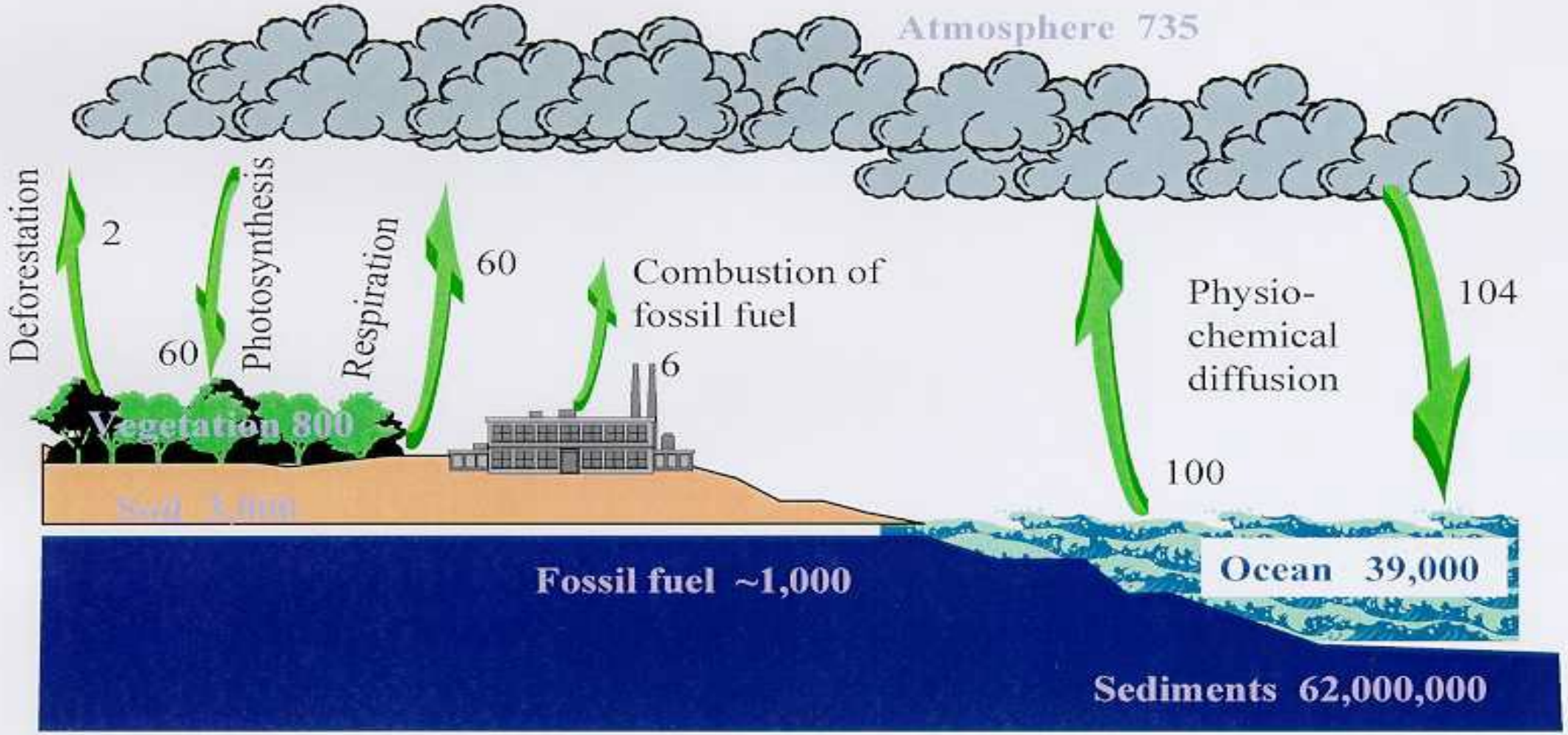
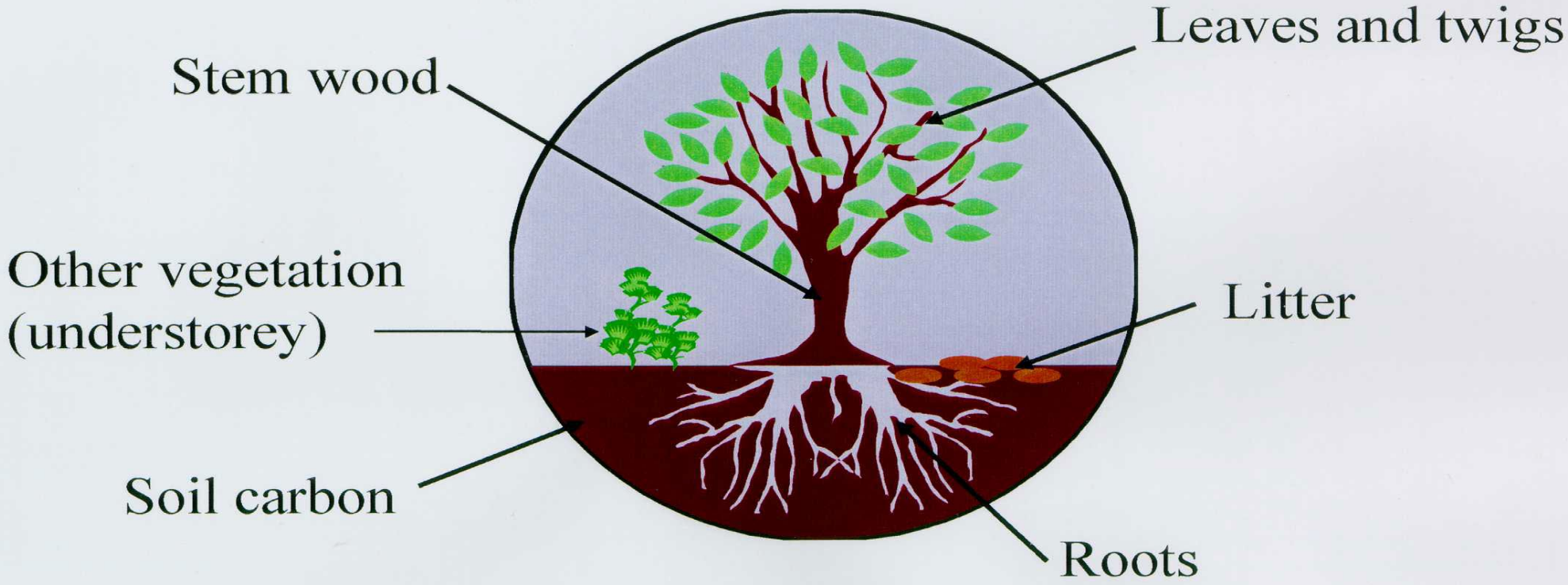
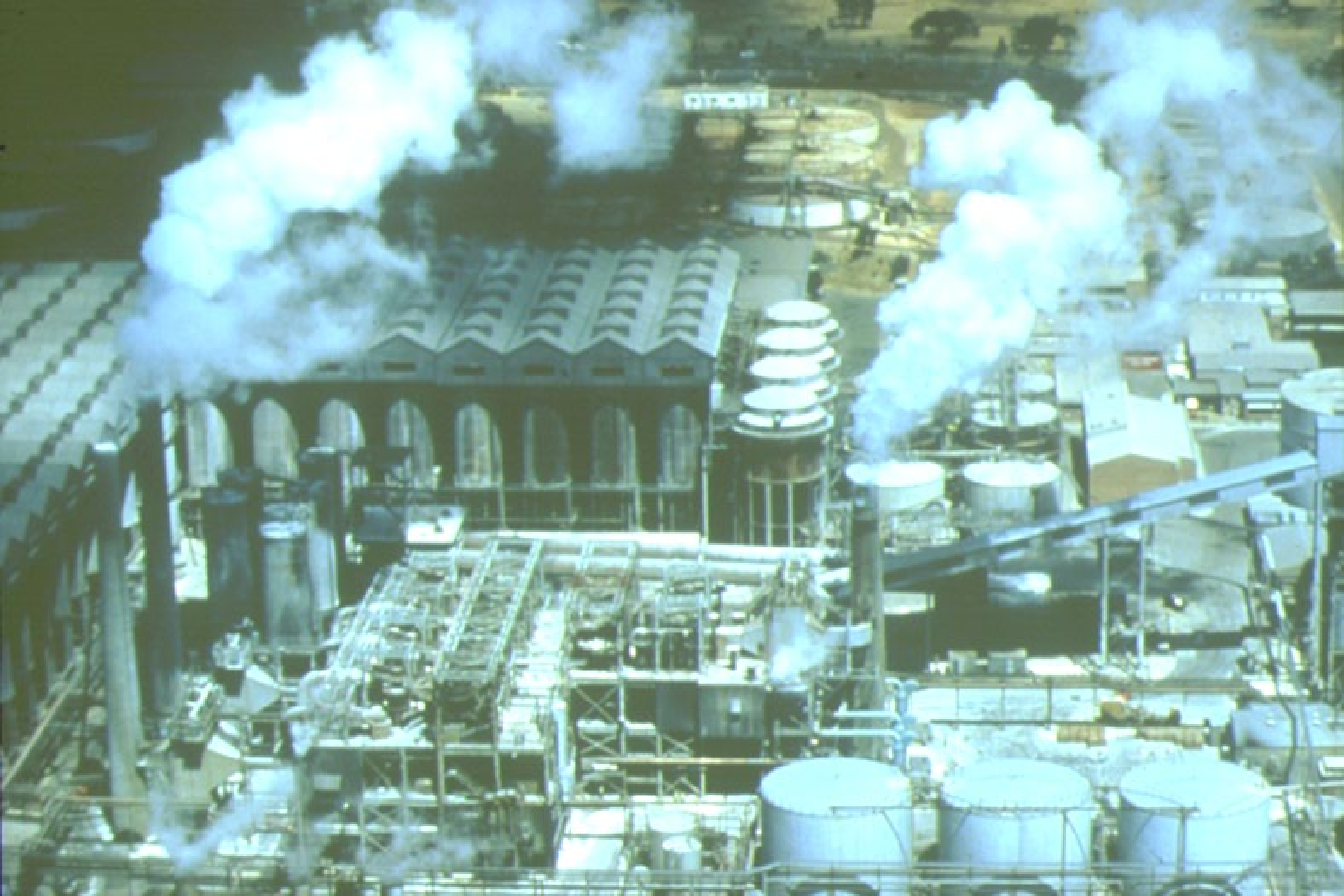

BP

The carbon cycle



Major pools of forest carbon





The Potential for Tree Crops To Sequester Carbon in Western Australia

Presentation by:

Dr. Andrew Rado

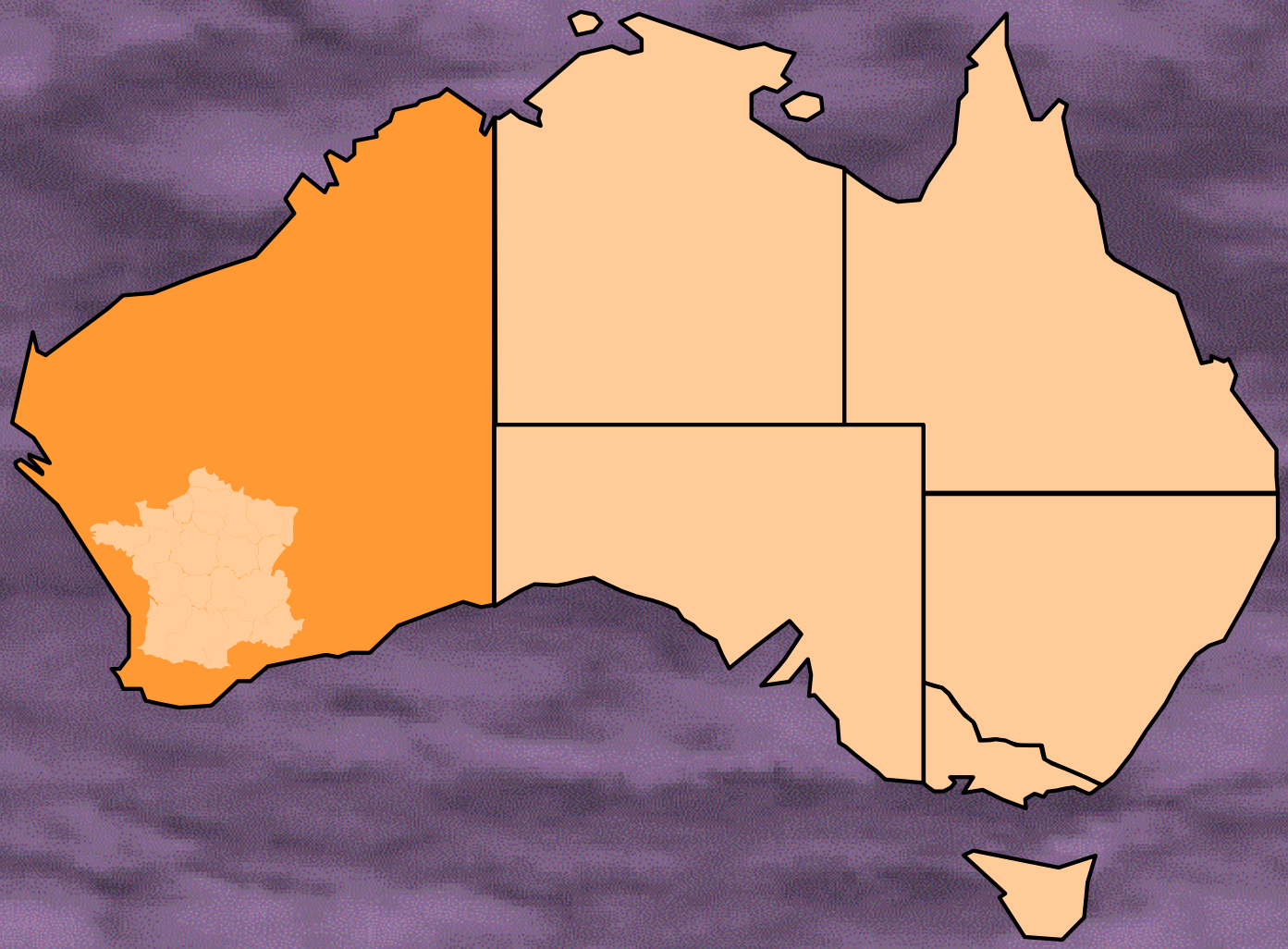
CALMSharefarms Maritime Pine
Department of Conservation and Land Management
Western Australia

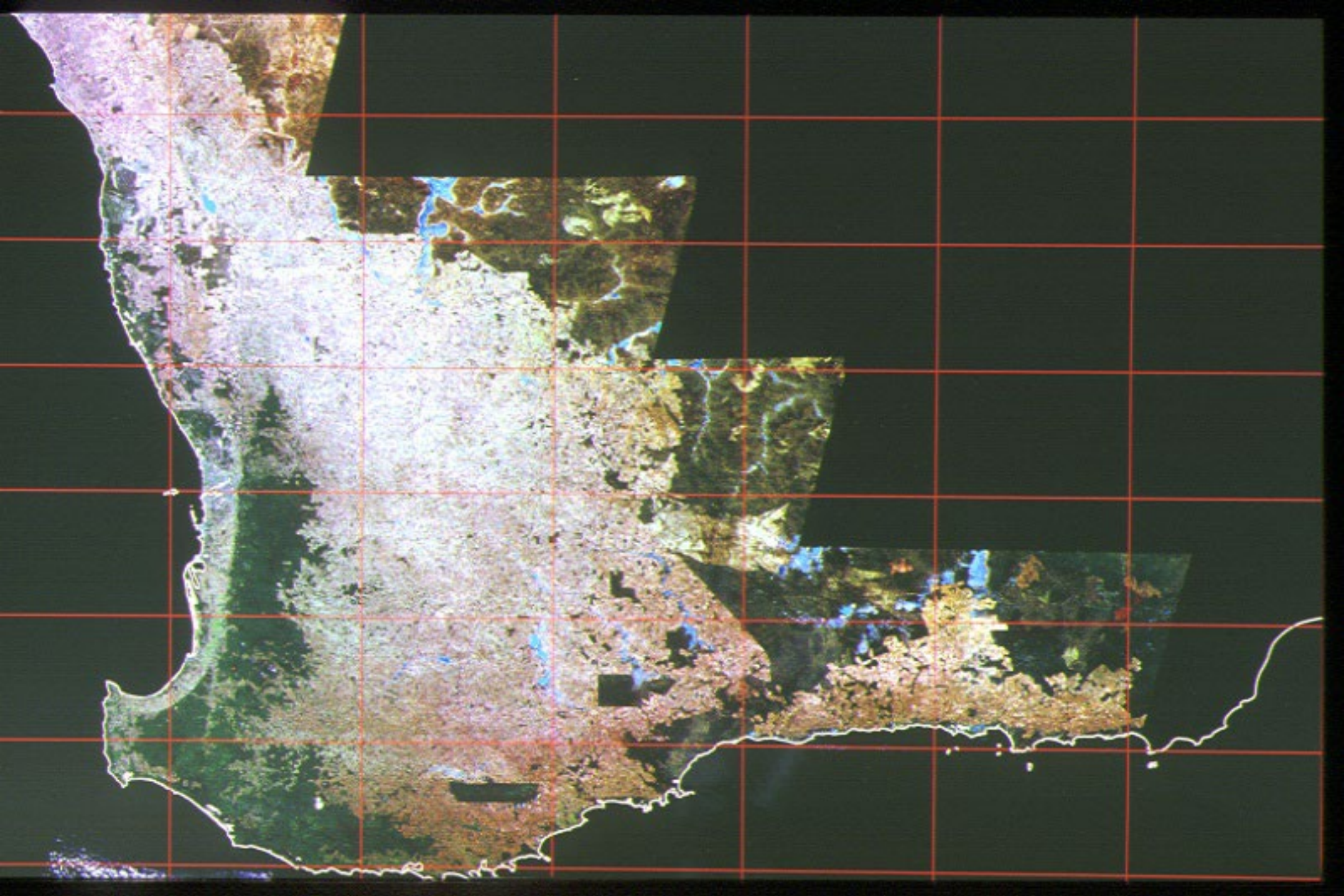
to the

Second Australasian Emissions Trading Conference

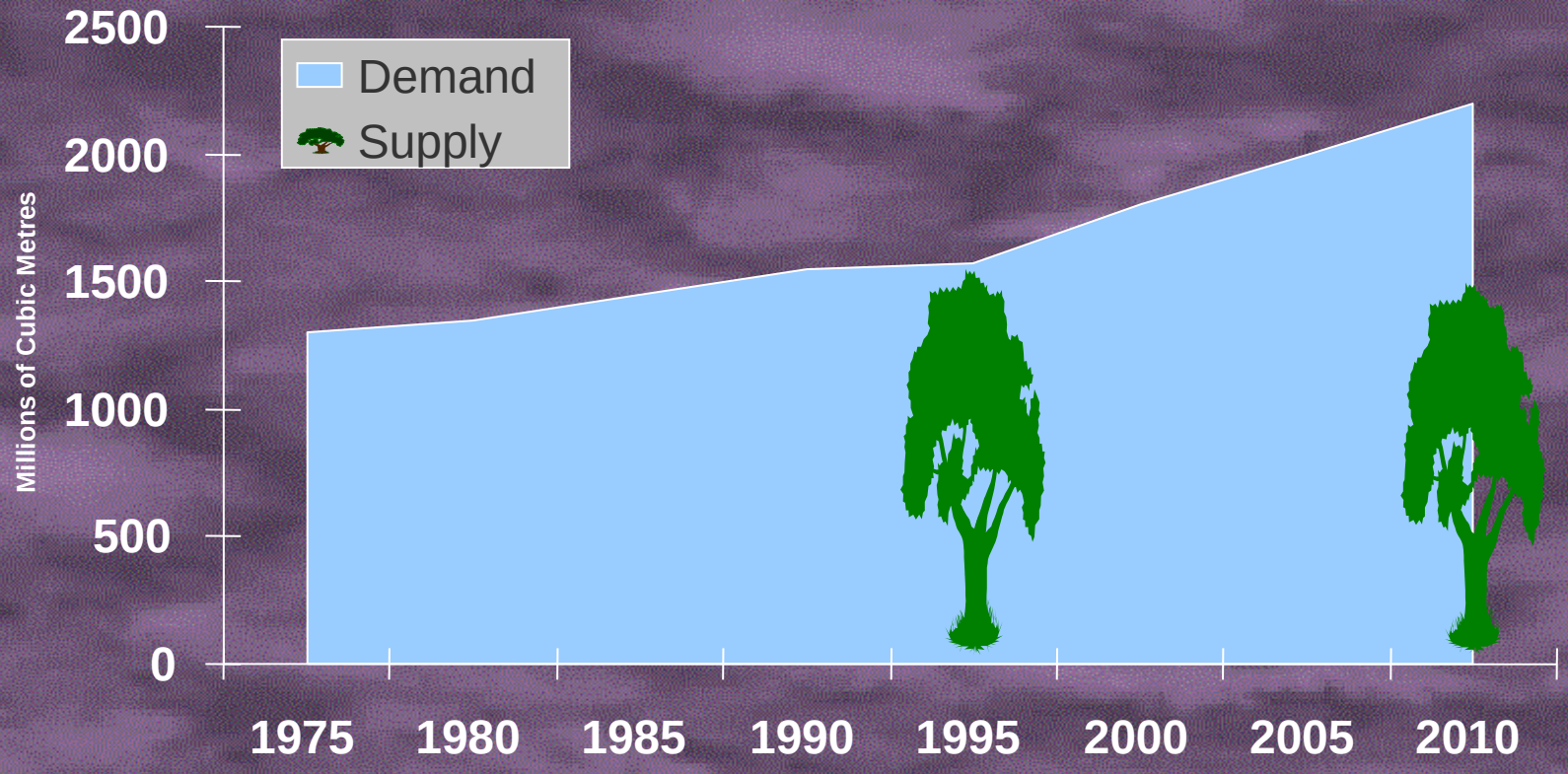
24 March 1999

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





Global wood demand rises as supply falls



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

- Carbon Sequestration - Science and Governance

Official: 1998 is the hottest for a thousand years

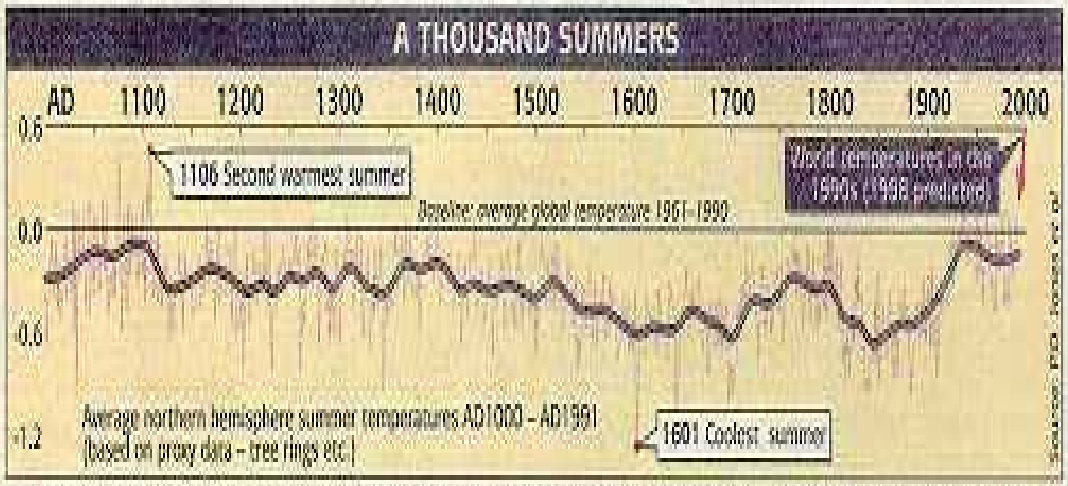
BRITAIN HAS experienced the hottest year in 1998 for the past 1,000 years, according to leading British scientists.

A team at the University of East Anglia has reconstructed the temperature peaks of every year in the last millennium, and these scientists are confident 1998 will be the warmest. Their research shows this year will have been hotter than 1106, the previous record summer in the northern hemisphere.

It is already certain to be the hottest year in the 140-year global temperature record that has been compiled from instrumental readings. In spite of Britain's own soggy summer, there have been record heatwaves and forest fires in many countries.

BY MICHAEL McCARTHY
Environment Correspondent

But scientists at the university's Climatic Research Unit (CRU) are convinced that, as 2000 approaches, 1998 will also prove to have been the hottest year of this millennium.



The scientists have put together the annual average summer temperatures of the last 1,000 years from "proxy indicators" – measurements of tree-ring growth and analysis of ice cores, which give information about the meteorological conditions deep in the past.

The record, published in the scientific journal *The Holocene*, shows that the 1990s were the hottest decade since before William the Conqueror landed.

The research will add further credence to global warming being caused by industrial gases, such as carbon dioxide from vehicle exhausts and power station emissions.

The research is published as ministers and officials from 180 countries begin a two-week conference in Buenos Aires to try to carry forward last year's Kyoto treaty aimed at countering climatic change.

The scientists at the CRU, led by Professor Phil Jones, are in a unique position to assess 1998 as the millennium's hottest year because they are also responsible for updating and maintaining the modern instrumental temperature record for the world, which goes back to 1856. Their data for this year already show that 1998 will beat the previous record – 1997 – by such a significant margin.

The five hottest years in the modern global temperature record are now all from this decade – in descending order: 1998, 1997, 1995, 1990 and 1991.

"The bottom line is that we believe the last three to four years have been the warmest of the millennium, and 1998 to have been the warmest of all," Professor Jones said.

1,000 summers, page 3

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:

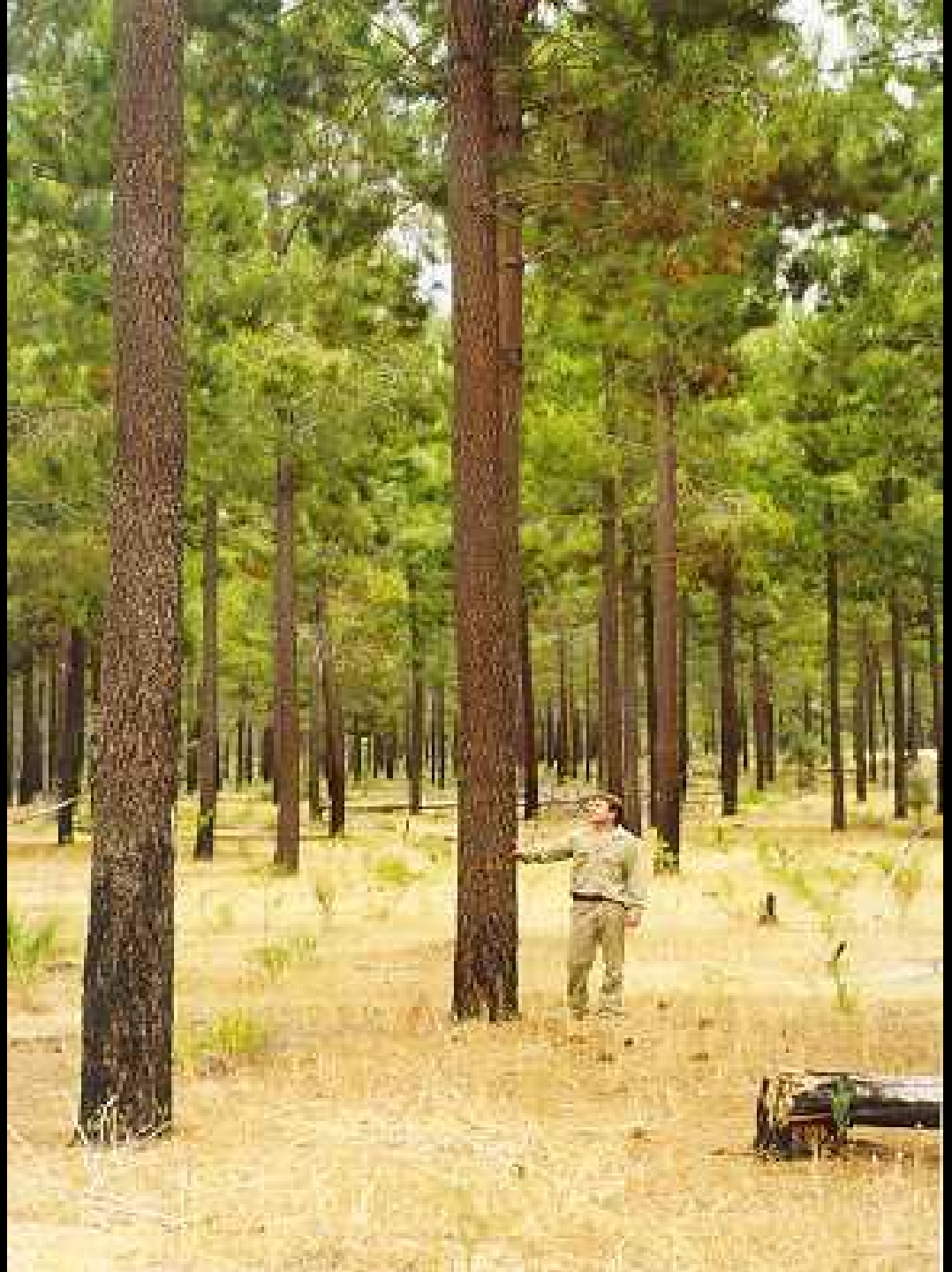
……

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

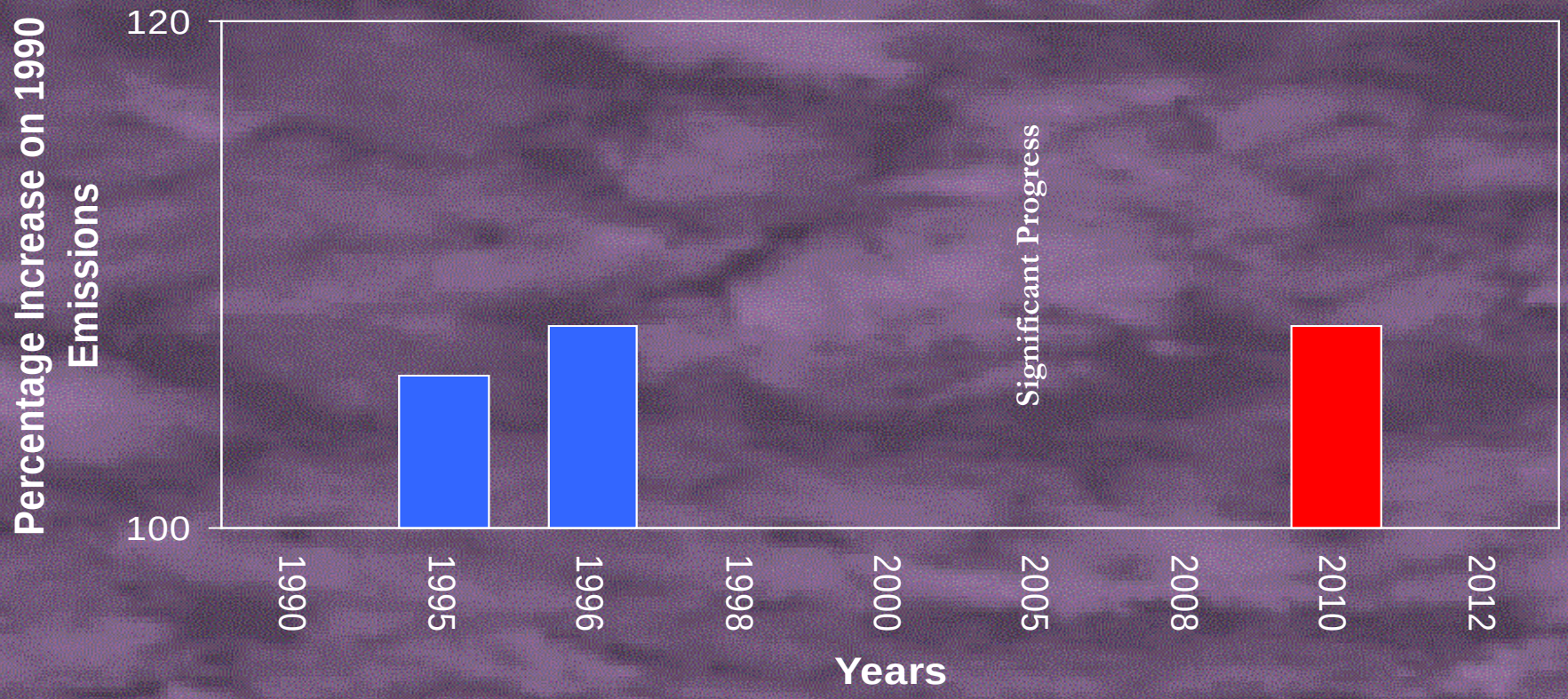
- Implementing the Protocol - Reforestation

Farm forestry zones by area and rainfall

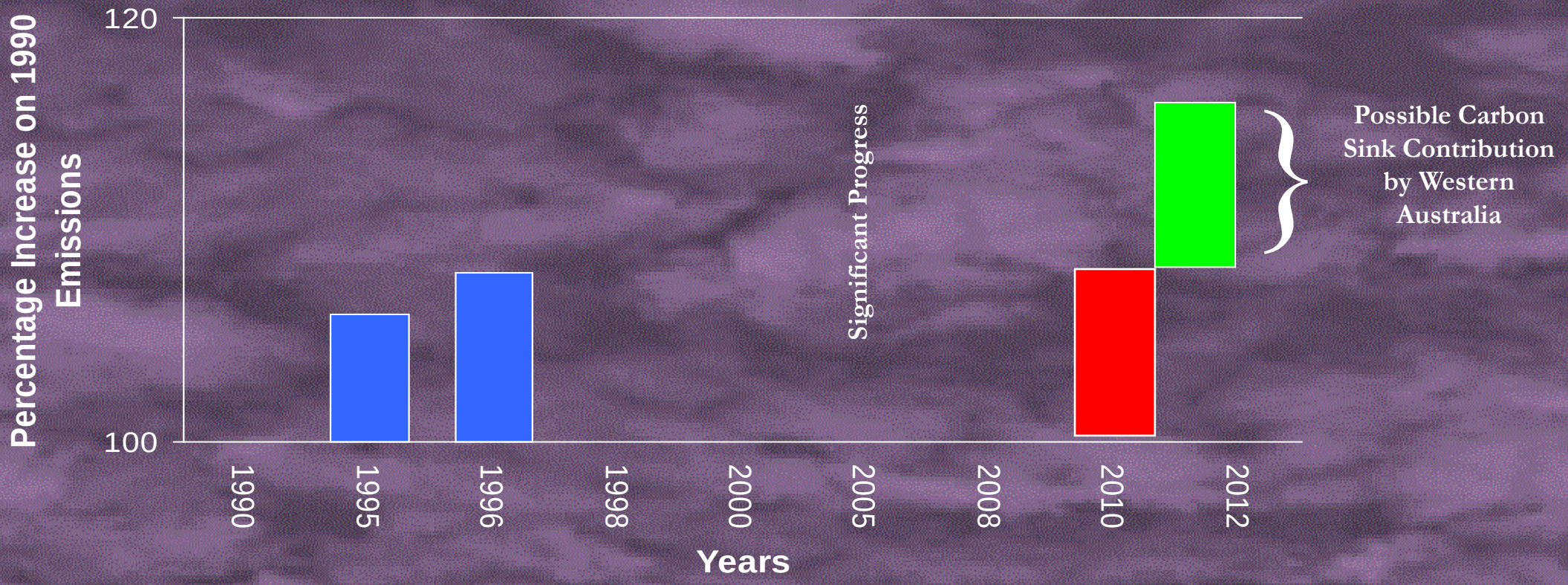
Farm forestry zone	Rainfall	Area (in million ha)
Traditional pine and new bluegum	> 600 mm	2
Maritime pine	400 – 600 mm	6
Wheatbelt	< 400 mm	10



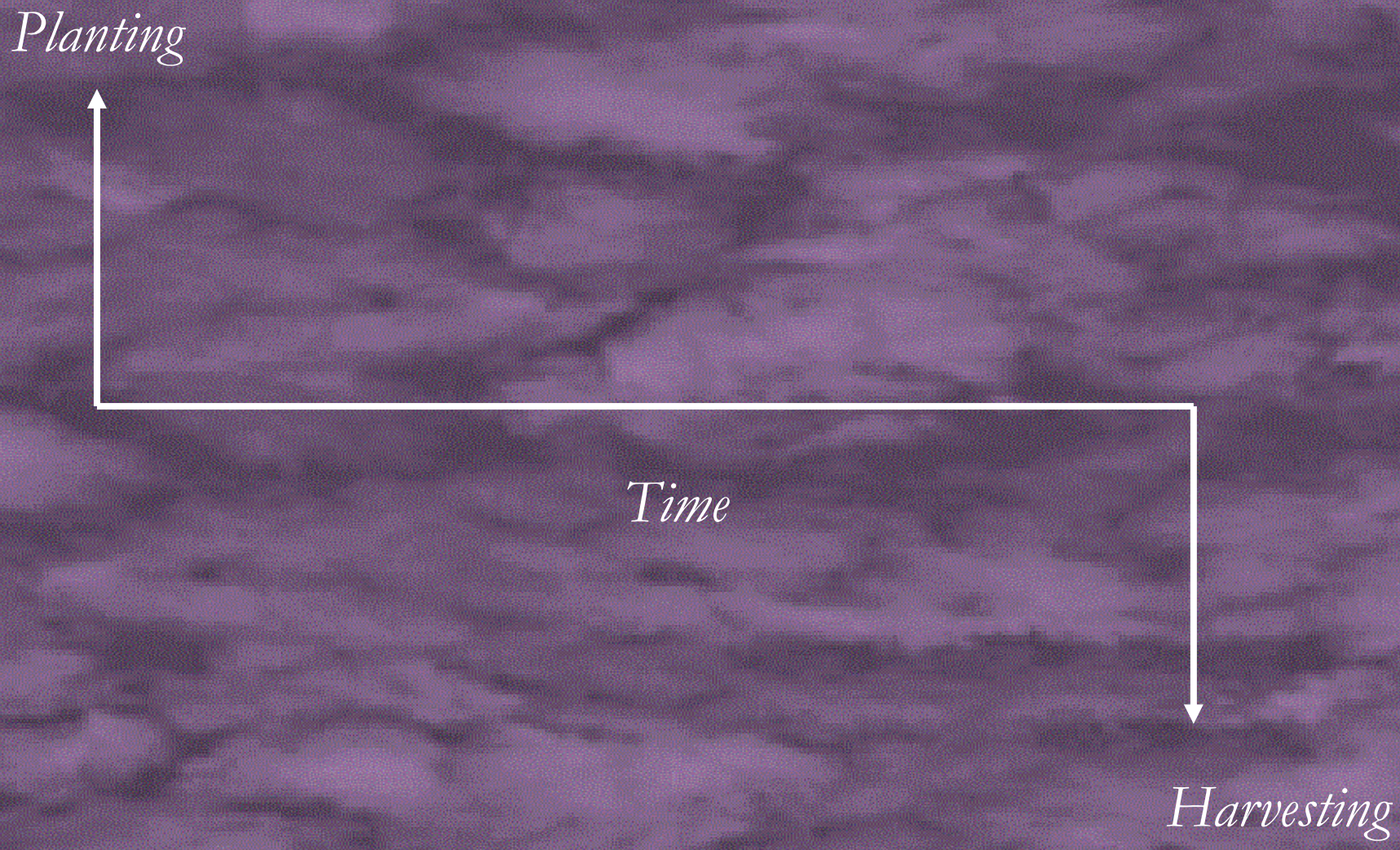
Australia's Kyoto Targets



Australia's Kyoto Targets



The Current Rules

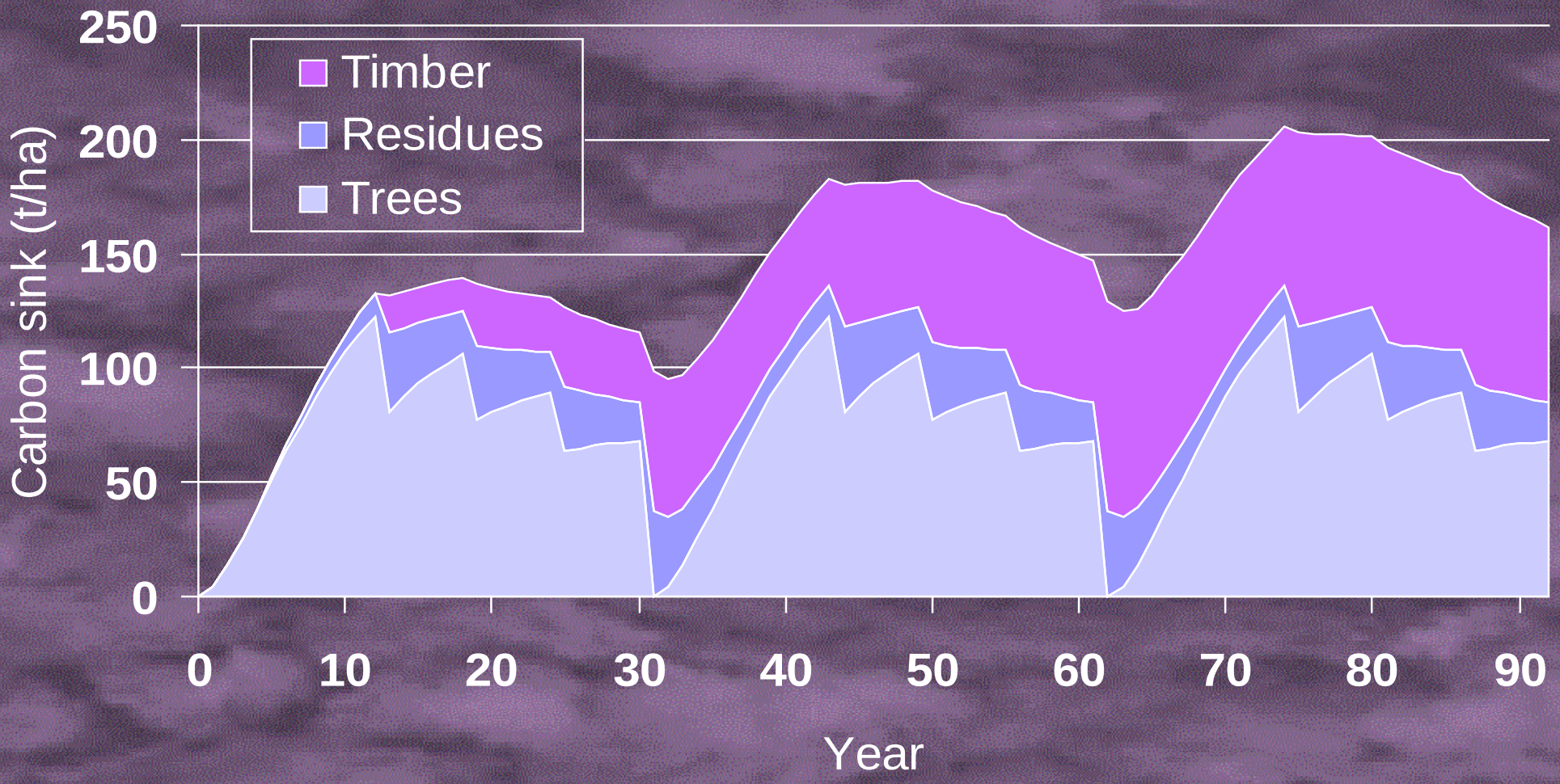


Australia's Kyoto Targets

Current proposed resource projects in Western Australia could consume Australia's allowable growth in emissions of approximately 40 million tonnes of CO_2.

- Measuring Carbon Sinks -

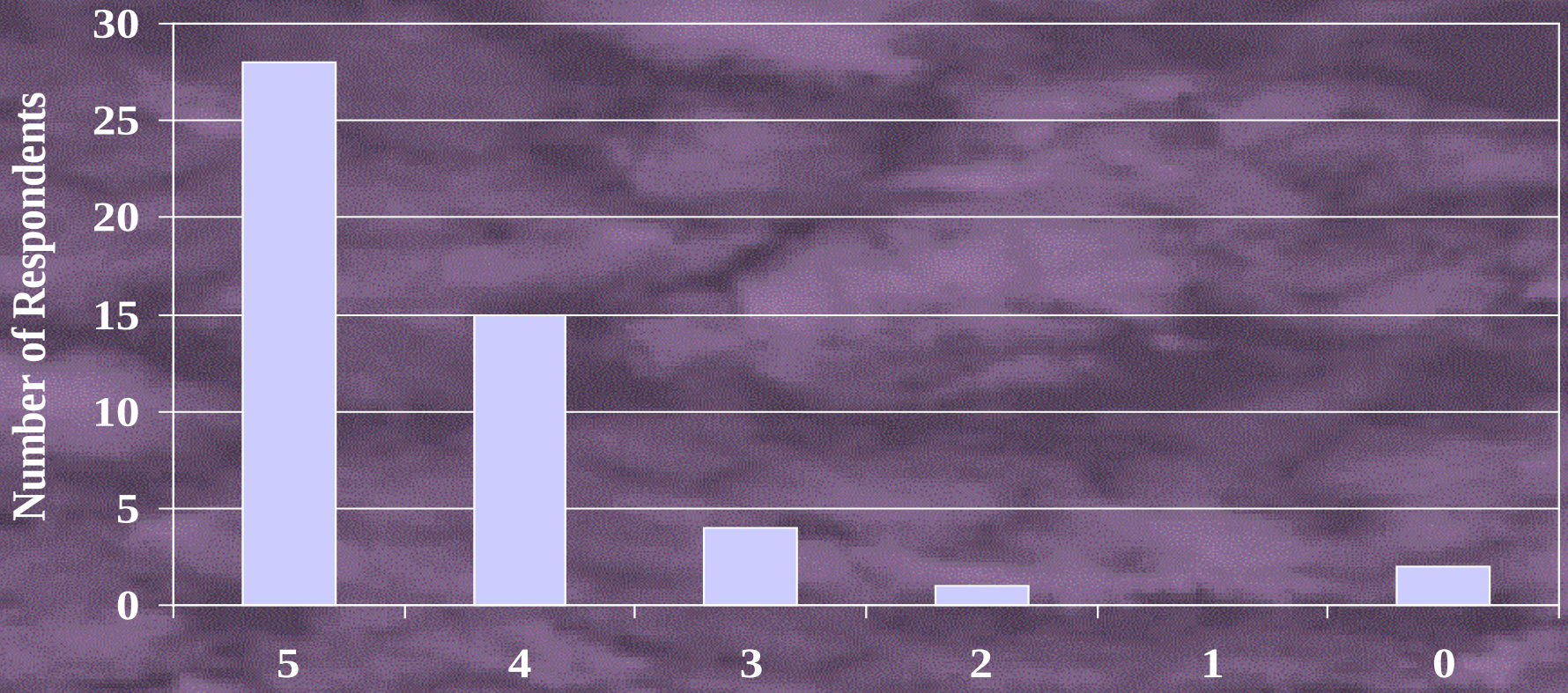
Carbon sinks from Maritime Pine



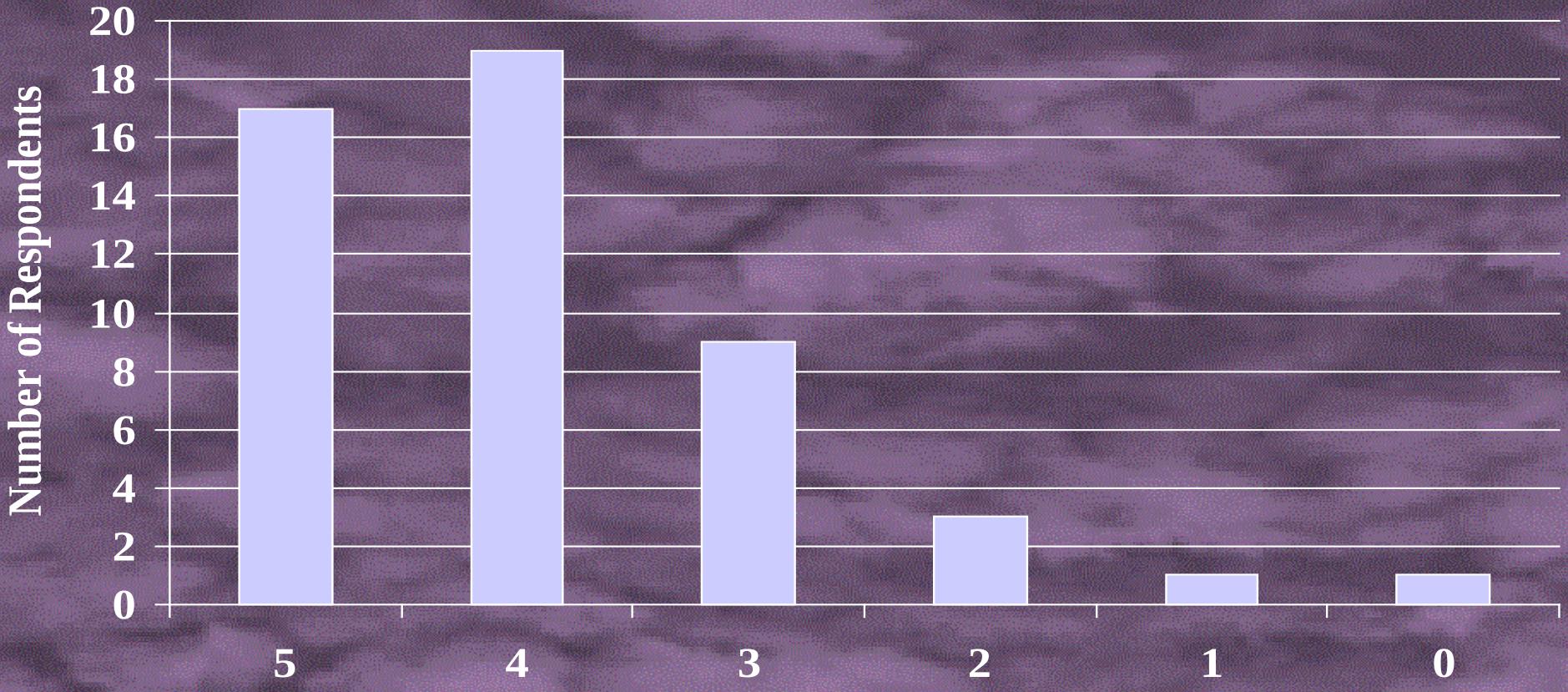
- Critical Elements of Carbon Sequestration Strategies -

Land Availability

Attitude of establishing tree crops on farms

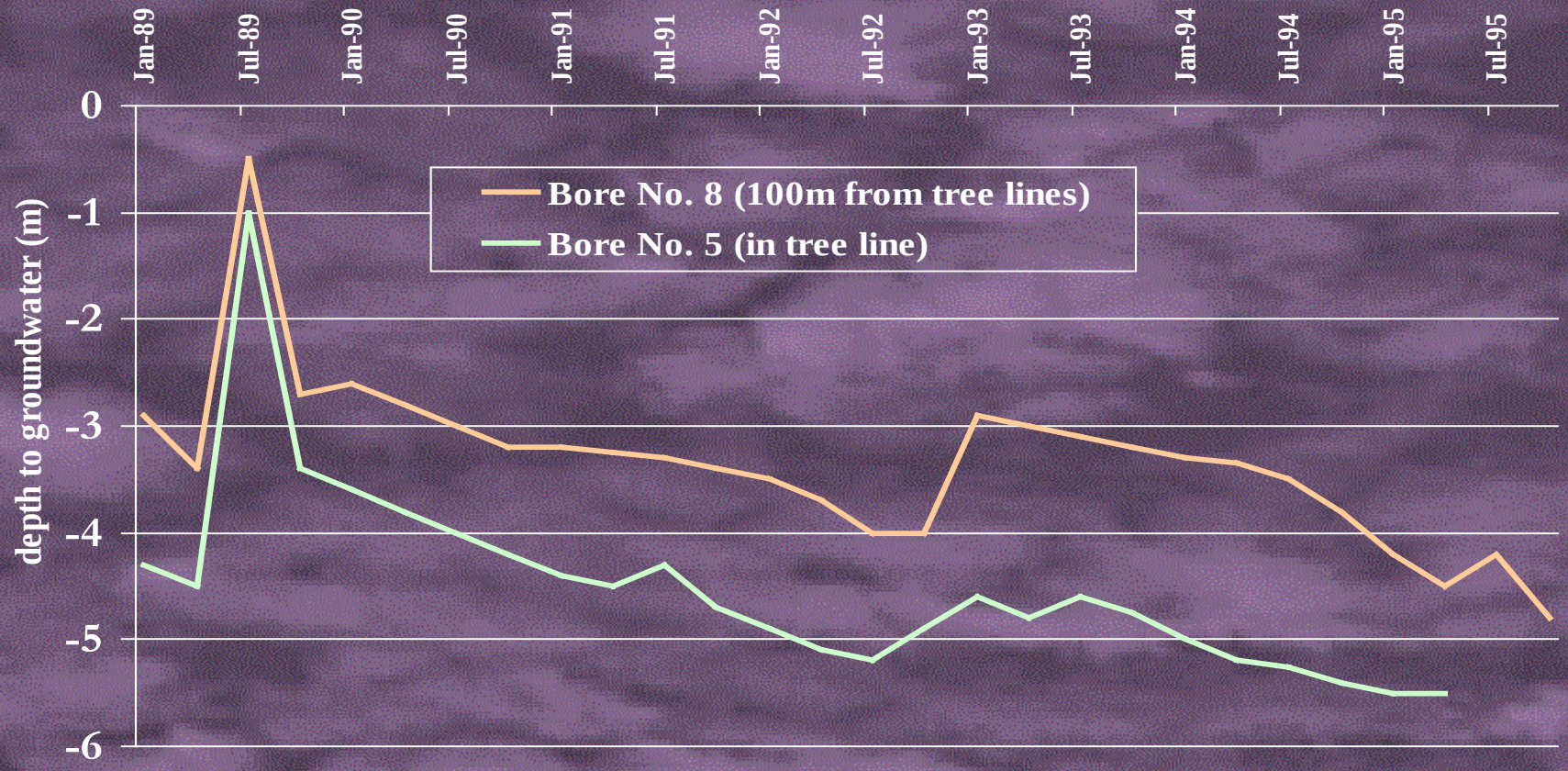


Importance of tree crops in increasing financial status of farming families

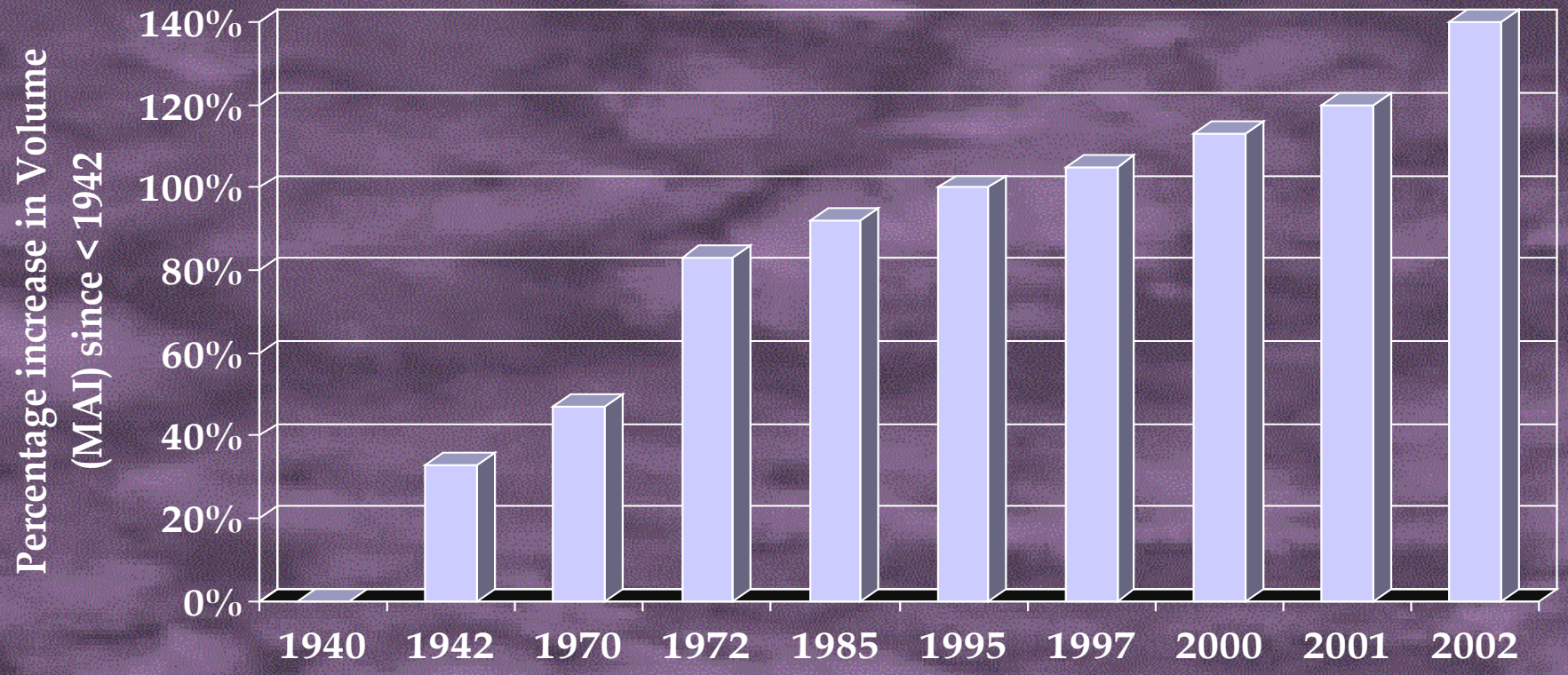


Integration with Environmental and Economic Objectives

Hydrograph showing groundwater response to alley farming system (after Short and Skinner, 1996)

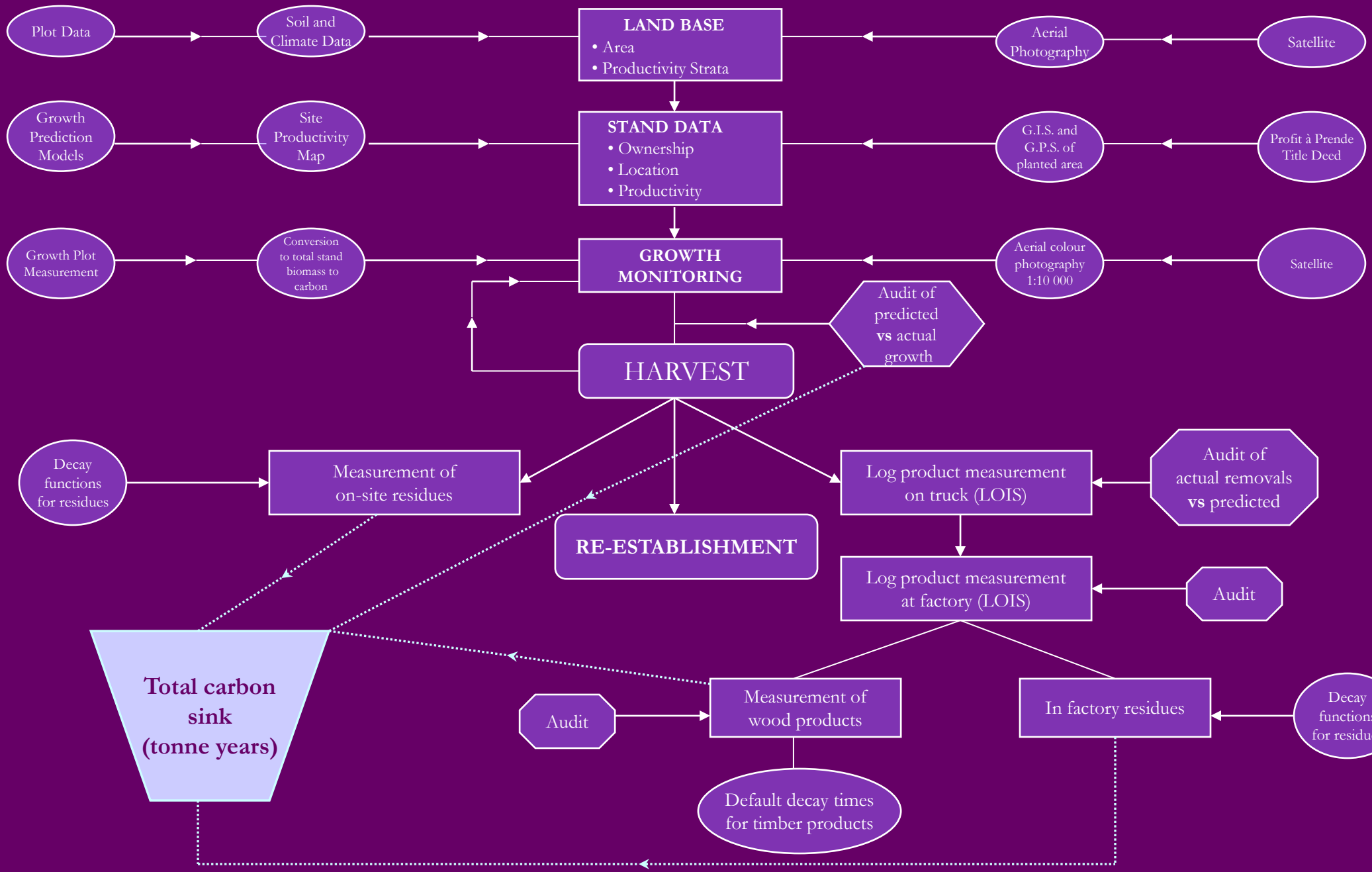


Volume gains from the tree improvement program for Maritime Pine

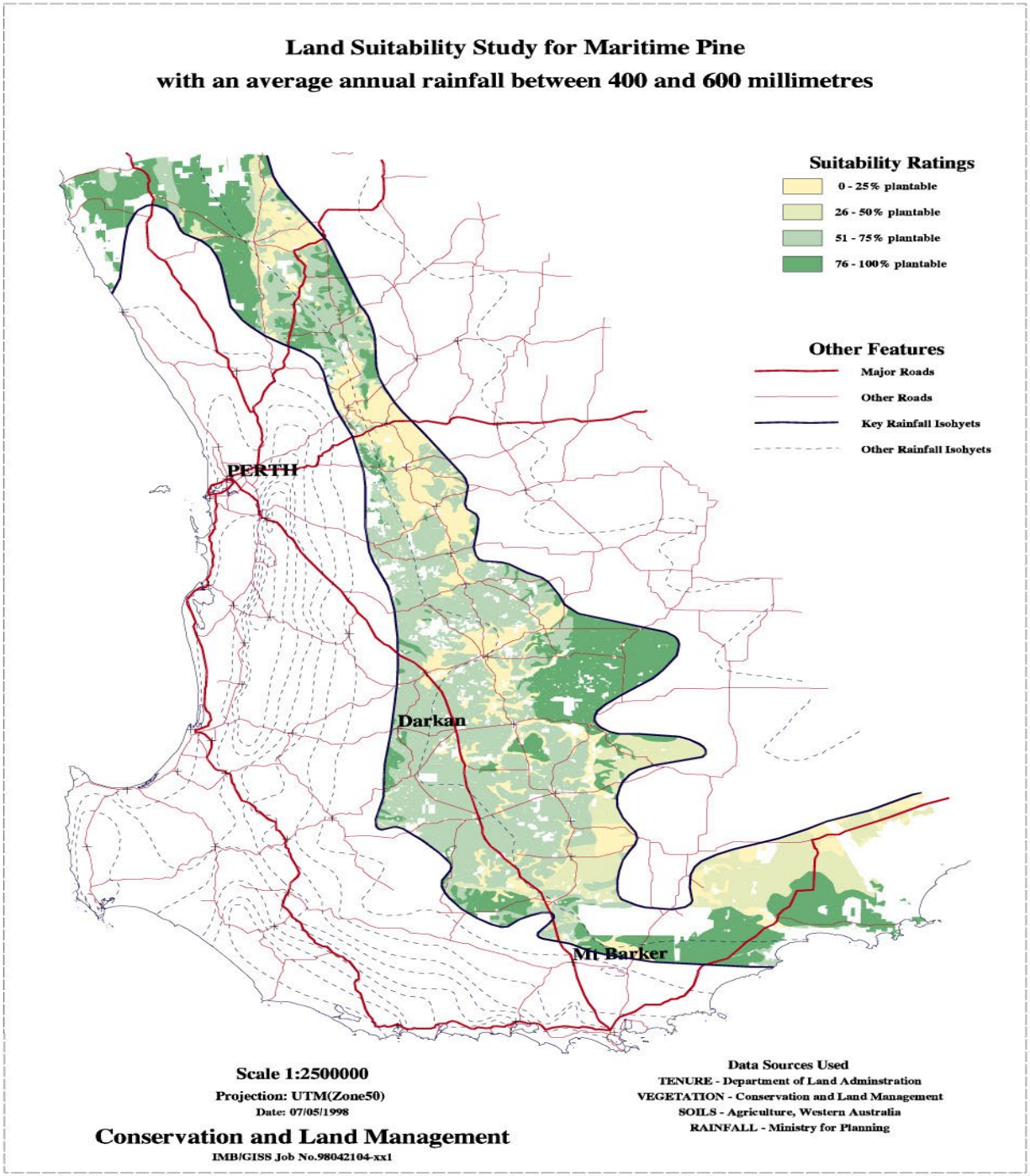


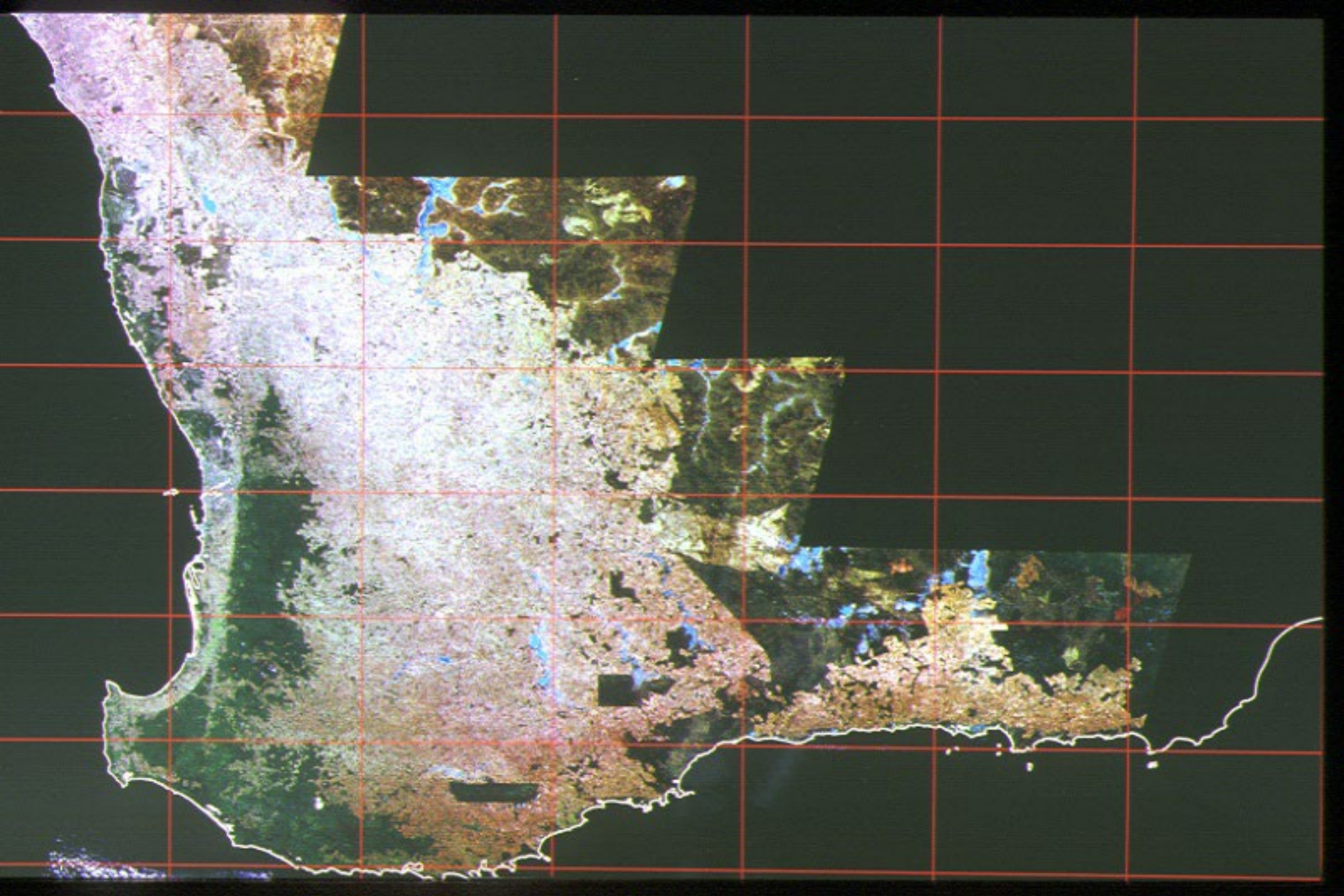
Measurement and Verification

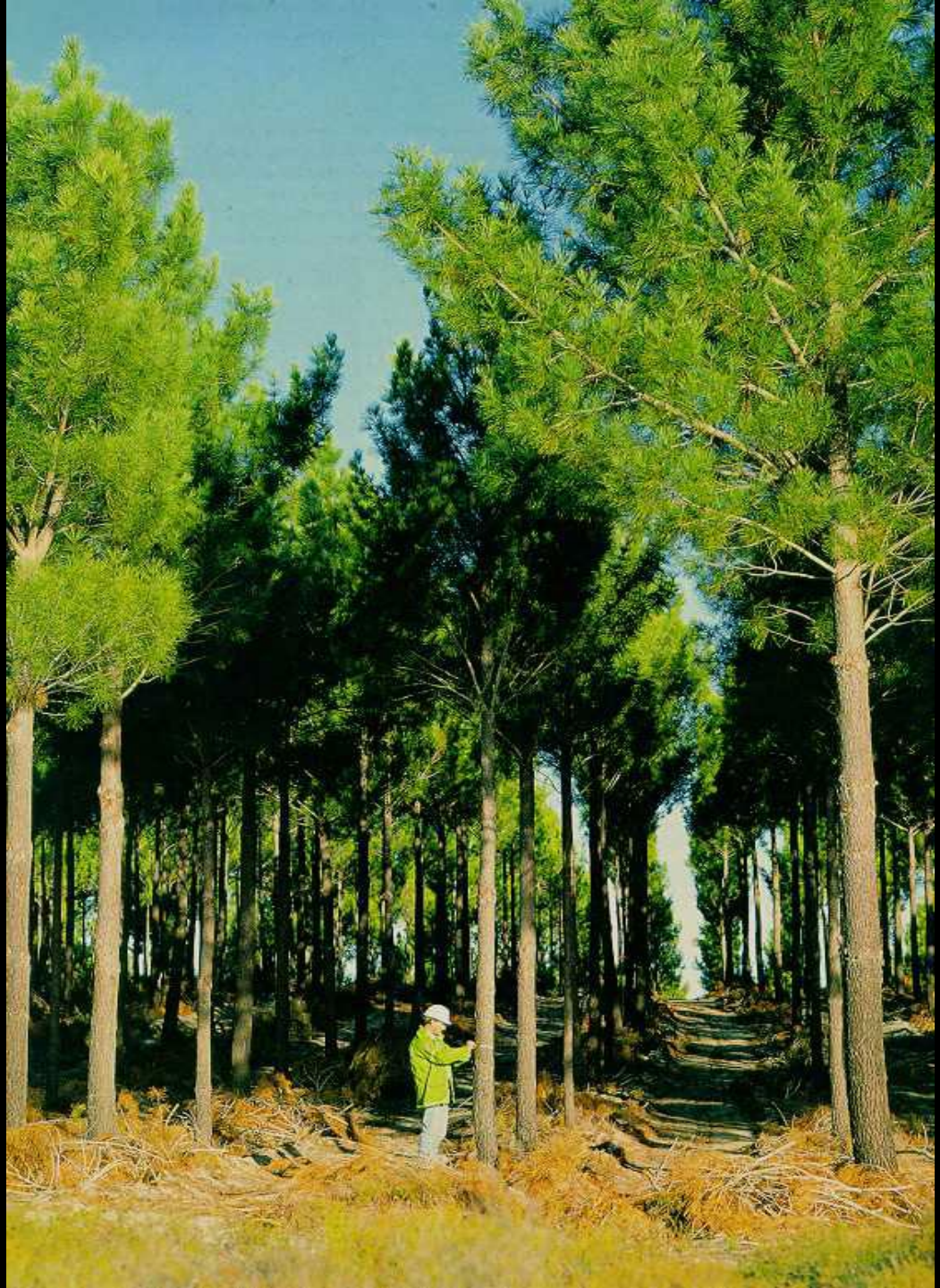
Forecasting, Monitoring and Verification of Carbon Flows in Tree Crops from Establishment to Product Decay



Land Suitability Study for Maritime Pine







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 IMS.

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

CLM 709 (1998)

LOGGING OPERATIONS INFORMATION SYSTEM (LOIS)

LOGGING OPERATION DETAILS

ACTION (√) ADD [/] DELETE [ ] UPDATE [ ]

Operation Name — District [A] PERTH — Plantation /Block PINJAR

Compartment [09] Coupe [ ] Operation [A] [P] [J] [P] [F] [2]

Operation Type FLAT — Description T2

Operation Area [10] ha — Supply Area SWAN

Contractor(S) Name SLS — Contract No.

Name — Contract No.

Name — Contract No.

Start Date [2][0][4][9][8] End Date [3][0][5][9][8] Transition Dump [Y] [N]

Private Prop. Owner — FOCIS Mgt Area

Silvicultural Type [5][2][2] NEW / 2ND THN / 3RD - 150 SPH

Contractor Payments To Be Printed At PERTH

WEST SIDE AQUA AS WESPINE THAL ORCHARD STOCK P71

Delivery Location Distances (and approved travel routes if applicable)

Delivery Location	Customer	Distance (km)	Approved Travel Route	Amendment (Date/Signature)
BASSENDEAN	PINEMAR	49	AQUA / PINJAR / WN / GN / FREEWAY	
WELSHPOOL	WESFI	61	" " " " " "	
ORANGUP	WESPINE	248	" " " " " " / SW HWY	
OSB PK	W/COAST	45	" " " / OCEAN REEF / FREEWAY	

INPUT at STATE HEADQUARTERS
21 APR 1998
Date
Operator- AW

Completed By: C.J. SAUNDERS Date 20/4/98

Business Unit Manager: Date 20/4/98

Department of Conservation and Land Management

SOFTWOOD LOG DELIVERY NOTE

S 079859

Part A: Harvesting information - All shaded parts to be completed by Contractor before truck leaves bush landing

Date of loading: 10/9/98 Time of loading: 5-45 Date & time of delivery/unloading: 10/9/98. 10-30.

Truck registration no.: 9KT 041

Terrain = F (flat) S (steep)

Op type = 1 (T1) 2(T2) 3(T3) C(clearfell)

Source of logs (Plantation): CRAYMORE

Logging operation: Dis R | Plant CH | Op No. RCF 1 | F/S 1/2/3/C

Product species: RADIATA.

Product type: SMALL SAW LOGS

Customer's name: PMET TEC.

Delivery location: BASSENDEAN.

CALM contractor (Production): PME - HAULIERS.

Harvesting contract no.: 95/P1 Ref no. ..... (Contractor use only)

Work description (√): Fall ✓ Extract ✓ Debark ☐ Prepare ☐ Measure ☐ Load ✓

CALM contractor (Delivery): " "

Harvesting contract no.: 95/P1 Ref no. ..... (Contractor use only)

Work description (√): Load ☐ Cart ✓

Feller's ID code(s): S.BERGISON R.MORTON

If point of sale is bush landing, tick box ☐

CONTRACT OF SALE NO: 2353 (CALM Use Only)

J. LODGE. (Felling) | (Processing) | P. ALLAN. (Extracting) (Contractor use only)

Part B: Signatures - All shaded parts to be completed by Contractor before truck leaves bush landing

Loader operater: [signature] Truck driver: [signature]

Customer: P. Lemma (Date 10/9/98. Time .....) Customer ref no. ..... (Customer Use Only)

Forest Officer conducting field check ..... (Date .....) ☐ Bush Landing ☐ On Road ☐ At Mill

Part C: Log Quantity - All shaded parts to be completed by Contractor before truck leaves bush landing (if measurement applicable)

(I) BIN MEASURE

Bin	Log Length (m)	Bin Width (m)	Bin Height (m)
1	2-4	2-3	1-7
2	2-4	2-3	1-8
3	2-4	2-3	2-0
4	2-4	2-3	2-0
5	2-4	2-3	1-8
6	2-4	2-3	1-8

Total Volume 2585-08. 37.998 m³

or (II) SCANNER MEASURE

Bin	Log Length (m)	Log Tally	No. of Logs
1			
2			
3			
4			
5			
6			

No.of logs on load

or (III) WEIGHT (see details as printed by weighbridge printer on this D/Note or on attached weighbridge docket)

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT 14 SEP 1998 COMO, W.A.

INPUT AT STATE HEADQUARTERS Date 14 SEP 1998 Operator

RECEIVED 14 SEP 1998

Net Load Weight: Tonnes

S079859

Part D: Distribution: (i)White original: CALM(via Customer) (ii) Pink duplicate: Customer (iii) Green triplicate: CALM Contractor (iv) Yellow quadruplicate: Remains in book at all times

LOG TIMBER RECEIVAL RECORD

(to be completed by Mill Owner/Manager and original forwarded to local CALM District office within 3 working day after end of calendar month

Buyers Name Wesfi Pty Ltd Month JUNE 19 98

Sawmill Welshpool

Delivery Date	Delivery Note No.	Product (species and type)	Quantity(✔) m³ ❑ No. of logs ❑ tonnes ❑	Delivery Date	Delivery Note No.	Product (species and type)	Quantity(✔) m³ ❑ No. of logs ❑ tonnes ❑
8/06/1998	S 073868	PinChip	✓ 29.00	10/06/1998	S 073702	PinChip	✓ 30.00
8/06/1998	S 073869	PinChip	✓ 28.30	10/06/1998	S 073703	PinChip	✓ 30.25
8/06/1998	S 073896	PinChip	✓ 30.25	10/06/1998	S 073704	PinChip	✓ 28.55
8/06/1998	S 073897	PinChip	✓ 28.05	10/06/1998	S 073754	PinChip	✓ 29.65
8/06/1998	S 073898	PinChip	✓ 29.30	10/06/1998	S 073755	PinChip	✓ 29.95
9/06/1998	S 073520	PinChip	✓ 30.05	10/06/1998	S 073756	PinChip	✓ 30.10
9/06/1998	S 073521	PinChip	✓ 32.50	10/06/1998	S 073757	PinChip	✓ 29.95
9/06/1998	S 073522	PinChip	✓ 27.65	10/06/1998	S 073785	PinChip	✓ 29.30
9/06/1998	S 073701	PinChip	✓ 30.55	10/06/1998	S 073786	PinChip	✓ 27.00
9/06/1998	S 073751	PinChip	✓ 28.35	10/06/1998	S 073787	PinChip	✓ 27.45
9/06/1998	S 073752	PinChip	✓ 29.30	10/06/1998	S 073873	PinChip	✓ 26.45
9/06/1998	S 073753	PinChip	✓ 29.80	10/06/1998	S 073874	PinChip	✓ 30.85
9/06/1998	S 073782	PinChip	✓ 29.50	10/06/1998	S 073875	PinChip	✓ 29.25
9/06/1998	S 073783	PinChip	✓ 32.05	11/06/1998	S 073677	PinChip	✓ 29.10
9/06/1998	S 073784	PinChip	✓ 29.85	11/06/1998	S 073678	PinChip	✓ 29.15
9/06/1998	S 073870	PinChip	✓ 29.25	11/06/1998	S 073679	RadChip	✓ 28.00
9/06/1998	S 073871	PinChip	✓ 30.80	11/06/1998	S 073705	PinChip	✓ 30.25
9/06/1998	S 073872	PinChip	✓ 28.70	11/06/1998	S 073706	PinChip	✓ 30.45
9/06/1998	S 073899	PinChip	✓ 29.20	11/06/1998	S 073707	PinChip	✓ 30.65
9/06/1998	S 073900	PinChip	✓ 29.90	11/06/1998	S 073758	RadChip	✓ 27.60
9/06/1998	S 073925	PinChip	✓ 31.60	11/06/1998	S 073759	RadChip	✓ 30.80
10/06/1998	S 073523	PinChip	✓ 25.90	11/06/1998	S 073760	RadChip	✓ 29.00
10/06/1998	S 073524	PinChip	✓ 31.90	11/06/1998	S 073788	PinChip	✓ 31.25
10/06/1998	S 073525	PinChip	✓ 32.30	11/06/1998	S 073789	PinChip	✓ 26.20
		Subtotal	714.05			Subtotal	701.20
						Monthly total	1415.25

NOTE: Deliveries ex private property to be underlined in *red*

RECORD OF FOREST OFFICERS' INSPECTIONS

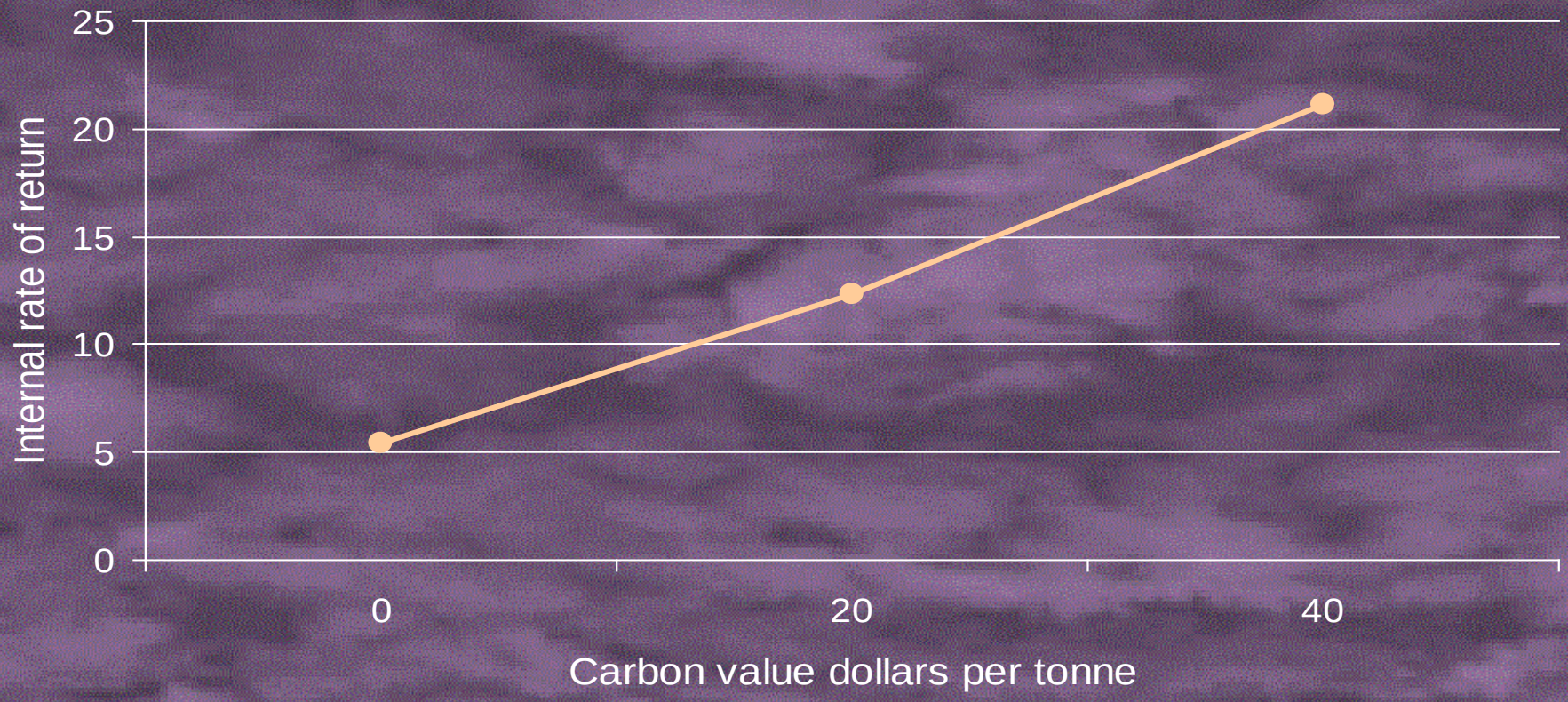
Date	Particulars of Inspection and Results	Action Required	Signatures: Forest Officer	Signatures: Mill Manager

THIS BOOK TO BE AVAILABLE FOR INSPECTION BY FOREST OFFICERS DURING MILL WORKING HOURS

04738/11/91—250 Bks—S/9625

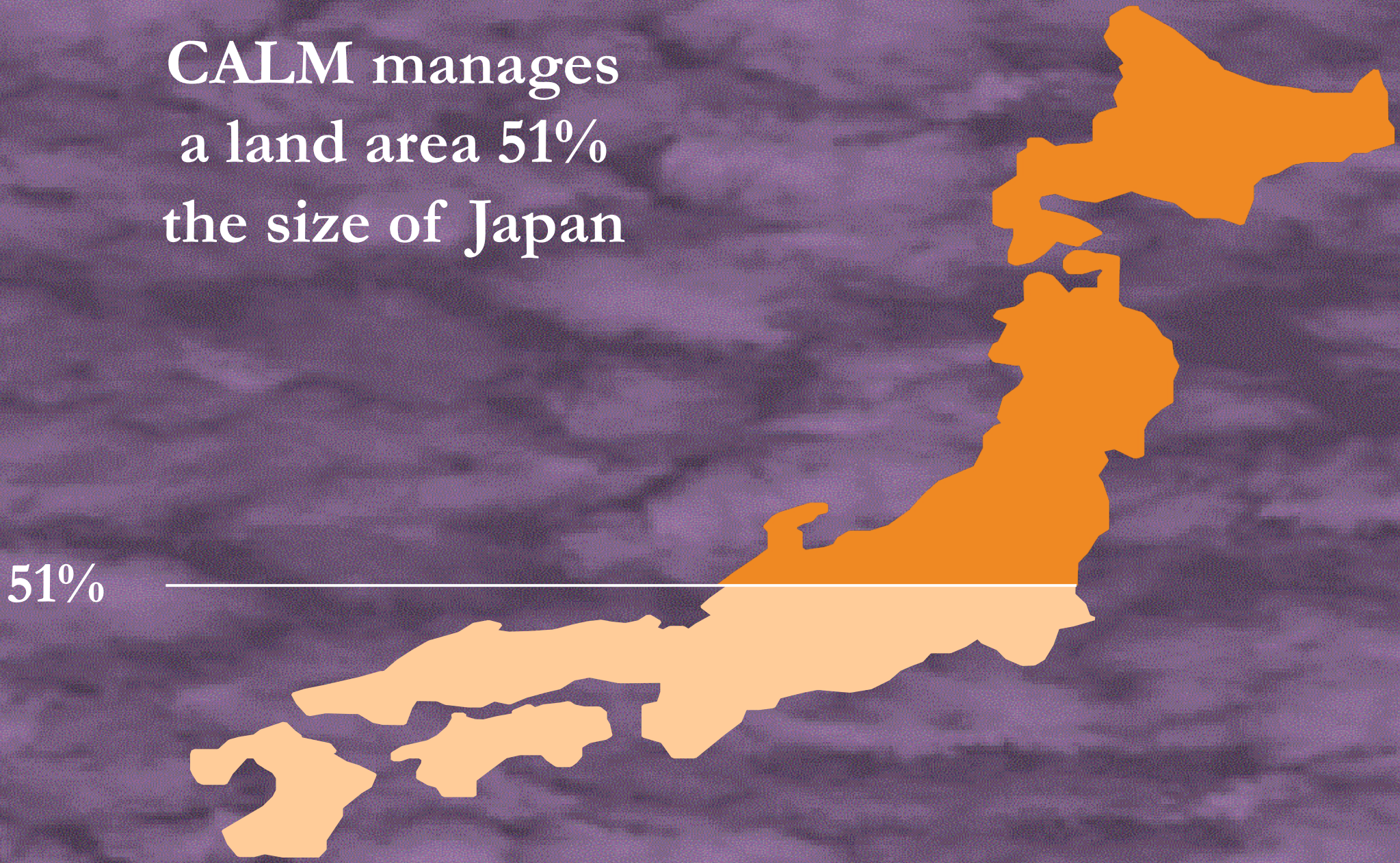
Costs

Return from Maritime Pine at Different Carbon Prices

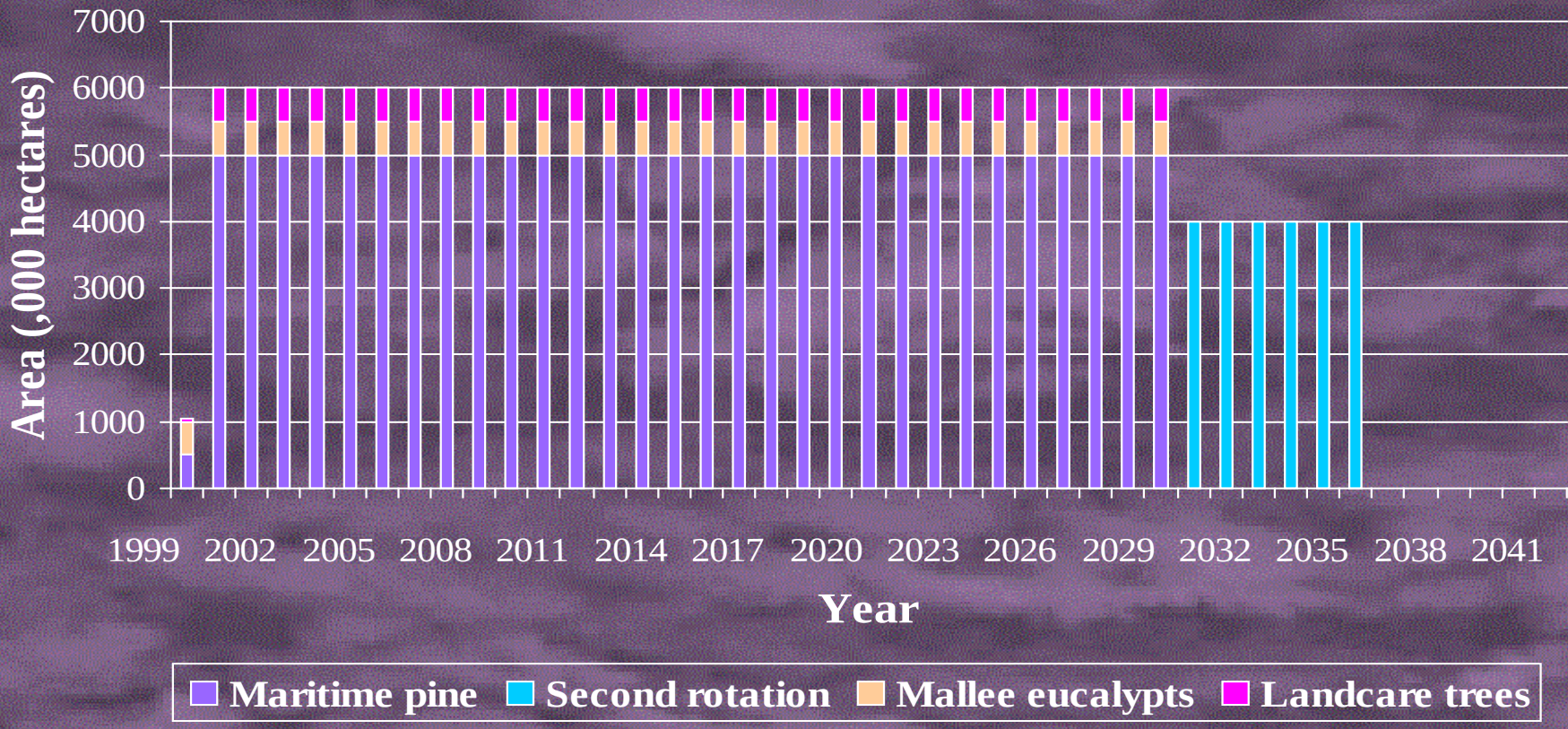


Implementation rate and scale

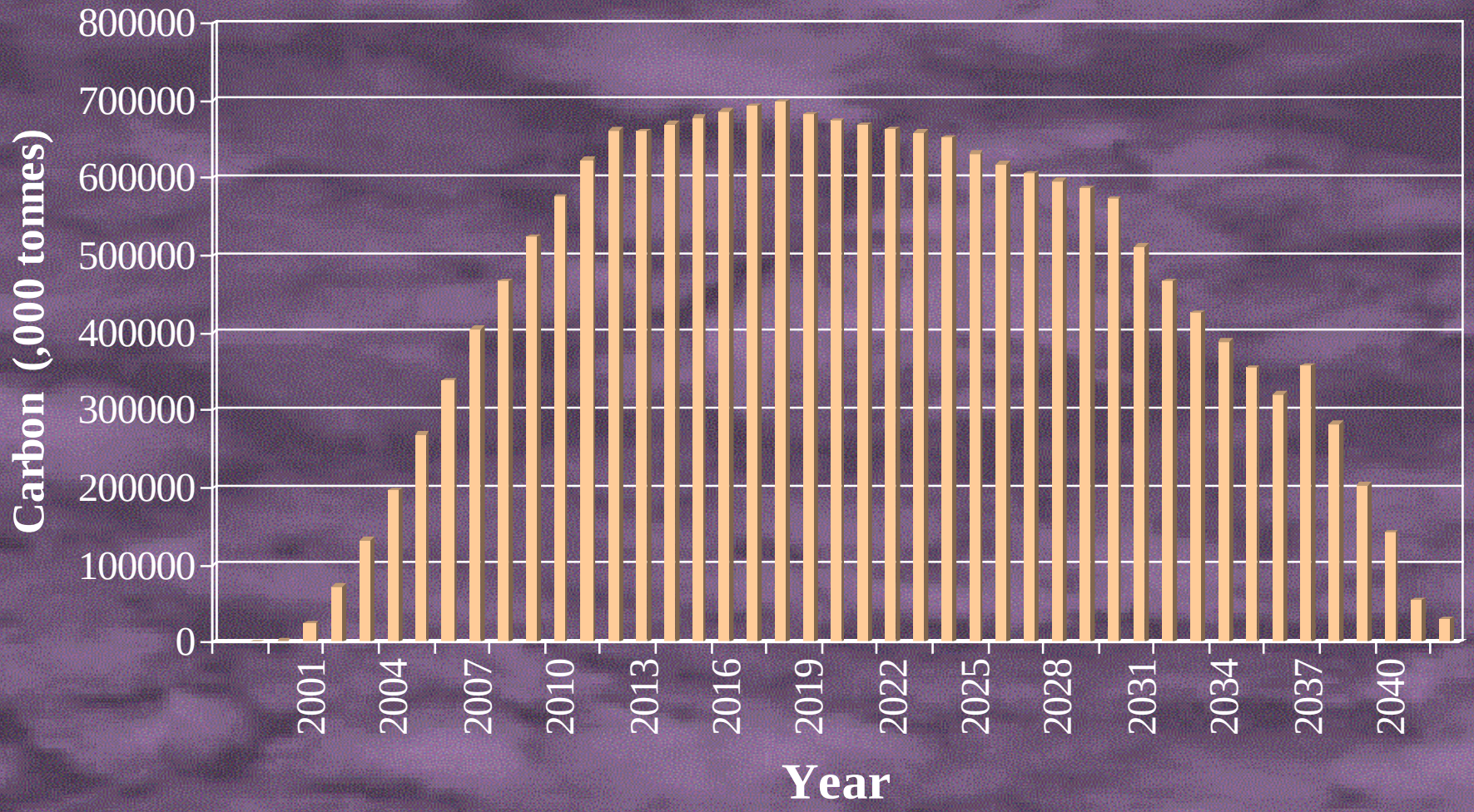
CALM manages a land area 51% the size of Japan



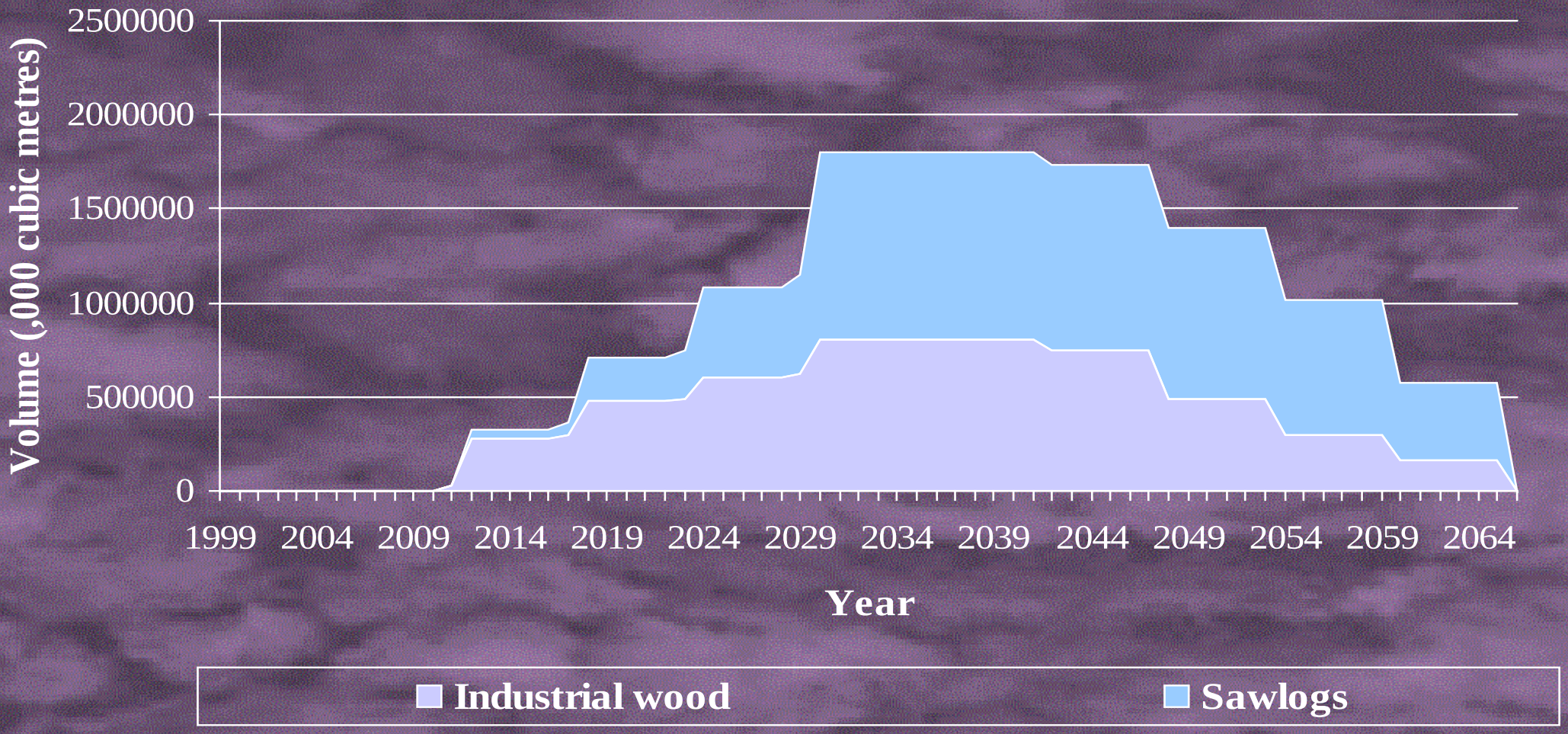
Proposed Planting Program



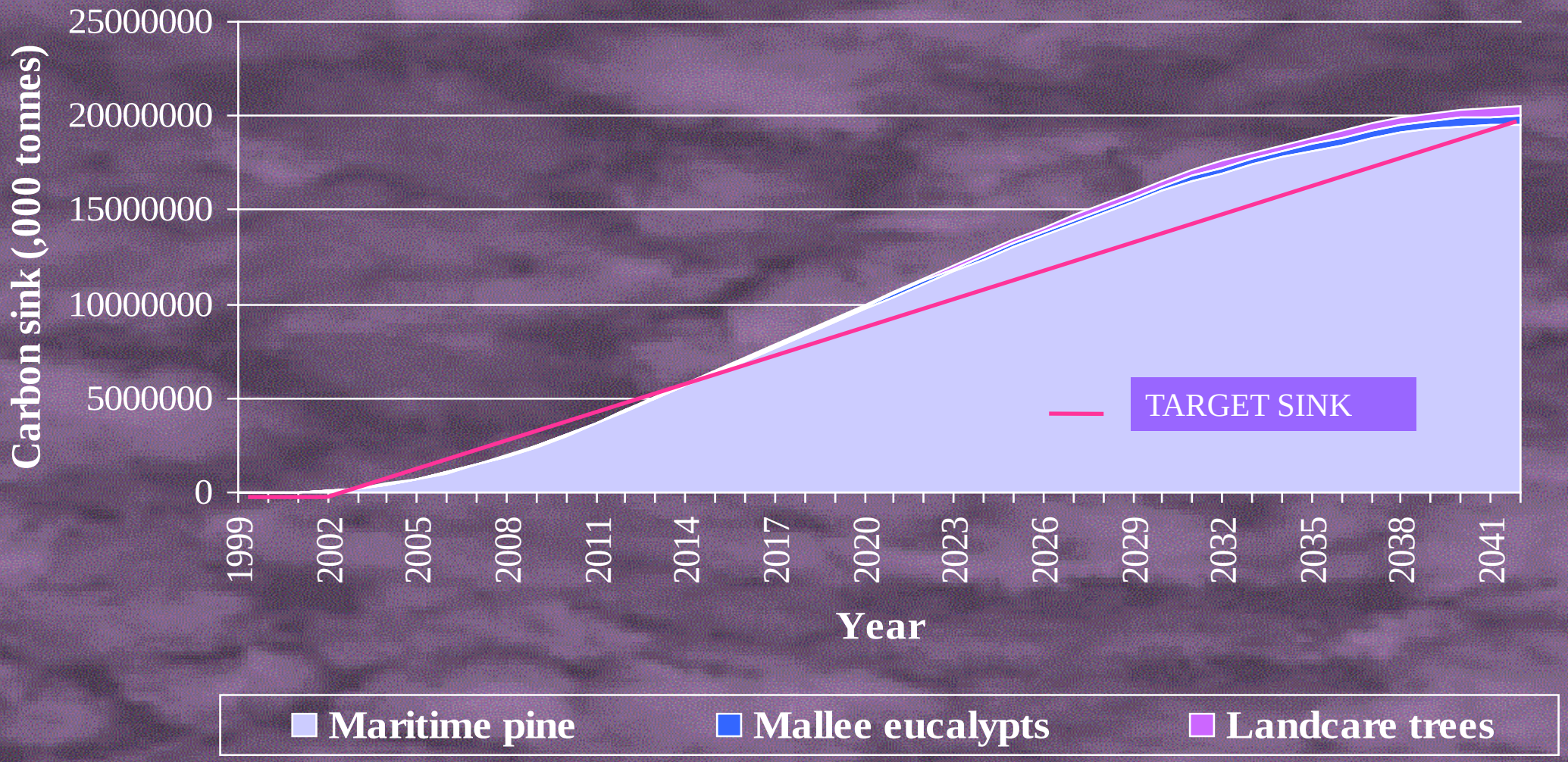
Annual Sequestration



Projected Woodflows



Carbon Sink


Carbon sink (,000 tonnes)
25000000
20000000
15000000
10000000
5000000
0
1999
2002
2005
2008
2011
2014
2017
2020
2023
2026
2029
2032
2035
2038
2041
Year
TARGET SINK
Maritime pine
Mallee eucalypts
Landcare trees

Financial Summary of a Strategy

Total cost ($ 000)	523,626
Total revenue ($ 000)	1,137,461
Discounted cost ($ 000)	142,006
Discounted revenue ($ 000)	82,110
Average carbon sink (000 tonnnes)	11,180
NPV ($ 000)	(58,896)
NPV per average tonne	($5.36)
IRR	4.1%

Effect of carbon value on Project performance (internal rates of return)

Value of Carbon	Strategy
$ 12	7.3%
$ 20	10.5%
$ 40	21.8%

How the early swallow proves global warming

Birds are yardstick for changes in climate

BY JOHN INGHAM
ENVIRONMENT CORRESPONDENT

ONE swallow may not make a summer but it could help prove that global warming is taking place.

Ministers are considering using the arrival date of the summer's first swallow as a yardstick for climate change. The proposal is included in a report commissioned by the Department of the Environment as part of its quest to find "environmental indicators" — measures by which the Government and public can test Britain's green performance.

The latest research shows that swallows are arriving on average nearly two weeks earlier than in the 1950s. But the real acceleration has come in the 1990s with the birds being spotted a week earlier than ten years ago.

This coincides with a dramatic increase in temperatures worldwide. The seven warmest years since records began 150 years ago have all occurred in the past decade. Earlier this week scientists confirmed that 1998 will be the hottest year in the past 1,000 years, easily surpassing the previous record holder, 1997.

The man behind the swallow research, Tim Sparks of the Institute of Terrestrial Ecology, said: "Summer migrants are getting here earlier. Research in Surrey also shows that trees are coming into leaf 11 days earlier on average than in the 1960s.

"Global warming is playing a major role in this. These birds and trees are sensitive to temperature and this decade has been the warmest on record. For every one degree increase in spring temperatures, swallows arrive two to three days earlier. If we see the expected four degree increase by the year 2100, swallows could by be regularly getting here by mid-March."

Mr Sparks was backed by the authoritative British Trust for Ornithology, whose newly-released Garden BirdWatch Handbook declares: "Our summer visitors do seem to be arriving earlier in many areas than they did in the 1940s and 1960s."

Details emerged as officials from 180 countries continued negotiations in Buenos Aires to tackle global warming by finding ways to reduce emissions of greenhouse gases such as carbon dioxide.

British ministers want a series of indicators to help them assess how rapidly global warming is advancing.

They commissioned a report which proposes 35 "barometers" from the natural world. Mr Sparks said: "Swallows are a good indicator because their arrival is sensitive to temperature."

Other indicators include temperatures, river flows, potato yields, the health of beech trees, breeding success of garden birds such as robins as well as wren populations because the tiny bird is vulnerable to cold winters.

● Deadly tropical diseases such as dengue fever, malaria and cholera could spread to the West as a result of global warming, Harvard scientist Dr Paul Epstein warned yesterday in a report for the World Wide Fund for Nature.