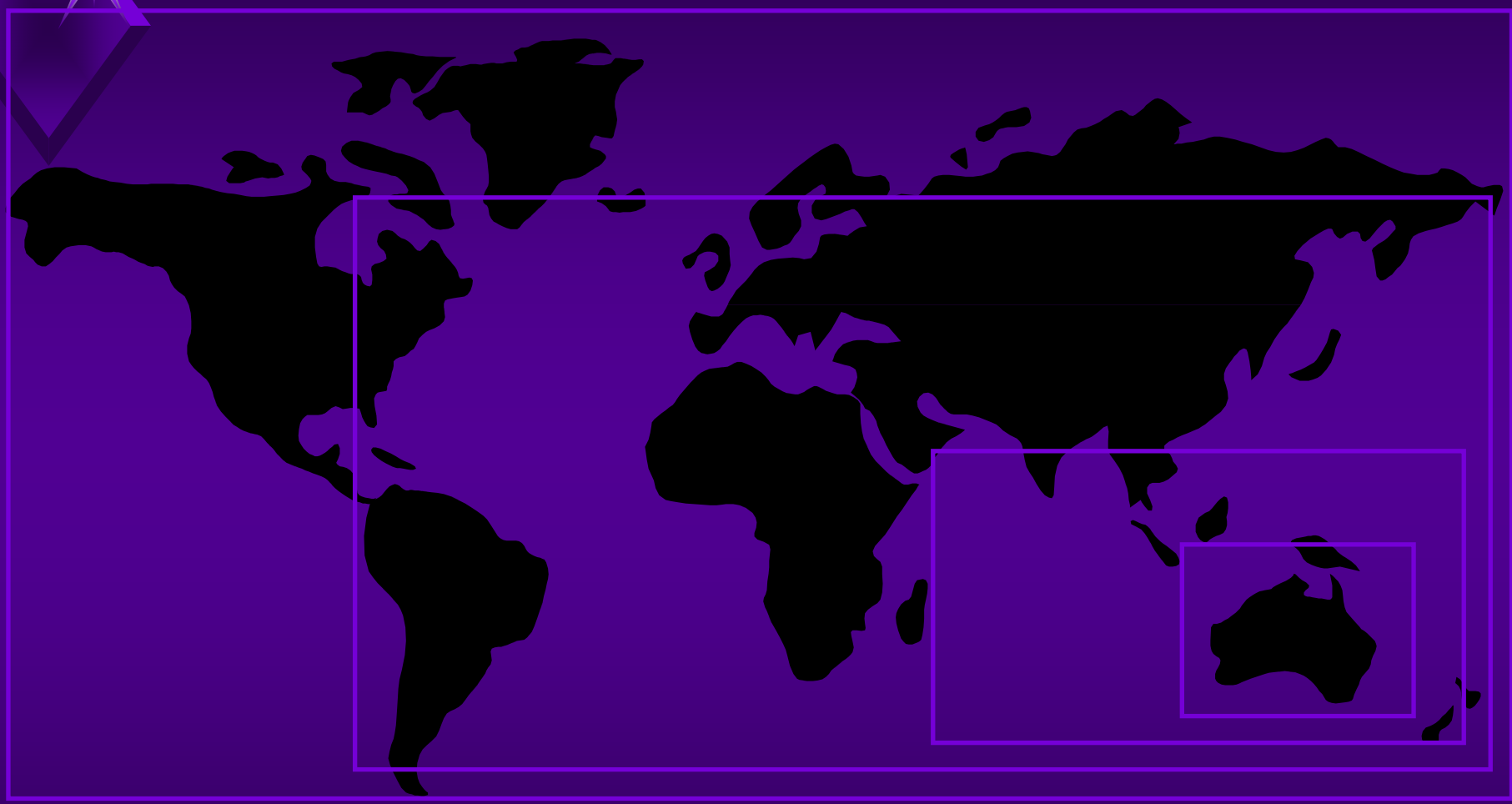
The potential for using tree crops and biodiversity plantings in Western Australia for Carbon sequestration

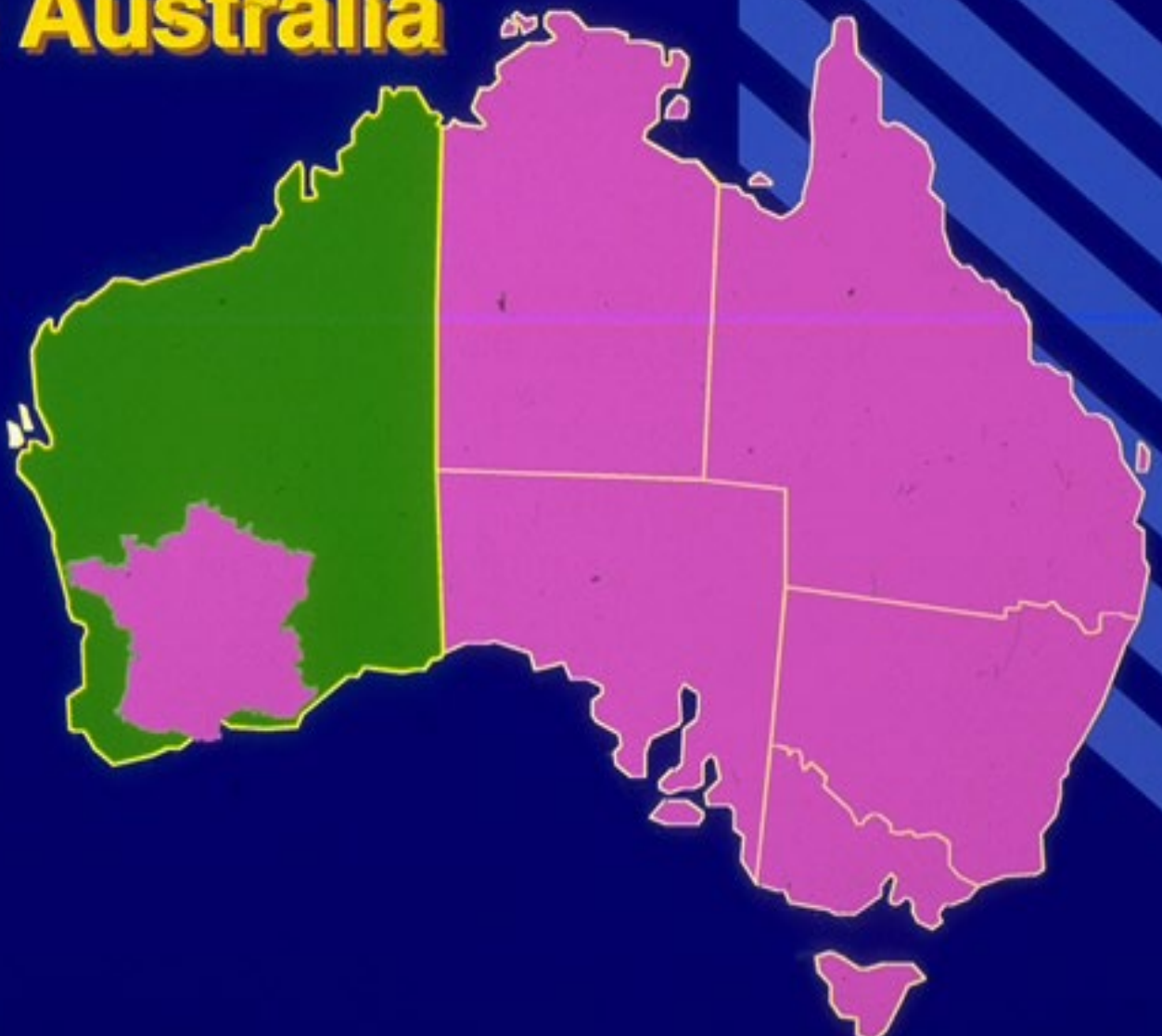
Presentation to BP Australia

by

CALM

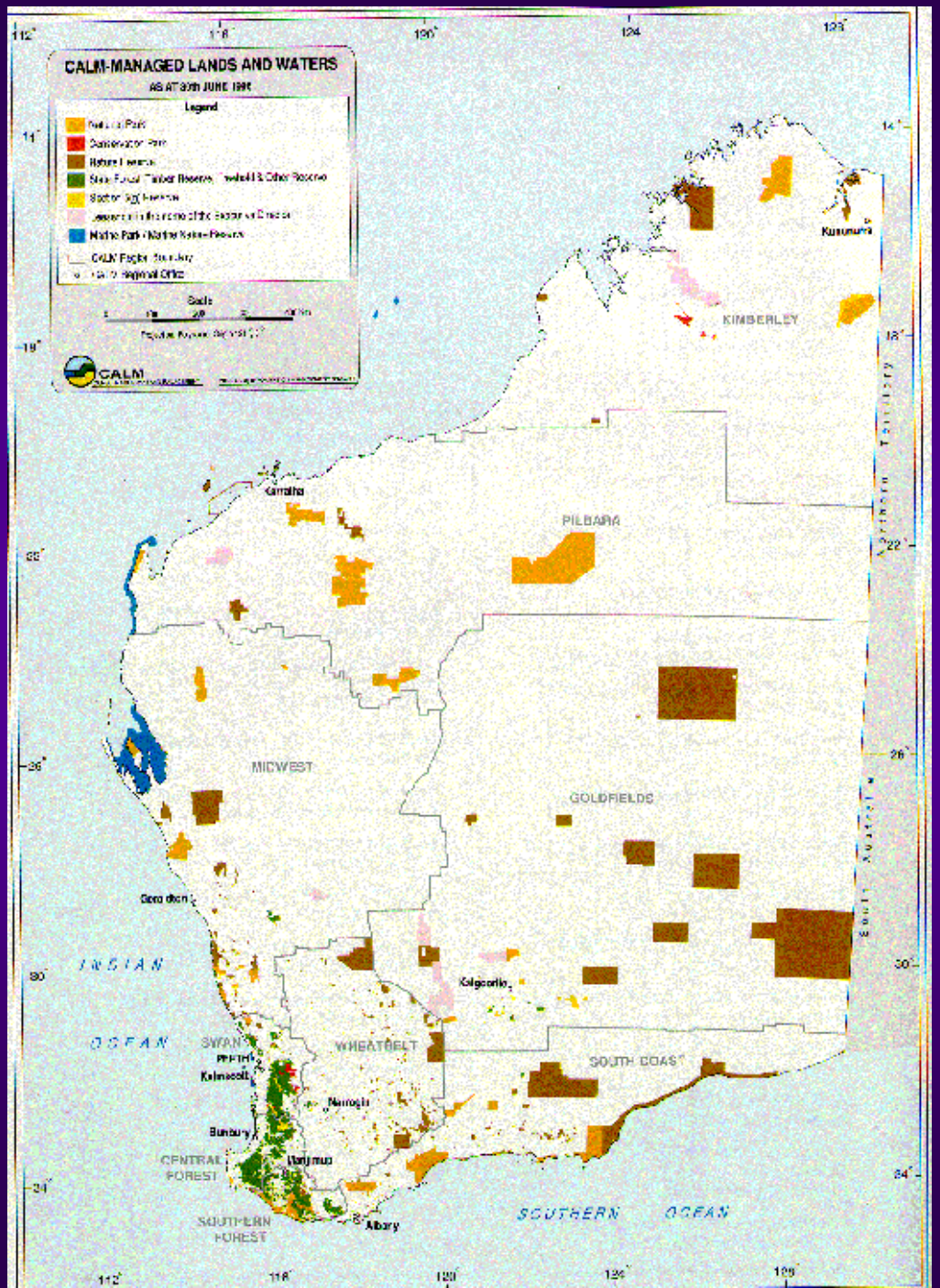


France occupies a land area about a quarter the size of Western Australia

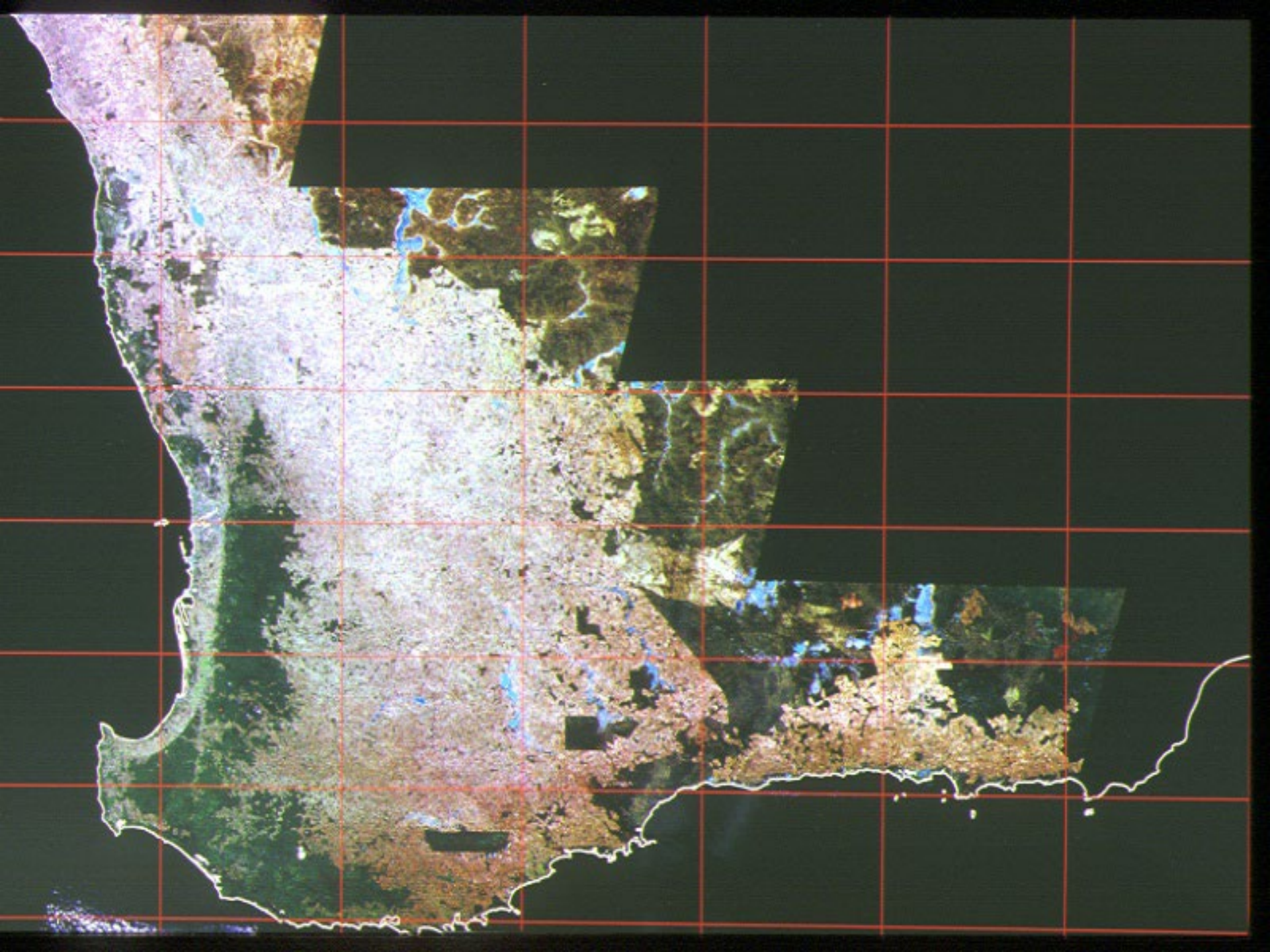



CALM manages a land area
51% the size of Japan
51%

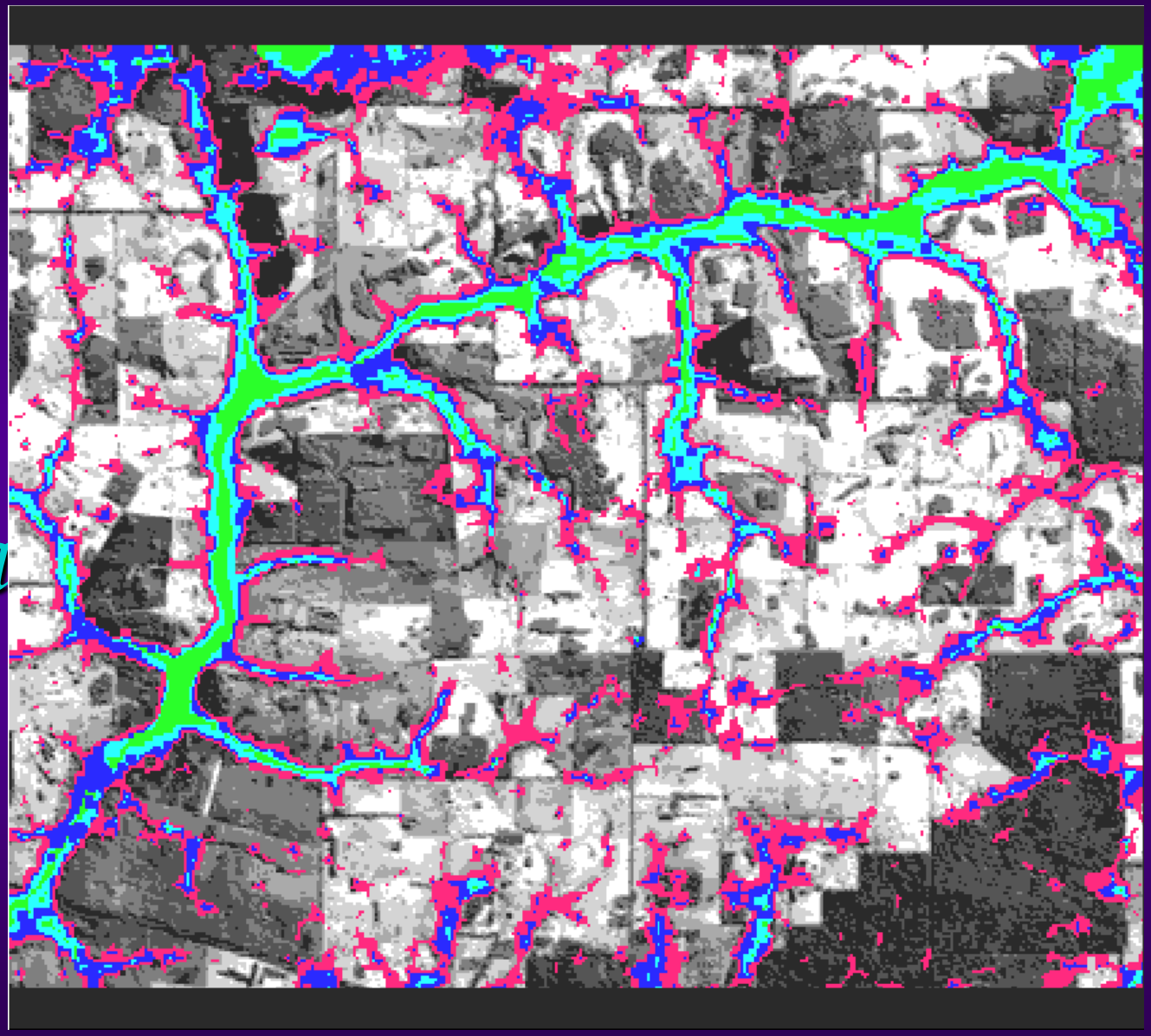
CALM managed lands and waters



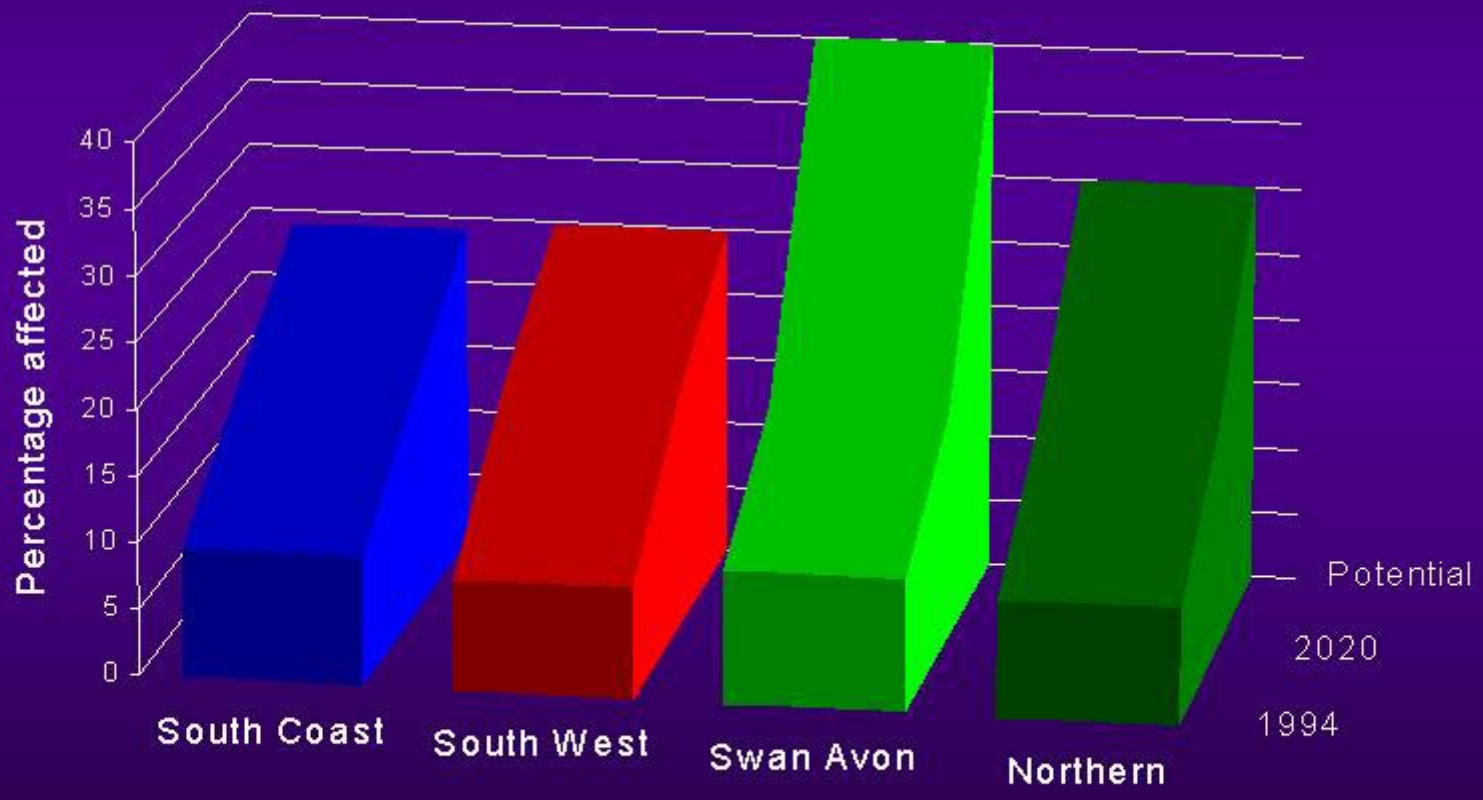

INTEGRATION



Satellite imagery a salinity



Estimated areas affected by salinity by region

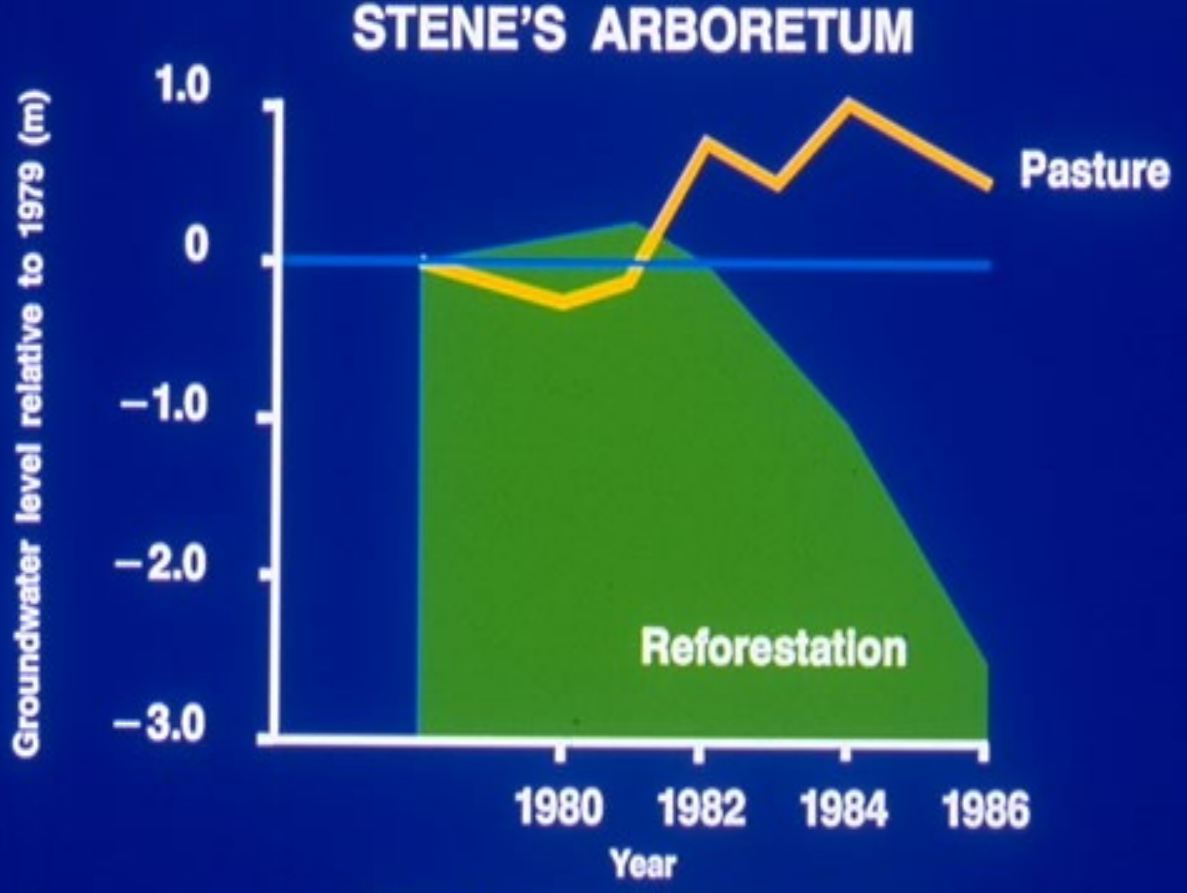


Estimated areas affected by salinity in 1994, 2020 and potential at full development

Region	Total Area 000ha	Salt affected 1994 000ha	%	Salt affected 2020 000ha	%	Potential area 000ha	%
South Coast	4 079	395	9.7	688	16.8	977	24.0
South West	3 310	274	8.3	596	18.0	820	24.8
Swan-Avon	7 591	759	10.0	1 290	17.0	3 035	40.0
Northern	4 252	376	8.8	723	17.0	1 276	30.0
Total	**19 231**	**1 805**	**9.4**	**3 296**	**17.1**	**6 111**	**31.8**

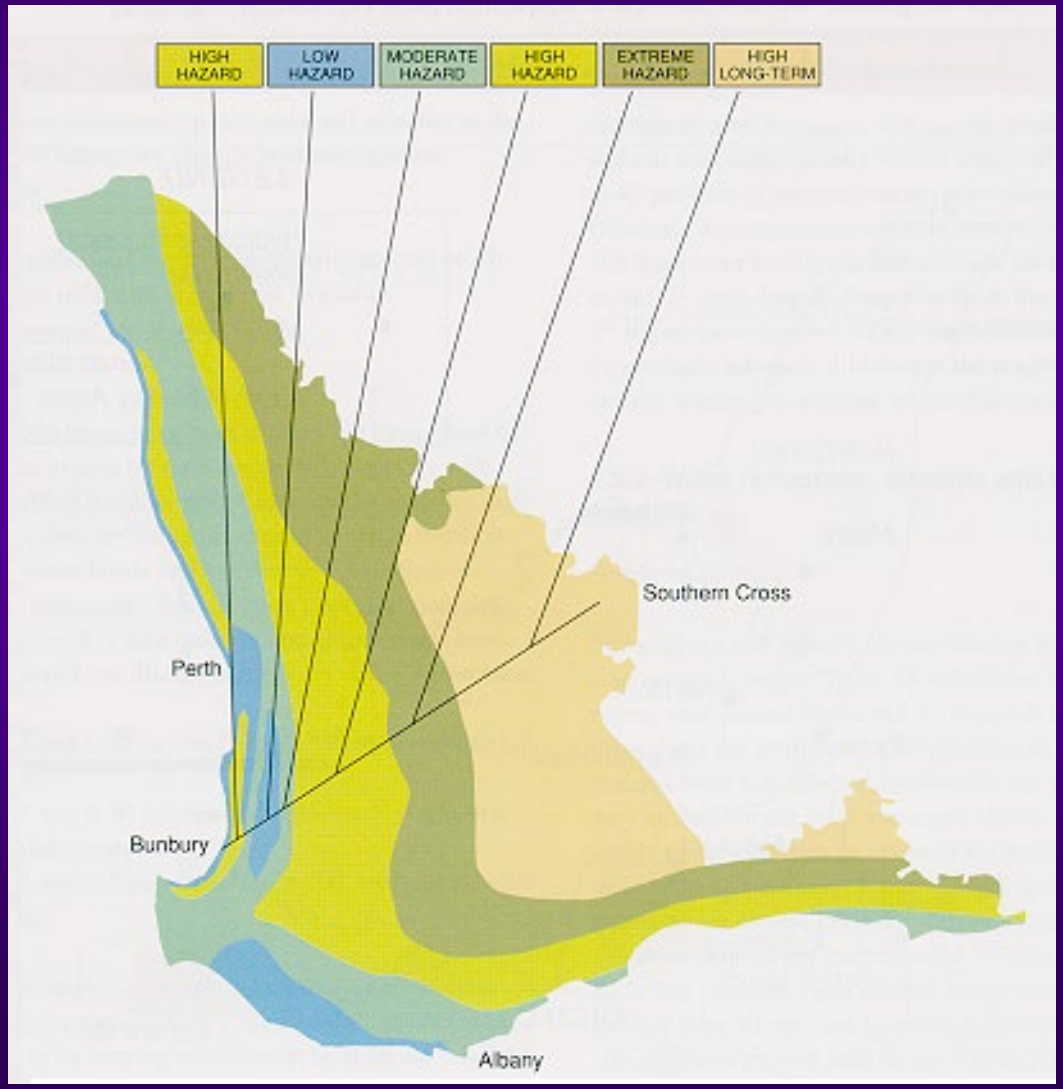
From Ferdowsian *et al*. 1996

THE EFFECT OF TREE CROPS ON WATER TABLE LEVELS



Water Authority of Western Australia
July 1989
Report No. WS 33

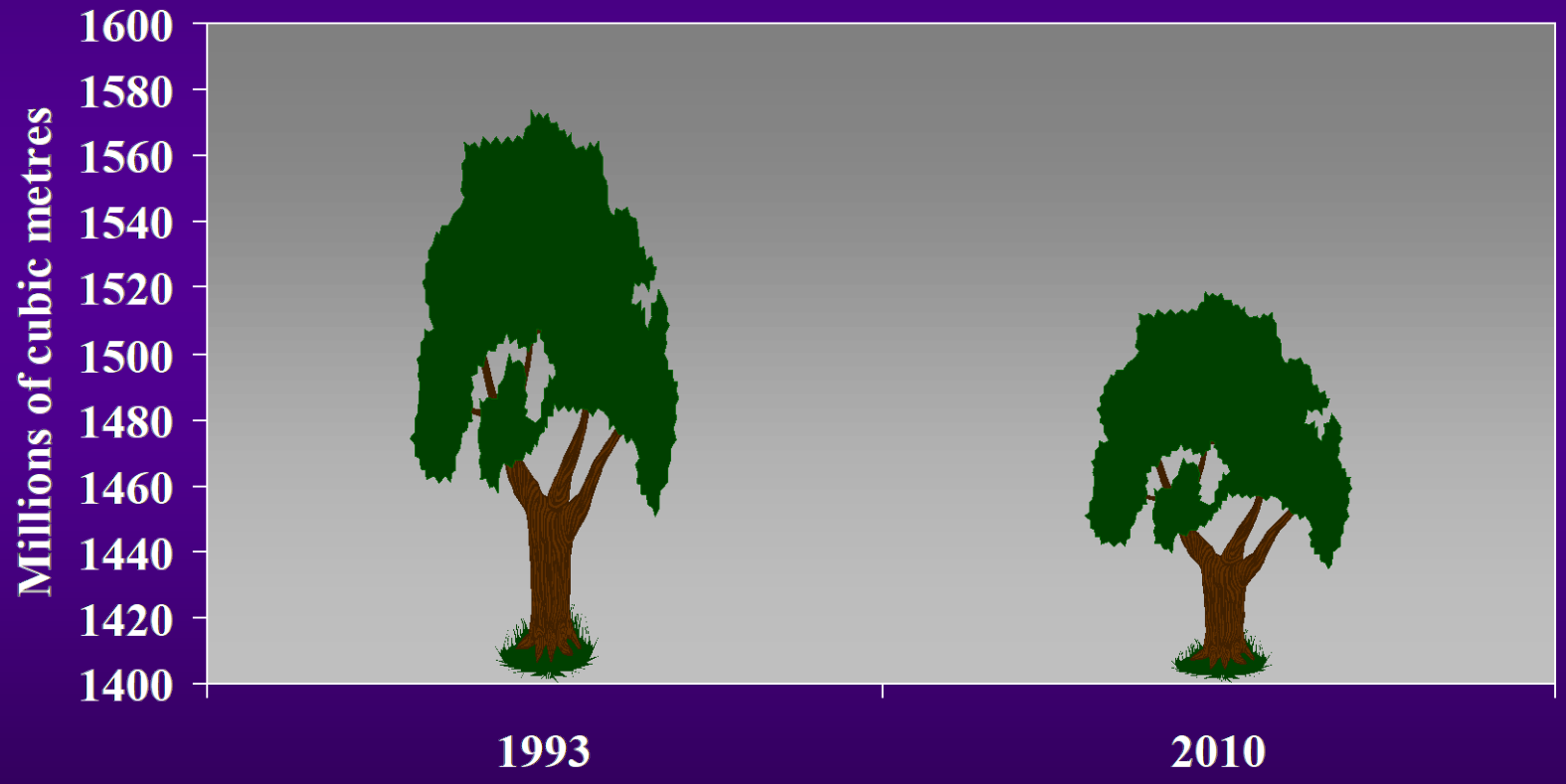
Salinity hazard zones in the South-west



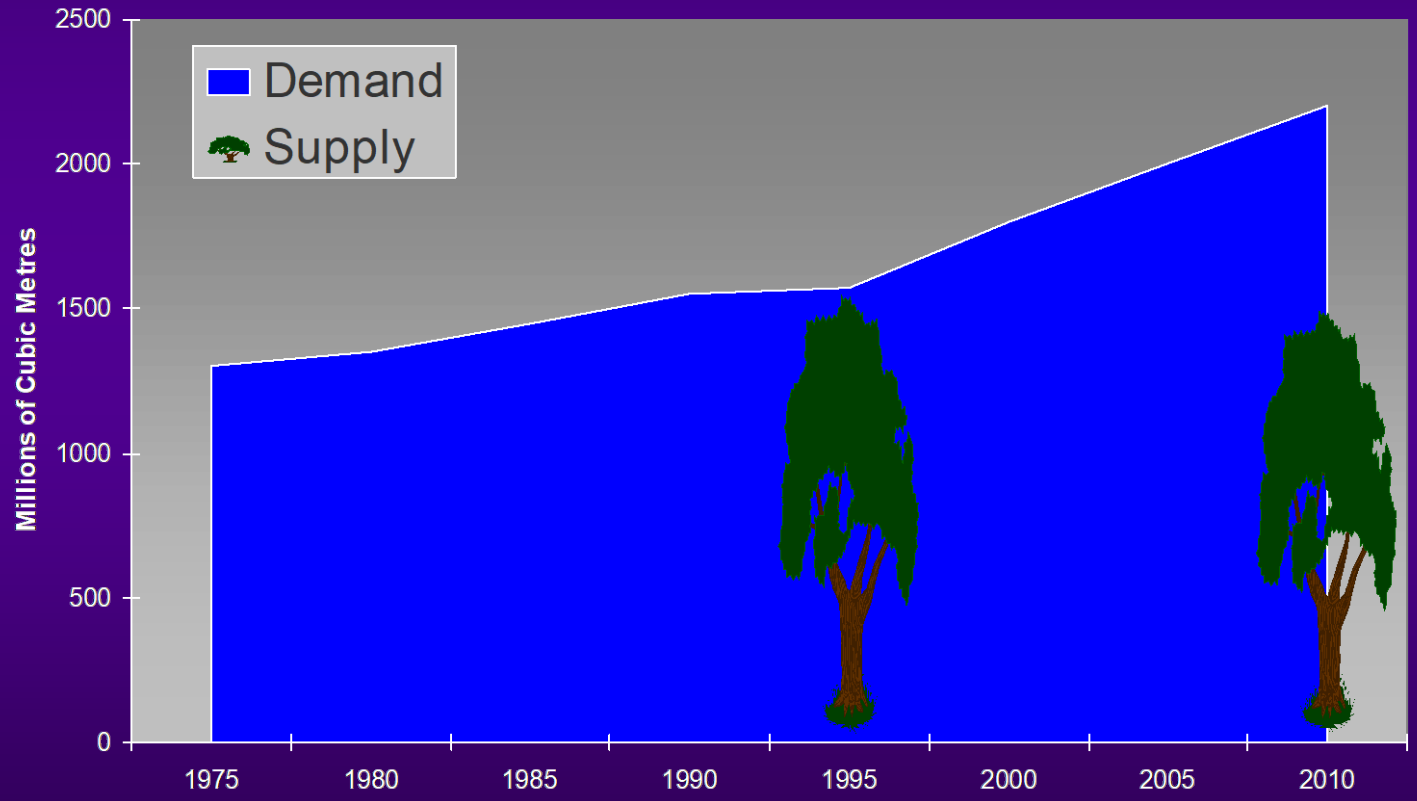
Farm forestry zones by area and rainfall

Farm forestry zone	Rainfall	Area (in million ha)
Traditional pine and new bluegum	>600 mm	2
New martime pine	400 to 600 mm	6
Wheatbelt	<400 mm	10

Declining global wood harvests

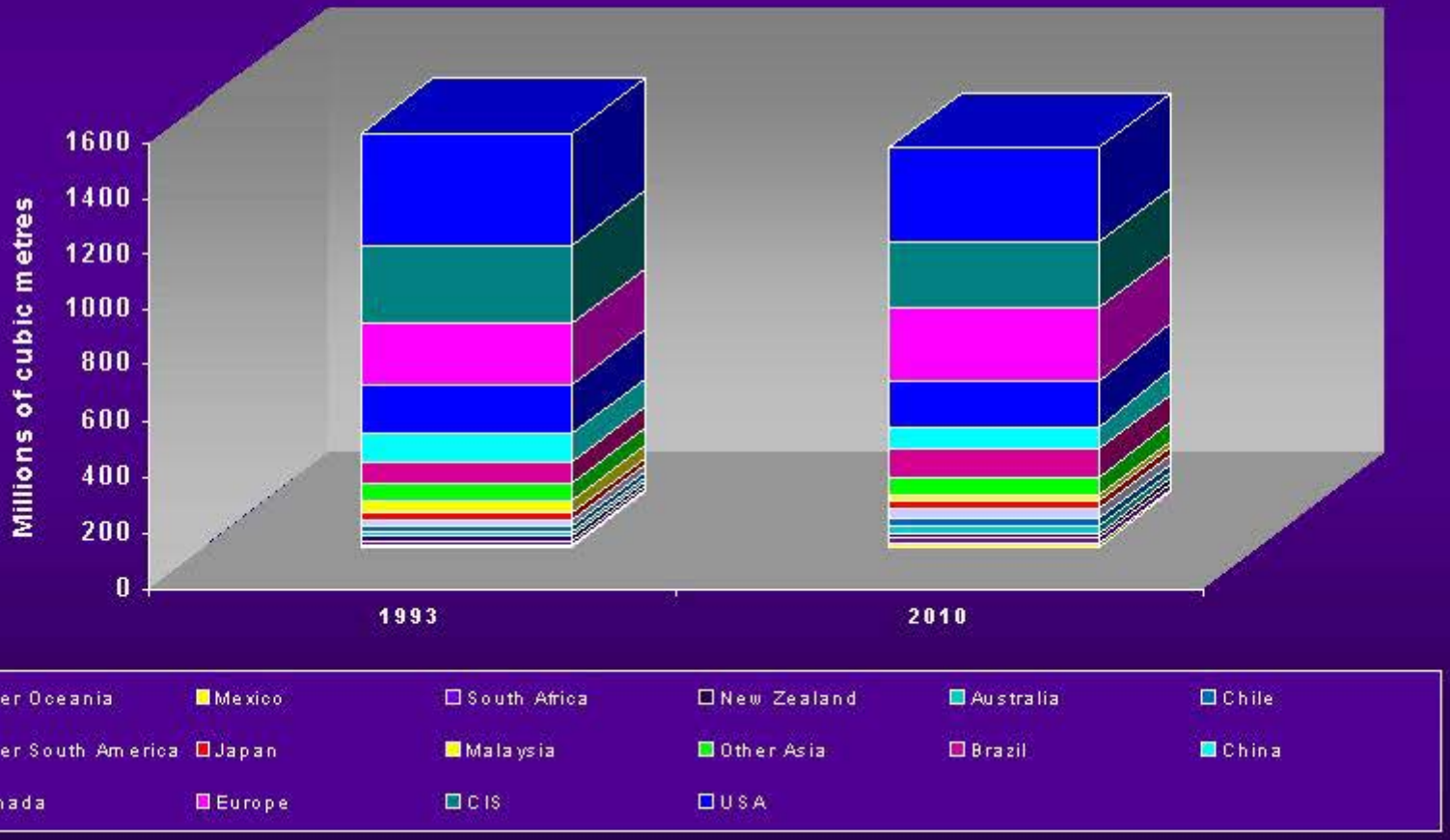


Global wood demand rises as supply falls



Sources: D A Neilson,UN FAO, Apsey & Reed, Jaakko Poyry, Widmans World Wood Reveiw, Xylem Investments Inc

Declining Global Wood Harvests



Water Drawdown under Bluegum Plantations compared to Pasture

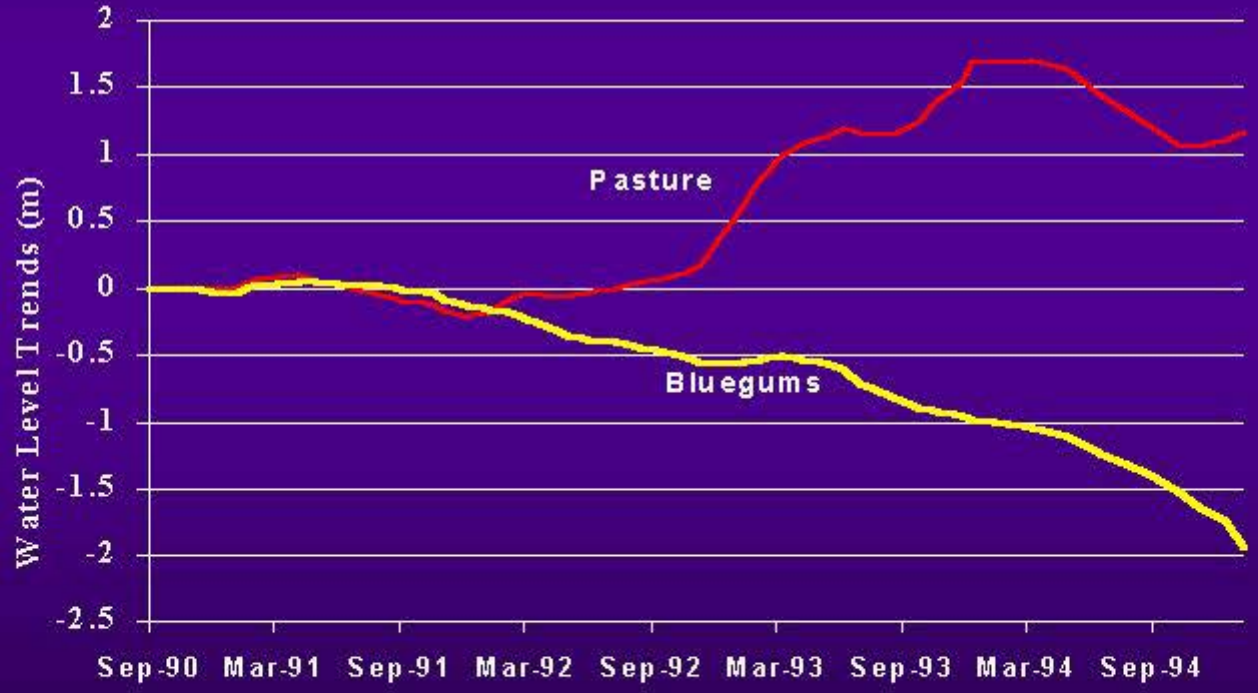


Figure 9

Land availability in the intermediate rainfall zone for maritime pine

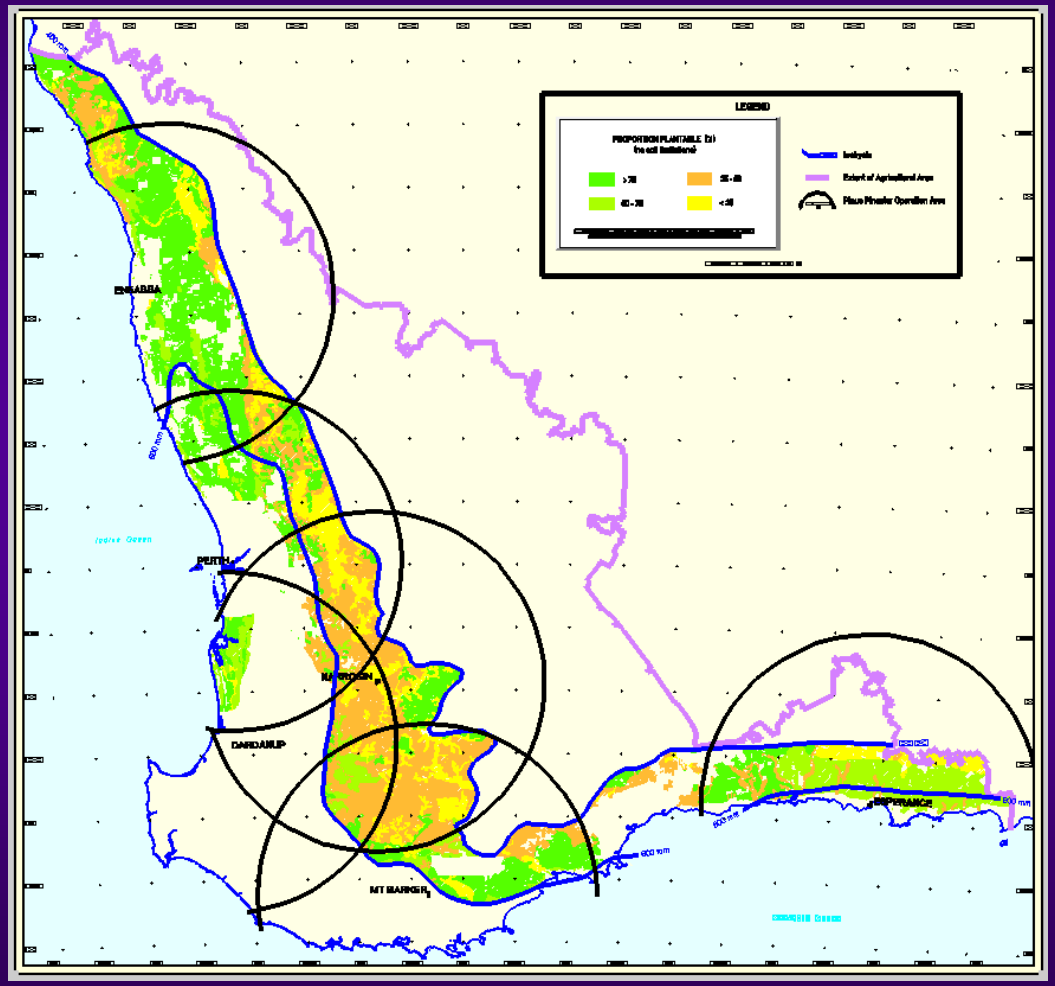


Figure 15


EUC
ANGUSTISSIMA
P.W3


Oil Mallee
Planting
Areas


CALM SHAREFARMS
MARITIME PINE
DORMAN PLANTATION PLANTED 1996

CALM has joint ventures with 1303 farmers

CALM has contracts with 84 land management contractors

E. globulus *site productivity assessment for a typical farm*

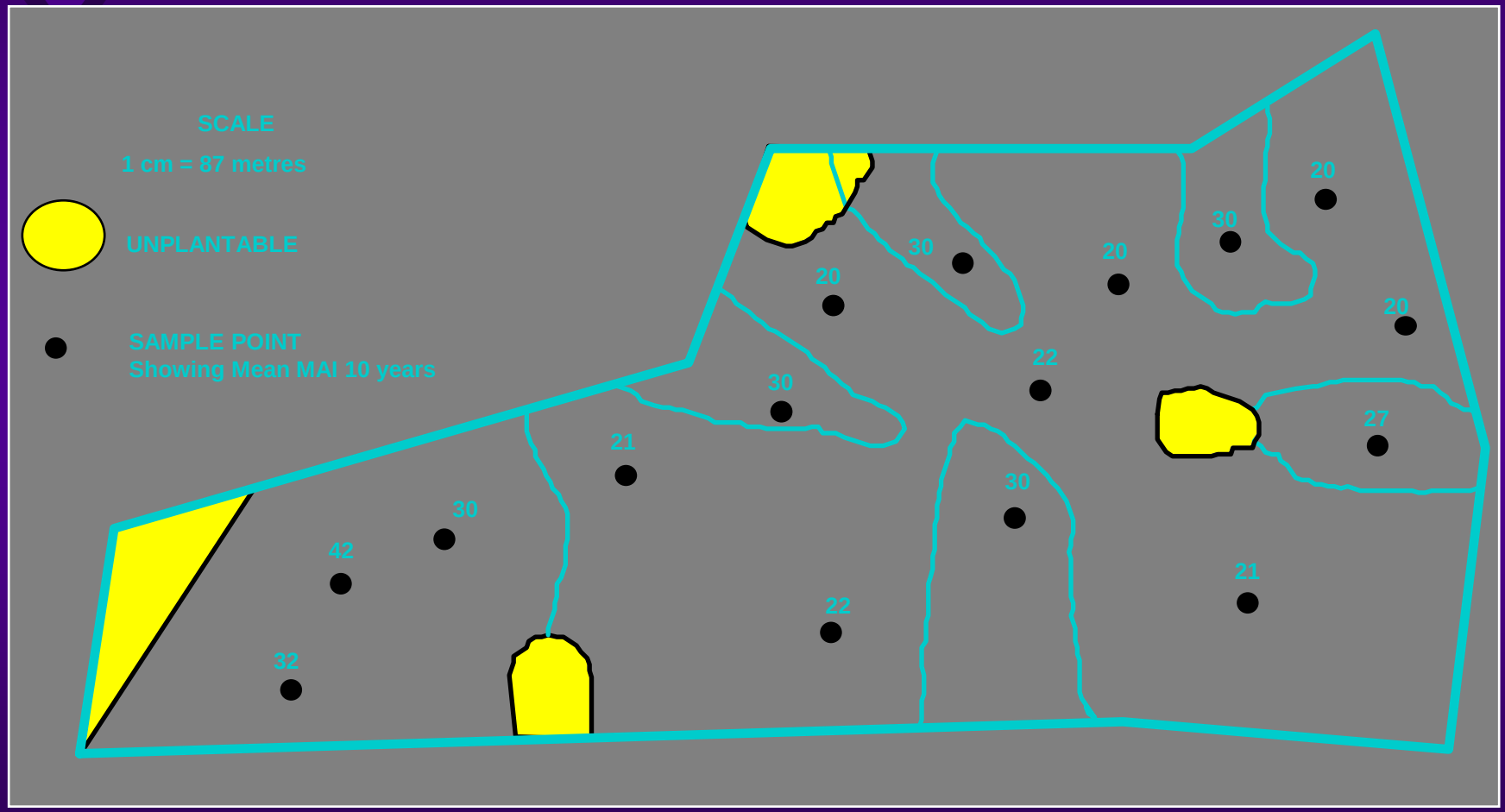


Figure 5

Effect of site preparation on tree volume and survival of E. globulus *after 9 months growth on a grey sand soil*

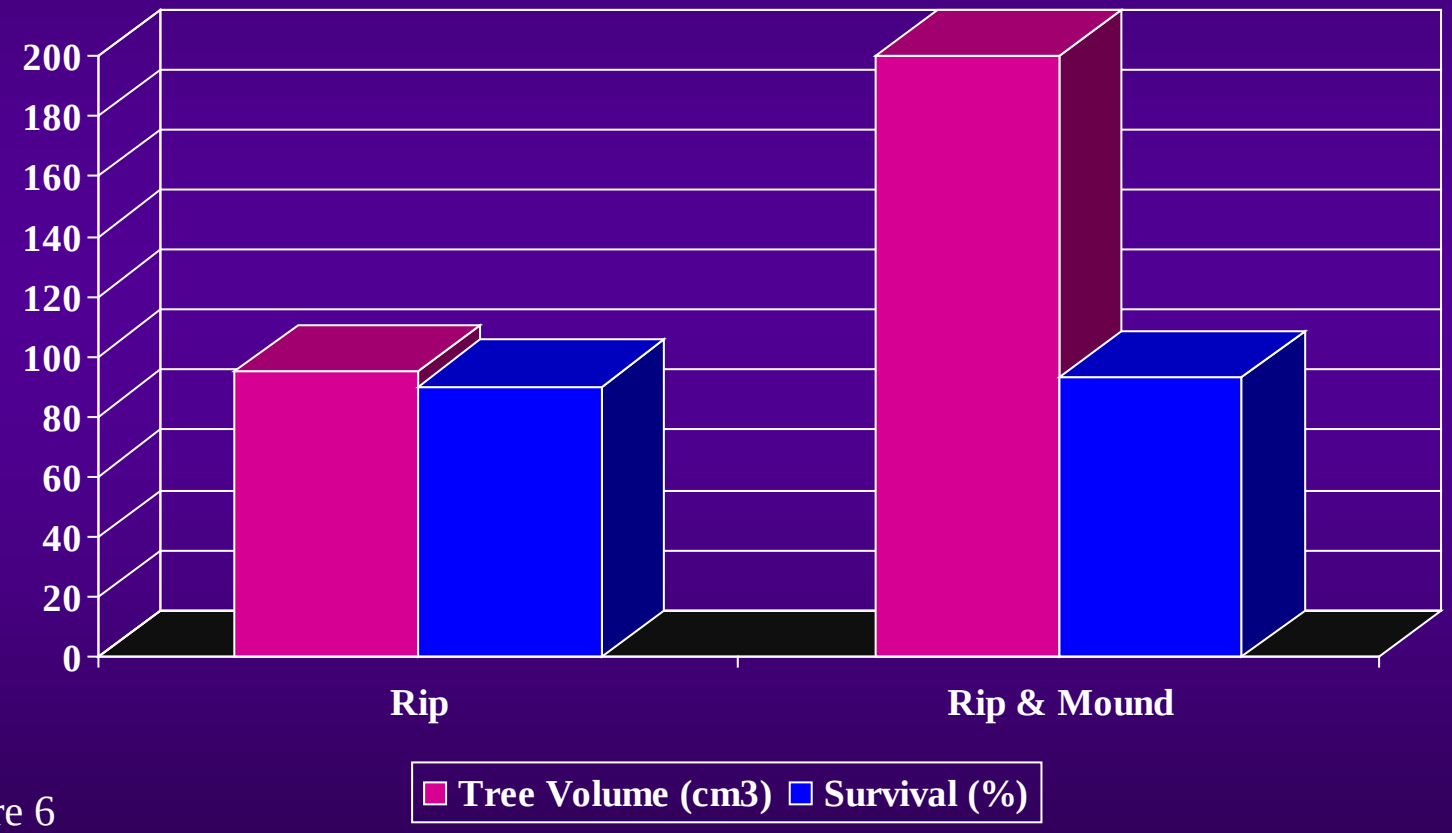


Figure 6

Basal area response to Nitrogen and Phosphorus over four years after fertilization

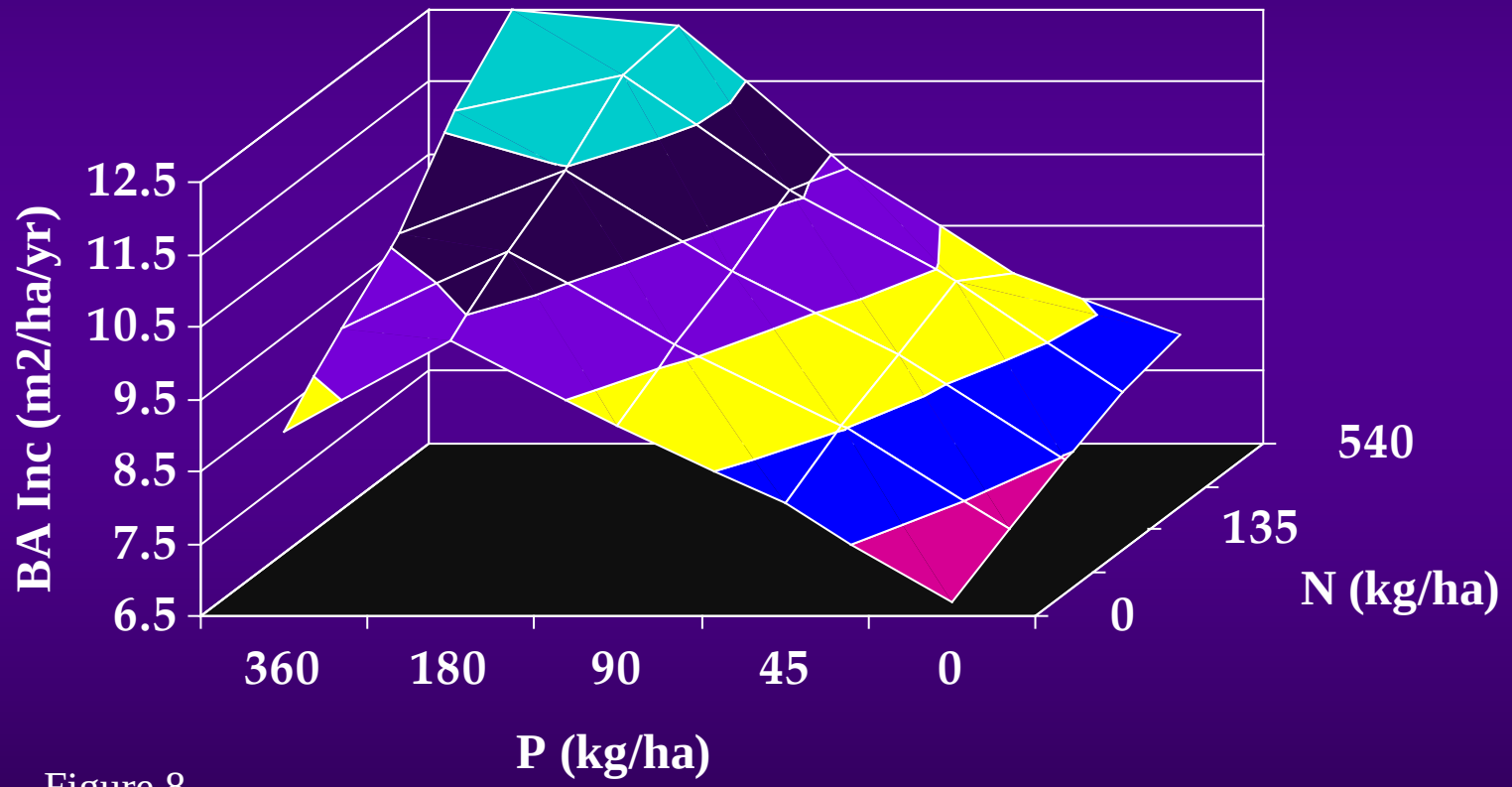


Figure 8

Response to second year weed control of E. globulus on different soils

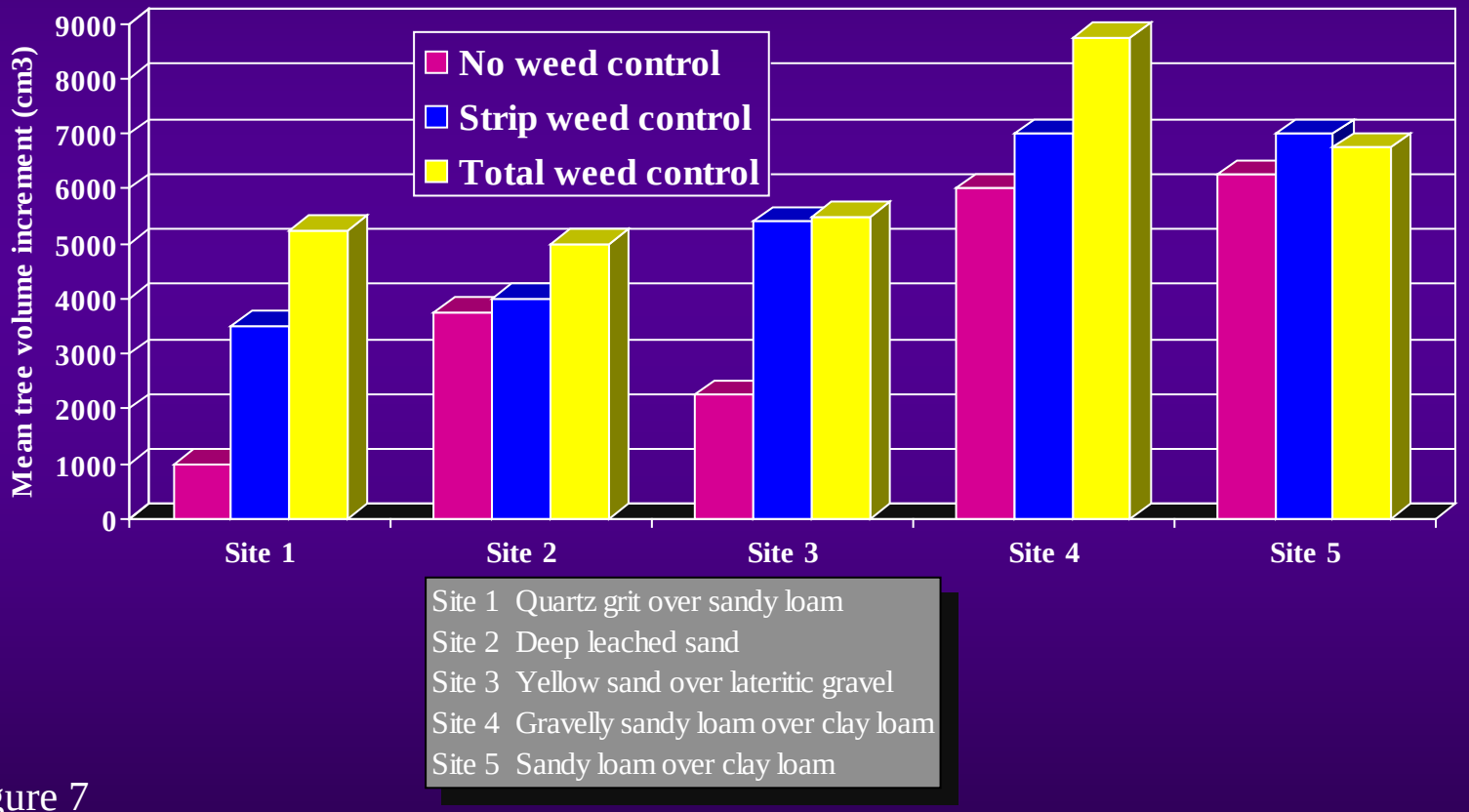
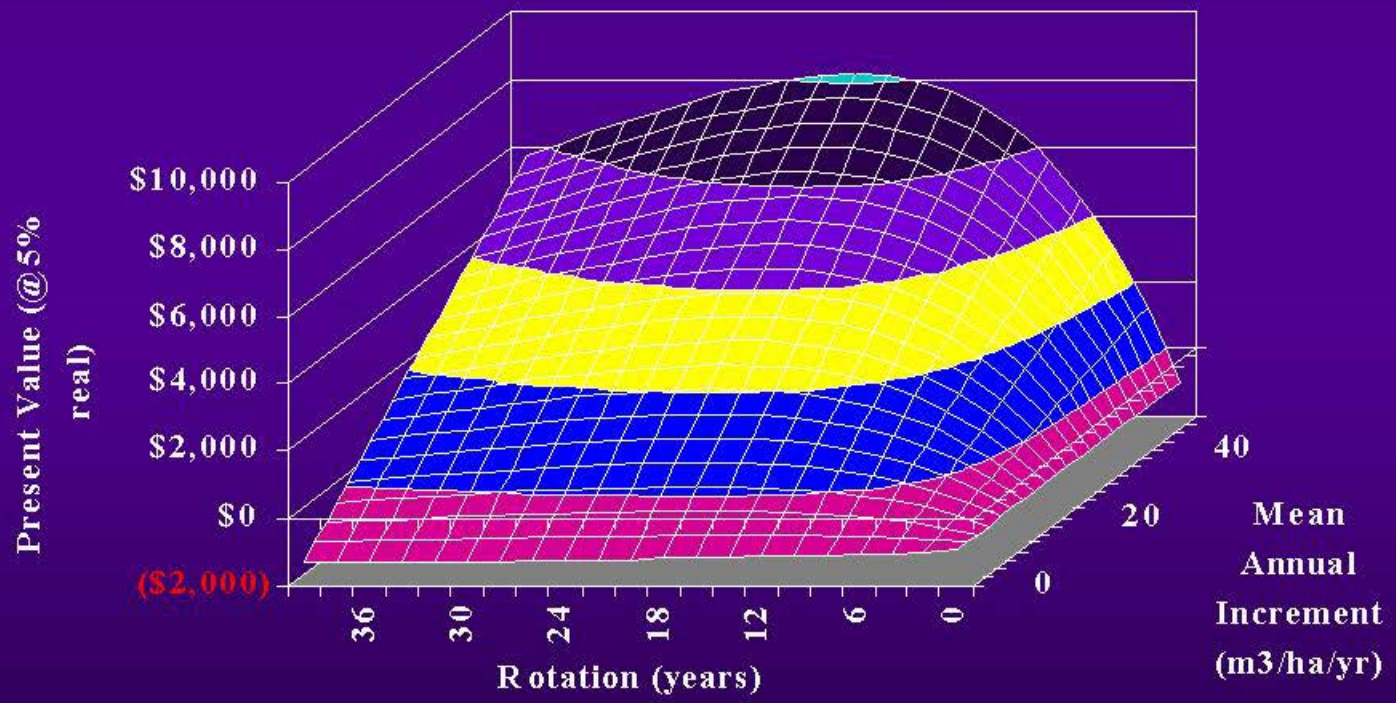
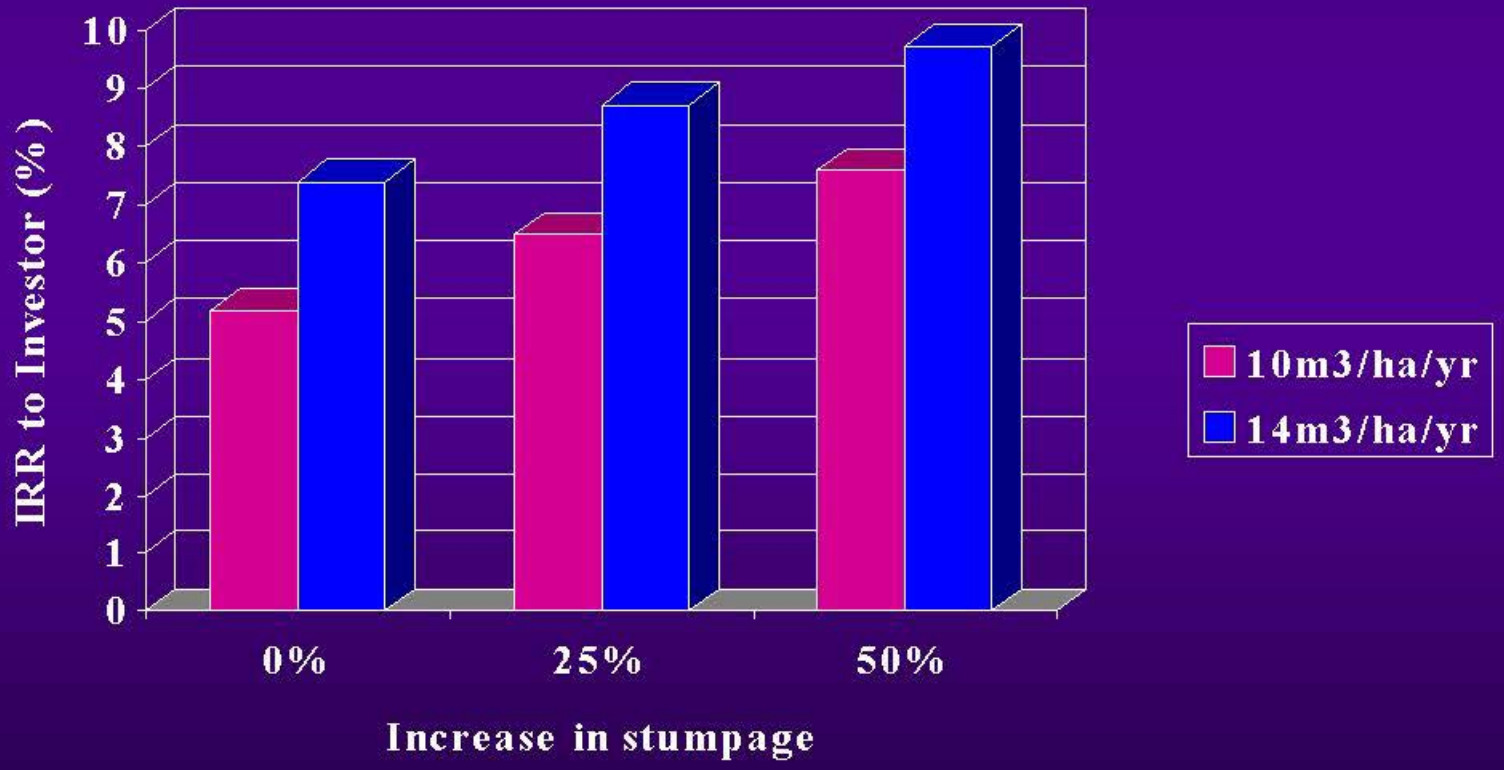


Figure 7

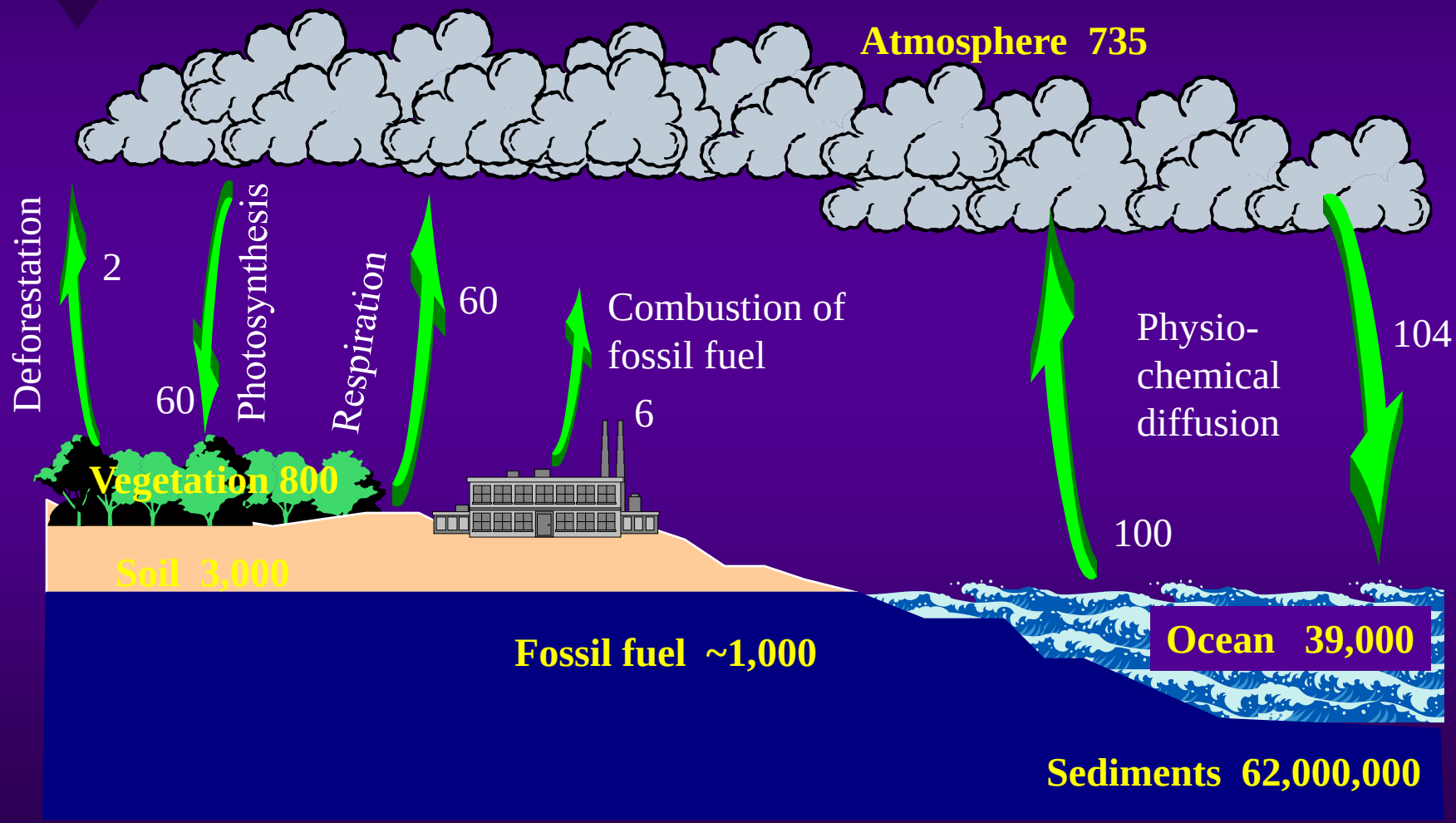
Plantation forest
Timber production profitability
Rotation age vs productivity (MAI)



IRR to an investor for various growth rates and increases in stumpage under a 25 year rotation with one thinning



The carbon cycle



Extract from Kyoto Protocol - Article 2

Each Party included in Annex 1 in achieving its quantified emission limitation and reduction commitments under Article 3, in order to promote sustainable development, shall:

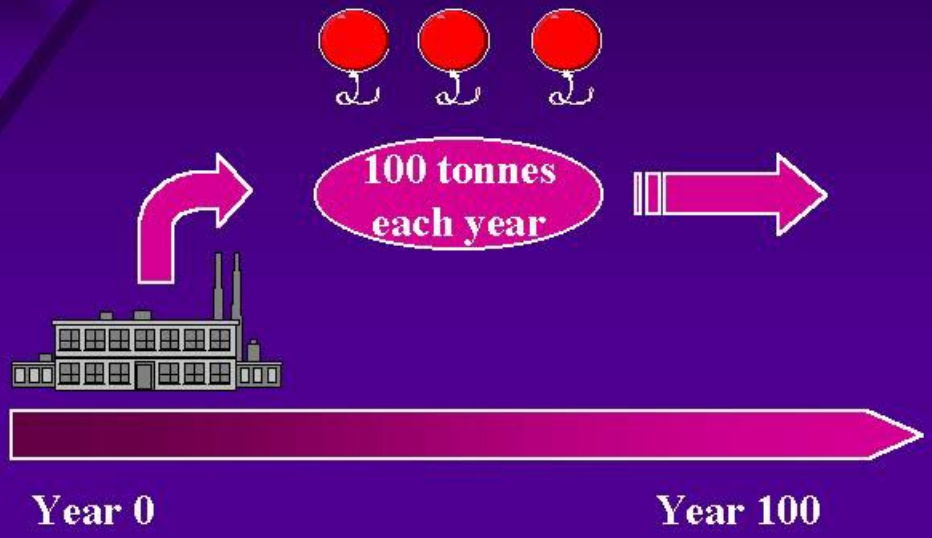
(a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:

……..…

(ii) Protection and enhancement of sinks and reservoirs of greenhouse gases ….taking into account ….promotion of sustainable forest management practices, afforestation and reforestation.

"Tonne-year" currency

Balance sheet of 1 year of emissions and storage



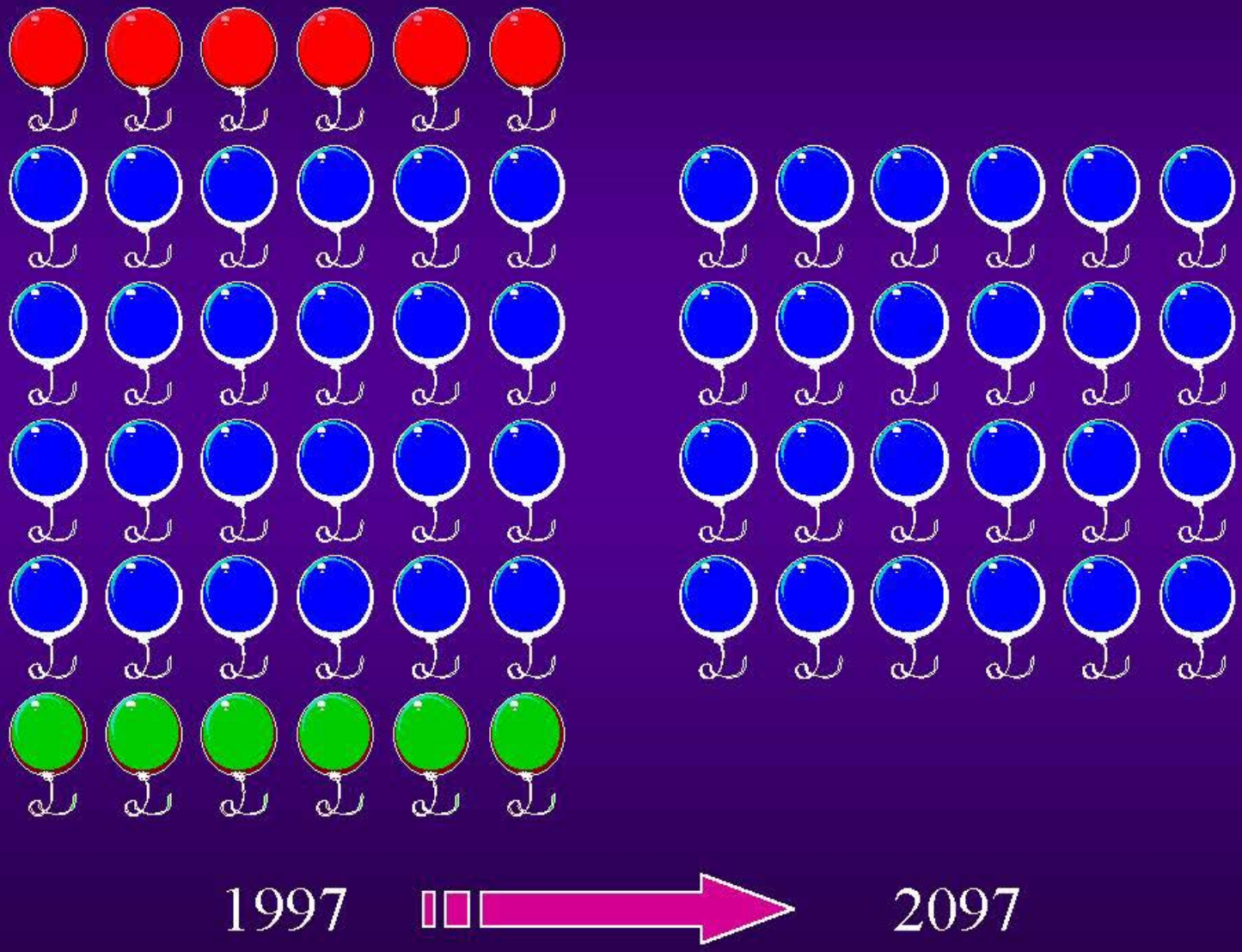
=> 100 x 100

= 10 000 tonne years

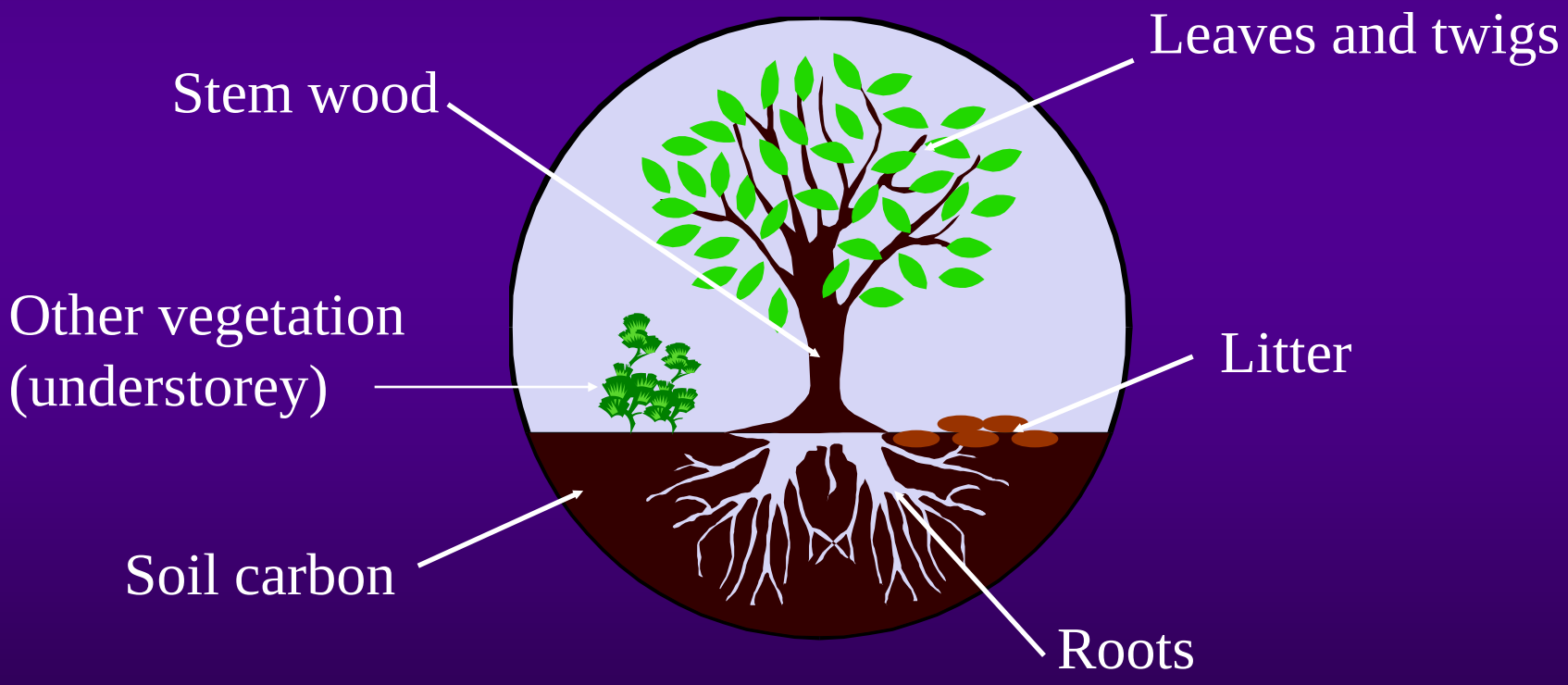
=> 290 x 35

= 10 000 tonne years

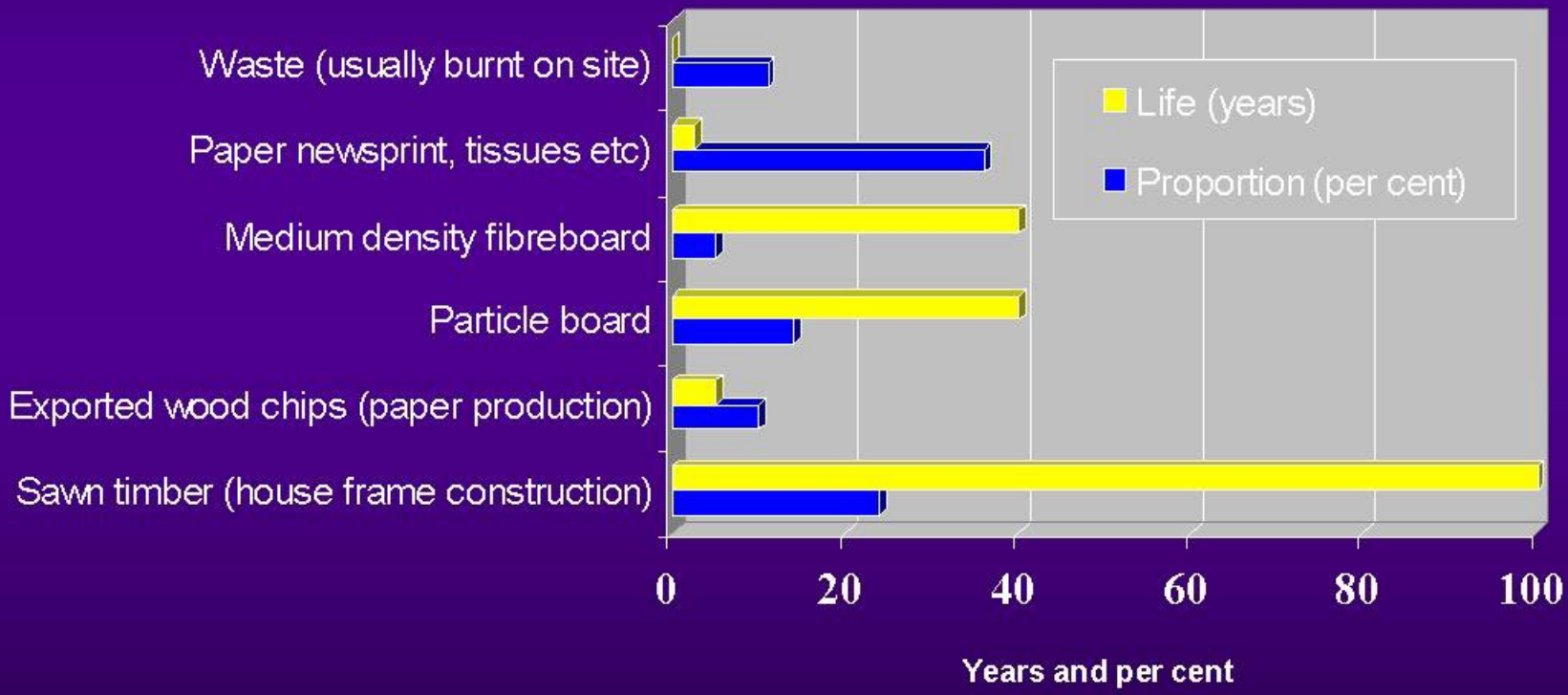

BP


1997
2097

Major pools of forest carbon



Estimate of typical proportions and lifetimes of merchantable pine wood used for different products



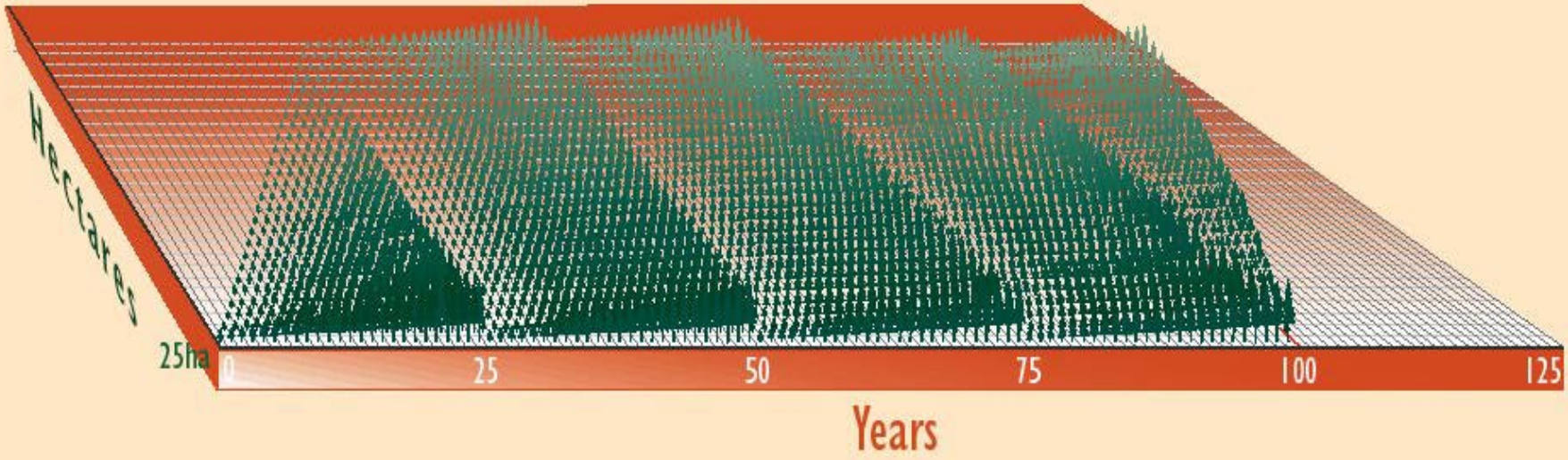
Energy required to produce one tonne of each product and tonnes of CO2 emitted during production

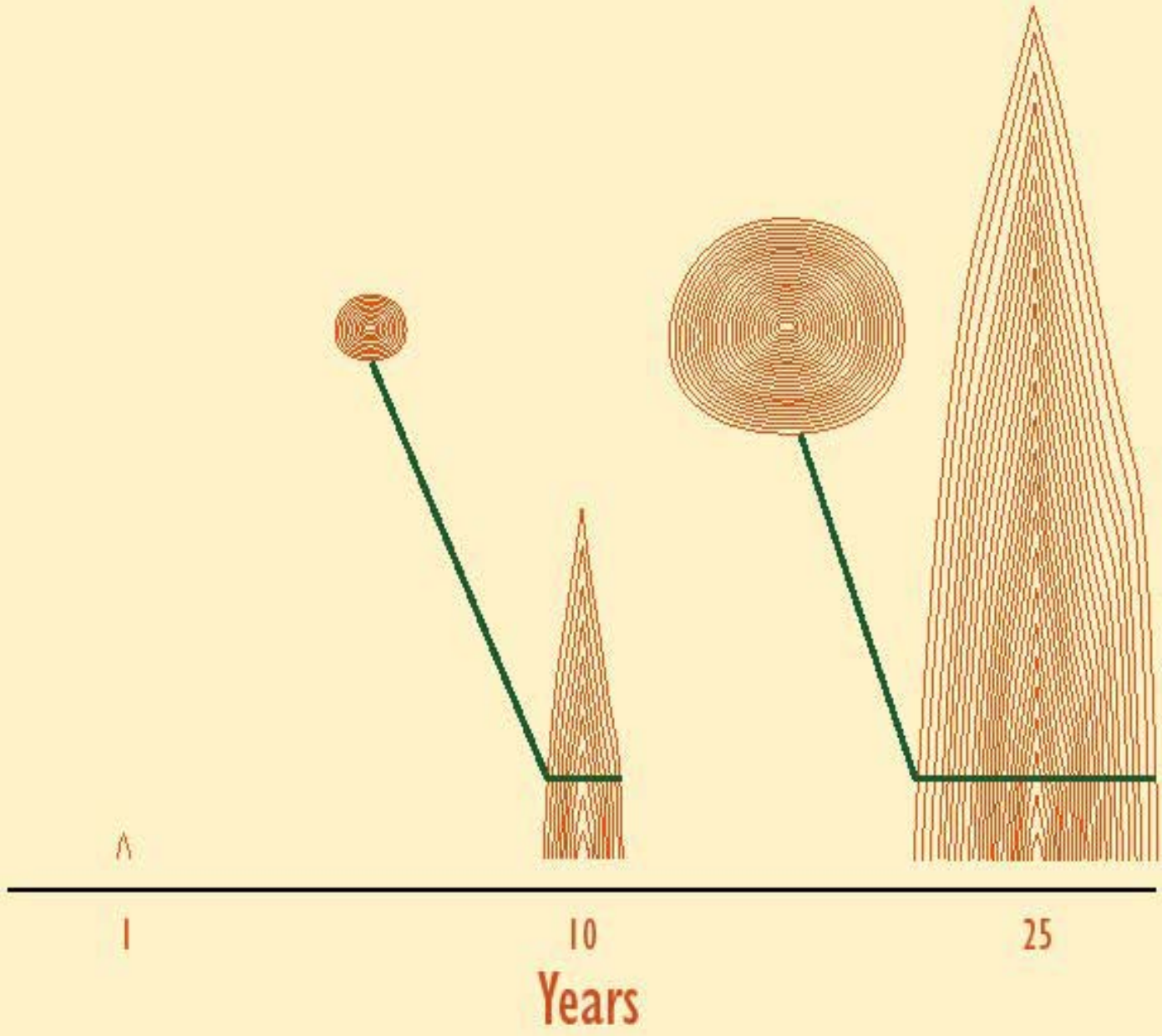
	Energy (KWH equivalent)	CO2 produced (tonnes)
Aluminium	15 000	25.0
Iron	3 000	2.5
Cement	2 000	0.3
Bricks	700	0.1
Timber	300	-0.2

Estimated tonnes and Carbon tonne years produced per hectare per year

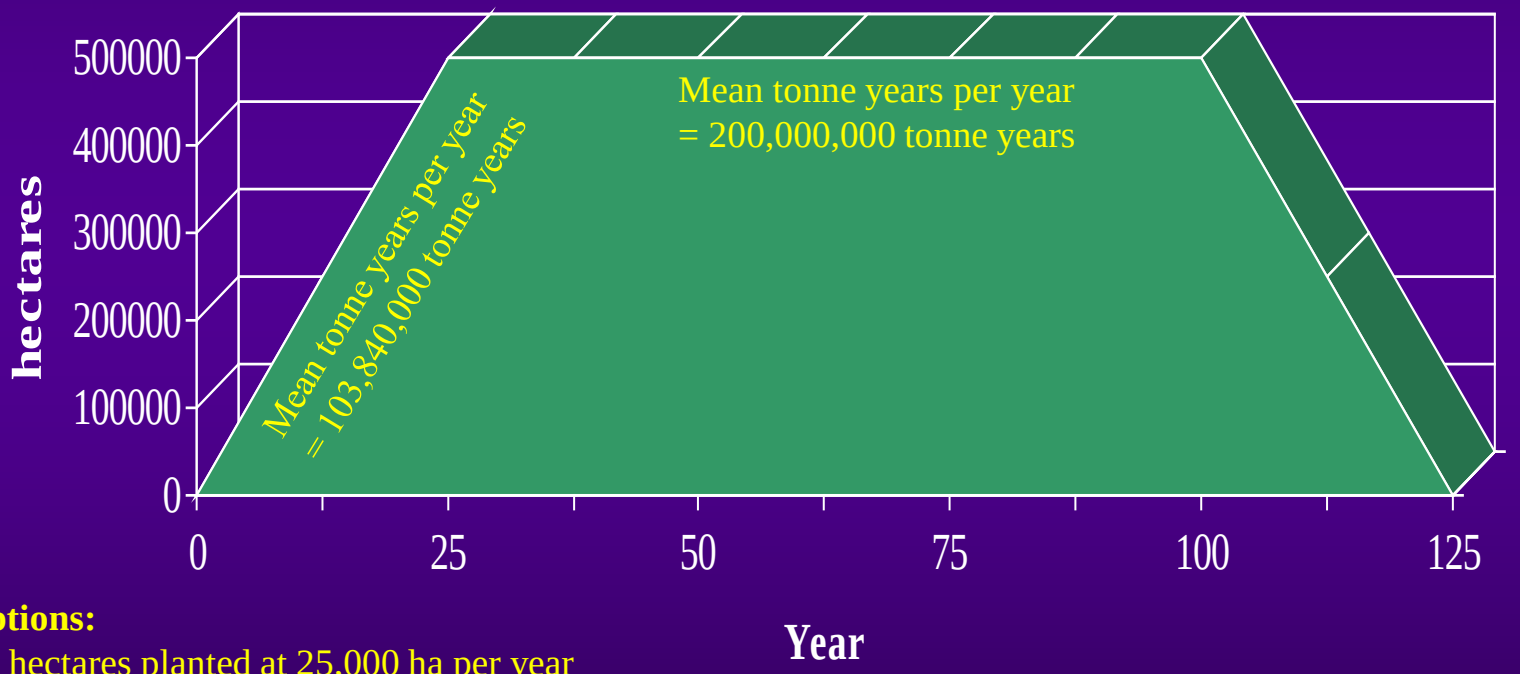
	Carbon Tonnes per year	Average Carbon storage time (years)	Tonne years
Maritime pine	10	40	400
Bluegum	20	7.5	150
Mallee Stems	1	5	5
Roots	1	100	100
Biodiversity planting	2	50	100

Model Forest – 4 Rotations of 25 years




1
10
25
Years

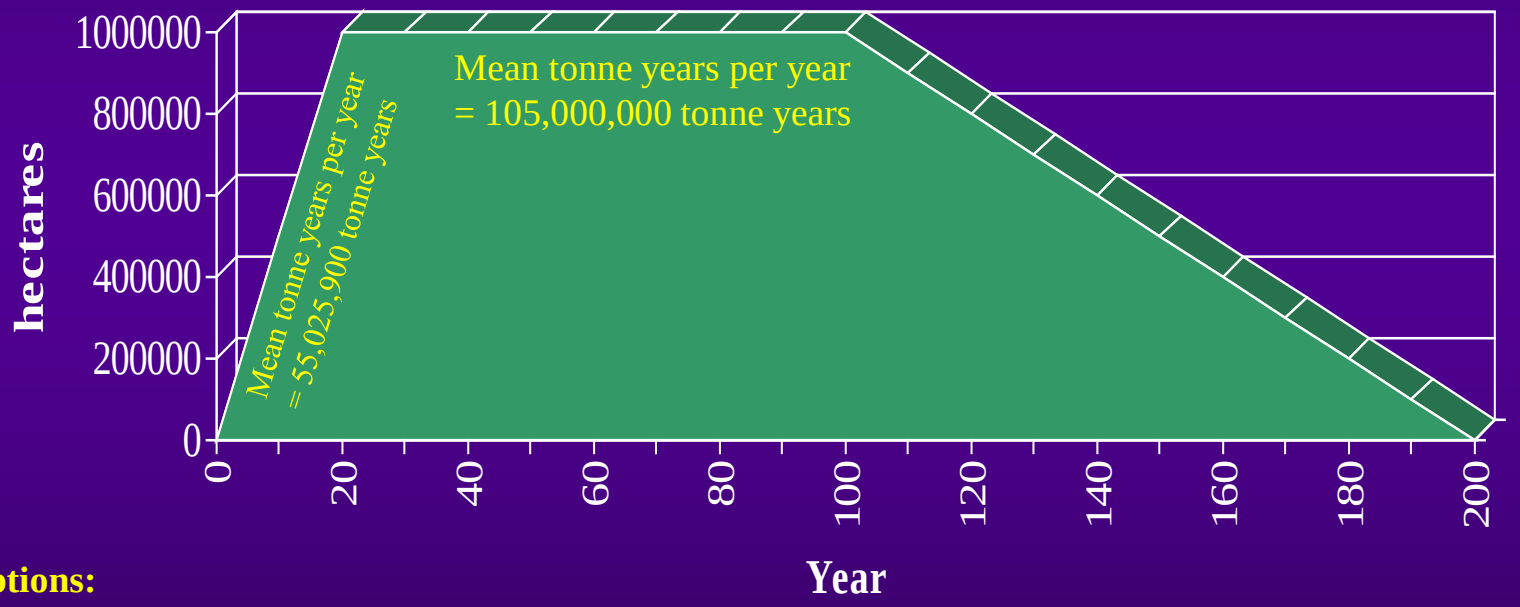
Maritime pine



Assumptions:
500,000 hectares planted at 25,000 ha per year
Carbon production 10 tonnes per year per hectare
Rotation 25 years
Assume 4 rotations
Average Carbon storage time 40 years

Mean
~ 150 million tonne years per year

Mallee Eucalypts



Assumptions:

1,000,000 hectares planted at 50,000 ha per year

Carbon production 2 tonnes

Rotation 100 years

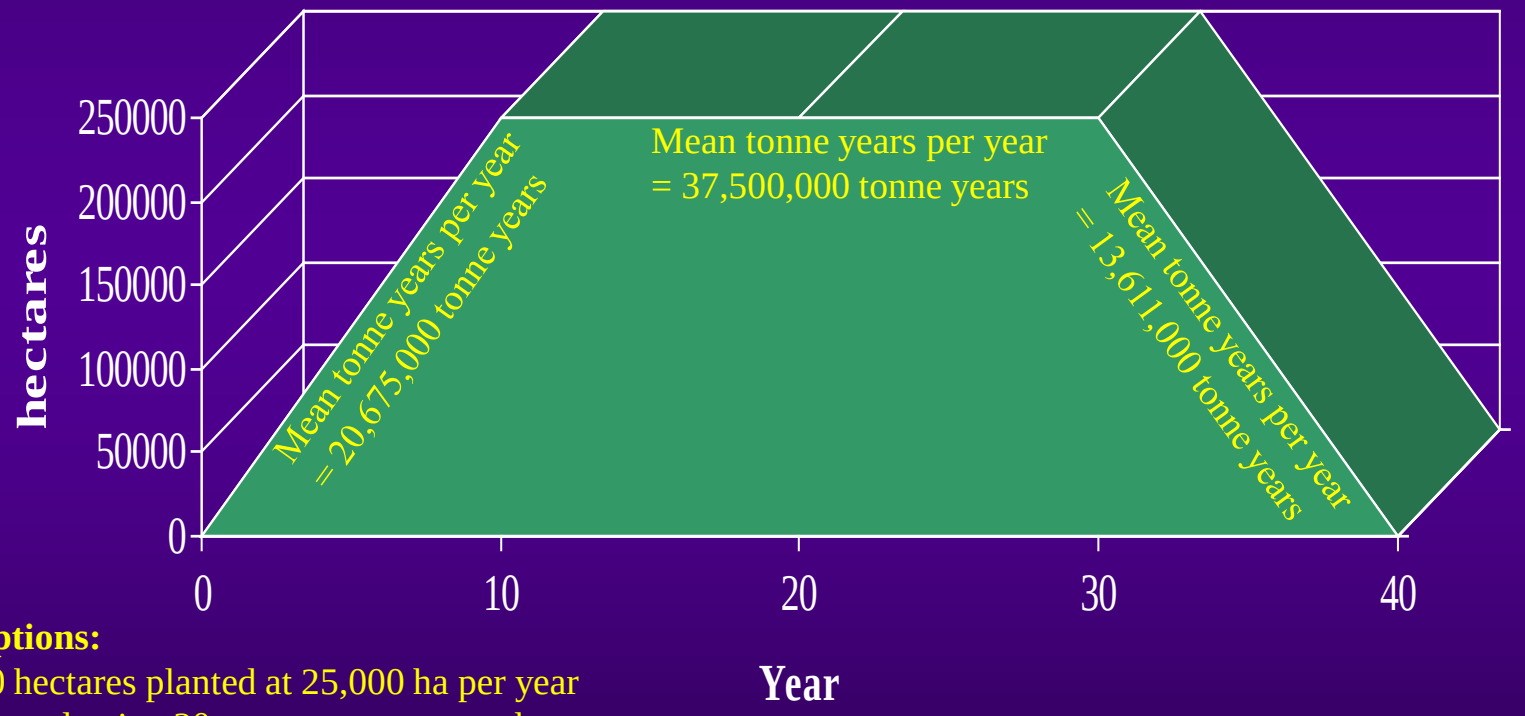
Carbon storage times

- 100 years for roots
- 5 years for tops

Mean over 100 years

~ 95 million tonne years per year

Tasmanian bluegums



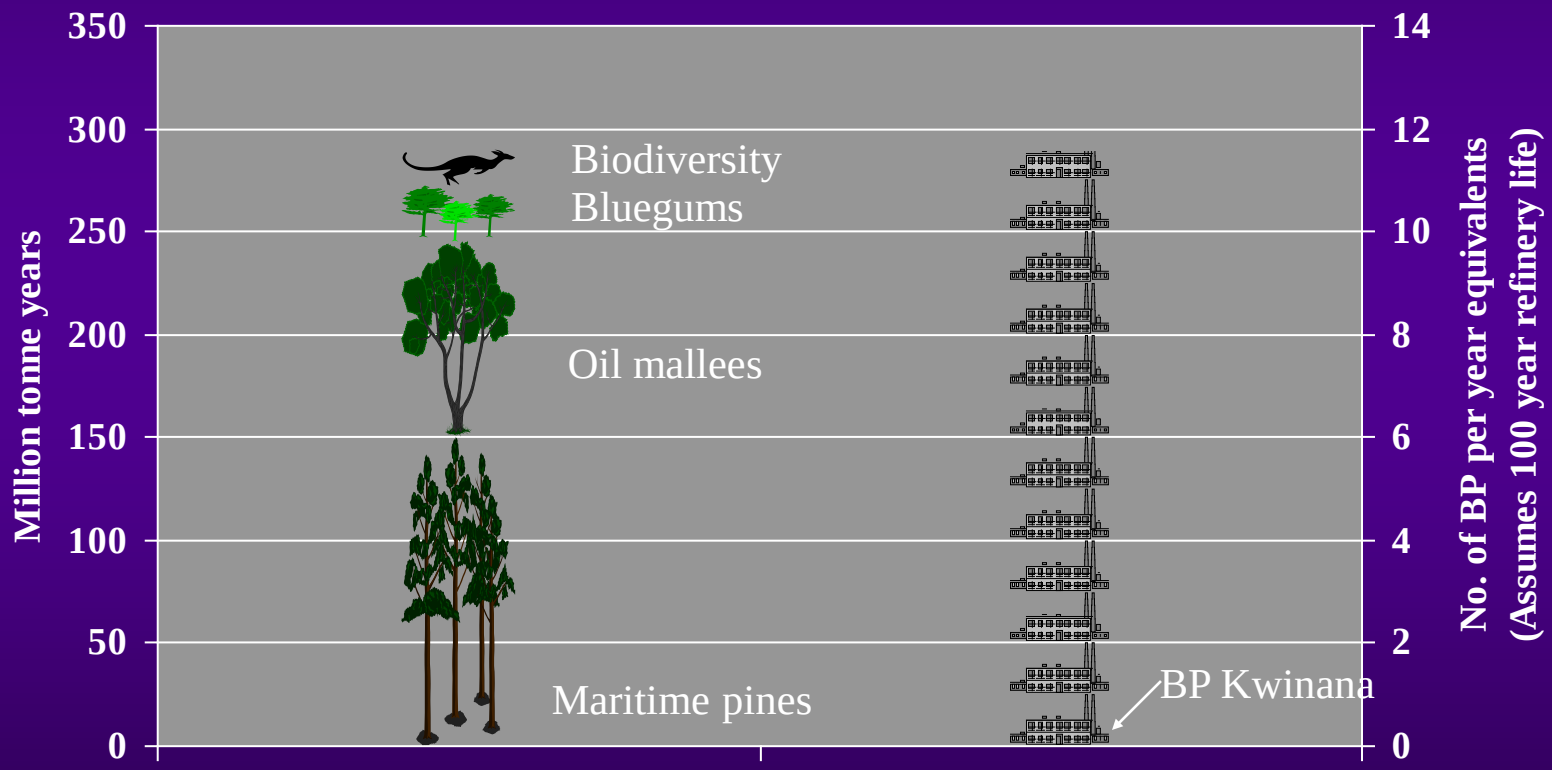
Assumptions:

250,000 hectares planted at 25,000 ha per year
Carbon production 20 tonnes per year per hectare
Rotation 10 years
Assume 3 rotations
Average Carbon storage time 7.5 years

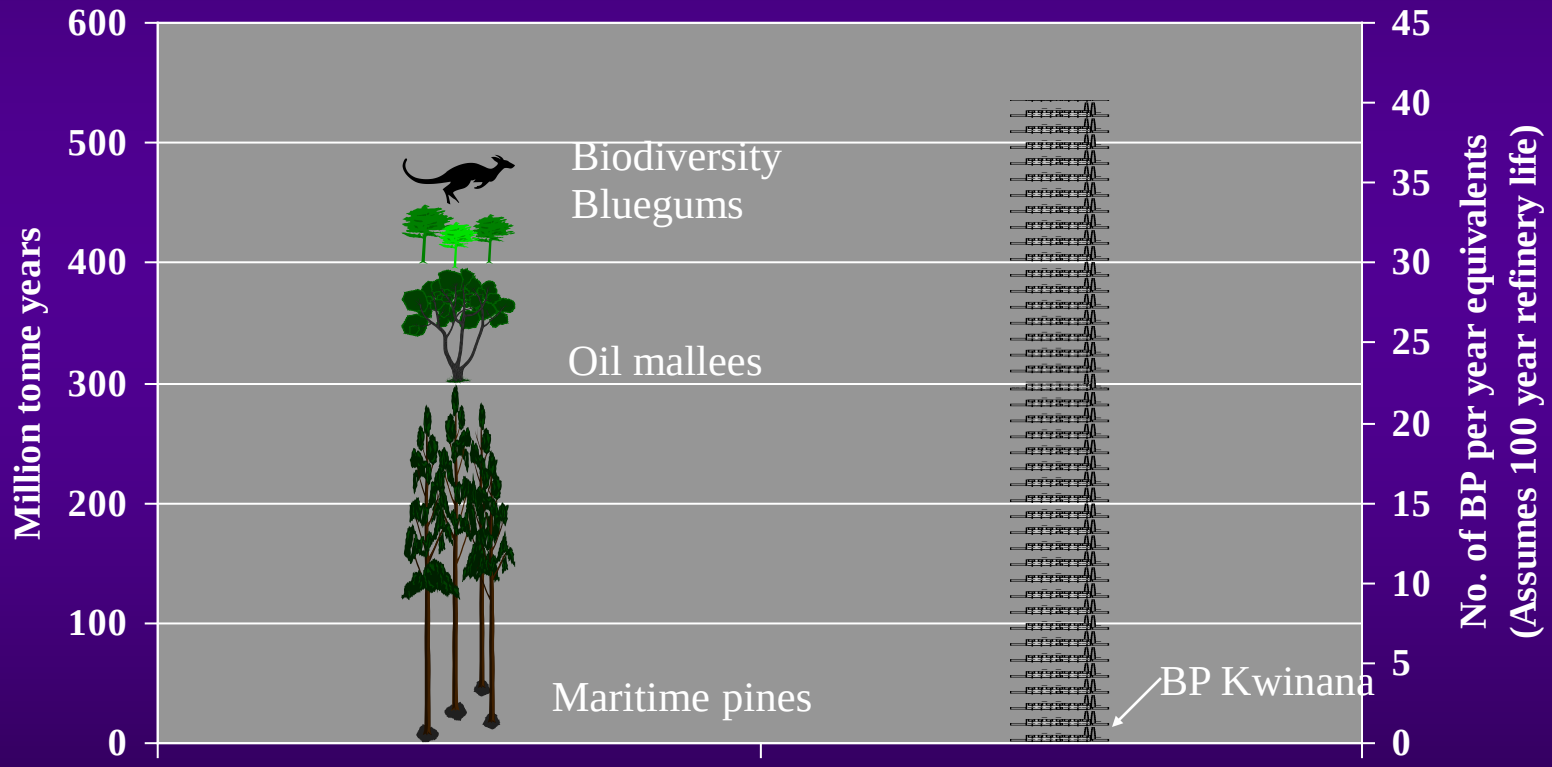
Mean
~ 27 million tonne years per year


BP

Conservative scenario



Optimistic scenario



Assumptions

Half life of refinery,

double carbon storage times for pine, bluegum and biodiversity plantings

Factors determining the effectiveness of tree establishment as a method of compensating for CO_2 emissions

- Cost
- Land availability, on the scale required, which has climate, soils suitable for maximum production of carbon tonne years
- Efficiency of planting and maintenance
- Productivity of tree crops
- Survival of seedlings and trees - eg. fire risk, pests, etc.
- Credibility of carbon accounting process, eg. inventory system
- The potential to integrate tree planting for carbon sequestration with other benefits, eg. reducing land degradation, increasing biodiversity
- The potential to offset the cost of tree planting by the commercial returns from wood products while at the same time maximising carbon tonne year accumulation
- Politics
  - a political environment which is secure for long time periods
  - farmer and local government support
  - integration with the community and other industries based on the land
- Speed

BP Refinery each year emits 270,000 tonnes of Carbon

- Each year, must absorb 270,000 tonnes for 100 years - ie. 27,000,000 tonne years
- 50,000 hectares of Maritime Pine absorbs (assume productivity 12.5 t Carbon, Carbon life 44 years) 27,500,000 tonne years
- Over 50 years BP emits
  270,000 x 100 x 50 = 1,375,000,000 tonne years
- Over 50 years (2 x 25 year rotations) 50,000 hectares of Maritime pine absorbs
  50,000 x 12.5 x 44 x 50 = 1,375,000 tonne years


Landsat TM Mosaic
Bands 5,4,2 (R,G,B)
Date of imagery January 1994
CSIRO DOLA
MAJOR DRAINAGE BASINS

Estimated carbon content for major farm forestry zones/types at full rotation age

Rainfall zone	Type	Rotation length	Biomass (dry tonnes/ha)				Total carbon	Average long term carbon
			Wood	Leaf	Roots	Total		
> 600 mm	Pine	25 years	150	90	60	300	150	75
	Bluegum	10 years	100	60		160	80	40
	- roots	30 years			72	72	36	18
	General revegetan	Perpetual	180	108	72	360	180	180
400-600 mm	Maritime pine	35 years	140	84	56	280	140	70
	General revegetatn	Perpetual	150	90	60	300	150	150
< 400	Oil mallee	2 years	2.5	2.5		5	2.5	1.3
	- roots	50 years			50	50	25	25
	General revegetatn	Perpetual	120	80	40	240	120	120

Notes: Total carbon is 50% total biomass
Bluegum and oil mallee roots have different life length to above ground parts due to coppicing
Average long term carbon = 50% of full rotation carbon for harvested crops

Land use by area in the South West of Western Australia

Land use	Area (million ha)	% area within the Agricultural region
Agricultural region	25.25	100.0
Area of private land	20.71	82.0
Area of cleared land	17.98	71.2
Private remnant vegetation	2.75	11.1
Public land	4.52	17.9

Farm forestry zones by area and rainfall

Farm forestry zone	Rainfall	Area (in million ha)
Traditional pine and new bluegum	>600 mm	2
New martime pine	400 to 600 mm	6
Wheatbelt	<400 mm	10

BP Refinery each year emits 270,000 tonnes of Carbon

- Have to absorb 270,000 tonnes for 100 years - ie. 27,000,000 tonne years
- 27,500 hectares of Maritime Pine absorbs 550,000 tonnes per year which lasts 50 years - ie. 27,500,000 tonne years
- Over 100 years BP emits
  270,000 x 100 x 100 = 2,700,000,000 tonne years
- 27,500 ha of Maritime Pine absorbs
  27,500 x 20 x 50 x 100 = 2,750,000,000 tonne years

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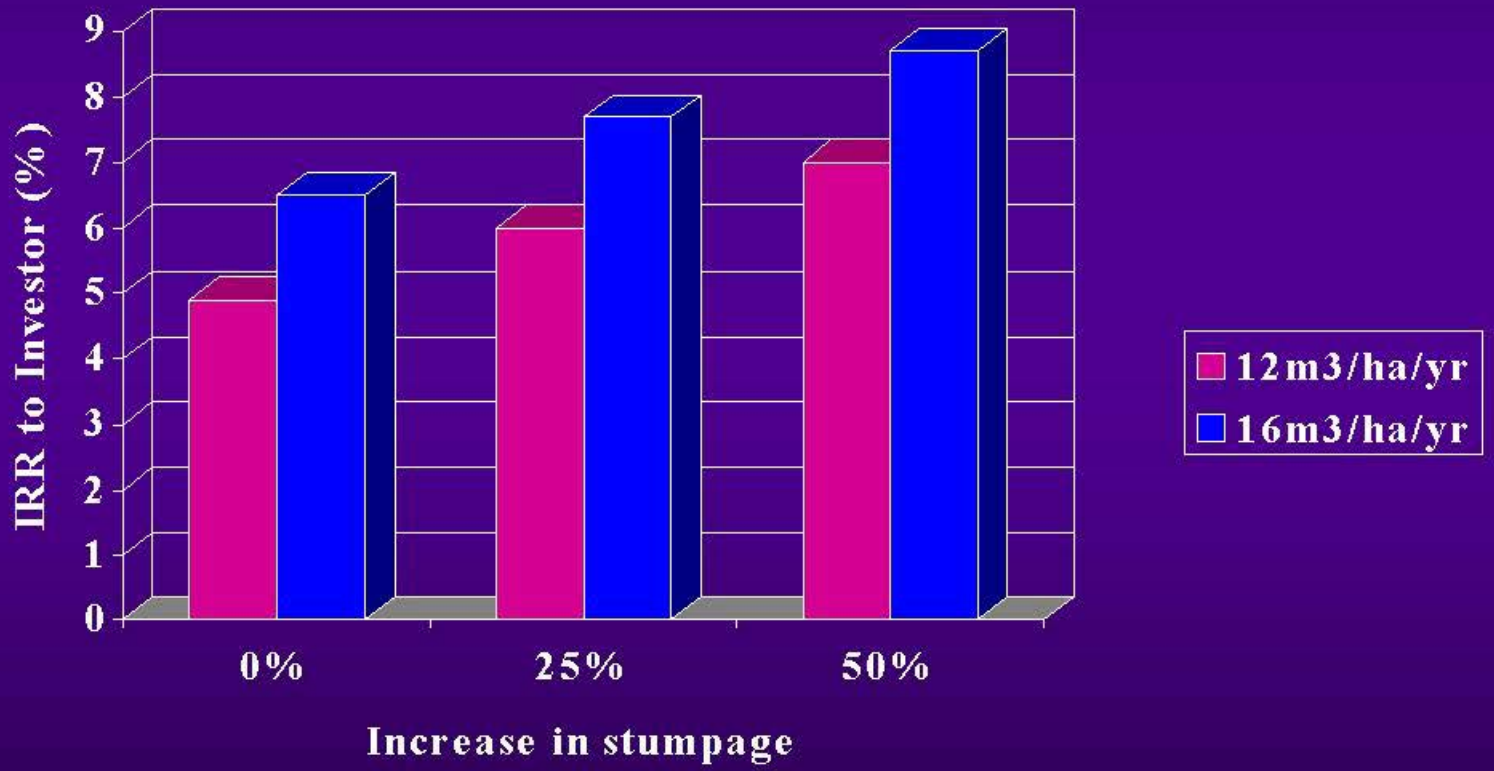
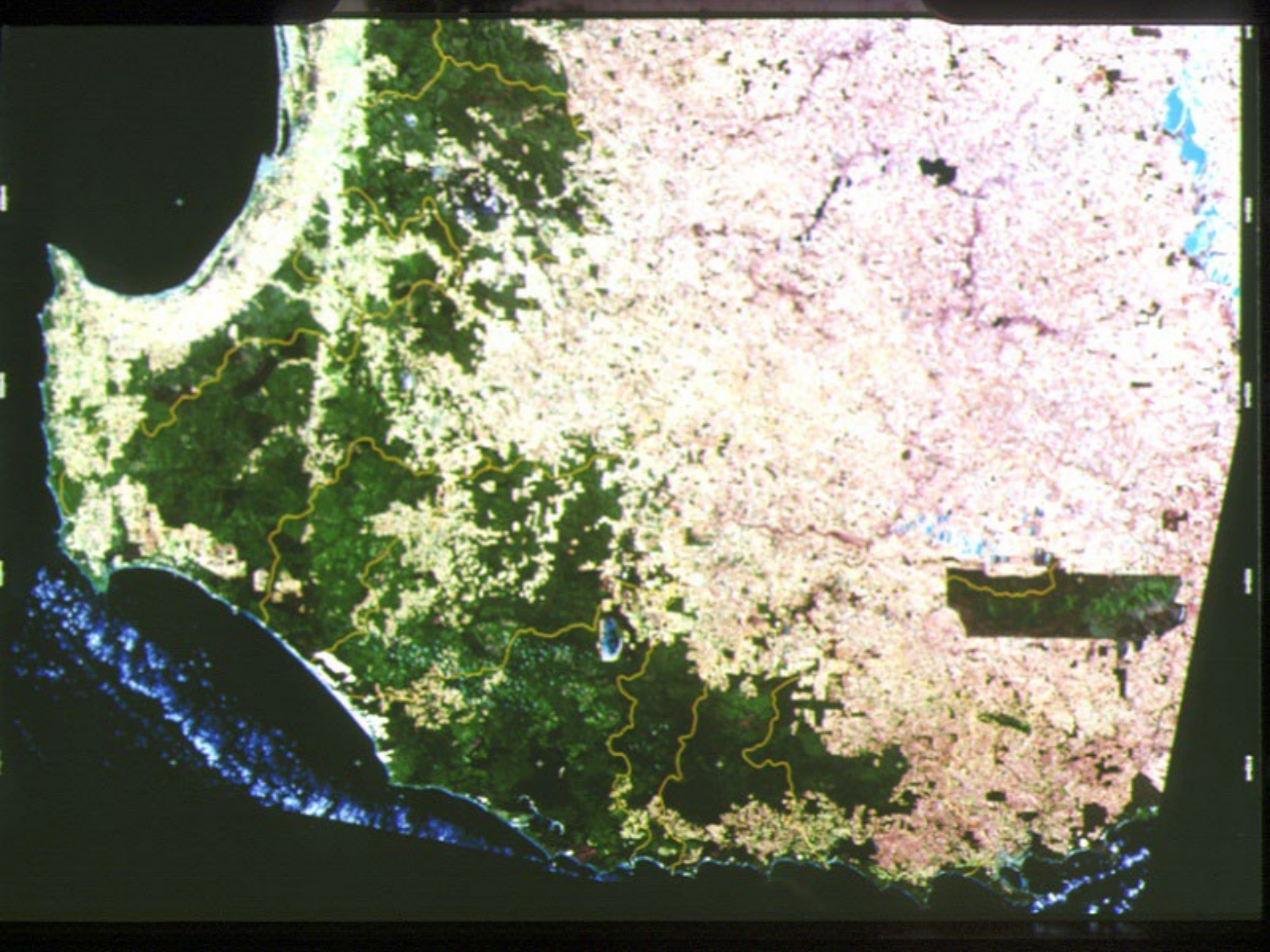




Groundwater level response at Lemon Catchment (annual rainfall 750mm)

(after Agriculture WA et al, 1996)

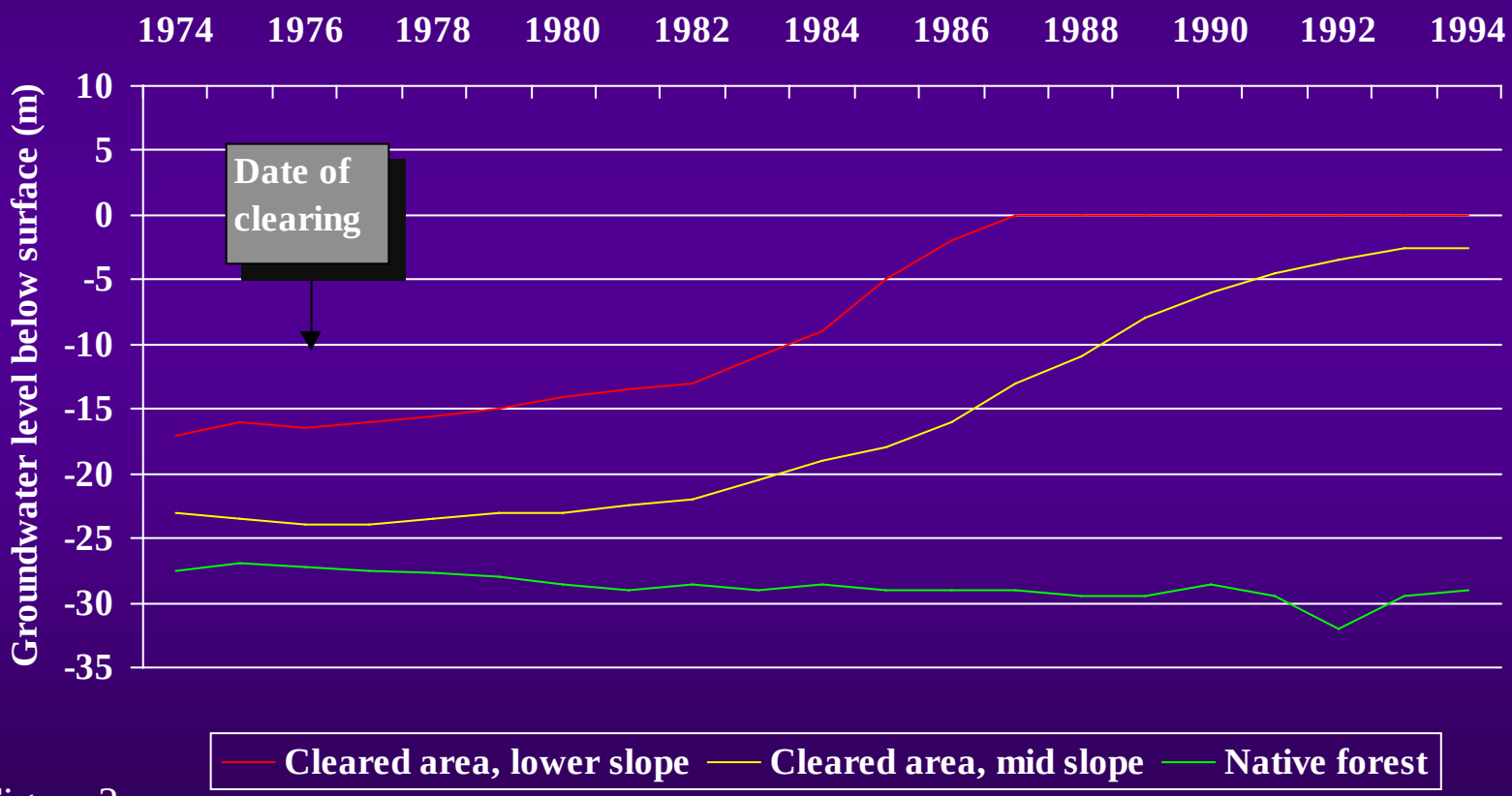
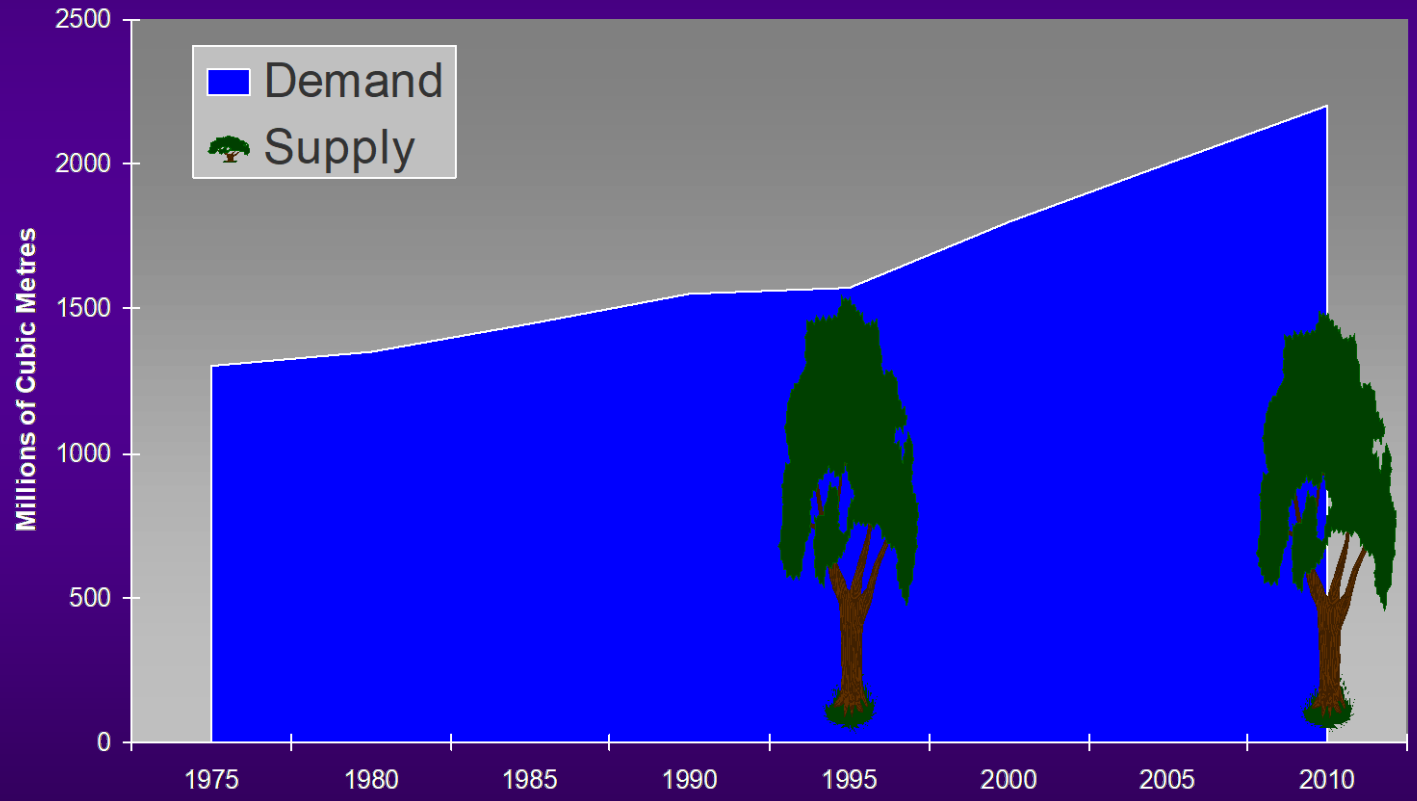


Figure 2

Global wood demand rises as supply falls



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