The tenuous tuart

by Drew Haswell and Alan Walker

Since the mid-1990s there has been growing community concern about the noticeable decline in the health of tuart trees south of Mandurah. The State Government's Tuart Response Group (formed in November 2001) is working with local communities to plan and implement the conservation and management of tuart trees and ecosystems, and to investigate the causes of tuart's decline.

Tuart (*Eucalyptus gomphocephala*) is found only on the Swan Coastal Plain, growing from Jurien Bay in the north to the Sabina River, east of Busselton, in the south of Western Australia, and is generally confined to limestone soils close to the coast. It is estimated that before Europeans arrived there were more than 111,600 hectares of tuart woodland. Most of these were later cleared for agriculture and urban development.

In recent years, reductions in the health and vitality of some remaining tuart woodlands at Yalgorup, south of Mandurah, has highlighted the need for a comprehensive conservation and management strategy for all tuart ecosystems. Likely threatening processes include climate variability, changed hydrology, altered fire regimes and repeated attack by insect wood borers. Little is known about the tuart's requirements for nutrients, or the role of soil-borne fungi.

Early descriptions

Tuart specimans were first collected from Geographe Bay and by the French explorer Leschenault in May 1801, and the name later published in 1828. Descriptions of tuart woodlands were undertaken soon after European settlement of WA's south-west. In 1831, Lieutenant William Preston described the Vasse estuary area:

> 'The country passed over this morning was beautiful, resembling a fine Park in England, with excellent timber, five or six to the acre.'

Later that year, John Bussell wrote:

> 'A farmer could hardly grudge the fine spreading trees of red and white gum and peppermint the small portion of the ground they occupied, with an understorey typically of bright scarlet and yellow flower, daisy, buttercup and a purple marigold'.

In 1836, Lieutenant H W Bunbury described the Lake Preston Capel River area as:

> 'Open country with a good deal of grass growing on a light soil under very large white gums called ... "tooarts".'

Sixty years later, in 1896, pioneer forester John Ednie-Brown wrote of the Ludlow area as:

> 'Limestone country with tuarts dotted in a parklike fashion, and occasional brakes of peppermint (*Agonis flexuosa*) ... and a rich carpet of annual grasses.'

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Large mature tuart tree at Manning Lake, Perth.
Photo – Jiri Lochman

Left Tuart grove within Woodman Point Regional Park south of Fremantle.
Photo – Sallyanne Cousans

Scales of mapping

State scale In 1964, the Director of the Kings Park and Botanic Garden, Dr J S Beard and others, initiated a project called the Vegetation Survey of Western Australia that was later published as a map series between 1979 and 1981. All vegetation in the State was classified according to dominant ecological structural units. The study defined the original pre-1750 extent and identified six broad dominant types for tuart on the Swan Coastal Plain from Moore River to Busselton.

Regional scale In 1983 the then Department of Conservation and Environment mapped vegetation communities of the Swan Coastal Plain as part of the review of conservation reserves within the Darling System 6 area. Geology, landform and soil values, climate zones and plant descriptions were used to determine the communities. Tuart woodlands were defined as part of this project.

Local scale In 1996 the Department of Environmental Protection and others used survey plots to assess the occurrence of local tuart populations. As expected, tuart occurs in a variety of floristic populations across its range including wetlands and uplands. Only in the southern tuart and peppermint woodlands of the Spearwood Dunes, and the tuart and/or peppermint woodlands of the Quindalup Dunes is tuart a defining species.

Noted botanists Greg and Bronwen Keighery have written that the most likely original vegetation in the Ludlow area was:

> '... a tall open forest to tall open woodland. In the southern area ... it appeared that tuart grew over scattered trees of *Agonis flexuosa* and *Banksia grandis* over low mixed shrubland over sedges, grasses and herbs. Towards the north, shrubs and *Banksia attenuata* became more common on the northern sandy rises.'

Tuart communities

Tuart is mostly confined to two coastal sand dune formations, the Quindalup Dunes and the Spearwood Dunes found to the north and south of Perth, although there are outlying populations near the Moore, Swan, Canning, Murray, Serpentine and Harvey rivers. There is also an interesting historical report, by Surveyor-General Vernon Fyfe, of tuart having once occurred on the Arrowsmith River, near Three Springs. Fyfe's report is supported by a specimen collected and lodged in the Melbourne Herbarium (circa 1840) by the botanist Augustus Oldfield, that was obtained near the Arrowsmith River.

The distribution of tuart and the vegetation in which it grows have been considered in a series of studies at a State scale (dominant ecosystems), regional scale (vegetation communities), and local scale (floristic populations)—see box on page 56.

Tuart has wide environmental tolerance and occurs in a variety of situations across its range, including fresh, brackish and naturally saline wetlands and upland limestone ridges. The occurrence of tuart in plant communities on the Swan Coastal Plain demonstrates a high reliance on soil type and rainfall.

There are 414 native flowering plants recorded within tuart woodlands, including 38 species of orchids. The wildlife of tuart woodlands is not well documented. Present research has recorded 158 species, including 92 bird species, 43 reptile species and seven species of frogs. In particular, 16 of the 35 Swan Coastal Plain's mammal species live in tuart woodlands, with the western

ringtail possum and the common brushtail possum well represented in the tall tuart-peppermint woodlands of the Ludlow area.

Invertebrates, the most diverse component of terrestrial ecosystems, are poorly known for tuart. They are vital to the ecology of the areas they inhabit, being the chief food of many birds, reptiles, amphibians and mammals. They also perform other essential functions such as recycling nutrients, pollinating plants and keeping nature in balance by supporting important predators and their parasites.

Tuart conservation and protection

Most tuart woodlands have been cleared for agriculture and urban development. The remaining tuart woodlands now occur equally on Crown and private lands, some of the latter being included in LandCare and Land for Wildlife programs. Prominent stands are found at Ludlow, Yanchep and Yalgorup national parks. Significant tuart woodlands are also located in Bold Park, Kings Park, Neerabup National Park, the Trigg Dune bushlands, the Leschenault Peninsula Conservation Park and The Maidens (south of Busselton). Tuart also occurs in Bush Forever sites at Yanchep, Woodman Point Regional Park and Lakes Cooloongup and Walyungup. Smaller remnants of tuart are scattered across its natural range.

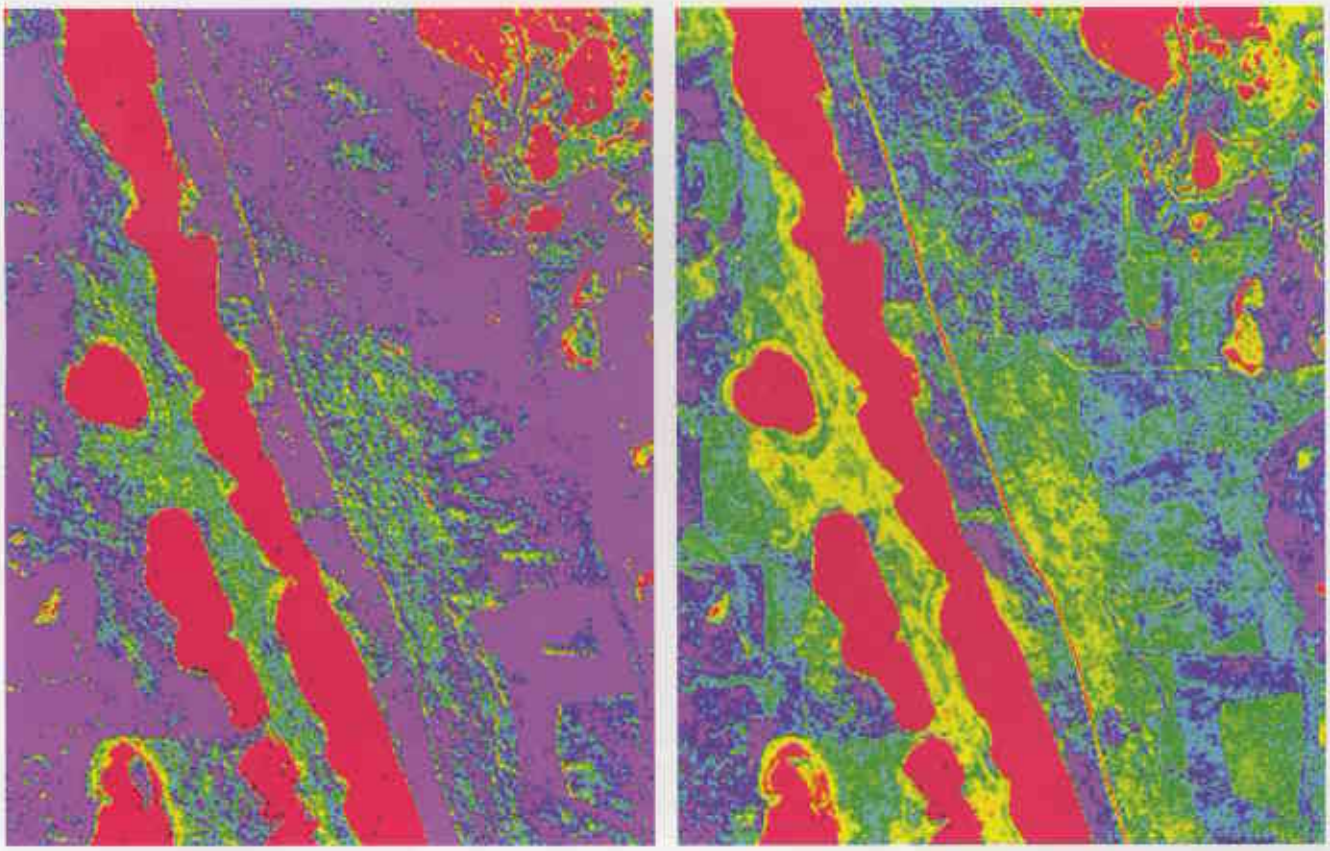
The conservation and management of tuart ecosystems is provided at three levels. The first and primary means is the existing system of secured reserves on the Swan Coastal Plain. Tuart's reserve status was last assessed in the early 1980s, as part of Conservation Reserves for Western Australia Sytem Six. The adequacy of tuart reservation requires further refinement in line with nationally agreed criteria for developing a comprehensive, adequate and representative reserve system.

The second level ensures that activities that may disturb tuart ecosystems outside reserves are carefully considered and, where possible, complementary to the objectives for tuart conservation and management within reserves. This level relies on effective statutory processes for controlling clearing and retaining native vegetation on lands intended for development. Sound tuart management and effective partnerships on freehold lands are also important at this level.

Because tuart woodlands are now remnants of their original (pre-1750) extent, a third level of conservation and management is necessary to protect plant and animal species, ecosystems and communities that have gone beyond the reach of the above two levels of protection, or where their survival is likely to be threatened. Management strategies aim to protect threatened plants, animals, ecosystems and communities, and control the impact of threatening processes.

Above left The western ringtail possum is an important mammal species of tuart woodlands.
Photo – Geoff Taylor/Lochman Transparencies

Left Dying tuart, Peppermint Road, in Yalgorup National Park.
Photo – David Mitchell



Above The above LandSat TM images show vegetation changes between August 1999 (above left) and November 2000 (above right). These figures have undergone preliminary analysis to contrast categories of tuart crown decline. The speckled red areas are dead tuart crowns (note that full colour equates to open water). The yellow represents bare branches and sparse crowns. Blue shows receding crowns and green represents full crowns. The areas of purple are those for which no interpretation is available.
Source – Li Shu

Right Tree borer feeding on a eucalypt flower.
Photo – Jiri Lochman

Since the mid-1990s, there has been a noticeable decline in the health and vitality of tuart trees, associated with chronic insect infestation, in the Yalgorup area. The reason(s) for the decline are not totally clear as there are a number of contributing and inter-related factors involved. Potential influences include the ongoing reduction in winter rainfall, changed hydrological and salinity factors near wetlands, soil type and nutrient supply, altered fire regimes, changes in the ecological balance between insect wood borers and their predators and parasites, competition with understorey species, land clearing and roadworks. It is likely that the insect attack is a secondary phenomenon that becomes significant once the trees have been weakened by other factors. Satellite remote sensing tools are being developed to monitor changes in the extent and the health of tuart trees.

What's being done

Government and community-based action is now under way to investigate the causes behind this decline in tuart health, and to devise a strategy and action plan for conserving and managing the tuart woodlands. As an initial step, the Minister for the Environment and Heritage established the Tuart Response Group in November 2001. The main work of the group is to use its combined resources and knowledge to investigate the hierarchy of causes behind the observed decline in tuart, to devise a tuart conservation and management strategy and action plan, and to compile educational material for individual landowners and the community to help combat the decline of tuart trees.

In August 2002, the Tuart Response Group released the *Status report for tuart conservation and protection*. It provides the latest information on tuart woodland communities, conservation within and outside reserves, tuart research and future management directions. That status report was developed to guide community input during the preparation of the Government's tuart strategy and action plan later this year. In October 2002, the group conducted seven stakeholder and community workshops between Lancelin and Busselton. These identified a range of tuart conservation and management concerns and issues, and will also assist the preparation of the strategy and action plan.

A Tuart Science Workshop was held

by the group in July 2002, to evaluate future research needs. Its purpose was to involve Government agencies, the scientific community and industry in the development of research priorities and actions for the sustainable management of tuart woodlands.

The group successfully collaborated with universities and industry in obtaining Australian Research Council funding for tuart research from July 2003. The three-year research program includes tuart vegetation system health modeling, eco-hydrology, investigation into pests and diseases, and the role of understorey competition in tuart health and regeneration. A tuart research business plan is now being prepared.

The Tuart Atlas

A key action undertaken by the Tuart Response Group has been to develop an 'atlas' to provide a more accurate assessment of tuart occurrence and the condition of its associated understorey.

The 'atlas' mapping process shows that there are now around 29,500 hectares of tuart woodlands on the Swan Coastal Plain. This compares with 38,829 hectares that were previously mapped in 1979. Mapping of tuart in 1979 was done at a scale of 1:250,000. The latest 1:10,000 fine scale mapping used high resolution aerial photography and more up-to-date computer mapping technology. The earlier mapping was part of a project that classified Western Australia's entire vegetation, whereas the new mapping focused only on tuart woodlands in the coastal strip between Lancelin and Busselton.

While some tuart may have been cleared since it was mapped in 1979, the 'atlas' shows that areas previously mapped as tuart are, in fact, other woodlands of the coastal plain. This occurred because the State-scale mapping, by definition, regionalised the patches that have been identified through the finer-scale atlas mapping. At the same time, the 'atlas' has revealed new tuart patches that had not been identified by the previous mapping. This includes some interesting occurrences on the Quindalup Dunes south of Bunbury, and at Woodman Point. While it means that tuart's extent is less than previously thought, the priority now is to work with the community to develop strategies and actions that ensure remaining tuart woodlands are properly conserved and managed.

The Tuart Atlas will contribute to recommendations for additional tuart conservation reserves, and identify special protection and management links between tuart in reserves and tuart on freehold land.

Conservation and management strategy

Currently, there is no specific document identified as the State's tuart conservation and management strategy. Tuart woodlands are managed in parks, forests and reserves by the Department of Conservation and Land Management. Tuart is also managed in other significant reserves by the Botanic Gardens and Parks Authority and by local authorities. Some tuart woodlands on private land are included in LandCare and Land for Wildlife programs.

Below Dead and dying tuarts at Lake Preston, in Yalgorup National Park, one of the worst affected areas.
Photo – David Mitchell

Above Tuart woodland from White Hill in Yalgorup National Park. The trees are kept low by salt winds.
Photo – Robert Powell

Right The short-billed black cockatoo is a key bird species of tuart woodlands.
Photo – Jiri Lochman

One of the newer means of conserving tuart is through the growing system of regional parks around Perth, Bunbury and Mandurah. Regional parks such as Yellagonga, Beeliar, Woodman Point and Rockingham Lakes, and the proposed regional parks at Peel and Bunbury, will assist in the protection of important tuart woodlands in urban areas.

The call for a comprehensive conservation strategy for tuart trees, ecosystems and associated communities requires the development of integrated and cooperative conservation and management approaches, to complement programs in existing reserves. The Government's strategy and action plan will enable the community to be more aware of tuart (see 'Cherish the Tuart', *LANDSCOPE*, Autumn 2003), and more involved and supportive of its conservation and management. The plan will promote partnerships with community groups having differing interests in tuart woodlands, and ensure tuart ecosystems are identified and adequately represented and managed for conservation within and outside reserves. It will also ensure that significant stands and specimens of tuart trees outside conservation reserves are retained and appropriately managed. It will introduce research-based support to minimise the impact of processes that threaten the health of tuart trees and ensure that accumulated knowledge leads to improved tuart management.

Hopefully, this important work will lay the groundwork for conserving the tenuous but magnificent tuart for future generations of not just people, but the other plants and animals that are associated with tuart woodlands of the Swan Coastal Plain.

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To view the *Status report for tuart conservation and protection*, the *Tuart communications and public involvement plan* and other tuart programs, visit the NatureBase website (www.naturebase.net).

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