For a deeper knowledge of the forest...

Books, journals, papers . . . ho hum. Bryony Bennett discovers a more compelling way to convey scientific findings.

I'm standing high on the Great Escarpment, midway between Canberra and the coastal town of Batemans Bay. The terrain is steep and rugged, dissected by deep valleys, rivers and creeks. Above me tower messmates (*Eucalyptus obliqua*), mountain grey gums (*E. cypellocarpa*) and narrow-leaved peppermints (*E. radiata*), their leaf litter carpeting moist, clayey soil beneath my feet.

Curious about the hills nearer Batemans Bay, I turn to my satellite image and select a site to the south-east. Seconds later, I'm sitting on a granite boulder, shaded by red bloodwoods (*E. gummifera*) and silvertop ash (*E. sieberi*), and gazing back at the escarpment's sapphire hues.

At this point I must confess that I'm not in the forest at all, but sitting on a chair in my office: grey walls, no views and no vegetation. Before me is my computer, running a CD-ROM called Remote Sensing of Forest Vegetation, Batemans Bay, NSW, Australia.

The CD-ROM was designed and created by Dr Nicholas Coops and Andrew Bishop from CSIRO's Division of Wildlife and Ecology as part of an international program involving researchers from Japan, China, Thailand, Indonesia and Australia. The five-year program is called the Global Research Network System and aims to develop datasets on meteorology, desertification, coral reefs, ocean colour and vegetation to help understand and document processes that affect the Earth's environment.

CSIRO's contribution to the program's vegetation component has been to promote the use of satellite-sensing technology in the assessment of forest vegetation. Forest productivity can be monitored through variations in the intensity of satellite signals received in red and infrared regions of the electromagnetic spectrum. For example, reflectance in the near infrared band is higher in vegetation that is growing rapidly.

Coops says satellite sensing is widely used for forest assessment in Canada and the United States, but in Australian and Asia-Pacific regions, aerial photography is still preferred. This is partly because satellite data can be complex to interpret, requiring special training and expertise. One way to help bridge this gap, Coops decided, was to demonstrate how satellite data could be applied in a typical forested region.

The Batemans Bay region was chosen for the study because it features a range of forest types and disturbance levels (due

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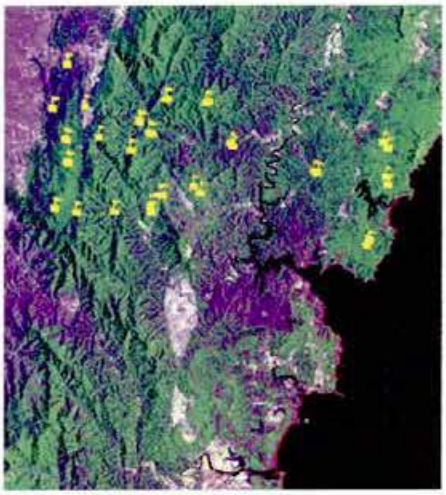
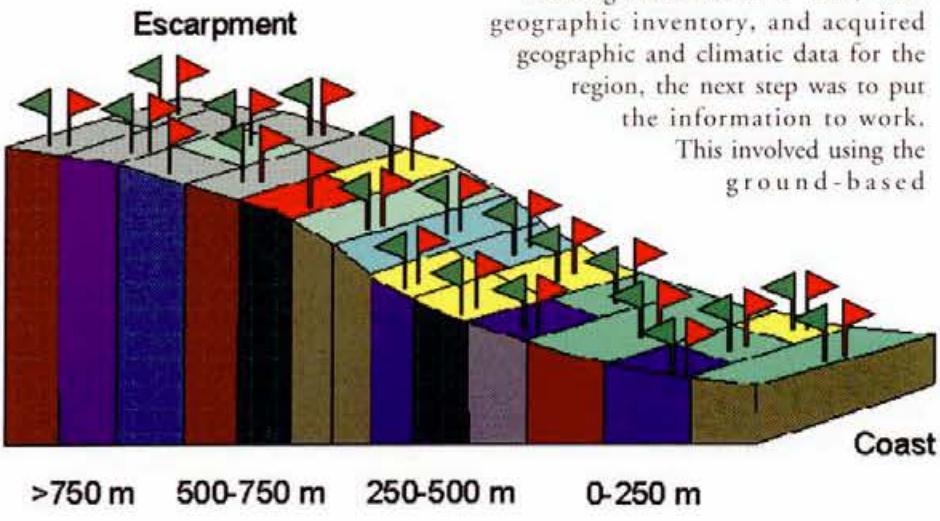


Each of the 42 survey plots can be selected from a three-dimensional transect, or from a satellite image of the region. (Landsat TM data provided by the Australian Centre for Remote Sensing.)

to logging and fire). During 1994 and 1995, 42 field plots in the area were surveyed. In addition to topographic features such as altitude, slope, aspect and soil type, measurements indicative of forest productivity were recorded. These included dominant tree species, their height and density, canopy density and basal area. The plots also were graded for disturbance.

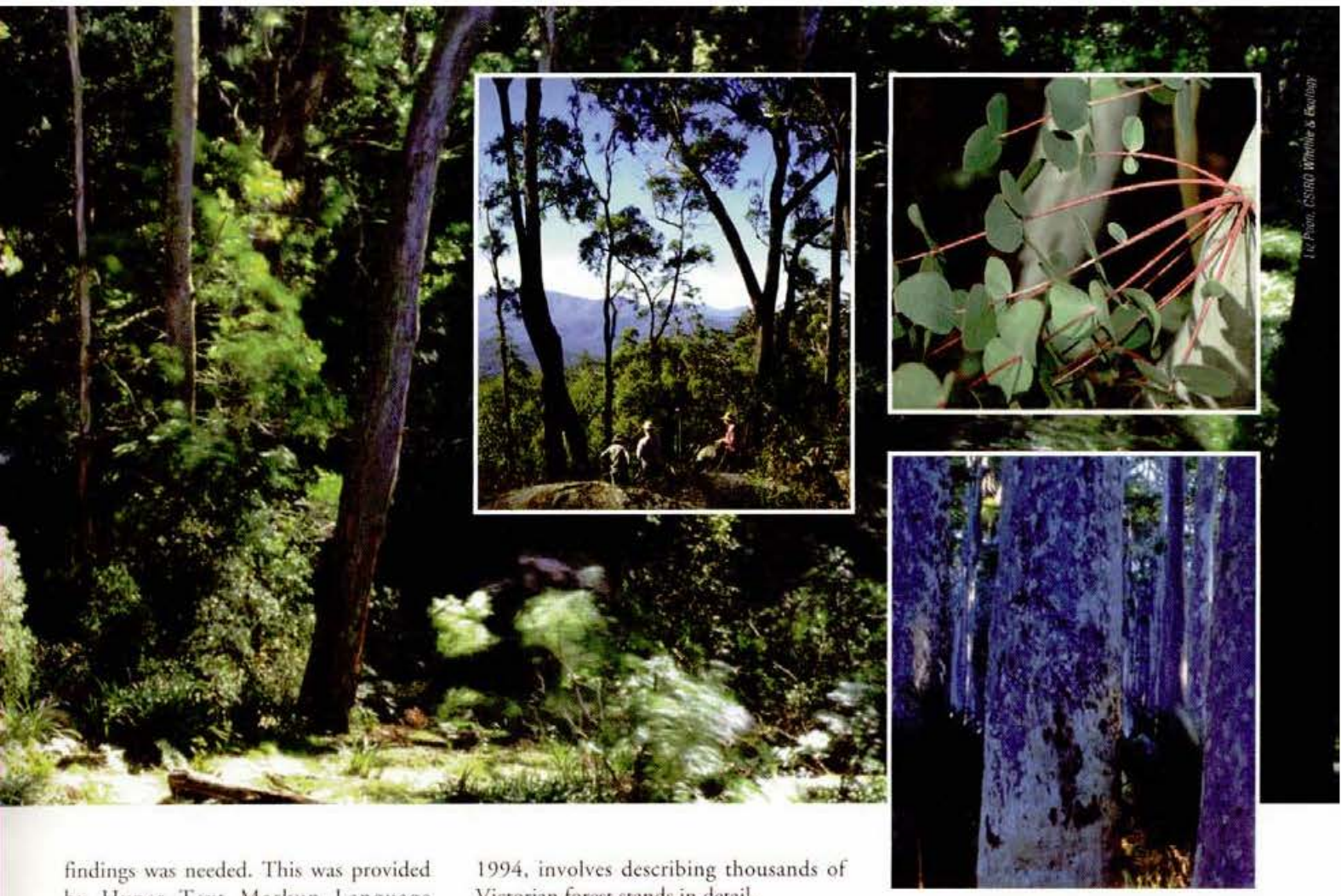
Having amassed this vast, bio-geographic inventory, and acquired geographic and climatic data for the region, the next step was to put the information to work. This involved using the ground-based measurements to investigate how variations in forest structure related to variations in remotely-sensed data for the same locations. In this respect, the project served a dual purpose, offering CSIRO's satellite-sensing specialists the opportunity to test and improve their data-interpretation techniques, as well as conveying their knowledge to others.



For example, statistical models have been developed relating the satellite responses and bio-geographical data to forest growth in the region. These models provide information to forest managers about the state of the forest resource for both conservation and wood production. The models incorporate data from satellites which image the Earth at a coarse spatial scale (one kilometre) through to satellite data collected in very fine detail (10 metres). Adapting the models to account for these variations in scale was one of the study's challenges. Another was to investigate the temporal variation in satellite data. 'Satellites have been viewing the Earth since the beginning of the space race and provide an immensely valuable archive as to how the forest has changed and grown in the past 25 years,' Coops says.

Communicating the findings

With the case-study finely tuned, an effective vehicle for communicating its



I.C. Peters, CSIRO Wildlife & Ecology

findings was needed. This was provided by Hyper Text Markup Language (HTML), a format enabling information to be presented as text and tables, clickable pictures, images, maps, photos and hyper-text links, offering many pathways through myriad data. And because HTML is the format used to present files on the Internet, the study results can be viewed by forest managers, other scientists and 'surfers', worldwide.

'Many forest agencies have access to similar kinds of data, but would never have pulled it all together in this way,' Coops says. 'The CD-ROM provides a great medium for showing the potential of remote-sensing which is much more fun than wading through a stack of dry, research papers. Already more than 400 copies have been sent to researchers and forest agencies overseas.'

The Batemans Bay CD-ROM has impressed foresters in Australia too, particularly as a means of making forest inventory data accessible to more people. Staff at the Forest Management Branch of Victoria's Department of Natural Resources and Environment are compiling the first statewide inventory of Victoria's 3.5 million hectares of public native forests. Team leader for Forest Growth and Yield, Fiona Hamilton, says the eight-year project, which began in 1994, involves describing thousands of Victorian forest stands in detail.

'In the past, data of this kind would sit here in a central database, accessed only by key clients and senior managers,' Hamilton says. 'But the information is also of interest to academics, students and researchers. We had been thinking that the data could be made more accessible on CD-ROMs, and the Batemans Bay project has shown how the various types of information can be brought together.'

Hamilton says aerial photography, rather than satellite sensing, is being used to compile the forest inventory. 'Our interpreters can't get the same discrimination of species from satellite data,' Hamilton says. 'But we are looking at how we can use a range of remotely-sensed data in the future.''

A click closer to reality

But the CD-ROM is more than a tool for the technicians. It's a terrific resource for anyone keen to learn more about forest structure. Desk-bound tourists can take a swivel-chair ride through the forests, either by clicking on a list of study plots, or by choosing sites from a satellite image showing the entire region's topography. From here they can be transported to any one of the 42 survey plots in a range of landscape zones, accompanied by site descriptions. And by clicking on the photographs at each site, tree species are identified, illustrated and described, including their environmental preferences and maps of their potential and present range. GIS data covering rainfall, temperature, radiation and lithology are available too.

Now I'm in the coastal lowlands, standing right in front of a solitary, fire-scarred blackbutt (*E. pilularis*). Surrounding us is a stand of spotted gums (*E. maculata*), their mottley grey trunks rising from dry sands high into the glossy canopy. . .

The CD-ROM of this research is available on the World Wide Web at: http://www.dwe.csiro.au/research/forest/bbproj. Contact Dr Nicholas Coops, CSIRO Multi-Divisional Program on Forest Productivity, PO Box 84, Lyneham, ACT 2606, (06) 242, 1600, fax (06) 241 3343, email: N.Coops@dwe.csiro.au.

Top left: The view from plot 17NW.

Top: Regeneration after fire. The burning and logging history of each plot is given, enabling recovery rates to be assessed.

Above: A close up of *Eucalyptus maculata* bark, one of many types featured in the Bateman's Bay CD-ROM.