Forest Practices news

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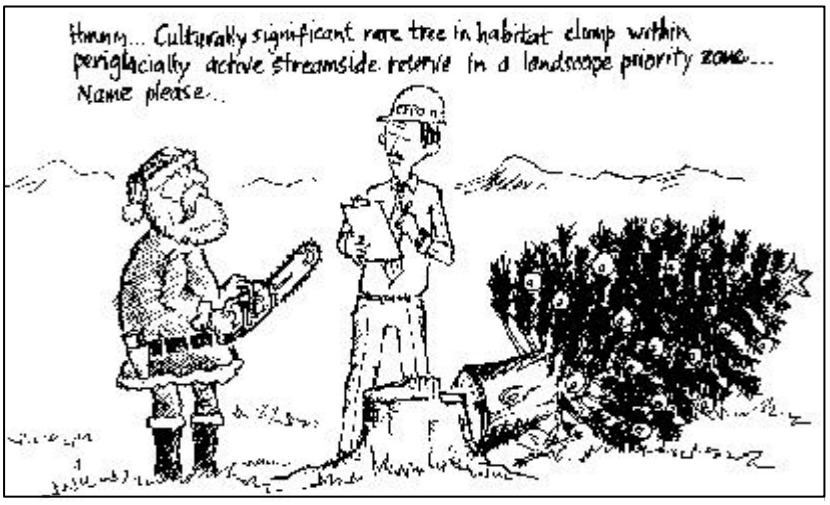

Revision of the Forest Practices Code

The review into the soil and water provisions of the Forest Practices Code is nearly completed and a final report from the Review Panel should be submitted to the Forest Practices Advisory Council in December 1998.

The recommendations from this review will complement the findings from the completed reviews into the harvesting of steep country and the occupational health and safety aspects of the Code.

The Board has agreed that work should commence forthwith into the revision of the Code. Matters of technical content will of course be considered in the context of the recommendations from the above reviews. A separate, crucial issue relates to the form and organisation of the Code.

There is no doubt that the Code needs to provide a framework for:

- Good planning, through effective and efficient processes;
- Good operational outcomes to agreed standards.

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Thanks for the welcome

Thank you to all those readers who responded so positively to the first edition of *Forest Practices News* – it was heartening indeed to find this newsletter so well received. We look forward to maintaining *Forest Practices News* as a means of communicating new developments and ideas among those interested in the sustainable management of Tasmania's forests.

We are very pleased to include in this edition of the newsletter our first contributions from outside the Forest Practices Board. We would like *FPN* to be more than just a newsletter from the FPB, and would particularly like to encourage contributions from practicing FPOs. Let us all know about your latest innovative ideas!

Many thanks who indicated their ability to receive an electronic copy of FPN rather than a hard copy. We haven't quite got that option sorted out, but have your responses on file ready for the great day…

Finally, it seems somehow Christmas is already upon us. With the following caution from our esteemed Senior Botanist:, we would like to wish you and yours all the best for the festive season and new year. See you in 1999 – preferably in print in *FPN*!

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Developments

Farm tractors, firewood and forest practices

The common question 'when is a timber harvesting plan required ?' is dealt with in the Forest Practices Regulations 1997.

Generally, the harvesting of timber must be covered by an approved timber harvesting plan. Harvesting of timber is defined as the cutting and removing of timber from a forest, and it includes the felling and extraction of any wood products, including sawlogs, pulpwood, firewood etc.

The Regulations provide some exemptions for small scale operations and for firewood gathering which doesn't involve the use of harvesting machinery.

These exemptions do not apply to 'vulnerable land'. Vulnerable land is defined in the Regulations and refers to land that has any of the following features- steeper than 26o; higher than 800m in elevation; erodible soils; within 40m of a stream; within a water supply catchment; or contains threatened species. An application for a timber harvesting plan must be made to cover any harvesting within vulnerable land.

The exemptions that apply outside of vulnerable land are as follows:

1. a timber harvesting plan is not required if the volume of wood harvested is less than 100 tonnes from any one property in any one year.

2. a timber harvesting plan is not required for firewood gathering which does not involve the use of harvesting machinery to extract the wood. Harvesting equipment is defined in the Forest Practices Code and includes farm tractors.

This means that people can cut firewood and load it by hand onto the tray or trailer of a truck or utility without a timber harvesting plan. However, if a tractor or any other machine is used to move wood from the stump to a loading area, then a timber harvesting plan is required, (for any volume in excess of the 100 tonne property limit referred to above). The principle behind this is to ensure that any machine trundling around in the forest is operated in accordance with the Forest Practices Code in order to prevent any damage to streams and soils.

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(from front page)

The current Code was designed to be a simple and practical guide for forest workers, landowners and Forest Practices Officers. We all recognise the increasing demands and complexity of planning and approval processes (see *Towards the summit – Pathways to sustainable forest management* elsewhere in this newsletter). The key question is how much of this complexity can and should be contained within the Code?

A number of approaches could be taken –

1. Keep the Code as an integrated document for planning and operations. This could be done in one of two ways:
   - Single document with an expanded planning section;
   - A set of documents dealing with separate sections for 'Planning' and 'Operations' and/or separate parts for operational activities e.g., separate 'Code' for roading, quarries, harvesting, reforestation.
2. Keep the Code simple (or even simpler than at present). Focus on operational standards. Incorporate the principles of good planning (e.g. "Threatened species will be considered in the planning of forest operations") but leave out the detail on process. Processes can be dealt with through a separate planning manual, which could combine the prescriptive parts of the specialist manuals and the administrative instructions to Forest Practices Officers. The planning manual would not be part of the Code but could be linked to the Code (e.g. 'Planning for threatened species will follow the procedures laid down in the Forest Practices Planning Manual').

I would very much welcome the views of Forest Practices Officers and others on this important matter. Please send me any thoughts you have so that we can begin to develop an agreed approach to the revision of the Code. Any proposed changes to the Code will, of course, involve consultation with all stakeholders. The Forest Practices Act also contains provisions in relation to formal consultation and public comment.

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Developments

Classification and training of FPOs

The Board has been reviewing the categories and training requirements of Forest Practices Officers (FPOs) to meet the future needs of the forest practices system.

The Board has resolved that:

1. FPO warrants should be issued for a maximum period of three years. Re-appointment should be subject to evidence of continuing training, maintenance of skills and active involvement in forest practices within Tasmania.

2. In addition to 1, re-classification at the level of FPO (Planning) should also be subject to evidence that the officer has approved at least two timber harvesting plans (THPs) per year. The standard of THPs will continue to be evaluated as part of the Board's annual assessment of THPs.

3. A new classification of Forest Practices (Manager) will be created, with the appropriate training and prerequisites to be determined by the Board. This classification will not be a statutory appointment under the Forest Practices Act. The position will be offered to forest managers who need an understanding and knowledge of the forest practices system, but do not need the statutory powers associated with the inspection and approval of THPs.

Other aspects under consideration in conjunction with Hollybank are:

- Changing FPO Training to a more modular approach which will allow better integration with other courses, the use of pre-requisites, and a separation in training requirements for FPO (Planning) and FPO (Inspecting).
- designing some training modules for non-FPO target groups such as supervisors, contractors, councillors and landowners.
- specific training for FPOs in auditing and other requirements which arise from planned changes to the Forest Practices Act.

The aims of the changes are to make training more targeted and relevant to the different needs of FPOs. If anyone has ideas to contribute we would like to hear from you.

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Conservation of the swift parrot habitat: are wildlife habitat clumps effective?

A study, funded by the Forest Practices Board, Parks and Wildlife Service and North Forest Products, has begun to review the effectiveness of management prescriptions in conserving swift parrot habitat in production forests.

Current Forest Practices Code (1993) prescriptions for the maintenance of fauna species dependent on 'old-growth' habitats in Tasmania's production forests include the retention of patches of mature forest (wildlife habitat clumps) in a particular harvest area. Retention of these wildlife habitat clumps targeting a particular forest habitat are often recommended for the management of habitat important for a particular threatened species. For example interim recommendations developed for the management of foraging areas important for the vulnerable swift parrot (ie.,grassy *Eucalyptus globulus* or *E. ovata* forest and shrubby *E. ovata-E. obliqua* forest) aim to retain patches of trees with 'old growth' characteristics within the harvest area in such a way as to ensure their retention and over successive cutting cycles. These recommendations have been developed from existing information on the habitat requirements of the swift parrot. However, their implementation and effectiveness in conserving habitat important to this species have not been assessed. It appears that in some situations there is confusion as to how the recommendations should be implemented on the ground, and in some forest types they may not be effective.

The study is assessing the extent to which current recommendations for retaining foraging habitat in production forests are being implemented, and it will identify ways of making the recommended actions more effective. It will clarify whether wildlife habitat clumps are suitable or whether in some forest types retention of individual trees across the harvest area is more effective. The first part of the project involves compiling a database of information from Timber Harvesting Plans and advice given through the threatened fauna notification process. This will include the area of the harvesting operation, the area of swift parrot habitat affected and actions taken to conserve swift parrot habitat within the area. The second part of the project involves surveys of a selection of harvested coupes of different forest structure within the range of the swift parrot to assess how the prescriptions in the Timber Harvesting Plans have been applied and whether they are adequate for retaining habitat. Two long-term monitoring sites will also be selected and the structure and availability of habitat and bird occurrences will be recorded before and after harvest. The results of this study will be used to refine the current interim recommendations for conserving swift parrot habitat in consultation with forestry industry personnel and landowners. It may be regarded as a pilot study into the effectiveness of the current Forest Practices Code prescriptions for the maintenance of fauna species dependent on mature forest habitats. In particular, it will provide information of use in refining the Forest Practices Code prescriptions for the retention of 'habitat' trees in dry forest types.

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(Niall Doran, Project Officer - Burrowing Crayfish Threatened Species Unit, Parks & Wildlife Service)

New resources

Use of matting techniques

With the increasing use of excavators in forest operations innovative contractors have explored further uses for these flexible machines.

The term "matting" was coined to describe the technique where snig tracks and landings are fully corded progressively in front of logging operations using an excavator.

The technique is most appropriate in wet forest clearfall operations where the excavator can knock down understorey species such as dogwood to form the mat. This mat is further built up with downers, heads and bark. In drier forests obviously less matting material is available so matting may be limited to wetter spots. The key difference to conventional cording is that material is placed before any snigging occurs on the snig track. Operations with two or more excavators often base one excavator in the bush matting and bunching timber for skidders. The bunching also helps in that the skidder doesn't have to leave the matted track.

The appearance of a coupe harvested using this technique is dramatically different to old style logging operation. There is virtually no rutting with almost a continuous layer of vegetation material over the ground. The environmental benefits are yet to be quantified but are likely to be less soil mixing and displacement, less erosion and slightly less soil compaction. If slash and downer material is placed before any bark, and the snig track is "fluffed up" at the completion of harvesting, a higher percentage of residue will be burnt in the regeneration burn. There is also the benefit that if bark is kept separate from soils it will burn and not incorporate with the soil causing nitrogen depletion. We can anticipate more even regeneration will result from these effects.

Matting is at worst probably cost neutral for the contractor. The extra cost to the contractor is in the additional time spent by the excavator in doing the matting (and also usually setting up logs). The savings to the contractor are: · reduced track/tyre wear as machines are no longer in contact with minera= l soil and rock. · reduced suspension/transmission damage and R & M as the matted tracks ar= e relatively stable and even. · reduced snigging time for same reason. · machines are kept cleaner. · longer life on chainsaw chains. · logs are kept cleaner. · wet weather shutdowns are reduced to a minimum.

Contractors are using this technique with the endorsement of the Board and logging companies. From its beginnings in the Southern Forests with Tony Clark and United Loggers it has spread to the Derwent Valley and beyond. We would encourage contractors to use the grapevine and visit other contractors who are using this technique if they are interested in adopting it.

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A new addition to the FPB Threatened Fauna Manual: the burrowing crayfish

Recent field studies have extended the known range of the Burnie Burrowing Crayfish, *Engaeus yabbimunna*. This species is listed as Vulnerable under the Tasmanian Threatened Species Protection Act (1995), and has previously only been known from small populations on three polluted waterways within urban Burnie. *Engaeus yabbimunna* is a new addition to the revised Threatened Fauna Manual (Forest Practices Board, 1998) as its extended distribution brings it into forestry areas, some of which have already been logged while others are due for logging soon.

Following the discovery of a specimen on Seabrook Creek by the Deloraine Field Naturalists, survey work has now identified healthy populations of the species along several catchments west of Burnie, including Camp Creek, Seabrook Creek, upper parts of Distillery Creek and tributaries of the Cam River. These new areas are very important to the species, as they represent far healthier habitat than that available within Burnie. (The species appears to be absent from waterways between the new sites and the Burnie populations, possibly due to high pollution in these streams and rivers).

A current project funded by the Natural Heritage Trust aims to determine the exact limits to the distribution of the species and its sensitivity in areas that have already been disturbed. While it is hoped that existing management prescriptions for forestry operations will prove adequate, it is possible that some additional protection may be required on currently approved and future coupes planned for the Calder, Yolla & surrounding areas (consult the FPB, Senior Zoologist).

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New resources

Revised Threatened Fauna Manual – now available!

The Tasmanian Forest Practices Code (1993) requires that Threatened species be taken into account in the preparation of timber harvesting plans (THPs), both on Crown land and on private land. The Threatened Fauna Manual for Production Forests in Tasmania was developed to help those involved in the forest industry to meet this requirement. The revised version of the manual, compiled by consultant Jean Jackson and the Forest Practices Board Senior Zoologist Sarah Munks with the help of others from PWS and FT was completed in early October. It replaces the original version by Jackson and Taylor (1995) and is a necessary resource tool for Forest Practices Officers and Fauna Liaison Officers, especially those involved in the preparation of Timber Harvesting Plans.

The revised manual includes;

updated map sheet localities for threatened species which occur in production forests,

updated information on the biology and habitat requirements of these species,

updated recommendations for the conservation management of the species,

updated reference list and,

summary information on additional forest dependant species which have a high conservation significance as recognised in the Tasmanian Regional Forest Agreement.

The manual is also of interest to others involved in the forest industry including contractors and landowners and copies are available from the Forest Practices Board, Roydon, Hobart for $15.

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New Atlas of Australian Birds

The updating of the Atlas of Australian Birds is up and away.. Some FPOs would have been involved with the first Atlas project which collected records of all Australian birds from every 1-degree grid block across the country. This update project will be carried out over the next four years and will renew information on where Australia's birds live and breed; which birds are more common and which have declined; which birds are returning to which landscapes; and which ones require special attention. Anyone interested in taking part or wanting more information should contact me or Sally Bryant, Parks and Wildlife.

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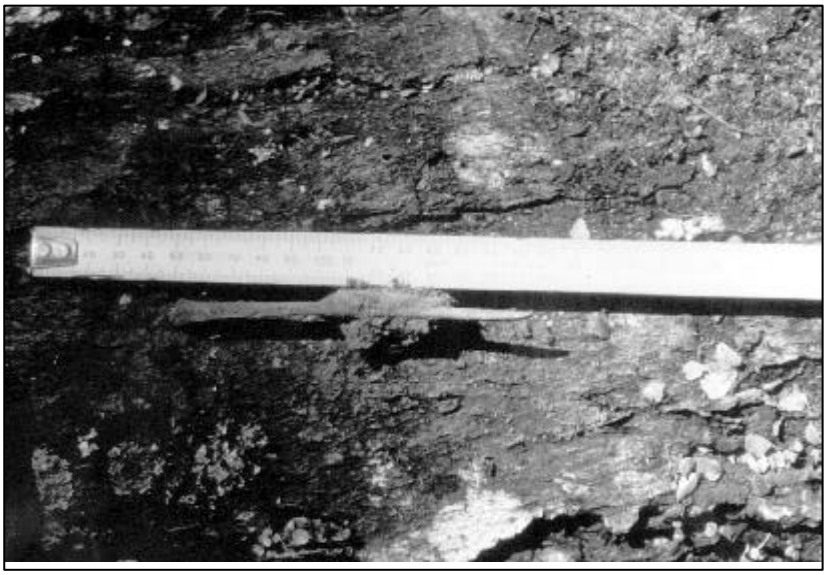


Aboriginal bone point tool in a small karst cave in the Corinna State Forest, western Tasmania

Feature

Towards the summit – pathways to sustainable forest management

The forest practices system is based upon a principle of continuing improvement. Most people acknowledge the tremendous changes and achievements in forest practices since the introduction of the Forest Practices Act in 1985. Where do we go from here?

Some time ago, a Forest Practices Officer remarked to the Chief Forest Practices Officer that the principle of 'continuous improvement' was a bit like walking up a mountain - every time you reach a high point and think that you are getting to the top, the summit seems to keep extending out to the horizon. The FPO was reflecting upon the rate of change in forest practices and was wondering at what point we would 'reach the summit'. The CFPO's response was that you never reach the final summit. You may think that you have reached it, but once there, new summits will again emerge on the horizon. The cartographers will tell you that the new summits arise as a result of new information, better technology and the continuing evolution of a dynamic landscape! ('dynamic landscape' is used in the sense of socio-ecological factors rather than tectonic forces!).

The summit in our sights at the moment is the achievement of sustainable forest management ('SFM', sometimes known as 'ESFM' or ecologically sustainable forest management). A number of pathways appear to lead to the summit. Whilst these pathways involve different routes to the summit, they cover much common ground. Progress has already been made along a number of pathways via processes known as Montreal, C&I, EMS and ISO14001.

Striving towards the summit of sustainable forest management is not a new goal - the objective of the Forest Practices Act in 1985 was clearly defined as 'to achieve sustainable management of Crown and private forests'. The current debate is all about how 'sustainability' is defined and measured.

The international Montreal Process deals with sustainability in terms of criteria and indicators (C & I). Criteria and Indicators are the tools for assessing trends in forest conditions and forest management. Criteria describe the broad forest values which society may seek to maintain. Indicators provide a means of defining and measuring change within the criteria over time. The seven criteria agreed by the Montreal Process are as follows:

- biological diversity
- productive capacity
- ecosystem health and vitality
- soil and water resources
- global carbon cycles
- socio-economic benefits
- an effective legal, institutional and economic framework.

Indicators can be applied at different scales. For example, indicators such as the extent of forest area by forest type and tenure may apply at the regional (State or National) level. In contrast, other indicators, such as the proportion of land area subject to soil damage after harvesting, are best applied at the management unit or coupe scale. A framework of regional indicators has been developed in Australia by the Commonwealth-State Montreal Implementation Group (MIG) based on the Montreal Process criteria. Under the RFA, Tasmania has agreed to develop by the end of 1999 a set of regional indicators of sustainability consistent with this framework. As part of this process, Forestry Tasmania has commenced the development of a set of indicators to be applied at the forest management unit level for State forest. These will provide data for the regional indicators. Results of research at the Warra long term ecological research (LTER) site will assist in this work. It is likely that reporting against the indictors will be done through the five yearly State of the Forest Report/RFA review.

The above processes have no direct link to certification and labelling of forest products. In Tasmania, most of the larger forest management organisations are pursuing the development and certification of an environmental management system (EMS) under the international ISO14001 process. The ISO14001 standard requires organisations to identify those activities with potential for significant environmental impact. Performance targets must be set for all significant environmental activities (SEAs) and the management system must deliver effective procedures for training all personnel and for monitoring and recording performance. ISO 14001 certification does not allow 'green' or 'eco' labeling of forest products produced by those organisations. Various international labeling schemes are being developed which link an EMS with defined forest management standards or principles and chain of custody systems for products from those forests. Tasmanian organisations have started to explore options for providing certification and labeling of Tasmanian forest products following the RFA.

In addition to the above, we have formal requirements for reporting on the State of the Forests and on the implementation of the RFA.

Although the above processes may appear to present convoluted and

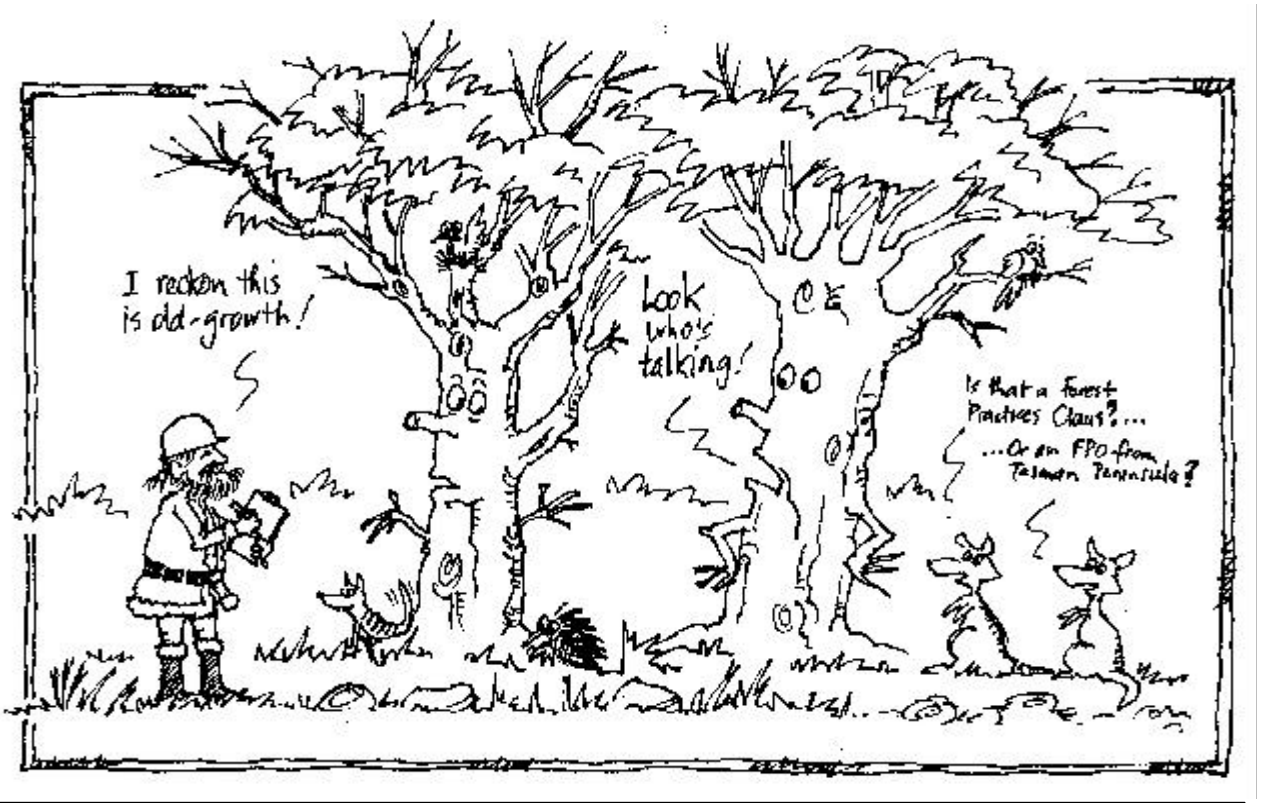
Flora

Assessment of Old-Growth Forest – A Guide for FPOs

I've received a lot of enquiries from FPOs about old-growth forests - in particular how to identify old-growth in drier forest types. Some information on identification and management of old-growth will be circulated to FPOs early in the New Year. However, I have summarised this information in FP News, knowing that many FPOs will want to get in a bit of practice over the festive season.

Several old-growth forest communities have a high priority for protection under the RFA. Generally, conservation of old-growth forest has a higher priority than conservation of regrowth forest of the same community. Old-growth forests provide habitat for many species that are uncommon or absent in younger forest types. It will take well over a century for young regrowth forest to develop old-growth characteristics.

Nineteen RFA forest communities (e.g. inland E. amygdalina forest) have been identified as requiring further protection for both old-growth and non-old-growth stands of the community. Five RFA communities (e.g. E. sieberi forest on granite) require additional protection for old-growth stands only.



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complex pathways towards the summit of sustainable forest management, there are opportunities for linkages to be established to avoid unnecessary duplication and to smooth the way. The forest practices system provides much of the 'common ground' which is fundamental to many of the above processes. The critical 'common ground' components include:

* comprehensive planning;
* approval of operations;
* consistent standards through the Forest Practices Code;
* training and education; continuing research and improvement; and
* internal supervision and monitoring through self-regulation, backed up by independent monitoring, reporting and enforcement by the Forest Practices Board.

The challenge for our system is to achieve good outcomes. Properly integrated processes will help us get there.

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Notes on conservation priorities and identification of communities have already been sent to FPOs (contact me if you don't have them).

Old-growth forests have an overstorey with a greater crown cover of over-mature to senescent trees than non-senescent mature trees or regrowth trees. Old-growth forests generally contain a greater range of habitats than regrowth forests and consequently support a different (and generally more diverse) suite of species. Woody debris is often abundant on the forest floor, particularly in forests which have had a long period without fire. Another characteristic of old-growth forests is that man-made disturbance has not significantly altered the pre-disturbance structure of the forest. (Note that fire is considered a natural disturbance and does not preclude classification as old-growth, providing other old-growth characteristics are present).

Hopefully, the information presented here will clear up some of the confusion about old-growth forests. Meanwhile, I hope the old-growth guy in the red suit with fur-trimmed hardhat appropriately rewards all FPOs for their efforts in 1998.

Identification of old-growth forest

Use the guide to assess whether old-growth occurs in your operational area. Then use the recommendations given in the next section to determine actions that should be followed.

1. From PI maps:

   Does the PI type show the forest as cut-over (c/o) and/or is the regrowth (ER) component of a greater density than the mature (E) component?

   YES - Unlikely to be old-growth

   NO - May be old-growth (depends on field assessment).

   Does the PI type show the forest to be over-mature (o/m), with little or no regrowth present?

   YES - Likely to be old-growth

   NO - May be old-growth (depends on field assessment).

2. From field assessment:

   Is the overstorey crown cover of regrowth trees greater than the overstorey crown cover of mature to senescent trees? (Note: Senescent denotes presence of dead branches and hollows. Be sure trees aren't just young and dying from die-back).

   YES - Not old-growth

   NO - Always old-growth if answer to the next question is NO.

   Has man-made disturbance had a significant effect on the structure of the forest? (Note: Forests with minor disturbance from tracks, light selective logging, grazing etc. may still qualify as old-growth)

   YES - Not old-growth

   NO - May be old-growth.

Recommended actions when old-growth forest occurs in operational area

1. If old-growth of RFA communities requiring additional protection is present:

   If any individual patches are > 3 ha (or if <3 ha, patches are continuous with forest requiring protection outside operational area):

   - Contact FPB Botanist, providing details of area, including map, proposed operation, RFA communities and old-growth present.

   If all individual patches are < 3 ha:

   - No need to contact FPB Botanist (unless other botanical values are present);
   - If appropriate, incorporate old-growth into retained areas (e.g. habitat clumps) in preference to regrowth forest.

2. If old-growth of RFA communities not requiring additional protection is present:

   - No need to contact FPB Botanist (unless other botanical values are present);
   - If appropriate, incorporate old-growth into retained areas (e.g. habitat clumps) in preference to regrowth forest.

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Fauna

Conserving invertebrates (the other 99%) in production forests: the stag beetles

Tasmania has a rich endemic stag beetle fauna with over 30 species described. Simsons stag beetle, *Hoplogonus simsoni*, is considered one of the most vulnerable and is listed under the Tasmanian Threatened Species Protection Act 1995. When it was listed it was known from only five localities in the Blue Tier region of north-east Tasmania and little was known of its habitat requirements. However, we have recently completed a study, involving lots of scrabbling through leaf litter and dirt in over 4,000 $1m^2$ plots, that has increased the number of known localities to over 100. This study also revealed some other beetle secrets including the characteristics of its preferred habitat and this has enabled us to develop a detailed conservation management strategy for the species and its habitat, one of the few such strategies in Australia for an invertebrate.

H. simsoni is a large flightless black beetle with a body length of up to 25 mm. The males have greatly enlarged, elongate jaws. It is easily distinguished from other stag beetles by the spines on the corners of its abdomen or wing covers. It is a relatively long-lived beetle, its larval stage lasting up to three years and its adult lifespan in the range of one to two years. The larvae are soil-dwelling and are believed to feed on organic matter in the upper soil horizon. The adults don't appear to feed but spend their time wandering amongst leaf litter during spring and summer nights (presumably looking for a mate) and sheltering under rocks, logs and leaf litter during the day.

H. simsoni was first described in the 1850's and was left pretty much to itself for the next 130 years until it caught the eye of stag beetle collectors. Our involvement began a decade later when these same beetle collectors advocated the listing of the species on the *Tasmanian Threatened Species Act*. The conservation of *H. simsoni* became a serious issue for land managers in the summer of 1995/96 when road operations commenced in an area containing an exceptionally high-density population of the beetle. An agreement was reached between Forestry Tasmania and the Tasmanian Parks and Wildlife Service to defer harvesting of this area until further research was conducted on the beetle.

Having obtained research funds from the WV Scott Bequest fund and Forestry Tasmania, we began a detailed study of the distribution, population densities, local habitat requirements and impact of logging on the beetle in late 1996. This study found that *H. simsoni* was restricted to an area of 240 km^2 and that the area of suitable habitat within its range was only 174 km^2. The beetle was not evenly distributed throughout its range, with moderate to high-density populations occurring in a narrow band along the eastern edge, and apparently isolated low-density populations in the west and north of its range.

Generalised linear modelling of the relationship between beetle abundance and habitat variables collected enabled us to identify optimal habitat for the beetle. The characteristics of this habitat appear to relate to the beetle's need for a cool, moist, stable microclimate and an absence of wildfire for some time.

Predictive maps of the distribution of *H. simsoni* were constructed at a scale of 100 m grid squares by coupling the habitat models with GIS data held by Forestry Tasmania, something that has rarely been attempted for invertebrates. Subsequent field-testing of these models (an even rarer event) has found them to be remarkably accurate.

These predictive maps and the results from their field-testing have formed the basis for the proposed conservation management plan for the species. The majority of quality habitat for the beetle is managed as production forest and there is a strong correlation between quality beetle habitat and areas suitable for conversion to plantation. Our study showed that the conversion of native forest to pine plantations can result in the local extinction of the species.

Our recommendations for the conservation of *H. simsoni* aim to limit the impact of plantation establishment on the species. A three-tiered management strategy has been proposed that reserves areas of optimal habitat as Wildlife Priority Areas, maintains links between these and other areas of optimal habitat, and manages forestry activities by prescription in habitat within the rest of its range.

Surveys on other stag beetles, including two newly described species of Hoplogonus, are planned for this summer (funded by Forestry Tasmania). At first glance these species appear to be at even greater risk of extinction as their current known distributions are in the order of only ten's of kilometres. However, the results of these surveys may prove otherwise.

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Soils

Plantation development on basalt talus

In this current phase of expansion of the plantation estate, basalt soils are being targeted for purchase or partnership arrangements with farmers. Basalt – high productivity, well drained, low erodibility – is certainly great for growing trees, but much of the 'good basalt soils' is in fact, derived from material commonly referred to on some older Tasmanian geological maps as basalt 'talus'.

This 'basalt talus' essentially comprises slope deposits derived from basalt and in fact varies considerably in its rockiness and precise origin. This soil parent material is widespread in the north, north-west and north-east of the state and much of it has been cleared for pasture, although some of it remains forested. Landforms developed on this material often indicate a much earlier history of slope instability. Such landforms include irregular or hummocky terrain, classically with large mounds topped with shallow, wet depressions. Depending upon the site, a large 'bowl' or amphitheatre in the slope above the mound may indicate where the mound debris has been derived from. These landforms are collectively the product of deep-seated slumping.

The soils developed on this material are described in Grant et al (1995) on pages 98-99, as '17 - Soils on Quaternary Basalt Talus'. As indicated, assessment of the landslide hazard should be made prior to harvesting and advice should be sought prior to planting trees. The point is also made that cultivation should be minimised to avoid triggering landslips. In all cases, a forest cover will improve the stability of these sites. Plantations are usually appropriate provided care is taken with site preparation.

The main problem with this material, apart from the inherent instability of the mounds (which are in effect debris piles that have stabilised to varying degrees), is the presence of a swelling clay, montmorillonite, in the subsoil. Montmorillonite forms a gel like suspension when mixed with water and rapidly loses strength when saturated, hence the need to avoid changing the hydrological character of the soil profile.

These prescriptions are an attempt to give guidance to foresters, but should not replace a inspection by an appropriate specialist which may result in more detailed or site specific prescriptions or recommendations.

Roading

• Roadlines need to be carefully planned to avoid cut batters at the toes of the mounds. Any batters to be kept as low as possible to minimise the risk of slumping.

• Similarly, roadlines must be planned to avoid wet depressions and seepages as much as possible.

• Drainage will also need to be carefully planned for all new roading, taking care not to direct drainage into depressions behind the mounds and ensuring that appropriately sited culverts are employed where crossing drainage lines.

Site preparation

• The site preparation must aim to prevent or at least minimise adverse effects on the hydrological characteristics of the soils. Deep ripping and spot cultivation are not recommended as they can lead to saturation of the subsoils, which in turn can trigger landslides.

• If mounding has to be carried out for weed control, ease of access for planting etc., the mounds must be slanted off the contour so as to disperse runoff into natural drainage lines and to avoid ponding behind mounds.

• For forested sites - consideration should be given to leaving steep slopes (above 35-40%), unlogged.

• For ex-pasture sites - similarly steep slopes should be hand cultivated and planted. The choice of broadcast or spot spraying will depend upon site factors such as steepness and recent instability.

• Machinery must be kept out of wet depressions to avoid unnecessary disturbance.

Other issues

• Active landslides need to be treated on a case by case basis. Possibilities include amenity plantings, hand planting of plantation species, cut-off drains to minimise water entering the site, avoidance etc.

Basalt 'talus' can great for growing trees, but what works on terrain where the soils are derived from stable basalt bedrock will not necessarily work on basalt 'talus' and a different approach is needed to avoid a new generation of instability.

References

Grant, J.C., Laffan, M.D., Hill, R.B., N eilsen, W A ., 1995. *Forest Soils of Tasmania. A Handbook for Identification and Management*. Forestry Tasmania.

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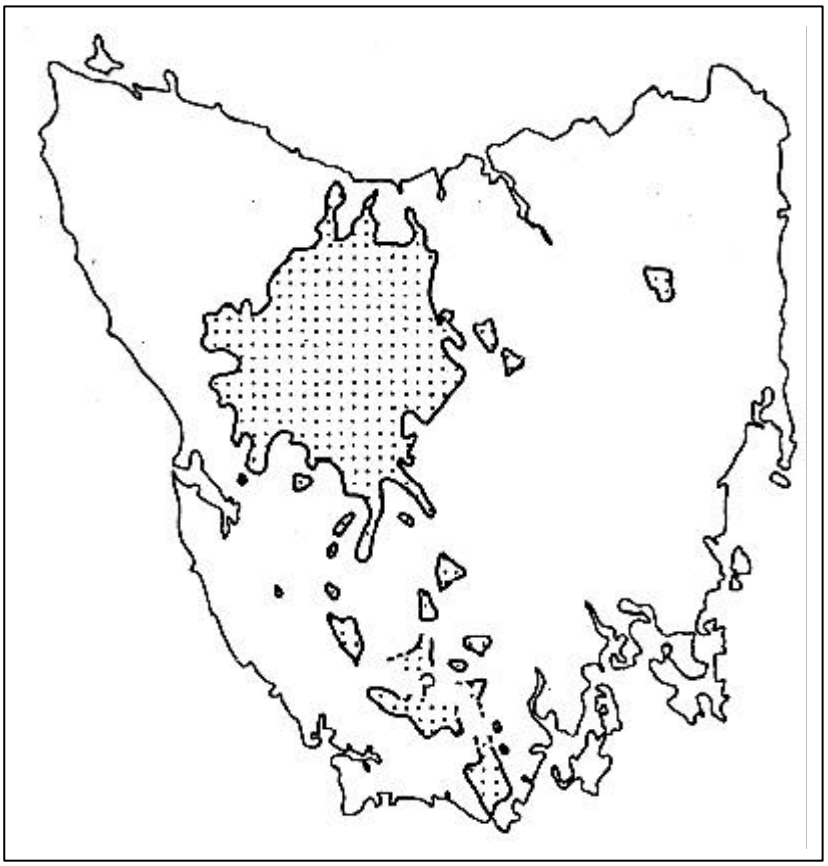
Geomorphology

Glaciers, landforms and sustainable forestry

Over the last couple of million years there has been a succession of ice ages during which glaciers formed in the Tasmanian mountains and conditions were generally drier and colder throughout the state than is the case today, and forest occurred on a much reduced scale. These periods were separated by relatively brief interludes of milder climate like that in which our present day forests are thriving.

During the time the glaciers were most extensive an ice sheet of over 7000 km2 occurred over the Tasmanian Central Highlands, with smaller glaciers forming in the western and southwestern mountains. Glaciers flowing down valleys deposited the soil materials in which substantial areas of commercially important timber in the Southern Forests, Mersey Valley and elsewhere now grow.

Beyond the glacier margins where the forest biomass was much less than now, hill-slopes were less stable and streams carried a heavy sediment load. For perhaps 80% of the last 2 million years the distribution of Tasmania's forest and the stability of the landscape has been vastly different to what we know today. The legacy of these times has important implications for forest management.



Approximate extent of Tasmanian glaciers during the late Cainozoic

Glacial geoheritage

Some of the landforms created by the glaciers are of considerable conservation significance. They are of intrinsic value. They also underpin the maintenance of natural processes in the landscape, including ecological processes - geodiversity is the foundation upon which biodiversity rests. And they are also of instrumental or economic worth to humans in many ways, for instance to scientists as sites for research, to foresters as places to supply the needs of the timber industry, and to the tourist industry as the basis of some of our most appealing scenery.

Most of Australia's glacial geomorphological heritage occurs in Tasmania (the proven extent of Pleistocene glaciers on the Australian mainland is less than 20 km2). Some of the glacial landforms present in Tasmania are not only of national heritage significance, they have no counterpart on Earth. Moreover, there are few areas in the predominantly oceanic southern temperate latitudes where patterns of past glaciation and the climatic change it implies can be studied on land. In contrast to the New Zealand Alps and Patagonian Andes, the Tasmanian land-mass is very stable and has allowed the preservation of very ancient glacial features. This includes the only evidence from the temperate zone of the glacial episode that saw inception of the Antarctic ice sheet over 30 million years ago.

Glacial geohazards

In addition to recognising the need to safeguard important glacial geoheritage sites, forest managers are faced with some significant operational issues in harvesting from the footprint of the glaciers. Rock debris transported by glaciers and deposited as landforms known as moraines may be unstable once the supporting ice that pressed them against valley sides has melted. Removal of the forests that help maintain their stability can increase the potential for landslides to occur. Where glaciers flow down major valleys, tributary streams from neighbouring hillsides may be deflected sideways by moraines. The channels these streams form may then be inherited by later streams. This may result in a landscape in which creeks are suddenly

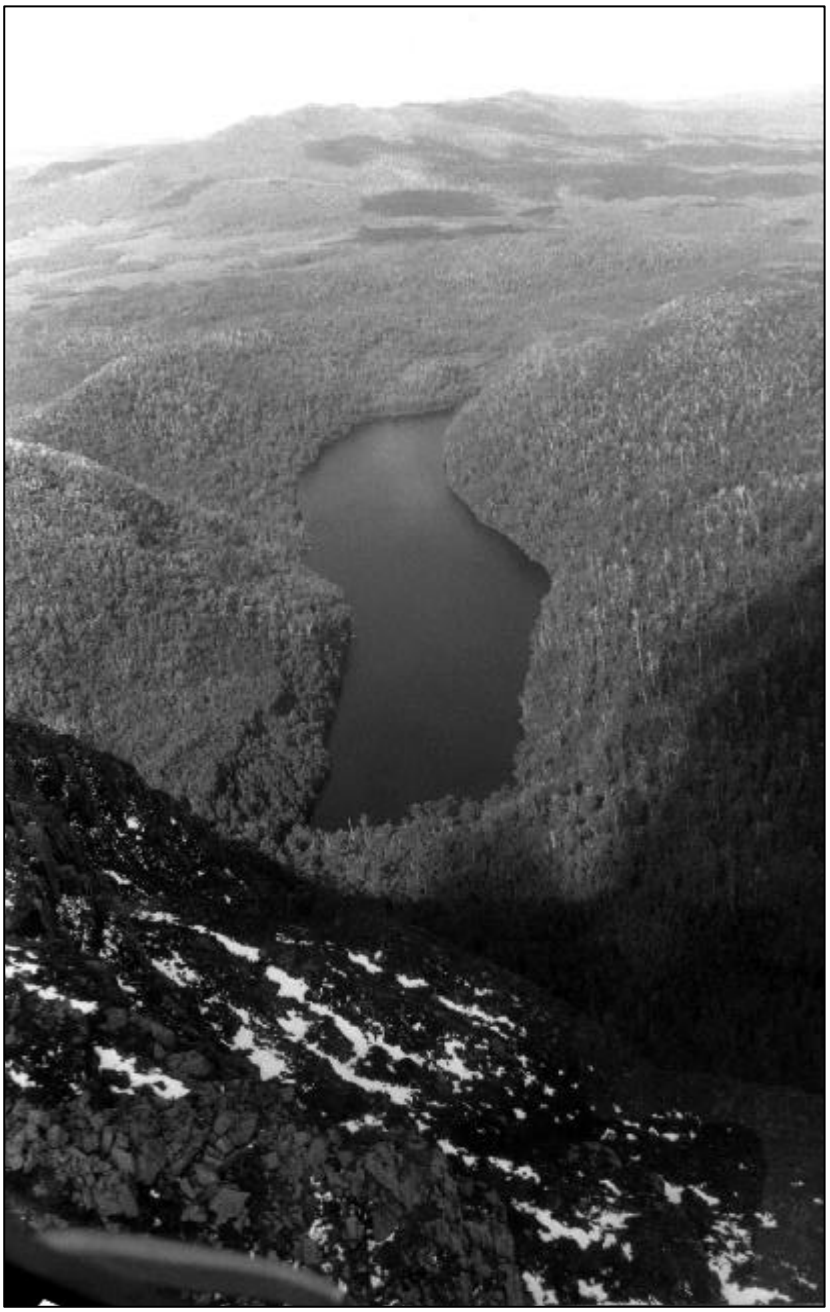
deflected laterally part-way down hillsides, and eventually curve back around the former nose of the glacier to join the river at the valley bottom.

As the climate warms and a glacier shrinks a 'staircase' of successively younger moraines may be formed down a valley side. Their crests may be only a few metres high, but they are often sufficient to impede drainage causing formation of elongate ponds, swamps or untrafficable soft ground that may pose significant operational and environmental problems if not recognised in advance.

The presence of glacial clays can lead to significant landslide hazards. In addition some moraines, in parts of the Derwent Valley for instance, consist of relatively unconsolidated sediment that accumulated on the edge of the glacier. These sometimes overlie more compacted sediment that was originally compressed under the glacier. Where swampwater seeps through the moraine between these two types of sediment landslide risk may already be naturally quite high. Road construction, or changes in tree root strength and soil water loading after logging, may further increase the landslide risk.

Inventory and planning are essential

Tasmania's glacial landscapes are thus both of natural heritage significance and also valuable resources for forestry. Adequate site identification, planning and management are the essential prerequisites for sustainable forest management. Topographic maps at a scale of 1:25,000 generally fail to pick up the subtleties in glacial landscapes. There is no substitute for ground inspection. Some of the most important glacial geoheritage sites are only likely to be found by inspection on the ground and so are some of the potential operational problems.



Glaciers were a major source of tasmania's scenery and forest soils, and have left an important scientific legacy

Integrated surveys of the geoheritage and geohazards present are fundamental to sustainable forest management in formerly glaciated landscapes.

And next time you find yourself geographically embarrassed on a cold snowy afternoon because the stream you are following doesn't seem to be going where you thought it would, try mentally filling the valley with ice - the insight into the drainage pattern that you gain from briefly living in the past may not only enhance the effectiveness of your planning, it may even get you home in time for breakfast (apologies to A.N. Onymous, FT employee).

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