

Stand structure and diversity in five silvicultural regimes including old-growth *Eucalyptus obliqua* forest, northern Tasmania.

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Abstract

The presentation reports on the analysis of forest structure, floristic diversity and habitat condition for contemporary silvicultural regimes applied on a small-scale, family-sized landholding - a 760 ha forested property in the Northern Midlands of Tasmania and located on the eastern foothills of the Great Western Tiers. Forest includes *Eucalyptus obliqua* high forest; advanced regrowth *E. obliqua* forest and remnant (old-growth) *E. obliqua* forest and comparative results are also presented for plot samples of young *E. nitens* plantations on ex-bushland and ex-pasture sites. The study demonstrates that at the farm forest scale, there is opportunity for an integrated mix of native regrowth and remnant old-growth eucalypt forests to be silviculturally managed alongside plantations, to achieve favourable outcomes for both wood production and biodiversity protection across the landholding as a whole. With careful planning and skilled forest management, this is creating a broad basket of social and community benefits without compromising either the environmental or commercial goals of the enterprise.

**Private farm forestry
in northern Tasmania:**



**Stand structure and diversity
in five silvicultural regimes**

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& Sally-Anne Smith¹

1. University of Tasmania
2. Landholder, farm forester
3. Private Forests Tasmania

➤ **Introduce the landholders
and their forests**



➤ **Compare Stand Structure in
Five (5) farm forestry silvicultural
regimes incl. E. obliqua old-growth**

➤ **Provide an audit of floristic diversity and
habitat condition for each regime**

➤ **Consider management implications for
production and biodiversity protection
in private farm forestry**

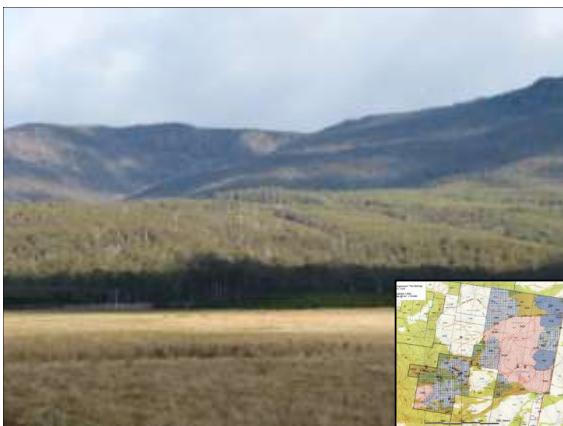


John and Diana Lord
Australian Forest Growers
National Tree Farmer of the Year Award
2006

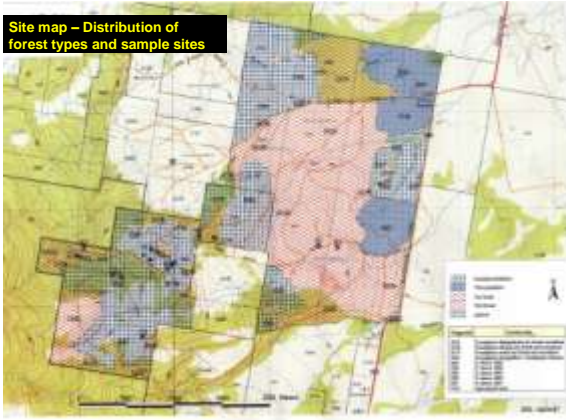
Family Enterprise: Farm forestry

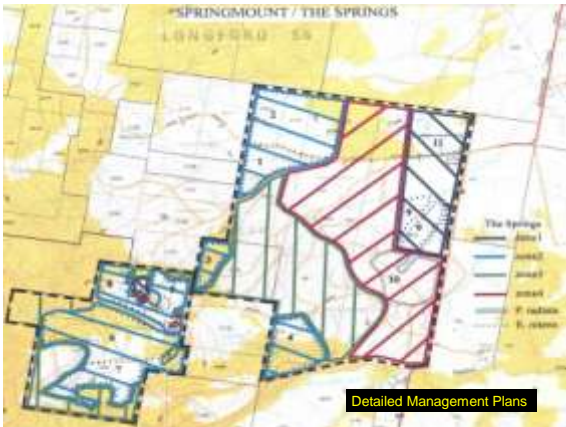
- Own and manage a 760 ha mixed forest in N. Tas.
- Past 30 y establishing and managing their family forests
- Planned, established and managed plantations & native forest for timber production and forest conservation
- Marketed and harvested timber for sawmilling, craftwood, pressure treatment, pulpwood and firewood
- Constructed and maintained roads, fire breaks, restored fire damaged forest and controlled weeds and vermin
- Conducted experiments to thin *E. obliqua* regrowth forest





Site map - Distribution of forest types and sample sites





Detailed Management Plans



Timber Stand Improvement plot with high stocking rates of *E. obliqua* regrowth.



Remnant native oldgrowth forest for riparian and steep slope protection



Riparian protection, Wet *E. obliqua* forest



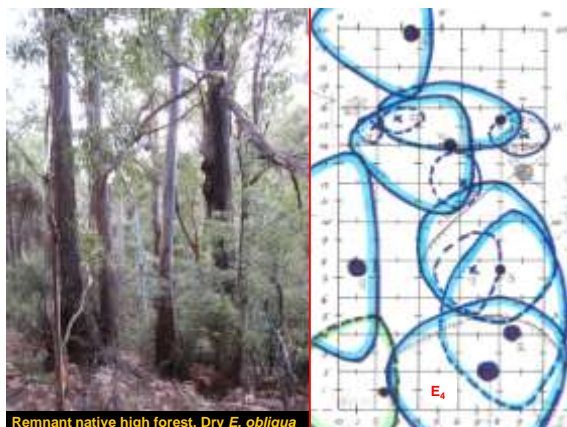
Native *E. obliqua* high forest, silviculturally thinned to a stocking of 120+ tpha, with excellent regeneration



Plantation *E. nitens*, formerly degraded forest. Mechanically thinned 2007.

Forest structure, Habitat and Biodiversity analysis
Stratification by forest habitat types:

1. **Remnant native high forest, Dry *E. obliqua* / *E. viminalis***
 Intact, ungrazed and essentially unlogged oldgrowth forest (excepting for isolated, occasional stems removed, early 1900's).
2. **Thinned native high forest, Dry *E. obliqua* / *E. viminalis***
 Silviculturally thinned 2000 (Timber Stand Improvement) for advanced growth release and regeneration
3. **Regrowth forest, Dry *E. obliqua***
 Established (during previous ownership) following clearfell for pulpwood and burning for regeneration, mid 1970's
4. **Plantation *E. nitens* on degraded ex-forest site, est. 1992**
 Coupe 6, age 15 yrs, silviculturally thinned by 3rd row removal for pulpwood at age 15 yrs (2007)
5. **Plantation *E. nitens* on run-down ex-pasture site, est. 1989**
 Coupe 5, age 18 yrs, silviculturally thinned by 3rd row removal for pulpwood at age 15 yrs (2004)B



Remnant native high forest, Dry *E. obliqua*

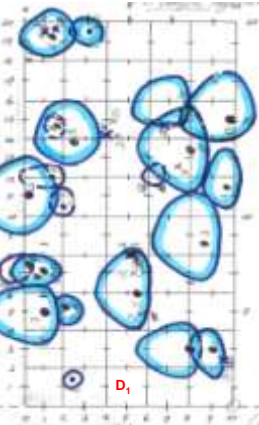


Thinned high forest, Dry *E. obliqua* (2000)



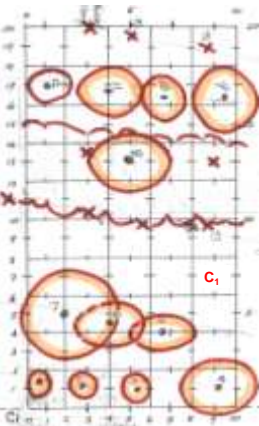


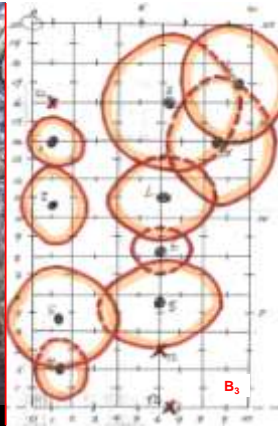
Regrowth forest, Dry *E. obliqua* (late 70's)

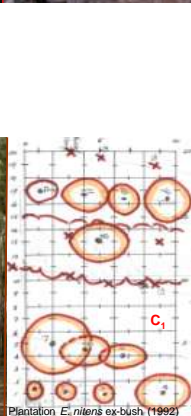
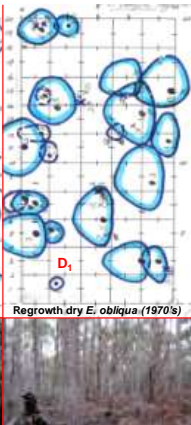
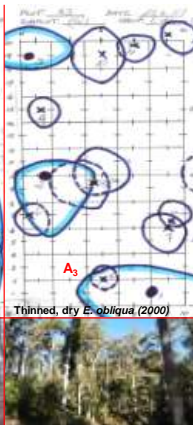
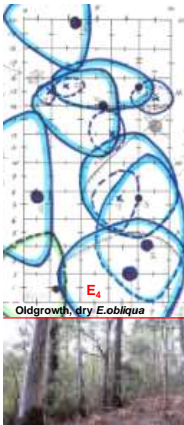




Plantation *E. nitens*, ex-bush (1992)







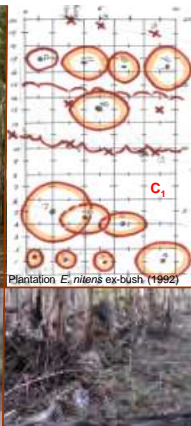
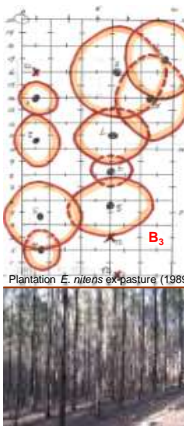


Table 1. Analysis of stand structure in 200m² forest sample plots in five forest silvicultural regimes, 2007.

(* Plantation tree density follows 3rd row thinning.)

STAND ANALYSIS Forest Structure	Mature Oldgrowth Forest Dry <i>E. obliqua</i>	Thinned High Forest Dry <i>E. obliqua</i> (2000)	Regrowth Forest Dry <i>E. obliqua</i> (mid 70's)	Plantation <i>E. nitens</i> ex-bush (1992)	Plantation <i>E. nitens</i> ex-pasture (1989)
Small Plots (x3)	E	A	D	C	B
Tree density per ha (+small trees)	425 (35) [300 (70)]	167 (28.0) [350 (150)]	1000 (70) [250 (0.0)]	565* (94)	585* (75)
Tree canopy height (m)	31.8 (0.2)	32.4 (2.3)	22.4 (1.8)	19.9 (1.1)	25.1 (1.7)
No. Tree Species (T)	3.5 (0.7)	2.3 (1.1)	4.0 (0.0)	1.7 (0.6)	1.0 (0.0)
Tree Basal Area (m ² ha ⁻¹)	117.7 (34.2)	36.4 (2.9)	48.4 (4.5)	20.0 (1.8)	37.1 (3.9)
% Basal Area (trees ≥ 60cm DBH)	76.0 (12.1)	41.7 (1.5)	15.4 ^a (21.7)	0.0	0.0
Foliage Projective Cover (FPC, %)	87.5 (6.5)	44.2 (10.9)	50.7 (0.5)	36.3 (14.2)	60.4 (2.5)

Table 2. Floristic analysis of forest sample plots in five forest silvicultural regimes, 2007.

STAND ANALYSIS Floristics	Mature Oldgrowth Forest Dry <i>E. obliqua</i>	Thinned High Forest Dry <i>E. obliqua</i> (2000)	Regrowth Forest Dry <i>E. obliqua</i> (mid 70's)	Plantation <i>E. nitens</i> ex-bush (1992)	Plantation <i>E. nitens</i> ex-pasture (1989)
Small Plots (x3)	E	A	D	C	B
No. Vascular Plants per plot (N)	396 (172)	432 (86)	261 (126)	301 (151)	301 (66)
No. Plant Species per plot (S)	12.5 (0.7)	22.7 (3.1)	9.5 (0.7)	14.0 (3.6)	12.0 (1.0)
Plant Diversity Simpson's Index (D)	0.77 (0.03)	0.74 (0.04)	0.71 (0.01)	0.76 (0.07)	0.61 (0.05)
Shannon-Weiner Index (H')	2.65 (0.36)	2.83 (0.26)	2.28 (0.11)	2.49 (0.50)	2.12 (0.27)

Table 3. Habitat condition analysis in five forest silvicultural regimes, 2007. (TASVEG. Ver.1.0, Michaels 2006)

TASVEG HABITAT SCORE	Mature Oldgrowth Forest Dry <i>E. obliqua</i>	Thinned High Forest Dry <i>E. obliqua</i> (2000)	Regrowth Forest Dry <i>E. obliqua</i> (mid 70's)	Plantation <i>E. nitens</i> ex-bush (1992)	Plantation <i>E. nitens</i> ex-pasture (1989)
Small Plot	E	A	D	C	B
Large Trees (10)	10	8	0	0	0
Tree Canopy Cover (5)	5	3	5	5	5
Lack of Weeds (15)	15	13	13	13	13
U/storey Life Forms (25)	15	20	15	15	10
Recruitment (10)	6	10	3	3	3

Table 3 (continued). Habitat condition analysis in five forest silvicultural regimes, 2007. (TASVEG. Ver.1.0, Michaels 2006)

TASVEG HABITAT SCORE	Mature Oldgrowth Forest Dry <i>E. Obliqua</i>	Thinned High Forest Dry <i>E. obliqua</i> (2000)	Regrowth Forest Dry <i>E. obliqua</i> (mid 70's)	Plantation <i>E. nitens</i> ex-bush (1992)	Plantation <i>E. nitens</i> ex-pasture (1989)
Small Plot	E	A	D	C	B
Organic Litter (5)	5	5	5	5	4
Large Logs (5)	5	5	5	4	0
Patch Size (10)	10	8	8	8	8
Nearby Native Veg. (10)	4	5	3	1	1
Connectivity with core (5)	5	4	4	3	3
TOTAL HABITAT SCORE (100)	80	81	61	57	47

Table 4. Basal Area increment 2007-2013.

Dry *E. obliqua* forest x three silvicultural regimes.

BASAL AREA Summary	Regrowth (1975) <i>E. obliqua</i> Forest 6.2007 - 9.2013	Thinned (2000) <i>E. obliqua</i> Forest 6.2007 - 9.2013	Mature Oldgrowth <i>E. obliqua</i> Forest 6.2007 - 9.2013
Plot Basal Area 2007 - 2013 (m ² ha ⁻¹)	45.2 - 53.5	34.2 - 42.3 26.7 - 50.3 33.5 - 46.7	141.5 - 156.0 91.7 - 102.9
BA increment (PAI, m ² ha ⁻¹ an)	1.39	1.30) 3.81) 2.14) 2.42	2.42) 1.87) 2.15
% BA Trees ≥ 60cm DBH	15.4* - 0.0	41.7 - 49.3	76.0 - 83.3
% BA Trees < 60cm DBH	84.6* - 100.0	58.3 - 51.7	24.0 - 16.7

Table 5. Biodiversity, habitat condition and structural complexity

Dry *E. obliqua* forest x three silvicultural regimes.

Summary (/100)	Regrowth (1975) <i>E. obliqua</i> Forest	Thinned (2000) <i>E. obliqua</i> Forest	Mature Oldgrowth <i>E. obliqua</i> Forest
No. Plant Species (S)	2007 9.5 (0.7) 2013 10.4 (1.7)*	22.7 (3.1) 12.7 (1.7)	12.5 (0.7) 12.4 (3.2)
Simpson's Index (D)	0.71 (0.01)	0.74 (0.04)	0.77 (0.03)
TASVEG HABITAT CONDITION 2007	61	81	80
TASVEG HABITAT CONDITION 2013	57	75	77
STRUCTURAL COMPLEXITY 2013 (after McElhinny et al. 2005)	55	76	71

Conclusions

- 1. **Significant biodiversity contributions** were compared among several different forest management regimes.
- 2. **A matrix of native forests and farm-scale plantations** is being managed successfully for both production and biodiversity protection, across contiguous regimes of unmanaged oldgrowth, managed regrowth, thinned native high forest, and young eucalypt plantations.
- 3. **Silviculturally managed native *E. obliqua* forests** are capable of matching and augmenting the biodiversity capacity of adjoining oldgrowth forest samples at the same time as enhancing stand quality and future timber production.
- 4. **A carefully managed mix of silvicultural strategies** contributes both to farm forest productivity and environmental protection across this enterprise.
- 5. **A dynamic and holistic interpretation of ecosystem biodiversity** is required in order to account fully for different forest disturbances, respective management histories and regeneration and production opportunities which are evident.

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