

**Climate Change Research Centre/ Crystal Creek Meadows Prize for PhD
Students**

Climate Research and the Tourism Industry

2010 Inaugural Winner – Sarah E. Perkins

Globally, eleven out of the past thirteen years have been the hottest on record. There is strong evidence that global warming trends observed since 1950 can be linked to mankind, mostly through activities which release greenhouse gases, trapping heat close to the surface of the earth. This evidence was reported by the Intergovernmental Panel on Climate Change (IPCC), a group formed by the United Nations Environment Programme and the World Meteorological Organization who review the scientific literature to provide a clear view on the current state of climate change and its impacts. The IPCC consists of many of the world's leading scientists, and the fourth report was published and released to the general public in 2007.

Locally in Australia, studies focusing on observed changes in climate have found an increase in average temperature, an increase in warmer nights, longer and more severe heatwaves, heavier extreme rainfall events, less total annual rainfall and an increase in the frequency and intensity of droughts. Climate change, particularly through the changes listed here is a very real threat to many human industries, including agriculture, forestry, health, power, and of course, tourism. The tourism industry plays a highly significant role in the Australian economy, with over 5.6 million international tourists visiting the continent in a single year. With international and domestic tourism combined, an annual GDP of over A\$40 billion was recorded in 2008.

My PhD thesis has focused on studying how the Australian climate may change throughout the 21st century, particularly if greenhouse gas emissions continue to rise, since most current research on future climate change has focused on either the global climate, or northern hemisphere regions. Research undertaken throughout my candidature focused on rainfall and minimum and maximum temperature, as changes in these climatic variables will have the largest impacts across a wide range of human industries and biophysical systems.

In order to study future changes in Australian climate, output in the form of climate projections from the most state-of-the-art climate models, which are endorsed by the IPCC, was analysed. The models underwent considerable testing to make sure they reproduced observed conditions well, and those that did the best job of this were favoured for future climate studies, where greenhouse gas concentrations increase continuously up to the year 2100. From these models, I found that the average daily minimum and maximum temperatures will increase across all of Australia throughout the 21st century; by 2100 the best models project average daily maximum and minimum temperature will be 3-5°C warmer than now. The best models also show a decrease in average daily rainfall in the southern and western parts of the continent, and an increase in the tropics. Warm temperature events that were experienced once per year in the 20th century are projected to occur 30 times a year by 2100, the number of days with no rainfall will increase, inferring longer dry periods and

drought. Temperature events that occur every twenty years will increase in magnitude by 4-6°C over most of Australia, indicating that extreme conditions are changing faster than average events. These changes in the Australian climate will have profound impacts on the country's tourism industry.

Examples of these impacts are abundant. The Great Barrier Reef attracts up to two million tourists each year due to its colourful and plentiful plant and animal life. However, warmer temperatures will increase coral bleaching incidents and if such events become yearly many fish within the ecosystem could not adapt and the coral would not recover from this frequency. This would entirely change the ecosystem and could result in a large negative impact on the country's economy.

Cooler climates of Australia will also be affected. Increasing temperatures may induce a considerable loss of snow in alpine regions by 2020, and an 80% decrease from current levels by 2070, inferring detrimental impacts on alpine resorts and tourism. Due to prolonged periods of dryness and higher temperatures, areas with thick sclerophyll forest such as the Blue Mountains and rainforests such as the Daintree will be at higher risk of bushfire. This will see national parks closed more frequently when these events occur, while also impacting on the intrinsic value of the landscape which attracts tourists to the area.

Other elements of the tourism industry that are vulnerable to climate change may also overlap with other industries. Cool minimum (night-time) temperatures are vital for many fruits to vernalise, including grapes. Warmer minimum temperatures will reduce grape- and the resulting wine- quality, not only impacting on the wine-making industry, but reducing the hundreds of thousands of thousands of tourists who visit Australian wineries and wine regions each year.

My research during my PhD candidature has shown that climate change trends felt globally and in Australia over the past 50 years will continue over the whole continent throughout the 21st century, as a result from rising greenhouse gas emissions. Australia's tourism industry relies heavily on the country's naturally diverse beauty and spectacular landscape which is in turn dependant on the governing climate. As Australia's climate continues to change so will its landscape, which may see billions of dollars lost from the tourism industry. Conclusions drawn from my research may help the Australian tourism industry and any other industry with a direct reliance on the climate to adapt to the projected changes before they occur. For the tourism industry, this will include protecting the entity which attracts so many people, ensuring both its survival and the survival of the industry itself.