

# Sustainable harvesting of medicinal bark: Experimental research and formulation of harvest prescriptions

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# Introduction (Mander 1998)

- Some **27 million traditional medicine consumers** in South Africa
- More than **100 000 practicing traditional healers** using indigenous plants
- The economic activity generated by traders and healers has a value of ca **R270 million per annum**
- More than **700 plant species**
- The most valued traditional medicine comes from **forest and woodlands**
- **Medicinal tree bark** important component



# Kruger National Park

- Botha, J. 2001. Perceptions of species availability and values of **medicinal plants traded in areas adjacent to Kruger National Park**. MSc. Thesis, University of the Witwatersrand.
- Botha, J., Witkowski, E.T.F. & Chackleton, C.M. 2001. An inventory of medicinal plants traded on the western boundary of the Kruger National Park, South Africa. ***Koedoe* 44(2): 7-46.**

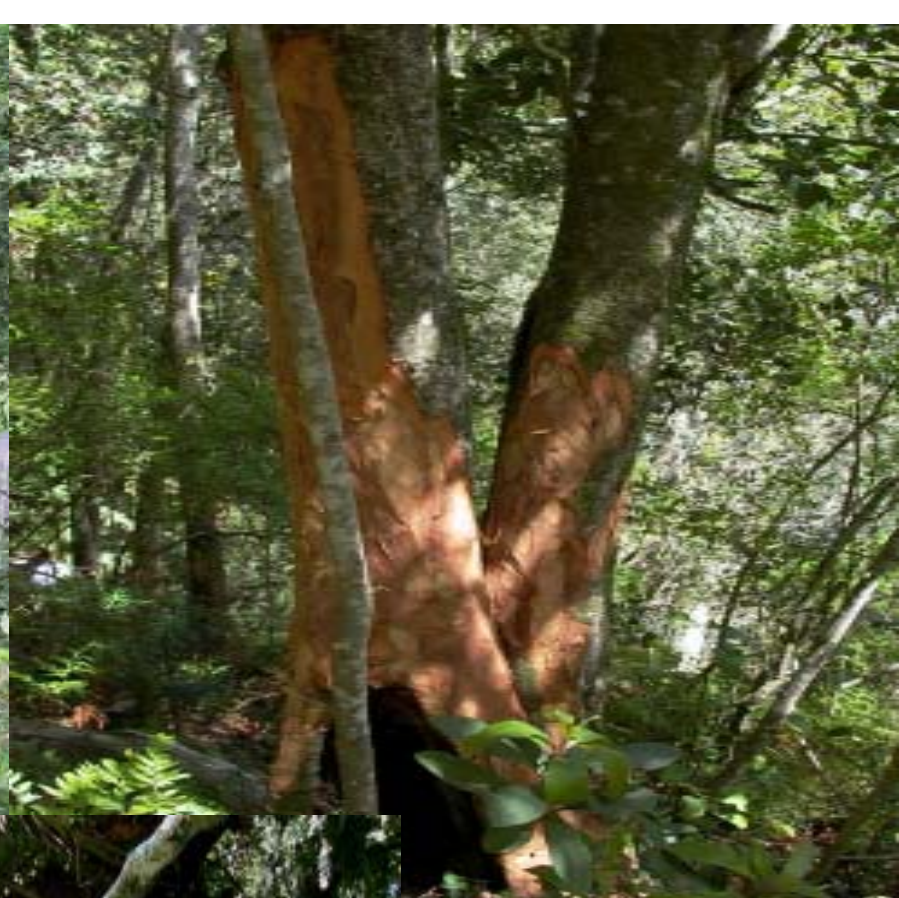


# Summary of results (Botha 2001)

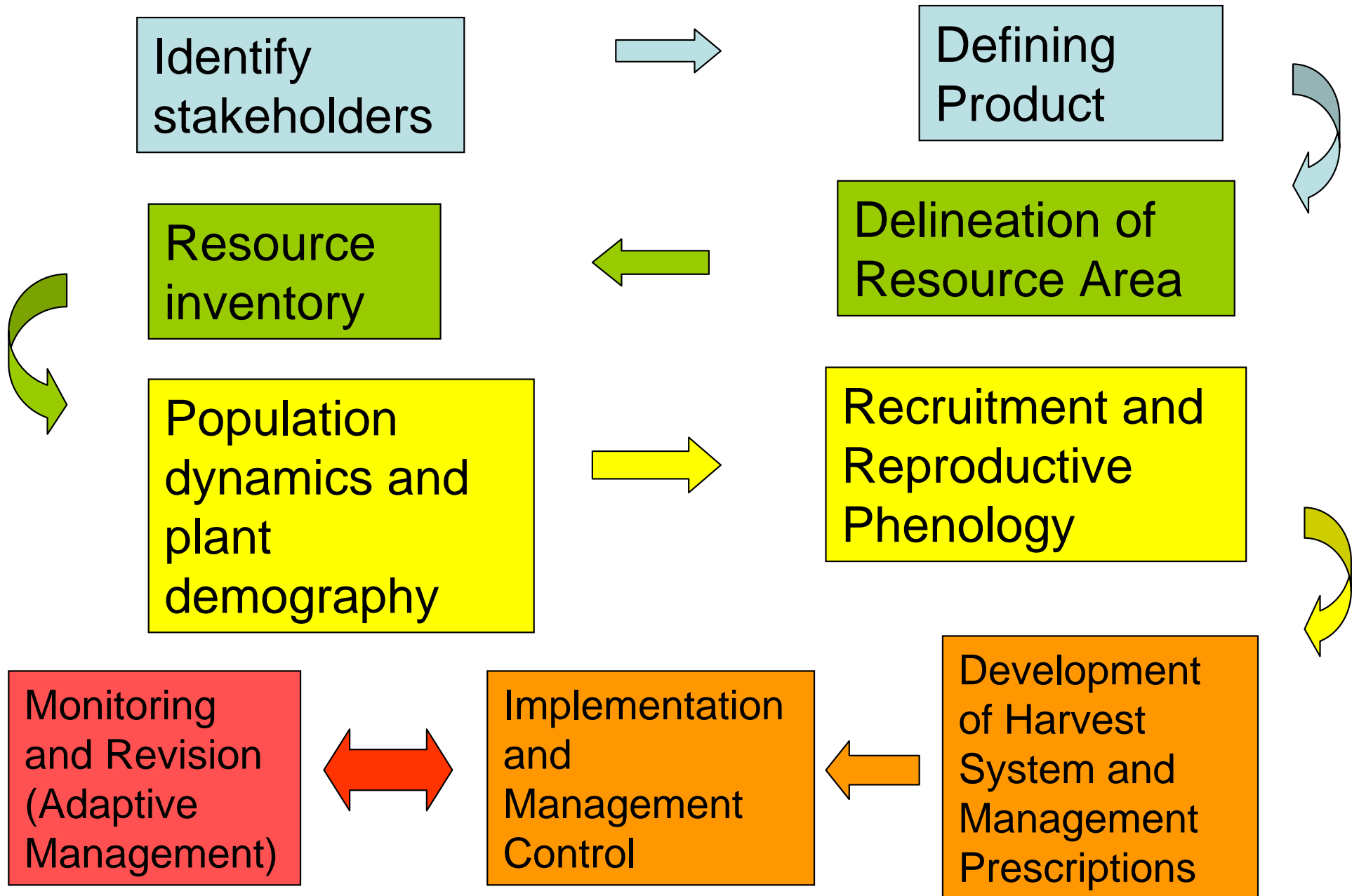
- Number of species traded
  - Mpumalanga: 176
  - Limpopo: 70
- Almost 50% species are trees
- Mpumalanga: Bark 23% of plant parts traded
- Common species and with highest turnover
  - *Acacia xanthophloea*
  - *Acridocarpus natalitius*
  - *Capparis tomentosa*
  - *Catha edulis*
  - *Croton megalobotrys*
  - *Cassine transvaalensis*
  - *Rapanea melanophloeos*




# Uncontrolled bark harvesting



# PROCESS OF SUSTAINED YIELD DETERMINATION





# Key issues for sustainable bark harvesting

Response of different species to bark stripping

- Bark regrowth
  - Extent
  - Rate
- Susceptibility to:
  - Fungal attack
  - Insect damage

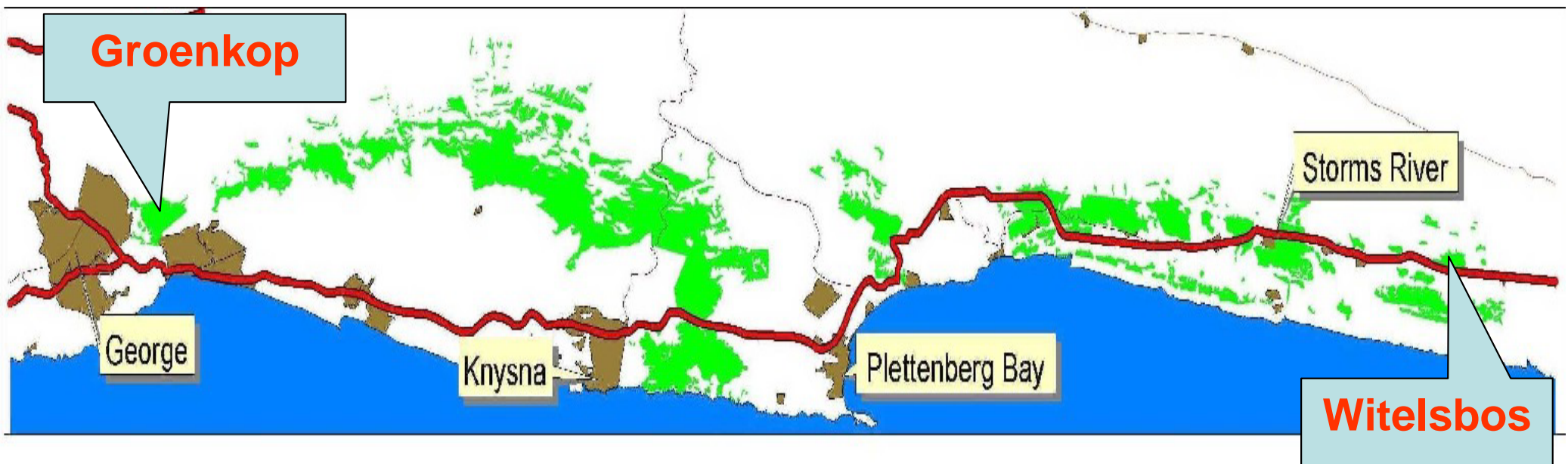


# Species selection (RSA, Malawi, Zambia)

Forest	Woodland
<i>Cryptocarya myrtifolia</i>	<i>Albizia adianthifolia</i>
<b><i>Curtisia dentata</i></b>	<i>Brachystegia bussei</i>
<b><i>Ilex mitis</i></b>	<i>B. spiciformis</i>
<b><i>Ocotea bullata</i></b>	<i>Dalbergia nitidula</i>
<b><i>Prunus africana</i></b>	<i>Elaeodendron transvaalense</i>
<b><i>Rapanea melanophloeos</i></b>	<i>Julbernardia paniculata</i>
<b><i>Rhus chirindensis</i></b>	<i>J. globiflora</i>
<i>Zanthoxylum davyi</i>	<i>Parinari curatellifolia</i>
	<i>Pseudolachnostylis maprouneifolia</i>
	<i>Pterocarpus angolensis</i>

# Study area

Medium-moist High Forest



Moist High Forest



# Treatments

- Removal of **1 m long strips**
- **Different strip widths (5 – 15 cm)**
- Range of **tree diameters**
- **Winter and summer treatments**



# Assessments

- Six month interval
- Bark regrowth
  - Edge growth
  - Sheet growth
- Damage through:
  - Fungal attack
  - Insect attack



# Edge growth

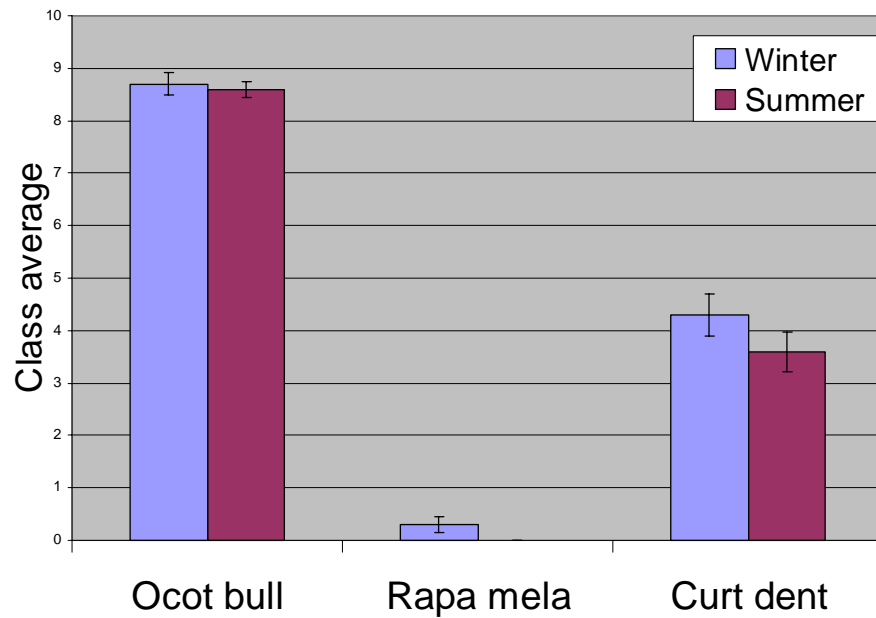
- Recorded percentage of wound edge with edge growth (% classes)
  - 0 = no edge growth
  - 1 = 1 – 10%
  - 2 = 11 – 20%, etc.
- Rate of wound closure



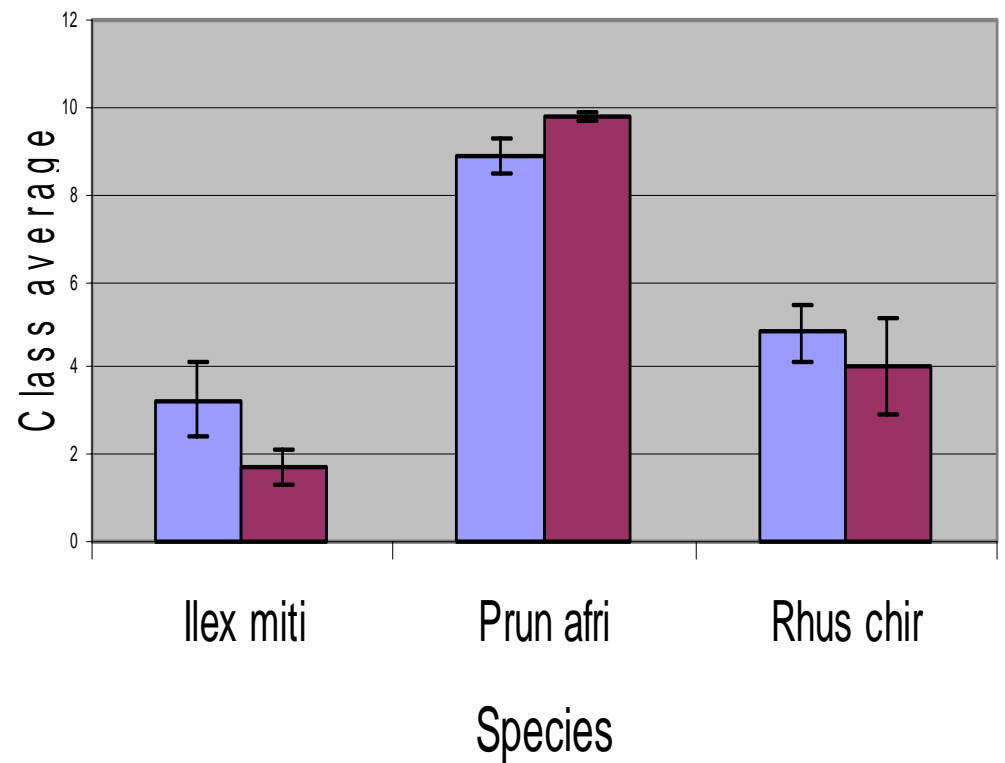
# Edge growth (%)



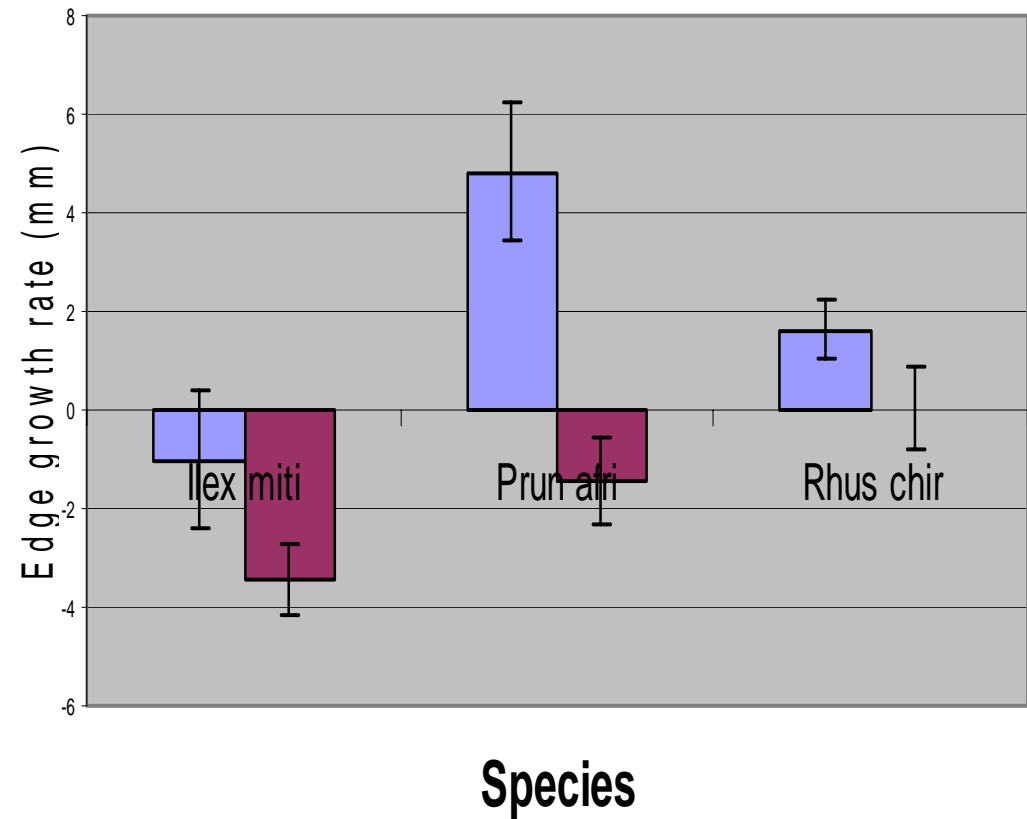
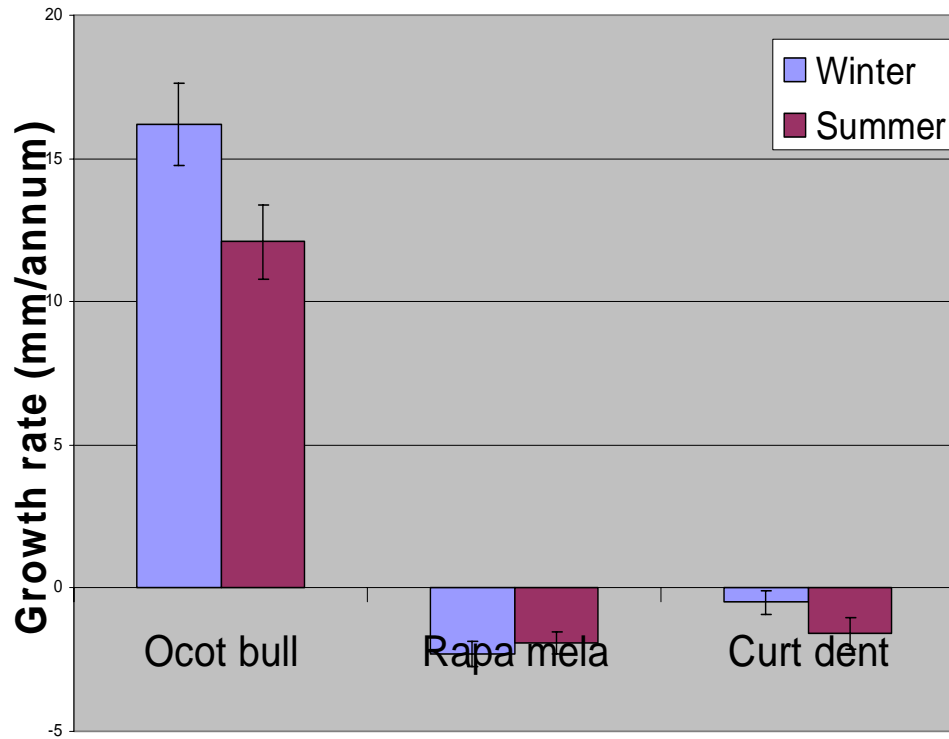
36 months



12 months



# Rate of wound closure



# Sheet growth

- Recorded percentage of wound edge with edge growth (% classes)

0 = no sheet growth

1 = 1 – 10%

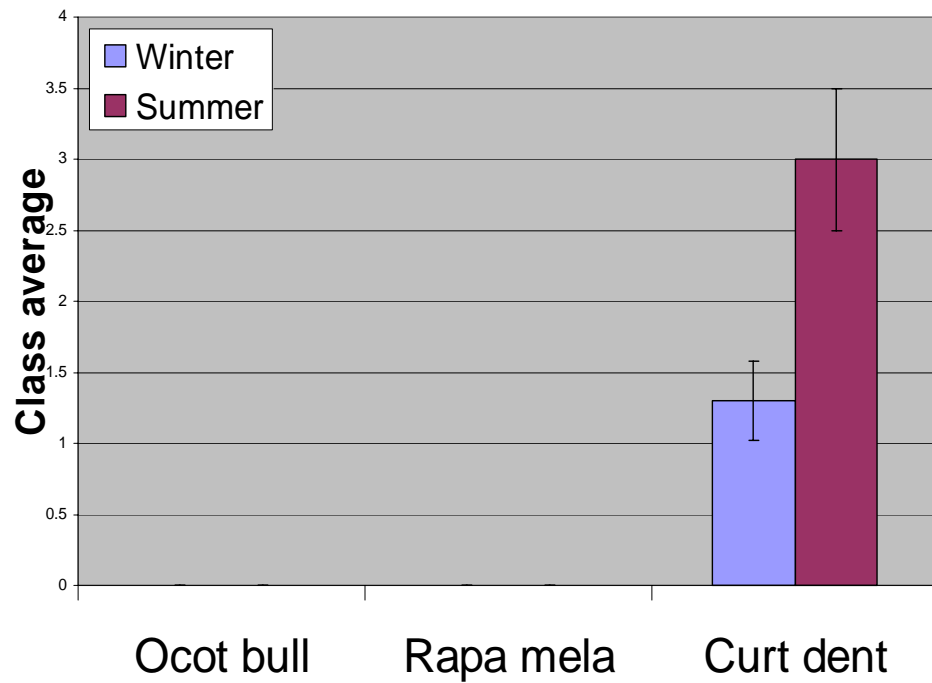
2 = 11 – 20%, etc.



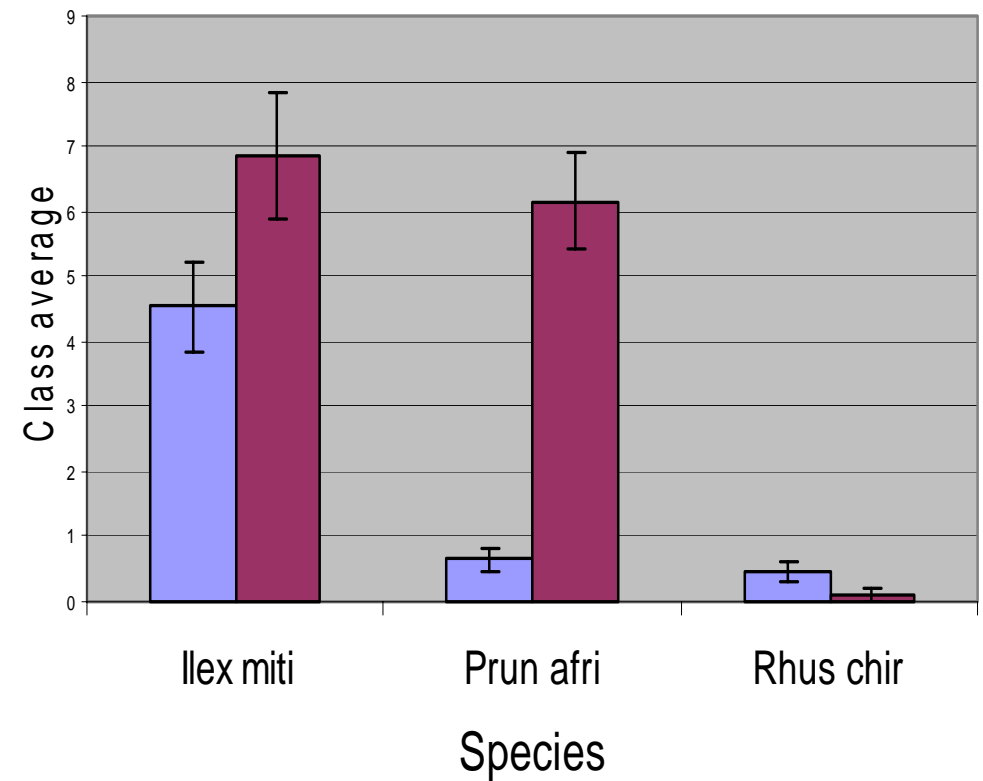
# Sheet growth (%)



36 months



12 months



# Fungal growth

- Recorded percentage of wound edge with edge growth (% classes)

0 = no fungal growth

1 = 1 – 10%

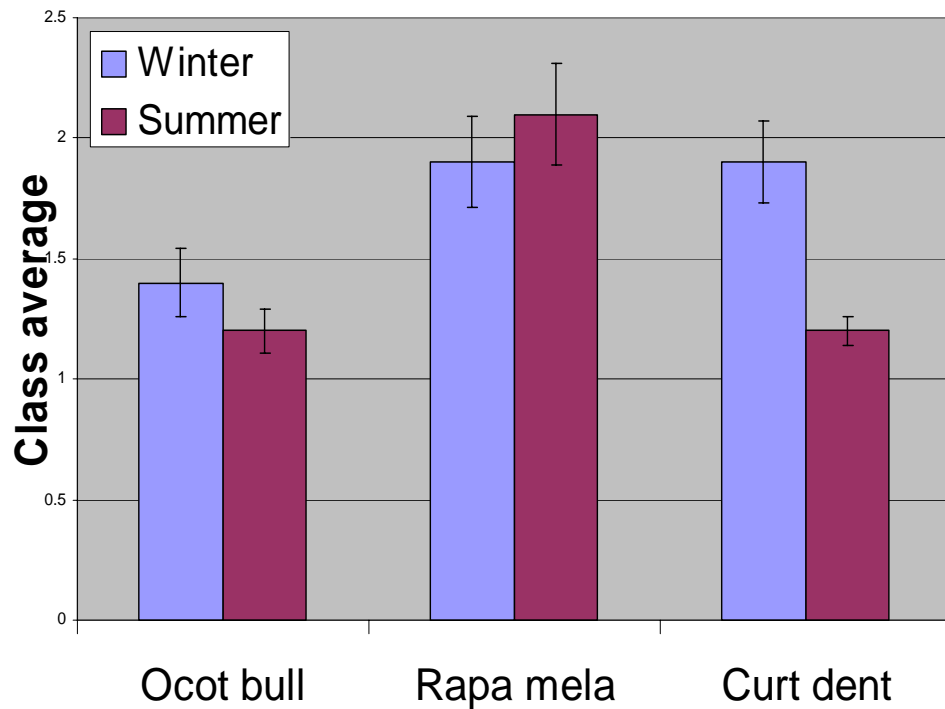
2 = 11 – 20%, etc.



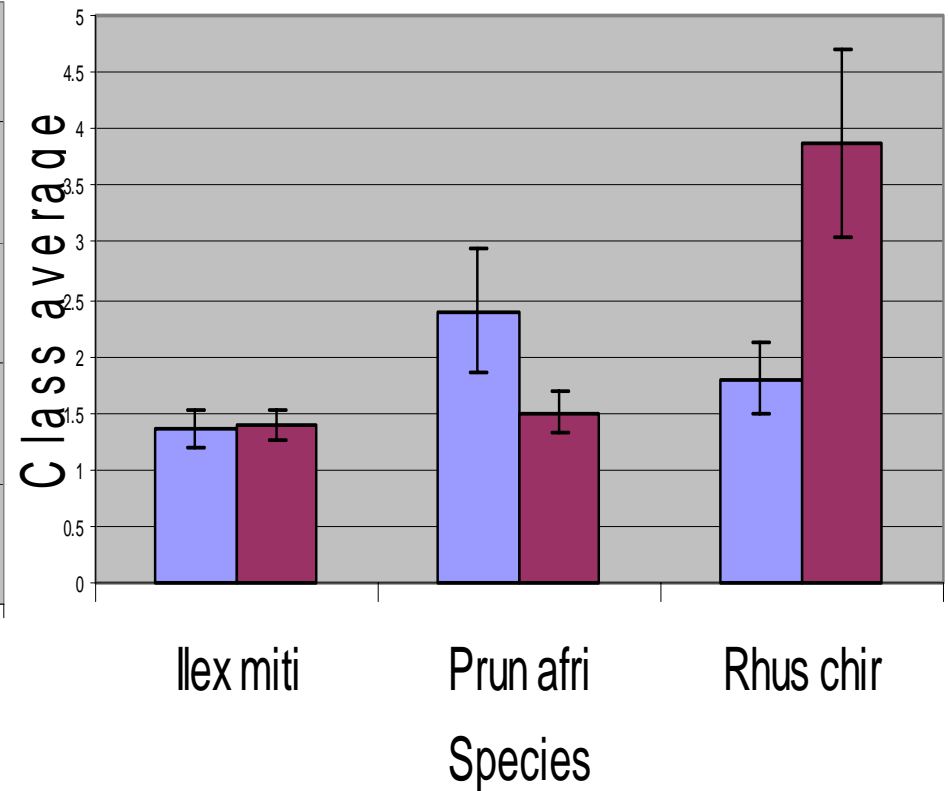
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# Fungal growth (%)

36 months



12 months



# Insect attack

- Pinhole classes

1 = 1 – 2

2 = 3 – 5

3 = 6 – 10

4 = 11 – 20

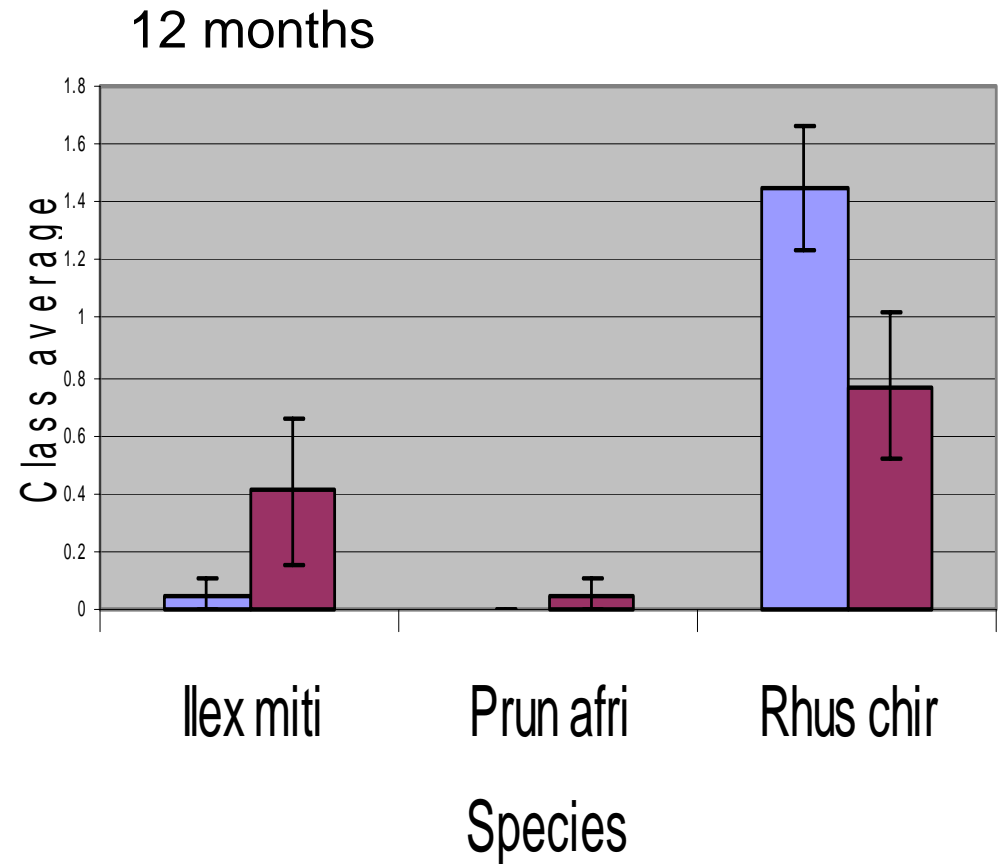
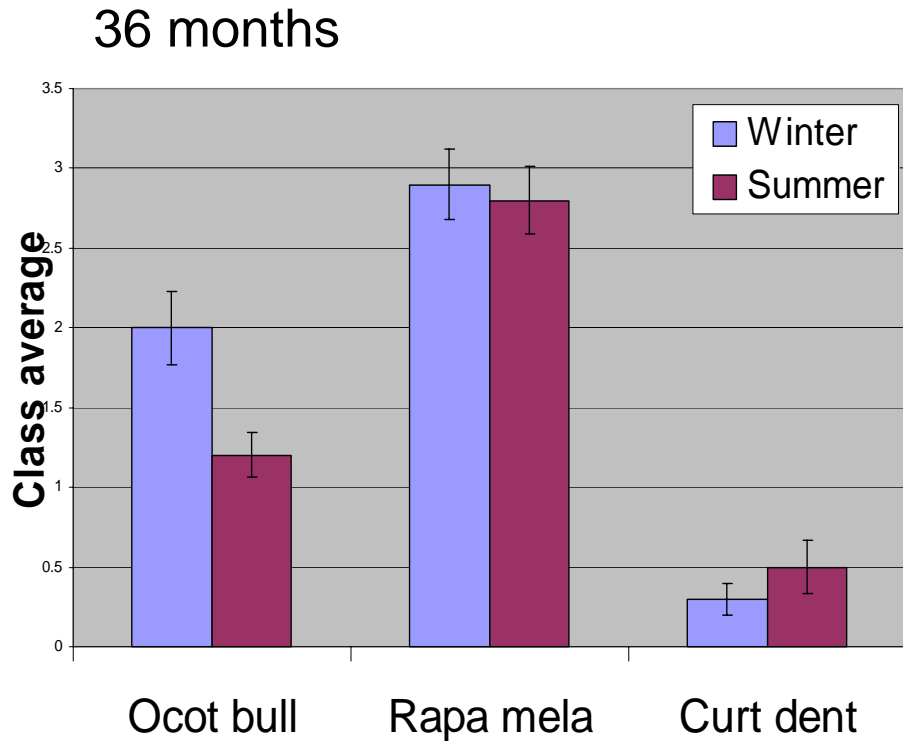
5 = 21+

- Damage other than small pinholes also recorded



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# Insect damage (pinhole classes)



Consistent with % of trees with that suffered insect damage

# Tree response: Summary

- **No** wound closure
- Wound closure through **edge**
- Wound closure through **sheet** growth
- Different **rates** of wound closure
- Varying degrees of susceptibility to **fungus** and **insect** attack

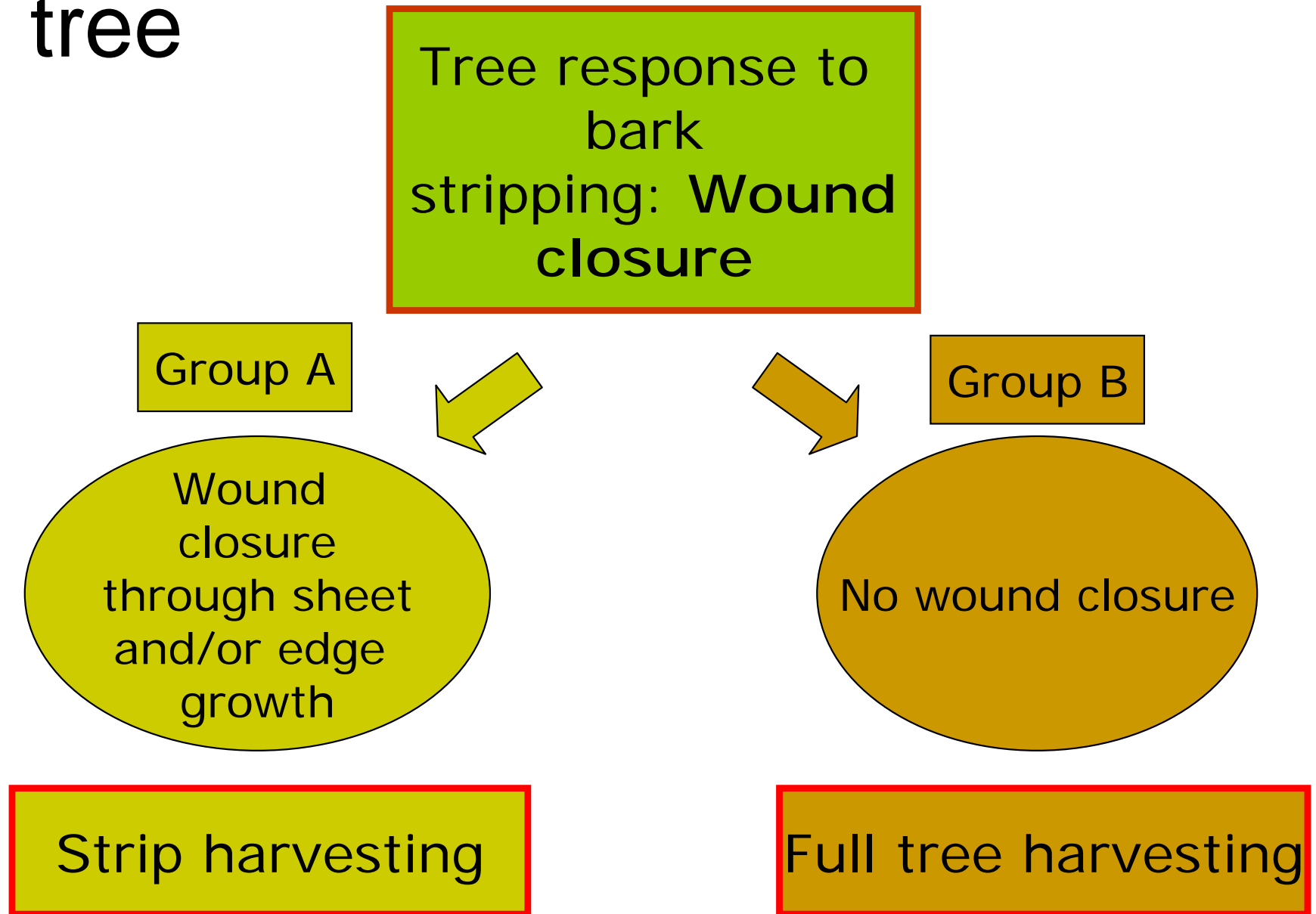


# Approach with development of harvest system

- **Group species** together based on their response to bark stripping
- Develop **harvest prescriptions** for species groups
- Objective way
- **Decision tree**



# Decision tree

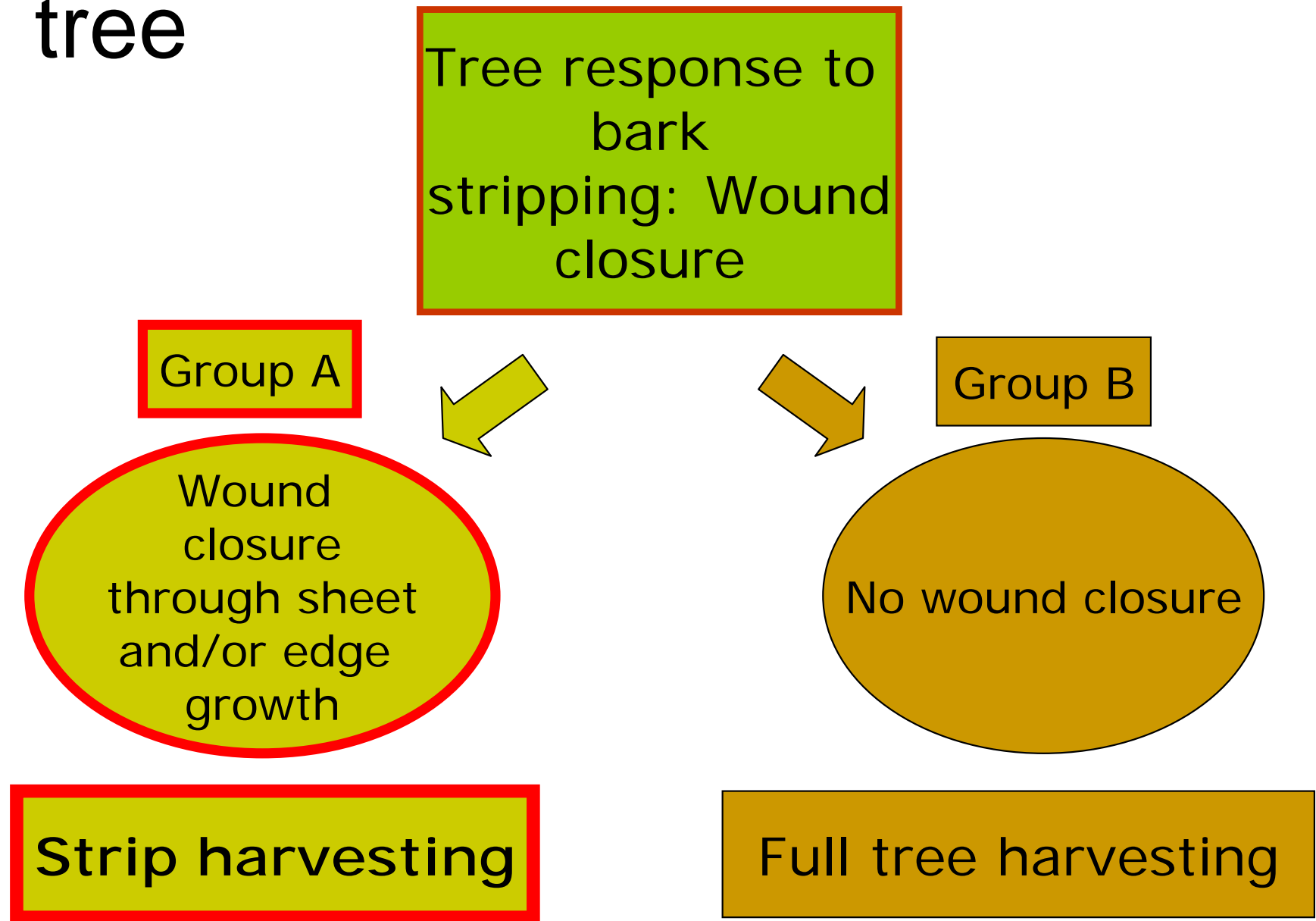


# Full tree harvesting

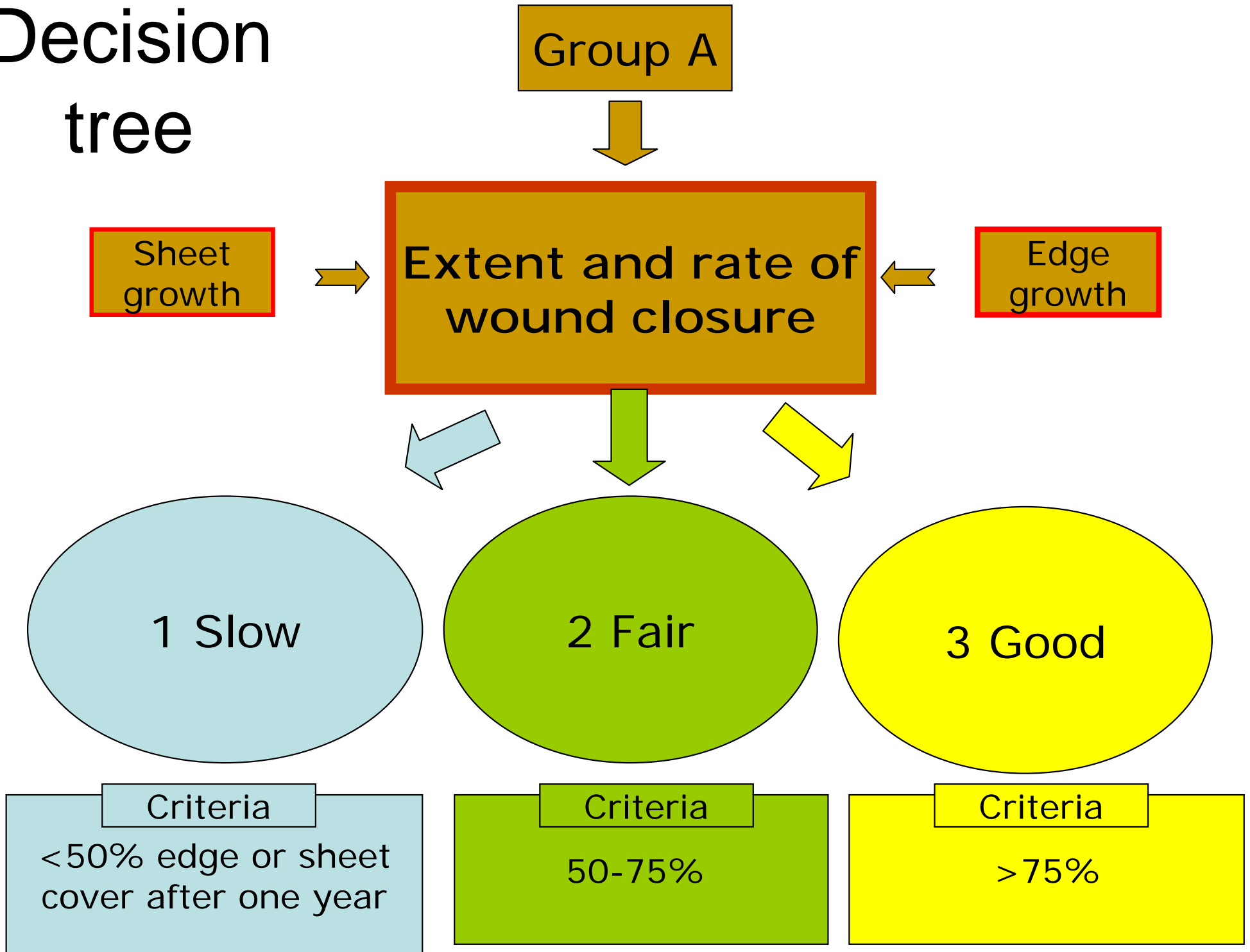
- **Sustainable felling of trees** for bark harvesting
- Harvesting of bark from stem and branches
- Could also be applied to species identified for strip harvesting, especially **commercial bark harvesting**
- **Timber yield regulation system**
  - Growing stock inventory
  - Rate of turnover (ingrowth and mortality)



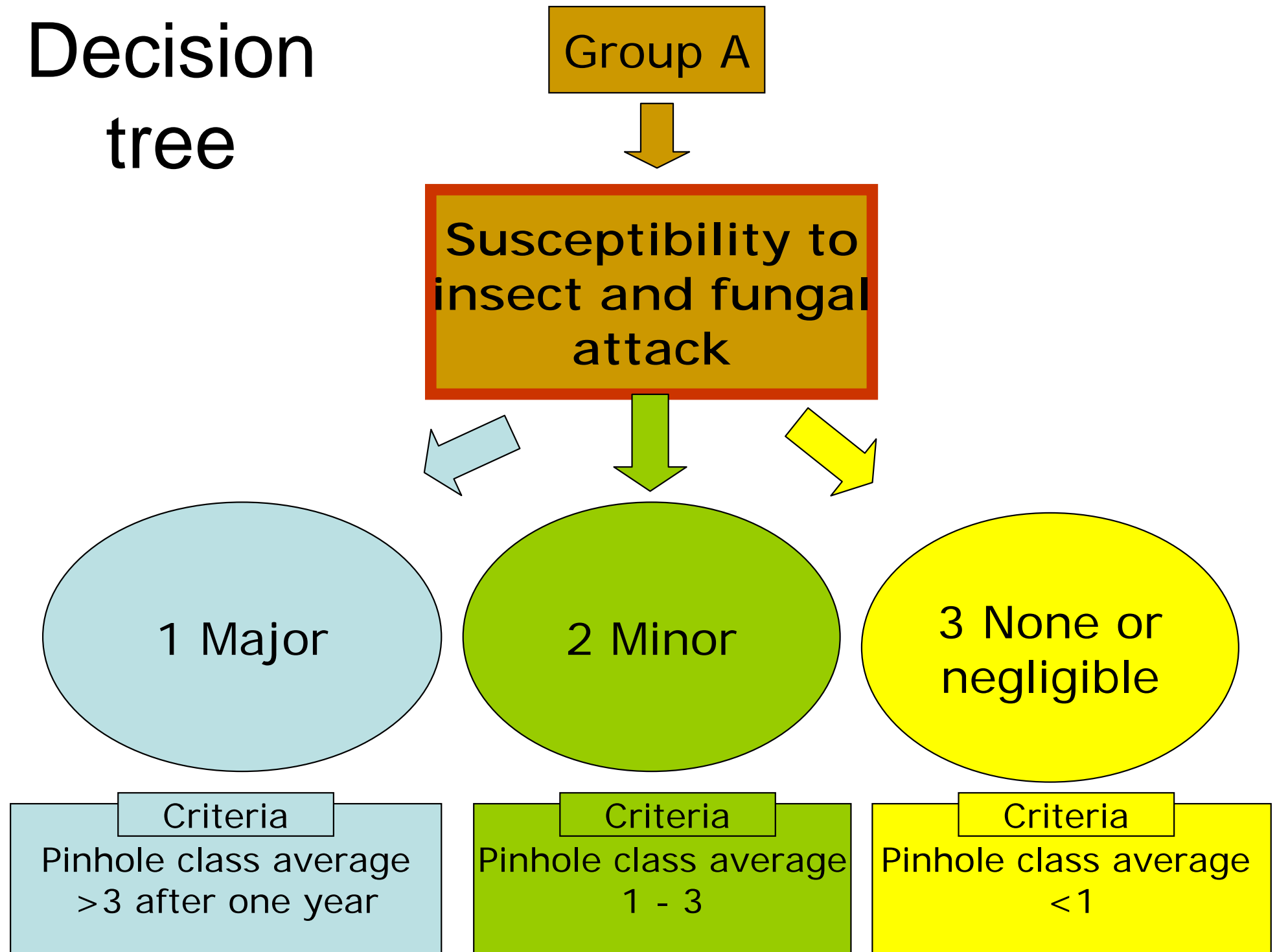
# Decision tree



# Decision tree



# Decision tree





# Development of harvest system

## Consider both

- the rate of **wound closure** and
- susceptibility to **insect and fungal attack**

in the selection of a harvest system

**Practical to apply**




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# Selection of harvest system



		Insect and Fungal attack		
				
		1 Major	2 Minor	3 None
Wound closure	None	Full tree harvesting	Full tree harvesting	Full tree harvesting
	1 Slow	Full tree harvesting	Full tree harvesting	Strip harvesting
	2 Fair	Full tree harvesting	Strip harvesting	Strip harvesting
	3 Good	Strip harvesting	Strip harvesting	Strip harvesting

# Selection of harvest system

		Insect and Fungal attack		
				
		1 Major	2 Minor	3 None
Wound closure	None	Full tree harvesting	Full tree harvesting	Full tree harvesting
	1 Slow	Full tree harvesting	Full tree harvesting	Strip harvesting
	2 Fair	Full tree harvesting	Strip harvesting	Strip harvesting
	3 Good	Strip harvesting	Strip harvesting	Strip harvesting





# Buffer zone species

Factors to be taken into consideration with final allocation to harvest system

Bark lift  
Agony shoots  
Excretions  
Other damage



# Allocation of species: Southern Cape Forest

		Insect and/or Fungal damage 		
		1 Major	2 Minor	3 None
Wound closure 	None	<i>Rapanea melanophloeos</i>	<b>FULL-TREE HARVESTING</b>	
	1 Slow		<i>Rhus chirindensis</i>	<b>BUFFER ZONE</b>
	2 Fair		<i>Curtisia dentata</i> <i>Ilex mitis</i>	
	3 Good		<b>STRIP HARVESTING</b>	<i>Ocotea bullata</i> <i>Prunus africana</i>

# Harvest prescriptions for strip harvesting

- **Strip width**
- Strip length
- **Harvest rotation**
- Number of strips
- Side of tree
- Harvest season
- Tree diameter
- **Percentage of growing stock**
- Harvest method



No fixed way of formulating prescriptions

# Harvest rotation and strip width

- **Rotation should allow for wound closure**
- Trade-off
  - The **wider the strip width, the longer the harvest rotation** and *vice versa*
  - Major insect/fungal damage: Short rotation
- Indigenous knowledge



# Harvest prescriptions: Strip width (edge growth), harvest percent and rotation

		Insect and/or Fungal damage 		
		1 Major	2 Minor	3 None
Wound closure 	None	FULL TREE HARVESTING		
	1 Slow			5cm strip 33% of stock
	2 Fair		5cm strip 33% of stock	10 cm strip 50% of stock
	3 Good	5cm strip 33% of stock	10 cm strip 50% of stock	10 cm strip 66% of stock

- ❑ Harvest rotation should allow for wound closure
- ❑ Strip width for sheet growth could be proportional to tree diameter

# Monitoring and revision

- **Long-term impact** of bark harvesting on tree survival not yet known
- **Monitoring** of harvest impact and tree response to bark stripping
- **Refine harvest prescriptions** as part of an adaptive management approach
- For species for which no research results are available: use available knowledge



# Alternative resources / management options

- **Coppice management** (for species with active coppice regrowth)
- Establishment of **forest stands** for bark harvesting (on forest edge, in forest clearings)
- Cultivation for **leaf harvesting** (where active compounds are also present in the leaves)
- Integrated resources use (e.g. **bark as by-product** of timber harvesting)
- In consultation with **stakeholders**



# Response of woodland species



*Brachystegia* spp.



# Woodland species



# Woodland species (Syampungani 2005)

Species	Bark recovery
<i>Albizia adianthifolia</i>	Very good
<i>Julbernardia paniculata</i>	Good
<i>Pseudolachnostylis maprouneifolia</i>	Good
<i>Pterocarpus angolensis</i>	Good
<i>Dalbergia nitidula</i>	Good (M) / Poor (Z)
<i>Parinari curatellifolia</i>	Poor (M) / Good (Z)
<i>Brachystegia bussei</i>	Poor
<i>B. spiciformis</i>	Very poor (M) / Good (Z)
<i>Elaeodendron transvaalense</i>	None
<i>J. globiflora</i>	None

# Relevance to KNP

- Unsustainable use has **socio-economic implications** (apart from environmental)
- What happens outside the park could eventually also impact on achieving management objectives inside the park
- Kruger Park Traditional Healer's Programme (1994)



# Acknowledgements

- UK Department for International Development – Forestry Research Programme
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