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## The dust-busters

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**You may have heard about science in the pub, but how about science *from* the pub? That's what one of the citizen scientists involved in a program called DustWatch is doing. When not keeping an eye on local dust activity, he's pulling beers in his hotel at Tibooburra, in far north-west NSW.**



Credit: © [Tibooburra on flickr](#)

The publican is one of 42 volunteer [DustWatch](#) monitors throughout NSW, Queensland, Victoria and WA, whose observations are helping improve agricultural productivity in rural areas and air quality in urban areas.

DustWatch volunteers are a diverse group. Apart from the outback publican, there's a council worker, a retired engineer, farmers and farm kids, and more. They all have two things in common: they live in areas where dust monitoring is useful, and they've put their hands up to be involved in a project that is refining our understanding of Australia's environment.

The idea to form a corps of dust-watching citizen scientists began in 2002, following a large dust storm in Sydney. Founder, Dr John Leys from the NSW Office of Environment and Heritage, says, 'I basically sent an email to everyone in my address book saying, "Seen any dust? Send photos".'

Keeping the initiative going over the last decade has not been easy. It is supported by a patchwork of funding – federal (Caring for our Country), state and regional. <sup>1</sup> In-kind support is provided by local inland catchment management authorities, landholders, community businesses and individuals like the Tibooburra publican.

### Soil health, from the sky

Dust is a reliable indicator of soil condition. When soil becomes degraded and is left bare, it's more likely to blow away in the next strong wind as dust. When it does, it lowers the land's productive capacity, reduces air quality in urban centres and releases stored carbon. Dust is an indicator of how well we care our soils: low dust = good care.

Wind erosion and dust storms account for the loss of about 1.6 million tonnes of carbon from Australian soils each

year: soil organic carbon dust emissions amount to around 10 per cent of Australia's carbon dioxide emissions.

When wind lifts dust into the atmosphere, the amount and location of soil carbon on the ground changes. While some carbon falls back to earth in Australia, some leaves the continent or ends up in the ocean, contributing to ocean acidification.

The soil over much of our continent is already poor compared with most of the rest of the world. This is especially the case for the dry central areas.

Why is this the case? Volcanic activity, absent in Australia, renews soil. Glaciers – also absent from the Australian landscape, even during the last Ice Age – grind unweathered rock into fine particles. When the glaciers retreat, these become soil enriched with new minerals.

The soils of arid Australia have been weathered and leached more than many others, making them among the world's most nutrient-deficient. The huge dunefields of central Australia are the skeleton left behind after millennia of wind erosion. Dust is a sign that soil is being lost and soil health is declining.



Credit: Stephan Heidenrich

Community DustWatch soil scientists in the NSW Office of Environment and Heritage, together with CSIRO, the Australian Bureau of Meteorology and the Australian Government Department of Agriculture use a range of techniques to keep an eye on soil health, such as the collaborative [groundcover monitoring system](#).

Every eight days, CSIRO scientists take a new image from the US monitoring satellite MODIS, perform a series of mathematical calculations, and deliver information about groundcover. Community DustWatch also uses fire data from the US Fire Information for Resource Management System and meteorological data from the Australian Bureau of Meteorology.

Satellite imaging and algorithms can only go so far. On-the-ground observations are vital. That's where the DustWatch volunteers come in.

The information derived from the satellite imagery can detect areas of low groundcover, helping the on-ground teams rapidly locate the likely sources of dust, saving researchers time and money.

### **Groundtruthing it**

DustWatch volunteers make observations of dust events using Bureau of Meteorology protocols for dust event type, visibility, wind direction and speed.

As well as recording dust events, volunteers at DustWatch nodes, located mainly in NSW, help maintain the 42 solar-powered, dust-monitoring instruments across southern Australia that take regular air samples for measuring the

concentration of aerosols.

The devices monitor dust concentration of particles less than 10 micro-metres – about an eighth the diameter of a human hair – in the air every 15 minutes. The rate increases to every minute when dust concentrations are above 25 micrograms per cubic metre.

The dust readings are downloaded daily and stored in a central Community DustWatch Information Interface data system.



Credit: Stephan Heidenrich

Maintenance involves keeping the device's air inlet clean (spider webs can be a problem), emptying the water tap (preventing the dust from becoming mud) and occasionally rebooting the system if mobile phone towers nearby have been out of service. Sometimes, when cockatoos bite through wires, they have to be replaced.

But volunteers need to do more than simple maintenance. The monitoring devices measure *all* aerosols – dust, smoke and fog – without differentiating between them. That makes the volunteers' local knowledge invaluable. They keep an eye on the local conditions, and can clarify what the data reveal and provide context for the observations.

Information flows both ways – DustWatch scientists fill the volunteers in on what's going on with dust activity and smoke activity at a regional level.

For instance, they can inform volunteers about fires seen on satellite images that may cause a spike in aerosol levels from many kilometres away. In 2009, smoke from Victorian bushfires was measured over 1000 km away in Tibooburra.



Credit: Merbabu/Wikimedia Commons

The volunteers who work with the Community DustWatch program save the taxpayer somewhere between \$400,000 and \$500,000 a year. Understanding and preventing dust storms can be a huge money saver: the 2009 Sydney 'Red Dawn' dust storm is estimated to have cost the NSW economy alone \$299 million for the single dust storm, not including losses in agricultural production.

Mitigation of dust at the source is the best form of prevention. Investing in mitigation efforts such as replanting vegetation cover and managing feral animals would not only assist regional areas, but the coastal and city areas of New South Wales as well. For this, data is vital, and the DustWatch volunteers are providing it.

<sup>1</sup> The program is currently funded by the NSW Office of Environment and Heritage, Murray Catchment Management Authority (CMA), Lachlan CMA, Murrumbidgee CMA, Western CMA. In other states the Western Australian Department of Agriculture and Food, Northern Agricultural and Wheatbelt Natural Resource Management (NRMs), the South Australian Eyre Peninsula NRM, Arid Lands NRM and Murray Darling Basin NRM, and the Victorian Mallee CMA and North Central CMA fund their own local stations. The Australian Government Department of Agriculture, CSIRO, the Bureau of Meteorology and the Terrestrial Ecosystem Research Network supports much of the research, data and infrastructure used by the DustWatch program.

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