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Forest as historic artefact: understanding cumulative landscape transformation in grazed and logged forests in north-eastern New South Wales

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Introduction

In what ways have the cultural values of historical land users and land managers shaped the structure and character of forested landscapes? What are the implications of humanly modified forests for the management of forests now within protected areas managed for conservation?

Typically a focus by heritage practitioners on structures associated with residence and work has limited focus on historical interaction with the wider landscape. The application of 'cultural landscapes' concepts provides a way of looking at the complex interactions between people and environment at the landscape scale. It does this by recognising that history has taken place across all parts of the landscape. Thus, evidence of human activity will be detectable in the vegetation and in landscape modifications as well as in the material traces of history.

Firstly, we outline a study undertaken in the tall open forest and tall moist forests of Washpool National Park (Umwelt Environmental Consultants 2007). The study investigated links between values held by graziers and foresters; their choices of land management practices;

the ways in which historic land management techniques affect the floristic composition and structure of vegetation communities; and the ways in which these constructed or modified landscapes continued to evolve since forestry and grazing activities ceased. Secondly, the paper discusses the implications of constructing present day forest as inseparably cultural and natural in the context of conservation and protected area management.

Our thesis is that protected area management requires knowledge of the character of vegetation as a physical marker of historical activity, as well as knowledge of biodiversity, in order to integrate ecological with cultural heritage management.

Situating the research

A study of the forested cultural landscapes within Washpool National Park was undertaken as part of a broader New South Wales Department of Environment, Climate Change and Water (DECCW) research project. The broader research project seeks to investigate how the history and heritage of protected area landscapes can be better managed (Brown 2007) and to move the cultural heritage management approach in New South Wales protected areas from a *site-based* to a *landscape approach*.

A site-based approach is an 'easy' concept for land managers and heritage practitioners, partly because it supports the separation of the natural and cultural for research and management purposes. It effects this separation by treating heritage as items contained within the natural environment rather than as traces of historical behaviour that have helped to constitute the 'natural' environment. A cultural landscape approach offers an opportunity to move away from a focus on objects and sites as ends in themselves, toward managing the material record in its historical and broader landscape context. The approach also offers opportunities to better integrate natural and cultural heritage conservation, particularly in an agency like the NSW National Parks and Wildlife Service (NPWS) that traditionally has focussed on nature conservation.[1]

Much has been written on the cultural landscape concept and its application, including as a category of property on the World Heritage List (Aplin 2007; Brown 2007; UNESCO World Heritage Centre 2010,

2003). Brown (2007) has argued that, both internationally and across Australia, different organisations use different approaches when applying cultural landscape concepts to heritage management, and that these approaches tend to reflect the specific operational contexts of the agencies. In the case of Australian protected areas, a number of 'principles' can be used to underpin a cultural landscape framework. These include:

1. Landscape is a living entity, and is the product of change, dynamic patterns and evolving inter-relationships between past ecosystems, history and cultures.

2. The interactions between people and landscape are complex, multi-layered and are distinctive to each different space and time.

3. Community engagement and dialogue, where all people's values are noted and respected, are characteristic of a cultural landscape mentality.[2]

4. All parts of Australia's landscape have community connection and associated values and meanings.

5. A key element of cultural landscapes is the continuity of past and present.

In considering how these principles might be applied 'on the ground', work has been undertaken in three case-study national park landscapes in New South Wales to document the histories of past and present human–environmental interactions, as well as the surviving material traces of those histories ('archaeologies'). The case study parks (Yuraygir, Washpool and Culgoa) were selected to represent, very broadly, different environments across the state (coast, mountain and semi-arid interior) and different historic themes (recreation, forestry and pastoralism). These historic themes are common to much of the New South Wales protected area system and therefore any approach to represent them in one landscape will have broader application.

Washpool National Park

The Washpool National Park case study investigates 'ecology as archaeology' and 'ecology as cultural heritage'. The cultural landscape approach considers human influences on landscape change as part of creating a cultural space, rather than in terms of environmental impact. Clearly there is an abundant literature, indeed an entire

industry, focussed on assessing and mitigating human impacts on environmental values. This case study looks at the cultural values of people living in remote landscapes, who mostly have 'touched the landscape only lightly' (Nugent 2005: 5).

Washpool National Park (WNP) occupies approximately 70,000 hectares, straddling the crest of the Gibraltar Range, on the eastern side of the Great Dividing Range (Figure 1). Core areas of the park were first gazetted in 1982, following one of the highly publicised 'battles' over rainforest protection that characterised forestry and conservation policy debate in the late 1970s and early 1980s. In 1985 the bulk of the newly proclaimed WNP was declared a wilderness area and in 1987 was included as part of the world heritage listing for 'Gondwana Rainforests of Australia'.[3] The western parts of WNP, formerly parts of the Curramore and Spirabo State Forests, were added to the park in 1996, following the Comprehensive Regional Assessment (CRA) process. Further areas continue to be considered for addition to the

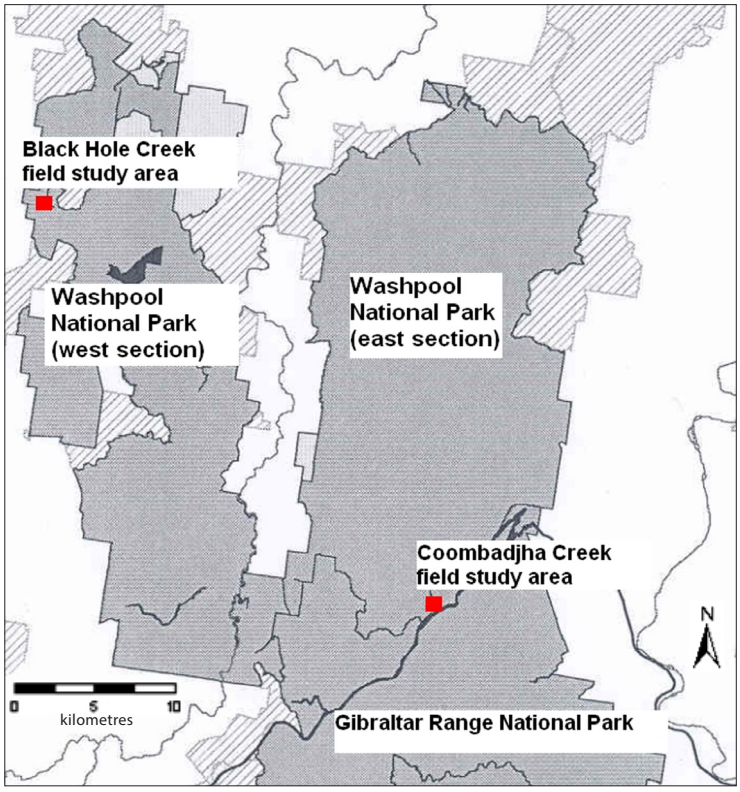

Figure 1: Location map showing national parks (shaded) and two field study areas.

park, principally along the Rocky (Timbarra) River which separates the eastern and western parts of the park.

The term 'Washpool forests', initially used to refer primarily to the core rainforest and wet sclerophyll forest sections of the park (generally considered to be 'old growth' or 'wilderness'), now refers more broadly to the diverse forest types that form a complex mosaic of vegetation assemblages across the escarpment, range crest, deep valleys and western undulating hills.

Hunter (2000) and Sheringham and Hunter (2002) have mapped ten vegetation communities across the Gibraltar Range (including six forested communities that dominate the eastern part of WNP) and a complex pattern of a further 27 communities in the western WNP area.

Several thematic histories of the broad WNP area (e.g. Allen 2006; Curby 1993; Wilkinson 1980) identify grazing, logging and mining as the major historic activities associated with the forests managed for conservation by NPWS and in adjacent forest managed by Forests NSW, Department of Primary Industries (now Industry and Infrastructure NSW). Cattle grazing and logging activities have a history in the Washpool forests that extends back to the mid-nineteenth century. The case study presented in this paper is concerned with the grazing and forestry aspects of past land use, although the interaction of mining with these land uses at some locations is acknowledged.

Local Aboriginal people have cultural associations with the landscape of WNP deriving from a long period of pre-contact association, post-1788 interaction and contemporary attachment (Murphy and Perkins 1995; Longdin 2000; McIntyre-Tamwoy 2005; NPWS 2005a: 27). Aboriginal use of the landscape was not a focus of the study, excepting where Aboriginal people were engaged in grazing and logging activities (e.g. 'Alf', an Aboriginal stockman, worked with the Sloman family in the former Curramore State Forest).

Research questions

The project sought to address a wide range of questions with regard to the ways that historical activity has shaped the structure and character of forest vegetation within WNP. The key research questions fall into four groups.

First are questions about understanding the cultural values held by past land users.[4] Such questions are relevant to recognising and identifying cultural landscapes (see discussion in Umwelt Environmental Consultants 2007: 2.1–2.5). For example, what were the values that brought multiple waves of land users to the Washpool forested landscapes? Are these values similar to, or different from, those that brought settlers to other parts of the New England area?

A second group of questions, at the core of the research, sought to tease out the implications of land use for landscape and vegetation change. For example, how has seasonal cattle grazing and selective logging activity shaped the current vegetation of Washpool?

A third group of questions considered the boundaries of cultural landscapes. How should boundaries between cultural landscapes be defined? How should connectivity within, and between, cultural landscapes be described and interpreted, particularly in relation to landscapes both within and outside lands managed by NPWS?

A fourth and final group of research questions considered how natural landscape processes and culturally induced changes could be integrated—how should landscape integrity be interpreted in a forest ecosystem? How do the scales of forest change due to natural processes and past cultural practices compare? In what ways might ecological change obscure evidence of past historic activity?

A position underpinning the research is that cultural landscapes are a cumulative but tangled record resulting from human values, ideals, philosophies, aspirations and human activity (as per Pearson and Sullivan 1995). Forested landscapes are continually transforming, with complex interactions between human values, human activities and natural processes (Figure 2). It follows that one cultural landscape in a forested area can be transformed into another, and at the time scale of forest ecology, which relies on disturbance and regeneration for continuity, culturally created landscapes do not revert to 'natural' landscapes. Thus, the effect on vegetation from cattle grazing and selective logging activity, which in Washpool followed from past Aboriginal use (plant gathering, burning practices), was not simply additive or consecutive, but cumulative because each action not only adds a new and distinct layer, but also influences the trajectory of later natural regeneration and transformation processes. Human activity has had a cumulative effect on vegetation and at some points the

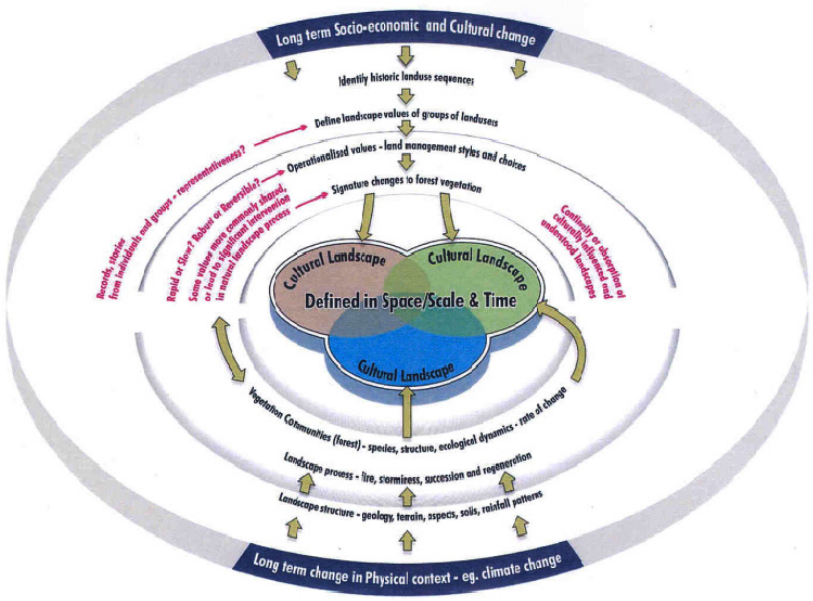

Figure 2: Conceptual framework for landscape change.

human and ecological process interactions pass thresholds that make them identifiable as new cultural landscapes.

Methods

The 'forest as historic artefact' study in WNP endeavoured to integrate information derived from both historical and ecological methods. Of these methods (outlined below), field-based discussions with current and former land users provided invaluable understandings of vegetation-based evidence of past and current land use and land management practices. The project could not have realistically progressed without the input of such local lived experience, knowledge and understandings.

Literature review: History

Mark Allen (2006) has prepared a detailed overview of the post-1788 history and cultural heritage of Washpool and Gibraltar Range National Parks. The major historical themes represented in WNP include: ongoing Aboriginal connection by Bundjalung and Gumbaynggirr people; forestry, comprising an early red cedar-getting period (from

the 1870s) and later selective logging (especially from the 1950s) and associated milling; seasonal (winter) cattle grazing; mining (tin and gold); road building (the Gwydir Highway was opened in 1960); and, from 1963, conservation. In addition to these major themes, other activities undertaken in the Washpool forests included scrub farming, beekeeping, the collection of wattle bark (for tanning), and silviculture (e.g. a stand of exotic pine trees was planted in 1984 near the Old Mill settlement site in the Spirabo State Forest).

The remote and rugged landscape of WNP has meant that inaccessibility is a dominant theme in Washpool's history. The survival of large tracts of both hardwood and brushwood forest, recognised in the area's World Heritage listing, has been a consequence of inaccessibility. Non-indigenous human interaction with this landscape has been characterised by short term, spatially restricted activity (mining, forestry and road building) and long term, broad scale, 'lower' impact activity (grazing, conservation and beekeeping).

Written and oral family histories

An understanding of the values held by the different forest user-groups through time is seen as essential in the identification of cultural landscapes. Values in this context are what a group identifies as important about a place—what attracts them to it; how it meets their social, economic or spiritual needs and interests. These values are the framework within which decisions are made, including decisions that lead to actions having a physical and observable impact on a landscape.

Review of previous oral histories[5] provided information about the values and associated land use practices connected with forestry, seasonal cattle grazing and conservation (Umwelt Environmental Consultants 2007: Tables 4.1–4.5); and enabled correlates between values held by land use groups and the physical evidence of historic activity associated with each value to be established. For example, a value relevant to intensive selective forestry practitioners is: 'timber as a sustainable resource'. Practices reflecting this sustainability value that would result in changes to vegetation included silvicultural techniques of thinning, selective logging (managed through quota systems and record keeping for each coupe), and control burning (to reduce risk of wildfire). Phil Kiehne (pers. comm. 2007) described how, in the 1970s, the Forestry Commission would burn all the tree 'heads' in autumn

or winter (to reduce fuel loads) after logging in a compartment was complete, and would then try to keep fire out of the compartment for 10 to 15 years (to support tree regeneration).

In attempting to understand and document the values of user-groups, a distinction is made between individual and collective values. For example, values commonly held by individuals practising grazing, forestry or conservation include(d) personal characteristics associated with remote living, such as resilience, good bush skills and independence; long-term family or community association with particular landscapes; and a sense of importance and pride in the activity being undertaken.

Collective values associated with grazing families tend to focus on the forest understorey. These particular values include a preference for openness and an absence of 'scrubby', mid-storey vegetation; reliable water sources; rugged terrain that provided natural boundaries (high ridges and deep creeks) that could contain cattle and thus would not require fencing; and a preference for dry tall open forests (rather than tall moist forests) where the understorey responds to regular firing to favour plant species edible to cattle.

Collective values associated with forestry land users tend to focus on forest productivity and include: productive forests comprising high quality timber that contributes to livelihoods and regional economies (including milling and construction industries); respect for technical tree felling skills appropriate to huge trees located in rugged terrain; regeneration of forest for both ecological and economic purposes; and a place to live and earn a living. Rugged country was initially a significant obstacle for forestry activities and thus was valued differently from graziers. Openness and an absence of mid-storey vegetation, valued by graziers who moved through the landscape on horseback, was not viewed as important to foresters because roads and tracks could be constructed to facilitate movement through the forests.

Collective values associated with conservation managers include: the scientific value (rarity, research potential) of undisturbed forest; the existence value[6] of remote forested landscapes; 'wilderness' viewed as providing evidence of ecological continuity, not change; economic non-use values rather than production or resource values; and the valuing of conservation campaigns that seek to protect the 'natural' environment.

Literature review: Ecology

A review of ecological literature relating to vegetation communities in the Washpool National Park and published research into the response of these tall open forests and tall moist forests to grazing and forestry land uses provided information about the scales of vegetation diversity across the National Park. Forest responses to variable fire regimes and to canopy disturbance were the key themes of this research. The research also considered information about impacts and rates of recovery after major disturbance events (such as wildfire) in the forest communities, to facilitate comparison of the scale of disturbance due to different factors and the subtlety, robustness and longevity of the ecological evidence.

The literature review collated ecological research on the impacts of fire and grazing in the temperate forests of north-eastern New South Wales. Many of these studies provide detail about the effects of fire intensity and frequency on individual plant species, or groups of species, within wet and dry sclerophyll forests. While these studies have an ecological focus, rather than a cultural landscape viewpoint, the fire management objectives of ecology reflect particular cultural values or norms associated with nature conservation and thus reflect cultural perspectives.

While Ashton (1981) discusses fire process and effects in tall open forests generally, Campbell and Clarke (2006) present a comparison of the fire response from WNP (the hot fires of 2002, which burnt all vegetation strata in areas unburnt for more than 50 years) and Mummel Gulf National Park, east of Walcha (low to moderate intensity fire that burnt the understorey and ground cover but not the tree canopy).

Campbell and Clarke suggest that the fire response in forests with a rainforest (mesophyllous) understorey and full canopy cover is broadly similar to the way the forest responds to other forms of canopy disturbance (such as windfall or senescence), rather than being a specific fire response. The authors suggest that these forests have a 'gap phase' process of regeneration whereby plants colonise areas of the forest floor where light penetration increases, by resprouting. This finding supports the idea that selective logging would produce a similar sprouting, rather than reseeding, response beneath newly created gaps in the forest canopy.

In contrast, John Hunter (pers. comm. 2007) has suggested that logging in old growth bluegum (wet sclerophyll) forests produces a quite different ecological response to fire disturbance. He argues that where very large old growth trees are present, with touching crowns (i.e. close to full canopy cover), selective logging does not open sufficient space for eucalypt regeneration by seedlings. He suggests that this is because of the extent of the root mass of the large trees. Where extensive logging has occurred and a renewed eucalypt forest is present (say, trees of 30 years age), the canopy and root mass is not so dense, so further forestry may produce seedling regeneration rather than mesophyllous resprouting in the understorey. This implies that continued logging activity will tend to encourage dense grassy/shrubby understorey over mesophyllous understorey, regardless of fire regime. Where fire does occur, it would tend to further encourage eucalypt seedlings in the understorey rather than mesophyllous species, so the effect on forest structure would be cumulative.

Based on the views of these expert ecologists, it could be argued that intensive logging in wet sclerophyll forests, followed by either an understorey fire or an intense wildfire, will tend to encourage even-aged stands of regenerating forest, because of regeneration from seedlings. Less intensive logging, however, could result in a continuation (and increased stem density from resprouting) of the mesophyllous understorey, without significant eucalypt recruitment. These are important concepts for identifying cultural landscapes created by forestry (discussed later in the light of field evidence from the case studies examined during this project).

Henderson and Keith (2002) report a detailed ecological study of the impacts of fire and grazing in the temperate forests within the Guy Fawkes River National Park, focusing particularly on changes to the shrub layer in the understorey. The study results support the hypothesis that grazing and associated burning practices are associated with a simplified forest understorey. Liz Tasker and Ross Bradstock (2006) surveyed 58 eucalypt forest sites on the northern tablelands of New South Wales to test the significance of grazing practices on forest understorey structure. Their results indicate that cattle grazing practices (i.e. grazing and the associated frequent fire regimes) can have major effects on forest understorey structure and composition at a regional level.

In contrast to the regular, low intensity seasonal (spring) burns characterising seasonal cattle grazing practice and the use by NSW Forests of controlled fuel reduction burns, NPWS seek to implement firing regimes (control burns lit in autumn to late winter) that are deemed appropriate to sustaining habitat diversity (e.g. prescribed mosaic burning for Hastings River Mouse; Meek and Shields 2005). The NPWS prescribed burning regime is less frequent than the fire regimes of seasonal graziers or forestry personnel. However, from a biodiversity conservation perspective and based on wildfire mapping of WNP from 1950, much of the vegetation of WNP is considered to be over burnt or vulnerable to over-burning.

Field recording program

A field program was undertaken to document how the cultural values of past grazing and forestry land users are reflected in the forest landscapes of WNP. Pam Dean-Jones developed a field recording form comprising 16 fields used to document reference information (location, place name, date, recorders), landscape character (geology, soils, landform, erosion, drainage, aspect), forest character and landscape disturbance.

A number of the field study sites were investigated with current and former land users, including Bob Sloman (a third generation grazier whose family had grazed cattle in the former Curramore State Forest), Phil Kiehne (a former logging supervisor in the Coombadjiha Creek area) and current NPWS staff including Peter Croft (Senior Ranger), Nathan Oliver (Ranger) and Mick Liebermann (Ranger). Information regarding land-use practices and vegetation change provided by these participants, combined with information garnered from historical sources and existing oral histories, was interrogated to consider how different past and present land users value forested landscapes and how these values are reflected in forest management and hence in the structure and composition of vegetation. The information collected on forest character and landscape disturbance comprised:

- vegetation structure—indicating undisturbed or disturbed forest (e.g. density of large trees, small trees, small shrub and ground layer vegetation, coppicing);

- species composition—reflective of past management strategies such as burning;
- data indicating natural disturbance processes (e.g. intense storms, wild fire, insect attack); and
- structural features indicating human disturbance. Indicators of human disturbance resulting from grazing activity include the presence of cattle pads/trails and dung and the presence of structures such as fences, yards and dams. Indicators of human disturbance resulting from forest harvesting include the presence of log ramps and loading areas, snig tracks, tree stumps, reject logs and logging debris (tree heads).

Twelve sample plots, each 100x100 metres (one hectare) in size, were investigated.[7] The plot size, required to document both vegetation indicators and land use indicators, provided a sufficient area to gain an appreciation of large tree density, but also allowed observations to be made of the variability of understorey species.

All field records, comprising field forms and photographs, were collected by a team that included the consultant (PD-J), DECCW staff and past local land users. Summaries of information from two of the sample plots recorded are outlined below.

Black Hole Creek—Former Curramore State Forest

The former Curramore State Forest was never logged and was mostly grazed by the Sloman family, who held leases and Permissive Occupancies from the early years of the twentieth century until the 1990s. A field sample plot, located near Black Hole Creek, comprises local upland tall open forest (New England Blackbutt, Stringybark and Round leaf Bluegum), locally considered 'old growth'. The general structural and floral characteristics of the sample plot (Figure 3) were recorded with reference to leaf litter (more than 80% cover), ground cover (75–100% cover; multiple 'fire tolerant species'; weed species rare), shrub understorey (less than 25% cover; bracken fern dominant), small tree understorey (less than 25% cover; *Banksia integrifolia*, *Acacia irorata*), and canopy (mix of juvenile and mature trees to 20m; tree hollows common; no evidence of coppicing).

The Curramore forest is known to have been burnt in wildfires in 1946/7 (destroying materials carted into the area by Bob Sloman's

Figure 3: Vegetation structure in seasonally grazed forest, Black Hole Creek field study site, former Curramore State Forest.

Figure 4: Field team (left to right: Pam Dean-Jones, Senior Ranger Peter Croft, and Bob Sloman) discussing past grazing practices, former Curramore State Forest.

family to construct a hut), 1994 and 2002 and is subject to fuel reduction burns by the NPWS. Multiple fallen logs are scattered across the sample area, and some of this material relates to the 2002 wildfires, as is probably the case with the dense patches of green wattle (*Acacia irorata*). Dead branches in the tree canopy were attributed to both the effects of the 2002 fire and the effects of prolonged drought (Peter Croft, Senior Ranger pers. comm. 2007). Bob Sloman, who participated in the sample plot recording (Figure 4), noted that the understorey had 'scrubbed up a lot' since grazing ceased.

Coombadjha Creek

A second sample plot, located adjacent to the Granite Lookout Track in the Coombadjha Creek area and within New England Blackbutt forest (Figure 5), was selectively logged in the late 1960s (Phil Kiehne pers. comm. 2007), soon after the opening of the Gwydir Highway. The area does not have a history of seasonal grazing activity. The general structure and florisitics of the forest in the sample plot were recorded with reference to leaf litter (full cover to 10 cm depth), ground cover (dense understorey of ferns, grasses, rush/sedges and small shrubs to 100 cm height), mid-storey (less than 25% cover of scattered tree ferns), and canopy (open canopy to 25 m of New England Blackbutt, Messmate and Silvertop Stringybark; mixed 'old growth' trees and post-logging regrowth). The vegetation in the sample plot has been affected by the very hot 2002 wildfires—effects can be observed in the mid-stratum and canopy of trees, and in the presence of burnt stumps and logs as well as surface burning and deep charring of bark on standing trees.

The diverse evidence of logging in the sample plot includes: multiple cut tree stumps (over 20 within the sample plot), reject saw logs on the ground (5–10), a heavily overgrown track, a log loading ramp, log loading area, and evidence of tree damage caused by forestry machinery. In addition, there is notable evidence in the vegetation of past selective logging including abundant regrowth of trees in various age/size classes with different stem densities including post-logging regrowth trees of 30–40 cm diameter (100–500 stems per hectare). Regrowth of slow growing tree ferns were noted to be in lesser numbers in logged than unlogged areas (Phil Kiehne pers. comm. 2007).

Figure 5: New England Blackbutt forest logged in the 1960s with mixed tree sizes and mixed fern understorey. Granite Lookout Track field study site. Phil Kiehne and Pam Dean-Jones.

Findings: Vegetation indicators of past historical activity

The case study assessments illustrate the complex task of disentangling disturbance evidencing past historic activity from 'natural' processes within a forest landscape. Although the sample plots studied for this project were large (one hectare), it is clear that many of the forest features vary at a local scale, so that the sample plots highlight vegetation diversity rather than unity. Overlaying this local diversity is the significant effect of wildfire on forested landscapes, effects that can mask less robust indicators of forest land use or land management.

This section considers the types of landscape variability that have been identified from the sample plots, to determine which (if any) characteristics can be used to differentiate between vegetation structure and composition associated with past historic activity and vegetation change that is not associated with historic activity. The first point to be made is that we were able to distinguish the effects of seasonal cattle grazing on vegetation from the effects of different selective logging regimes on vegetation within the WNP forests.

Past seasonal cattle grazing activity has taken place in the former Curramore and Spirabo State Forests within the western part of WNP. Although there are local variations in species and canopy community within these forests, the form of the open forests of both state forests is broadly similar—a eucalypt canopy, mostly comprising New England Blackbutt, to 20 metres in height. Grazing, of itself, does not affect either the height or the stem density of trees. The predominantly old growth forest is distinct in structure from forests that have been logged. Grazing pressure and frequent fire may interfere with regeneration of eucalypt species by reducing the survival of seedlings. However, in the WNP study sample plots, where grazing has been suspended for some 10 to 15 years, younger eucalypts are now present beneath old growth canopy trees.

Other key features of the vegetation in these grazed landscapes are, firstly, there is close to 100 per cent ground cover of leaf litter and low grass and shrub species with considerable species diversity in this part of the forest community. Grasses and low shrubs (particularly blady grass and poa), as well as bracken, may be common in grazed areas, and stands of grass trees or stands of tree ferns more common in ungrazed areas. Secondly, dense understorey patches of *Acacia* (such as *A. irorata*), probably a response to recent hot wildfires, are likely to be rare in grazed forests because of past firing regimes and because young shoots of these species were grazed by cattle, thus preventing the emergence of dense coppices. However, the evidence is equivocal (e.g. the literature suggests that *Allocasuarina* may be preferentially encouraged by high fire frequency) and detailed floristic studies are required. Thirdly, there is a tendency toward limited timber, including fallen trees, on the ground in forests that have been grazed and subject to regular, frequent, low intensity burning.

It is to be noted that past grazing in the former Curramore State Forest, described above for the Black Hole Creek area, differs from that practised in the former Spirabo State Forest. In the latter forest, in the Four Bulls Creek Hut area, permanent settlement is evidenced by cleared paddocks, fences, yards and a hut as well as the presence of weeds (e.g. scotch thistle) and pasture species. Native species regeneration in open paddocks tends to be concentrated around remaining mature eucalypts.

The project included study areas and sample plots in previously

logged forests in both wet (tall moist forest dominated by Bluegum with rainforest understorey) and dry sclerophyll forest. A few features of the vegetation evidencing logging are common to both forest types, principally related to the canopy species, reflecting the resource focus of foresters on trees for saw-log timber production, which contrasts with a focus by graziers on understorey and ground cover vegetation for cattle feed.

The features common to wet and dry forest types subject to logging since the late 1950s include, firstly, the presence of large old growth trees (canopy height at least 20 m in dry forest and 40 m in wet forest). However, the density of old growth trees in logged forests (less than 10 per hectare based on sample plots) is significantly less than in unlogged forests—John Hunter (pers. comm. 2007) suggests that old growth trees in tall moist forests might naturally have a density of 30 to 40 per hectare. Secondly, and correspondingly, all selectively logged forests contain tree stumps which match the diameter of the remaining old growth trees. Stump density in our sample plots was generally less than 20 per hectare. Thirdly, in logged areas, a few rejected old growth tree logs remain on the ground. The reason that logs are rejected is usually apparent—the trunks were unsuitable for milling because either the central pipe is rotten or there is extensive branching and/or burls on the trunk.

There are a number of plot specific vegetation features that indicate past logging activity. For example, poor light penetration to the forest floor in wet forests produces a sparse ground cover in comparison to dry open forests. Vegetation response in wet forests varies with the presence or absence of wildfire.

Findings: Longevity of vegetation indicators of historic activity

How long after grazing and selective logging have ceased will evidence of those activities be observable in vegetation structure and the distribution of plants? Based on the study, we make a number of observations with regard the longevity of evidence in the vegetation of past historical activity.

Seasonal cattle grazing in the dry open forest of the former Curramore State Forest was associated with frequent low intensity

burning. This firing regime, combined with seasonal grazing, appears to have changed the species composition and structure of the understorey, and increased the density of naturally occurring grass species. The observations of former graziers in the Curramore (and Spirabo) State Forests, including Bob Sloman who described how the country has 'scrubbed up' since grazing activity has ceased, tend to suggest that these vegetation changes are much altered within decades of reverting to a less frequent fire regime and with the absence of cattle.

A further possible effect of high frequency fire regimes and grazing pressure on vegetation is a reduction in the regeneration capacity of canopy trees. This would lead to a longer-term change in vegetation structure, attributable indirectly to cultural factors (i.e. a change to reduced canopy density would not have been an objective of the practice of seasonal grazing). In the former Curramore State Forest, the landscape is framed by an intact 'old growth' canopy (trees more than 20 m in height), which were observed to be showing some signs of stress and/or senescence. A second layer of young canopy species is present. One explanation for this vegetation structure could be that the grazing activities over eighty or so years suppressed the regeneration of canopy eucalypts, and that the observed young trees have mostly grown up in the ten or more years since grazing pressures were removed. Complicating factors include the ongoing control burning of parts of this forest, and ongoing grazing pressure from macropods. It is clear that resolution of forest dynamics in this area requires more detailed ecological studies than have been conducted for our study.

In the logged forests, past forestry management focused on canopy trees. In all sample plots where selective logging occurred, old growth trees (a key element of the landscape) remain but the distribution of stumps indicates that the stem density of old growth trees is reduced. In the Coombadjha Creek sample plots, it was evident that in the 25 to 30 years since logging ceased, young Bluegums had reached heights approaching the old growth canopy trees, but had much smaller trunk girths and less heavy crown timber. In this tall moist forest, the merging of a logged forest back into a pre-logged form depends on the time required for the dominant Bluegums to reach a more mature canopy form. This is likely to take multiple decades.

In general, changes to the understorey and mid-storey in wet and dry logged forests appear to be independent of past forestry practices,

with wildfire, which is not associated with the practice of logging, the most important factor. There are suggestions in the literature that tree ferns, grass trees and some other mid-storey species become more common in logged forests with the opening of the canopy, though this differs from the view expressed by former forester Phil Kiehne (noted previously). Certainly, these species were present in clusters in some of the forest sample plots for this project. However, more detailed studies, including a longitudinal study of the mid-storey over a long period, would be necessary to make definitive statements about the presence and density of tree ferns and grass trees as indicators of past logging.

Conservation of forested landscapes: What is being conserved?

Evidence of past seasonal cattle grazing and selective logging is visible in the structure and composition of the vegetation within WNP, though the task of disentangling the effects of ecological processes and wildfire from historic activity is complex. What therefore are the implications for the management of the forests for 'conservation' in WNP?

In NSW, national parks are managed in accordance with principles prescribed in legislation. The principles include: 'the conservation of places, objects, features and landscapes of cultural value' (*NP&W Act 1974* 30E(2)(b)). Grazing and forestry in WNP were activities undertaken at a landscape scale—the activities operated over large areas of the landscape and selectively targeted different parts of the vegetation within the forests.

Although not discussed in this paper, the Umwelt study (Umwelt Environmental Consultants 2007: Section 6) argued that four cultural landscapes could be distinguished within WNP: the former Curramore State Forest (a grazed landscape, notable for the absence of 'sites'); parts of the former Washpool State Forest around Coombadjha Creek that were selectively logged in the 1960s and 1970s; and two parts of the former Spirabo State Forest—the cleared landscape around Four Bulls Creek hut, and the area around the Old Mill site (mill and settlement site, surrounding logged and grazed forest, and a later pine plantation). In the words of the legislative principles, these are 'landscapes of cultural value'.

How then are these cultural landscapes to be managed and should they, or elements of them, be conserved? A traditional heritage management approach would focus on documenting, assessing, managing and interpreting the tangible evidence of past human activity (such as stockyards, dams, mill sites, settlements, log ramps, roads and tracks, and perhaps even some tree stumps) as well as documenting peoples connections and stories linked to place and landscape. However, it is rare to include the documentation of vegetation, beyond cultural plantings, in a standard heritage management approach, and certainly so to recognise or manage elements of forest structure and composition indicative of historical activity as cultural heritage.

We argue that understandings of the character of vegetation as a physical marker of historical activity are necessary to achieve a goal of integrated management for protected area landscapes. The forest communities of WNP, and the structure and composition of forest vegetation, are the product of deep time ecological process and more recent (in geological terms) human/environment interactions resulting from Aboriginal occupation, grazing, forestry, mining and conservation. The forested landscapes were not the product of solely ecological processes in 1788 and neither are they today.

Constructing present day forest as inseparably cultural and natural is necessary to ground the management of forested landscapes within protected areas. We recognise, and support the approach, that the Washpool forested landscapes are managed by the NPWS primarily for the purpose of conserving outstanding and representative ecosystems (NPWS 2005a). We understand that the ecosystems themselves are not always well understood or adequately researched, let alone how human activity complicates the nature of landscape and the job of conservation.

Ecological processes are dynamic and we do not argue that the evidence of past historical activity reflected in the forested landscapes of WNP should or can be 'frozen' in time such that it is 'conserved'. In any case, the research project has considered the longevity of vegetation indicators of historical activity and suggested that for grazing these indicators may become invisible within decades after the activity has ceased. Vegetation change cannot be made static.

Thus we argue that documenting past land-use of the Washpool forests is an essential part of conservation. By documenting past

land-use we mean: (1) integrating information from the historical and ecological literature; (2) documenting people's past use of, and connection to, forests; and (3) conducting detailed field studies drawing on ecological, archaeological and historical field methods. These methods and approaches are essential to 'conservation' because they can provide understandings of forest as both natural and cultural for the purpose of conservation management, and also provide information that enables forests within national parks to be interpreted to the public. Both outcomes are in alignment with the mandated management principles for national parks, which include 'the promotion of public appreciation and understanding of the national park's natural and cultural values' (*NP&W Act 1974* 30E(2)(d)).

Conclusion

We conclude with a call to protected area agencies in Australia to re-invigorate programs that document and integrate the ecological and human histories of landscapes. It is our observation that detailed documentation of the biodiversity, geodiversity and the cultural histories and heritage of protected area landscapes in NSW, as well as the complex interactions between ecology, people and landscape, is not being undertaken to a great extent or in a systematic manner. We are under no illusion about the magnitude of, or resources required for such a task, since, for example, NSW has over 800 reserves covering more than eight per cent of the state. Our study of the ways historical activity has shaped the structure and character of forested environments in WNP offers the beginnings of an approach, and by no means the first or only approach, that can support integrated understandings of landscape for the purposes of managing protected areas and promoting public appreciation of the complexities and heritage of the amazing landscapes within our national parks.

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Notes

1 The NSW National Parks and Wildlife Service (NPWS) was integrated with the Environment Protection Authority, Resource NSW and Botanic Gardens Trust in September 2003 to form the Department of Environment and Conservation (DEC). This department became the Department of Environment and Climate Change (DECC) in April 2007, and the Department of Environment, Climate Change and Water (DECCW) was established in July 2009. NPWS is titled the Parks and Wildlife Group (PWG) within DECCW.

2 Principle derived from Fairclough (2002: 3).

3 Information available at http://whc.unesco.org/en/list/368

4 The concept of 'values' was a key concept for the research in this paper. The term is used in heritage management and in community decision making in several different ways: first, as a synonym for significance (social or spiritual, scientific, historic and aesthetic value as in the Australia ICOMOS Burra Charter); and, second, as a personal standard by which individuals or groups judge places, events or behaviours. Value is used in this study in the latter way—values being what a group thinks is important about a place—what attracts them to it; how it meets their social and economic needs and interests; the framework in which they make decisions (Umwelt Environmental Consultants 2007: 1.10–1.11)

5 The previously recorded oral histories comprise a series of interviews undertaken by Nicole Secombe (1998) and individual interviews by J. Wilcocks (1985) and Ian Rolph and Mick Liebermann (NPWS 2005b).

6 Existence value means that living organisms, earth processes and ecosystems may have value beyond the social, economic or cultural values held by humans (Commonwealth of Australia 2003: 27).

7 The twelve plots documented represent: a seasonal (winter) cattle grazing landscape (one sample plot in the former Curramore State Forest); landscapes with mixtures of seasonal and permanent grazing and logging (six sample plots); landscapes in the Coombadjha Creek area where selective logging in the 1960s and 1970s took place (three sample plots); and areas of forest thought to represent the interface of former cedar getting and later grazing (two plots). The field recording process is described in Umwelt Environmental Consultants 2007 (Section 6; Appendix 1) and the locations of the sample plots are shown on Figure 1.1.

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