia) has allowed retention of local ecological knowledge and intellectual property and local ecological knowledge which has lead to consistent and improving implementation.

The major modification we intend to make in the future is to increase our focus on restoring the native grass layer both following woody weed removal in high resilience sites and in our broad-scale revegetation of degraded sites. To achieve this, the major barrier to overcome is a shortage in supply of indigenous native grass seed. The project has invested in developing native grass seed production areas on former market garden sites. These sites, planted out with native grasses, are managed for maximum seed production and will provide sufficient seed to rehabilitate massive areas. The next step is to trial application methods.

## **Further reading**

SOUTH CREEK CORRIDOR- LAND AND VEGETATION MANAGEMENT PLAN November 1998. PREPARED FOR THE NSW DEPARTMENT OF URBAN AFFAIRS AND PLANNING. Ian Perkins Consultancy Services.

Christie 2004. Volunteer attitudes and motivations: research findings and their application for sustainable community involvement programs in natural resource management. Conference Paper for Effective Sustainability Education: What Works? Why? Where Next? Linking Research and Practice 18-20 February 2004, Sydney, Australia.  
<http://www.environment.nsw.gov.au/resources/cee/christie.pdf>

Davies R and Christie J (2001) Rehabilitating Western Sydney's bushland: Processes needed for sustained recovery *Environmental Management & Restoration*, 2:3. 167-178.

Lomov, B., D. R. Britton, D. A. Keith, and D. F. Hochuli 2006. Butterflies and moths as indicators for restoration monitoring: A case study in Cumberland Plain Woodland. *Ecological Management & Restoration* 7:3, 204-210.

Wilkins S., Keith D. A. and Adam P. (2003) Measuring success: Evaluating the restoration of a grassy eucalypt woodland on the Cumberland Plain, Sydney, Australia. *Restoration Ecology* 11, 489–503.

Peter Nichols (2006). *An evaluation of restoration*. Unpublished PhD thesis. University of Western Sydney. (Several papers in preparation or in press. Two other PhD thesis as follow ups to this work are at or near completion.)

### **Contact information**

Greening Western Sydney provide significant opportunities for volunteers including nursery work, tree plant, seed collection and bush regeneration. For more information on volunteer opportunities contact:

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**Project Image Gallery**





