Site Assessment of *Eucalyptus nitens* at Cappoquin, Co. Waterford & Comparison with *Eucalyptus delegatensis* at Kilbora, Co. Wexford.

ShortFor Stakeholders Meeting at Teagasc Research Centre, Ashtown.
Wednesday 14th December 2016

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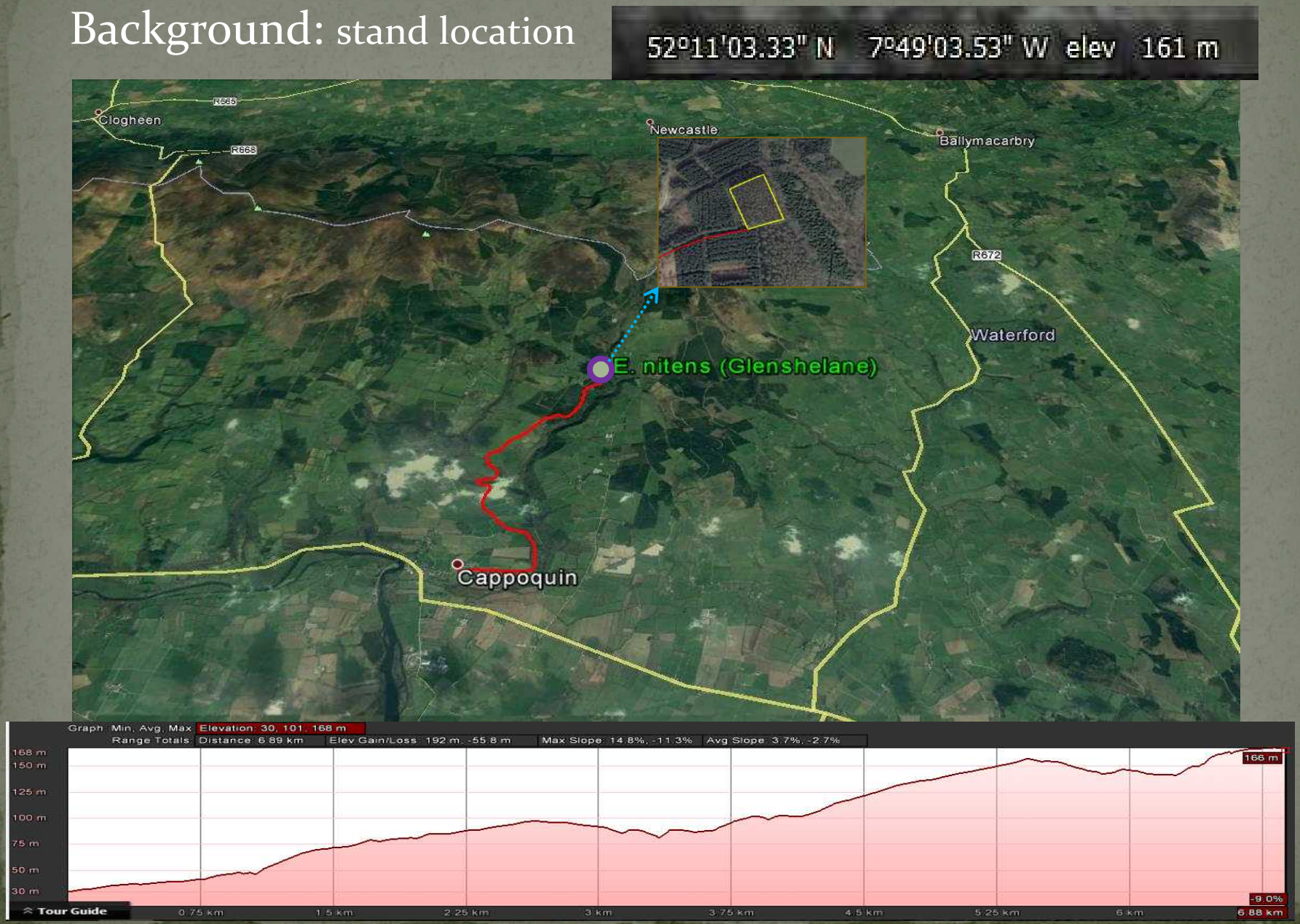
- Aim
- Background
- Stand inventory
- Field /Lab work
- Sample tree results
- Comparison with previous assessment (*E. delegatensis*)
- Conclusions
- Further work

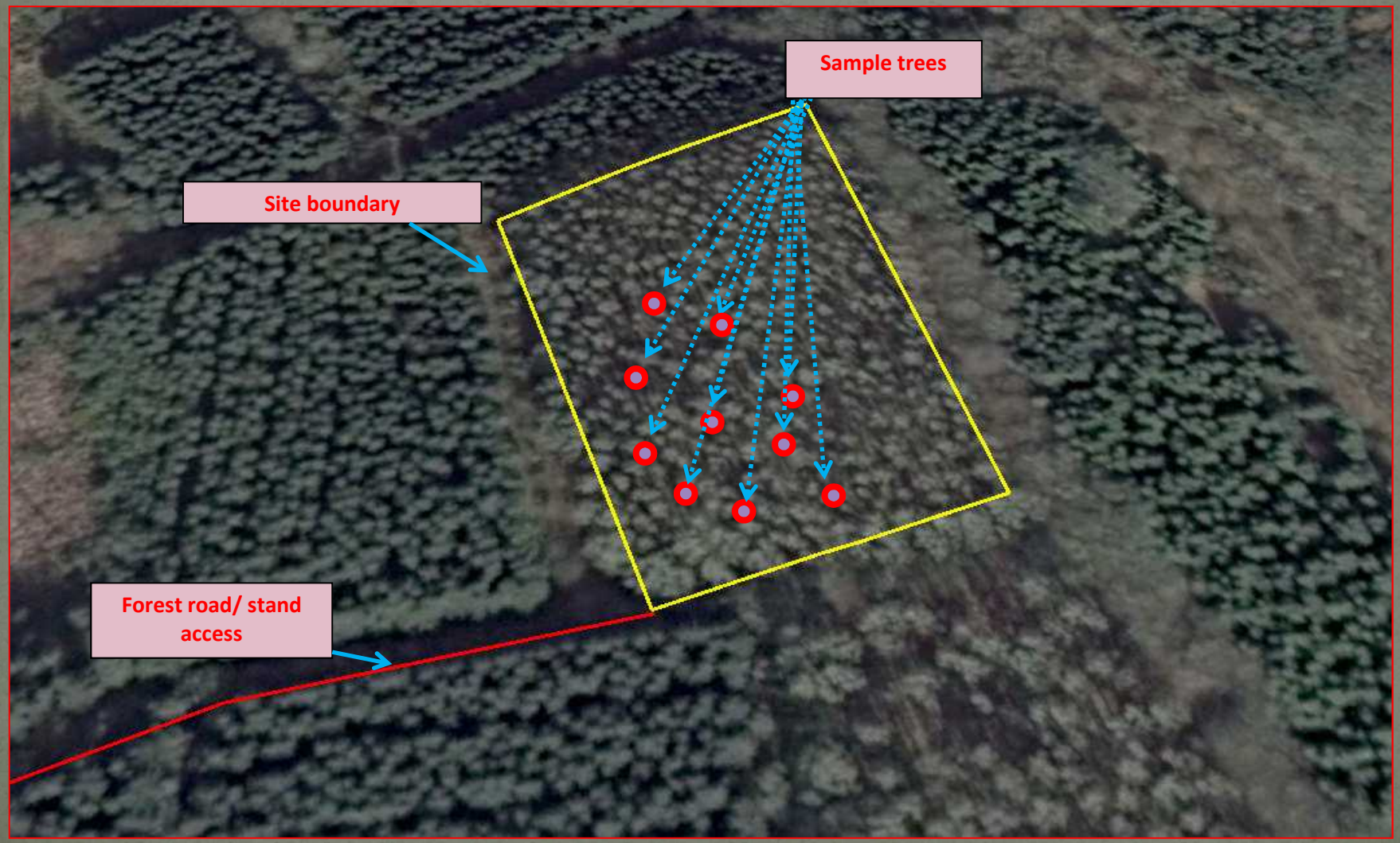
- Aim:
  - Investigate the allocation of aboveground biomass and accumulation patterns to optimise productivity.
  - Target➔ Optimum rotation length.
  - Estimation of the most suitable species according to rotation length.

Background: stand location



Fieldwork: Stand details

E. nitens- P.1993 at Capponquin (Glenshelane), Co. Waterford



Fieldwork: Stand inventory

- Stand age 23 yrs.
- Stand area 0.93 ha
- Dimensions 125 m × 75 m

- Six 0.02 ha plots defined
- All standing trees were counted and measured for DBH (n=101)
- Top height in each plot (n=10)
- Windblown trees measured for DBH (n=48)
- Total length of the largest DBH trees measured (n=6)
- Intact windblown trees measured:
  - Stem diameter at 1 m intervals.
  - Timber height
  - Branch diameter

Coates, Cronin & Kent, WIT

Fieldwork: Stand inventory II

	E. *nitens*	E. *delegatensis*
Stand age (years old)	23	22
Stand area (ha)	0.93	1.28
Dimensions (m^2)	125 x 75	160 x 85
Total number of trees on the site	1,155	558
Total number trees per ha	1,242	436
Mean DBH (cm)	26.52	32
Top height (m)	35.79	28.1
Mean volume (m^3)	0.06	0.08
Mean basal area (m^3)	0.58	0.81
Volume per ha (m3)	724	354
Total site volume (m^3)	673.63	453.87

Coates, Cronin & Kent, WIT

Fieldwork: Stand details

- Biomass determinations for all volume sampled trees.
- Cross-cut stems, and cut disks at 3 m intervals (weight disks immediately, labelled and placed into co-extruded bags)
  - Moisture samples.
  - Ring sampling (high resolution scans of fresh disks).
- Annual ring analysis carried out with WinDendro Density. *Eucalyptus* rings difficult to differentiate.
  - Ring counts and widths carried out on at least two radii per disk, perpendicular to widest Radius.

Sample tree results -biomass

GROUP	TREE	DBH (cm)	STUMP HT (cm)	TIMBER HEIGHT (m)	TOTAL HEIGHT (m)
LARGEST	1	29.10	0.16	27.88	31.40
	2	27.10	0.18	27.50	30.93
	3	42.50	0.21	29.85	35.79
MEDIUM	4	46.30	0.13	31.55	35.60
	5	17.20	0.10	16.50	22.00
	6	37.70	0.15	28.43	32.90
SMALLEST	7	23.00	0.10	20.75	24.95
	8	34.70	0.11	28.10	31.80
	9	23.90	0.10	23.50	28.20
	10	16.80	0.08	15.60	16.30

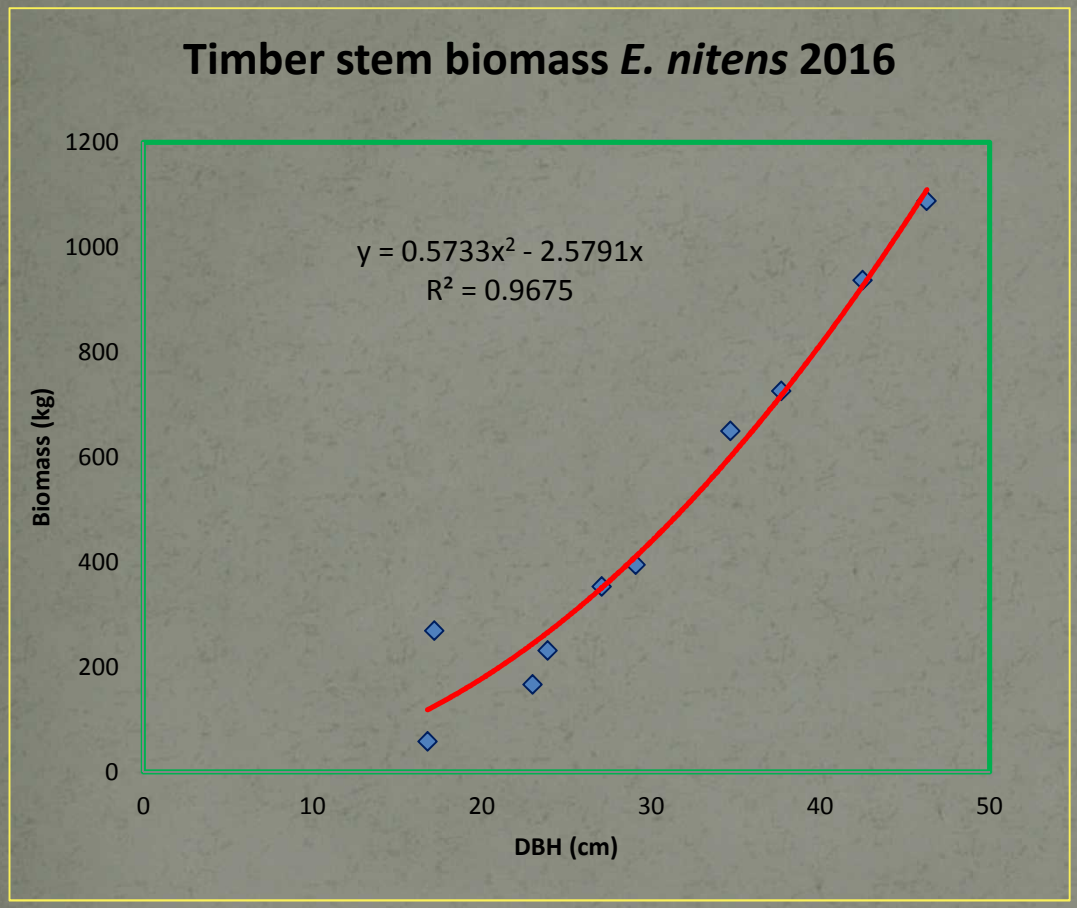
Sample tree results –diameter increment

GROUP	TREE NUMBER	RING WIDTH SUM (cm)	DBH	AVERAGE DBH (cm)	SHRINGKAGE (cm)
LARGEST	4	18.83	46.30	42.17	38.70
	3	18.20	42.50		
	6	14.92	37.70		
MEDIUM	8	14.16	34.70	30.30	27.75
	1	12.31	29.10		
	2	11.74	27.10		
SMALLEST	9	10.52	23.90	21.37	19.68
	7	8.65	23.00		
	5	6.11	17.20		
	10	6.41	16.80		

DBH INCREMENTS

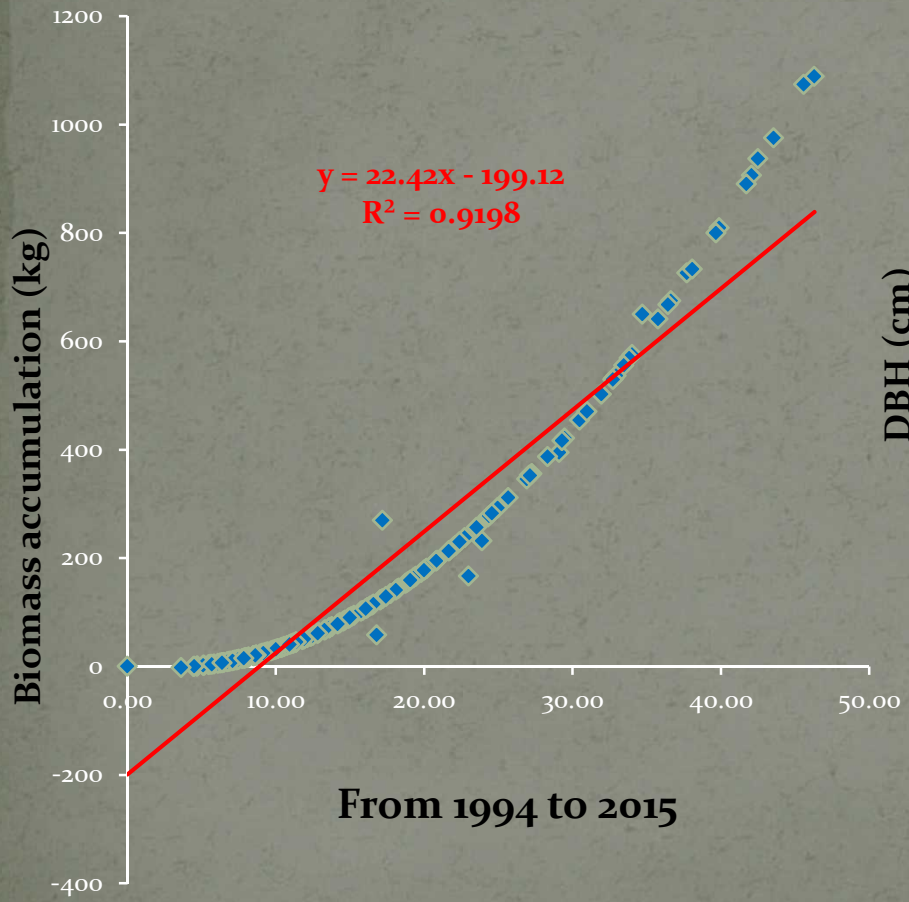
GROUP	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
SMALL	20.23	18.78	16.64	14.81	13.45	12.48	11.57	10.88	9.88	9.97	8.98	8.28	7.57	7.17	10.55	9.48	8.53	7.89	7.36	6.72	5.70
MEDIUM	30.30	28.75	26.59	24.48	22.09	19.95	17.78	16.05	14.61	13.18	11.89	10.84	9.91	8.98	8.05	7.21	5.97	5.82	7.46	7.10	6.38
LARGE	42.17	41.43	39.70	37.17	34.43	32.09	29.55	26.79	24.54	22.32	20.37	18.47	16.93	15.19	13.99	13.01	11.66	10.67	9.70	9.16	8.35

Sample tree results II



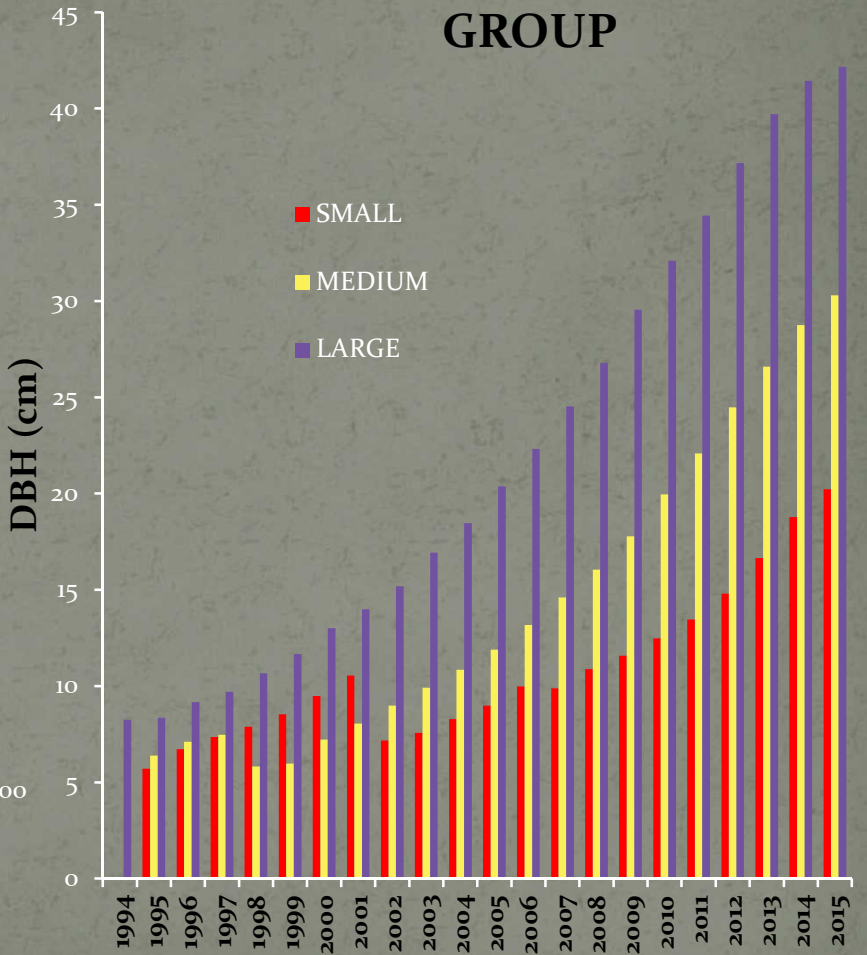
Sample tree results-biomass accumulation

E. *nitens* DBH BIOMASS VARIATION MODEL

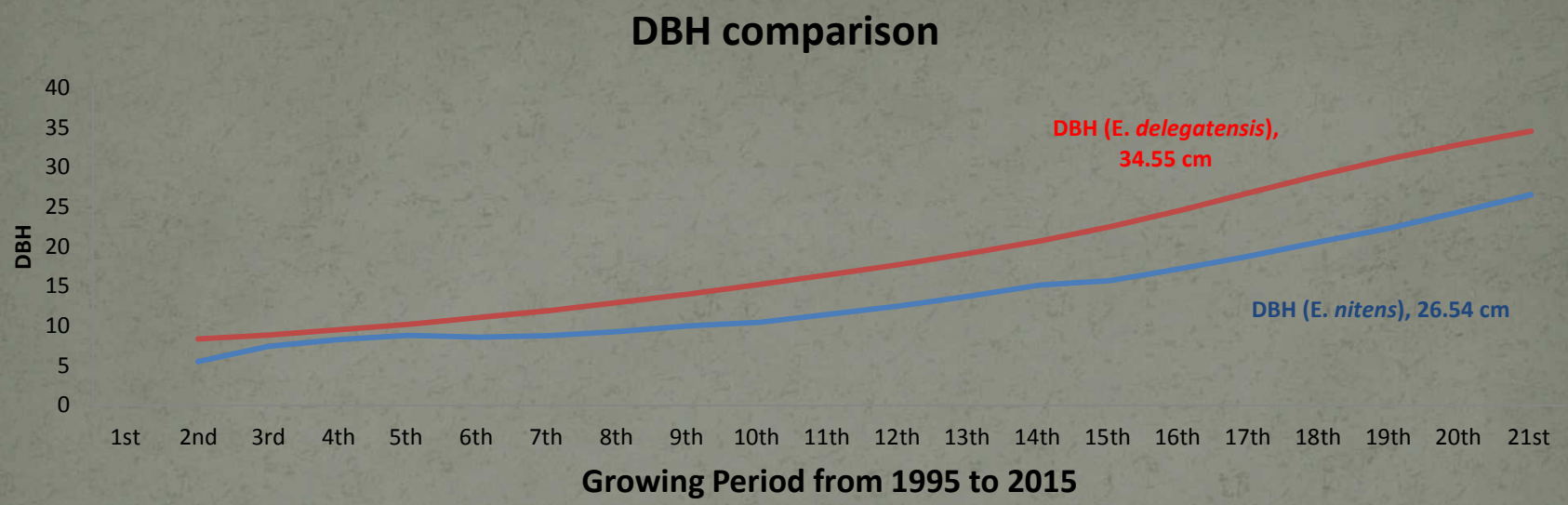


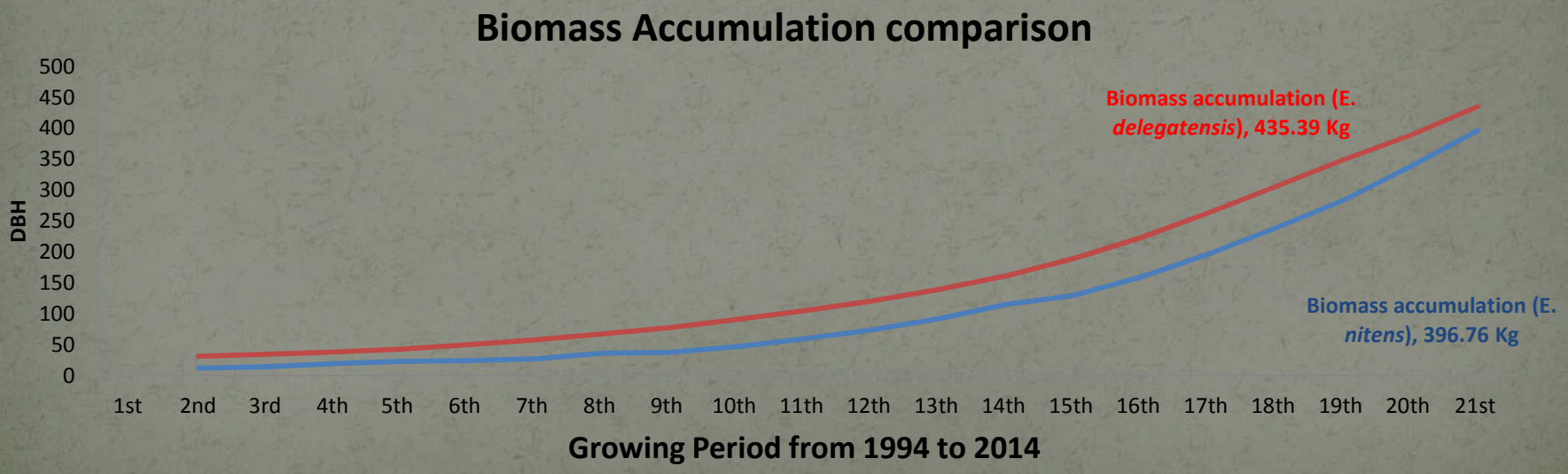
From 1994 to 2015

E. *nitens* DBH VARIATIONS PER GROUP



Comparison with previous assessment (*E. delegatensis*)





Stand level –biomass production comparison

E. *nitens*									
Tree No.	DBH (cm)	Total Dry Matter (kg)				Total Above Ground Biomass (kg)			
		Merch Stem Dry weight	Branches Dry weight (live + dead+ top)	Foliage Dry weight	Total AGB Dry Matter	Merch Stem Biomass	Branches Biomass (live + dead+ top)	Foliage Biomass	Total AGB
1	29.1	410.42	6.89	5.57	422.88	336.95	5.01	2.11	413.78
2	27.1	351.14	4.61	2.66	358.42	291.00	5.03	1.88	354.62
3	42.5	925.91	3.42	2.74	932.08	899.78	4.88	3.68	940.23
4	46.3	1109.57	4.49	6.66	1120.72	1188.79	4.84	4.13	1131.95
5	17.2	125.24	5.70	0.64	131.58	140.85	5.13	0.72	132.40
6	37.7	717.59	6.40	0.00	724.00	632.90	4.93	3.12	725.18
7	23	243.96	3.75	0.36	248.07	215.47	5.07	1.40	248.53
8	34.7	600.81	6.39	1.27	608.47	507.96	4.96	2.77	605.91
9	23.9	265.83	3.94	1.12	270.89	230.16	5.06	1.50	270.09
10	16.8	118.48	5.20	0.96	124.63	136.78	5.14	0.67	125.82
AVERAGE	29.83	486.90	5.08	2.20	494.17	458.06	5.00	2.20	494.85

E. *delegatensis*									
Tree No.	DBH (cm)	Total Dry Matter (kg)				Total Above Ground Biomass (kg)			
		Merch Stem Dry weight	Branches Dry weight (live + dead+ top)	Foliage Dry weight	Total AGB Dry Matter	Merch Stem Biomass	Branches Biomass (live + dead+ top)	Foliage Biomass	Total AGB
1	37.3	656.71	3.97	3.45	725.32	605.69	4.68	6.00	640.18
2	40.4	710.08	5.57	6.96	745.05	706.85	5.79	6.19	747.98
3	24.9	294.68	1.73	5.72	313.84	277.15	1.59	5.11	291.19
4	40.8	430.75	0.65	4.76	449.29	720.46	5.95	6.22	762.48
5	47.5	1111.35	1.23	6.87	1162.74	966.84	8.92	6.60	1025.53
6	21.6	153.41	1.89	5.32	161.93	210.50	1.09	4.83	220.71
7	33.8	578.46	2.57	4.41	601.88	500.57	3.60	5.77	528.31
8	27.7	421.88	0.99	6.12	434.36	340.60	2.12	5.33	358.42
9	25.4	335.54	2.31	2.42	347.24	288.02	1.68	5.15	302.70
10	38	649.39	16.57	2.31	704.00	627.88	4.92	6.04	663.80
AVERAGE	33.74	534.23	3.75	5.99	564.56	524.46	4.03	5.72	554.13

Conclusions

- In theory:
  - E. *nitens* (Shining Gum)
    - It is an important species for fibre production .
    - Very good for early rapid growth, volume production and cold hardiness.
    - Good for sites with a lower risk of cold temperatures (hardy to -12°C).
    - Does well on a wide range of moderately fertile soil types. Has timber production potential and for fibre production.
  - E. *delegatensis* (Alpine Ash)
    - Provides good cold tolerance (hardy to -12 or -14°C).
    - Not a fast grower.
    - Grows well on most well drained, deep soils.
    - Low wood density may make it more useful as a fibre than as an energy species.
- What can we conclude with this assessment?
  - E. *nitens* has shown a rapid growth, specially at early growing stage, performing the tallest trees among both trials, however E. *delegatensis* has eventually accomplished greater DBH throughout the rotation period. Nevertheless, both species have grown well at the chosen trials matching practically same thickness levels.
  - E. *nitens*, in terms of AGB accumulation, has kept a positive trend as showed in the previous slide, specially in the second decade of growth, whilst E. *delegatensis* remained more productive accumulating more biomass (larger DBH).

Further work

- To convert data from single tree to stand level.
  - Apply biomass equations to full stand inventory.
  - DBH and biomass accumulation from the whole site.
  - Total biomass (aboveground/belowground).


Thank you