A Western Australian Perspective on Agroforestry

Presentation to the

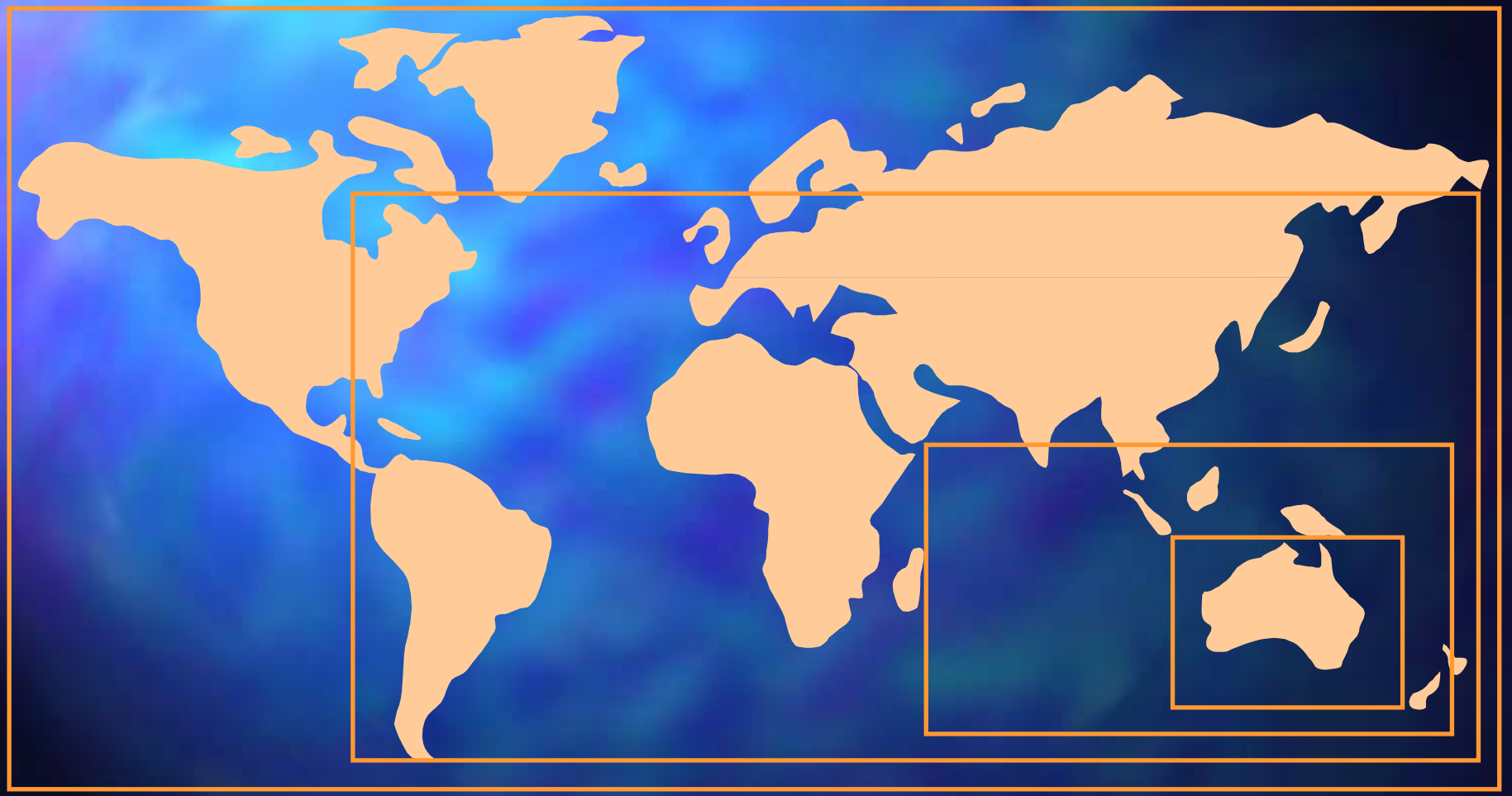
Natural Resource Management Students,
University of Western Australia

15 July 1998

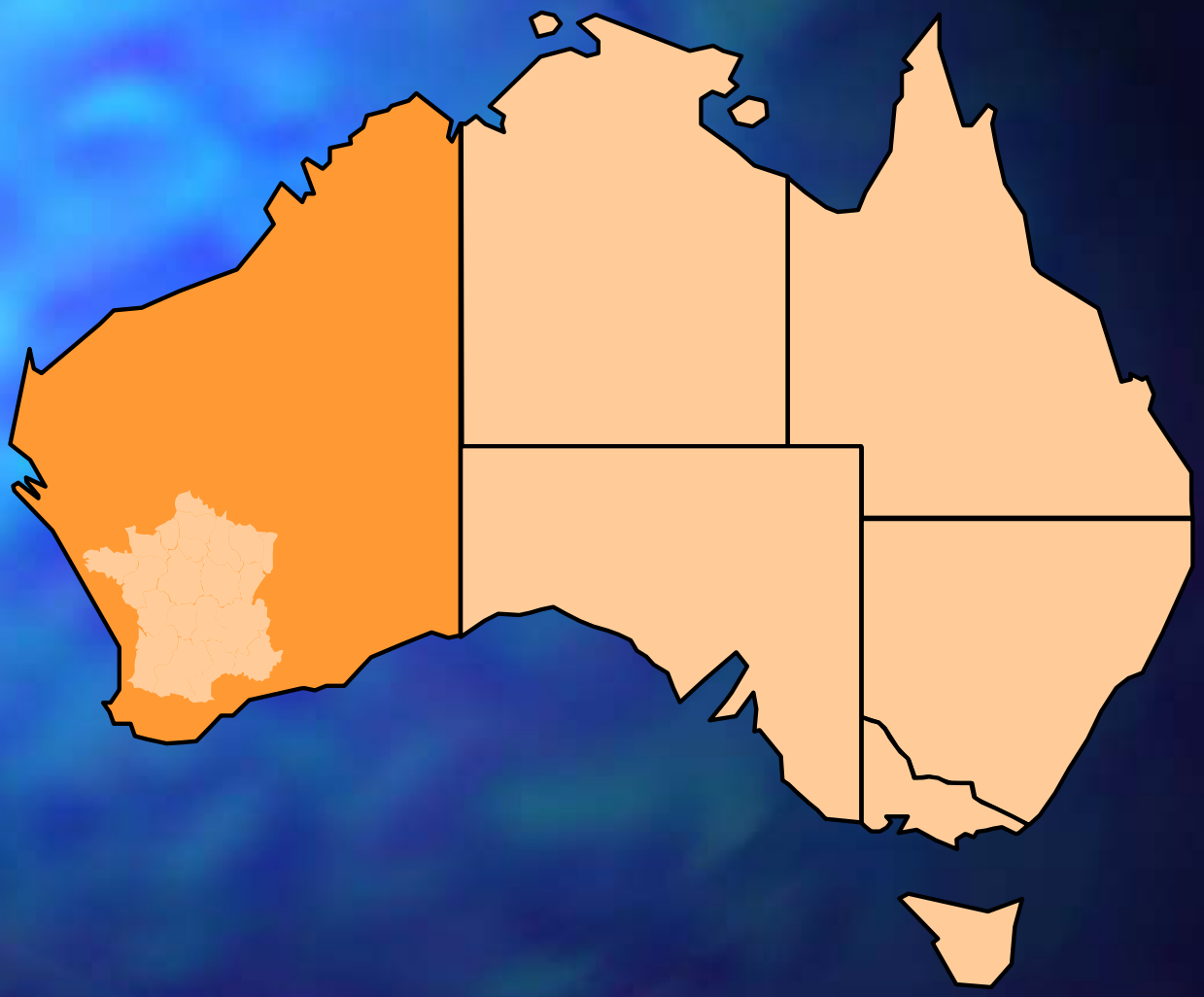
Dr Syd Shea

Executive Director

Department of Conservation and
Land Management, Western Australia

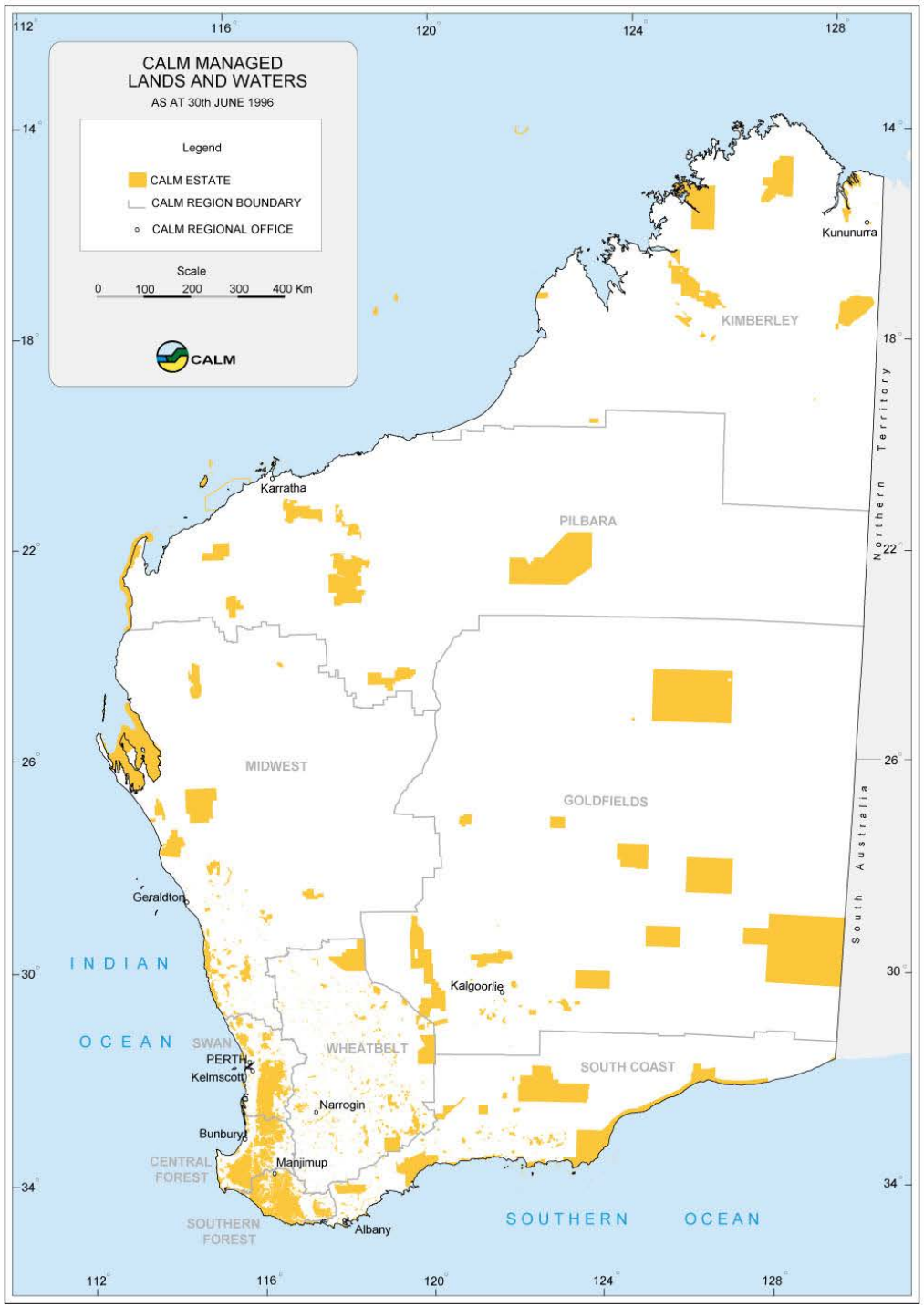


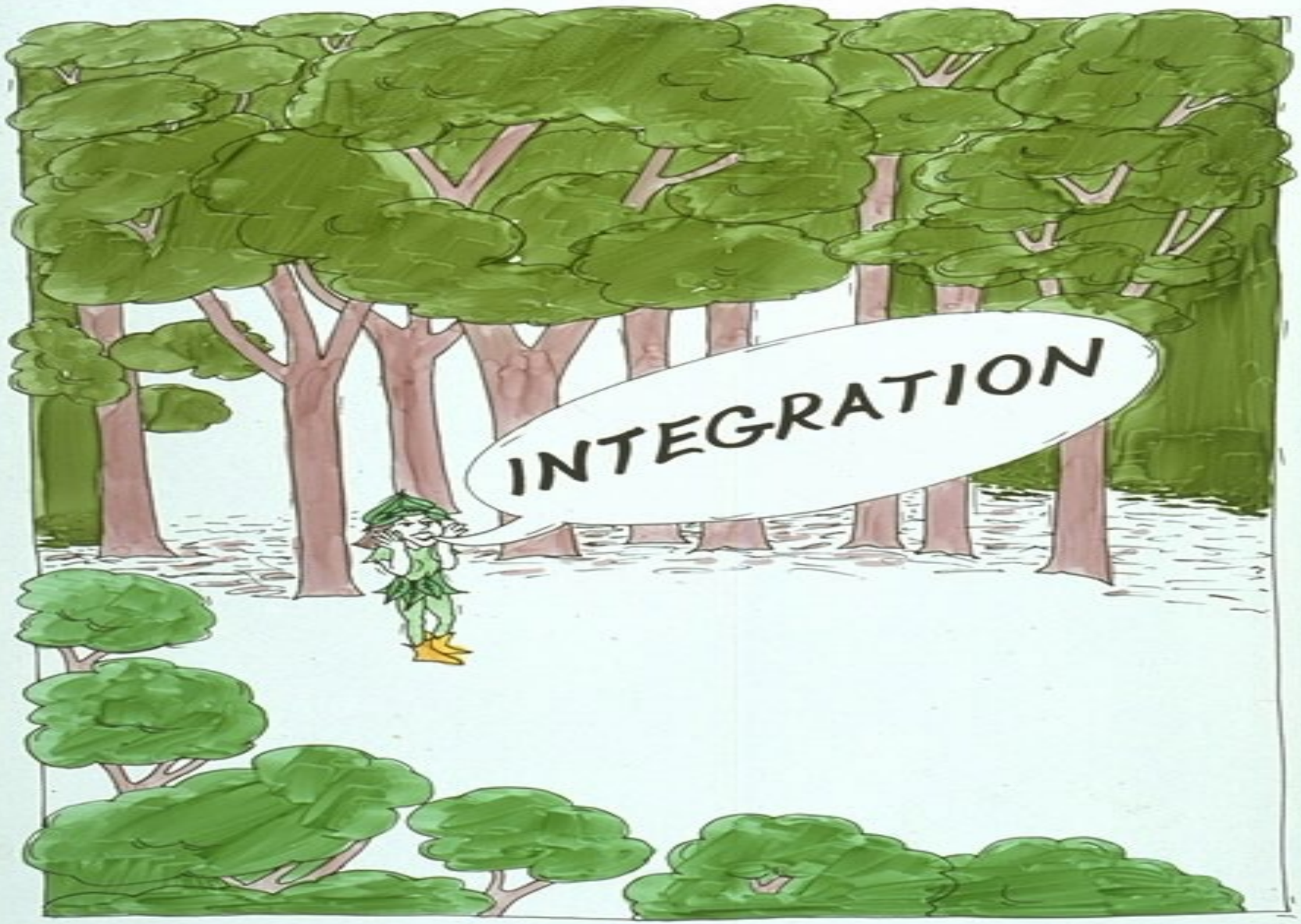
France occupies a land area about a quarter the size of Western Australia



CALM manages
a land area 51%
the size of Japan

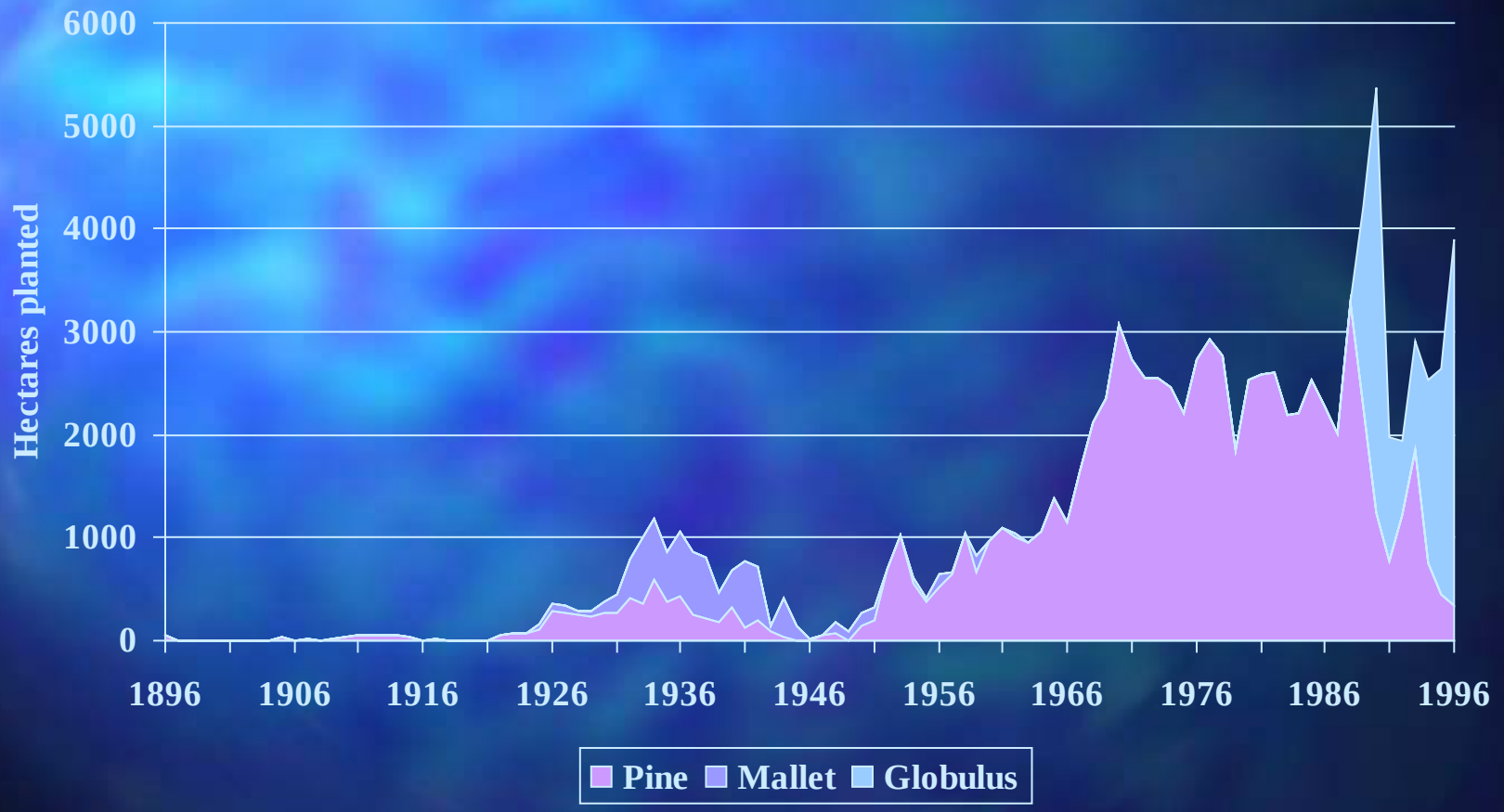
CALM managed lands and waters

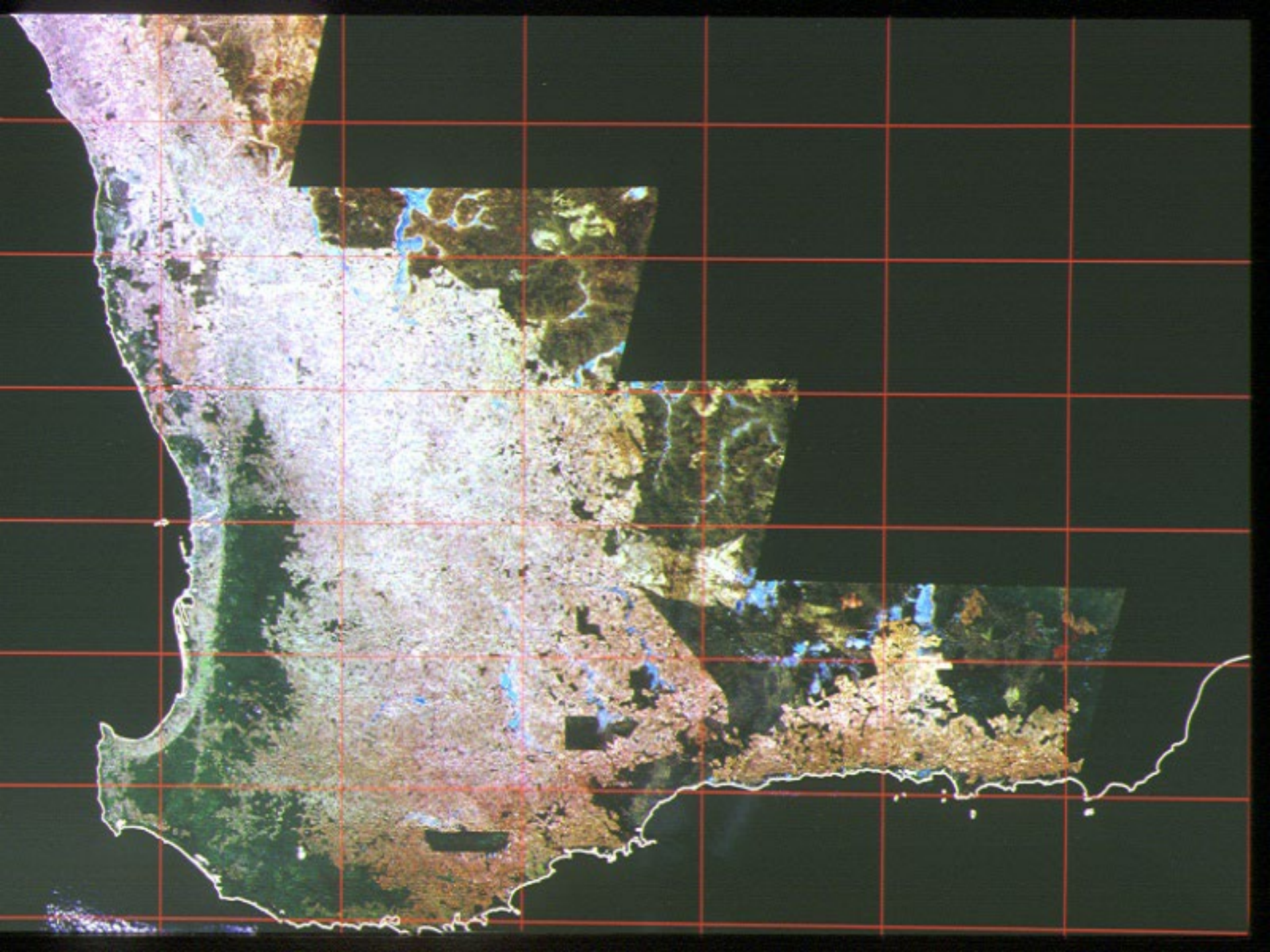


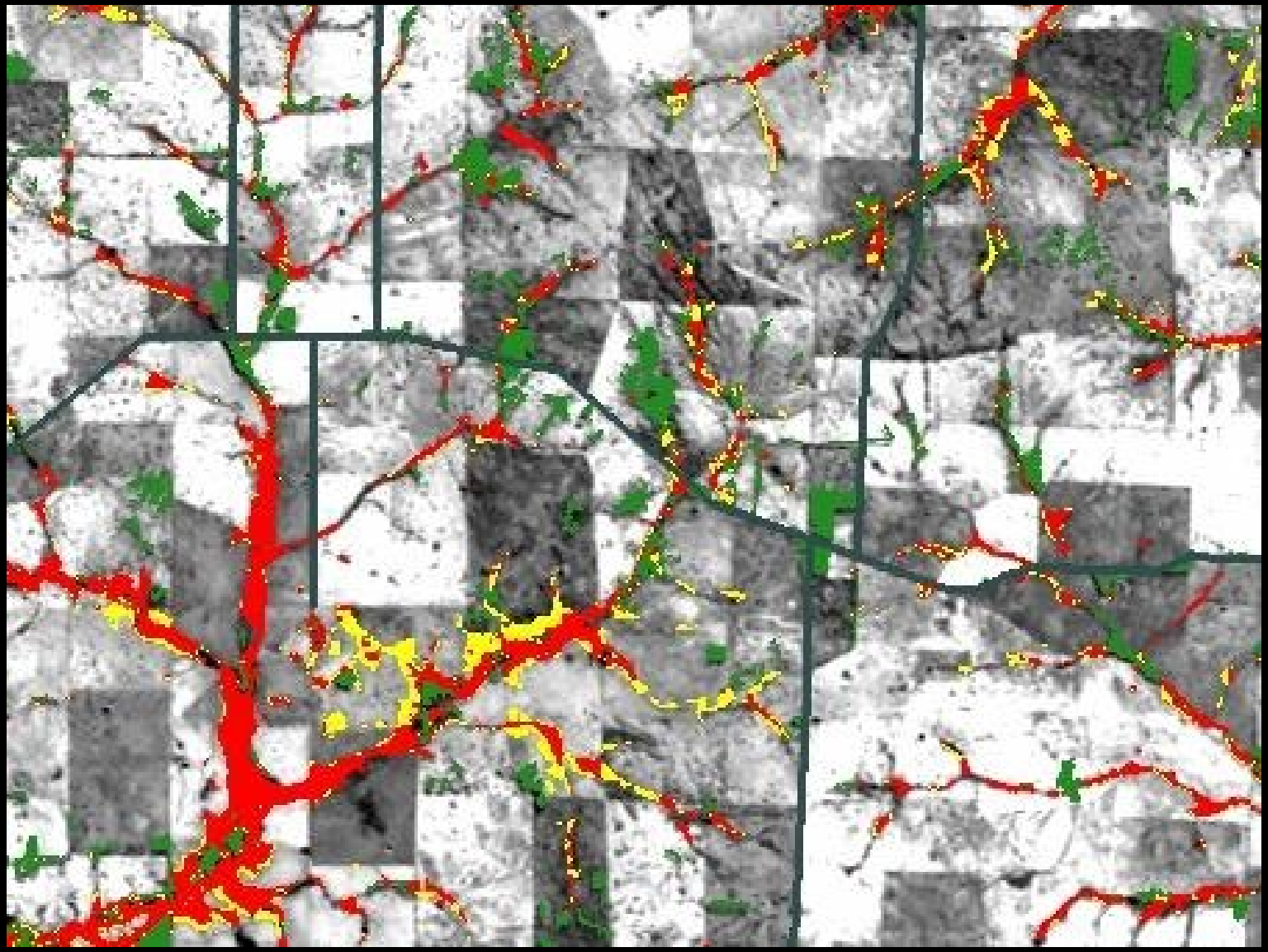

INTEGRATION

- Integrating the needs of all of the community now and in the future
- Integrating different sustainable land uses with sustainable conservation
- Integrating conservation with wealth generation and employment creation
- Integrating management and scientific skills to achieve these objectives

Tree plantings in Western Australia
(WAFD/CALM)



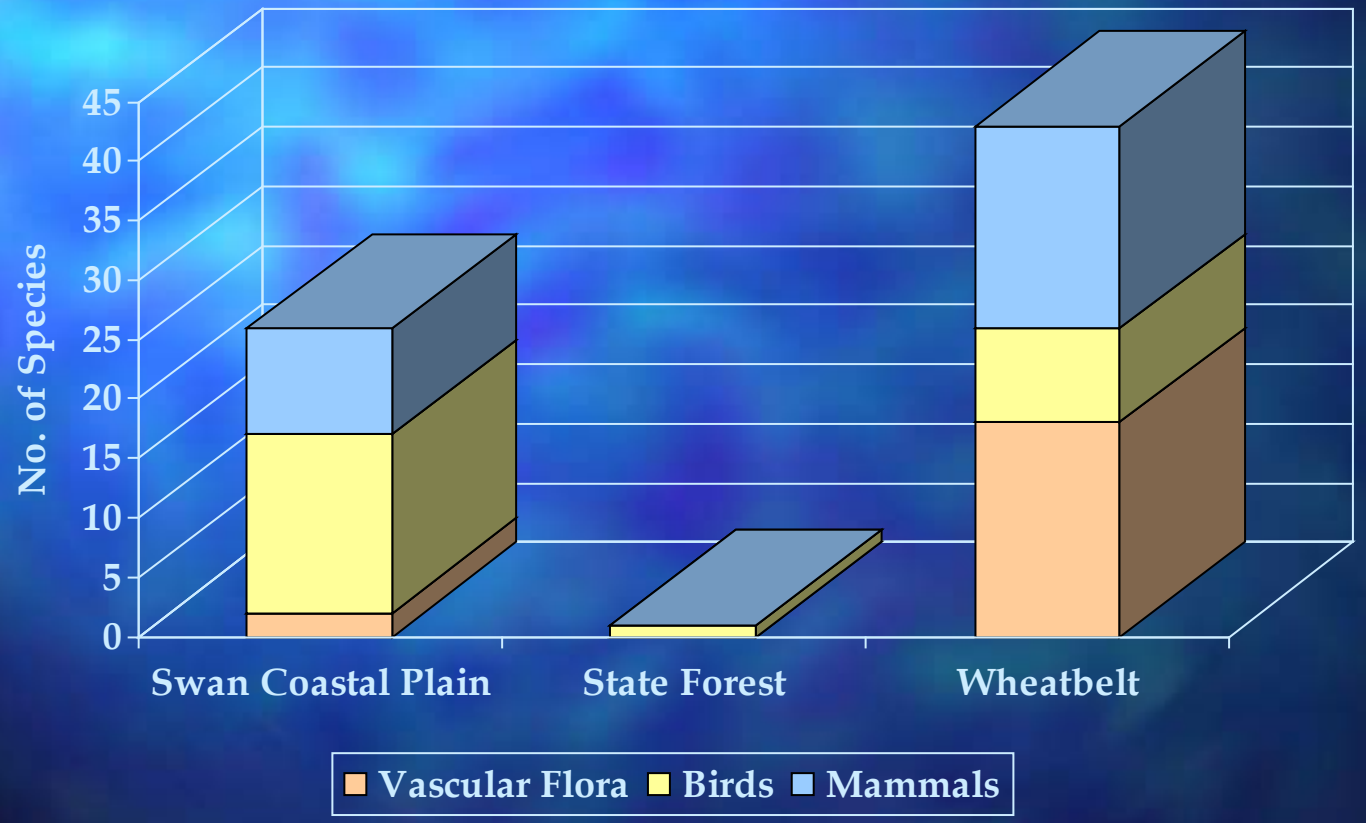




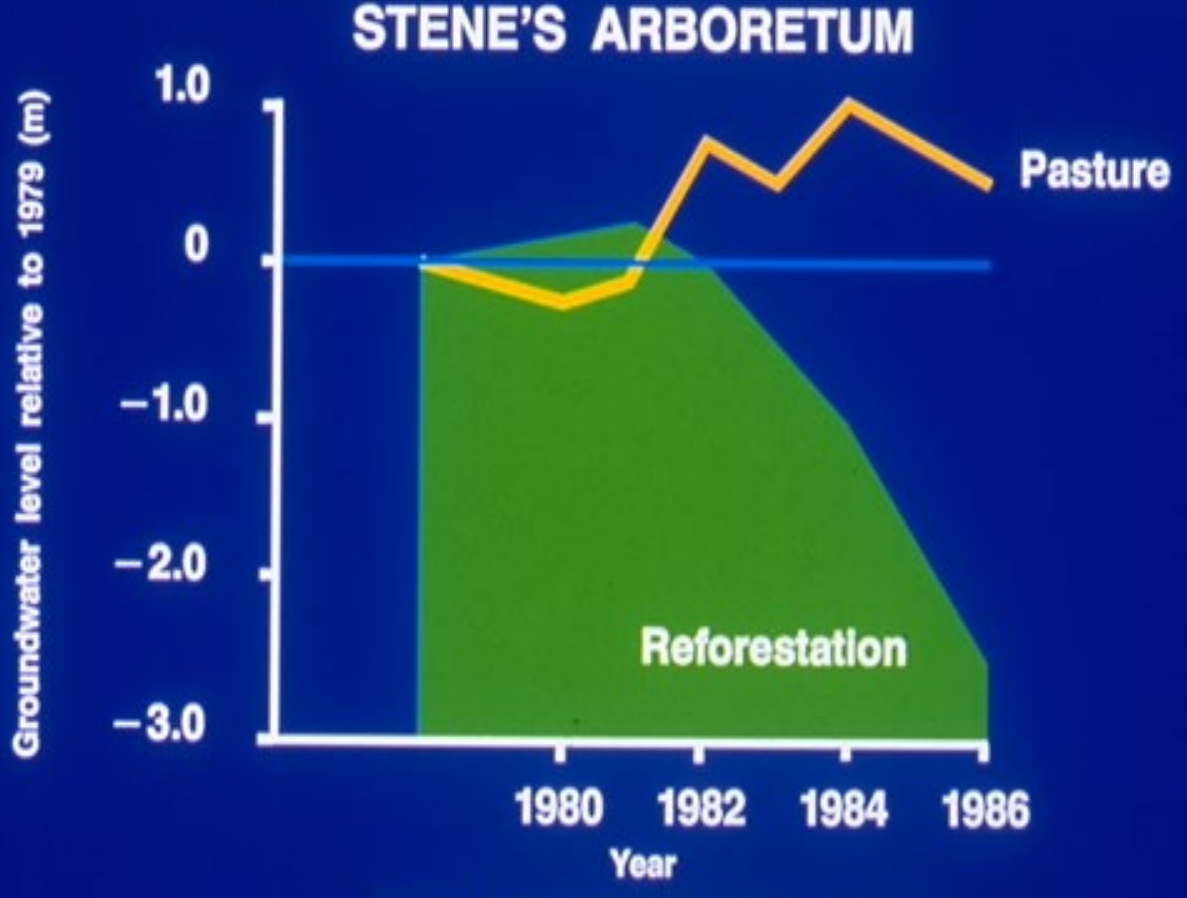
Predicted Salinity Risk Areas

Species Extinctions Since European Settlement in 1829

(After Armstrong and Abbott, 1995)

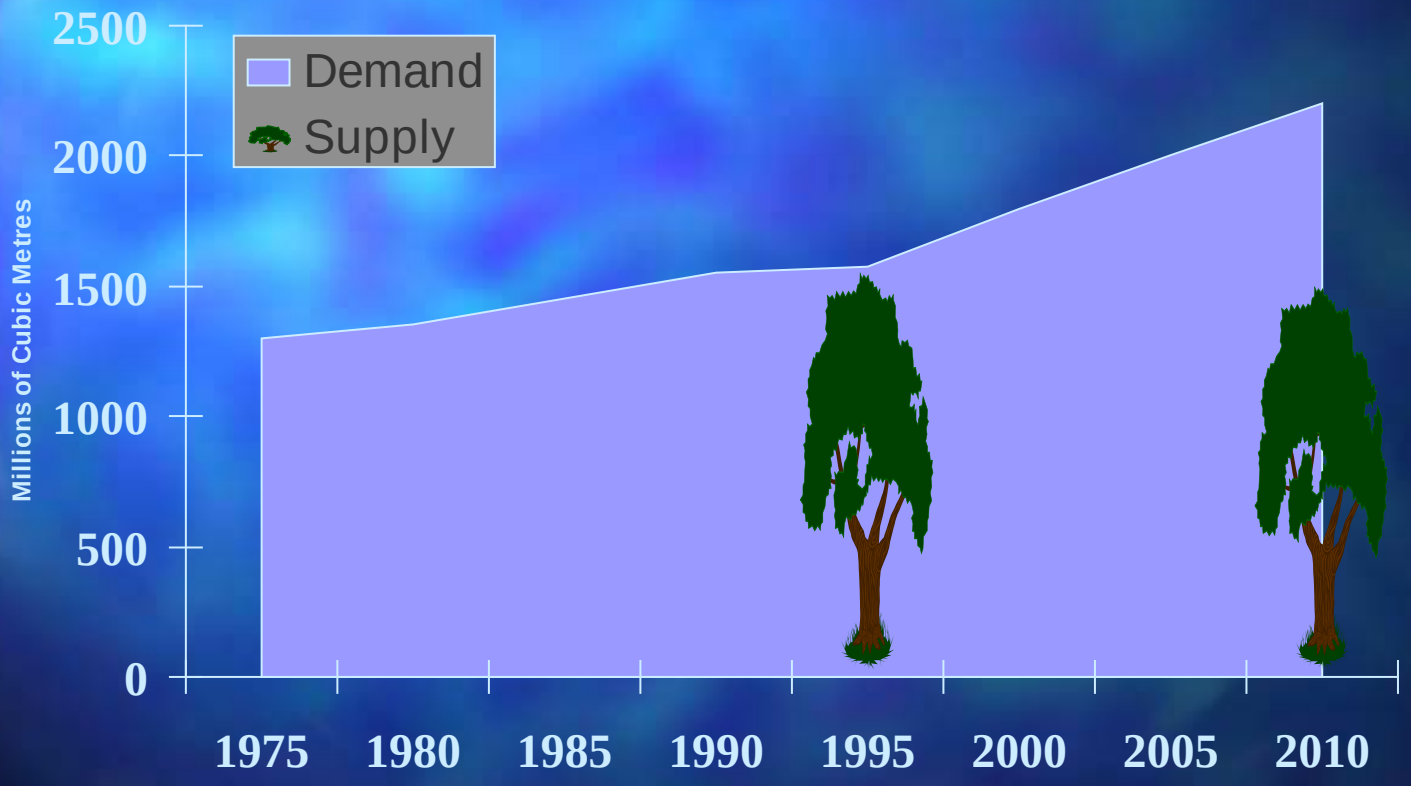


THE EFFECT OF TREE CROPS ON WATER TABLE LEVELS



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

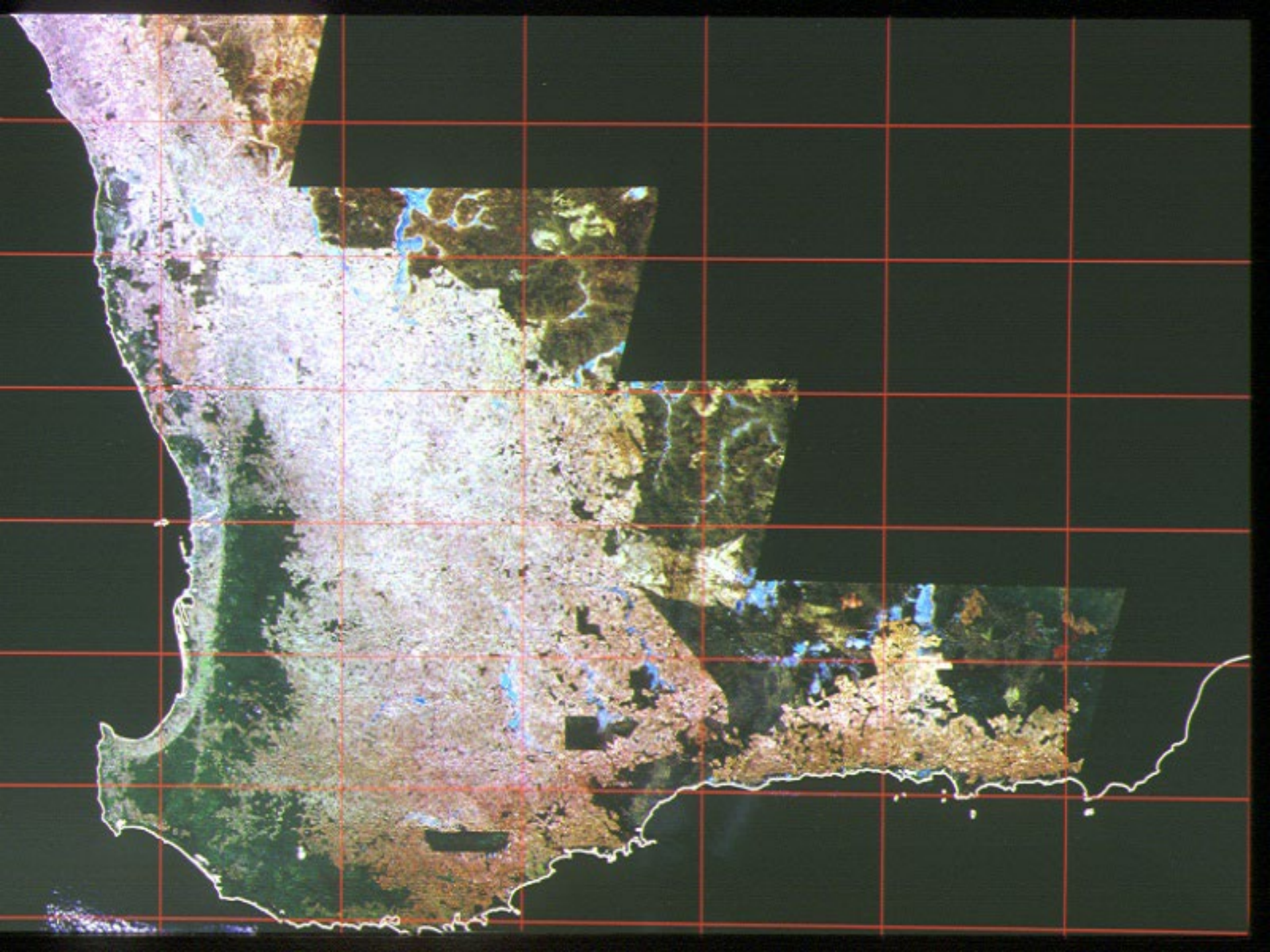
Global wood demand rises as supply falls



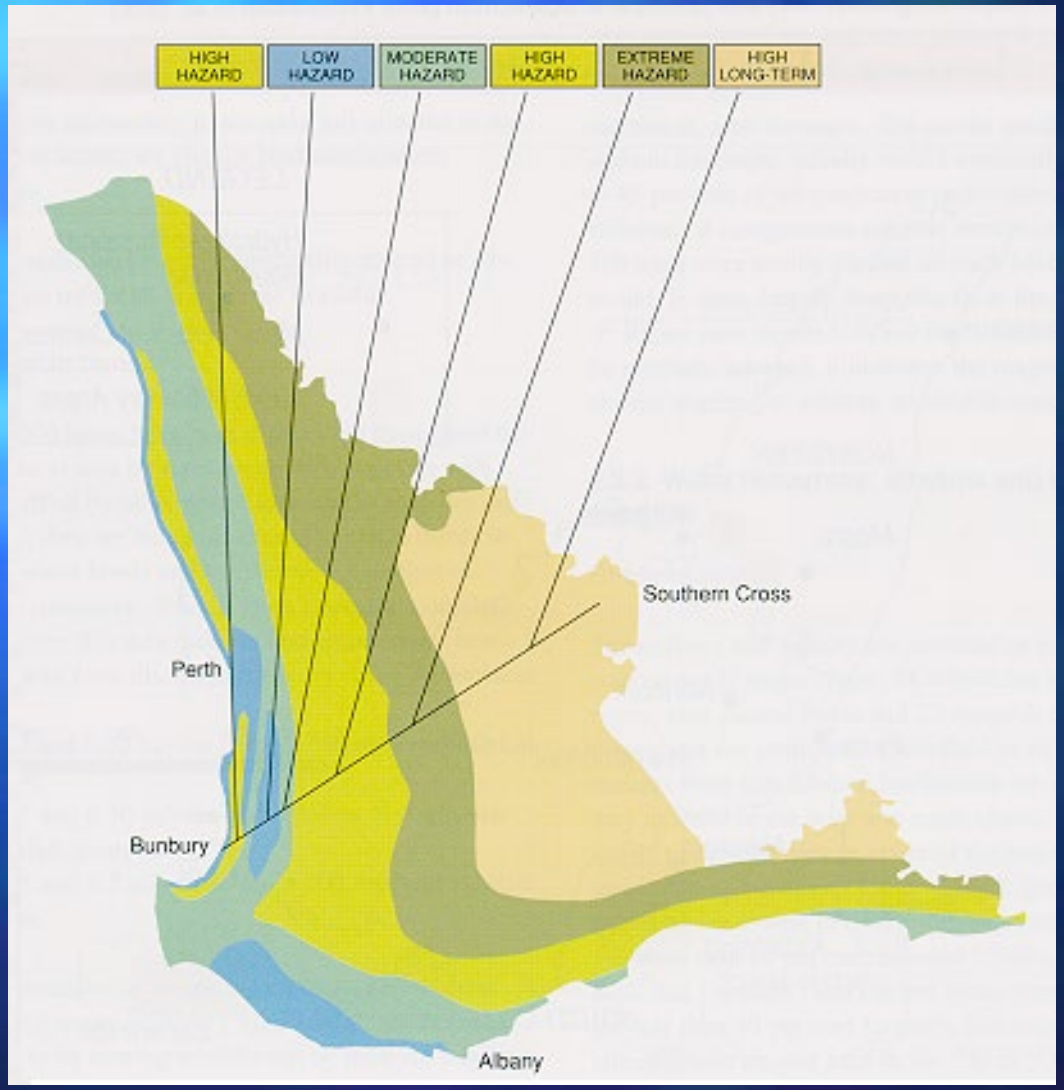
Sources: D A Neilson,UN FAO, Apsey & Reed, Jaakko Poyry, Widmans World Wood Reveiw, Xylem Investments Inc

Suitability by country for hardwood pulpwood plantation development to supply Asian markets

After Groome, 1989



Salinity hazard zones in the South-West

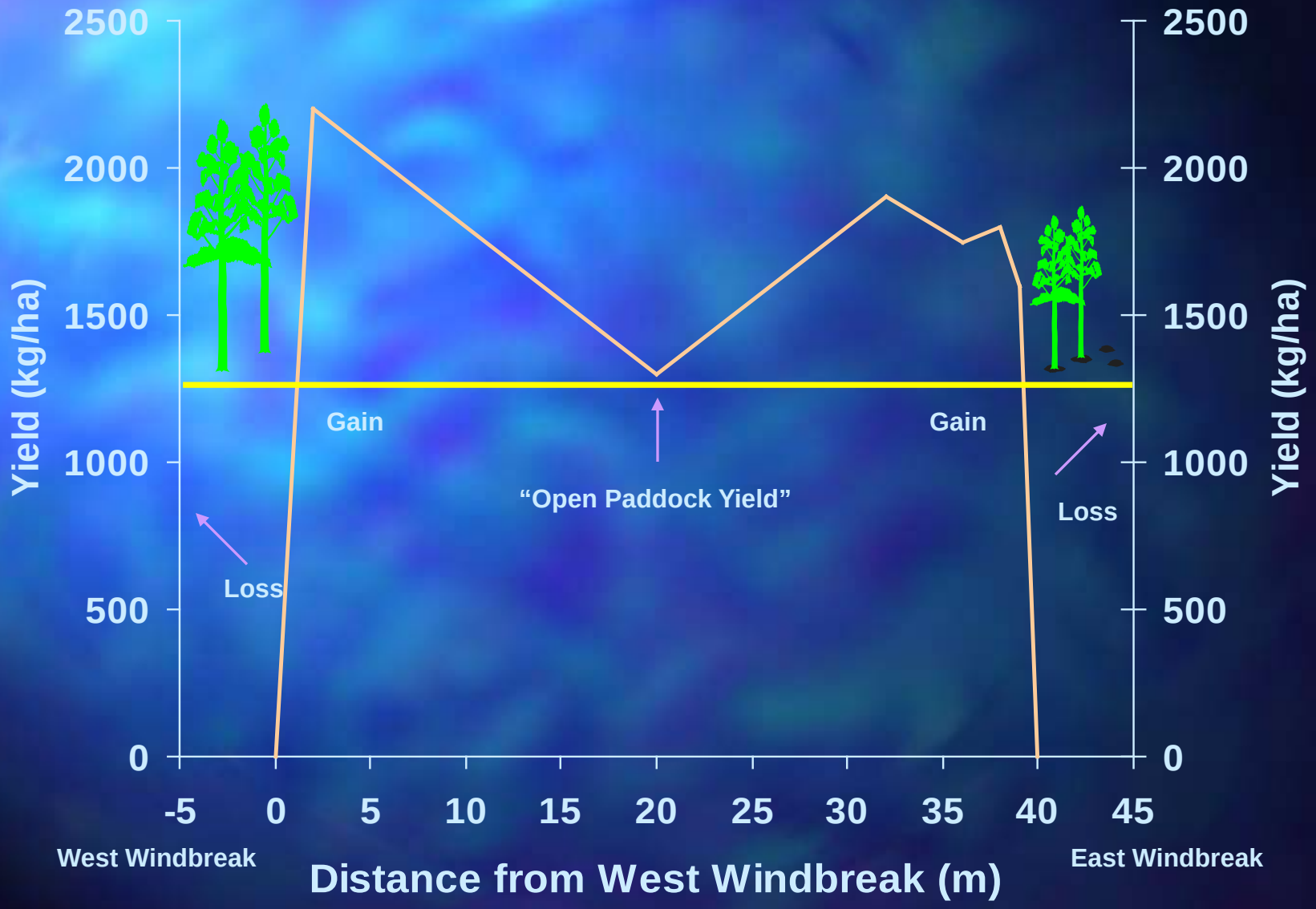


Farm Forestry Zones by Area and Rainfall

	Rainfall (mm)	*Area (x 10^6 ha)*		
		Cleared land[1]	*Suitable land*[2]	*Plantable land*[3]
Pine and Bluegum	>600 mm	2	1.3	.26
New Maritime Pine	400-600 mm	6	4.0	0.8
Wheatbelt	<400 mm	10	6.7	1.3
Total		**18**	**12.0**	**2.36**


CALM SHAREFARMS
MARITIME PINE
DORMAN PLANTATION PLANTED 1996

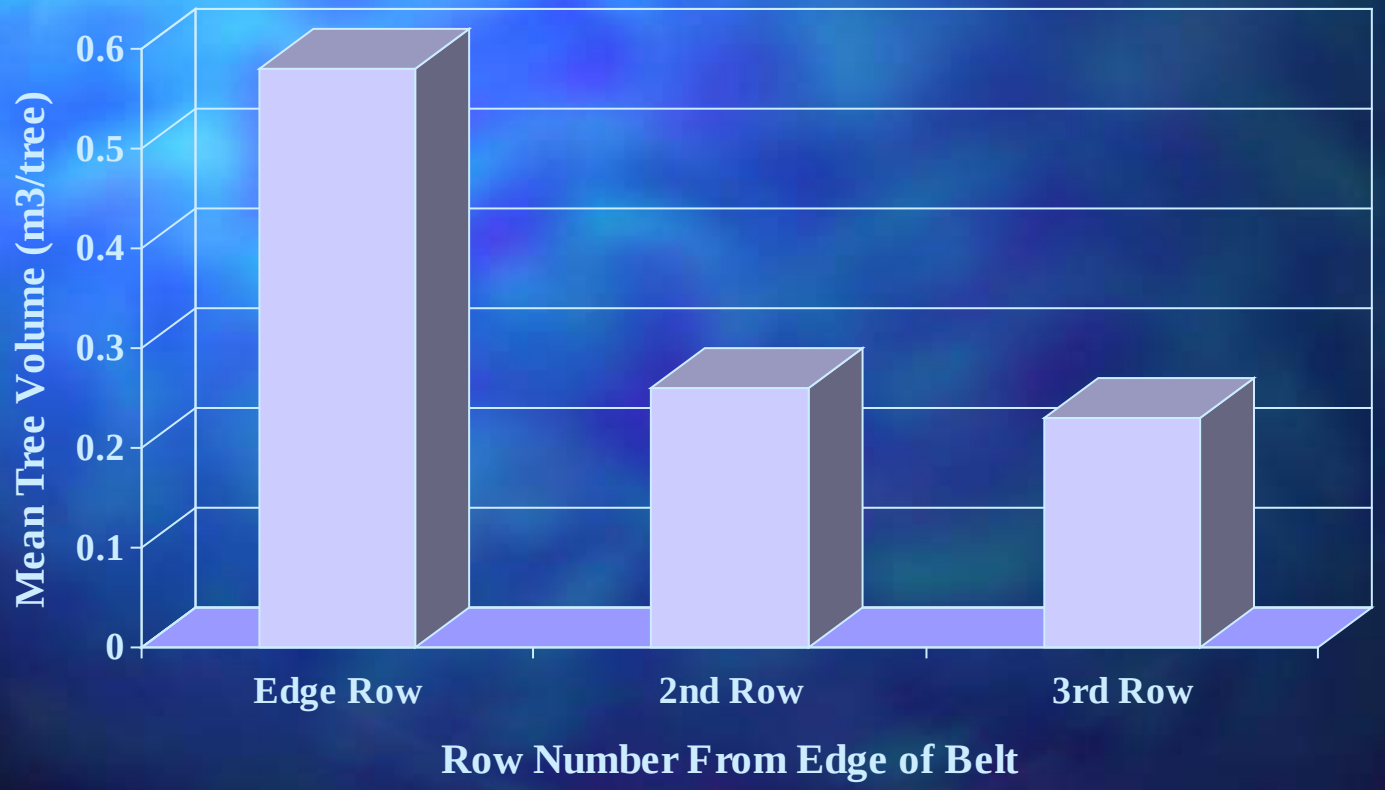
Lupin Grain Yield Between Parallel Pine Windbreaks at Esperance, Western Australia (Property of G & J English, 1988)



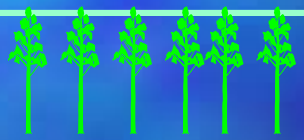
Mean Tree Diameter, Height and Volume by Row in 8.7 yr old *E. globulus* (eastern aspect) on Oats' Property near Busselton

Row Number	Mean Diameter (cm)	Mean Height (m)	Mean Tree Volume (m^3/tree)
1 (Edge Row)	31.2	17.7	0.47
2 (2nd Row)	19.5	18.3	0.21
3 (3rd Row)	19.2	18.2	0.19

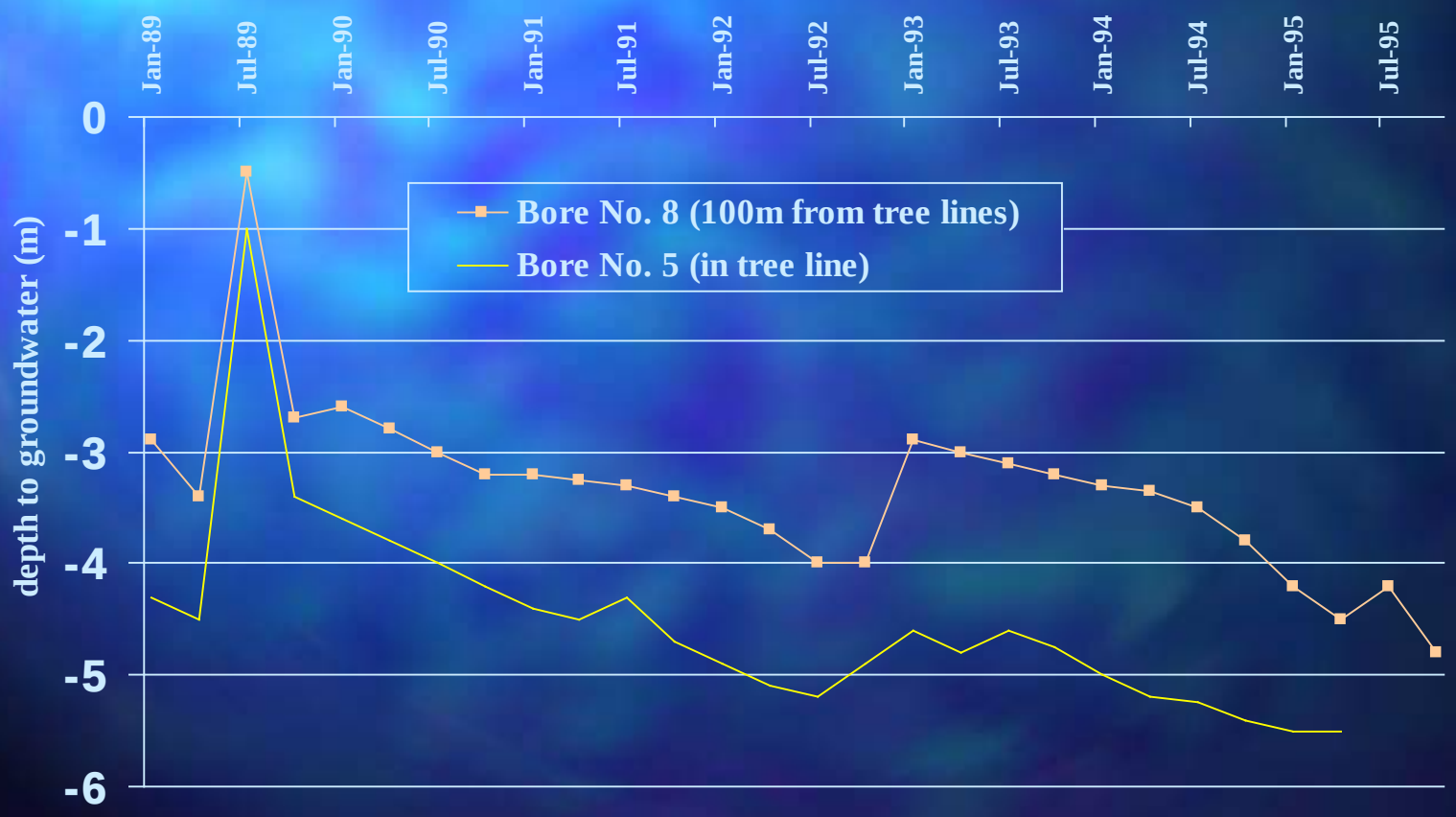
Mean Volume per Tree by Row from Edge



Impact of 'Edge-Effect' on Overall Wood Production in Bluegum Belts of Various Widths

Rows/Belts		Average Production (m^3 /ha)	Extra Production (%)
2	 400 400	400	100
4	 400 200 200 400	300	50
6	 400 200 200 200 200 400	260	33
8	 400 200 200 200 200 200 200 400	250	25
10	 400 200 200 200 200 200 200 200 200 400	240	20

Hydrograph showing groundwater response to alley farming system



FORM P2
APPROVAL NO. B1629
WESTERN AUSTRALIA

TRANSFER OF LAND ACT 1893 AS AMENDED

PROFIT A PRENDRE

[Under s.34B Conservation and Land Management Act 1984 as amended]

DESCRIPTION OF LAND (Note 1)	EXTENT	VOLUME	FOLIO

ESTATE AND INTEREST (Note 2)

ENCUMBRANCES (Note 3)

OWNER (Registered Proprietor) (Note 4)

GRANTEE (Note 5)

EXECUTIVE DIRECTOR OF THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT a body corporate constituted by the Conservation and Land Management Act 1984 ("the Act") of Corner of Hackett Drive and Australia II Drive, Crawley Western Australia.

TERM OF PROFIT A PRENDRE (Note 6)

40 years, subject to earlier termination in accordance with clause 8, commencing on and including the First day of January 1998.

The Owner hereby Grants a Profit a Prendre to the Grantee for the term specified above over the land described above subject to the encumbrances shown hereon in accordance with the terms and conditions contained in this Deed.

CALM SHAREFARMS LOWER WEST

JACKSON

Nelson Loc's 2868, 2869 & 2870.

PLANTATION PLAN LEGEND

P.97 TREE CROP AREA E.globulus G.P.S. CAPTURE.	SEALED ROAD
P.96 TREE CROP AREA E.globulus G.P.S. CAPTURE.	UNSEALED ROAD
EXISTING BUSH G.P.S. Capture inside tree crop area only.	POWERLINE, PYLON
SALT AFFECTED G.P.S. CAPTURE.	SWAMP
PRIVATE PLANTING	DAM
CALM PLANTING	WATER POINT
FENCE	BUILDINGS
CADASTRAL BOUNDARY G.P.S. CAPTURE	CADASTRAL BOUNDARY NON G.P.S. CAPTURE

STATISTICAL REPORT

Categories	Area (ha)
P.97 TREE CROP AREA	372.5
TOTAL AREA	372.5

SHIRE: BOYUP BROOK
MAIN ACCESS ROAD: CRAIGIE ROAD
FIRE CONTROL DETAILS
OWNER:
CONTACT:
FIRE CONTROL CONTACTS:
1.
2.
3.
FIREBREAKS
10m BOUNDARY
10m ADJOINING 1st CLASS ROADS
10m ADJOINING 2nd CLASS ROADS
6m INTERNAL BETWEEN COMPARTMENTS
6m INTERNAL

NB.- The surrounding location boundaries have been determined using 50 series mapping and are for schematic purposes only, there may be inconsistancies between the G.P.S. plot and the Cadastral data. If this is important for the intended use then the matter must be resolved by reference to RMS.

DEPARTMENTAL PLAN FOR OPERATIONAL USE ONLY.

Part of CALM 1/50 000 map: 2230-4
Part of CALM 1/25 000 map: 2230-4SW & SE

G.P.S. (Global Positioning System).
The Global Positioning System used is a real time differential G.P.S. which obtains accuracy of +/-1.5m.

G.P.S. Surveyed By: JOHN MOSAJ	Date: MAY 97
Plan Compiled By: S. MOUNTFORD	Date: JULY 97
Plan Checked By:	Date:

SCALE 1:25 000

1000 800 600 400 200 0 500 1000 metres

PROJECTION: TRANSVERSE MERCATOR C.M. 117 E
HORIZONTAL DATUM: AUSTRALIAN GEODETIC DATUM 1966
VERTICAL DATUM: AUSTRALIAN HEIGHT DATUM 1971.

CALM
CONSERVATION AND LAND MANAGEMENT

CALM has joint ventures with 1303 farmers

CALM has contracts with 84 land management contractors

Inspect an *E. globulus* seedling for quality. Check the stem diameter, look for a pruned fibrous root system and notice if the foliage has a red tinge to show the seedling is hardy. All these aspects will help in the survival of the seedling. To be confident that the seedling will give you extra profit from its volume production in 10 years' time, look for the Western Blue Gum label.

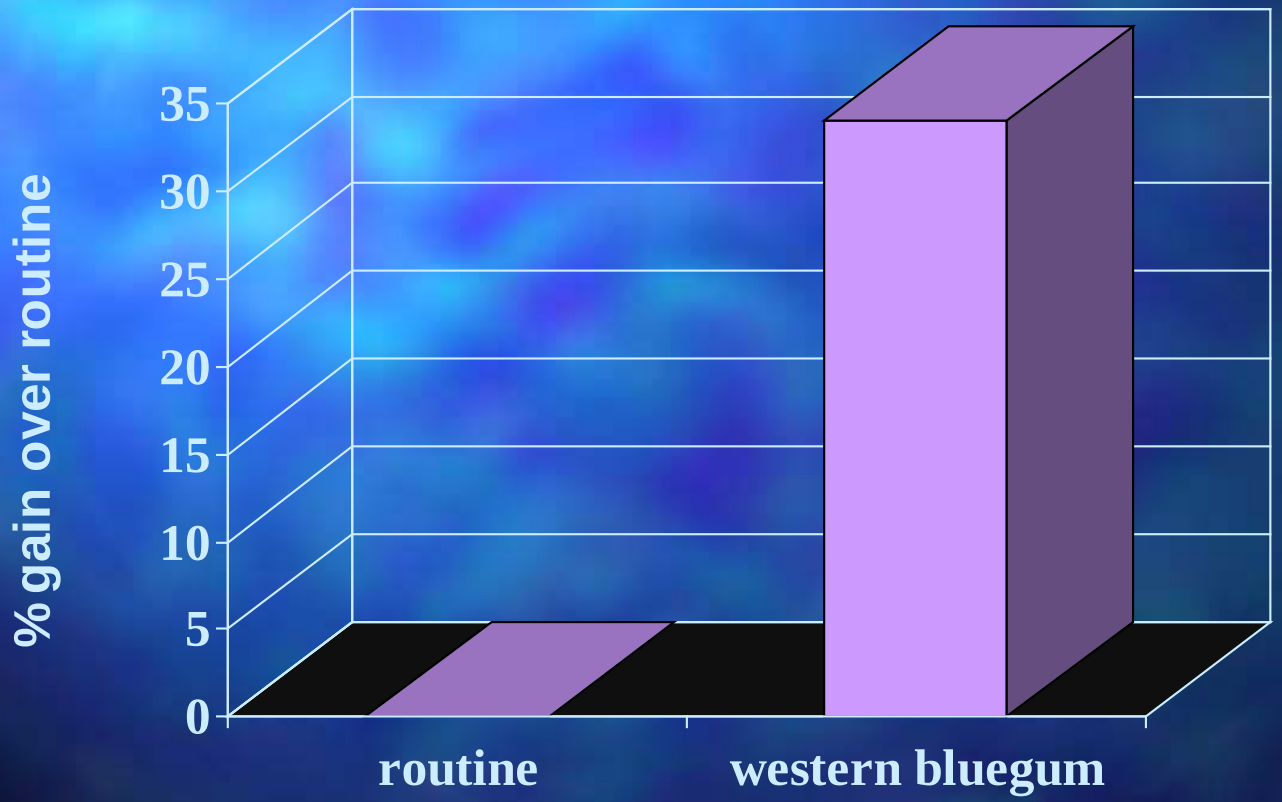
Eucalyptus globulus
Breeding population trials
Program commenced in 1980

Source	Parents	Number	Area	Trees
CSIRO 1987 - 90	766	29	117 ha	107 000
King Island	83	1	3	3 000
Salt Tasmania	44	3	2	2 000
Orme	73	1	4	4 000
Orme (Prov)		2	11	6 000
APPM	73	4	4	3 000
CSIRO cc	135	1	3	3 000
Total	1174	41	144	128 000

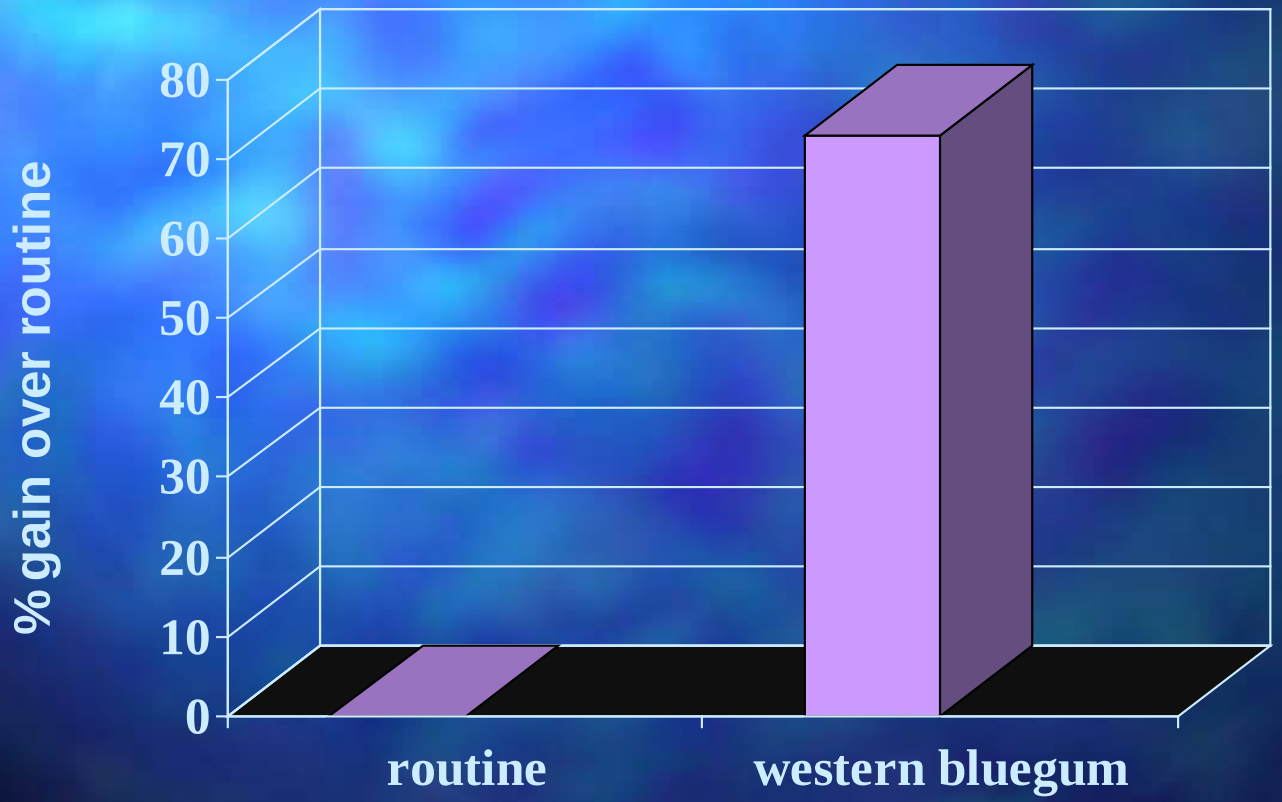
Traits assessed that influence breeding objective

- survival and health
- growth rate
- wood density
- tree form and branching
- drought tolerance
- salinity tolerance
- pest resistance
- flowering precocity and synchrony
- graft compatibility
- rooting ability

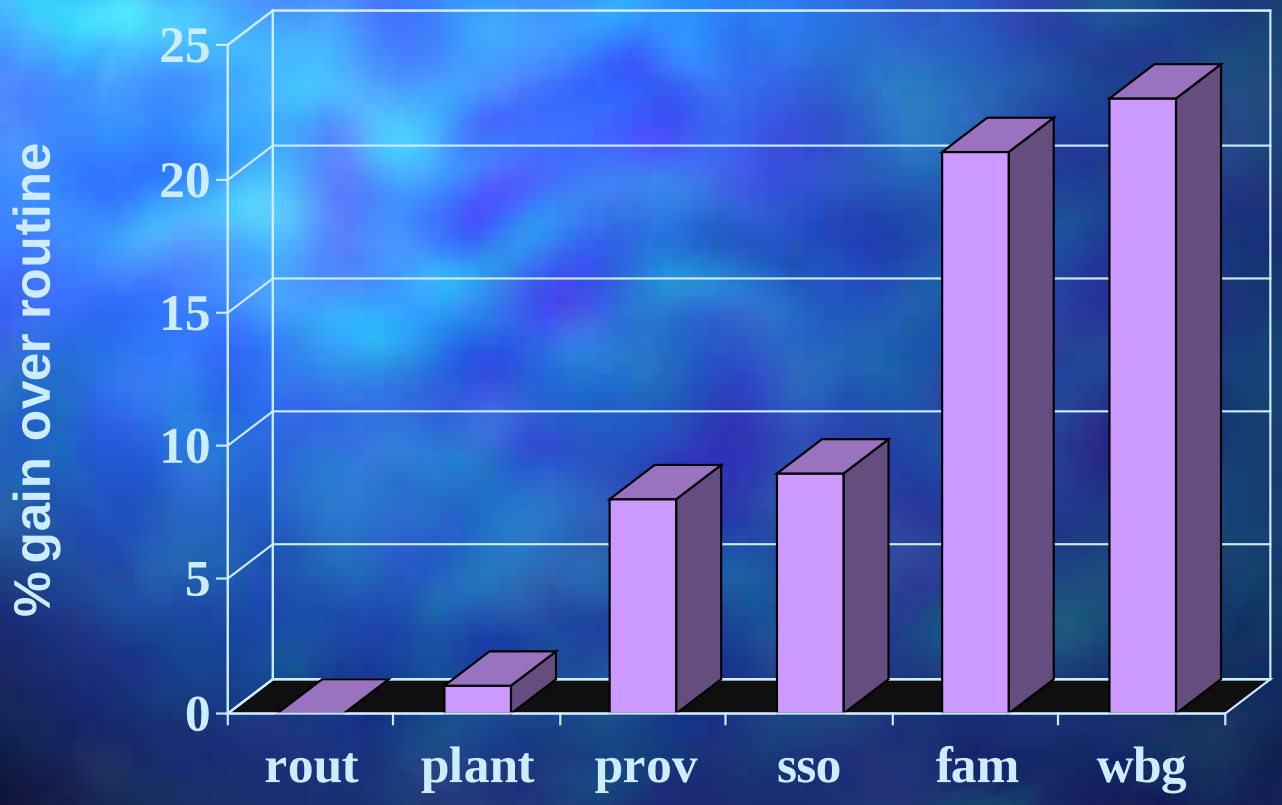
Genetic Gains Trial: **stem form**



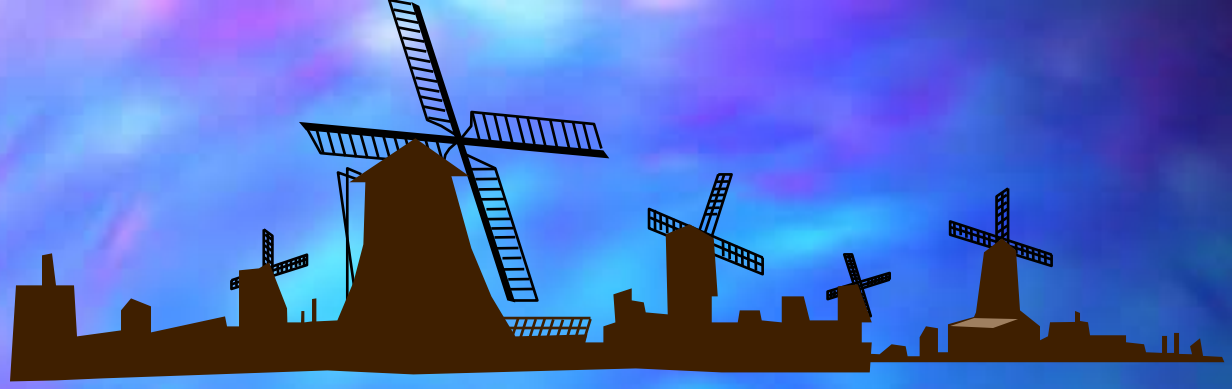
Genetic Gains Trial: **crown**



Genetic Gains Trial: **wood volume**




Western Bluegum
Tasmanian Bluegum
Trees are 2 years 8 months old



La Mancha

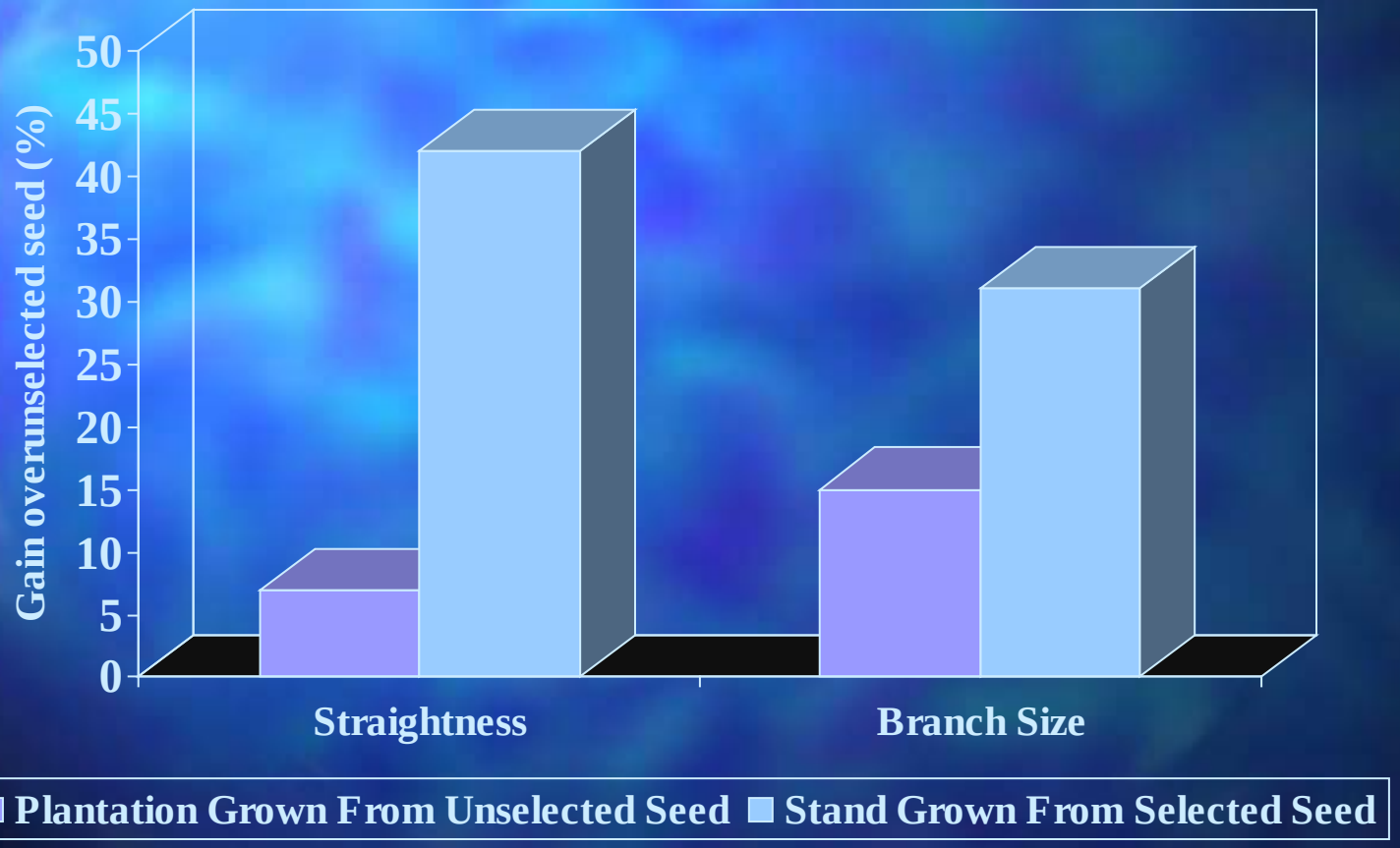
Maritime Pine

CALM's Genetic Resource: *Pinus pinaster*

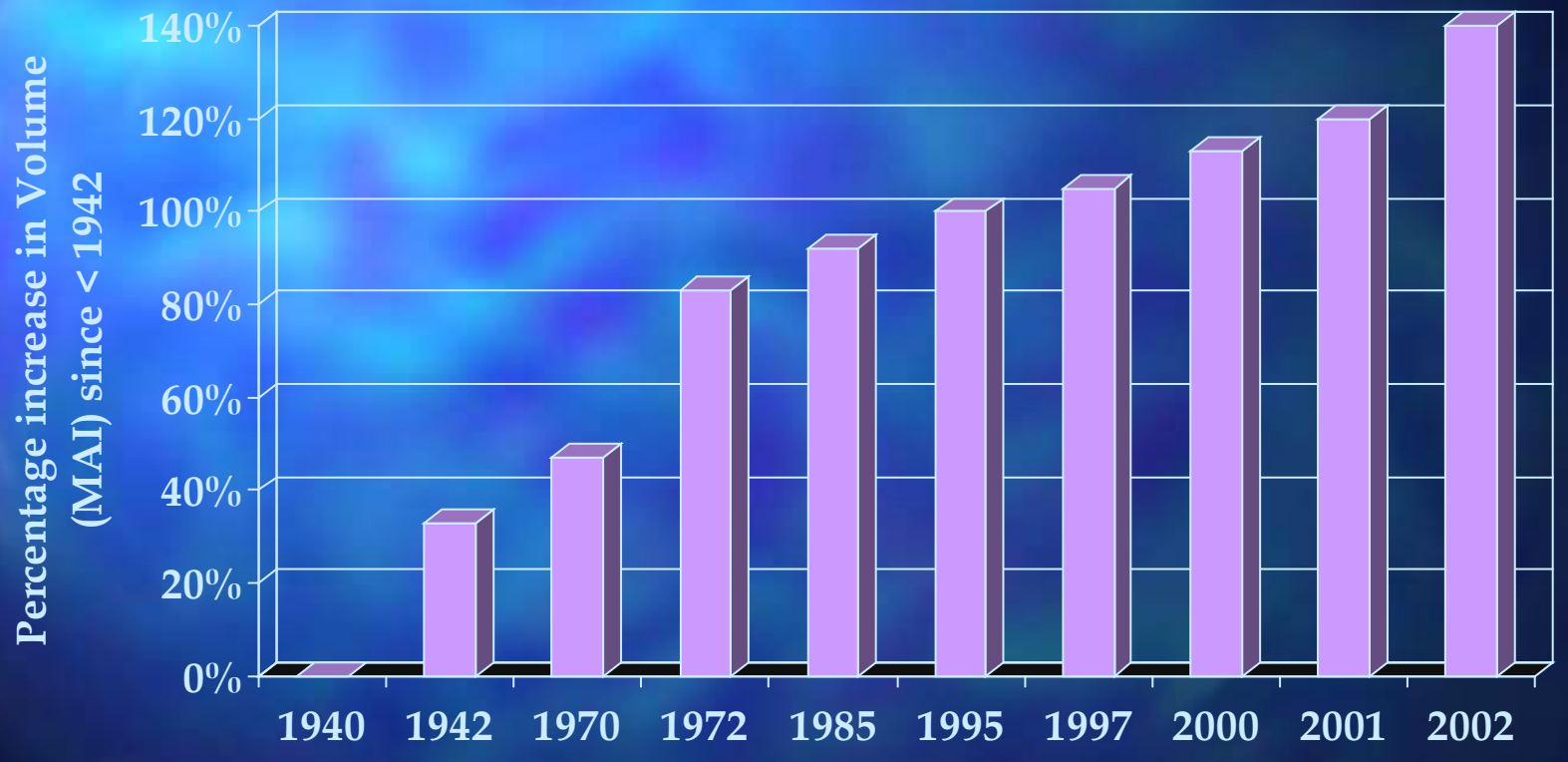
Program commenced in 1957

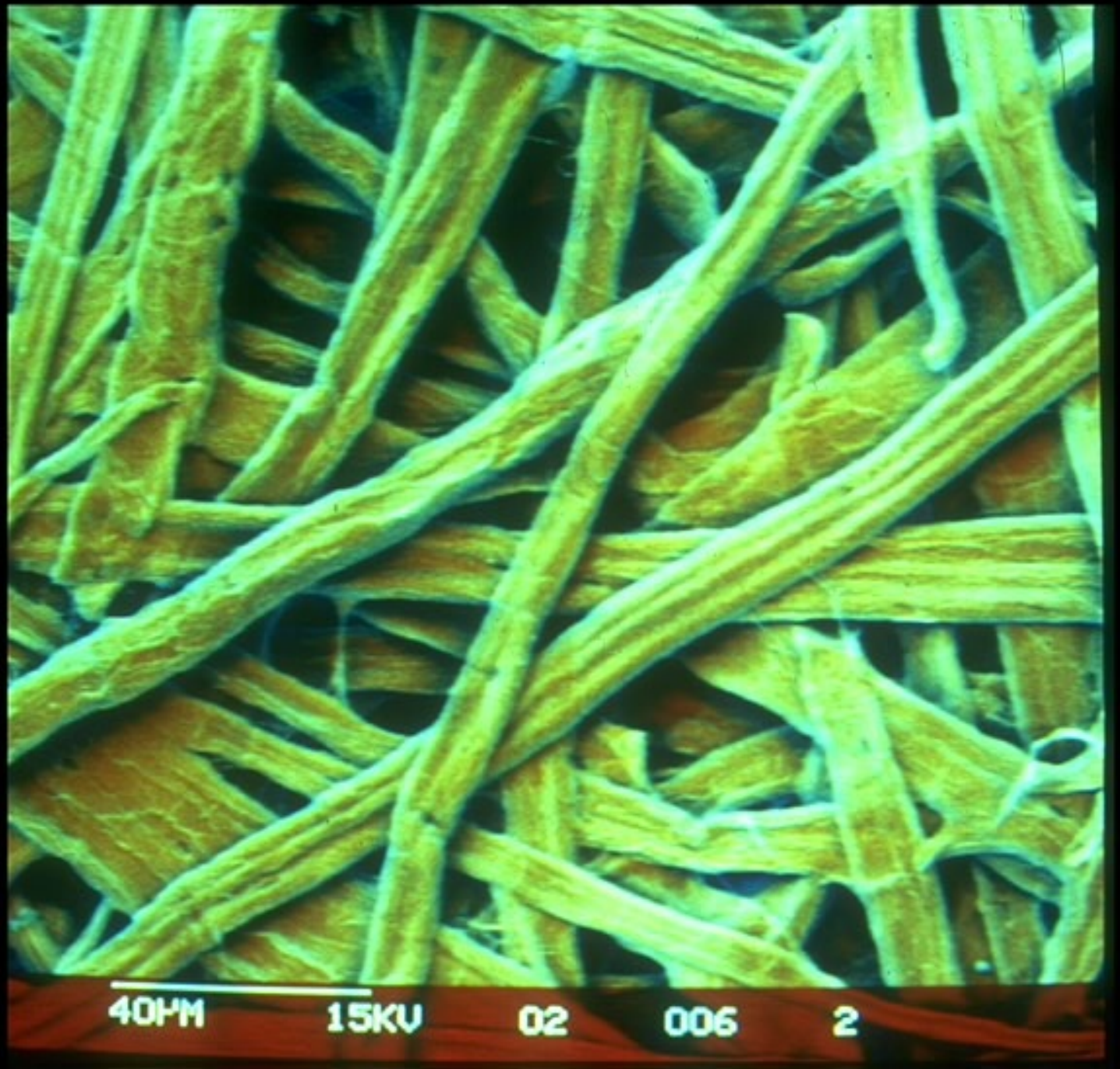
	Parents	Number	Area	Trees
Breeding Population Trials	313	93	171 ha	202 000
Breeding Research Trials		11	43 ha	45 000
Clonal Seed Orchards		4	48 ha	(24 ha active)
Clonal Archives		3	6 ha	

Maritime Pine Breeding Improvement

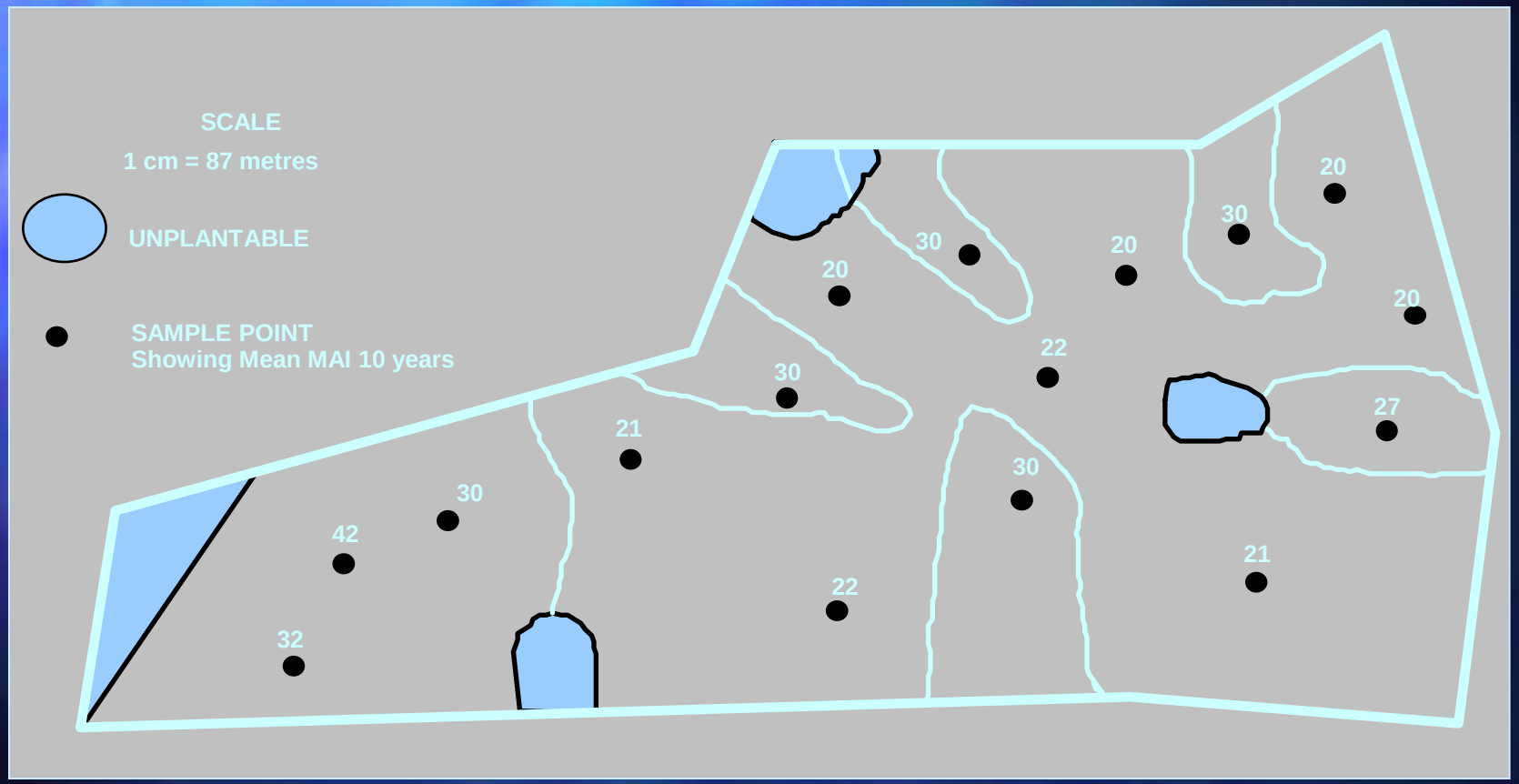


Volume gains from the tree improvement program for Maritime pine



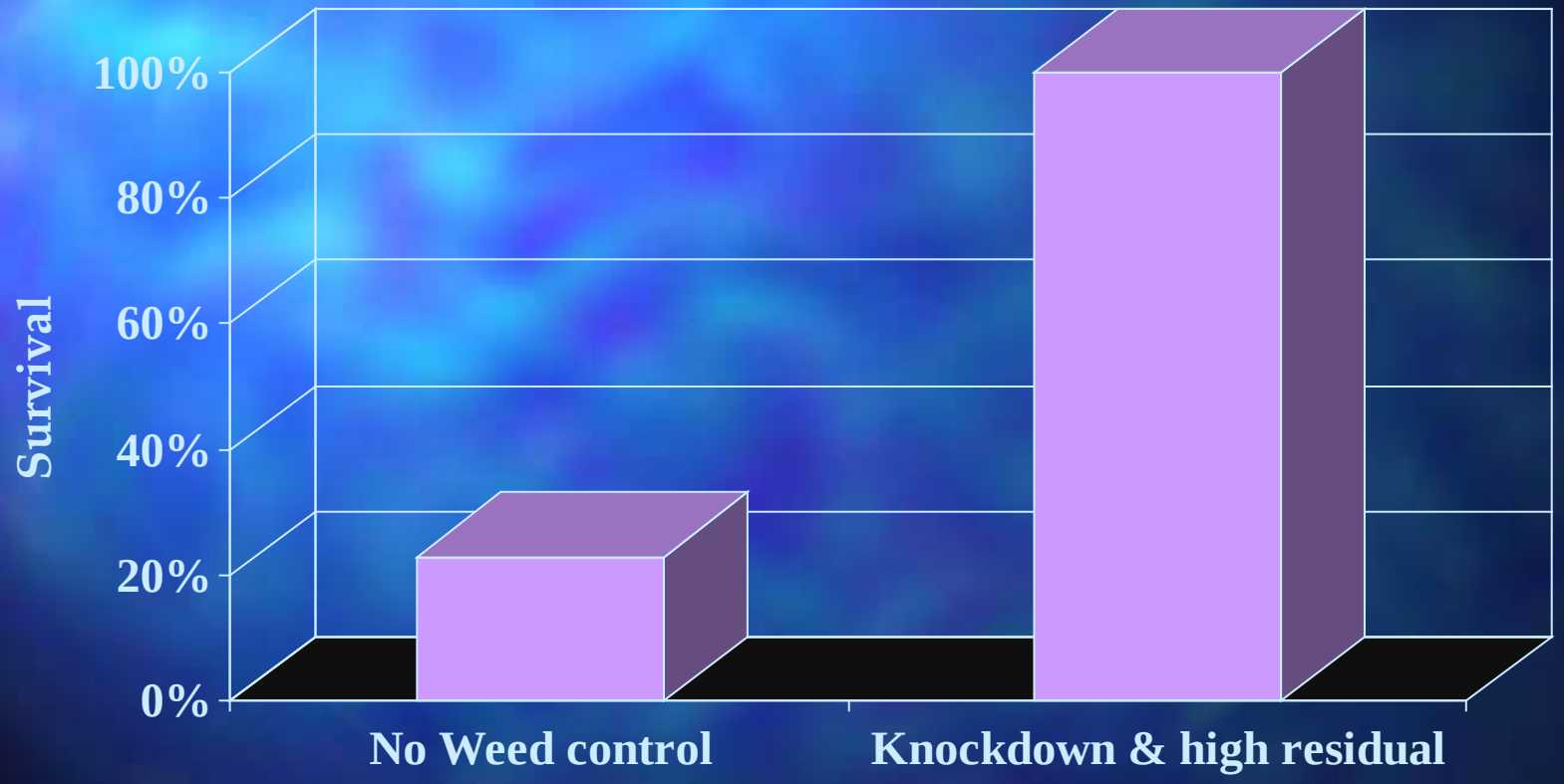

40µM
15KV
02
006
2

E. globulus site productivity assessment for a typical farm



Tree Crop Establishment

Effect of chemical weed control on *Tree Crops*



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

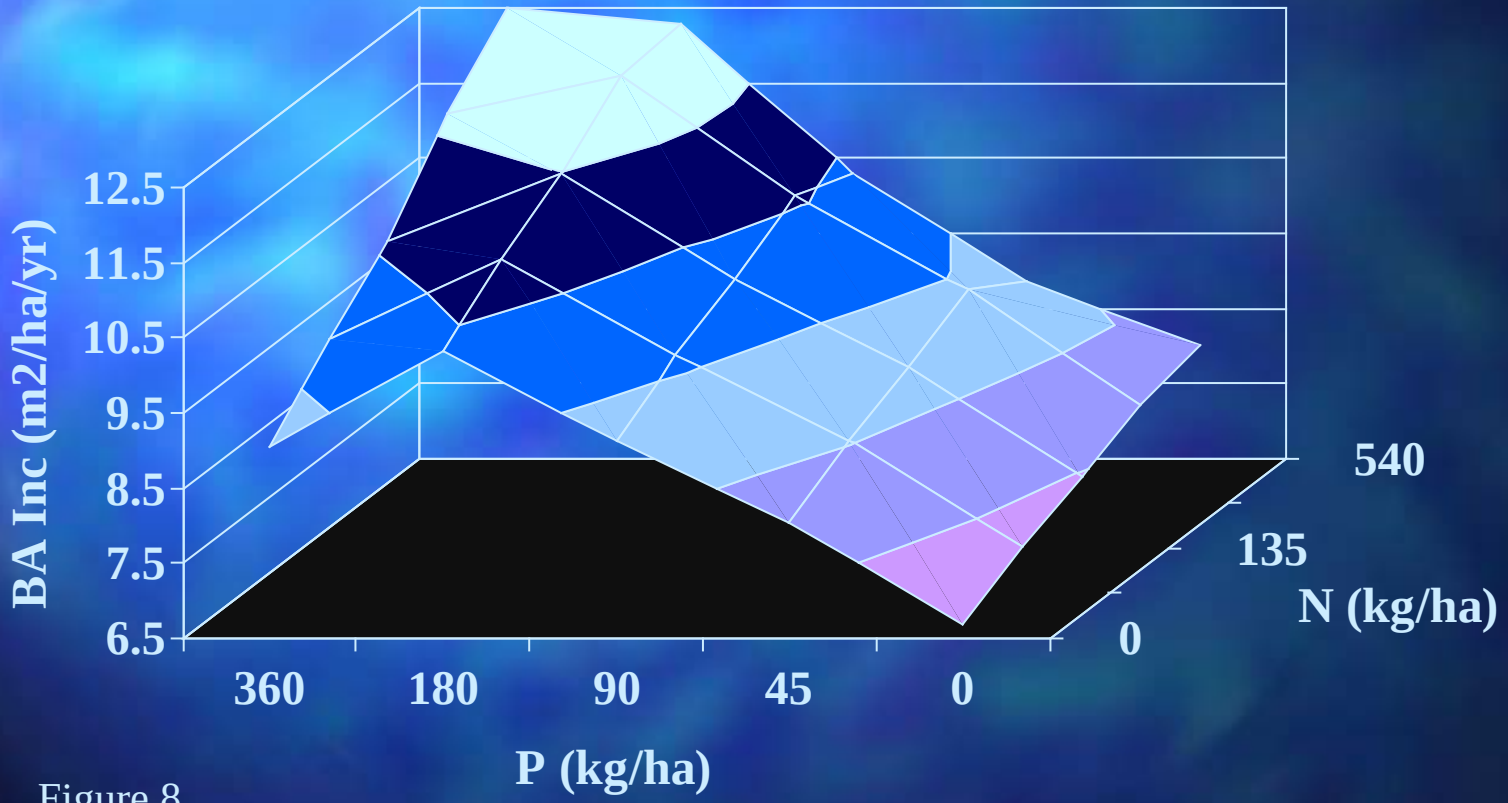
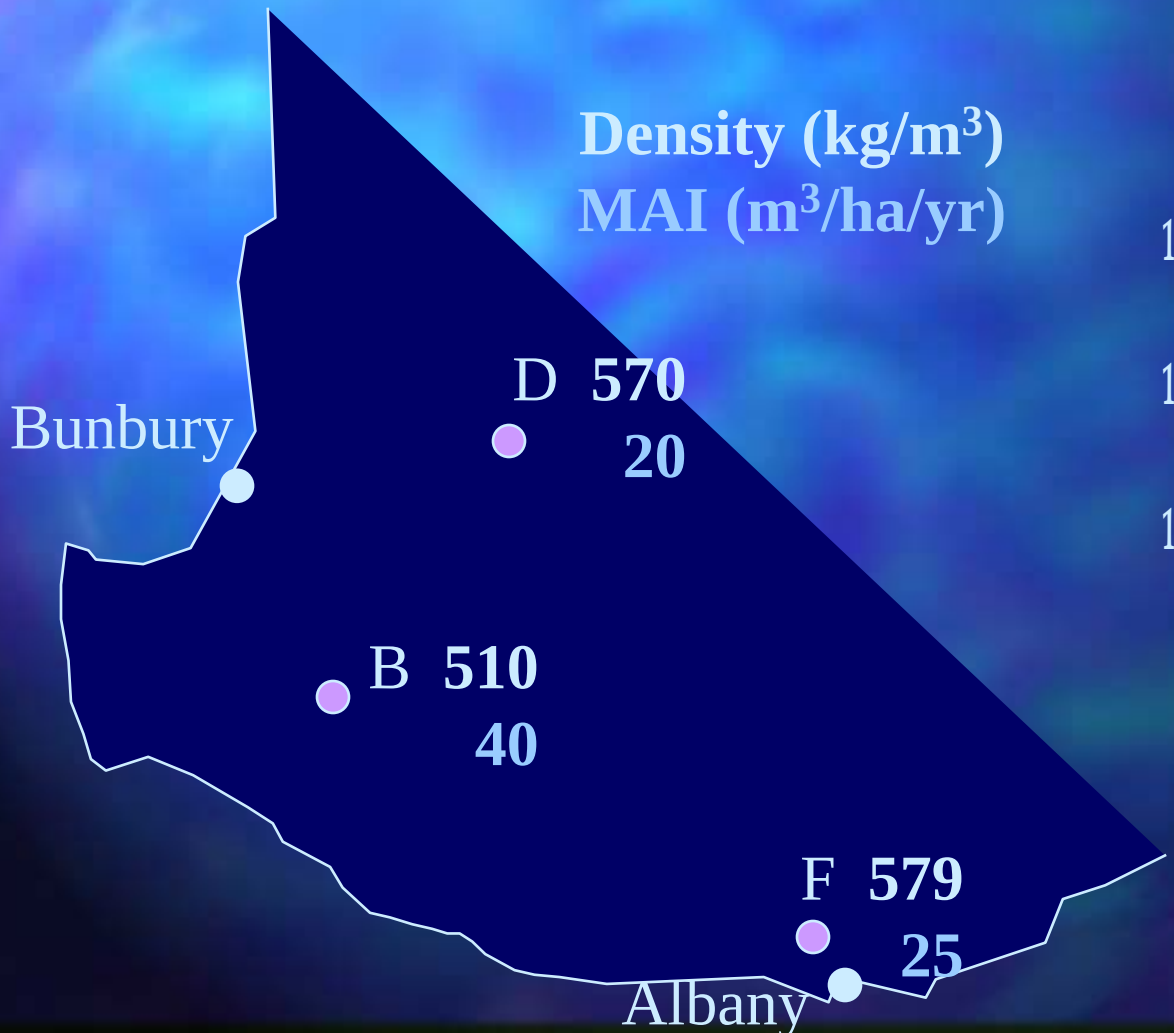
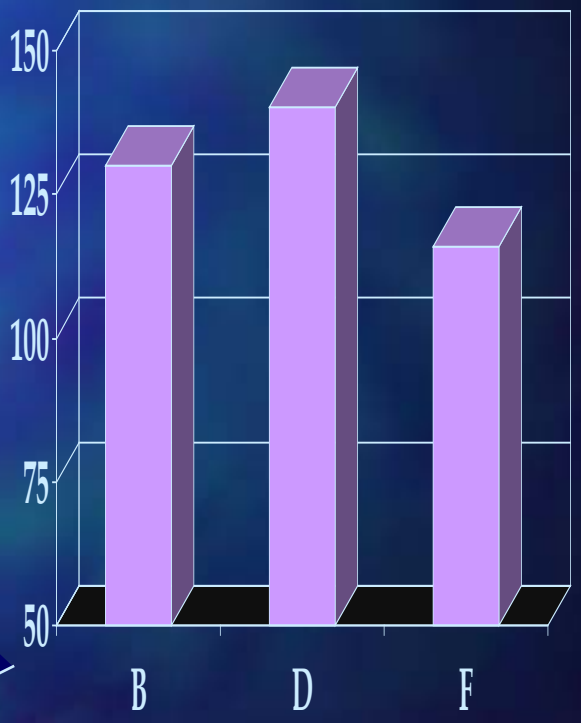


Figure 8

Costs of E. globulus fibre at the port from farms at different locations and with different site productivities



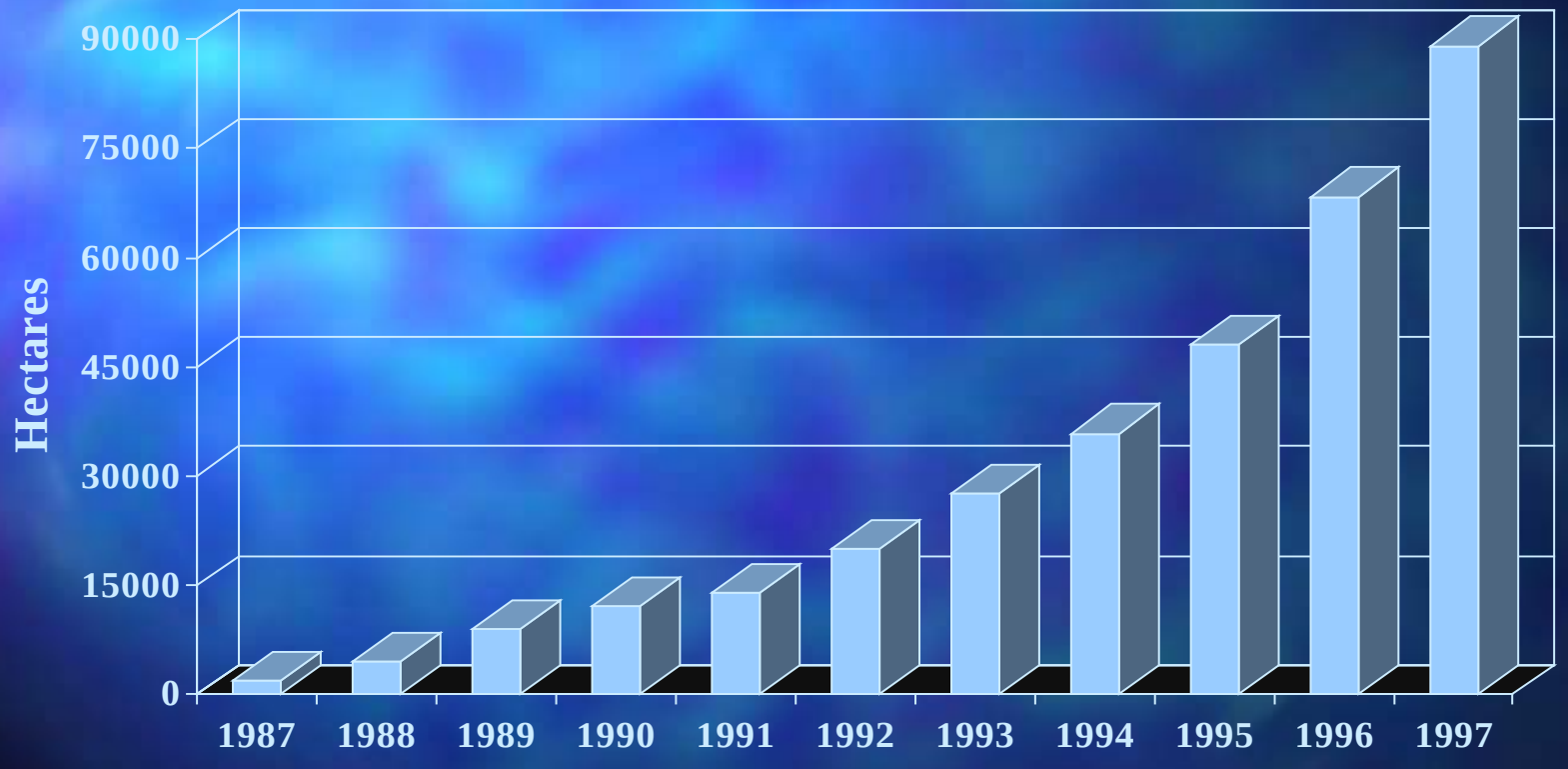
Compounded cost of chips at port ($/BDU, FOB)



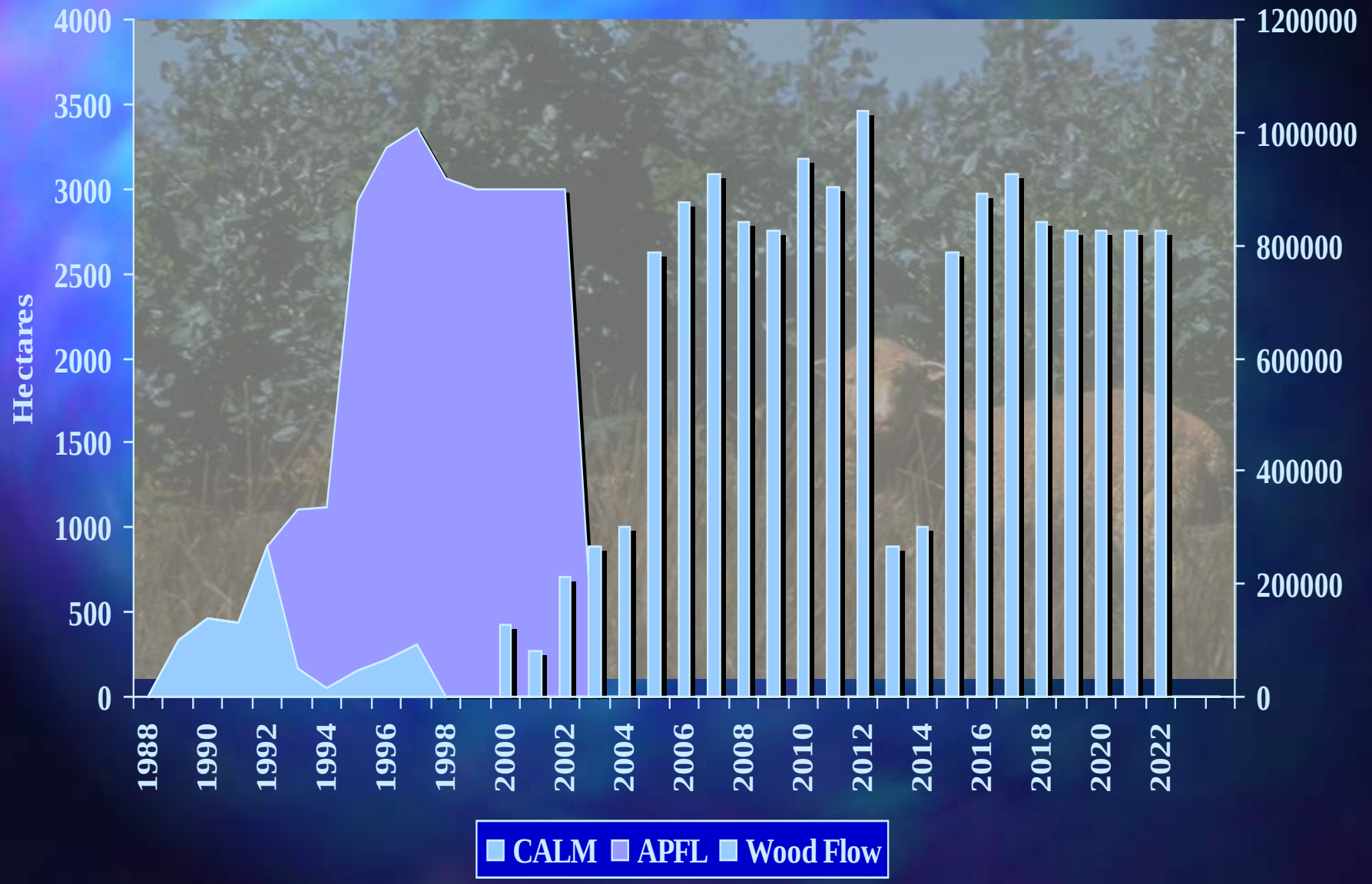
Costs of Production

Species	*Rotation Age*	*Net Present Value @ 7% $*	*Establish-ment Costs $*	*Intermediate Costs $*	*Total $*
Maritime Pine	30	1 920	1 580	860	2 440
P. radiata	30	4 332	2 120	5 890	8 010
E. globulus	10x2	4 920	2 117	5 920	8 037
Mallee	100+	1 000	1 000	---	1 000

Total area of *E. globulus* in WA



Area of bluegums planted each year (CALM and APFL) and predicted wood flows



Investment to date:

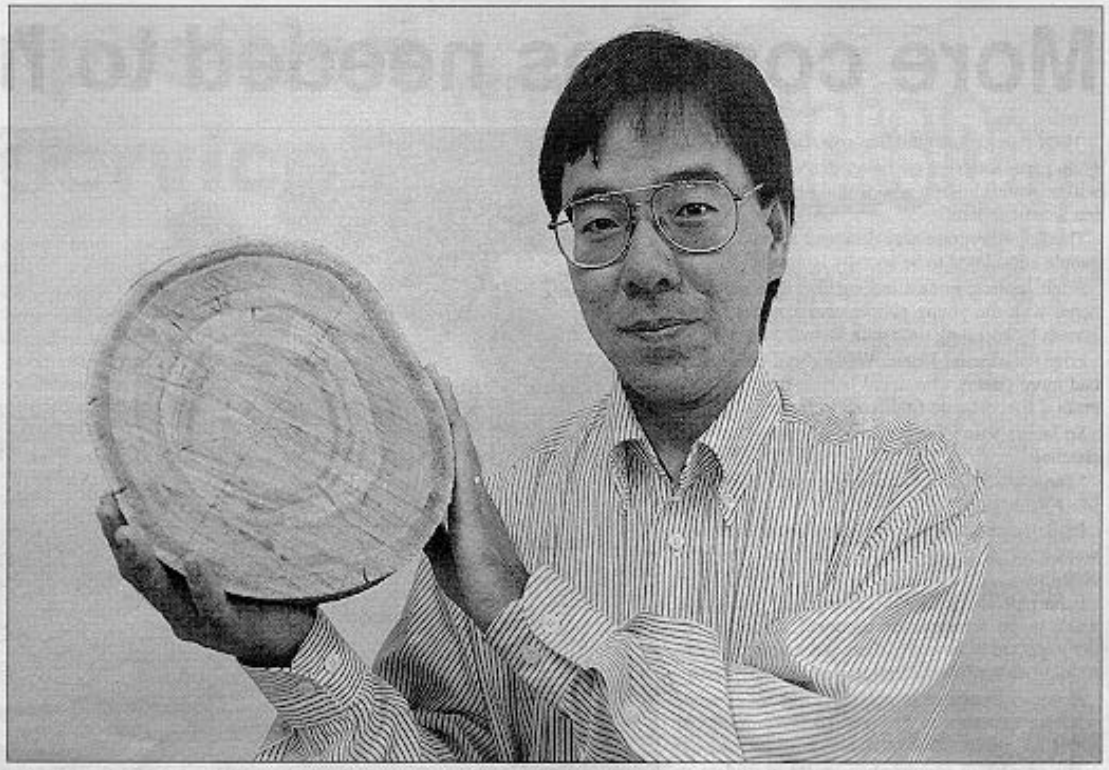
- $20 million

Investment to complete plantation program:

$30 million

Investment required for harvesting, transport and processing:

$20 million to upgrade facilities at Albany Port
$15 million for a mill to process the harvested logs
$3-4 million for a transport system
$16 million for harvesters
$12 million for loading machinery
$22 million for log trucks



WINNING WAYS: Albany Plantation Forest Company director Tom Okada plans to accept the Asia Pacific Marketing Federation's inaugural gold environmental marketing award in Bangkok later this month.

Conservation work wins praise

AN Albany company has won an international award for its services to the environment.

Albany Plantation Forest Company this week took out the Asia Pacific Marketing Federation's award inaugural gold marketing award, launched last year to encourage environmental conservation.

It was chosen from four finalists, from companies working in the 15 countries represented in the Asia Pacific Marketing Federation.

The company was formed in 1993 and plans to establish more than 20,000 hectares of bluegum plantations in the Albany region.

Working with CALM, it had already planted nearly 14 million trees locally.

Its parent companies Oij Paper and Itochu Corporation are part of a WA-Japanese joint venture (with Bunnings Forest Products) who are planning a $30 million woodchipping mill in the Great Southern. The project has been tipped to be operational by next year.

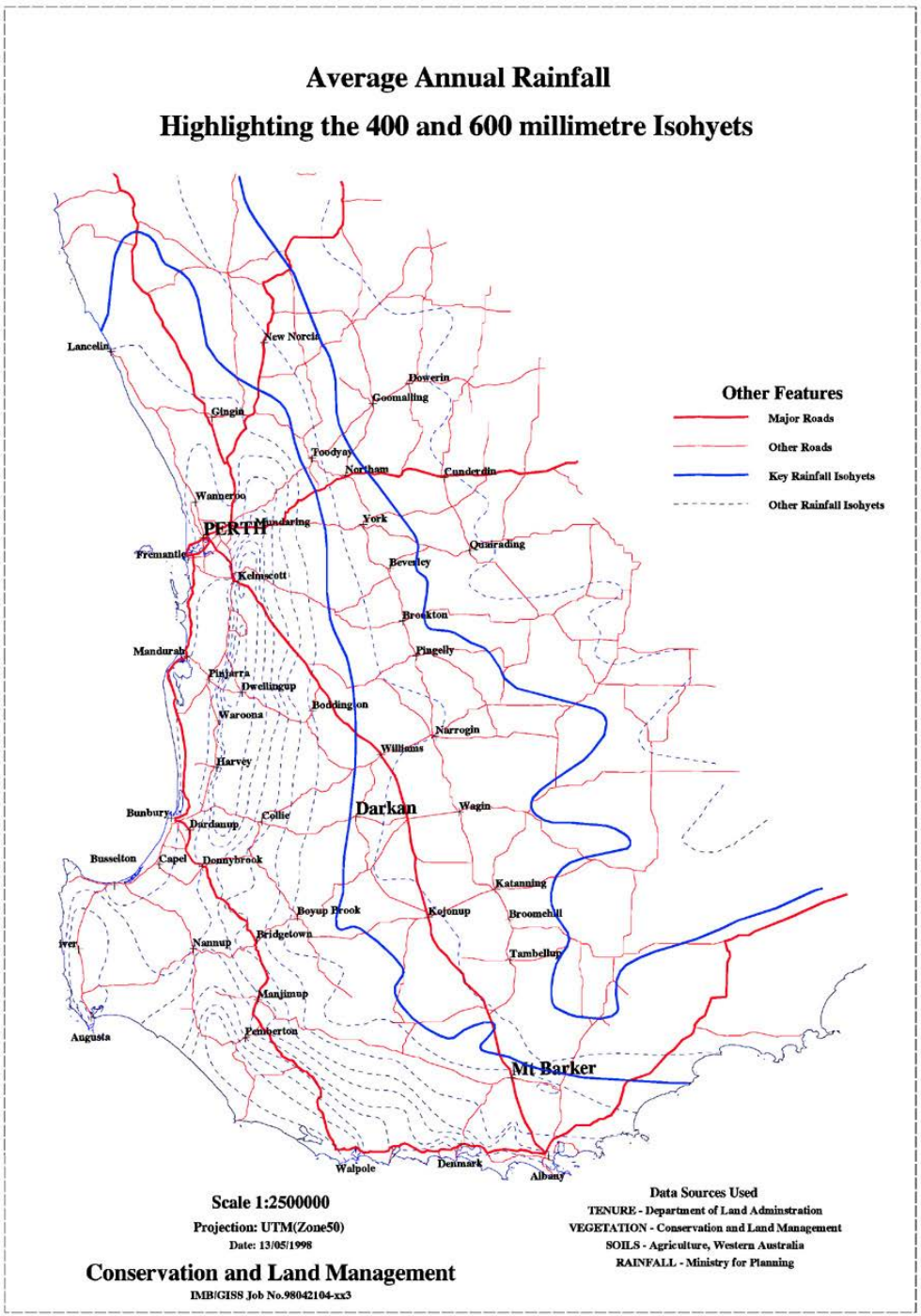
Director Tom Okada said the company was committed to preserving the global environment.

"Our project to establish commercial bluegum plantation is a long-term commitment to the environment and economy of the Albany region," he said.

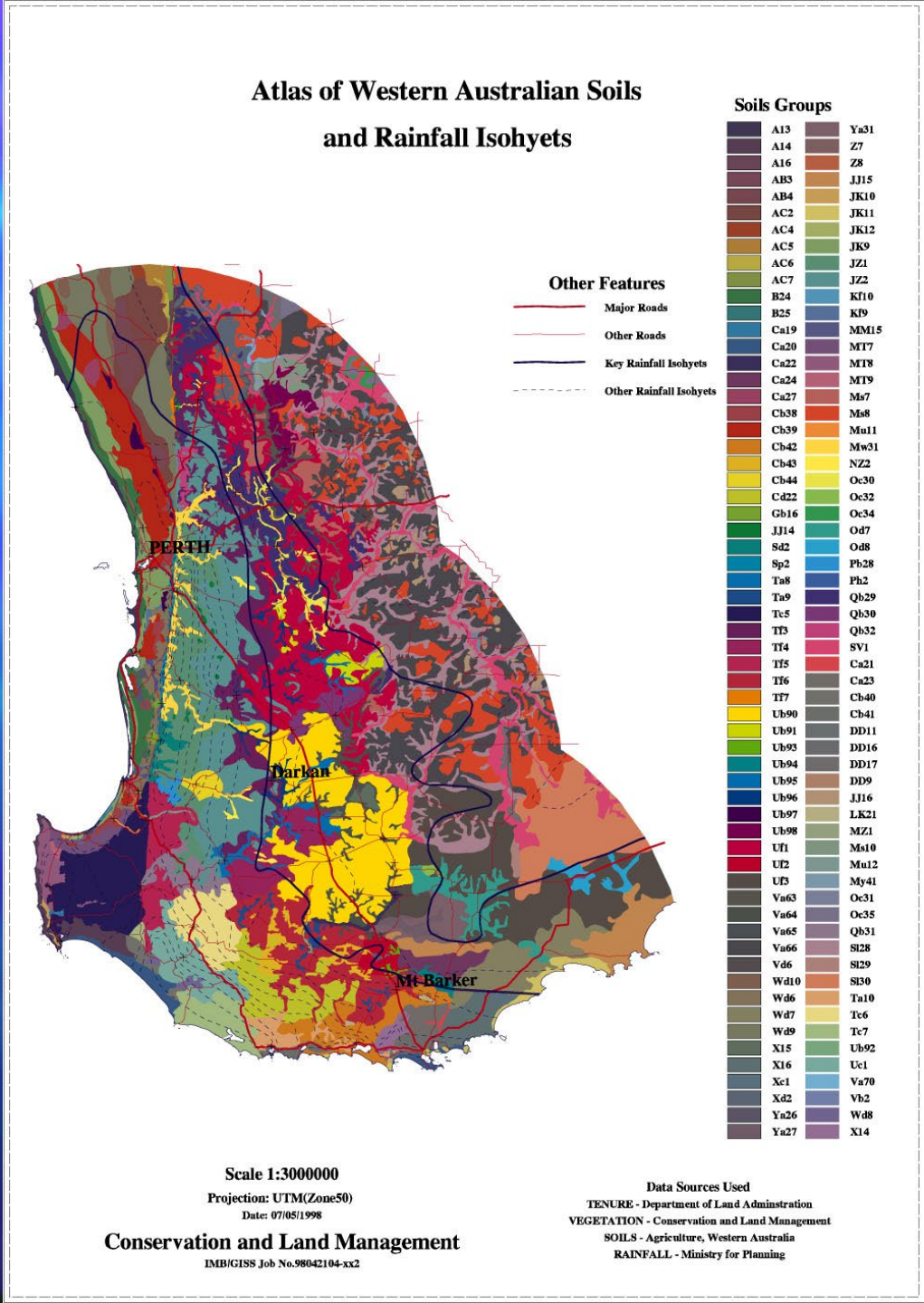
"Our sophisticated sharefarming scheme, which is being carried out in partnership with the local community, has now brought APFC international recognition."

Mr Okada will accept the award, with representatives Oij Paper, Itochu Corporation and Senshukai Co Ltd, at a ceremony in Bangkok on March 26 by her Royal Highness Princess Maha Chakri Sirindhorn. It is the second environmental award won by the company. In 1995 it won the Landcare Australia award for WA business.

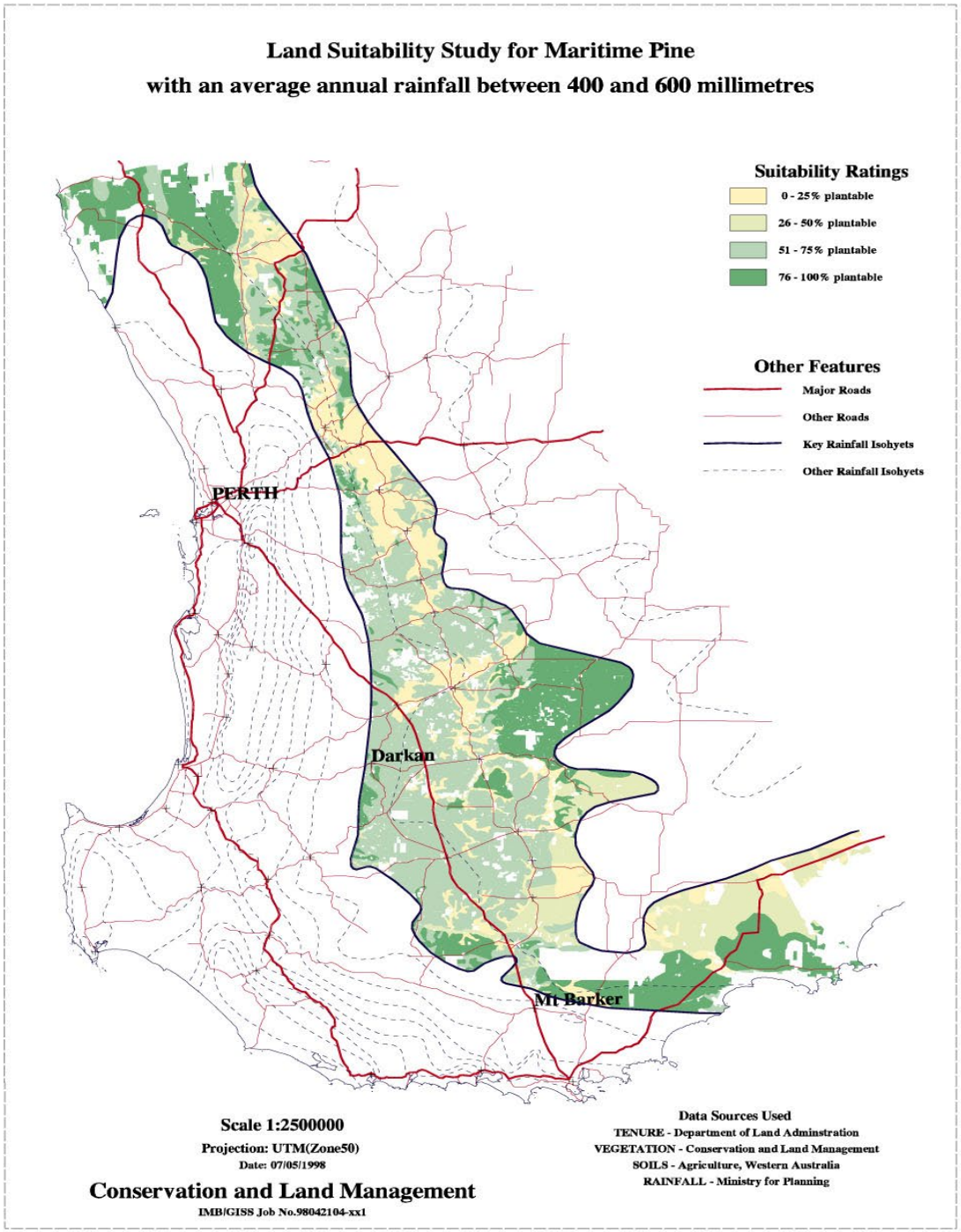
Rainfall Isohyets for South West of Western Australia



Atlas of Western Australian Soils



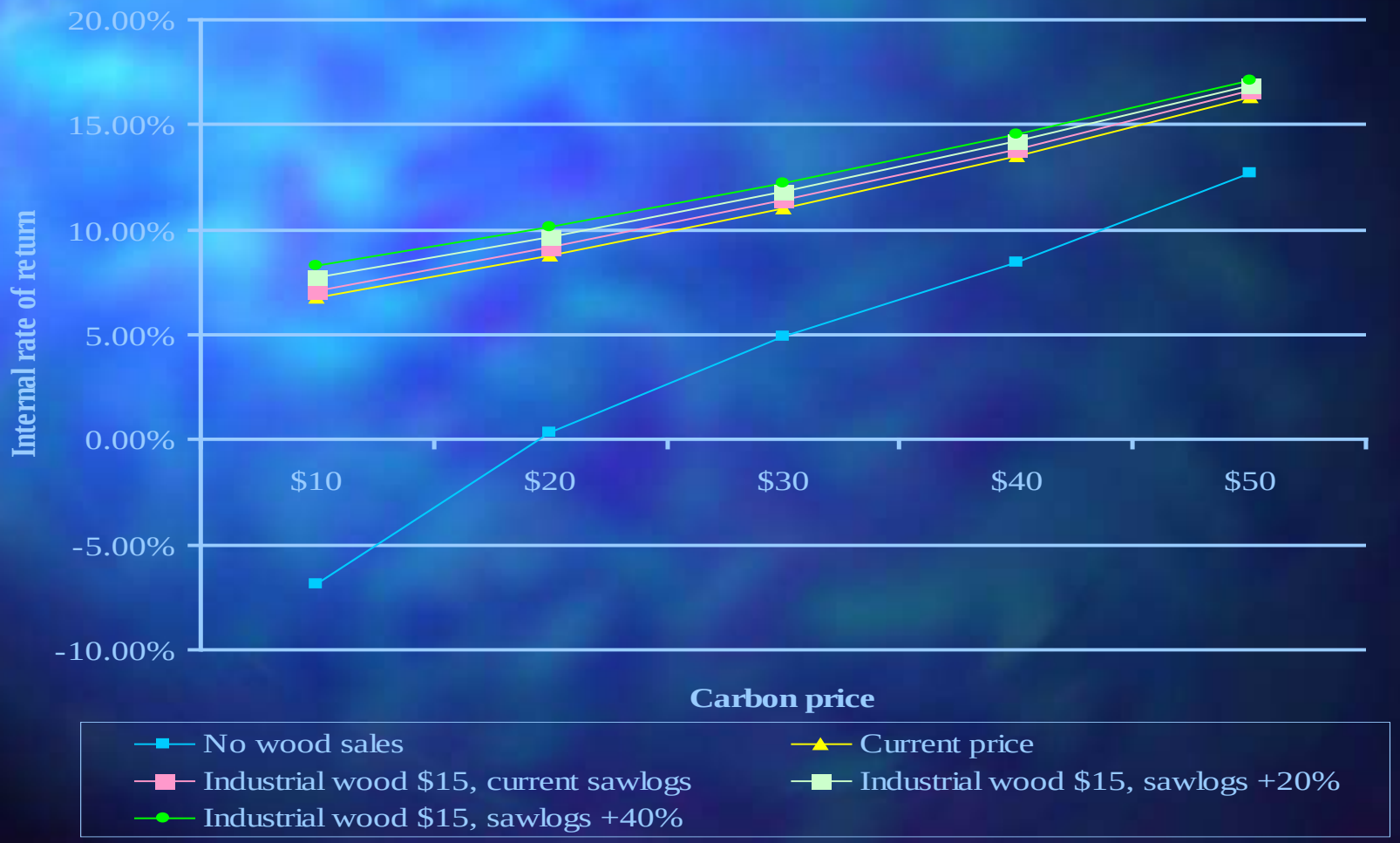
Land Suitability Study for Maritime Pine

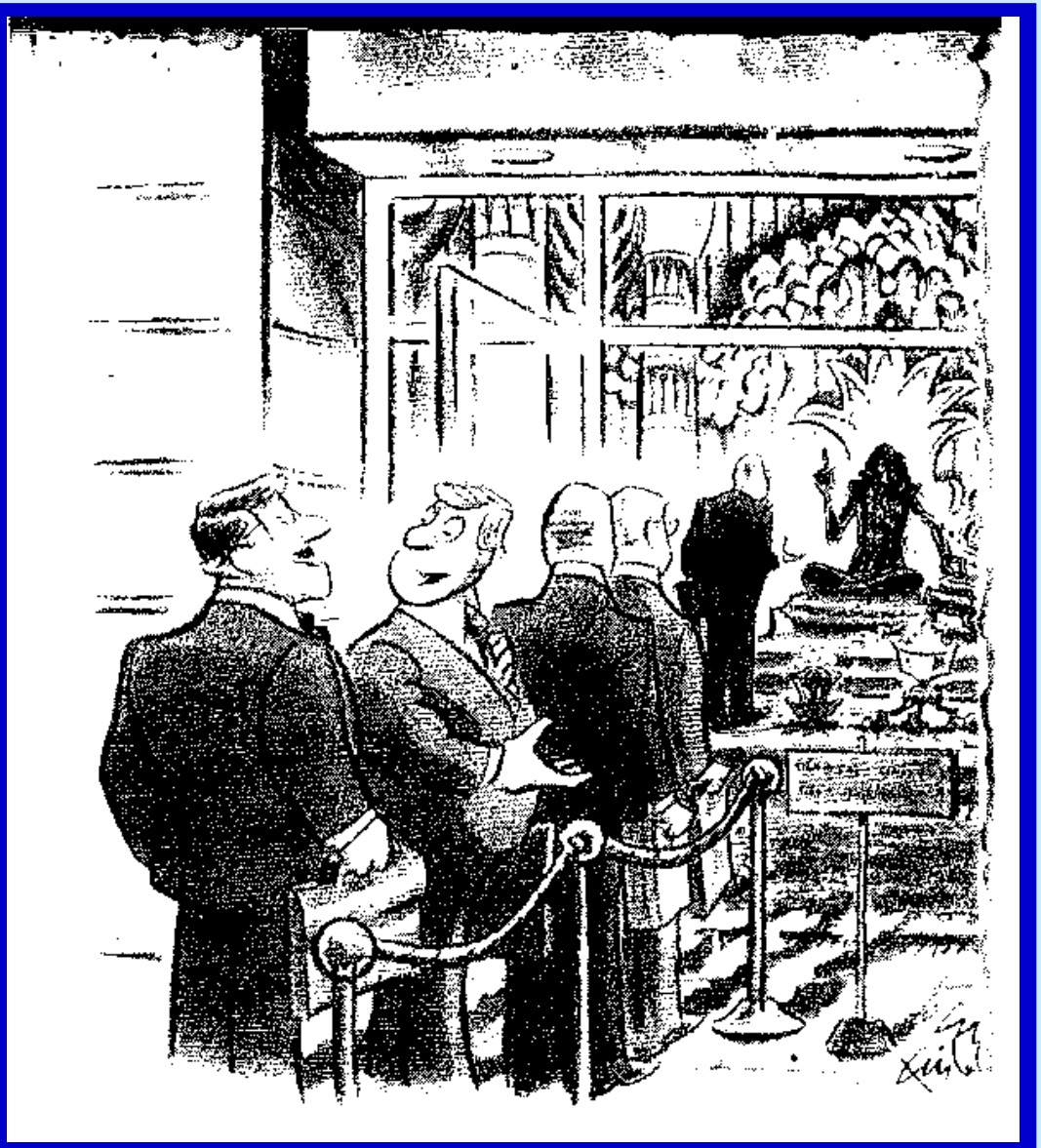


Effect of growth rate on the timber rate of return from a conventional regime of 30 years

Increase in stumpage over current	*Growth rate*	
	$12m^3$/ha/yr	*$16m^3$/ha/yr*
Current	5.1%	6.7%
20%	6.2%	7.8%
40%	6.8%	8.4%

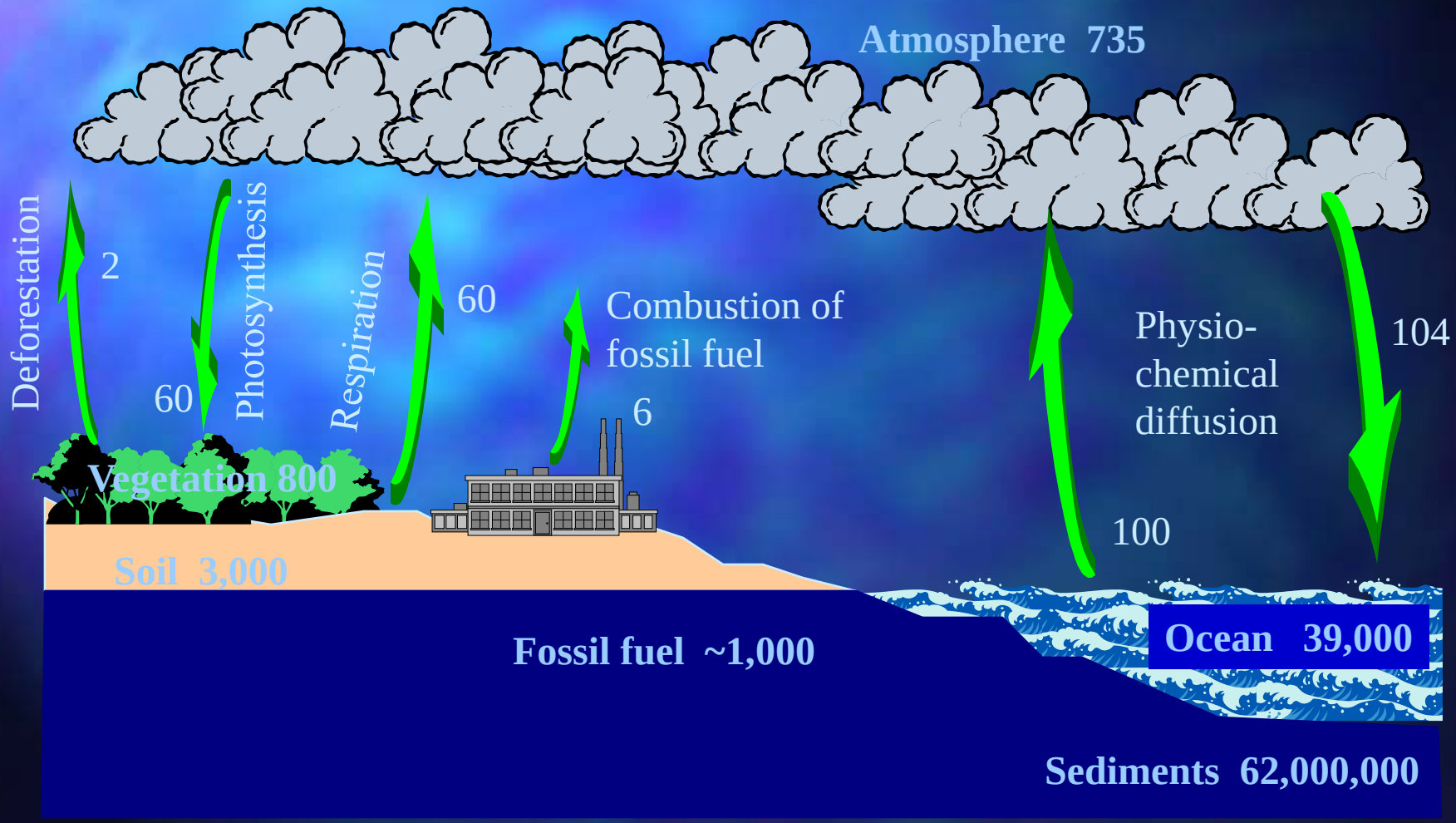
Effect of varying wood and carbon price on internal rate of return for 30 year rotation



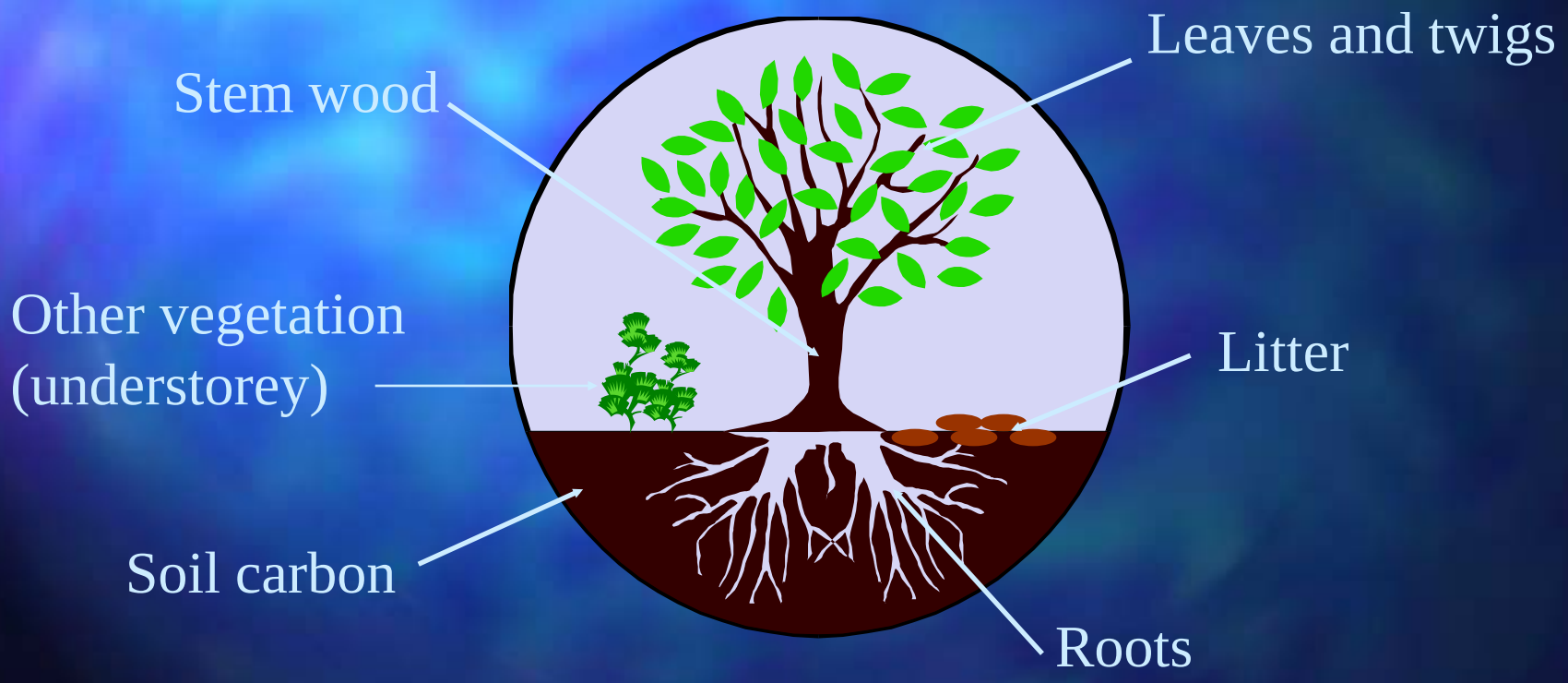


"It's great! You just tell him how much pollution your company is responsible for and he tells you how many trees you have to plant to atone for it."

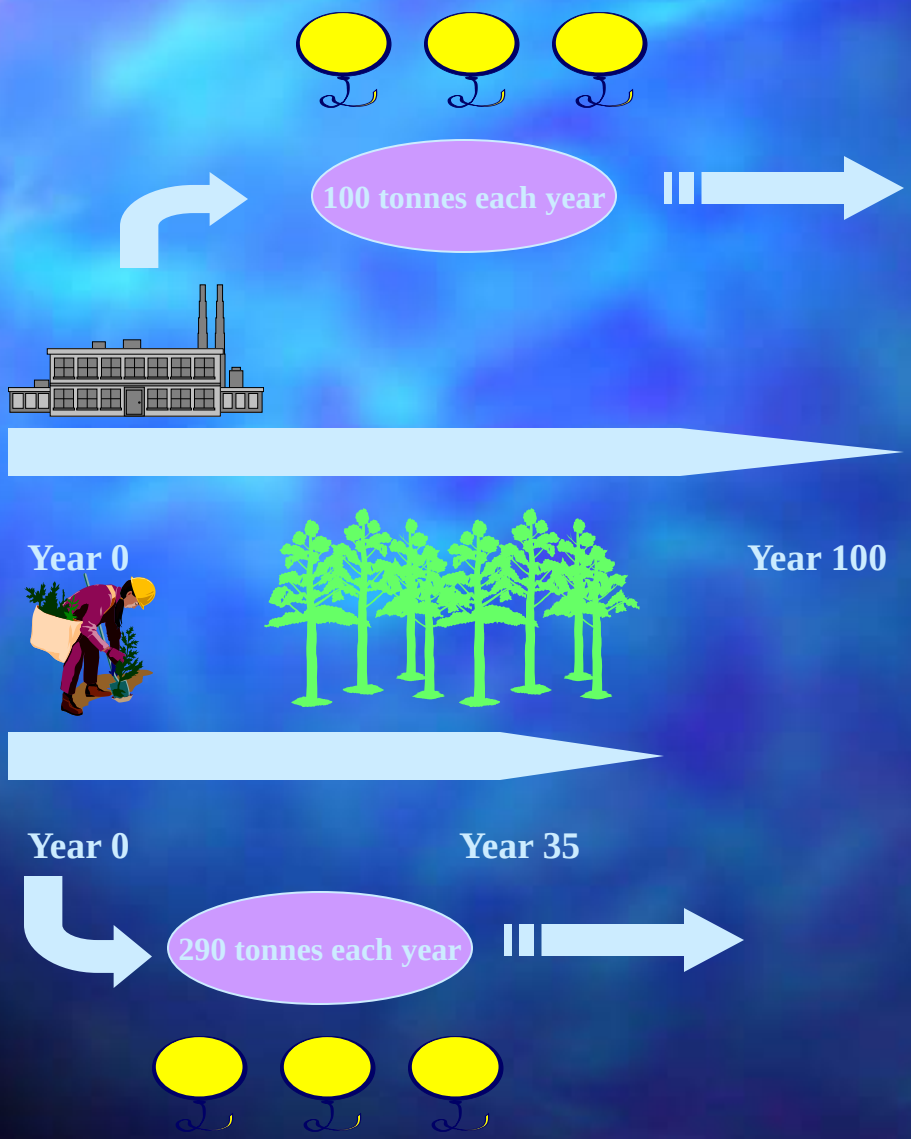
The carbon cycle



Major pools of forest carbon



“Tonne-year” currency (Balance sheet of 1 year of emissions and storage)

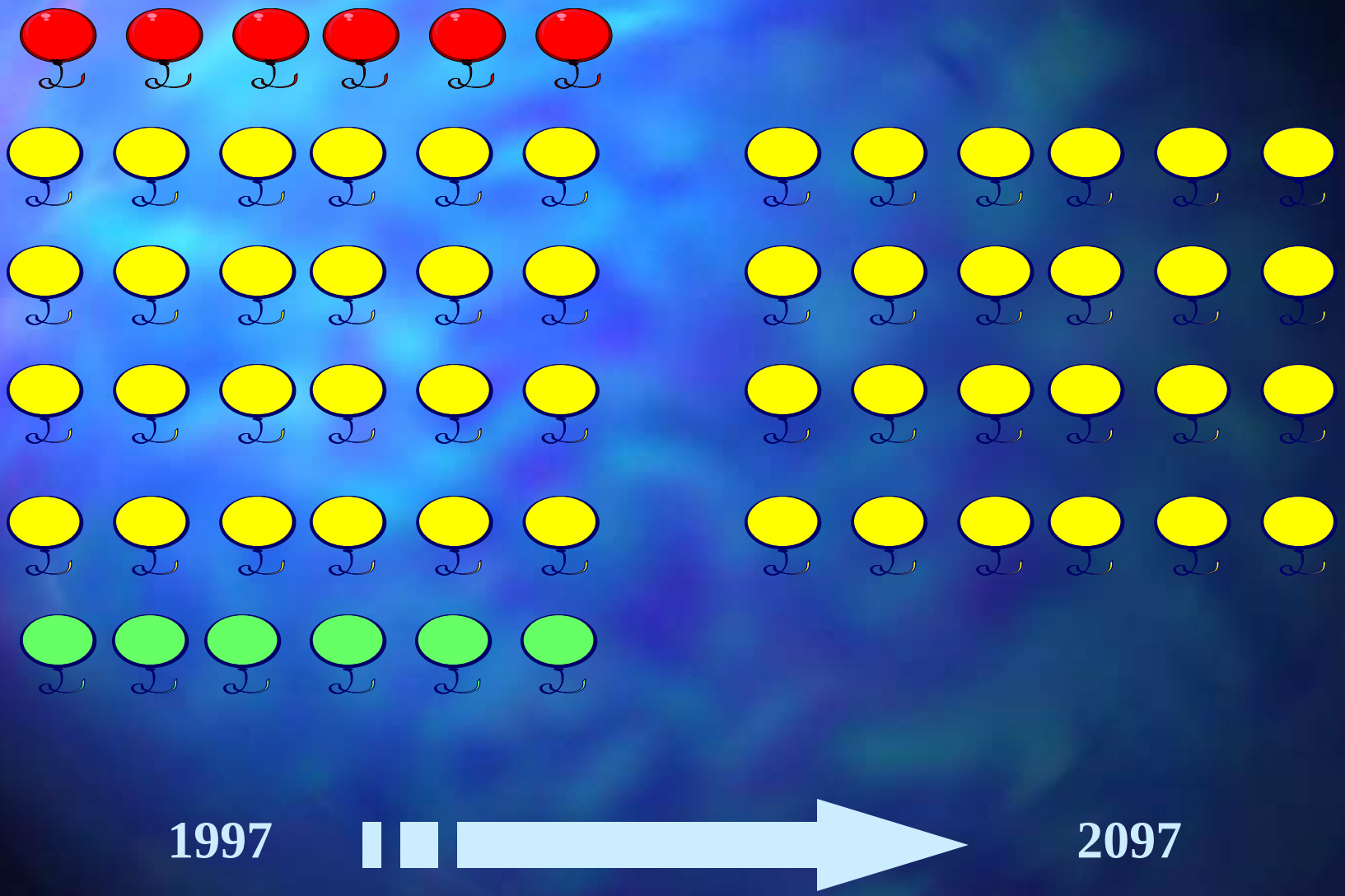


100 x 100

= 10 000 tonne years

290 x 35

= 10 000 tonne years


1997
2097

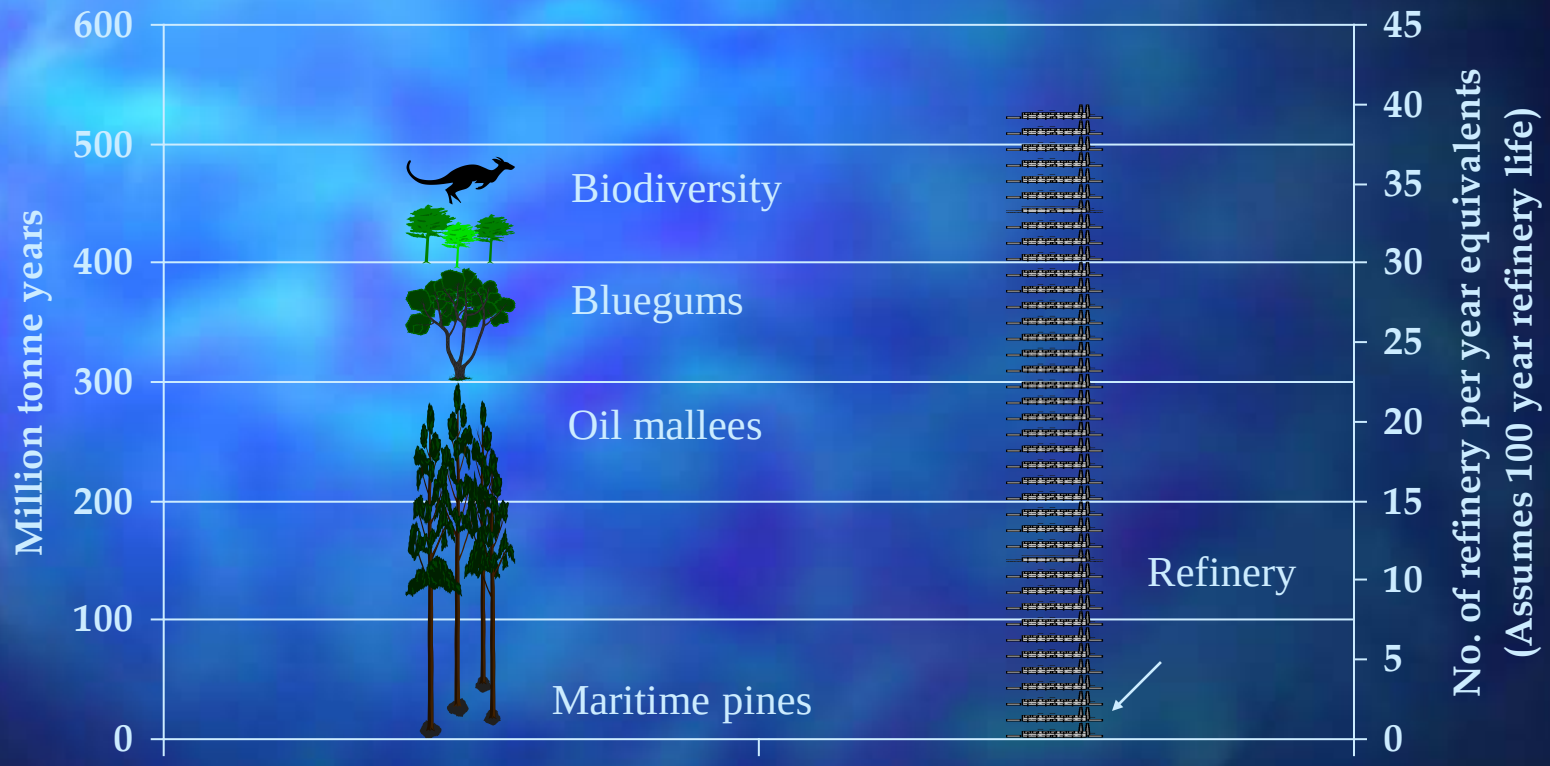
Estimated tonnes and Carbon tonne years produced per hectare per year

		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

Energy required to produce one tonne of each product and tonnes of CO_2 emitted during production

	Energy (KWH equivalent)	CO_2 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

Optimistic Scenario

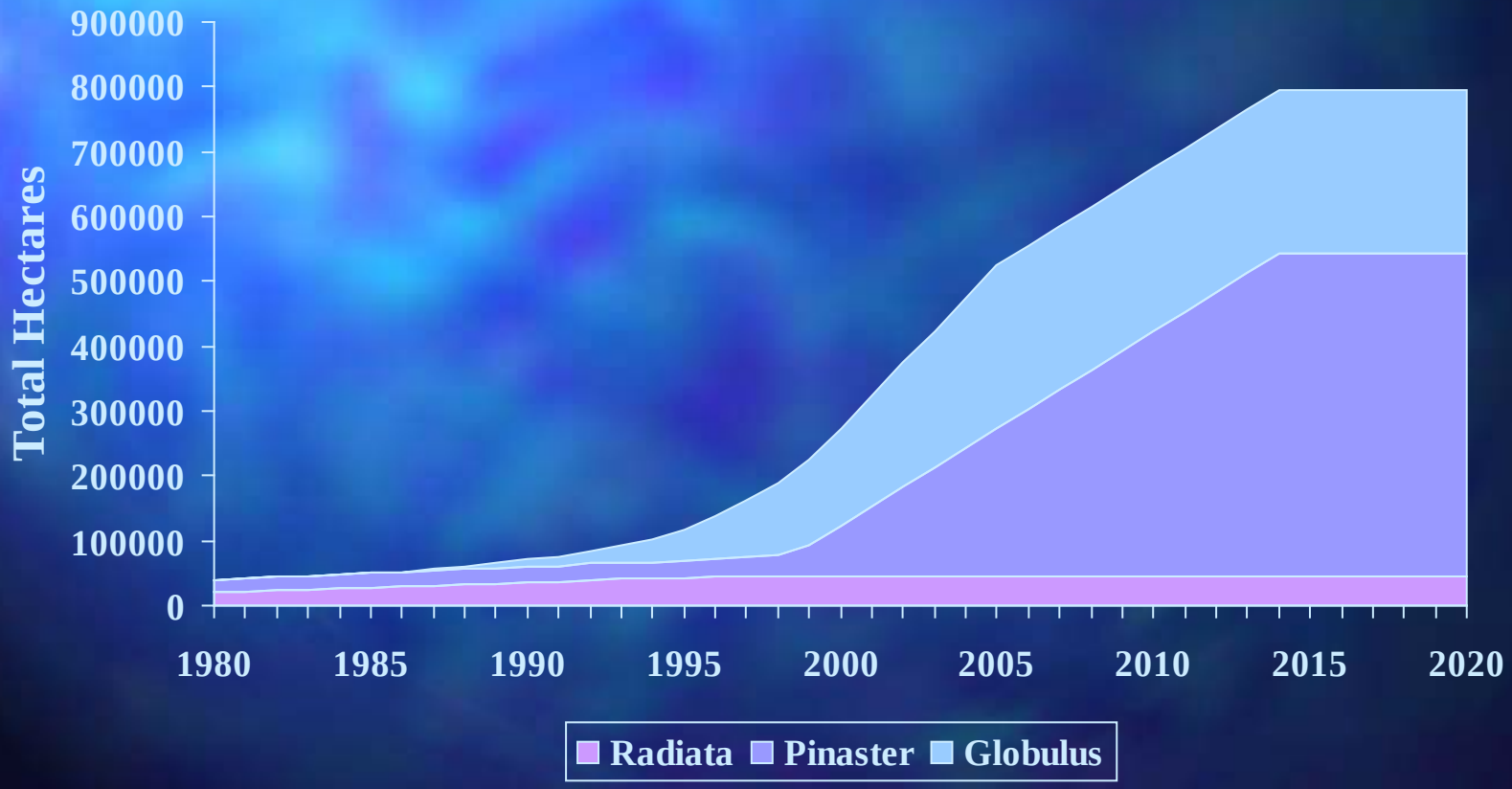


Assumptions

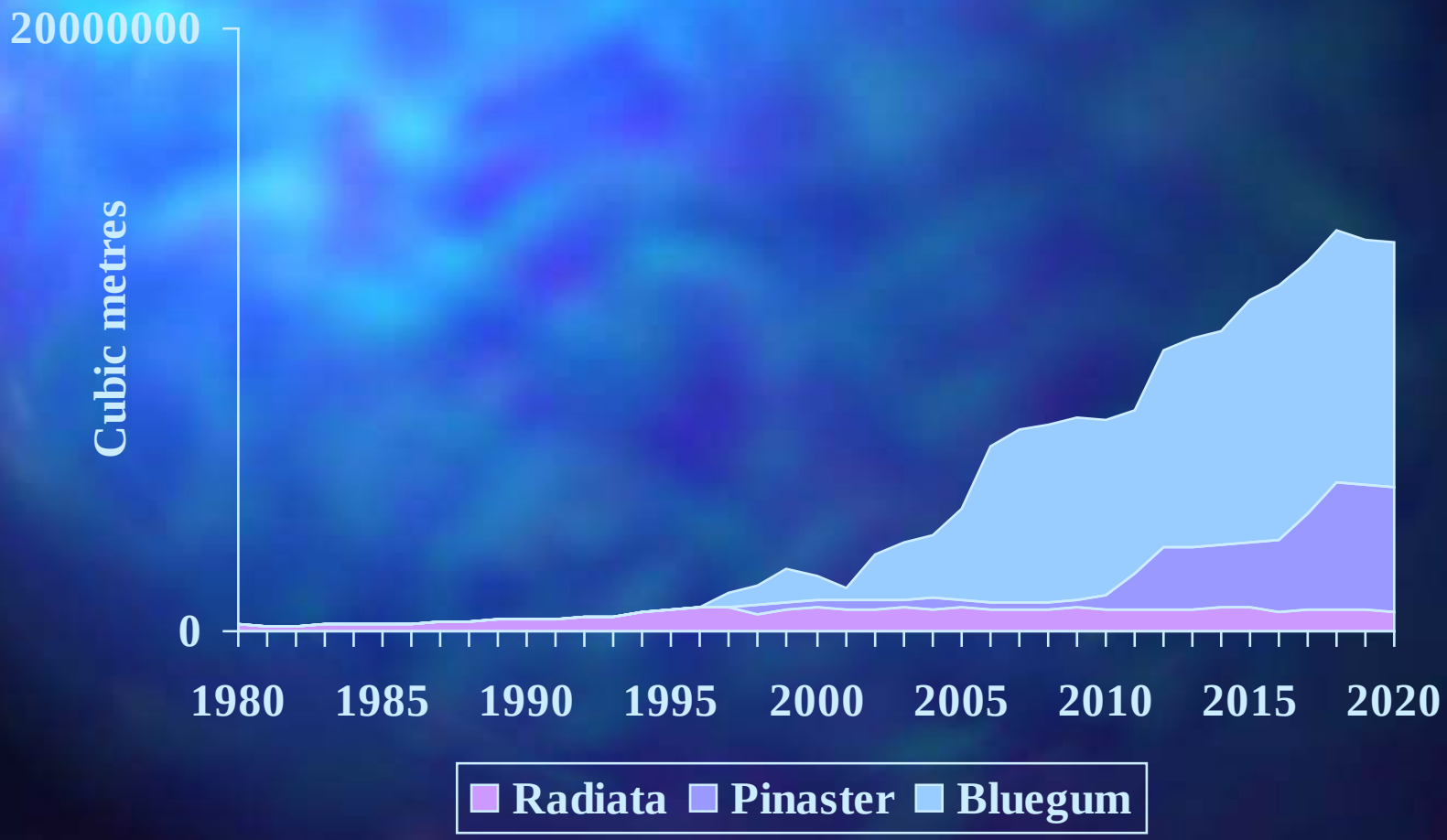
Half life of refinery,

double carbon storage times for pine, bluegum and biodiversity plantings

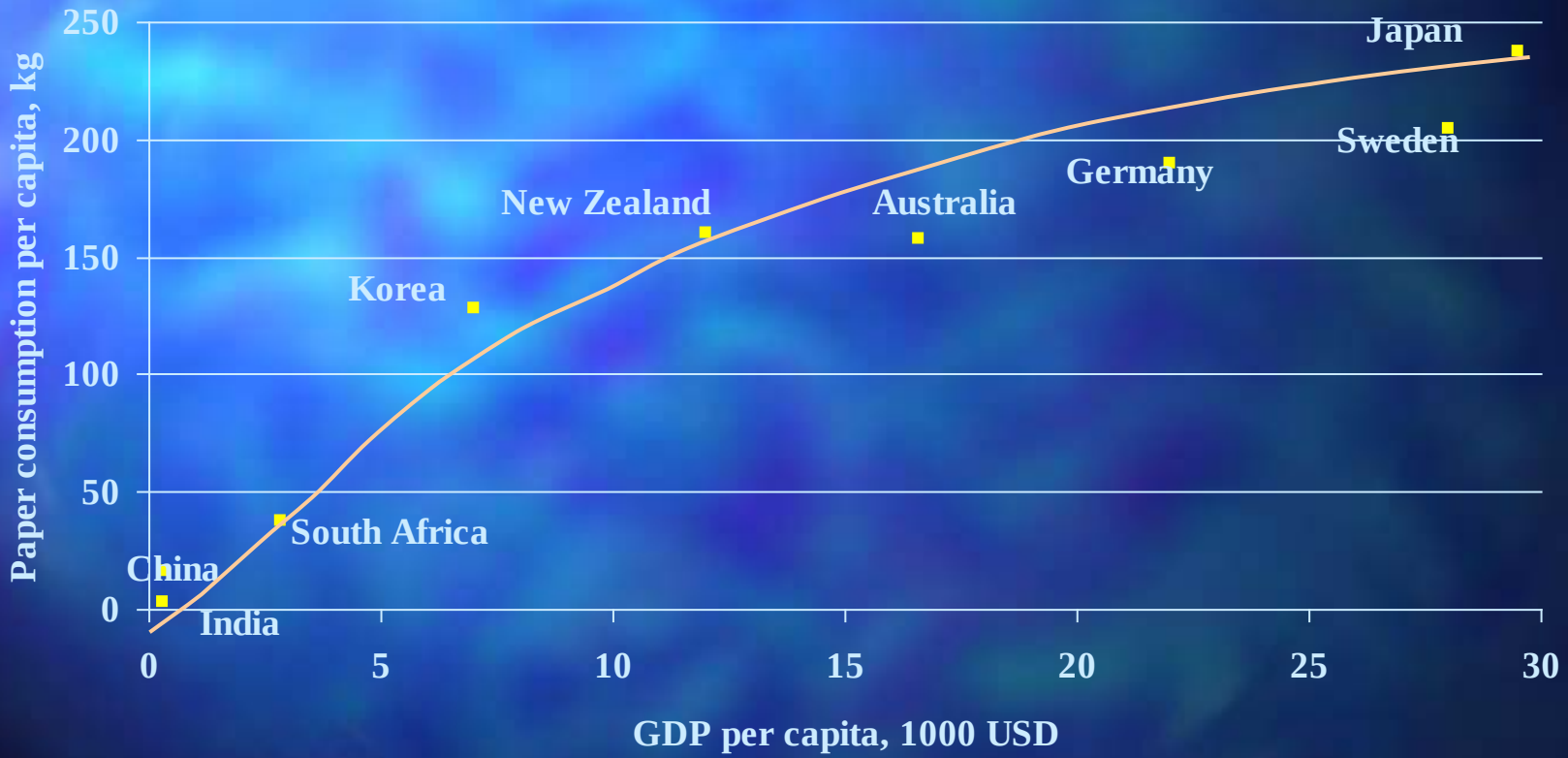
Predicted Growth of Tree Crop Plantings in Western Australia



Current and predicted wood fibre production from tree crops and plantations in Western Australia

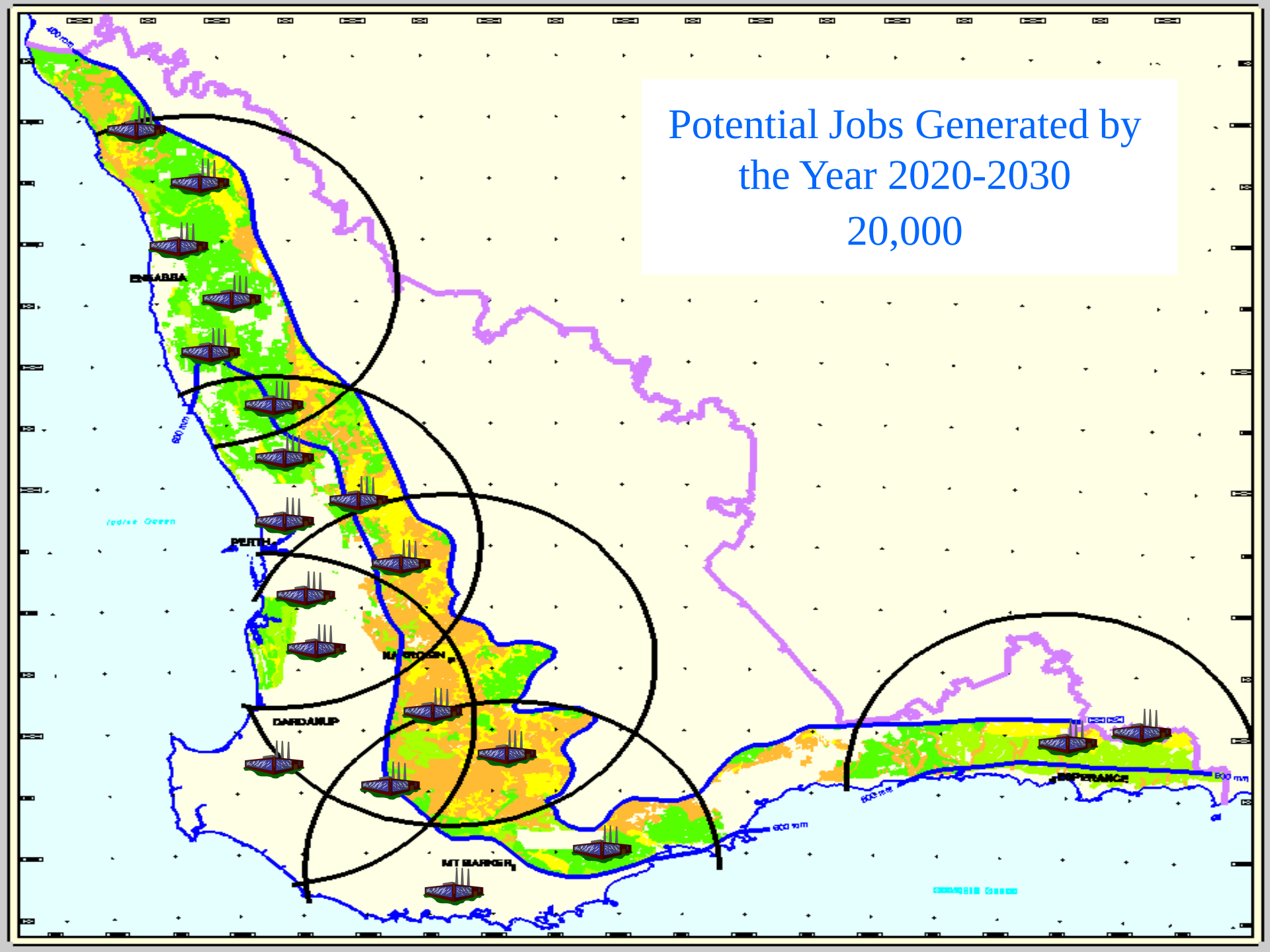


GDP and paper consumption (for selected countries in 1992)



If growth 1990-96 (12% pa) continues, China will use the current world paper demand (279 million Mt) by 2015

Source: Jaakko Poyry Dana Ltd


Potential Jobs Generated by
the Year 2020-2030
20,000
PERTH
DARDANUP
MT BARKER
ESPERANCE

Water Drawdown under Bluegum Plantations compared to Pasture