I am going to talk about trees at a grasslands forum! The trees are in the Monaro region of southern NSW, which is well known to many of you here today. The story I am going to tell is a summary of my Honours’ research through the Australian National University and sponsored by Greening Australia. The work finished in mid-2013, and there have been few changes in the treescape since.

Tree dieback is very visible from the road when driving towards the Snowy Mountains between Cooma and Jindabyne. Over the last 10 years or so, the Ribbon Gums (*Eucalyptus viminalis*) have been gradually declining in health and most of them are now either dead or very close to it.

The Monaro region is a high plain that extends between Bredbo, Numeralla, Nimmitabel and Jindabyne, south of Canberra. The map (right), drawn from a road survey I did, gives an idea of the extent of the problem. The dieback in this area, which is dominated by *E. viminalis*, covered just under 2000 km² at that time – almost the size of the ACT. The central area of the map is more severely affected than the entire region. The dieback seems to gradually lessen towards the edges of the mapped area, and the edges are defined by a change in species composition to either Snow Gum *E. pauciflora* or Box–Gum *E. melliodora* – *E. blakelyi*.

Dieback refers to a general decline in the health of a stand of trees, which can lead to premature death, and the declining health can be caused directly by things such as salinity, pollution or disease. Usually, however, the term dieback refers to a more complicated situation which is often a result of a range of interacting factors. It can be associated with insect attack, and that can either be the main cause or the result of an underlying problem. When trees are defoliated by insects they attempt to replace their crown by generating epicormic growth. However, that is growth very palatable to insects, and there is a feedback effect with repeated defoliation and regrowth until the trees eventually exhaust their resources and die.

In the situation on the Monaro, the dieback is associated with the Eucalyptus Weevil *Gonipterus* sp. (photo, right) and we know that this is the...
Scott: If I can quote you, I think you said that the weevil is introduced.

Ross: Yes, it is. It has been introduced to New Zealand and other places. When it is introduced to new areas, it can cause significant damage. It prefers to feed on Ribbon Gums, which are a native species in the area. It is not native to this region and does not have any natural enemies here. This makes it easier for the weevil to thrive and cause significant damage to the trees.

Scott: And is this weevil a known pest anywhere in the world?

Ross: It is known to be a pest in New Zealand and possibly in other areas as well. However, it is not considered to be a major pest in this region. It is more of a nuisance pest that can cause some damage but not as severe as other pests that are more widespread and common.

Scott: So it's been introduced to New Zealand, and it's not native to Australia. Is it a common pest in New Zealand?

Ross: Yes, it is. In New Zealand, it is considered to be a major pest that causes significant damage to Ribbon Gums. It has been managed through the use of pesticides and other methods to control its population.

Scott: And has it been introduced to any other countries?

Ross: It is not known to have been introduced to any other countries apart from New Zealand. It is a relatively rare pest and not considered to be a significant threat to eucalyptus trees in other areas.

Scott: Thank you for your time today.
soil compaction, and reintroducing native understorey species to attract insect predators, or using burning. These strategies might be very important in solving other issues, but they seem unlikely to solve the dieback problem.

The only factor remaining from the list above is climate. The lack of small-scale differences in dieback suggests that the cause is acting on a much larger scale, and therefore I suggest the most likely explanation of this dieback is that it is related to climate. The Monaro is in the rain shadow of the Snowy Mountains and is very dry in comparison to the surrounding areas. The most severely affected area of dieback, in the centre, also has the lowest annual rainfall. The timing of this dieback also coincides with one of the worst droughts on record, as well as, over the longer period, a changing climate. There has also been a change in the distribution of rainfall in this area. The net result is that although there has been a small drop in annual rainfall overall, there is a large difference in its distribution, with more in summer and very much less rainfall in autumn.

During the Millennium Drought, annual rainfall dropped from about 550 mm to 450 mm. Ribbon Gums normally grow in relative wet areas. At 550 mm the tree is already at the edge of its natural range, and the reduction of rainfall to 450 mm could have had a major effect on that species. I conclude that the most likely cause of the Monaro dieback is climate, possibly related to a number of other factors. However, much of the evidence is circumstantial and it is unclear how the climate and the insect attack interact to cause the dieback.

There has been no evidence of recovery of the trees, despite the drought ending, and there is little regeneration happening. Therefore it seems that Ribbon Gums may disappear entirely from this area where they have been dominant in the past, and this could be one of the first examples of significant vegetation change due to climate change in eastern Australia. The challenge for managers now is to decide not just how to restore this landscape, but also what to aim for, given that we cannot go back to what was there before and we know that there are likely to be further changes in the future.

The team at Greening Australia want to know what species to plant there, and that raises two questions. What will survive in the future climate? What will provide the ecosystem values that have been lost or that we want to have there?

One suggestion is to translocate species into this Monaro area from an region that resembles our expectation of the Monaro climate in the future. That is quite controversial. Translocation has been widely talked about in the context of species that are threatened by climate change and are likely to be lost altogether. We are talking about moving these to a new location, but we have not really talked about translocations into a new gap left by the loss of a widespread species. I think that is an important discussion that we need to have and I hope the audience here will consider it and make suggestions.

Catherine recently completed her degree at the Australian National University, and received first class for her honours thesis. She now works as a project officer at Greening Australia Capital Region. This presentation is based on research for her honours project investigating the causes of eucalypt dieback in the Monaro region of NSW, at the Fenner School of Environment and Society, ANU.

* The work reported here is now published as:
http://www.tandfonline.com/doi/pdf/10.1080/00049158.2015.1076754