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#### Eucalyptus in Great Britain Species choice, yields and financial returns

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Woody Crops: Growing a Bioeconomy

9th Biennial Short Rotation Woody Crops Operations Working Group Conference, November 5-8, 2012, Oak Ridge, Tennessee

### Contents



- Potential species
- Records of yields
- Eucalyptus gunnii growth curve
- Costs and revenues
- Economic analysis
- Risk



# Potential species



### **Potential species**



Figure 1: Comparison of latitude and area of Europe and Australia (adapted from Turnbull and Eldridge1983. The natural distribution of E gunnii (black) and *E*, nitens (grey) (Brooker and Kleinig 1990). (Leslie, Mencuccini and Perks 2011)

UNIVERSITY of Solution



Frost Less Moderately Hardy tender hardy hardy Hardiness

Figure 2: Growth and hardiness of eucalypts in Great Britain (Leslie, Mencuccini and Perks 2011)

## Records of yields (mass)

Daneshill – Nottinghamshire
24.2ha of Eucalypts planted in
2005. *E gunnii* and *E nitens*.
Stems killed December 2010.

Woodchip harvested in June 2011 was 2076.4 tonnes or 85.83 tonnes / ha or 17.16 tonnes ha<sup>-1</sup> year<sup>-1</sup> (greenish) (6.95 tonnes acre<sup>-1</sup> year<sup>-1</sup>) (Wooddisse 2011)





# Records of yields (volumes)

Red Marley – Worcestershire - second rotation coppice measured at 10 years old

Species	Height (m)	Dbh (cm)	Stools ha <sup>-1</sup>	Stems ha <sup>-1</sup>	Vol m³ ha⁻¹	Biomass odt ha <sup>-1</sup>
E. gunnii	17.19	13.2	2370	3792	248	193
E. dalrympleana	17.08	16.1	530	954	69	49
			2900	4746	317	242
Assuming a dry density ~700 kg m <sup>-3</sup> (McKay 2010)				Or 31.7 r ha <sup>-1</sup> y <sup>-1</sup>	n <sup>3</sup>	Or 24.2 odt ha <sup>-1</sup> y <sup>-1</sup>

- 0
- 1<sup>st</sup> rotation: 15 years 26 m<sup>3</sup> ha<sup>-1</sup> y<sup>-1</sup> based on interpolated data from sites from across GB
- 2<sup>nd</sup> rotation: 10 years Red Marley MAI
   Coppice = 30 m<sup>3</sup> ha<sup>-1</sup> y<sup>-1</sup> @ 10 years old

















Dbh @ 15 years = 16.3 cm Height @ 15 years = 17.4 m

AFOCEL (2003) volume equation: Stem volume = -5.04+(0.03556\*(dbh<sup>2</sup>)\*height))/1000

Tree volume @ 15 years  $=0.16 \text{ m}^3$ 



#### Income – 1<sup>st</sup> Rotation

- Stem volume @ 15 years =  $0.16 \text{ m}^3$
- Standing volume @ 2,500 stems/ha = 396 m<sup>3</sup> ha<sup>-1</sup>
- MAI = 26 m<sup>3</sup> ha<sup>-1</sup> y<sup>-1</sup>
- <u>Standing sales prices</u> for material of stem volume of 0.16 m<sup>3</sup> for GB is approx £11 m<sup>-3</sup> (\$5 ft<sup>-3</sup>)
- So standing value =  $\pounds 4365 \text{ ha}^{-1}$  (\$2587 acre<sup>-1</sup>)
- Delivered biomass prices for the UK electricity sector are £30-60 odt<sup>-1</sup> (ex VAT) for UK feedstocks and a price range of £105-135 odt<sup>-1</sup> for imports (DECC 2010)

# Income – subsequent rotations

- Coppice volume @ 10 years = 300 m<sup>3</sup>
- MAI =  $30 \text{ m}^3 \text{ ha}^{-1} \text{ y}^{-1}$
- 300 m<sup>3</sup> @ 1.05 t m<sup>-3</sup> = 315 tonnes wet weight or 150 tonnes dry weight (based on AFOCEL 2003)
- <u>Standing sales prices</u> for material of stem volume of less than 0.124 m<sup>3</sup> for GB is approx £11 m<sup>-3</sup> (\$5 ft<sup>-3</sup>)
- So standing value =£3,300 ha<sup>-1</sup> (\$2,138 acre<sup>-1</sup>)
- In 55 years get 5 rotations



## Establishment costs



#### NDR @ 5% discount rate

Year	Operation	Cost/ Revenue (£)	Disc Cost/ Revenue (£)
0	Establishment	-1850	-1850
1	Herbicide	-200	-191
2	Herbicide	-200	-181
15	Harvesting single stems	+4365	+2100
25	Harvesting coppice	+3300	+975
35	Harvesting coppice	+3300	+598
45	Harvesting coppice	+3300	+367
55	Harvesting coppice	+3300	+225
	TOTAL	+15315	+2043



#### NDR & IRR





# **Comparison alternative**

Sitka Spruce, YC20, 2500 stems ha-1, intermediate thin

Year	Operation	Cost/ Revenue (£)	Disc Cost/ Revenue (£)
0	Establishment	-1850	-1850
1	Herbicide	-200	-191
2	Herbicide	-200	-181
20	Thinning	+287	+108
25	Thinning	+559	+165
30	Thinning	+1102	+255
35	Thinning	+1055	+191
40	Thinning	+739	+105
45	Thinning	+1129	+126
50	Thinning	+959	+84
55	Clear fell	+9125	+754
	TOTAL	+12705	-434





Figure 3: Minimum temperature for January (1961-1990). (Met Office undated)





Figure 4: **Projections for** Accumulated Temperature and **Moisture Deficit** for Great Britain (Broadmeadow, Webber, Ray and Berry 2009)



a) Baseline climate 1961 - 1990

b) Projection for 2050 low

c) Projection for 2050 high

### Conclusions



- Cold tolerant eucalypts possible crop
- Highly productive
- Higher returns than other trees
- But...Risk of cold damage
- Future risk not predictable



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