Giant chambers to test climate change effects on native trees

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A climatic time machine has been built at the University of Western Sydney's Hawkesbury Campus to mimic a world facing new environmental conditions.

Twelve giant chambers will house individual, living trees in controlled environments as part of a multi-million dollar experiment to help predict what will happen to the Australian bush over the next century.

Professor Jann Conroy, from the UWS Centre for Plant and Food Science, says the Hawkesbury Forest Experiment is not only an Australian first, but one of the most ambitious studies of climate change to be undertaken in the Southern Hemisphere.

"While it's now widely accepted that carbon dioxide levels are rising in our atmosphere faster than ever before, the scientific jury is still out on the full impact this will have on our planet," says Professor Conroy.

"Science has shown that the change in the mix of gases in our atmosphere will enhance the greenhouse effect - where carbon dioxide and other gases trap heat from the sun and raise a planet's temperature.

"Rising atmospheric levels of carbon dioxide will also have an impact on the water use and carbon storage potential of trees, and alter the water cycle of the environment, but the consequences of more carbon dioxide available to our bush ecosystems are still far from certain," she says.

"The aim of this experiment is to provide field data to better understand how our woodlands and forests will respond to the carbon dioxide levels expected by 2100," says Professor Conroy.

12 spotted gums will be planted as saplings, which will grow up to 12 metres while completely contained in unique 'whole tree chambers' (WTC) where the mix of gases can be controlled.

Six of the chambers will be kept at the concentration of carbon dioxide currently in our air, while the remainder will be 'boosted' to create a greenhouse rich mix of 700 parts per million of carbon dioxide - approximately twice the concentration in today's atmosphere.

"The chamber's aluminium frame is covered with tough clear plastic sheeting that seals below ground level to create a mini ecosystem - as the tree grows so will the chamber, up to a maximum height of 12 metres.

"The entire volume of gas in the chamber is exchanged every hour and kept at a slightly higher pressure than the outside atmosphere to reduce the chance of cross contamination," says Professor Conroy.

Maintaining this isolated environment will be critical to the experiment's success.

"We will measure how much water and carbon dioxide enters and leaves the chamber. This will help show how efficiently the tree uses water and how much carbon it absorbs."

"The unique isotope or atomic fingerprint of the carbon dioxide used in the chamber will also be tracked to give a picture of just how much is being absorbed in the trees, and the micro organisms living in the soil," Professor Conroy says.

By 2100, parts of Australia may be experiencing a climatic double impact of increasing carbon dioxide and decreasing rainfall.

"Water and carbon dioxide are key factors in any plant's growth. The extra carbon dioxide could make the tree grow more efficiently - boosting forest productivity with increased stem growth and more rapid production of wood, despite possibly less rain.

"However, a tree growing with a denser canopy due to elevated carbon dioxide concentrations might also stop rainfall reaching the soil to recharge groundwater and streams - impacting other parts of the ecosystem," says Professor Conroy.

Source: University of Western Sydney