# ForestPractices news

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## Successful wedge-tailed eagle nest searches in NW Tasmania


*Stephen Scott, David Fulford, Jody Cartwright and Dot Drevenkar,*
*Forestry Tasmania employees, Smithton*


**The exciting news from Smithton is that TWO wedge-tailed eagle nests have recently been found during prescribed searches.**

The forests in the far north-west of Tasmania support mostly wet sclerophyll and rainforest species, with the understorey often a daunting mix of thick bauera and cutting grass. It had been notoriously difficult in the past to find nests before harvesting contractors had moved into an area and on one occasion in the past the nest was not seen until the first chainsaw cut was just about to be made into the tree with the nest. Such late discoveries are invariably very disruptive to all concerned. The contractor must move his operation to another area, the forest organisation is under pressure to find another suitable area at short notice and must quickly prepare the necessary paperwork and demarcate the new coupe. As for the eagles, they are possibly even more traumatised by the loss of their habitat.

Searches by helicopter and fixed wing aircraft were trialed some years ago with no success. It is still sometimes difficult to locate a known nest site from the air.

In coupes with suitable habitat a standard phrase is inserted into the Forest Practices Plans, to the effect that, *all persons working in the coupe are to be made aware that wedge-tailed eagle nests can be found and that if such nests are seen, work is to cease and the nest reported immediately*. This advice is followed but by the time any nests are found in this way, it is generally very difficult to place an adequate reserve around them.

With the introduction of the *Threatened Fauna Adviser*, suitable habitat within coupes scheduled for harvesting is now searched systematically by the Management Crew. Scotty, Jody and David have shown both an interest and an

## The black box

*Kevin Kiernan, editor, FPB*

Once again in this issue we see the need for interdisciplinary approaches to planning and management. In a world where reductionist science and narrowly defined bureaucratic structures tend to pull things apart, it's all too easy to sever the strands of interconnectedness. The FPB is not alone in being structured as a series of discrete specialist pigeon holes, but the environment in which FPOs operate is an integrated whole. Most of us enjoy good music, even if none of the individual notes played are on any Rare and Threatened Notes list. If we dished out custodianship of one set of notes to one specialist, a different set of notes to another specialist, a different set of notes to yet another specialist, would we ever get to hear the music again? So what about the notes in the forest environment symphony? As the old saying goes, if you're not part of the solution you're part of the problem. FPOs are the crucial integraters in the Forest Practices system.

Once again, many thanks to all contributors to this issue. Now I am back in harness, I would particularly like to thank Suzette Wood for taking over editorship of *FPN* 3(2) while I was away.

## contents

# Developments

On the 31 July, gates providing access to the vicinity of wedge-tailed eagle nestreserves on State Forest in the District are locked. The photo shows, from left, Scotty, Jody and David in front of one such gate.

aptitude for these searches. Their first searches were under the tutelage of Jeff Meggs, now based in Hobart. The Management Crew became so keen that the District supplied them with a new, compact pair of binoculars, which could be taken with them during other forestry work in case they saw something likely.

***First nest discovery – as told by Scotty***

On the 11 May I was working in a party of five in a combined coupe demarcation / wedge-tailed eagle nest search exercise which involved both the Management Crew and two persons from Sales. I was walking along the edge of a creek and shouting to the Sales guys at regular intervals to help them know how far they were from the streamside reserve. Walking in the gully gave me a good view of the trees on both sides. When I saw limbs hanging in a fork of a tree on the other side of the gully I thought at first that it was nothing but when I looked with the binoculars I could see that the limbs were stacked neatly one on top of the other. So I called the rest of the crew back to have a closer look and from looking from a different angle we could see it was definitely a nest.

***Second nest discovery – as told by David***

On the 15th September, Scotty, Jody and myself were doing an eagle nest search in a coupe planned to be logged within the next few months. For lunch we drove up to the top of a ridge. Scotty spotted two eagles flying low from the coupe below us. This coupe had been harvested in 1996 / 97 and converted to an *E.globulus* plantation in 1999*. Scotty and I decided to go and have a look. Walking down the edge of the bushline I spotted what looked to be a nest approximately 200 - 300 metres away. We then walked down and back up a steep gully to the nest to make sure that it actually was a nest. When we found it we decided that it was definitely an eagle nest and we then decided to get out pretty quick so we didn't disturb anything.

*Well done, Management Crew!*

*The nest is actually in one of the designated Wildlife Habitat Clumps on the edge of the coupe and adjacent to an unlogged area.


Murchison District's new explanatory signs

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# Noticeboard

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## Guidelines for contributors

*Forest Practices News* is published quarterly by the Forest Practices Board, Tasmania. FPN provides a means for communicating new ideas and developments among those interested in the sustainable management of Tasmania's forests. We particularly welcome contributions from practicing FPOs. We welcome both feature articles and shorter contributions of even just a paragraph or two. Please include illustrations with your contributions if at all possible. Contributions can be supplied either as hard copy or electronically. If forwarding material electronically, the address is info@fpb.tas.gov.au. We look forward to seeing you in print in FPN!

# Feature
## Getting fresh:
## habitat conservation for threatened freshwater fish*

*Jean Jackson, Inland Fisheries Service*

**Foresters spending a lot of time planning and marking streamside reserves may wonder just what lives in those streams. Anyone who has attended a fauna training course including stream fauna will appreciate some of the enormous diversity of life in streams. Fish and crayfish are the largest fully aquatic animals found in our streams, although not always the most easily seen.**

The freshwater fish fauna in Tasmania is quite diverse, with 25 different native species consisting of 15 galaxias, 2 eels, 2 lampreys and blackfish, pygmy perch, sandy, whitebait, smelt and grayling. The fauna is also unique, with 12 species found only here. Many species have very limited distributions, and combined with threats from introduced fish and habitat degradation, this means a high proportion (12) of our species are considered threatened.

Five of the threatened species are the subject of concentrated conservation efforts, described in a recovery plan funded by the Commonwealth government's Natural Heritage Trust, the Inland Fisheries Service and other stakeholders. Two of the endangered species (Swan and Clarence galaxias) occur mainly on State forest or forested private land, so appropriate forest management is critical for protection of the habitat of these species. All relevant sites are included in the Threatened Fauna Manual. General prescriptions for habitat protection are given in the Threatened Fauna Advisor, but some situations may require site visits and specific recommendations. Some examples are described below.

Swan galaxias habitat at Parramores Creek

Swan galaxias *Galaxias fontanus*
photo by Ron Mawbey

**Swan galaxias**

The Swan galaxias live in some headwater streams in the Derwent East area, from Rocka Rivulet in the south to St Pauls River and Tullochgorum Creek in the north. The species is considered endangered due to the very small number of natural populations and a decline caused by trout and redfin invasion of the streams. There are 14 sites known, of which 5 are natural populations. The other 9 populations have been established by moving fish into secure, previously fish-free sites. One of the natural populations, at Paramores Creek, was thought to be extinct after trout invasion but late last year fish were discovered to still be present. Efforts are now being made to allow the population to recover, including removal of trout from a small dam on the stream, development of prescriptions for any logging in the catchment, and reduction of impact from an unimproved track crossing of the upper stream.

Clarence galaxias *Galaxias johnstoni*

**Clarence galaxias**

The Clarence galaxias is also an endangered species which has been eliminated by trout from much of its previous range. It occurs in the south-eastern area of the Central Plateau in parts of the Clarence, Nive and Derwent Rivers and only 7 populations are known. Management recommendations have been developed to help protect several populations occurring on State Forest. These include not improving access to isolated lagoons where illegal trout introduction is a risk, not conducting fuel reduction burning across a wetland containing the species, and increasing streamside reserve widths. A site of particular concern is Dyes Marsh, where trout are invading the lower marsh. With generous assistance from Forestry Tasmania planners and engineers, we are working towards building a barrier on the outflow stream to stop trout movement upstream.

The overall aim of this work is to ensure the species survive and are secure into the future, ideally without the need for ongoing intensive work.

(*Apologies to Niall Doran for the title rip off)

# Feature

Measuring up a potential fish barrier site

Logging water levels near Dyes Marsh outflow

**Further reading**


Crook, D. and Sanger, A. 1997 Recovery plan for the Pedder, Swan, Clarence, swamp and saddled galaxias. Inland Fisheries Commission, Hobart. (text is on IFS website www.ifs.tas.gov.au).

Fulton, W. 1990. *Tasmanian Freshwater Fishes.* Fauna of Tasmania handbook no. 7, University of Tasmania, Hobart.

McDowall, R. (ed). 1996. *Freshwater Fishes of South-eastern Australia.* Reed New Holland.

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## Forward training program – Forest Practices Board

**Confirmed and proposed training 2001**

| Course (Contact) | Timing | Duration | Location | Course Content |
|---|---|---|---|---|
| Fauna values and forest manage-ment (S. Munks) | 3-5 April, 8-10 May 2001 | 3 days | 1 in south, and 1 in NW | Train FPOs in procedures for threatened species |
| Forest Practices Manager training (C.Mitchell) | May 2001 | 2 days | To be confirmed | Update forest managers on requirements of the forest practices system |
| Risk assessment (C.Mitchell) | May 2001 | 1 day | To be confirmed | Train selected FPOs to complete a safety risk assessment for trees retained under the FP Code |
| Integrated Karst Management[1] (K.Kiernan) | To be confirmed | 1 day | To be confirmed | Train FPOs who work in karst areas on fauna, cultural heritage and geomorph-ological requirements |
| Forest Botany Manuals (F. Duncan) | To be confirmed | 1 day? | Various locations | Train FPOs in use of the new Botany Manuals |
| Forest practices training [1] | Approx. May 2001 | 4 day | Orford? | General training in forest practices for FT supervisors |
| Forest Practices Officer course | Winter / Spring 2001 | 12 day | Various locations | Pre-requisite course for appointment as FPO |
| Cultural Heritage refresher course (D. Gaughwin) | Oct. or Nov. 2001 | 1 day | 1 each in north, north west, and south? | Upgrade skills in cultural heritage management. Prerequisite is prior competency in cult. heritage (archaeology) course |


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[1] Dependent on demand

# Travel log

## More international consultancy work

*A Skua, Honorary Forest Practices Officer*

**As world leaders in Forest Practices the expertise of the FPB is eagerly sought after by land managers everywhere, as illustrated in the accompanying photographs.**

The FPB Senior Geomorphologist Kevin Kiernan explains the finer details of the new Forest Practices Code to trainee Forest Practices Officers attending a recent FPO course on Laurens Peninsula, Heard Island (photo by former FPU Senior Archaeologist Anne McConnell, co-presenter of the course).

Outcrops of limestone on the southern side of Laurens Peninsula, photographed during assessment of site suitability for a Private Timber Reserve. The continued existence of this particular rock type would not be threatened by logging, and this part of the limestone outcrop is not populated by any known species of fauna or flora included in any list of Rare or Endangered Species. The site is not host to any known relicts of cultural heritage significance and is visually inevident from the nearest tourist road. Although steep slopes overlook the site the outcrop itself is within acceptable FPC slope limits. Hence, there is no specific reason why this site should not be considered suitable for a Forest Practices Plan. In view of the demonstrated lack of any particular special value at this precise site, its present inclusion within a Wilderness Preserve and World Heritage Area is clearly an accident based on a technical oversight. Hence, following this inspection we can now look forward to a vibrant industry harvesting driftwood from the rich kelp forests of this treeless sub-Antarctic island.

The report should finally silence unpleasant suggestions spread by some greenies that the PTR application does not reflect a genuine commitment to commercial forestry but is simply a bid for compensation dollars by a cartel of moulting entrepeneur elephant seals in need of a new suit. Such a cynical attitude and so bad for an investment climate that is already quite cold and wet enough!

A Skua, *Officcialei Forestii Practicium Honorariia*

# Fauna

## Keeping our snails on the trail

*Kevin Bonham. Honorary Research Associate, Zoology Department, University of Tasmania*

**Tasmania has at least eighty different species of native land snails. They live in all habitats, but are most successful in wet eucalypt forests and mixed forests. Most shelter under rocks and logs, in piles of leaf litter and in moss on low tree branches. Many species are small and take careful searching to find. Many Tasmanian snails are very unusual, and few occur anywhere else.**

Most Tasmanian snails don't need much help from us to survive. Many species are very well reserved, others are hardy and recover rapidly from disturbance. Some even benefit from it. A few species have conservation significance, mainly because they are confined to small ranges, and have therefore become relevant to forest managers.

Burgundy snail

The best-known threatened species in Tasmania is the keeled snail (*Tasmaphena lamproides*), a large yellow / red snail with a prominent "keel" on its shell, which lives mainly near the far north-west tip of the state (between Woolnorth, Stanley and Arthur River). The keeled snail is unusual because it eats other snails and worms, unlike most snails which eat fungi and decaying plant matter. By snail standards it is streamlined and built for speed, but its numbers are limited by how much prey is about. This depends on the amount of litter and hence on the age of the forest. The keeled snail is rare in forests less than thirty years old, and prefers forests at least fifty years old.

Work on the keeled snail has involved mapping its range and determining its basic habitat needs. In the future, more information will help us predict which soil types the species likes, and hopefully where the densest populations will occur. The snail has become much better reserved over the last ten years, and what we mainly need to do to secure this snail's future is make sure not too much of its habitat is cleared at any one time. In areas where plantation development is planned, Forestry Tasmania and the University of Melbourne are working on models to predict how the impact of plantations can be reduced.

Another localised species is the burgundy snail (*Helicarion rubicundus*), a spectacular bright red and green animal with a thin yellow shell. This colourful animal, which looks like it belongs in a tropical rainforest, is found only on the Forestier Peninsula and a small part of the Tasman Peninsula. Despite its very small range, it is very common in wet forests, especially those with large piles of eucalypt bark, and can live in regrowth which is only 15 years old. At this stage, the species' range is well-mapped but we are not sure which forest practices are most favourable to this species.

A third species relevant to forest management is the Skemps snail, which is so recently discovered that it has no scientific name. It lives in the area between Lilydale, Nunamara and the Sideling in the north-east. So far, this small, flat yellow-white snail has only been found in the bottoms of forested gullies. For forestry, this makes it an easy species to manage because it is mainly found in streamside reserves – but maintaining streamside reserves in good condition becomes very important. More work on this species is also needed to work out its exact range.

Tasmania's remaining threatened species (four species, with another one nominated for listing) occur mainly in specific public reserves and very rarely directly affect forest management. However, new species are sometimes discovered, and can occur almost anywhere. All snail species, common or rare, are likely to gain from simple, commonsense environmental care. This includes retaining streamside vegetation in good condition, retaining a range of habitat types unlogged, dispersing the harvest of particular coupes within a particular area in space and time, and avoiding regeneration burn escapes.

Heeled snail

Photographs: Fred Koolhof

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# Flora

## An intriguing interaction between forest species at Stonehenge in the eastern Midlands of Tasmania

*Fred Duncan, Senior Botanist, Forest Practices Board*

**The spring and early summer of 1999 was a period of profuse flowering of *Eucalyptus globulus* subsp. *globulus* (Tasmanian blue gum) in southeastern Tasmania. An observant farmer, who has large stands of E. *globulus* on his property at Levendale, described it as the heaviest flowering he has seen in the 40 years he has lived in the area.**

In November 1999,1 surveyed an area of bushland on Stonehenge property in the eastern Midlands [Whitefoord 1:25000 mapsheet-5583 (E), 53061 (N)]. I was accompanied by Robyne Leven of North Forest Products. Dolerite tiers and slopes on the property mainly supported regrowth stands of *E. globulus* forest,

Fig. 1 The site of the impaled opercula of *E. globulus* on Stonehenge property showing the landscape context of the patch of *Lepidosperma laterale* surrounded by close-cropped grassland and distant trees

with *E. pulchella* and *E. viminalis* present to varying degrees (the latter species were not associated with the site described below). The understorey had been grazed heavily by stock but was relatively diverse, and contained several dolerite endemics, such as *Clematis gentianoides, Hibbertia hirsuta* and *Lepidosperma inops.*

My eyes were drawn to a patch of *Lepidosperma laterale* (sword sedge), about 20x20 m in area, that emerged conspicuously from the close-cropped grassland that surrounded it (Fig. 1). It was reminiscent of the bristly tuft, also surrounded by close-cropped stubble, favoured as a hairstyle by American sailors and basketballers.

Inspection of the *Lepidosperma* patch revealed an intriguing connection between it and the heavily flowering *E. globulus.* Impaled on the sharp points *of the Lepidosperma* leaves were many opercula (caps) that had been forced off the *E. globulus* buds by the emerging stamens of the developing flowers. (The operculum actually comprises the fused petals and sepals of the eucalypt flower. A cross-section through the operculum shows these two distinct layers. In fact, the genus name, *Eucalyptus,* refers to this feature: from the Greek *eu* meaning well or good, and *calyptus* meaning cap or cover.) The *E. globulus* opercula in the area were disc-like in shape and typically 16-18mm in diameter (at their widest point, about 2mm above the rim) and 10mm in height (from rim to tip). This falls within the range described and illustrated in Chippendale (1988).

Opercula that had committed hari kari on the *Lepidosperma* "swords" could be seen throughout the sedgeland. We conducted an intensive survey on a 2x2 m area, representative of the sedgeland. Forty-one caps were impaled *on Lepidosperma* leaves in the area sampled. Most caps were more or less "suspended" on the leaves of *Lepidosperma,* the leaf tips penetrating into but not through the opercula. However, about 40% of the caps were skewered, the leaf tip generally entering the inner (corolla) side of the opercula, before passing out through the outer (calyx) side (Fig. 2).

Maximum distance of leaf emergence was 11 mm. Three buds or young capsules were also impaled in the 2x2 m area, as was a faecal pellet of a brush-tailed possum *(Trichosurus vulpecula).*

The edge of the *Lepidosperma* sedgeland was 29 m from the base of the nearest flowering blue gum, and at least 20 m from the closest branch of the same tree. To estimate the density of capfall under the canopy of this old-growth tree we randomly located twenty 20x20 cm quadrats within 5 m of its base. There was an average density of 9.5 fresh (1999) caps per quadrat (range 2-17), giving a rough density of 240 caps / m2 under the tree.

We used the same techniques to assess the density of caps reaching the representative *Lepidosperma* site. The density of *E. globulus* opercula on this site (on the ground or held up by *Lepidosperma* leaves and other vegetation) averaged 5.9 caps per quadrat (range 0-15), giving a rough density of 150 caps / m2, substantially less than under the tree. This means that the *Lepidosperma* leaves impaled about 7.5% of blue gum opercula that were deposited on the site.

Although the understorey at the sampled site gave the impression of being dominated by *Lepidosperma,* I estimated that *Lepidosperma* only covered about a quarter of the ground surface, with grass species (notably *Ehrharta stipoides, Danthonia* species, *Poa rodwayi, Themeda triandra)* and herbs being the major contributors to ground cover. There were about 38 "clumps" of *Lepidosperma* in the 2x2 m plot, the clumps varying in coherence from very distinct to somewhat diffuse. The average number of hard, pointed leaves per clump was 19.8 (range 6-38, 20 clumps assessed).

The efficiency of *Lepidosperma* leaves in intercepting opercula can be further examined using the information presented above. Assuming 25% effective cover of *Lepidosperma,* 30% of the opercula falling on *Lepidosperma* clumps were impaled or pierced by its leaves.

# Flora

About *5.5%* of the *Lepidosperma* leaves on the site carried an operculum of *e. Globulus*.

The heights of *Lepidosperma laterale* leaves varied, but most were 25-40 cm in length. The threat posed by *Lepidosperma* leaves to incoming opercula is largely a function of leaf age and height. The most effective interceptors were taller, mature leaves with hard and sharp tips. These are probably "lethal" for long periods. Very young leaves are unlikely impalers because they have soft tips and are shorter (i.e. less emergent) than mature leaves. Old leaves have hard tips, but these were often broken or blunt.

Another important variable in this phenomenon is the resistance (or penetrability) of the opercula. Freshly fallen caps are softer, moister and more pliable than older caps. It takes only a short period for caps to dry out and become rigid. Some caps on the ground at Stonehenge appeared to have been liberated from their capsules for only a couple of days, but had already developed a hardness that would prove too great a barrier for a *Lepidosperma* leaf to penetrate. This is probably a moot point: opercula that are impaled *on Lepidosperma* leaves will (like many of the American sailors seen wandering around Hobart) have only recently been separated from their buds.

Fig. 2 *Lepidosperma laterale* leaves with attached opercula (caps) of *E. globulus* from Stonehenge property in the eastern Midlands. The photograph shows leaves collected from across the sampled plot and not a single clump of *Lepidosperma*.

From the detailed analysis presented, it can be seen that the leaves *of Lepidosperma* are effective interceptors of downwardly mobile opercula. The flight path of the caps is likely to vary with their aerodynamic attributes and wind parameters. The distance from nearby trees indicates that the angle of opercula approach would be less than 45°. Unfortunately, over-stretched departmental resources did not permit further investigation of the interactions between *Lepidosperma* leaves and falling *E. globulus* opercula. These included velocities reached by falling opercula, and the forces of impact when opercula make contact with a hard, sharp point. The possibility of incoming opercula developing a frisbee action in flight cannot be discounted, as most caps were impaled on their lower side. The dimensions and mass of *E. globulus* opercula may also be critical. The opercula of other Tasmanian eucalypt species are considerably smaller and lighter than those of *E. globulus*, and may not reach sufficient momentum to be impaled when confronted with a sharp object. In addition, most have a more conical shape, which is more likely to shear or ricochet off an acute leaf compared to the relatively flat cap of *E. globulus*. Though here too are dimensional uncertainties, as the cylindrical possum pellet was well impaled! There is potentially fertile ground for a major long-term interdisciplinary university research program.

The situation observed at Stonehenge does not seem to have been previously recorded in Tasmanian botanical literature. Despite the location of the site, it is unlikely that paranormal forces were responsible. The interactions analysed in this paper may occasionally occur elsewhere in southeastern Tasmania, as *Lepidosperma laterale* and *E. globulus* are commonly associated in grassy forests and woodlands. There may be fewer opportunities for similar events on the eastern Australian mainland, despite the widespread dominance of eucalypts in the landscape. Apart from other members of the *E. globulus* complex, there are no eastern mainland eucalypts with opercula approaching the size and mass of those of *E. globulus* (Brad Potts, pers. comm.). The Western Australian goldfields region may hold promise, with its rich heritage of large flowered Myrtaceae.

In an interesting adjunct to the situation described in this paper, the bodies of grasshoppers impaled on the leaves of *Lepidosperma* species have also been observed in the Midlands (Louise Gilfedder pers. comm.), suggesting that the taxonomic relationships between *E. globulus* and the order Orthoptera may require revision.

**Acknowledgements**

I thank Robyne Leven for field assistance, though I suspect that she did not appreciate the wider implications of our research at the time. Louise Gilfedder provided food for thought, and Rob Taylor had some useful comments on the manuscript, particularly in relation to future research requirements and priorities. I would also like to thank John Hickey for encouraging me to analyze and publish quantitative data on forest ecology.

**References**

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(This article is republished from The Tasmanian Naturalist 122, 2000.)

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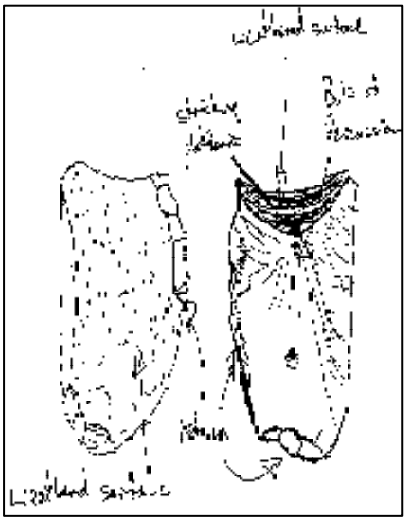
# Archaeology

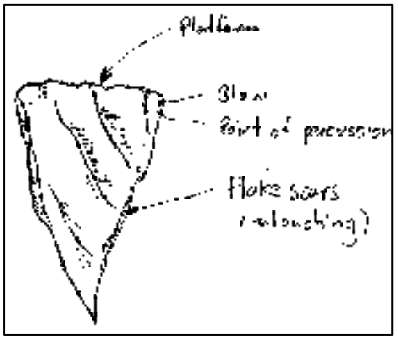
## Cultural Heritage Course 2000

*Denise Gaughwin, Senior Archaeologist, Forest Practices Board*

**A cultural heritage course was held in December 2000. Twenty four participants were involved over two two-day sessions held at Somerset and St Helens. Participants came from most forestry work places across the State and three staff of Mineral Resources Tasmania attended.**

They participated in a number of activities including lectures, workshops, field visits and site recording exercises. Stone tool making was one of the most popular of the lessons held. On the final competency test they were asked what they had learnt from this session. Most answers focussed on the difficulty of making an artifact and the increased sense of appreciation for the toolmakers of the past. Even the skeptics had to acknowledge that they could now identify the diagnostic features of a stone tool that clearly made it a manufactured item rather that a naturally fractured stone. The participants made drawings of the artifacts. Several are illustrated here showing the range of talent in the group.



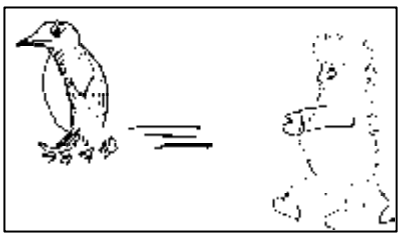



The course offered a mix of classroom teaching and field based exercises and visits to cultural heritage sites. While most of the participants appreciated the need for the formal class room lessons the field based activities were more appreciated. The most popular were the visits to the Aboriginal chert quarry at Parrawee and the historic tin mines on the Blue Tier.

It was a pity that group D got lost on their site recording exercise and recorded some races and forkings in the scrubbiest part of the Tier while the other groups provided excellent plans of the historic mine sites.

Participants were keen to complete the competency test at the St Helens venue but a photocopying error meant that this needed to be sent out for completion at the work place. Many commented that they found this test quite challenging. To provide a bit of light relief and to ascertain the attention skills of the students one test question was posed - "Why don't eskimoes eat penguins?" The answers make for interesting reading and some are presented here.

- Would you eat your cat?
- Penguins are part of their mythical religious beliefs and are therefore too important an icon to eat.
- The Eskimos can't afford the airfare.
- Too far to row to get a feed.
- Because they are slippery little buggers and too hard to catch as they live at the other end of the globe.
- Penguins taste like shxx.
- Because penguins are too high on the pecking order.
- Eskimos are a chocolate coated ice-cream without a stick.



- Penguins are too slippery to catch and don't taste nice.
- Because they run too fast.
- Bloody long way to go to get a feed.
- Penguin is a common name for flightless aquatic birds of the Southern Hemisphere. The name penguin was originally applied to the now extinct Great Auk of the North Atlantic, a large flightless black and white bird with an upright stance. So there are no penguins for Eskimos to eat.

Jokes aside, the enthusiasm and interest shown in this course was impressive. The participants were hard working and dedicated in their approach and are to be congratulated on their efforts. This was the first time that the course was run over two shorter sessions and the feedback on this was very positive. From the co-ordinators point of view it allowed a greater variety of choices for field visits and meant that people did not tire of the content.

Twenty two new cultural heritage trained staff are now competent to assist in the management of this part of the special values planning and management. If you missed this one you will have to wait two years until the next. Pencil it into your programme now!

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# Soils

## Subsurface stream channels in dolerite talus

*Peter McIntosh, Senior Soil and Water Scientist, Forest Practices Board*

**A feature of forestry coupes on dolerite terrain is that they frequently contain streams that flow partly or wholly beneath the soil surface.**

Such subsurface streams are especially common in areas that have thick deposits of dolerite slope colluvium or "talus", for example the Florentine and Styx valleys. The slope deposits mostly accumulated as coarse screes in cold dry glacial climates when slopes were largely unvegetated. Initially these screes were very porous, so it was natural that existing streams (probably carrying seasonal meltwater from high altitude snow) would flow between the rocks that constituted the screes. As the screes weathered over tens of thousands of years (and possibly >100 000 years for red-weathered deposits) most of the larger pore spaces in the screes got filled up with clay, producing the characteristic clayey soils in dolerite described in the book "Forest Soils of Tasmania". During this slow weathering process, however, the stream channels were able to keep to their subsurface courses, as weathered material was continually being washed away. The result is that the streams in dolerite talus still flow a couple of metres below the surface, sometimes in stony channels (Figure 1), and sometimes in conduits completely enclosed by clayey soil, probably following channels first occupied thousands of years ago.

Figure 1. Subsurface stream in dolerite talus in the Florentine Valley.

These streams generally cause few problems for foresters, except where road cuttings bring them to the surface. When road constructions staff come across these streams in cuttings, the question arises: how should the streams be classified – are they Class 4 streams, and how should they be treated?

The draft dolerite talus guidelines (Forest Practices News, December 1999) should be followed:

- Treat larger susbsurface streams as Class 4 streams, i.e. one culvert per stream, in line with stream.
- Avoid collecting more than 3 small subsurface streams into one culvert
- Avoid creating "new" streams by diverting subsurface drainage to a point where no stream (surface or subsurface) already exists.

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# Geomorphology

## Karst management: still plenty to learn

*Kevin Kiernan, Senior Geomorphologist, Forest Practices Board*

**The issues with which managers of karst terrain must contend are remarkably diverse and too often intractable.**

I was reminded of this recently when I attended an international karst symposium. Such gatherings are inevitably humbling experiences for two reasons. First one is reminded of the vast expertise and effort being brought to bear on karst issues around the world, and how very modest are our own contributions. Second, one is reminded how karst has such a sobering knack of responding to all this expertise and effort by still surprising us and sticking pins into the cockiness of any humans who become too convinced they are in control of the karst rather than vice versa, and who over step the mark.

A great diversity of karst types from many countries was considered at this conference which was organised by the International Research and Application Centre for Karst Water Resources with support from various agencies including UNESCO and several international scientific bodies. Just to give a very brief taste of the scope of the many thematic sessions….

1. *Karst and Sustainable Development, karst ecosystems, sustainability of karst waters, water quality and pollution in karst.* Papers from China, Iran, Malta, Italy, USA, Jordan, France and Tasmania (mine) addressing: landuse and integrated landuse planning; risk mapping; GIS applications; forestry bacterial contamination of ecosystems; effects on karst springs caused by thermal power plants; artificial recharge of aquifers; problems of

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storing surface water; particulate pollution caused by quarrying practices (don't buy Italian marble!); and means of inhibiting the infusion of oil into karst.

2. *Engineering problems in karst*. Papers from Greece, Yugoslavia, USA, Croatia, Iran, Boznia, Turkey and Spain on: leaky dams; dam foundation treatment; problems of accelerated sinkhole formation (in one USA case pumping of a well caused 700 sinkholes to form in just a few hours!) and related issues. The need for good hydrogeological maps was stressed, very relevant to our own activities in Tasmania. Incidentally, what do you do if limestone is too leaky to allow surface water storage for hydro-electric developments? Why, try storing it in the underground cavities in the karst somehow of course! Watch this space....and see if it dissolves any bigger?

3. *Exploration techniques*. Papers from France, Switzerland, India, Albania, Turkey and Yugoslavia on: studies of aquifer porosity; the significance of discharge rates of springs; use of electrical resistivity, electromagnetic response and seismic techniques; the relevance of fissures to karst permeability; methods of mapping submarine freshwater springs (a potential water resource); and using natural water tracers such as the time variations of common inorganic ion content of karst waters to characterise the hydrological function of karst aquifers. The problem that water tracing only tells you where the water goes underground and where it comes up again, not the exact route taken, raises its head again and again. But with floating geobombs linked to seismic gear on the surface. Sigh.

4. *Evaporite karst*. Contributions from USA, Canada, Ukraine, China, Sicily, Poland, Iran, Spain, Israel, Romania, UK, Austria and Siberia on the under-recognised topic of karst formed in gypsum and salt, the most soluble of all common rocks and more widespread than commonly recognised (underlies 35-40% of the contiguous USA), and hosting the same range of landforms and geohazards as limestone karst. Some limestone karst may be triggered by preliminary dissolution of evaporites.

5. *Karst hydrogeology*. Karst groundwater can be a very important resource, especially if environmental degradation allows more surface water to leak underground than occurred naturally – one single karst aquifer in Cyprus accounts for 25% of annual domestic water use. Understanding how much water is stored underground is critical. Delegates from Croatia, Turkey, Lebanon, Cyprus, Iran, France and Romania addressed: the applicability of stream classification schemes in karst; ground water supplies; impacts of intense drought; the behaviour of springs; statistical treatment of discharge figures; and GIS-based planning.

6. *Palaeokarst, palaeoclimate, palaeohydrology*. Present day karst landforms are just the latest crop produced by karst processes. Contributions from Azerbaijan, Bulgaria, Indonesia and Libya addressed aspects of karstification in the past under different climatic and hydrological conditions that have left a major geological legacy. Understanding these factors may sound a bit academic but it is important for management because these influences have commonly conditioned evolution of the karst with which we must contend today – and in the future.

7. *Regional karst systems*. While there are many unifying consistencies between karst areas around the world, and many fundamental requirements for sustainable management that are applicable to all karsts, at a more detailed level there is also tremendous diversity among karsts , much as there is great diversity within any plant or animal phylum. These sessions saw reflections of that diversity from the Phillipines, China, Spain, Belize, Uganda, Sudan, Egypt, Oman, Turkey, Yugoslavia, Libya, Albania, Germany, Hungary, Azerbaijan, Iran, Bulgaria, Hawaii and elsewhere. The focus was on the influence of karst evolution on the management issues that arise in these various environments: the significance of different types of limestone; the significance of tectonics; water budgets; the effects of drought on karst aquifers; groundwater recharge processes and rates; groundwater pollution; and groundwater policy. The management significance can be huge. For instance, karst aquifers provide over 95% of the water used in metropolitan Cebu, the second largest urban centre in the Philippines (population 1.3 million). The need for integrated environmental management of karst was a recurrent theme.

8. *Carbon cycle in karst and environment, karst hydrochemistry*. Contributions from Switzerland, Libya, UK, Croatia, Turkey, USA, Germany, Slovenia and Spain on the importance of karst geochemistry for determining long term erosion rates and processes of natural acidification of groundwater; determining different sources of groundwater; understanding seawater intrusion into karst aquifers; and addressing agricultural pollution and soils.

9. *Karst geomorphology and speleology*. Again a wide geographical spread – contributions from Canada, Belize, Switzerland, Turkey, Lebanon,

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Iran, Yugoslavia, Albania and India on: the relationship of limestone type to karst evolution; formation of natural subsurface pipes in karst; effects of tectonics; sea level change; cave studies from alpine zones to deserts; natural storage of water in the eipkarst (soil and uppermost limestone); and relationships between geomorphology, soils and vegetation.

10. *Geothermal karst*. While most karst forms by rock being dissolved by water that becomes acidified due to biological activity in the soil, acidic waters of geothermal / volcanic origin are these days more widely acknowledged to have played a role in some cases. Understanding these processes and their outcomes is important to correctly interpreting and managing karst. Contributions from Vietnam, Turkey and Yugoslavia related to tectonic relationships and the diversity of geothermal impacts. In Turkey some karsts contain waters at 41° C on the surface and 80-120° C in subsurface reservoirs. In Vietnam the chemistry of some cave waters is related to geothermal influences and the underground intrusion of seawater to karsts several kilometres from the coast.

11. *Modelling*. A scattering of papers from Germany, China, Serbia, Iran and elsewhere on modelling: of the earliest phases of rock dissolution; of the flow of exploitable groundwater; and of contaminant flow.

12. *Remote sensing and GIS*. Some interesting contributions from Turkey, Iran and Malta: mapping karst units; identifying karst geohazards (water loss, flooding, pollution); and resource assessment and planning.

Fresh sinkholes are uncommon where forest vegetation remains, but are relatively common following forest removal.

All in all, the conference reinforced recognition of the mind boggling range of considerations with which karst managers can be confronted. Although these twelve thematic programs were structured as discrete units, the linkages between them were constantly apparent. And while the focus of this meeting remained largely on the geosciences, the inadequacy of that particular family of sciences to single-handedly understand and resolve the myriad of issues that arise in karst management was widely acknowledged- for instance, connections to fauna in caves and karst botany were barely touched upon, let alone cultural heritage or the inspirational and spiritual values for which some karsts are important in various parts of the world. The need for interdisciplinary studies and integrated management of karst issues is beginning to emerge very strongly and is increasingly reflected in the focus of new international research programs and conferences now scheduled for various parts of the world over the next few years.

A whole-ecosystem approach to karst studies and management, integrated management and long term sustainability are the themes now gaining ascendancy internationally. We are fortunate in Tasmania that we do not have the population pressures and the sometimes horrendous legacy of centuries of karst mismanagement with which people in some other parts of the world have to contend. But there is nothing fundamentally different about Tasmania's karsts that would not permit our karsts to rapidly go the same way if we fail to manage them properly. Succesful management rests on the intelligence and good will of informed decision makers. The adequacy of the information upon which the manager of karst or any other natural resource must rely depends on their society's commitment to ensuring an adequate level of research. Many countries much poorer that ours are making research investments much larger than those that are being made here. It is up to us whether we want to get it right at the outset or end up accelerating along the same expensive downward slide of karst degradation.

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