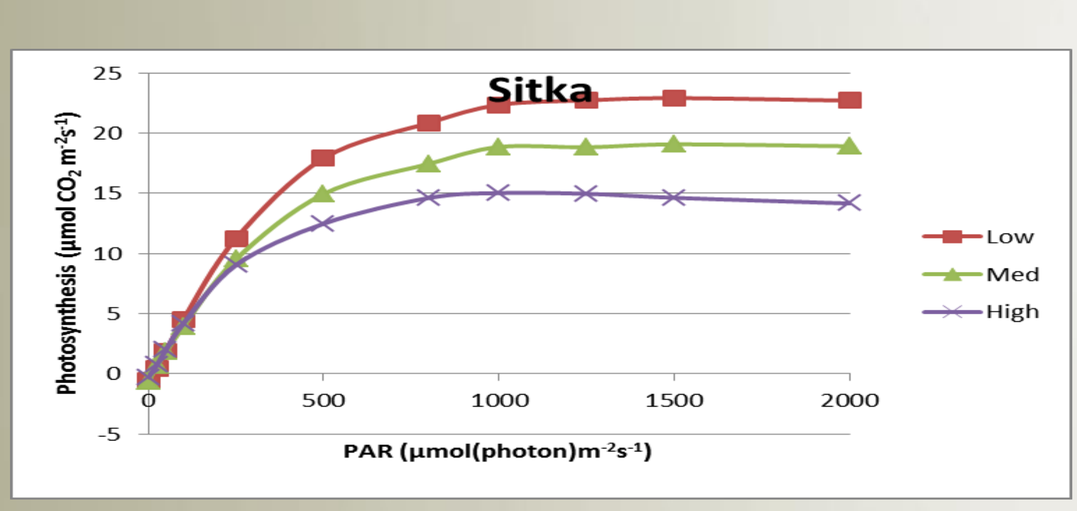
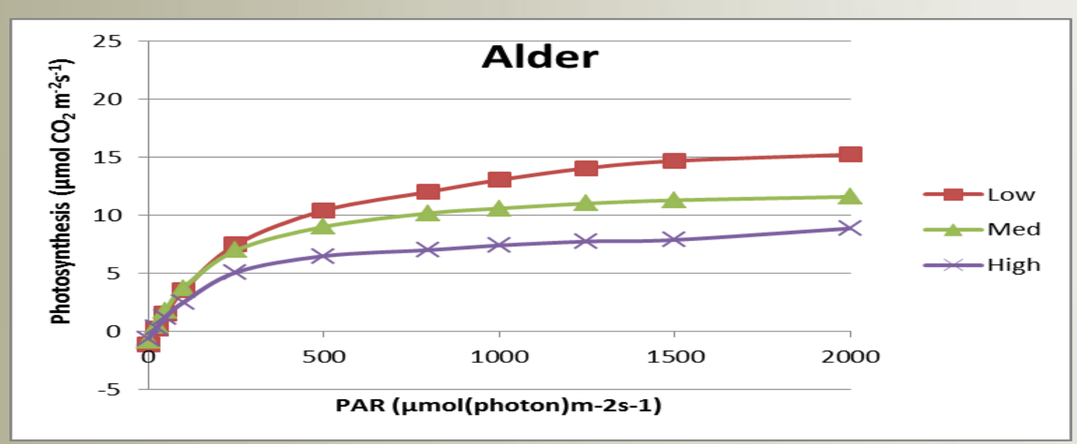
Measuring the physiological and growth responses of potential short-rotation forestry species to variations in planting density

Susan Foreman[1,2], Niall Farrelly[3], Brian Tobin[1], Ian Short[2], Conor O'Reilly[1]
[1] UCD School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4.
[2] Teagasc, Ashtown Research Centre, Ashtown, Dublin 15.
[3] Teagasc, Athenry Research Centre, Mellows Campus, Athenry, Co. Galway

- Short rotation forestry (SRF) has potential to provide biomass, contributing towards Irelands 2020 EU renewable energy target
- There is a need to provide information on the optimum planting density to maximise production for a range of species over a short rotation period.
- The effect of planting density on juvenile competition, survival, growth and physiological response of three potential SRF species – Italian alder (*Alnus cordata*), Sitka spruce (*Picea sitchensis*) and shining gum eucalyptus (*Eucalyptus nitens*) are being investigated
- A potted experiment at Teagasc Kinsealy was used to assess the impact of competition stress
- Observations and measurements have included leaf-level gas exchange, shoot growth phenology, height and diameter increments and other measures of biomass production
- SRF trials will take 8-12 years to mature. The data collected herein will provide information on likely responses to competition which can be scaled up from leaf to canopy level to enable stand productivity to be modelled. To this end a field trial site has been set up at Teagasc Johnstown Castle, Co Wexford

Sitka, eucalyptus and alder growing in 35 litre pots at three planting densities at Teagasc Kinsealy





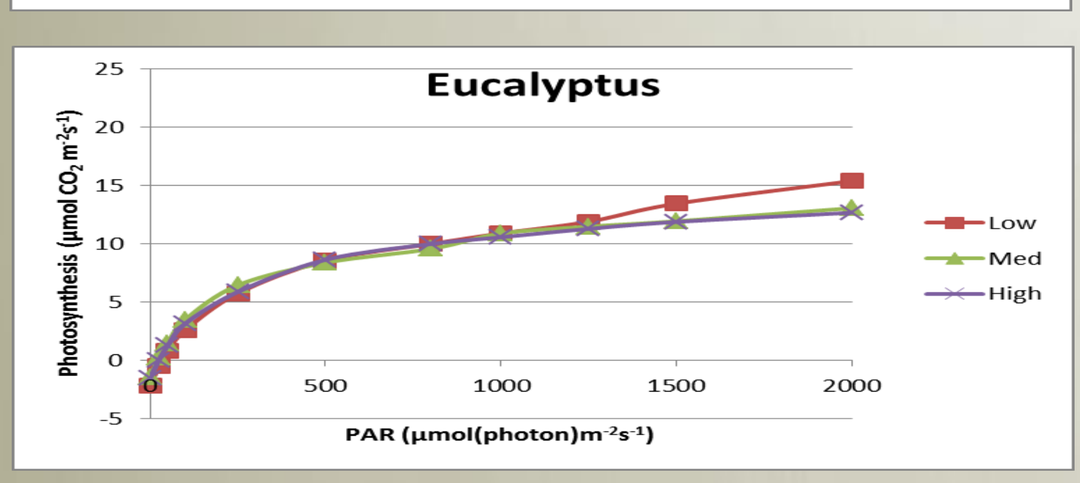


Figure 1: Light response curves on Sitka, alder and eucalyptus at three planting densities. Low density ≈ 79500 stems ha^{-1}, medium density ≈ 318000 stems ha^{-1}, high density ≈ 557000 stems ha^{-1}.

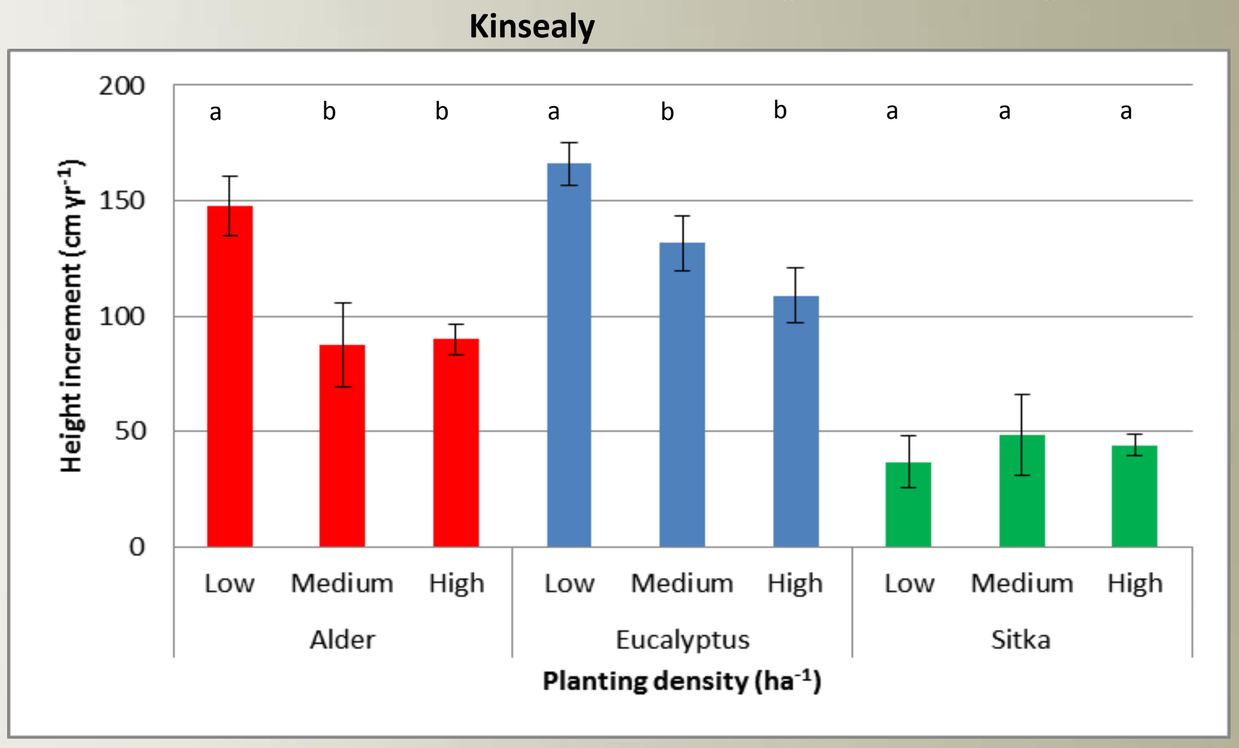


Figure 2: Mean height increment of alder, eucalyptus and Sitka after 8 months growth. Low density ≈ 79500 stems ha^{-1}, medium density ≈ 318000 stems ha^{-1}, high density ≈ 557000 stems ha^{-1}. Error bars = 95% confidence interval of the mean. Letters indicate significant differences (P<0.05) within a species.

- Light response curves of eucalyptus suggest there is little effect on photosynthesis rate caused by planting densities tested (Figure 1)
- Photosynthesis rates of Sitka spruce appear higher than for either eucalyptus or alder (Figure 1)
- There was no difference in Sitka height increment between three planting densities (Figure 2)
- Both alder and eucalyptus had significantly greater height increment at low density than at medium or high density (Figure 2)