

Appearances Vs Performance; managing endangered Tasmanian Wedge-tailed Eagles in Forestry Operations

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INTRODUCTION

Forestry is an important industry in Tasmania and logging of old-growth eucalypt forests for export woodchips has been the backbone of the industry since the early 1970s. Where trees are to be regrowing, plantations (usually of hybrid eucalypts and exotic pines) vie with clear-fell, burn and wide-cast sow regimes in wet areas and thinning (removal of old-growth) in dry areas. Some old growth forest is cleared for agriculture and industrial/urban areas, while some agricultural land is replanted to a plantation.

The endemic Tasmanian Wedge-tailed Eagle *Aquila audax fleayi* is the only threatened population of this species, being *endangered* at the federal level and *vulnerable* at the State level (Garnett 1992).

Like many of its genus, the Tasmanian Wedge-tailed Eagle uses traditional nests, sometimes for many decades. Unfortunately, it also has the trait of being a shy nester and few pairs will tolerate frequent or heavy disturbance when breeding. In Tasmania, nests share many physical characteristics. With rare exceptions only large, high-limbed, old-growth eucalypts on sheltered aspects are used and nests in less than 10ha of attached forest are rarely used for breeding. Thus, forestry with its loss and disturbance of critical nesting habitat is the species' key threatening process (Mooney & Holdsworth 1991). If nests are secure and the species is not persecuted, like many other raptors that appear to require forest (eg. *Accipiter gentilis*, Reynolds *et al.* 1992), the Wedge-tailed Eagle does well in mixed-age native forest, grassland and wetlands (Marchant & Higgins 1993), a mosaic sometimes promoted by limited forestry. Wedge-tailed Eagles do not reach their highest densities in large areas of continuous, closed forest. Therefore, reserves of such are not needed for the Tasmanian Wedge-tailed Eagle, as distinct from some totally forest dependent species (Thiollay 1989; Lamberson *et al.* 1992; Blakerseley *et al.* 1992) and hence, nest by nest management has been chosen as the key for its conservation.

As a wholly protected species, the eagle, its eggs and nests have straight-forward legal protection under the National Parks and Wildlife Act 1970 but as a threatened species the eagle is also

accommodated in commercial forestry under the Forestry Act 1985.

A radical increase in forestry in the early 1970's (due to the advent of wood chipping for export) coincided with gradually increasing interest in nature conservation. One result was that increasing numbers of eagles' nests were reported, giving opportunities to experiment in their conservation (Mooney & Holdsworth 1991).

Raptors do not necessarily have special conservation problems in regard to forestry although they often get special attention, probably because of their charismatic nature. However, large raptors with their conservative K type breeding strategies and low mortality rates (Newton 1979) are more at risk than most other wildlife because forestry rarely stands alone. Usually it is one of a plethora of problems (eg. Meyburg 1989).

Although superficially not as sophisticated as some management regimes for threatened raptors (eg. Reynolds *et al.* 1992), ostensibly, Tasmania has a useful system for managing Wedge-tailed Eagles in forestry operations (or managing the effects of forestry operations on Wedge-tailed Eagles). There is adequate legislation, a Forest Practices Code with mechanisms for regular updating (Forestry Tasmania 1993; Jackson & Taylor 1994) and protection prescriptions that can work (Mooney & Taylor 1996), a semi-independent body to administer such and an active wildlife conservation authority with experienced specialists. Moreover, the State has a high standard of living (arguably with sufficient resources to manage the issue), few disputes over land ownership, the island is small (6,500,000 ha) with a low human population (480,000) and reasonably good communications and access. All in all, the conservation of eagles in forestry should be comparatively successful in Tasmania, but is it?

The aim of this paper is to compare the potential and actual performance of the system by evaluating a sample of nests in forestry operations. Prescriptions themselves, rather than breeding success, were fundamental in these comparisons, because their full application results in successful conservation of eagles, i.e. more breeding (Mooney & Taylor 1996).

METHODS

The conservation process

In Tasmania, nature conservation in commercial forestry is controlled through the Forest Practices Code by the Forest Practices Unit (FPU), a semi-independent government body funded by the industry and the State. Before commercial harvesting can begin in a coupe a Timber Harvesting Plan (THP) undersigned by a Forest Practices Officer (FPO) must be approved by the FPU for that proposed operation. Amongst other things, the THP has to take account of threatened species such as the Wedge-tailed Eagle. Each district of Forestry Tasmania (FT) has a Fauna Liaison Officer who promotes and facilitates the application and improvement of the Code.

Tasmania's Code is rather unique in that it applies equally to private and government land. However, conservation actions are only endorsable for the duration of the THP, unless a legal covenant has been put in place. A THP is also needed where land is being cleared for agriculture and logs are being sold. The Code and its attendant manuals are updated every five years with interim prescriptions issued in between as the need arises.

The number of THPs approved each year has slowly increased from 830 in the 1995/96 financial year through 895 in 1996/97 to an anticipated 1000 in 1997/98 with about 40% having notification of threatened species. Most notable is the dramatic increase in notifications for Wedge-tailed Eagles, from 13 in 1995/96, through 110 in 1996/97 to an estimated 250 in 1997/98 (Forest Practices Board 1997).

Conservation of Wedge-tailed Eagle nests in commercial forestry involves:

- Establishing a reserve of at least 10ha around a nest, concentrated uphill (usually the windward side of a nest tree). Even if this area has been encroached on by logging, areas of a regrowth are dedicated to the reserve to make up the 10ha.
- Restricting heavy disturbance during breeding (July - January inclusive) to at least 500m from active nests (1000m if in line of sight).

If a nest is found during forestry operations in the breeding season, disturbance must immediately cease within the 500/1000m limit and the FPU zoologist must be notified immediately. This person and/or the Tasmanian Parks and Wildlife Service (TASPAWS) specialist will make a priority visit to check the nest's breeding status, perhaps using an aircraft. Depending on the nest status the specialist will make recommendations to the FPO responsible for the coupe, as to placement and sequencing of further forestry operations to maximize any breeding opportunity for the eagles and minimize disruption to the operator. Amendments to the THP are made and approved by the FPU zoologist.

If a nest is discovered during a forestry operation during the non breeding season forestry activities must stay outside a 10ha area (i.e., a circle of about a 360m diameter) around the nest and the FPU zoologist is notified immediately. After he and/or the Tasmanian Parks and Wildlife Service (TASPAWS) specialist visits the site the responsible FPO and preferably the contractor(s) finalize details of the nest reserve. Removal of logs felled before the nest was found and inside the 10 ha boundary may be allowed. Other activities to rehabilitate the site in terms of erosion control, facilitation of regrowth and control of access by people may also be undertaken. Negotiations of detail (road and log landings' placement and use, fire protection boundaries etc.) usually occur and such amendments to the THP are made. Instructions for conserving nests follow pre-agreed, published protocols and are modified in detail by negotiation to suit the local situation. Instructions are tiered to account for the finding of a nest in or adjacent to the coupe, before or during forestry operations (including road work and site preparations). In an attempt to streamline the process, recommendations and instructions are now also being offered to FPOs through a software 'Expert Systems Program' (basically an electronic flow chart).

To facilitate the planning process, FPOs have access to a shared TASPAWS and Forestry Tasmania database of eagle nests and must notify the FPU of nests or potential nesting habitat existing in a proposed coupe. This database is provided on a 'need to know' basis where certain map sheets are flagged as having a nest(s). If the coupe falls on such a map sheet the FPO contacts the FPU zoologist for details, the TASPAWS specialist then being consulted for an update on the nest's status. Recommendations about searching for nests in potential habitat and instructions on conserving known nests are sought from the TASPAWS specialist through the FPU zoologist (mainly for reasons of accountability). Searches are recommended for about 60% of the THPs on which there is notification of eagle nesting habitat.

In Tasmania, it is not obligatory to search for eagle nests in areas due for harvesting, although once known they must be accommodated. However, searches are increasingly encouraged through text, training and peer pressure. TASPAWS and FPU specialists conduct training and they, FPOs, FT officers, experienced consultants and volunteers from the Australasian Raptor Association, help searches. Other concerned people local to the logging area are also guided in searches for nests, due attention (usually) being given to safety and legalities of access. Thus, nests can be discovered by a variety of methods and/or people. During logging operations nests are invariably found by the road work or logging contractors, or an FPO alerted by them.

Practical, map-based methods for prioritising areas for nest searching are established (Mooney 1996) based on a simple model of the physical characteristics of the nearest known eagle nest sites (the area within 50 m of a nest tree) and nearest neighbour distance. Any area can be ranked for its likelihood of containing a nest/nests, allowing easy prioritization of searches, necessary because resources are limited and in any case nests are found in specific habitats. More sophisticated GIS-based models of eagle nest sites can also be used to predict where nests should be (eg. Brown & Mooney 1997). As a policy, coupes are not searched more than three years before operations, to minimise the likelihood of a new nest being built after searches. Monetary rewards (A\$200/nest) for those first reporting nests have been tried on a limited basis.

Several FPU officers have the task of auditing THPs, the aim being to check 10% per year in terms of how they were researched (eg. was the data base checked?), presented and applied in the field. FPU and/or the TASPAWS specialist occasionally conduct spot checks on operations and react to complaints from the public. Where there are serious breaches of the Code, FPOs can lose their licenses which affects their income.

Efforts are made to monitor the productivity of nests that have undergone active conservation in forestry for comparison with a sample of undisturbed nests (Mooney & Taylor 1996).

Under the National Parks and Wildlife Act 1970, compensation can be claimed by private landowners for losses of forest production due to instructions on a THP. Compensation applies where losses to the area to be logged exceed 5% where the conservation of a significant value would require the total exclusion of forest practices, or 10% where the conservation of a significant value could be achieved with some constraints, eg. selective logging instead of clear felling (this 5%/10% is considered a 'duty of care' under the relevant legislation). If compensation is paid, a specific conservation covenant is placed on the area. Claims for compensation follow strict protocols (Appendix 1).

Measuring performance

Issues of the conservation process that were examined were:

- Access to database: the updating process, availability and application of FPOs.
- Notification of nests or potential nesting habitats: did FPOs research the database and/or report potential nesting habitat?
- Finding nests. The method for finding nests, before or during forestry operations, was examined over time to see if the establishment of search mechanisms has reduced 'accidental' discovery of nests during operations. Usefulness of predictive models and times between discovery and reporting were also of interest.
- Reporting nests. The interval between finding and reporting nests can be critical.
- Responses to reports of nests. How credible were authorities' responses?
- Application of prescriptions. How well nests are protected from disturbance by reserves. Encroachment on the 10 ha to be reserved around a nest was scored in preference to amount of habitat left in the 10 ha, because nests might be left on the very edge of large forest blocks.
- Auditing and checks of conservation measures. How seriously were they taken?
- Permanence of conservation techniques. Techniques are only enforceable for the period of the THP so it is important to see if reserves were later cleared or disturbance protection curtailed.
- Disruption to contractors. The inconvenience/cost to the industry of stopping or moving operations is of great interest.
- Monitoring of nests. Few managed nests have the exact same prescriptions applied, giving *de facto* evolution of conservation measures. To take advantage of this, managed nests and controls have to be monitored.
- Compensation: the system makes much of compensation so the success of applicants must be examined.

RESULTS

Performance of conservation measures

Access to database. Access to the database was very good. However, hard copy lists of maps with nests can quickly become dated, putting 'new' nests at risk if searches are not carried out. If a nest is on the edge of a map, it may be affected by an operation on the adjacent edge of the neighbouring map on which it would not be flagged.

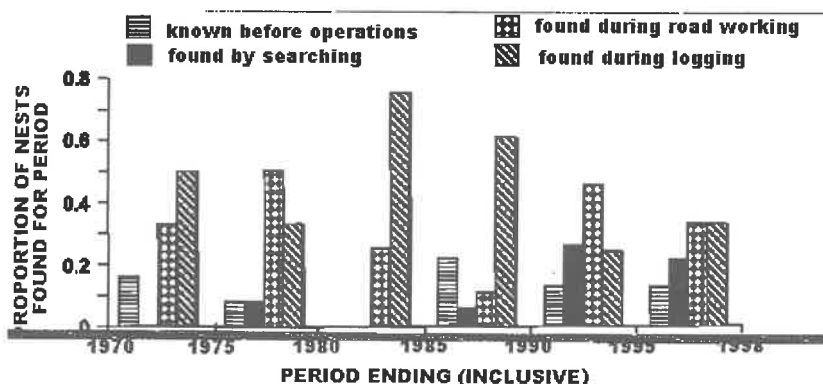
Notification of nests or potential nesting habitat

FPOs usually consulted the database. However, if a search was not conducted, a nest might be compromised. This happened only once in the past five years and there were negative repercussions for the FPO. By its very nature, logging of old-growth usually involves potential nest habitat - hence the high rate of notifications. Plantation harvesting and some thinning operations do not involve some nests or potential habitat, unless they are adjacent.

Finding nests

Searches are recommended on about 60% of the forms notifying eagles and some others are done 'just in case' (usually by FPOs who have compromised nests previously and wish to avoid a repetition). Prioritized searching, really a process of risk assessment, seems efficient at finding nests before forestry operations. This style usually shows that less than 20% of a coupe need be searched and some need not be searched at all. Although 20-40 nests are found per year, not all are in areas covered by THPs. They might be in a stream side reserve and their conservation administered by a slight alteration to that reserve as a recommendation (as distinct from an instruction) to the THP. Usually one nest is found every 30-40 coupes. Over the past decade the rate of nest 'findings' has dramatically increased (Figure 1).

Figure 1. Methods of finding nests and the stage of forestry operations during which nests became known (total n = 6 for 1970-1975, 12 for 1975-1980, 8 for 1980-1985, 18 for 1985-1990, 46 for 1990-1995 and 33 for 1995-July 1998).



If high search standards are maintained, few nests are missed (to be later found during road making or logging). In four of the five cases where a nest was missed in a search the actual searchers were in haste and/or inexperienced and/or also asked to do other tasks or using a search method not suitable to the habitat, eg. ground searching a forest with dense understorey where a helicopter would have been both more effective and efficient, or searching with fixed wing aircraft (an efficient method for checking, not finding nests; Mooney 1988).

Once the FPC was applied and searching was encouraged and facilitated the proportion of nests found before forestry operations increased slightly with a corresponding fall in the proportion found during operations (Figure 1), still the most common way nests were found in forestry areas (67% cf. 21% of 33 found from 1995 to mid-1998, compared to 72% and 26% of 46 from 1990-1995). This trend of the minority being found by searching applies by degrees both in State forest and on private land (33% of 43 and 21% of 29 respectively since 1990).

Although GIS-based modelling has great potential for suggesting where nests should be, there are a number of practical restrictions. Adequate ground proving is essential but can be very expensive. Where the physical environments of areas differ, models might have to be formed for each area. Consider the aspects slopes nest trees are on, a key feature of many models (eg. Brown & Mooney 1996). In the eastern district of Tasmania a model using an aspect range of 90° (from 90° -180°) will pick up 77.2% of nests. However, looking at the spread of aspects in different regions, aspect spread would only pick up 45.7% in the central north, 31.8% in the north-west, 71.4% in the west, 54.3% in

the central, 55.9% in the south-east and 58.2% of all the nests known. Some regions have a great variety of aspects, reflecting complex wind and precipitation regimes and aspects may be of little use in a model since they may result in a greatly increased area predicted for nests. In such areas where physical characteristics of nest sites vary greatly, almost as many nests are needed to create a model as actually exist in the region, amounting to an academic exercise rather than a practical tool.

Nearest-neighbour distances have great potential for narrowing possibilities of nest placement for such territorial species as Wedge-tailed Eagles. However, where there has been much development, deserted nests may exist and the proximity of nests alone may not be a useful predictor; what is needed are active nests, necessitating regular monitoring. Again, the productive efficiency may be reduced to the point where the chances of an 'unpredicted' nest being found justify most areas of potential habitat being searched. Predictions incorporating nearest-neighbour distances seem to work much better where there has been less development, i.e. where territories are more stable and fewer nests exist.

Forestry's pace and time/cost of searches

Reporting nests. One concern is that some nests are reported well after being found. In several cases investigations strongly suggested that nest trees were found by the contractor several days before being reported. Meanwhile, logging continued in the trees' vicinity with the report being made only when they had finished logging, or a forestry officer was due to visit the operation. In several cases nests next to roadworks were only reported once the roadworks were so far advanced that they could not be moved. Always the claim was that the nest was not seen until immediately before reporting.

The offer of financial rewards by a large, private logging company for the first reporting of a nest were an attempt to defeat this time lag. This seemed a successful strategy with one claim and several enthusiastic false alarms over a period of several months. Unfortunately, senior management discontinued the practice.

Response to reports of nests. With rare exception the response of the FPU, FTs' Fauna Liaison Officers and the TASPAS specialist has been reliable and on time, lessening uncertainty and inconvenience to the contractor and reducing damage to eagles' breeding prospects. Responses to reports of nests during the breeding season have all been managed within two days, most in one, and outside breeding in three to five days.

Application of prescriptions. Once a nest was known, protection from disturbance was adequate in 90% of cases, about the same proportion in State forest and on private land (Table 1). The 10ha area around a nest tree was physically compromised 61% of times with the worst performance on private land. In most cases compromise of the area was from logging coming too close but in others it was due to roadworks being established before the nest was reported (not always the same as found).

Table 1. Adequacy of protective measures placed on nests in coupes since 1991, as prescriptions in the Forest Practices Code.

TENURE	LEVEL OF PROTECTION FROM DISTURBANCE OF 10 ha AROUND NEST TREE					
	During operations once known		Actions After THP Expired			
	adequate	inadequate	in place	none	compromised	intact
Private Land	27	2	15	14	22	7
State Forest	38	5	31	12	22	21

Permanence of prescriptions. Non-compulsory actions, those designed to reduce disturbance after the THP expires (eg. restricting access in the long term), were in place 63.8% of times in total

(46 of 72) but only in a clear majority in State forest (72%, 31 of 43). The best endurance of prescriptions was on areas of private land and State forest where access was strictly controlled, eg. little or no firewood cutting, trail bike riding etc. About 20% of nests in State forest have some restrictions such as locked gates. Most areas of private land have tightly restricted access but rarely is this meant to protect the eagles. Consequently, disturbance by careless users is common, even occasioning the felling of trees close to nests.

Despite conservation prescriptions not being compulsory beyond the lifespan of the THP no eagle nest reserves are known to have been cleared although a few have been burned. In their embracing of conservation, there seemed a slight tendency for owners of larger properties (and FPOs contracted to them) to be more positive about conserving eagles (Table 2) but there was no significant difference in the average size of properties where post-THP measures were in place or not.

Table 2. Degree of enthusiasm of private landowners and Forest Protection Officers for eagle conservation measures since 1991 as prescribed by the Forest Practices Code.

AREA	BASIS OF CONSERVATION		
	<i>Enforced Prescriptions (resentment)</i>	<i>Passive Cooperation (ambivalence)</i>	<i>Active Cooperation (enthusiasm)</i>
0 - 100 ha	1	2	1
100 - 500 ha	3	6	11
500 + ha	0	2	5

The system has benefited considerably from the FT policy of conservation measures applied to THPs in State forest being permanently applied under FT's own reserve system. Beyond operational protection this also provides all important priority protection from fires, wood cutting etc.

Auditing and checks of conservation measures. The diligence of auditing FPU officers has meant auditing has generally been of a high standard with FPOs generally concerned with the results and potential consequences. Spot checks have given more mixed results. Typically a visit was made immediately after instructions were given on moving the operation due to the reporting of a nest. The advantage of aircraft is that a check can be made without reference to the contractor, FPO or landowner. On about half the checks operators did not meet the letter of the instruction, contractors invariably claiming a misunderstanding. Later spot checks often showed that the logging area had been revisited to retrieve logs etc. This type of mismanagement has lessened as auditing has become further entrenched and some FPOs have been officially cautioned; it is in their direct interest to follow the FPC.

Disruption of contractors. It was clear that operations were far more likely to suffer disruption, especially having to move to a another site, if nests were found during road work or logging as distinct from before (Table 3 categories pooled to before vs during works finding X planned changes vs disruption, chi-squared=4.5, df=1, .05>p>.01). Obviously the finding of a nest during works meant they were too close.

Costs of disruptions were very hard to estimate, different contractors making wildly varying claims about identical circumstances, possibly reflecting their frustration/chagrin or perhaps other financial pressures. Forestry operations are disrupted for many reasons (usually for soil and water conservation) and contractors/FPOs habitually keep areas in reserve in case of unforeseen moves. Moving or stopping to wait for a nest status assessment usually costs 0.5 to 1.5 days of productive work but is probably less of a consequence nowadays since the operations are so mobile and work is on a contract basis rather than an hourly rate. Most contractors agree the problem is one of inconvenience and nuisance rather than monetary cost, and many accept such disruptions as part of modern forestry.

Table 3. Effect on forestry operations of the prior knowledge of nests compared to finding nests during works.

NESTS KNOWN	DISRUPTION TO FORESTRY OPERATIONS		
	<i>Work Schedules Changed Before Works</i>	<i>On Ground Works Affected</i>	
		<i>Temporary Halt</i>	<i>Moved</i>
<i>Before Works</i>			
database	4	0	1
search	23	1	1
<i>During Works</i>			
roading	3	8	10
logging	0	7	20

Monitoring of nests. Until recently productivity of most managed nests and a control sample (in 30 territories) could be monitored by aircraft using TASPAWS funds. However, with recent ‘fiscal challenges’ and an ever growing list of nests, rarely has the full task been possible. Recently a sample has been used, usually restricted to those nests at which there is some history of eagle activity.

Compensation. Although straightforward on paper, the compensation process is extremely cumbersome. This inevitably leads to confusion and great frustration on the part of claimants and embarrassment to conservation authorities since there was never money actually dedicated to the compensation legislation. Of the four claims so far lodged, three claimants gave up within months and only one is still pursuing the issue, nearly a year from lodging the claim.

DISCUSSION AND CONCLUSION

The increasing rate of nest reporting seems somewhat in excess to areas logged. Some areas are being re-logged as part of changing harvesting regimes and those areas are far less likely to have nests. New areas of undisturbed old-growth forest logged per year are reasonably consistent but likely to fall as that resource lessens. Increasing numbers of nests recorded maybe due to a cocktail of:

- Methods of finding nests. Logging is a very thorough, if *de facto*, ‘search’ compared to anecdotal knowledge (more the case in early years). However, logging is now encroaching on a remnant habitat (typically slopes) that eagles prefer but previously were of little interest to forestry.
- Improving attitudes of people in forest industries. In the past, many nest trees were felled, some when it was not allowed by law, and few nests were reported. Nowadays this is very rare and nearly all nests are reported promptly. Conservation of eagles has demonstrated that, although often nuisances to contractors, rarely do the measures seriously affect the economics of the operation. The vast majority of the industry has accepted that non-timber forest values are here to stay.
- Improved policing of forestry activities. This has accentuated the above point.
- Numbers of nests per territory are closely related to disturbance (Mooney & Holdsworth 1991). Increasing numbers of territories undergoing disturbance might indicate more nests to find. There is a limit of course. Some territories have few remaining nest trees and although occupied, these territories often have low productivity. Often these remnant nest sites are sub-standard in extent and shelter from wind and disturbance. In some areas, competition with White-bellied Sea Eagles *Haliaeetus leucogaster* for remaining nest sites is intense (Terry & Wiersma 1997).

The reluctance of industry to accept compulsory searches may in part be a resistance to ever increasing bureaucracy and partly due to cost. However, searching is not very expensive - most coupes are 30-70ha, a day’s work for an experienced searcher, but obviously a cost many contractors/landowners/FPOs gamble that they can avoid. Without doubt, those in the industry that have been disrupted by eagle conservation are more inclined to do searches but since individual contractors may only ever deal with a few nests in their careers, the change in habit is slow.

Despite the cost of searches and their not being compulsory, attempts to find nests before logging are increasing. Doubtless this is partly due to peer pressure, changing professional standards and changing public expectations but the wish to avoid disruptions is a powerful influence. Making searches of certain habitat compulsory and/or making disruptions more 'expensive' could accelerate this trend. However, rapid change (for such a conservative industry) is occurring without aggressive conservation measures and public opinion should continue the process. As finding nests before any road work or logging operation becomes part of industry 'culture' the whole process will be more successful. Searching very early in planning, at the catchment level is the ideal and can be greatly aided by predictive modelling, but these models have to be funded and ground proved.

A key characteristic is even nest spacing by eagles (eg. Ridpath & Brooker 1987; Watson & Rothery 1986) and this gives models great potential. In areas with a history of human disturbance or unusual/complex winds they must be used with caution and all habitats assessed, models perhaps being best used to prioritise and plan, not just in forestry but also with recreation and rural residence (eg. Cline 1990). In such areas predictive parameters may be hard to identify and a large number of nests can be needed, sometimes almost all the nests in the area, defeating the exercise.

Of concern is delay between finding and reporting nests. This problem seems restricted to a few contractors, interestingly in regions where they have little competition. They may therefore feel that disciplinary measures may not be applied as stringently. Such people have local political power through their providing work. As frustrating to conservation authorities as these attitudes might be, they are a minority and it is important to balance the time spent trying to change them. To defeat the problem, it may be possible to introduce regional compulsion for searches.

The success of conserving Wedge-tailed Eagles in forestry has been minimally described (Mooney & Taylor 1996). However, since protocols are continually being refined, ongoing monitoring is essential, especially if the hoped for adaptation to land 'development' (i.e. a improvement in population productivity) is to be detected, possibly allowing down listing of the species. Monitoring must involve both affected and undisturbed nests. One problem is that the control sample of nests used itself is being compromised. Some nests are now disturbed and eagles no longer use others, probably having moved elsewhere in their territory to an unknown site. Obviously efforts must be made (i.e. resources committed) to maintain a credible control sample. This means finding alternate nests and identifying undisturbed nests.

A key to the success in Tasmania might be that conservation of Wedge-tailed Eagles in forestry was introduced well before it was compulsory, avoiding serious conflict (eg. Gup 1990) and at a time in history (the late 1970s) when Tasmania's economy was buoyant and conservation/forestry conflict was limited. This allowed the introduction of new concepts and ideas via the most interested parties. Considerable debate and negotiation were undertaken on a personal level and protocols developed with the voluntary cooperation of particularly interested forestry officers, landowners and contractors (all of whom were by no means unwilling to try new ideas). Thus, early efforts were heavily reliant on favour, goodwill and personalities. Interestingly, despite considerable recent conflict in forestry management and a worsening economic climate, the momentum has remained.

As much as industries and conservation are 'rationalised', truly successful conservation relies heavily on the human touch. People, it seems, still like to deal with people (eg. Alvarez *et al.* 1996).

About 80% (175 of 220) of Tasmania's eagle territories are in State forest or on private land, areas prone to development (Mooney & Holdsworth 1991). Consequent disturbance and habitat loss reduces eagle productivity and with continuation of the process more nests are becoming disturbed (Mooney 1998). Without deliberate efforts to conserve eagles in forestry it is possible that in several decades 150 of the 175 territories at risk will undergo serious disturbance. However, the increased application of the Code has slowed the attrition (nests being lightly instead of moderately, or moderately instead of heavily disturbed), especially if searching is further consolidated.

Generally, conservation measures are more fully and consistently applied in State forest, perhaps because of the luxury of community ownership - any particular THP amendment is not key to the economy of the project. This can be very different on private land where the compensation issue must be settled. Perhaps an eagle chick production bounty could be more effective; it would be then

in a landowner's interest to follow the best conservation advice. However, compensatory measures must be of clear benefit to affected people, otherwise they will not work (Salvador 1994)

One surprising result of this assessment was the loose connection between landowner enthusiasm and property size (one might expect owners of small properties to resist conservation measures). However, Tasmanian landowners are a diverse group and many have financial interests elsewhere, so total assets might be a better comparison than the size of one property.

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Appendix 1. Process to be followed in claiming compensation for loss of income to conservation requirements for threatened species under timber harvesting plans

1. Before any commercial logging operation can legally begin, a Timber Harvesting Plan (THP) must first be lodged with the Forest Practices Board (FPB) for approval under the *Forest Practices Act 1985*. The THP may include special recommendations about conserving a threatened species before it is approved; it may even be refused.
2. You are entitled to claim compensation for loss of income due to these special recommendations or refusal of the THP.
3. Firstly, you must appeal against the recommendations or refusal by writing to the Forest Practices Board at 30 Patrick Street, Hobart 7000.
4. If your appeal to the FPB is successful, then your Timber Harvesting Plan without some, or all, of the special recommendations will be approved.
5. If your appeal is unsuccessful and you still want to claim compensation, you then become an 'affected owner' and you have 180 days to appeal to the Minister of the Parks and Wildlife Service for compensation under the *National Parks and Wildlife Act 1970*.
6. If the Minister rejects your claim then you can reapply to the FPB for approval of your original THP without special recommendations. The FPB cannot then refuse the THP or add conditions regarding the threatened species already considered.
7. If your claim is accepted, the Minister will call the Conservation Compensation Committee (CCC) together to arbitrate and negotiate a settlement.
8. A payment for compensation will be accompanied by a conservation covenant - that is a legal agreement between the Parks and Wildlife Service and the landowner.
9. If the payment is not made within 180 days of agreement to pay, then you can reapply to the FPB for approval of your original THP without special recommendations. The FPB cannot then refuse the THP or add conditions regarding the threatened species already considered.