

# The Darwin Smoke Project



A research partnership of Charles Darwin University,  
the NT Government and the Bureau of Meteorology

Volume 1, Issue 3

March 2005

The CDU smoke project is funded by the Australian Research Council with generous financial and in-kind contributions from the NT Government Departments of Infrastructure Planning and Environment, Health and Community Services, and Business, Industries and Resource development, the Bureau of Meteorology, Flinders University, Australian National University, CSIRO Division of Atmospheric Research, the Top End Division of General Practice, and Asthma NT.

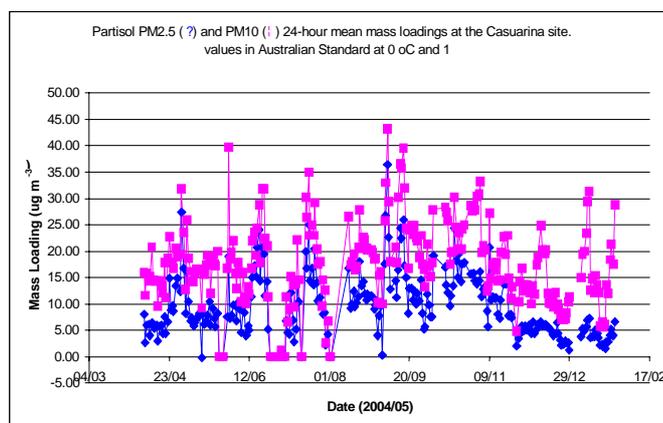
Welcome to the third newsletter from the Darwin Smoke project, a multi-disciplinary research program that aims to identify causes and consequences of high air pollution episodes in the Darwin region. The project has several components:

- **Atmospheric Chemistry** – measuring the concentration of particles arising from smoke pollution in Darwin and Palmerston.
- **Aero-biology** – measuring the amount of pollen and fungal spores in our air and identifying the predominant species.
- **Meteorology** – measuring the daily temperature, rainfall and humidity, wind speed, direction and temperature inversions to help understand and predict the dispersal of smoke from savanna fires.
- **Landscape Ecology** – examining how different land management affects the fuel loads and fire cycles in the savannas and examining the timing and geographic distribution of fires using satellite imagery.
- **Epidemiology** – examining the impacts of environmental factors including smoke pollution, weather, fungi and pollen counts on the health of the population of Darwin.

## Atmospheric Chemistry

**The Team:** A/Prof David Parry and Francoise Foti - Charles Darwin University, Dr John Gras – CSIRO Atmospheric Research. Contact – david.parry@cdu.edu.au

Measurements of particulate matter (PM 10 and PM 2.5) are continuing at both Palmerston and Casuarina sites. The data (7/4/04 - 26/1/05) from the Partisol Dichotomous sampler at Casuarina campus is shown below. The graph shows that there have been no exceedances of the PM10 Air NEPM standard of  $50 \mu\text{g m}^{-3}$ . In contrast there have been four days on which the PM2.5 Air NEPM standard of  $25 \mu\text{g m}^{-3}$  was exceeded, the highest of  $36.5 \mu\text{g m}^{-3}$  on 6<sup>th</sup> September 2004. The PM2.5 values from mid-November 2004 to end of January 2005 have remained constantly low.



We have recently purchased a second Dichotomous Partisol sampler, jointly funded by CDU and NTG (DIPE and DHCS). This sampler will initially be used for quality control work with the current samplers,

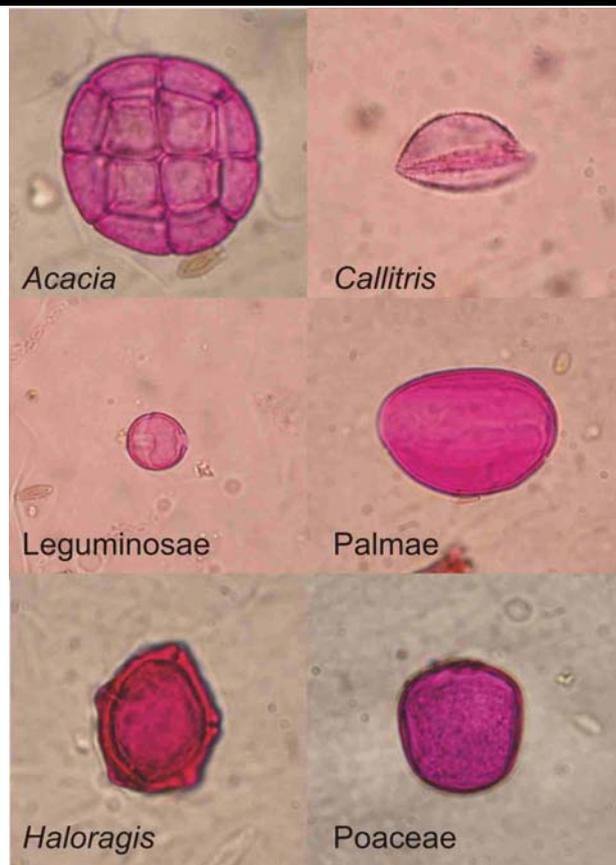
beginning with the deployment at the Palmerston site in parallel with the TEOM and ACCU systems that are operating there.

The MicroVol sampler that has been deployed in Darwin city area has continued to malfunction which has been traced back to problems with high humidity and water penetration. The system has now been repaired twice and a solution proposed by the manufacturers. As a result very little data has been obtained with this sampler.

Pollen sampling is continuing at Casuarina and Palmerston. The samplers are set up for continuous sampling however we have encountered a few problems with the samplers stopping in mid cycle. We have been investigating the problem but as yet cannot determine what is causing the problem. We have changed the solution applied to the plastics strips used in the samplers. We are now using a Silicon solution that is applied to the strip in one thin coat, as opposed to the old method where two different solutions were applied. The original solution was quite thick when applied and ran in the hot weather. The new method has overcome these problems and also makes mounting of the strips easier and more efficient.

#### **Aerobiology at ANU, report from Dr Simon Haberle**

The daily pollen and fungal counts for the two sampling stations in Darwin have yielded a diverse assemblage of airborne pollen and fungal spore types. Clear pollen seasons have emerged over the last 9 months of daily count data with Palms, *Callitris* and *Eucalyptus pollen* dominating the Sept-Nov quarter. Over 40 pollen types are consistently encountered in the daily counts and many of them can be identified to at least genera level. Currently we are processing around 300 herbarium specimens of locally collected flowering plants to develop a Darwin Pollen Reference Collection to assist in refining our identification of pollen taxa encountered during the daily pollen counts.



Images of common pollens collected by the samplers and identified at ANU

## Landscape Ecology

**The team:** Prof David Bowman and Don Franklin from the ARC Key Centre for Tropical Wildlife Management.

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### **Spear-grass and fuel loads**

As reported in the last newsletter, our survey revealed that grass fuel loads in Stringybark (*Eucalyptus tetradonta*) savannas are higher where annual spear-grass (*Sarga* spp.) is prevalent. Since then, we have made considerable progress in considering why this is so. We have identified that spear-grass is more prevalent in areas with higher rainfall, where there are less trees and shrubs, and where soils are heavier. No great surprise there. But of considerable interest is that these effects explained only about 20% of the variation in the prevalence of spear-grass. So what accounts for the other 80%?

We believe that this must be largely an effect of management. But what is the management impact? It's not as simple as how often the country is burnt, because parts of Arnhemland have little spear-grass (and consequently low grass fuel loads) even though they're burnt as often as areas near Darwin where spear-grass is abundant. We are currently investigating the idea that the answer lies in the patchiness of burning – where the landscape is burnt with numerous small fires, annual spear-grasses may have trouble tracking the set of circumstances that suits it.

We hope to have a manuscript reporting our results ready for peer review in the next few weeks.

### Introducing Louis Elliott

Lou has recently joined the team as an Honours student. His project is to assess grass fuel loads and composition in Woollybutt (*Eucalyptus miniata*) savannas at sites around Darwin, and also in the Daly River region. His work should provide an independent test for the conclusions about spear-grass made during the above study.



## Epidemiology

**The team:** A/Prof Ross Baillie (Menzies), Prof Louis Pilotto (Flinders University), Dr Fay Johnston, (Centre for Remote Health), Dr Ros Webby (ANU and Darwin Centre for Disease Control), Anne Myerscough and Janelle Fisher (CDU).

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### The Darwin Asthma Study: interim results from April – June 2005

The study commenced on March 1<sup>st</sup> and was completed on November 7<sup>th</sup> 2005. Environmental data became available from April. Dr Ros Webby has completed an interim analysis of the data from April to June 2004 and the results are summarised below. Analysis of the entire study period has now commenced.

The mean number of people providing data each day was 234 of 251 participants.

The mean daily prevalence of symptoms were as follows; wheeze 11%, breathlessness 11%, chest tightness 10% and cough 21%, asthma attacks 4%, missed school or work due to asthma 1% and health care visits for asthma 0.66%. The mean daily prevalence of medication use was 42% for inhaled steroids, 23% for bronchodilators and 1% for oral steroids.

Multi-variate statistical models were used to examine the effects of:

- particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub> recorded at Casuarina)
- dew point temperature at 9am
- daily rainfall
- total pollen count
- total fungal count
- influenza rate in the community
- weekends, public holidays and school holidays
- autocorrelation of symptoms within each participant

These showed no association between air pollutants and asthma symptoms or asthma attacks. Some positive associations were demonstrated between breathing difficulty with exercise and PM<sub>2.5</sub>. No association was shown between particulate matter and missed school or work due to asthma, health care visits for asthma or medication use which was measured as bronchodilator, oral steroid or inhaled steroid use.

These results are reassuring. They suggest that during the initial stages of the study, none of the environmental triggers we monitored were important contributors to asthma symptoms in our study group. During this time levels of smoke pollution remained low with a mean PM<sub>10</sub> level of 18 ug/m<sup>3</sup> well under the national air quality standard threshold of 50 ug/m<sup>3</sup>.

## Meteorology

**The team:** Jim Arthur, Ian Shepherd, and Dr Michael Foley, BOM Darwin and Alan Wain, BOM Melbourne

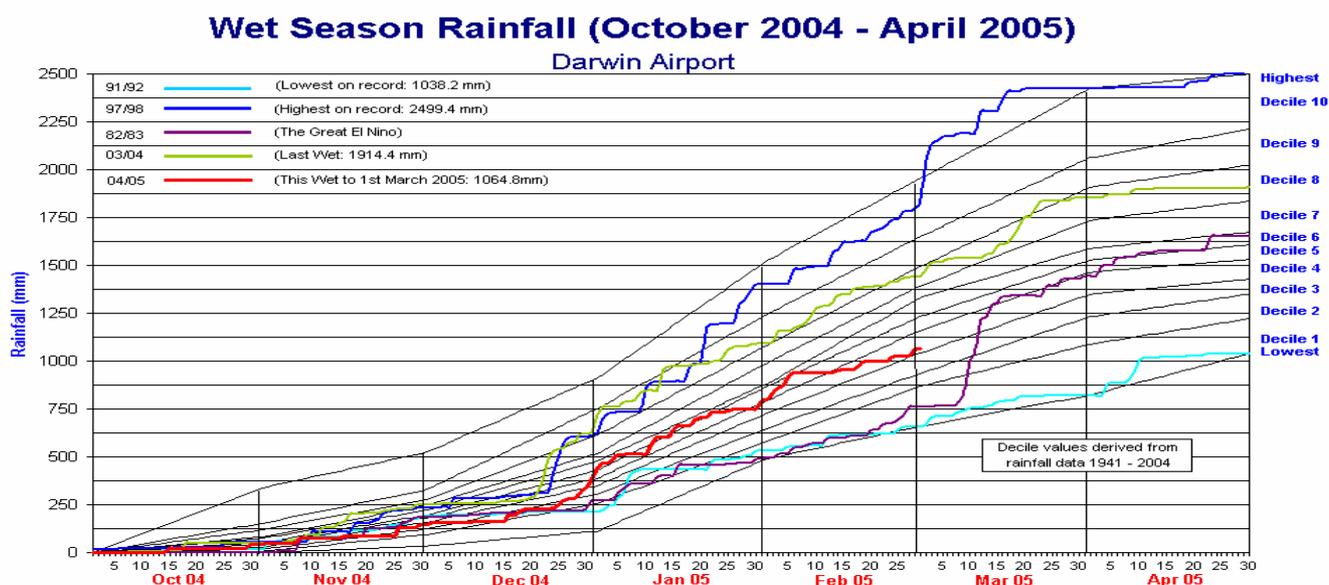
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Since the end of October, there have not been any significant fire weather situations over the Top End. A burst of the monsoon around Christmas brought the

first substantial rains to Darwin, and by the end of January, fuel curings (as estimated by the Bushfires Council) had dropped from 85% to 60%, effectively removing any chance of raised fire dangers for the time being.

Despite another short monsoon burst at the beginning of February (prior to the formation of TC Harvey in the Gulf of Carpentaria), wet season rainfall has been below somewhat below average. Darwin rainfall currently lies in the 4th decile (see Figure). Monsoon bursts have so far been well correlated with active phases of the Madden-Julian Oscillation (an equatorial disturbance which tends to move around the globe from west to east with a period of 30 to 60 days). Another monsoon burst may be developing in early March.

With two months of the Wet Season remaining, it is too early to predict whether or not wet season rainfall totals will be lower than usual, and hence what the likelihood is of an early start to this year's fire season.



For more information about the Darwin Smoke Project contact Trisha Butler at the Key Centre for Tropical Wildlife Management Charles Darwin University NT 0909 telephone 89466574 or email [patricia.butler@cdu.edu.au](mailto:patricia.butler@cdu.edu.au)