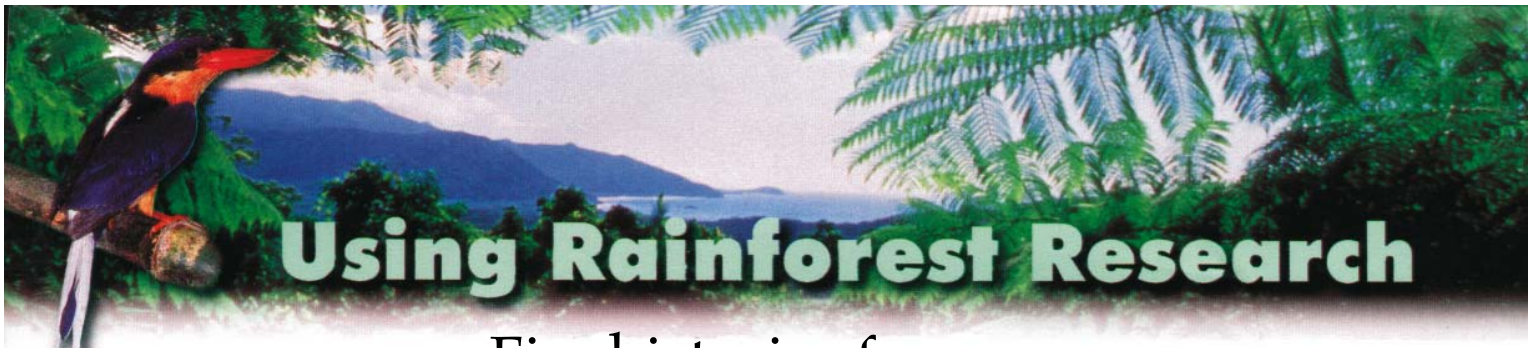


# Using Rainforest Research

## Fire histories from space

*February 1998*

Concern for the maintenance of the biodiversity of the wet sclerophyll forests in the wet tropics has sparked a series of investigations into the vegetation and faunal dynamics of these forests. One such investigation used satellite images to map fire scars in wet sclerophyll forests.

Looking at the areas which have been burnt over a period of time will give scientists an idea about present day coverage and species make-up. This information could contribute to designing optimal burning strategies to maintain the wet sclerophyll forests. Many land managers believe that effective fire management schemes are essential in maintaining a diverse 'mosaic' landscape of vegetation communities and the species which rely on them.

Wet sclerophyll forests occur as a 400km discontinuous strip along the rainforest margins on the western side of the Wet Tropics World Heritage Area (WTWHA). These forests grow where the soil and climate would usually support rainforest were it not for the influence of fire. While they are estimated to cover 82,800 hectares, these open forests are under considerable threat from the expansion of the closed forest vegetation we know as rainforest. Aerial photographs taken in 1943 were compared with photographs taken in 1992 and revealed that 69% of the wet sclerophyll forests have been invaded by rainforest.

Dr Graham Harrington and his research team from the CSIRO Tropical Forest Research Centre in Atherton have been working to develop improved fire management techniques by compiling fire histories of specific regions. While satellite images have been used to map fire scars in the Northern Territory, no image processing techniques have been developed for the purpose of mapping fire scars in the wet sclerophyll forests and rainforest ecotones. That was until Honours student Mark Noonan initiated a pilot study using satellite imagery to identify burnt vegetation and map the fire scars of the Koombooloomba region.

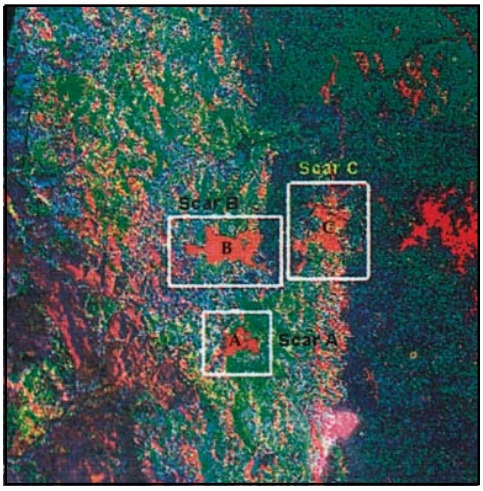



*Figure 1 Image from 29 Sept 1996*

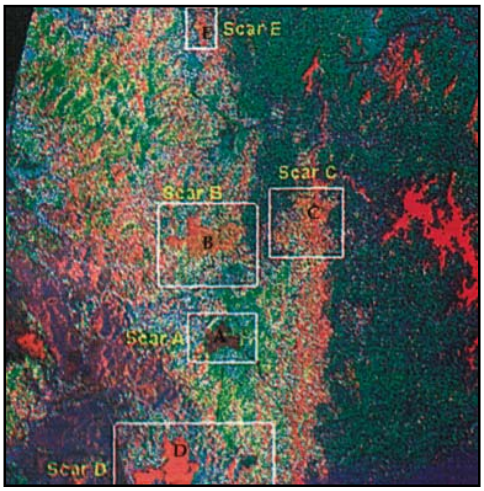


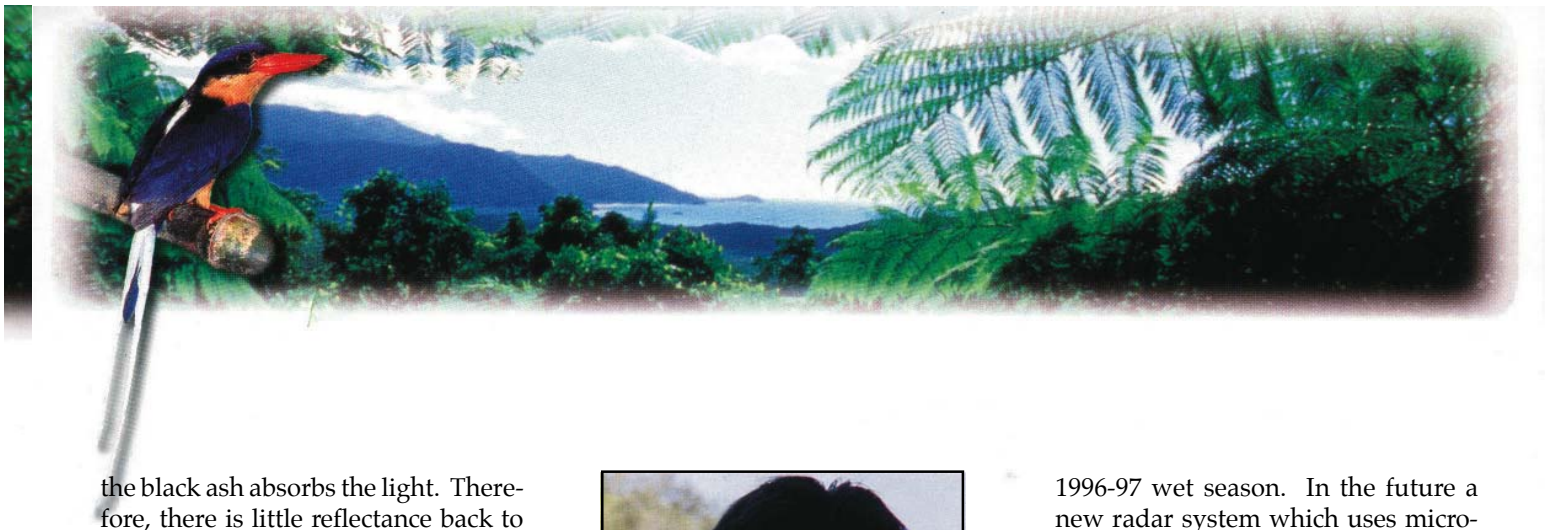

*Figure 2 Image from 16 Nov 1996*

*On these satellite images, the fire scars (A,B,C,...) are red to orange, depending on the age of the scar, with red representing the most recent fire. The pink area delineates Koombooloomba Dam and the dark green areas on the right depict closed canopy rainforest. The wet sclerophyll forest to the west of the rainforest is pale orange and the open woodlands, in yellow, lie to the left. The streak of purple at the bottom of figure 2 is the smoke from a fire which was burining on 16 November 1996.*

**What are fire scars and what do they tell us about the fire?**

Before explaining this, it would help to understand what type of information the satellites are retrieving. Satellites do not just take pictures, in this particular case they are looking at the 'spectral reflectance values' of the fire scars. In other words, the satellites receive data on what is reflected from the Earth's surface. In the electro-magnetic spectrum (infra-red to ultra-violet), red light is absorbed by plants because of the chlorophyll and other photosynthetically active materials from the leaves, while near infra-red light is reflected. Rainforests reflect more infra-red than open woodland forest because of the closed canopy and the amount of chlorophyll in the leaves is higher.

Fire scars which appear on satellite images can give indications of the time, extent and intensity of the fire. When an area of vegetation is burnt,

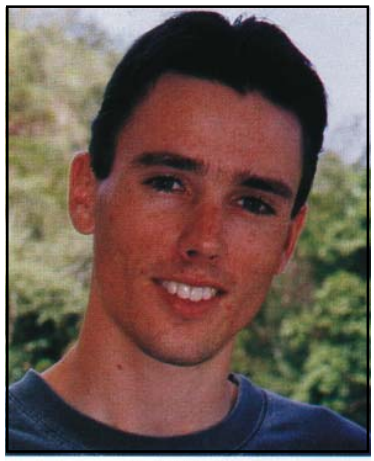


the black ash absorbs the light. Therefore, there is little reflectance back to the satellite. This shows up on the satellite image as a prominent spot amongst the surrounding vegetation. The darker the colour of the spot, the more intense the fire because there is less healthy vegetation to absorb light.

Fire scars mapped from satellite images provide an accurate assessment of the area of forest which has been burnt, no matter what its shape. However, it can sometimes be difficult to determine if weaker scars represent regeneration from an old fire or a low intensity fire is where the canopy remained intact.

Mark selected Landsat Thematic Mapper ™ satellite images which were taken before and after a major fire event, which burned between the 20 and 27 September 1996. The fire scars appear orange to red in the RGB (red, green and blue) false colour composite images in Figures 1 and 2. The Koombooloomba Dam appears as a red to pink region in the central right of the images, rainforest as dark green regions along the right section, wet sclerophyll forest as orange and open woodlands covering the left section. Fire scars in the savanna, open woodlands and wet sclerophyll forests provided a variety of contrasting environments for the evaluation of these techniques.

Low to medium intensity fire scars in the wet sclerophyll were sometimes difficult to delineate. With these types of fires the canopy had remained intact, which reflected the infrared be-



*Mark Noonan*

cause of the leaf cover. Similarly grass regrowth in the wet sclerophyll forests which occurred after the fire, between the 29 September and 16 November 1996 satellite Passovers, made it nearly impossible to delineate the fire scars because of the increased reflectance from the new grass.

Fires which had also occurred in other parts of the region during this period are evident as bright red spots in the bottom section of the 16 November 1996 satellite image (Figure 2).

In order to test the accuracy of the information collected by satellite images, Mark conducted vegetation surveys of the burnt areas. He found that 90% of what had been mapped from the satellite images in Scar B and 64% of Scar C was actually burnt.

Another challenge with relying on satellite technology is that clouds obstruct the images. In fact, Mark was not able to get an image again until after the 1996-97 wet season. In the future a new radar system which uses microwaves (voids out cloud cover) may be used to build fire histories but since it is an untested technology and more costly, the Landsat imagery will suffice.

Mark's pilot study demonstrated that visual and digital analysis of Landsat TM data produces adequate fire scar maps for the compilation of fire histories for wet sclerophyll forests. The study also showed that satellite imagery analysis can help scientists monitor post-fire regrowth, an important step in the assessment of contemporary effects of fire on vegetation dynamics. While, more extensive field work to 'ground-truth' the fire scars will be needed, this technique will certainly give a clearer understanding of the fire processes which occur in the area.

**For more information**

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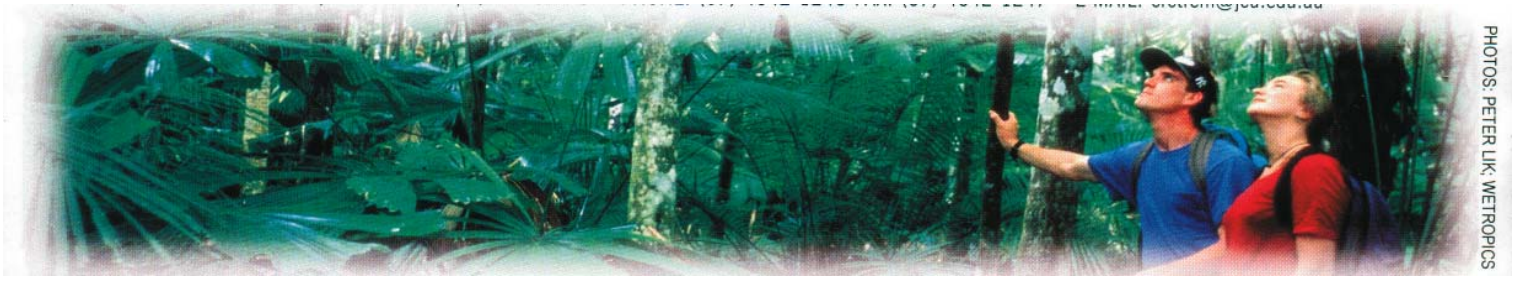

PHOTOS: PETER LIK: WETROPICS