AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

The Irish Agriculture and Food Development Authority

NDP
National Development Plan 2007 - 2013

COFORD
NATIONAL COUNCIL FOR FOREST RESEARCH & DEVELOPMENT

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

Silviculture of broadleaves for quality timber

Dr Ian Short

Jerry Campion

Teagasc Forestry Development Dept.

Ashtown Research Centre, Dublin 15

B-SilvRD
Broadleaf Silviculture Research and Development

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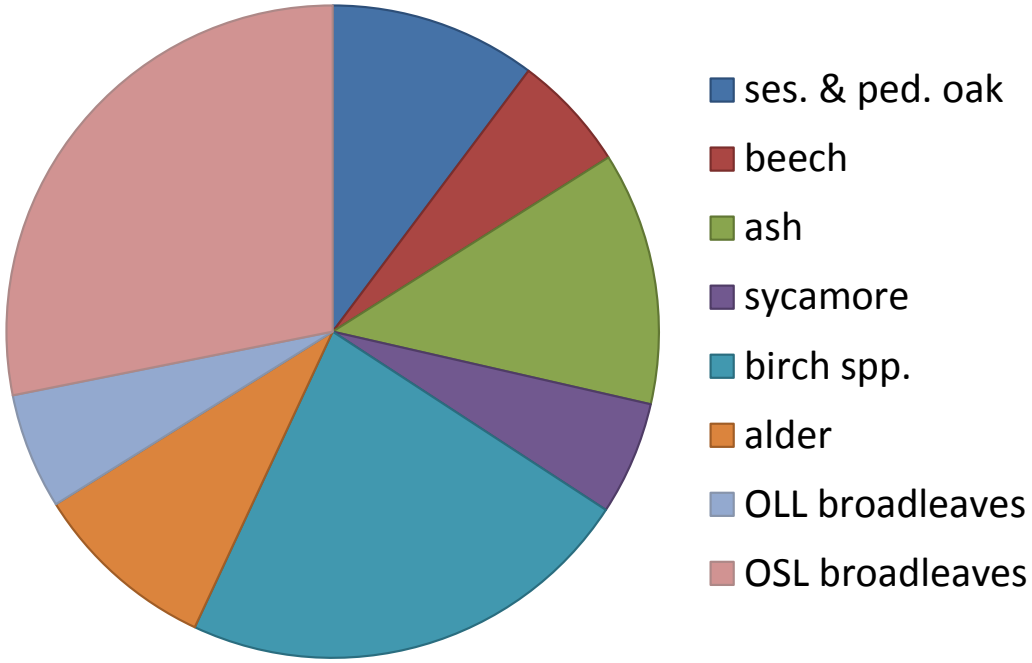
Overview of presentation

- Broadleaves in Ireland
- Age profile
- Why silviculture is important

- Silviculture
  - Species choice
  - Microclimate
  - Formative shaping
  - Pruning
  - Thinning
- Remedial silviculture
  - Systems

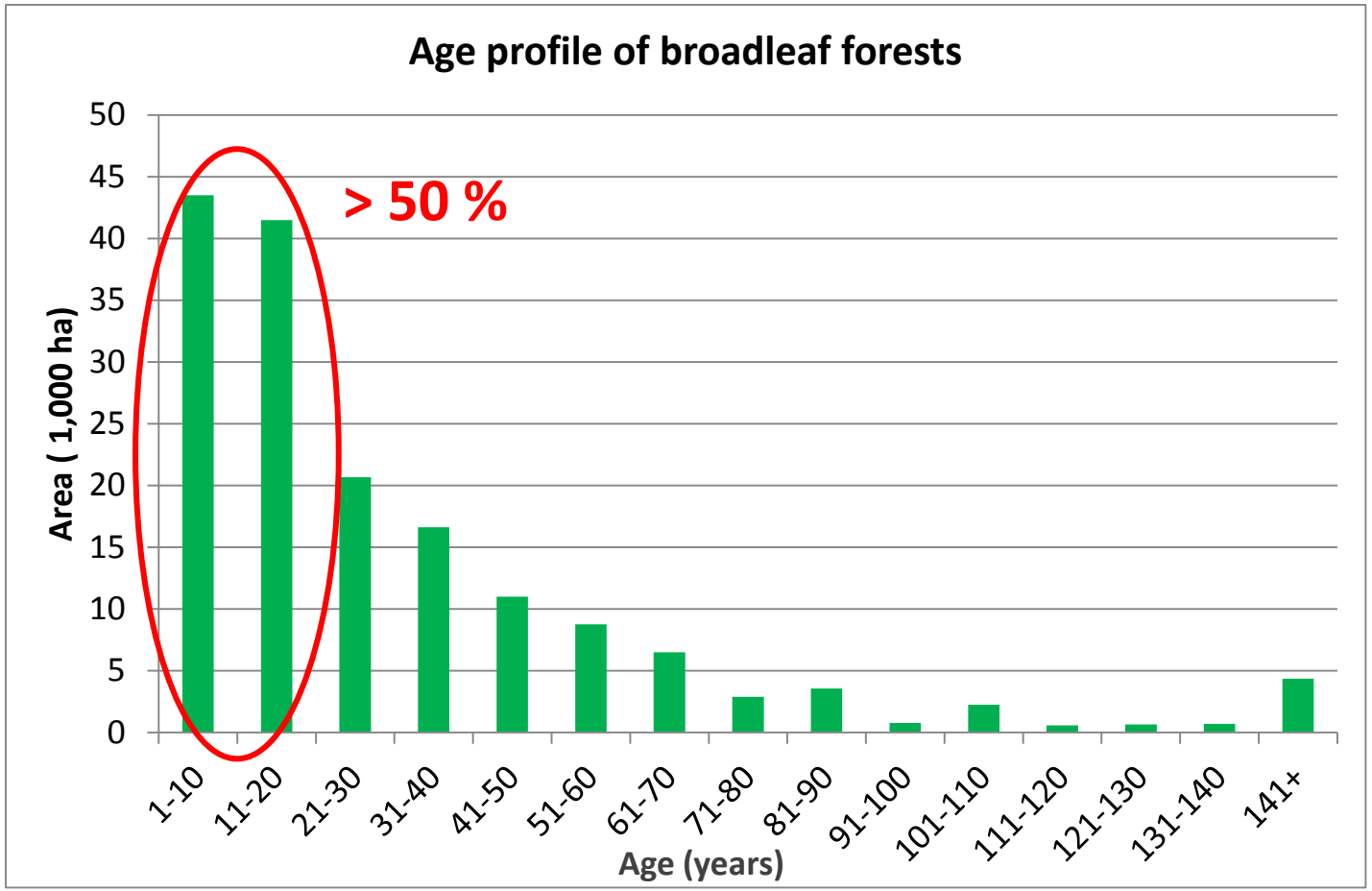
Broadleaf estate

- Broadleaves = 26% of forest estate

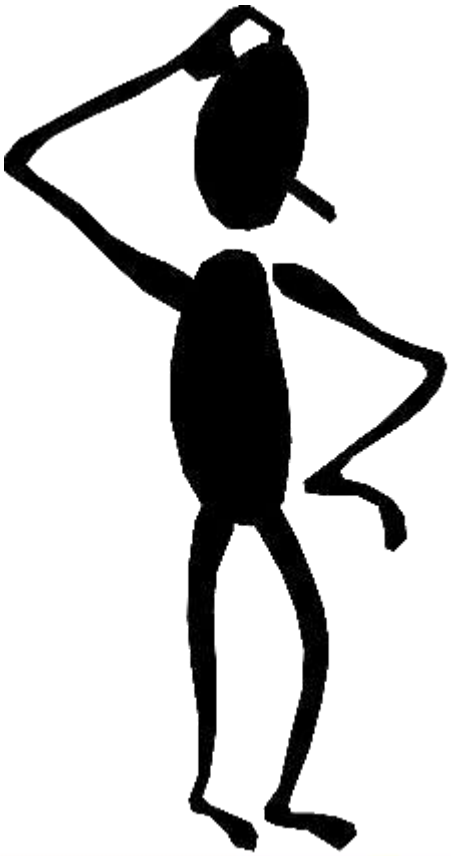


- Ash = 12.5%
- Oak = 10%
- Beech = 6%
- Sycamore = 5.5%
- Alder + birch = > 30% of broadleaves

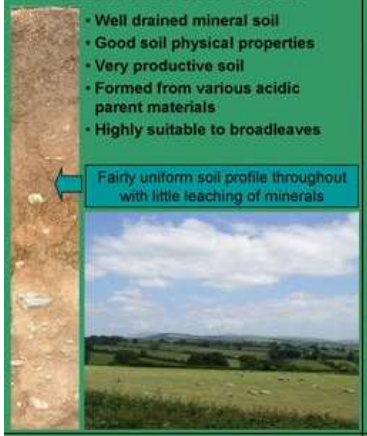
Age profile


Age profile of broadleaf forests
> 50 %
Area (1,000 ha)
50
45
40
35
30
25
20
15
10
5
0
1-10
11-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
91-100
101-110
111-120
121-130
131-140
141+
Age (years)

Soil



Acid brown earth



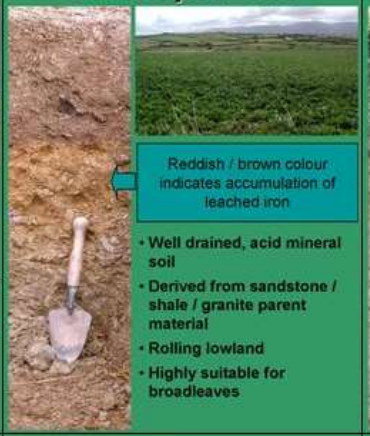
- Well drained mineral soil
- Good soil physical properties
- Very productive soil
- Formed from various acidic parent materials
- Highly suitable to broadleaves

Fairly uniform soil profile throughout with little leaching of minerals

Brown earth (high base)

- Well drained mineral soil
- Possess desirable soil physical characteristics
- Formed from lime-rich, calcareous parent materials
- Little leaching or translocation of elements in the soil profile
- High pH may limit use range for certain tree species

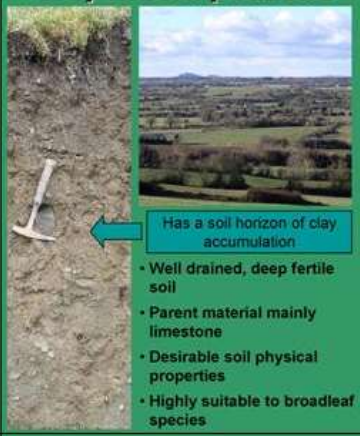
Brown podzolic



Reddish / brown colour indicates accumulation of leached iron

- Well drained, acid mineral soil
- Derived from sandstone / shale / granite parent material
- Rolling lowland
- Highly suitable for broadleaves

Grey brown podzolic



Has a soil horizon of clay accumulation

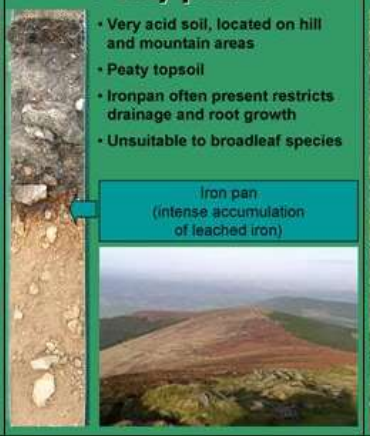
- Well drained, deep fertile soil
- Parent material mainly limestone
- Desirable soil physical properties
- Highly suitable to broadleaf species

Podzol

Horizon of leached minerals

- Well drained acid mineral soil
- Subject to intense leaching of minerals
- Have a distinct leached soil horizon
- Located mainly on hill-land areas
- Limited to certain species e.g. birch

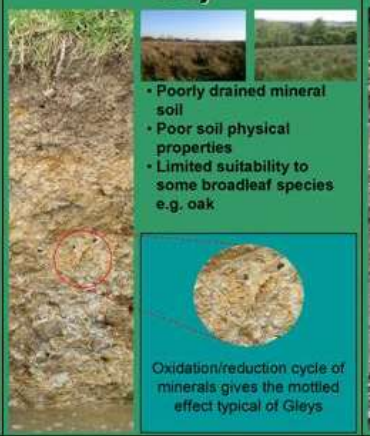
Peaty podzol



- Very acid soil, located on hill and mountain areas
- Peaty topsoil
- Ironpan often present restricts drainage and root growth
- Unsuitable to broadleaf species

Iron pan (intense accumulation of leached iron)

Gley



- Poorly drained mineral soil
- Poor soil physical properties
- Limited suitability to some broadleaf species e.g. oak

Oxidation/reduction cycle of minerals gives the mottled effect typical of Gleys

Peaty gley

- Poorly drained soil with peaty topsoil
- Poor soil physical properties
- Suitable mainly to spruce species
- Unsuitable to broadleaf species

Rendzina

Shallow topsoil directly above parent material

- Well drained, shallow (<50cm), mineral soils
- Very dark soils with high lime content
- Derived from limestone bedrock or limestone sands and gravels
- Often limited in their use range by shallow depth and high pH

Lithosol

- Skeletal stony mineral soils (often organic in nature)
- Normally overlying solid or shattered bedrock
- Located mainly in areas of high elevation
- Bare rock outcrops at frequent intervals
- Unsuitable for broadleaves
- Often located in important aesthetic and amenity areas

Peat

Cutover Basin peat

Basin peat

Cutover Blanket peat

- Characterised by a high level of organic matter
- Very high moisture content
- Two main types: Basin and Blanket
- Cutover and drained Basin peat suitable to some broadleaf species

Toddy Radford

Ian Short

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Soil

Acid brown earth

- **Well drained mineral soil**
- **Good soil physical properties**
- **Very productive soil**
- **Formed from various acidic parent materials**
- **Highly suitable to broadleaves**

Fairly uniform soil profile throughout with little leaching of minerals

Podzol

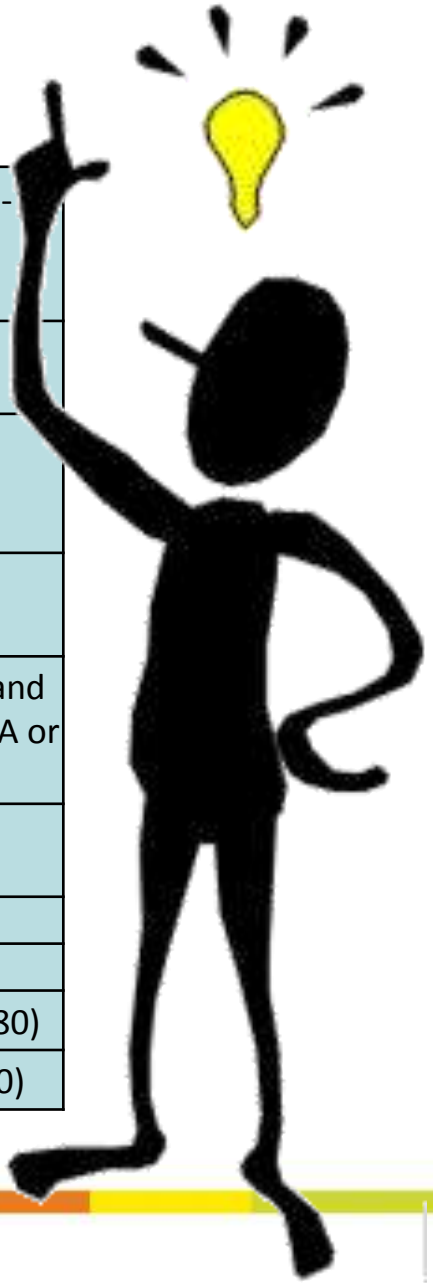
Horizon of leached minerals

- **Well drained acid mineral soil**
- **Subject to intense leaching of minerals**
- **Have a distinct leached soil horizon**
- **Located mainly on hill-land areas**
- **Limited to certain species e.g. birch**

Species choice – soil type

Species	Soil type: A	B	C	D	J	K	L	M	P	Q
Alder (common)										
Alder (grey)										
Alder (Italian)										
Ash										
Beech (European)										
Beech (Southern)										
Birch (downy)										
Birch (silver)										
Cherry										
Hornbeam										
Lime										
Maple (Norway)										
Oak (pedunculate)										
Oak (red)										
Oak (sessile)										
Rowan										
Spanish chestnut										
Sycamore										

A	Alkaline brown earth and free-draining deep grey-brown podzolics
B	Acid brown earths and brown podzolics
C	Rendzinas/shallow brown earths/shallow grey-brown podzolics
D	Podzolics/peaty podzols +/- weakly developed iron pan
J	Gleys/peaty gleyw (mottled) and gleyed grey brown podzolics (A or B fertility)
K	Gleys/peaty gleys (blue/grey profile) (B fertility)
L	Gleys/peaty gleys (C fertility)
M	Flushed blanket peat
P	Cutaway raised bogs (post 1980)
Q	Cutaway raised bogs (pre 1980)



Redrawn from Horgan *et al.* (2003) A guide to forest tree species selection and silviculture in Ireland

Species choice – species characteristics

Species	Characteristic A	B	C	D	E	F	G	H	I
Alder (common)									
Alder (grey)									
Alder (Italian)									
Ash									
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Beech (Southern)									
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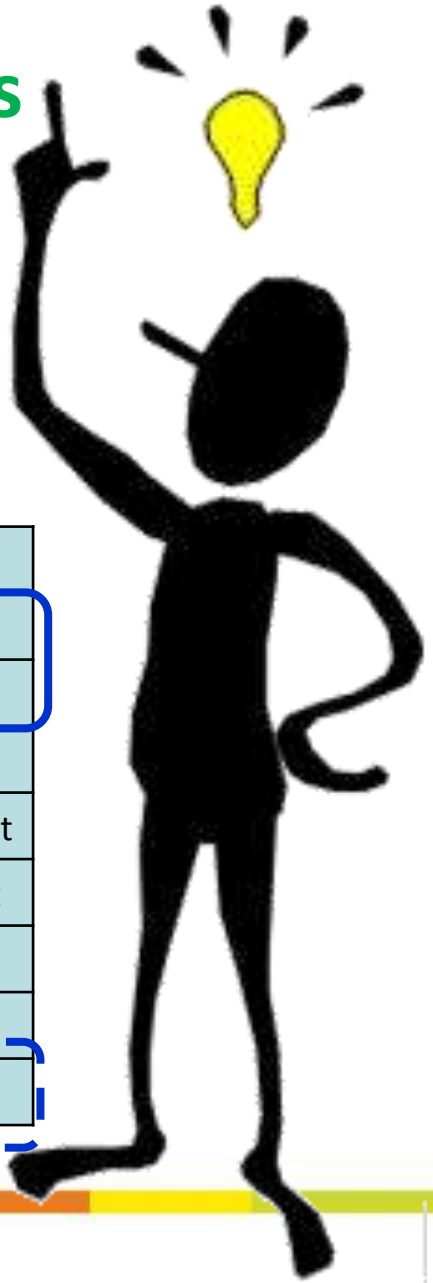
Birch (silver)									
Cherry									
Hornbeam									
Lime									
Maple (Norway)									
Oak (pedunculate)									
Oak (red)									
Oak (sessile)									
Rowan									
Spanish chestnut									
Sycamore									

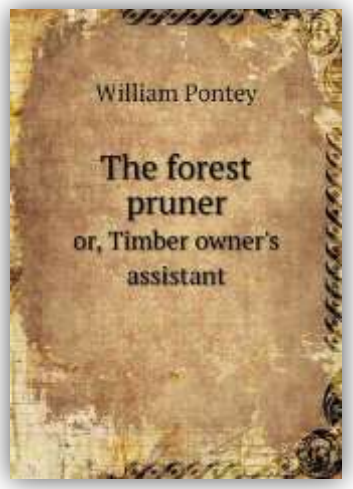
A	Easy to establish
B	Tolerant of spring frost
C	Tolerant of exposure
D	Tolerant of salt spray
E	Low moisture requirement
F	Low nutrient requirement
G	Shade bearer
H	Deep rooting depth
I	Soil improver



Redrawn from Horgan *et al.* (2003) A guide to forest tree species selection and silviculture in Ireland

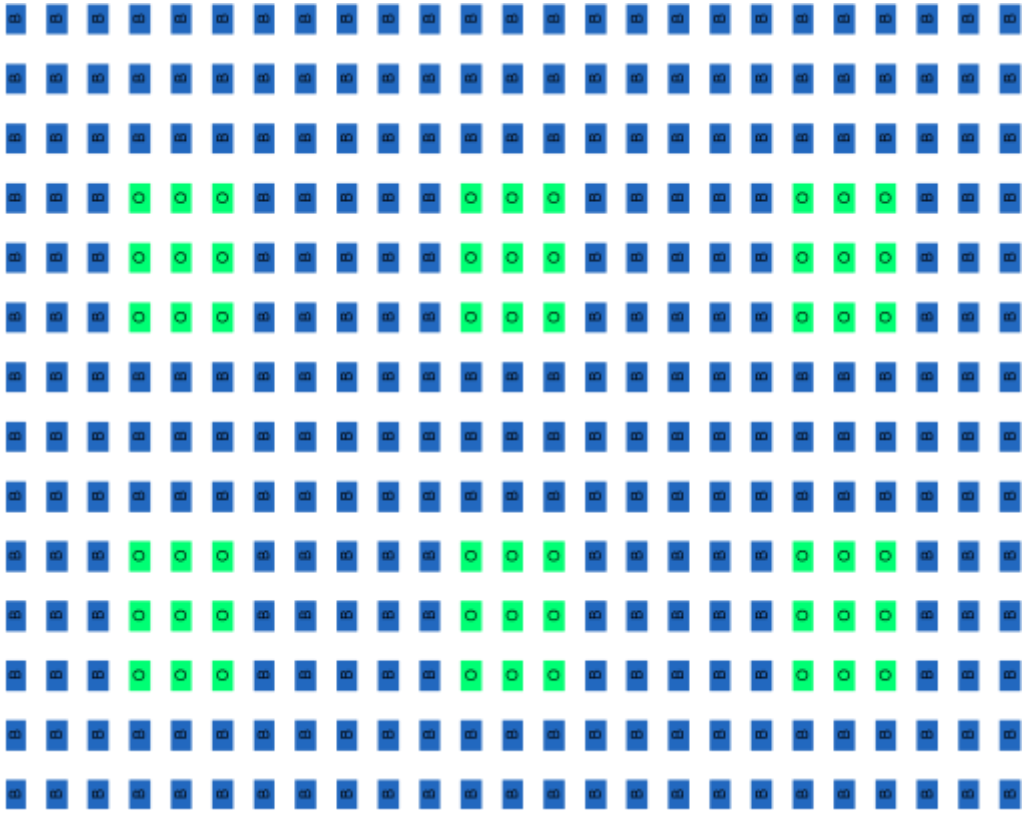
Mixtures

- If I were asked the abstract question,
  - "Which way can you *most* benefit plantations, at the *least* expense?"
- the answer would be –
  - "By SHELTER." Pontey, 1808; p. 190
- Establish shelter in advance of main crop?
- Nurse species
  - Stem form
  - Frost
  - Nutrition



Establishment of mixtures?

- Anderson Squares?
- Alternate lines?
- Bands?
- Intimate?
- How many species?
- Silviculture is more complex



Establishment

Spacing

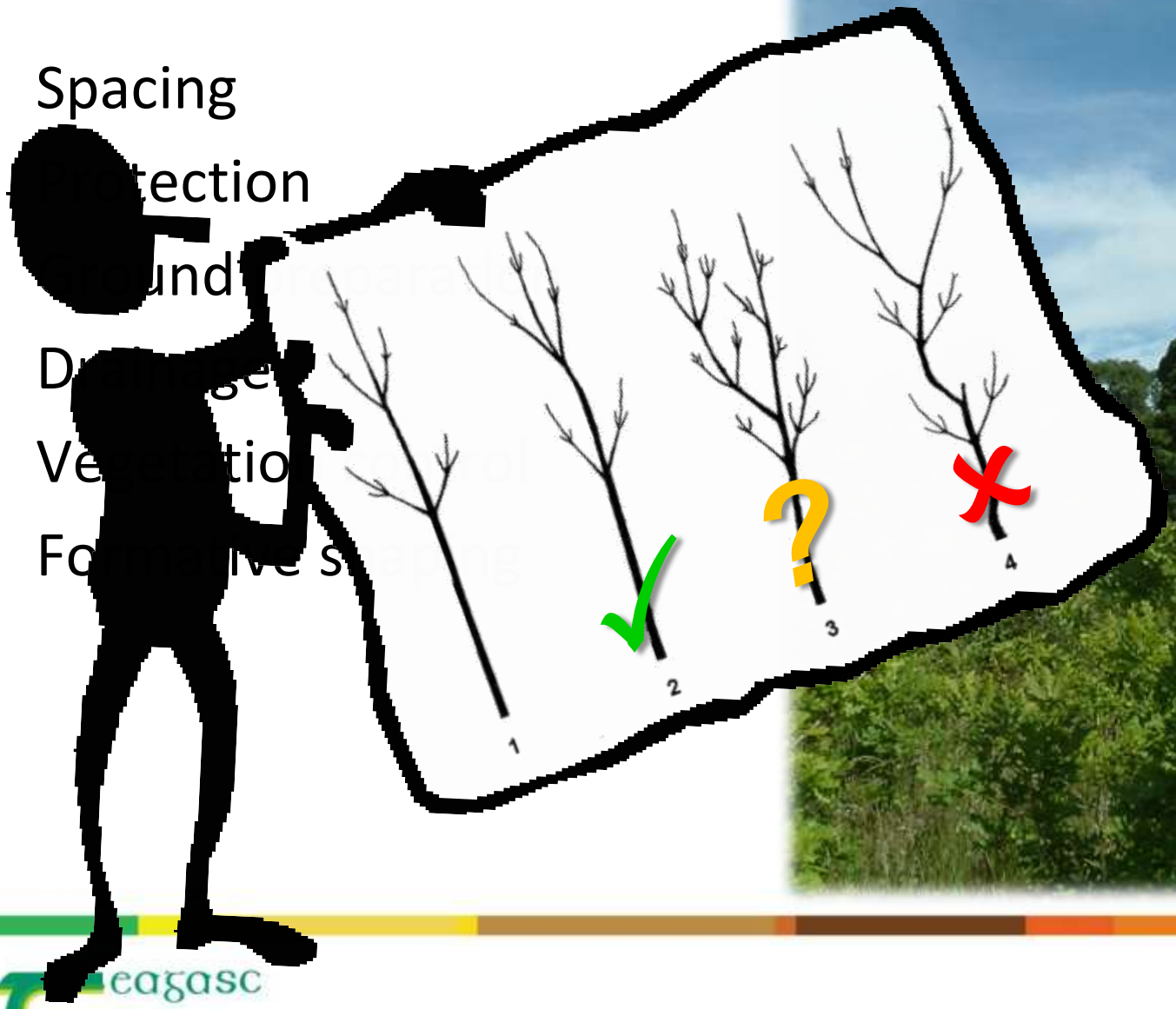
Protection

Ground preparation

Drainage

Vegetation control

Formative pruning



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Where's the timber value?

French oak

- 6 m = 85%
- 6-12 m = 11%
- Crown = 4%

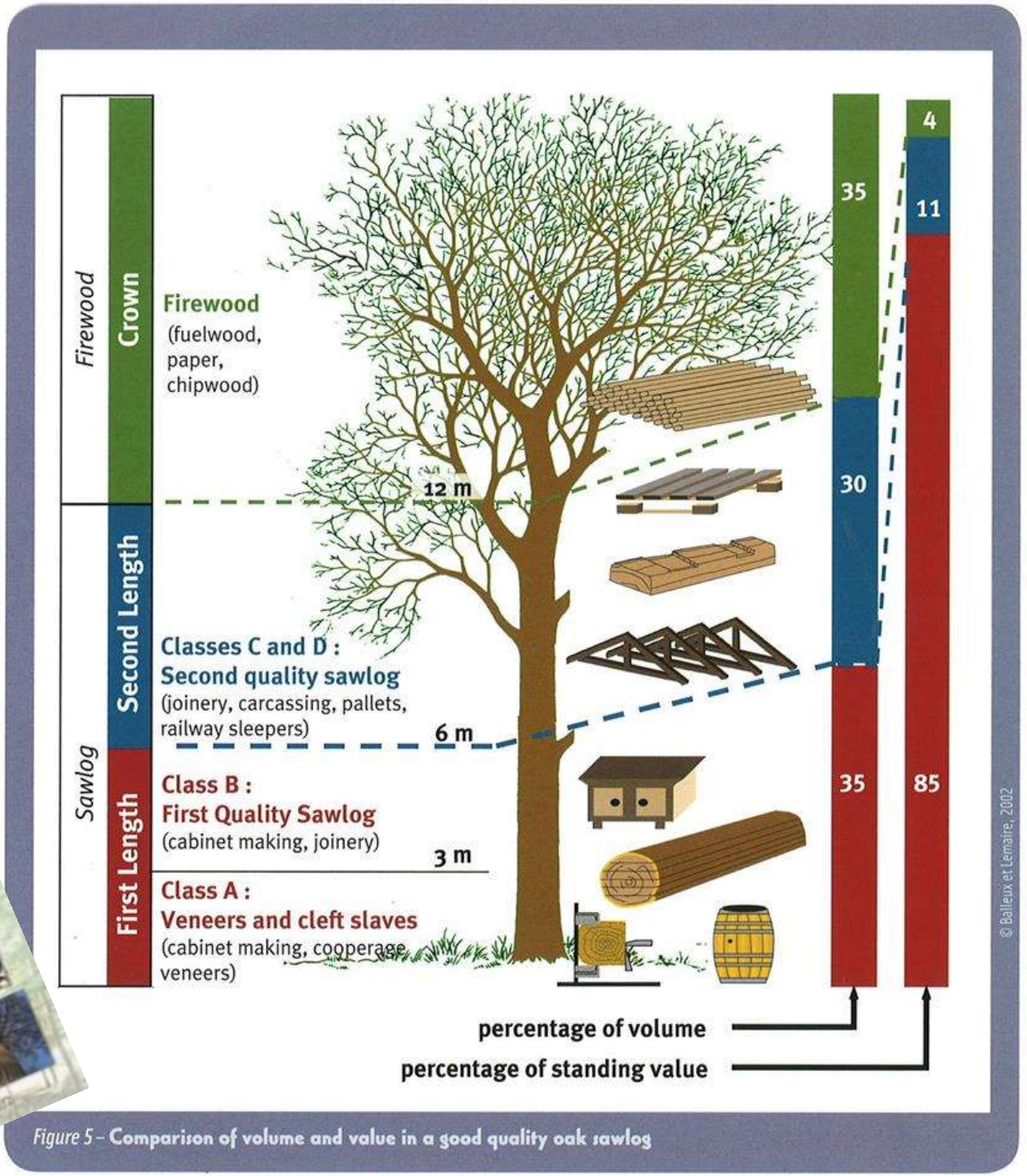

Figure 5 – **Comparison of volume and value in a good quality oak sawlog**

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Formative shaping / pruning

High pruning

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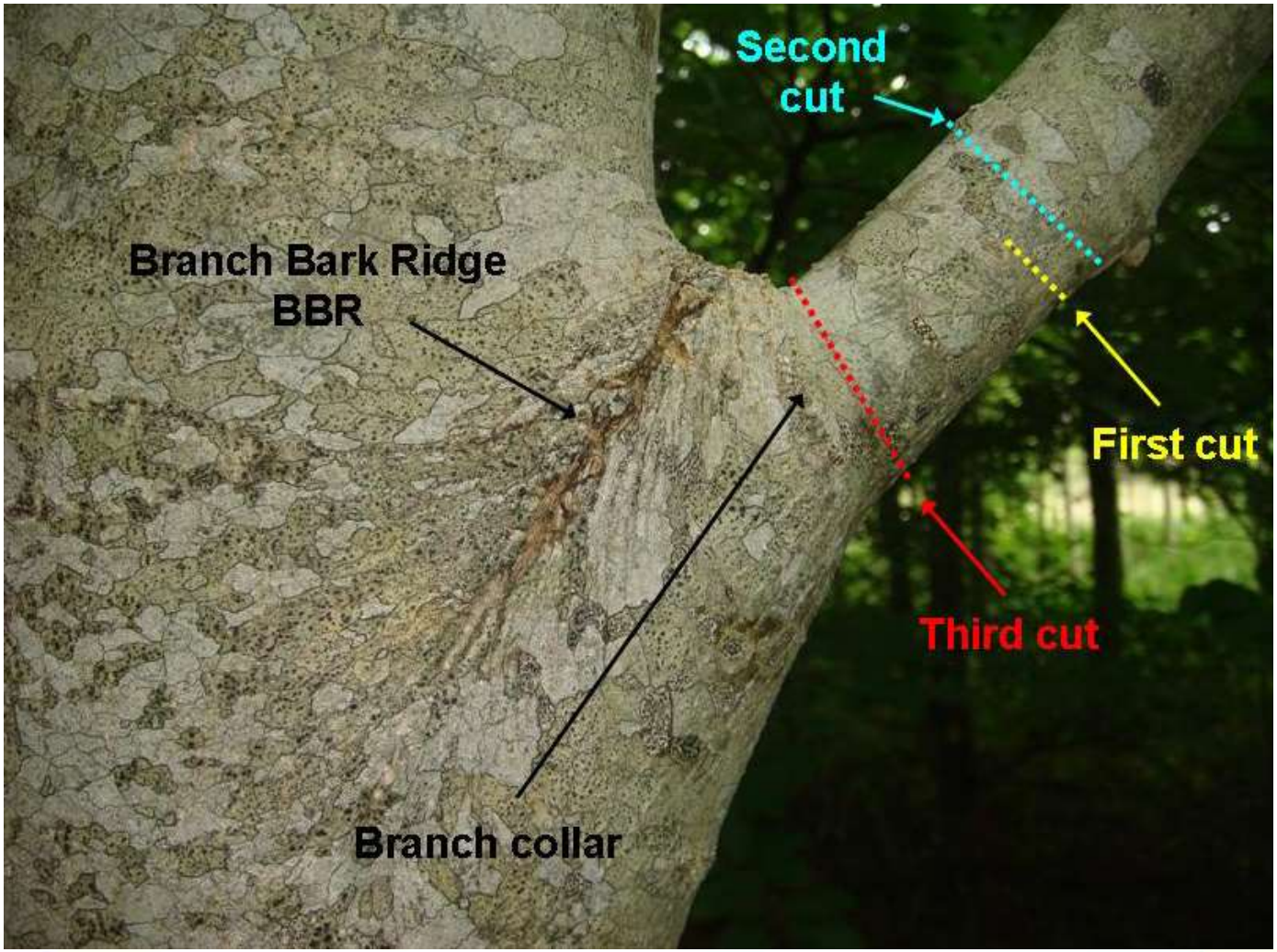
Pruning


Second cut
Branch Bark Ridge
BBR
First cut
Third cut
Branch collar


Pruned
Increased €€€
Pruned branch
Small defect core
Unpruned
Decreased €€€
Large defect core
Unpruned branch

Giuseppe Penone

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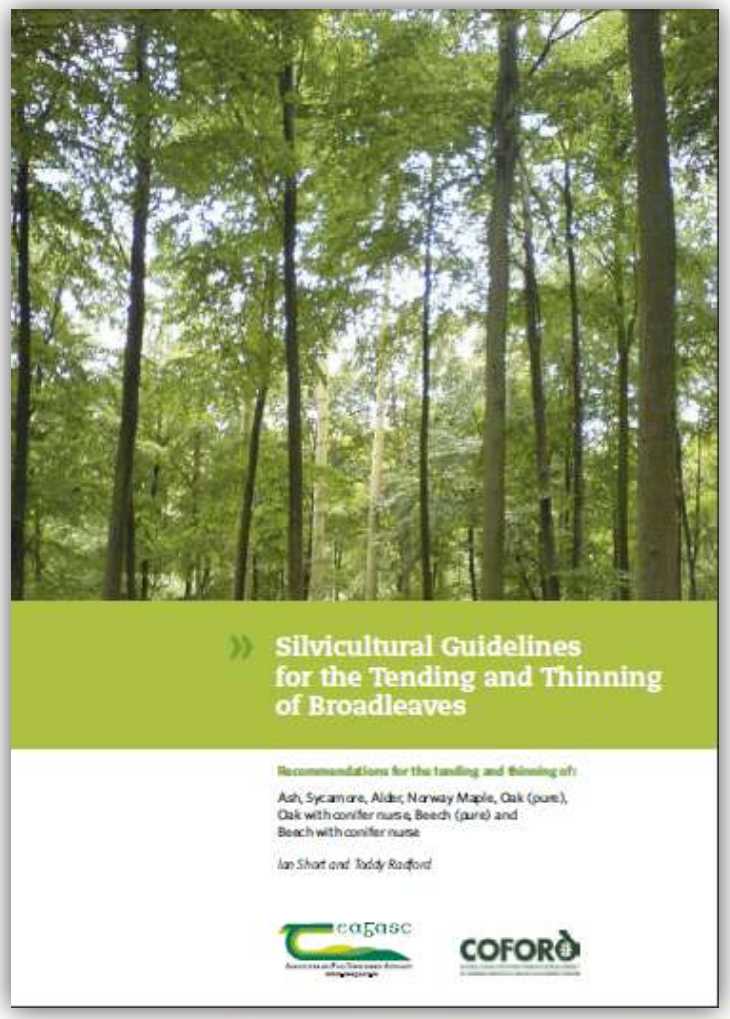
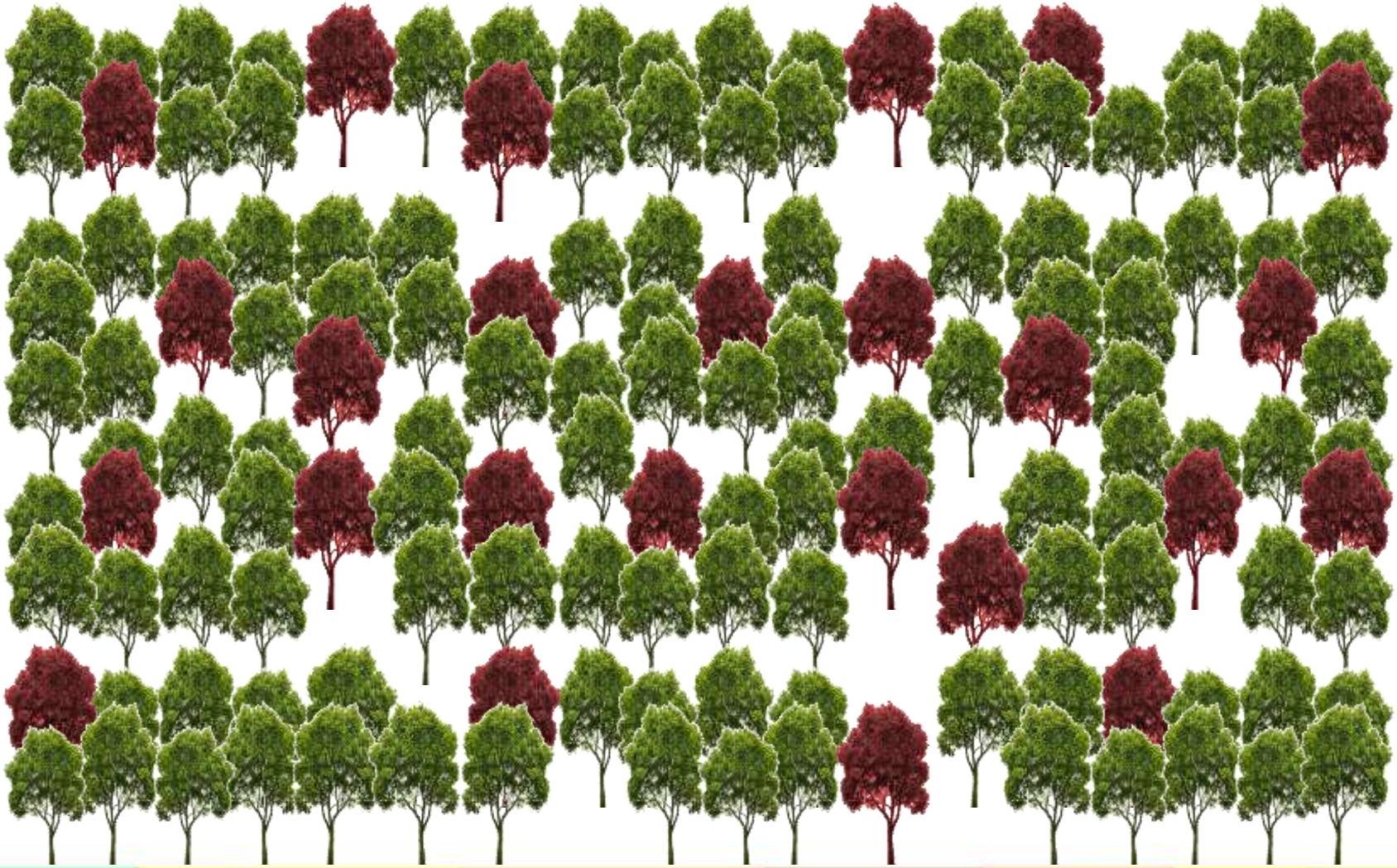
Later operations

- Access
  - Inspection paths
  - Roads
- Thinning
  - Racks
  - Selection of PCTs
  - Favour better trees



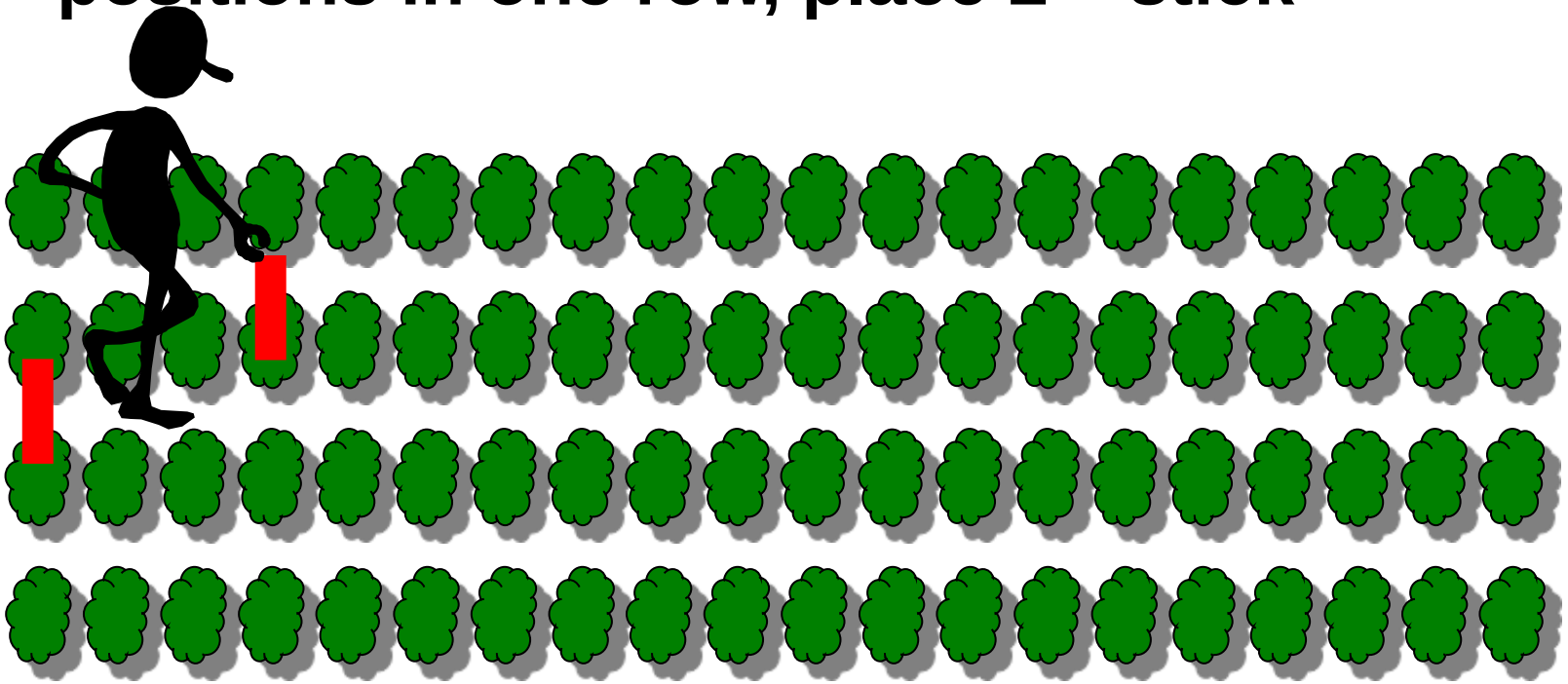
Rack and selection thinning

Rack and selection thinning



Ash / Syc 3,300 stems ha^{-1}

Place 1st stick at start, count 20 planting positions in one row, place 2nd stick



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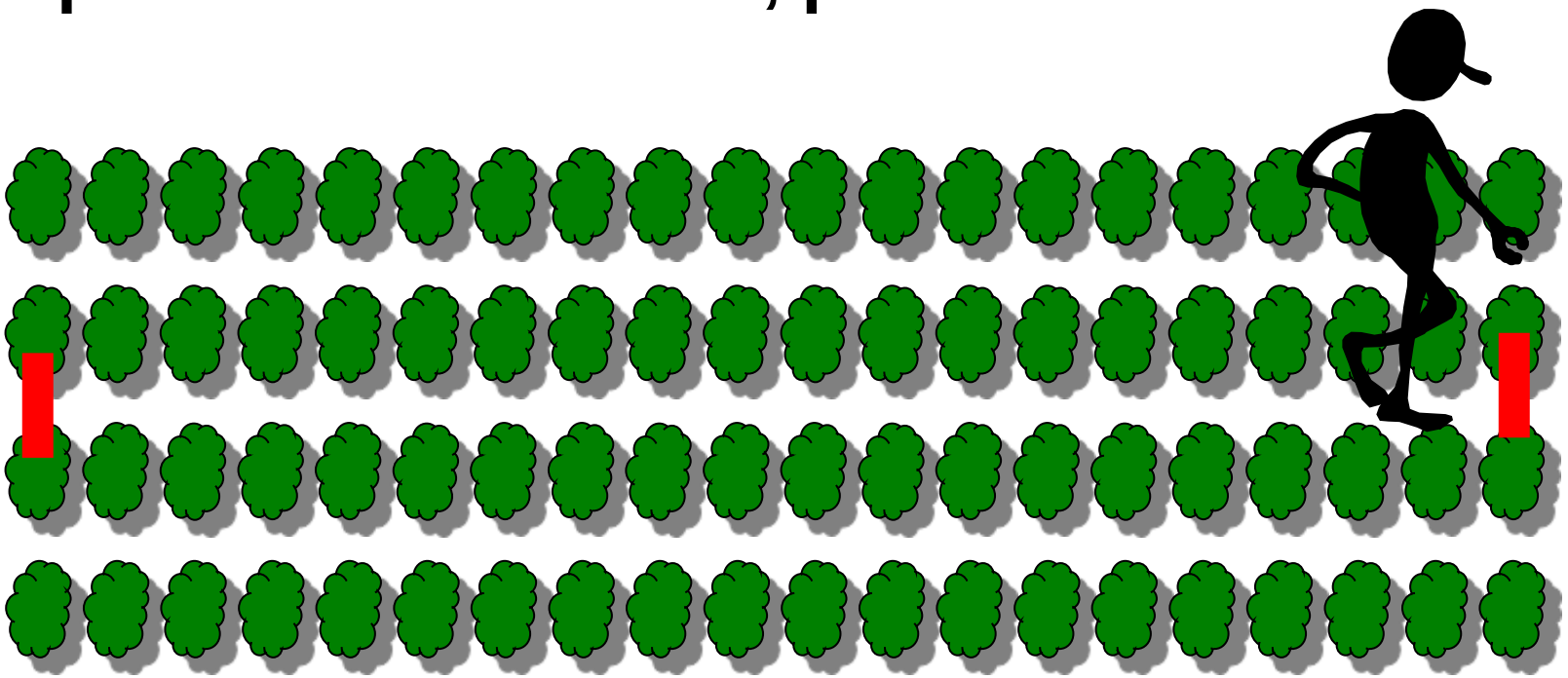
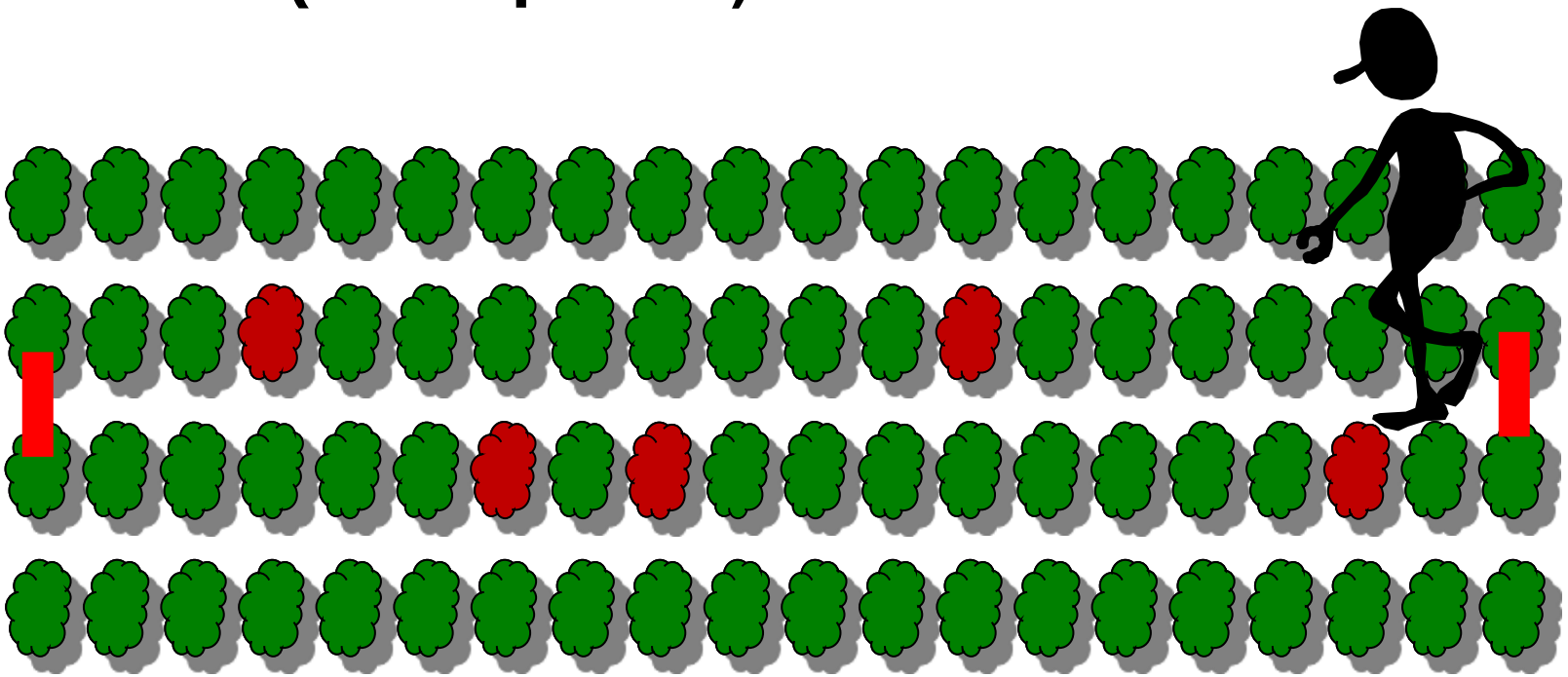


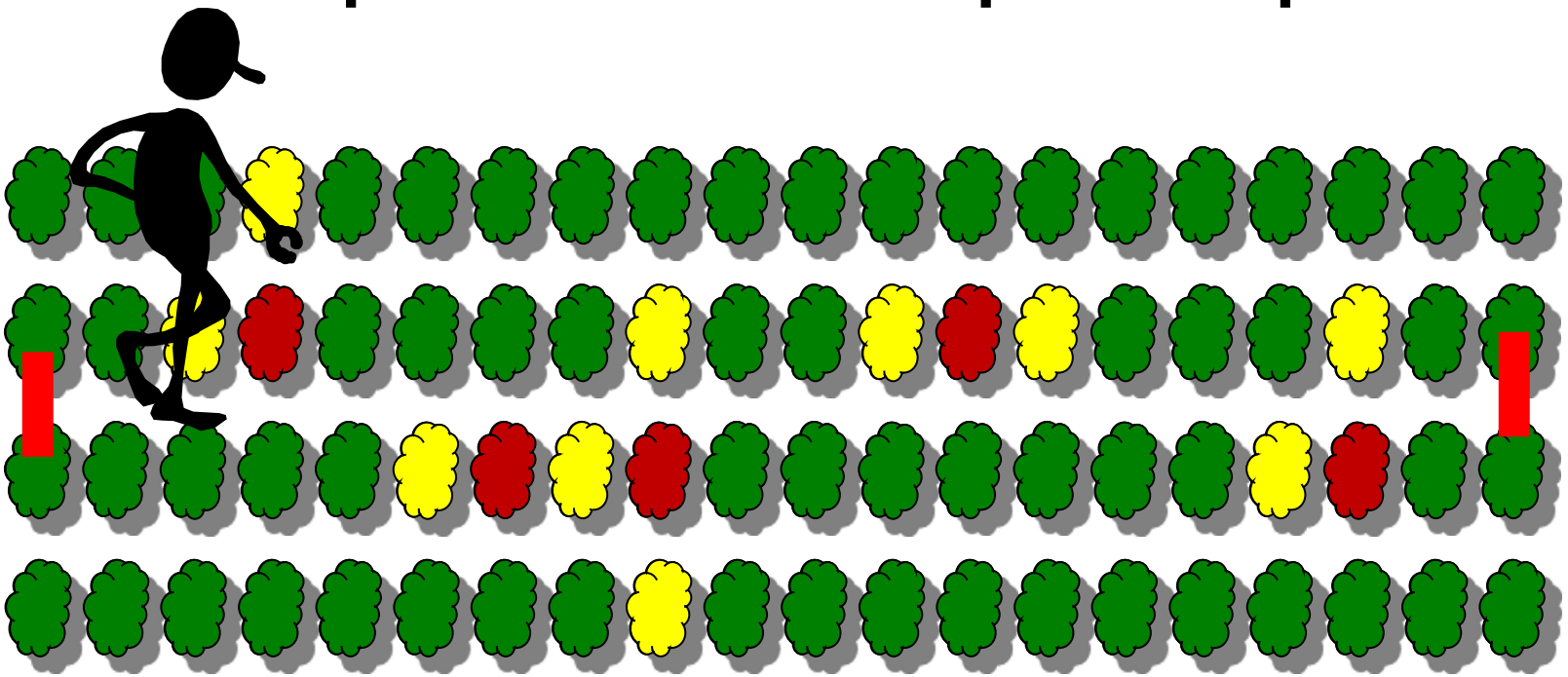
Ash / Syc 3,300 stems ha^{-1}

Identify & mark 4 – 5 PCTs between the two sticks (≈ 350 per ha)



Ash / Syc 3,300 stems ha^{-1}

Identify & mark 2 competitor trees to be thinned per PCT … then repeat the process



Rack and selection thinning

Rack and selection thinning

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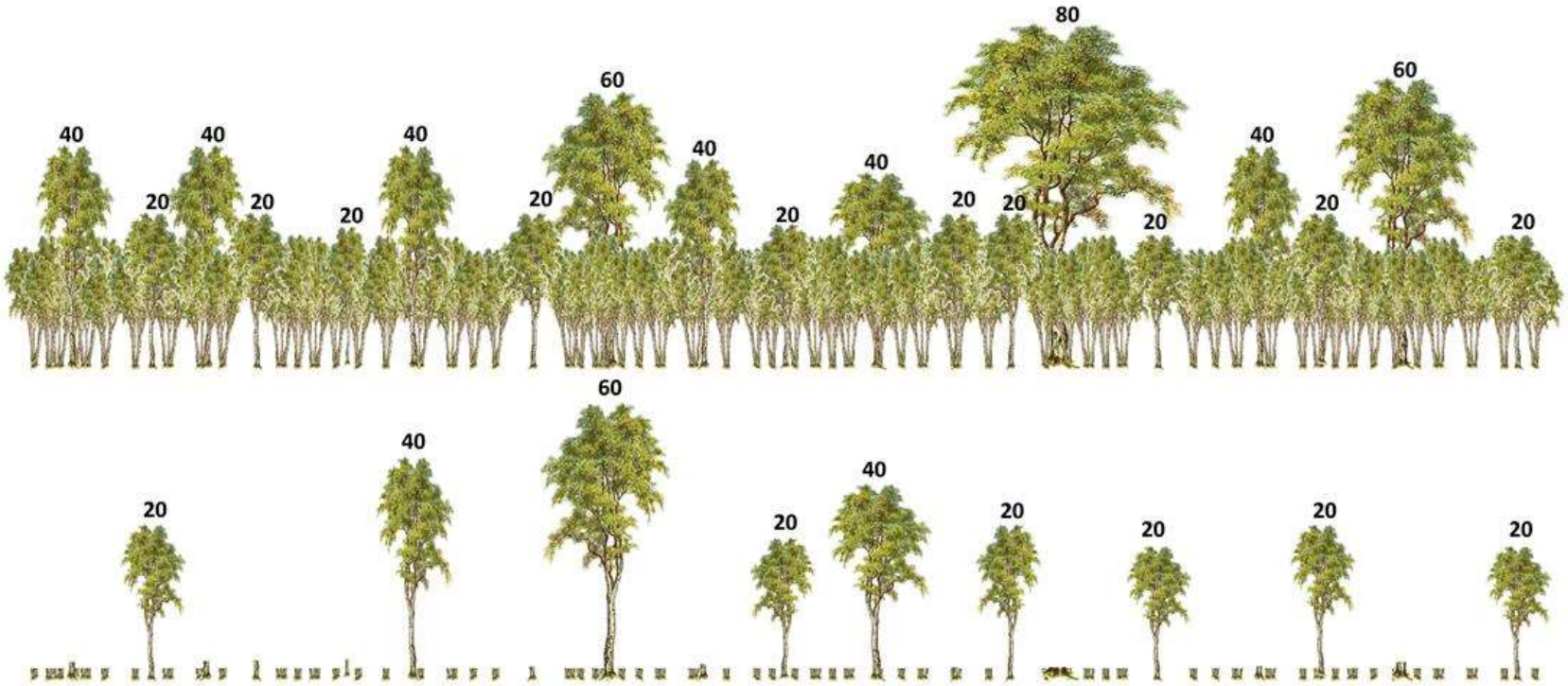
Alternative systems?

- CCF / back to nature
- Shelterwood systems
- Selection systems
- Coppice-with-standards



Poor quality stands

- B-SilvRD project
- Remedial silviculture
- Why is the quality poor?
  - Species / provenance choice?
  - Biotic / abiotic factors?
- How poor is it?
  - PCT density

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Influence the silviculture to be carried out

Systematic thin and underplant / coppice?

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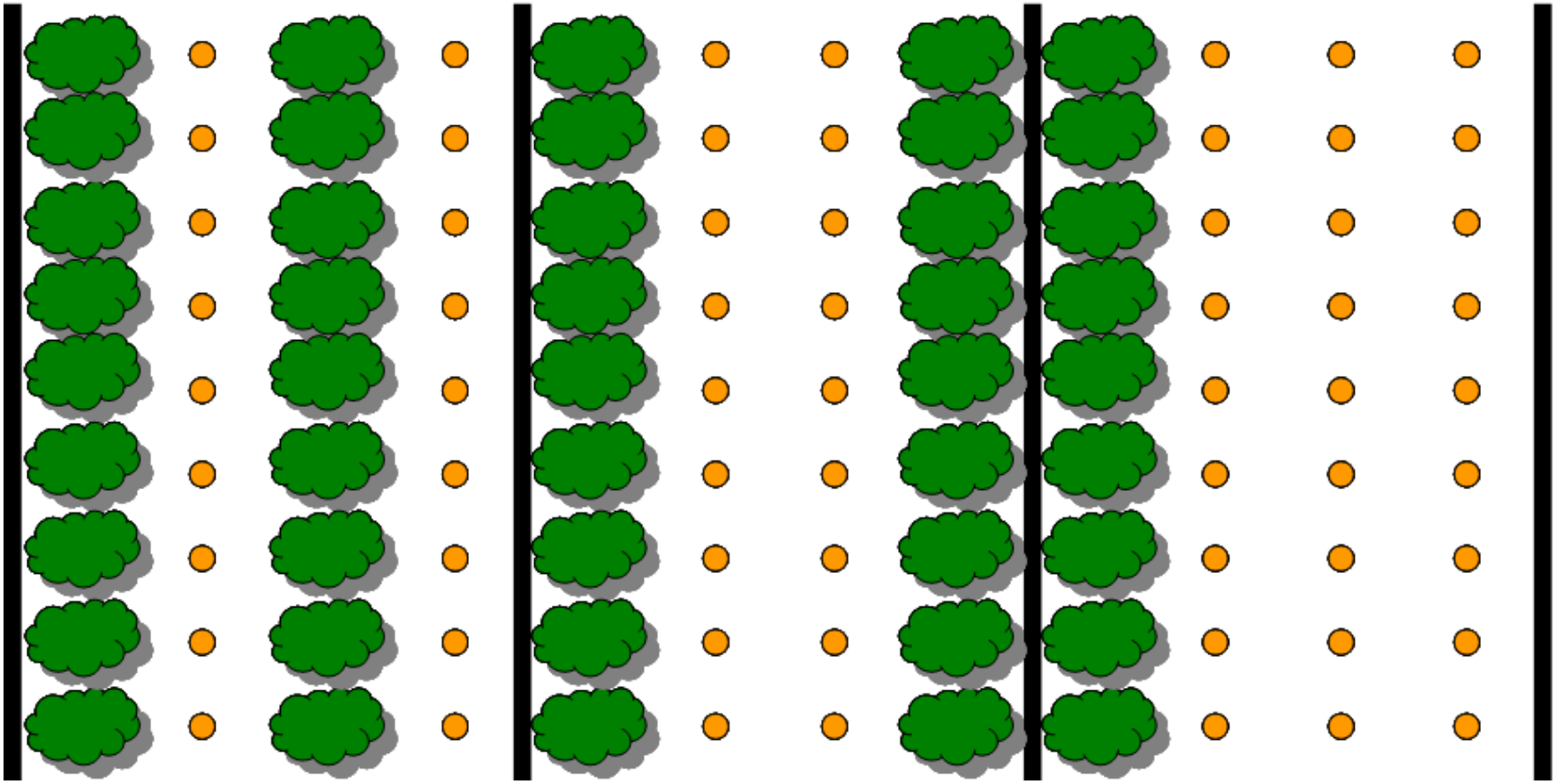
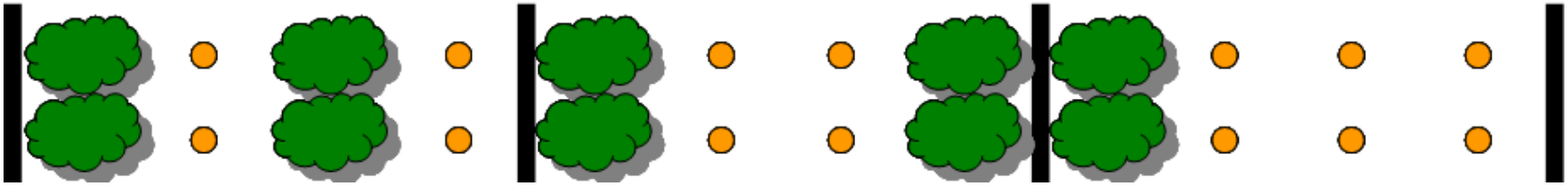
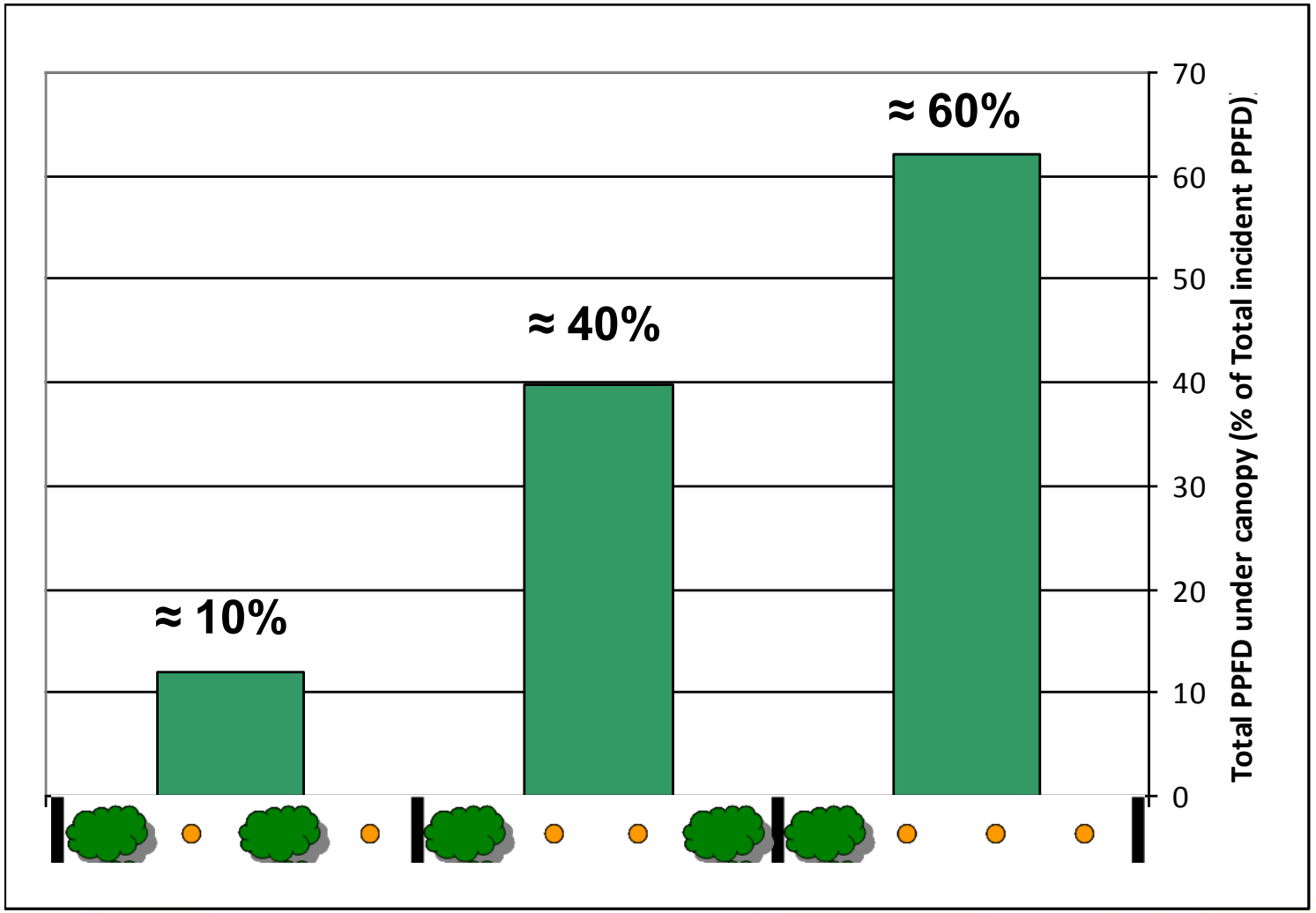
Systematic thin and underplant / coppice?



Systematic thin and underplant / coppice? - light



Relative illumination (sycamore overstory)



Systematic thin and underplant / coppice?

- Sycamore coppice influenced by light availability
- Singling trial

Coppice singling

Species for underplanting? - Conifer

Western red cedar	4
Lawson cypress	5+
Douglas fir	6
Western hemlock	6
European larch	7+
Lodgepole pine	7+
Scot's pine	7+
Pinus nigra	7+

Norway spruce	7+
Sitka spruce	7+
Coast redwood	n/a
Leyland cypress	n/a
Monterey cypress	n/a
Grand fir	n/a
Serbian spruce	n/a

Ellenberg's indicator values for British plants – sapling stage

3. Shade plant, mostly **<5%** relative illumination, seldom **>30%** illumination when trees are in full leaf
5. Semi-shade plant, rarely in full light, but generally with **>10%** relative illumination when trees are in leaf
7. Plant generally in well lit places, but also occurring in partial shade
8. Light-loving plant rarely found where relative illumination in summer is **<40%**

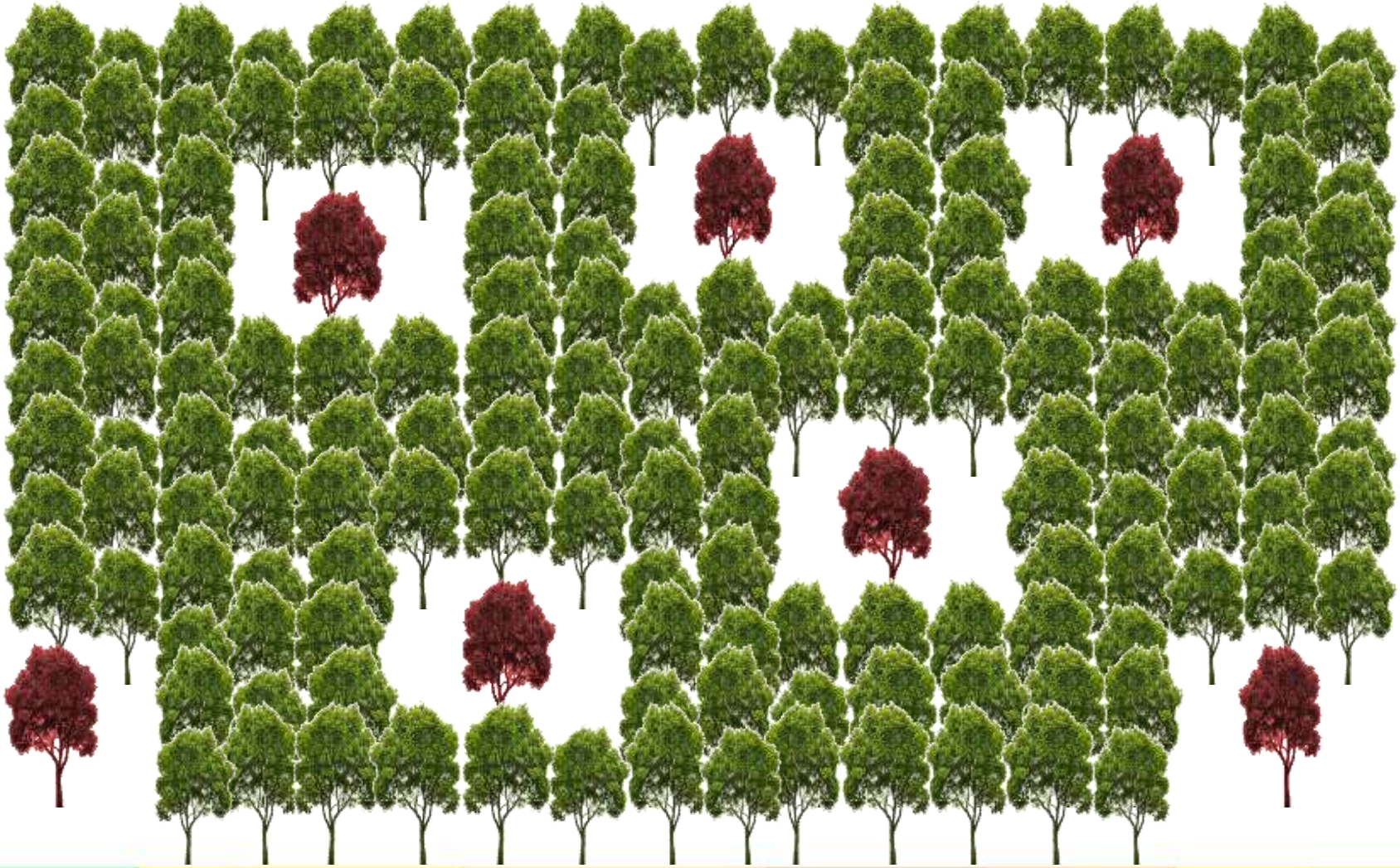
Species for underplanting? - Broadleaf

Common beech	3+
Hornbeam	4
Wild cherry	4
Large-leaved lime	4
Norway maple	4+
Sycamore	4+
Common alder	5
Ash	5
Small-leaved lime	5
Common lime	5
Spanish (sweet) chestnut	5
Holly	5
Field maple	5+
Horsechestnut	5+

Black poplar	6
Walnut	6
Aspen	6+
Hybrid poplar	6+
White poplar	6+
Sessile oak	6+
Downy birch	7+
Silver birch	7+
Pedunculate oak	7+
Red oak	n/a
Southern beech	n/a

Free-growth / halo thinning

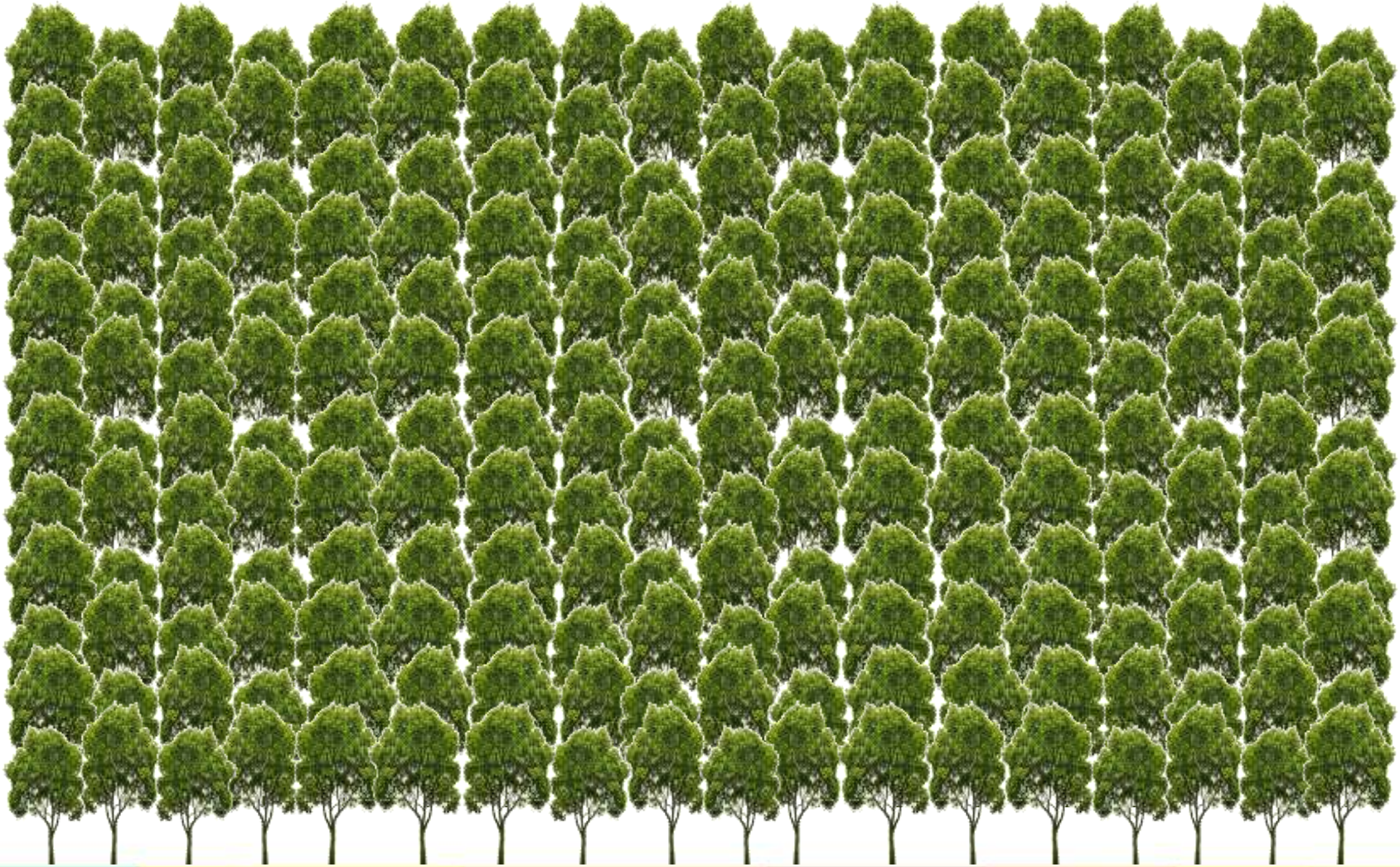
Free-growth / halo thinning



Free-growth / halo thinning

Free-growth / halo thinning

Group selection and nat regen / underplant



Group selection and nat regen / underplant / coppice

Group selection and nat regen / underplant / coppice

Summary

- Species choice
- Planting stock
- Establishment
  - Protection
  - Mixture?
  - Spacing
  - Land prep.
- Formative shaping
- Inspection paths
- Pruning
- Roading
- Thinning
  - Introduce 2nd spp?
- Timely interventions
- Provision of product choice
- Remedial silviculture

Acknowledgements

- CoFoRd
  - Funding
- Site owners
  - Facilitating research
- Sylviron Ltd.

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