Transecting the Top End

DRIVING for hours down bumpy, outback roads to get to work might seem tough to some of us. Others might call it a dream come true! But when your 'office' begins at Darwin and extends 1000 kilometres south into the navel of the Northern Territory, commuting means packing the camping gear and slipping into 'four-wheel-drive'.

The elongated office, called the North Australia Tropical Transect (NATT), is really just a vertical line on a map of the Northern Territory's 'Top End'. It has special significance though, because it stretches the length of Australia's savanna country, transecting all its ecosystems: tropical ocean; coastal flood plain; monsoonal savanna; woodland; and semi-arid shrub land. This makes it an ideal base for broad-scale ecological studies.

During the past 18 months, researchers from the Division of Wildlife and Ecology have ventured up and down the transect, marking out 45 study plots, building fences, collecting samples and assessing soils and vegetation.

The activity is part of the Savanna Ecology and Land Condition Project, led by Dr Garry Cook and Dr Dick Williams from CSIRO's Tropical Ecosystems Research Centre at Darwin. The project is being conducted by CSIRO in collaboration with the Conservation Council of the Northern Territory and the NT Department of Primary Industries and Fisheries, and is funded by the Land and Water Resources Research and Development Corporation.

Cook says the landscape of north-west Australia has changed relatively little since European settlement. Thus there is an opportunity to learn from the mistakes of southern and central Australia to ensure that economic development in the north does not degrade the land. The savanna project will aid this process by producing a framework for identifying the fragility of different land types.

Developing the framework involves defining how soil type and rainfall affects vegetation, and then rating associations of soil, rainfall and vegetation for their susceptibility to degradation relative to land use. Observing how degradation occurs will provide a basis for identifying early warning signs in susceptible land types. It will also determine the effects of grazing. This is important to restoration techniques.

Investigating the PAM/AN plane

Answers to three basic questions are being sought during the project. The first two involve evaluating an established method of predicting the behaviour of savannas, called the PAM/AN plane.

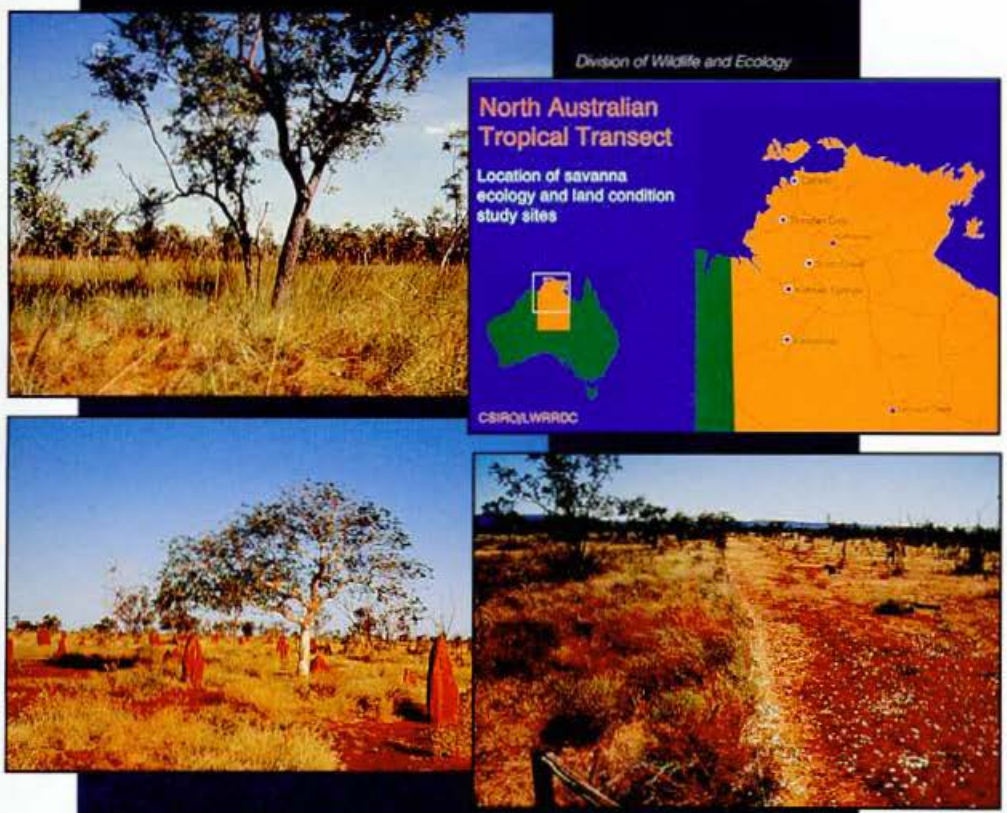
Savannas exist in various stable or semi-stable states which can change in response to disturbance. Scientists hypothesise that the way savannas respond to disturbance depends on the extent and variation of plant available moisture and available nutrients (the PAM/AN plane). Any given point on the PAM/AN plane approximately responds to a combination of a particular soil type at a particular level of mean annual rainfall.

The first question is whether the structure, composition and growth of plants in different landscape types can be accounted for by their location on the PAM/AN plane. The second is whether grazing in a range of landscapes affects the PAM/AN location of any landscape, and if so, whether that change affects plant performance. And finally, can the observed responses of savannas to grazing can be attributed to changes in soil water nutrients? To answer these questions, the scientists are studying landscapes at five locations along the 1000-km transect.

Cook says that for every kilometre travelled south along the NATT, the average annual rainfall decreases by about two millimetres. The project's

Division of Wildlife and Ecology

Joint project leader Dr Gary Cook bags some 'biomass' while technical officer Michael Greatz samples the soil. It takes up to one-and-a half hours to conduct the necessary field work at each trial plot, which might contain anything from four to 25 species.



Top right: Study sites have been set up at six locations along the North Australian Tropical Transect.

Top: An area of clay soils at Douglas Daly, towards the northern end of the transect. The research team is comparing the effects of different levels of disturbance on three different soil types: sand, loam and clay.

Above: Termite mounds in the Victoria River district. For every kilometre travelled south from Darwin, the average annual rainfall decreases by about two millimetres.

Above right: A stock enclosure at Kidman Springs highlights the difference between grazed and ungrazed sections of the landscape.

most northerly location, at Annaburroo Station, receives about 1500 mm of rainfall a year, while Mt Sanford Station, the southernmost site, gets only 500 mm.

At each location, the scientists have established separate study sites on sand, loam and clay soils. At each site, three 20 m by 20 m plots have been marked out. These are subjected to three different levels of disturbance.

The least-disturbed plots are fenced to exclude cattle, feral pigs and other grazing mammals. Plots of intermediate disturbance are marked by corner posts and grazers have free access. These are called the ambient plots. The most-disturbed plots are clipped two to four times early in the wet season after the first rains in November-December. This makes the grass more attractive to cattle.

The initial condition of each study site has been characterised by collecting information on the standing biomass of grass, forbs and tree litter; plant species and their cover; basal area of trees; patterns of fertile and infertile sites; soil microtopography; and soil texture. Cook says it takes up to one-and-a-half hours to sample each plot which might contain anything from four to 25 different plant species. The data will be coupled with rainfall records and other climatic data to place each study site on the PAM/AN plane. These surveys will be repeated twice yearly until the project concludes in 1998.

Between them, the four scientists on the NATT project boast an impressive range of skills. Cook is a soil scientist, Williams is a plant ecologist, and their colleagues, David Tongway and Dr John Ludwig, are specialists in landscape ecology and ecological modelling respectively. When they're out on the road in 40°C heat, however, they also need skills in outback survival.

It takes about two weeks for the necessary field work to be carried out on all 45 plots: a whole day in fact, to reach the southern-most site at Kalkarinji (800 km from Darwin). Behind the four-wheel-drive, the research crews tow a trailer loaded with two quad bikes which, in wet season, are the only way to reach the study sites. They also carry plenty of water, rations, spares, safety gear and radio equipment.

At most sites the accommodation is at Northern Territory Department of Primary Industries and Fisheries research stations. At Kalkarindji though, it's camping under the stars.

Global experiments

The North Australian Tropical Transect is part of a network of research contributing to an international project called Global Change and Terrestrial Ecosystems (GCTE). This project is led by Dr Brian Walker, chief of the Division of Wildlife and Ecology. A transect similar to the NATT is established in West Africa, (from Cote d'Ivoire to Niger) and others are planned for Europe, the United States and South America.

Cook, who has visited the west-African transect, says while other savannas have a similar rainfall gradients to the Top End, their population density is much higher. For example, six million people inhabit the drier section of the transect in Africa. The Australian transect therefore provides scientists with a unique opportunity to study savanna ecosystems in relatively undisturbed condition.

The main aim of the GCTE project is to bring together research laboratories from various organisations to better understand how terrestrial ecosystems interact with the forces of global change. Another project taking place along the NATT, led by colleagues of Cook and Williams at Northern Territory University, relates directly to this aim.

Cook and Williams believe the NATT will become an important international facility for global change research in ecology, biochemistry hydrology, atmospheric chemistry and meteorology. Scientists from all the countries involved in the GCTE project meet annually to exchange ideas and give updates on their respective research. They also contribute to a special newsletter. Some have already expressed interest in visiting Australia to carry out research along the NATT.

They may be lucky enough to ride quad bikes, count eucalypts, and pitch a tent at Kalkarindji.

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