EUCALYPTS IN THE REPUBLIC OF IRELAND

Andrew Leslie made use of a Randle Travel Fund Bursary to visit Ireland to examine the work being done there on *Eucalyptus* species.

I was fortunate to obtain funding from the Royal Forestry Society's Randle Travel Fund and the University of Cumbria for a visit in June 2012 to the Republic of Ireland to examine the work being undertaken on *Eucalyptus*. As part of the conditions for the funding, I was asked to write a brief article. As a start to the article, I would like to thank a number of Coillte staff for providing information and for being most generous hosts; most notably David Thompson but also Kevin Hutchinson, Bill Berkerey and Kevin Black, a private consultant. For a more detailed account of recent developments, a paper is being written for Irish Forestry by David, Bill and Kevin Hutchinson and will be published soon.

The Republic of Ireland has a long history of planting eucalypts, with the first trees being established in the 19th Century. The original focus for investigating a role for eucalypts in production forestry was as a source of timber, feedstock for panel boards and as pit props. Those species that grew well in Ireland did not meet the required wood properties for these markets and so research on eucalypts ceased until the mid 2000s, when there arose a demand for woody biomass as a source of fuel.

The search for other sources of biomass for this burgeoning market began. Options included willow, which was found to be too site demanding, growing best on agricultural land and also required specialised machinery for harvesting, while another possible crop, *Miscanthus*, was found to produce copious quantities of ash when burned. Hybrid aspen, another possibility, was not considered because it was expensive in terms of producing transplants as root cuttings are used. Sitka spruce, the mainstay of production forestry in Ireland remains a reliable option but even with its fast growth, *Eucalyptus* can produce a greater volume in a shorter time. Observations from small forest plots and from arboreta suggested that eucalypts may be an attractive genus. Initially *Eucalyptus nitens* was identified as being the most promising species due to its rapid growth and excellent stem form. Testing of the wood of this species also showed it to be suitable as a constituent material for OSB (orientated strand board) and MDF (medium density fibreboard), both produced by Coillte in Ireland. However, the wood from *E. nitens* grown in Ireland is of poor quality as sawn timber. The limited experience in Ireland suggested that mean annual increments of $28 m^3 ha^{-1} year^{-1}$ at a stocking of 2,500 stems ha^{-1} and over rotations of 13-14 years were possible over a range of sites. However, complete failure of this species, including the killing of trees of 17 years old during the winter of 2009-2010, the coldest in Ireland in thirty years, has meant that future planting of this species has been confined to areas without cold air drainage and within 30 to 40 km from the coast. The photograph opposite shows a stand of 1993 *E. nitens* adjacent to a stand of 1992 Sitka spruce at Cappoquin in County Waterford and illustrates the superior growth rate of the eucalypt.

On colder sites, the intention is to plant *Eucalyptus gunnii*, a native of montane areas of Tasmania and one of the most cold-hardy eucalypts. This is a slower growing species than *E. nitens* but the greater cold tolerance makes it a lower risk.

Furthermore, experience in Ireland has been positive, with growth rates of $26 m^3 ha^{-1} year^{-1}$ over a 13-14 year rotation and when planted at a

The superior growth of eucalypts is shown by these 1993 *E. nitens* adjacent to a stand of 1992 Sitka spruce at Cappoquin in County Waterford.

stocking of 2,500 stems ha^{-1}, stem form has been good. Origins of intermediate altitude are being used; high altitude origins show slow growth rates and low altitude origins are less hardy. A constraint to planting *E. gunnii* is that it is a species that has palatable foliage and so planting in areas of high deer or rabbit population densities is not recommended without protection, which is expensive.

Currently three other eucalypts have been identified as also having potential on colder sites: *E. subcrenulata*, *E. glaucescens* and *E. rodwayi*. This selection is based on observations of growth at a number of small-scale plantings and plots at arboreta. In the past *E. johnstonii*, *E. viminalis* and *E. urnigera* were planted on a range of sites and have done well, but there are other cold hardy faster growing species options. Some other species that may be adapted to Irish conditions have been rejected for silvicultural reasons. For example, *E. coccifera* has proved to be very slow growing in the nursery.

Biomass is a low value product and so there is a need in establishment, harvesting and transportation to keep costs low if a profit is to be realised. For establishment, this means no deer fencing, and no recurrent herbicide after an application pre-planting and some initial weed control. Even on poorer, peaty sites no fertiliser has been applied. Experience has shown that fast initial growth can lead to instability and fertiliser application may favour allocation to shoot growth and away from root development. While extensive cultivation is not necessary, some soil disturbance, such as ripping or screefing has been shown to be beneficial when establishing eucalypts. Planting has involved the use of 25-30cm containerised stock at an initial spacing of 2,500 stems ha^{-1}, the aim being a final stocking of 1,800 stems ha^{-1} without the need for beating up. To date, establishment costs have been around €1,500 to 1,700 ha^{-1} (around £1,200 ha^{-1}). Harvesting using processors is likely to be cost effective, while the greater wood density of eucalypts over Sitka spruce is likely to result in lower costs for transportation. An economic analysis indicated that transporting the wood up to 50 to 75 miles from the forest was still financially viable and that returns were comparable to or better than those from Sitka spruce.

A couple of constraints have been identified to using eucalypt wood for biomass. The moisture content has been found to be as high as 54% when felled and drying has proven to be difficult. Trials using wood from *E. nitens* has however shown that removing the bark resulted in more effective and rapid drying. De-barking had to be done manually because the fibrous eucalypt bark jammed conifer debarking equipment. The wood of *E. gunnii* is also known to be difficult to dry.

Concerns about planting eucalypts include the possibility of invasiveness, site degradation and impacts on biodiversity. Evidence from Ireland and the UK shows limited natural regeneration of eucalypts, those examples where this has occurred being confined to sites where there is usually some form of disturbance to the canopy or soil. At a fine plantation of various eucalypt species planted in 1935 at Gleneally Forest, regeneration of eucalypts has occurred in adjacent subcompartments, following harvesting or on road sides following ground disturbance from road maintenance. Impacts on biodiversity

are not well understood as only small areas have been planted but it was interesting to compare adjacent plantings of *E. nitens* and Sitka spruce planted in the early 1990s. While the light canopy of the eucalypt allowed good cover of ground vegetation, the dense unthinned spruce canopy inhibited any sort of ground flora.

This lighter canopy and lesser light interception of eucalypts in comparison with Sitka spruce suggests that their greater productivity may be due to a longer growing season. Some eucalypts, such as *E. nitens*, exhibit a naked bud, which enable growth to occur when air temperatures are above a certain minimum of around 5-6^{o}C. This means they can be opportunistic and in one study winter growth rates of *E. nitens* in Australia were almost as rapid as those in summer. However this lack of true dormancy makes them susceptible to damage from extreme cold. In Ireland and the UK it is cold, particularly unseasonal low temperatures that is the main risk to planting eucalypts. A study on cold tolerance and the development of hardening off of seedlings is currently being undertaken by Kevin Black in collaboration with Coillte. In most literature the focus of cold hardiness is on minimum lethal temperatures. Kevin's study has investigated this for eight species of eucalypts, concentrating on the LT50 (temperature that results in 50% mortality). However, in addition to this he has also examined the pattern of hardening off over time. For some species differences in cold tolerance are small between unhardened and hardened states, whereas for others there are appreciable differences. Ideally species that are both highly cold tolerant and where there is little variation in cold tolerance in hardened and unhardened states would be favoured.

Eucalypts are relatively free of pests and diseases in Ireland. In 2007 there was an outbreak of a paropsine beetle on plantations managed for foliage for floristry and a fungal leaf spot has attacked seedlings of *Eucalyptus delegatensis* in the nursery. Most species of eucalypt are relatively unpalatable to mammals, enabling them to be established with minimal protection, the exception being *E. gunnii*.

In conclusion, eucalypts offer an exciting opportunity in Ireland for rapid production of biomass to meet increasing future demands for renewable fuel. The current programme of planting is in its early years but already species that can be productive under Irish conditions are being identified.

Andrew Leslie is Head of School at the National School of Forestry, University of Cumbria, Penrith Campus. Penrith CA11 0AH.

Email: Andrew.leslie@cumbria.ac.uk