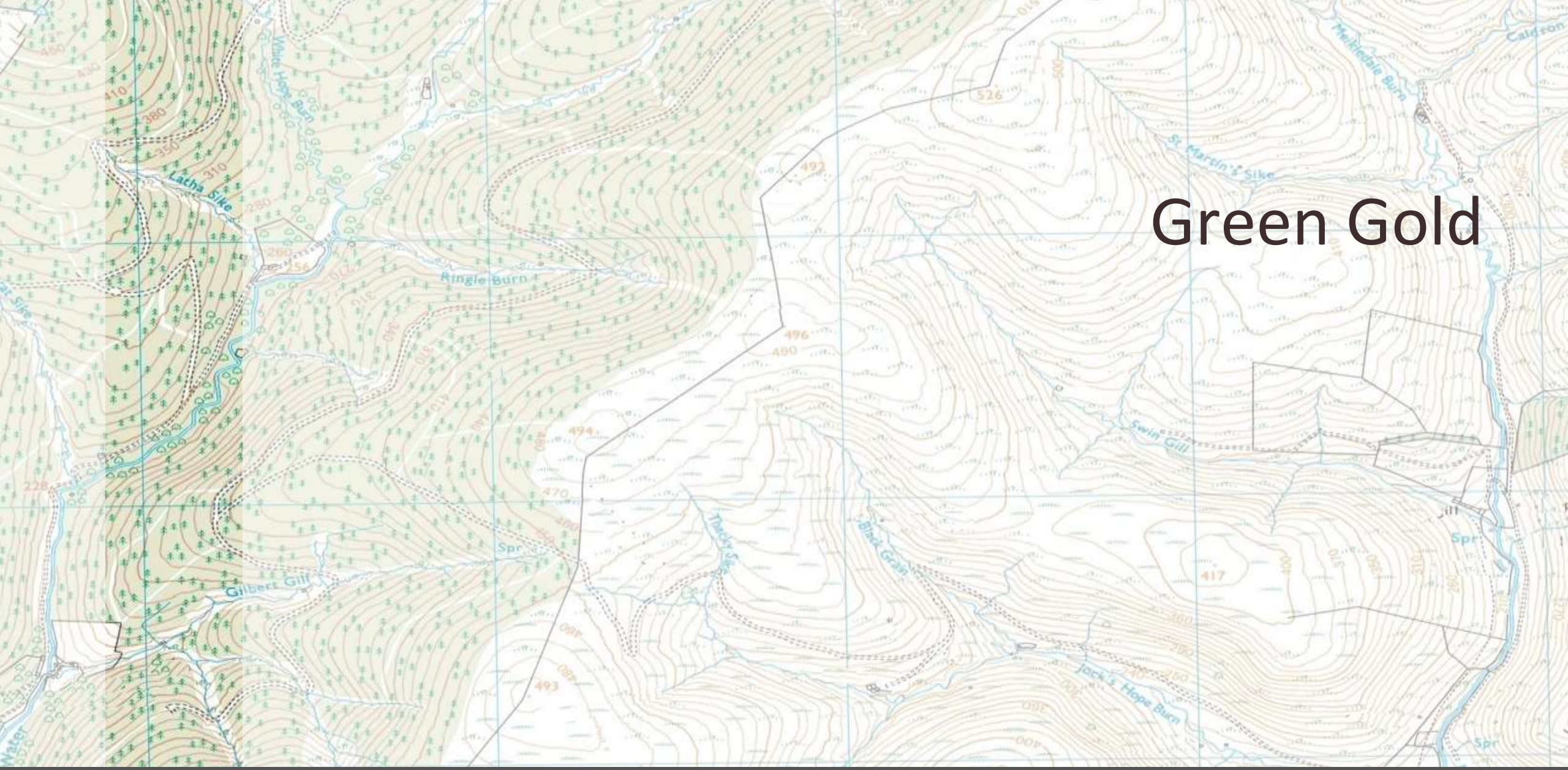
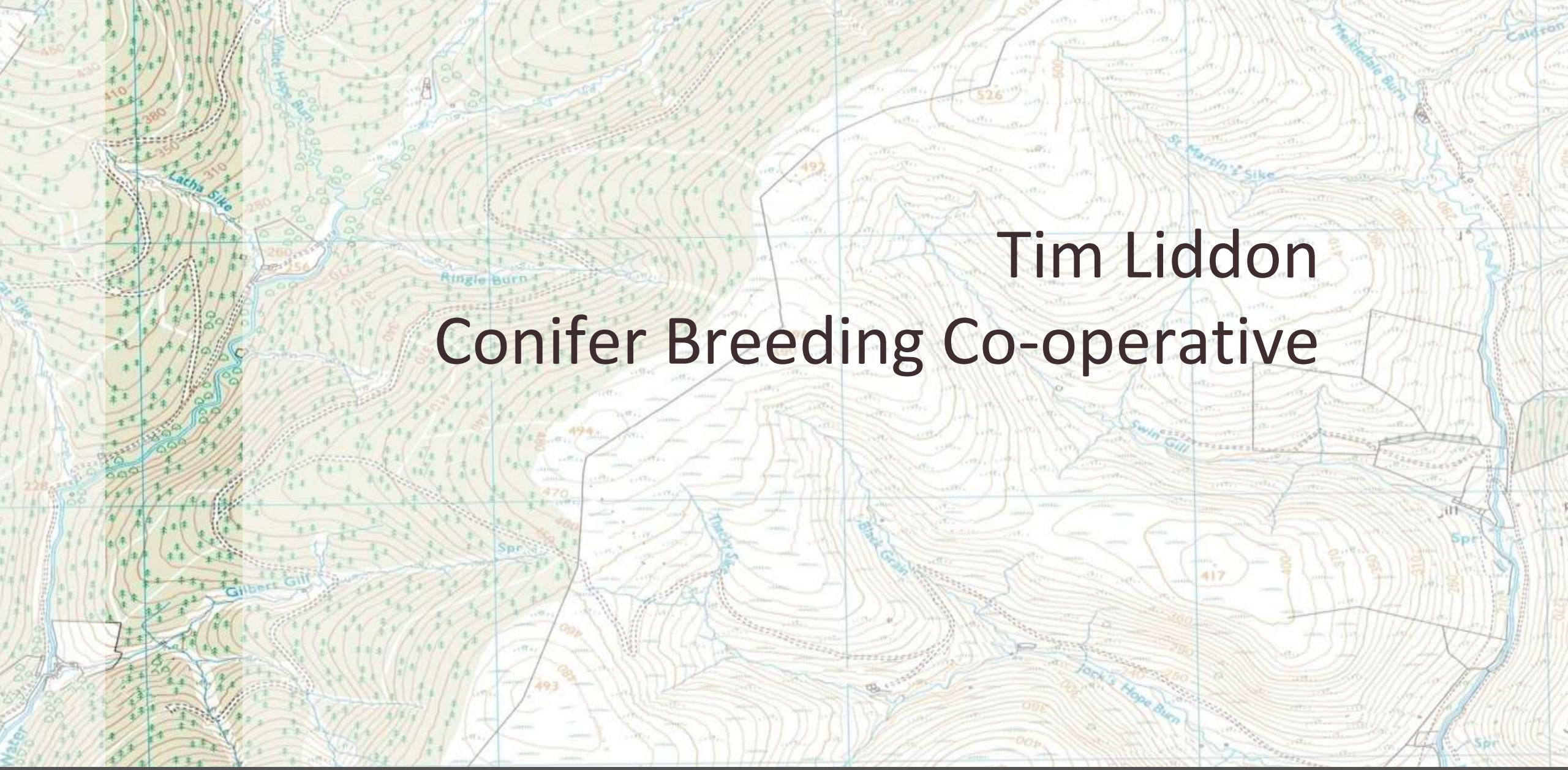

Green Gold



Tim Liddon
Conifer Breeding Co-operative

CONIFER BREEDING
CO-OPERATIVE

Getting You More Value

Tim Liddon – Director, Conifer Breeding Co-operative

Royal Welsh Show

24th July 2018

The Conifer Breeding Co-operative

CONIFER BREEDING
CO-OPERATIVE

Objectives:

- To ensure that there is an adequate supply of improved vegetatively propagated Sitka Spruce resource for growers.
- Take forward the breeding programme for Sitka Spruce and the following important commercial conifers:
  - Douglas Fir
  - Norway Spruce
  - Western Red Cedar
  - Western Hemlock

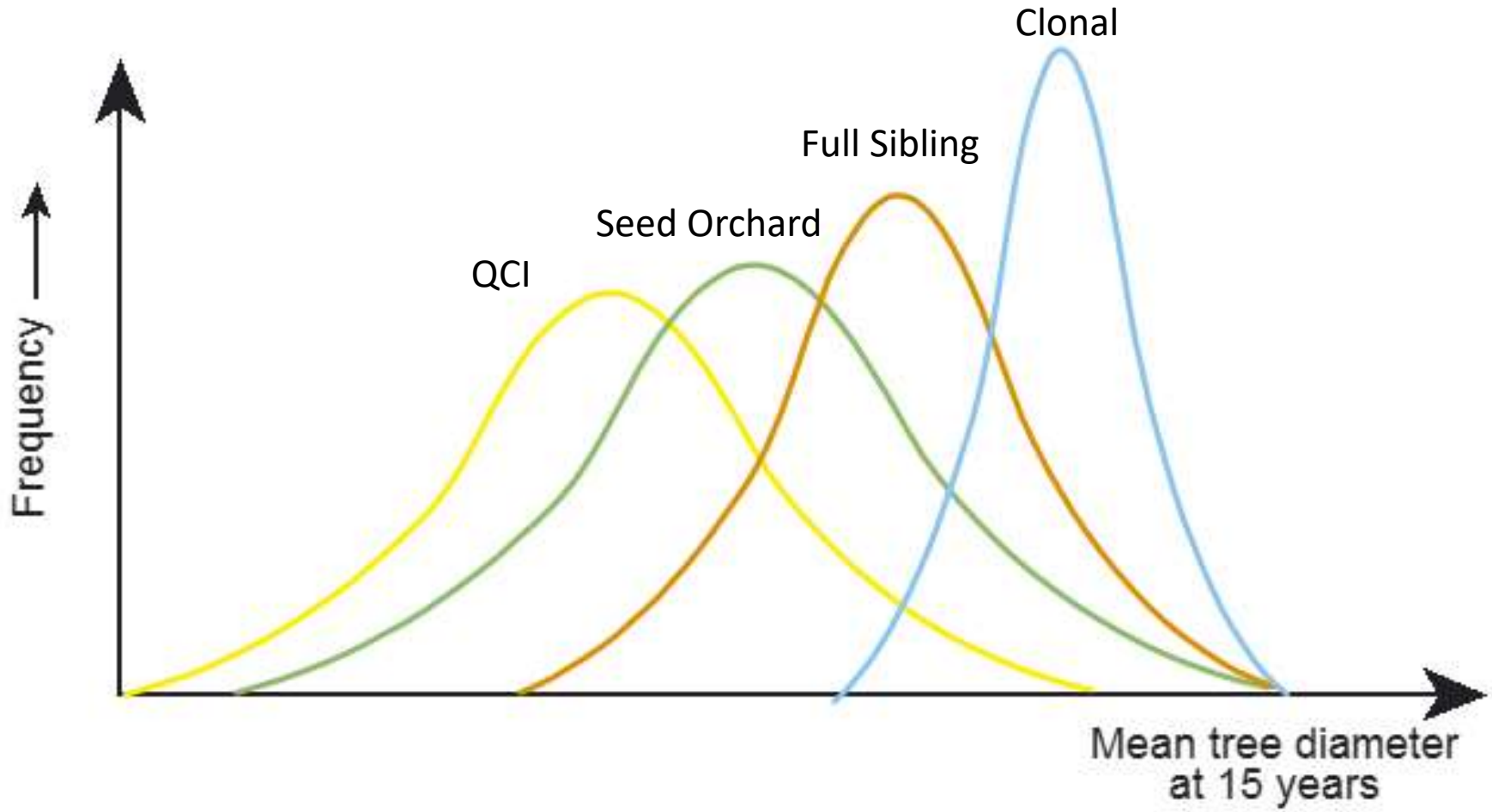
Sitka Spruce Tree Breeding

CONIFER BREEDING
CO-OPERATIVE

- Tree breeding in Sitka Spruce started in the 1960's
- It is well advanced of alternative species
- Some 1700 plus trees have led to seed orchards
- More latterly controlled pollination has led to Full siblings
- There are some demonstration clonal plots but as yet no commercial plantings
- First gains were from increased growth as seen in seed orchard material
- Now more quality traits have and are being pursued.

Quality Improvement

CONIFER BREEDING
CO-OPERATIVE



Enhancing the Crown Jewels

CONIFER BREEDING
CO-OPERATIVE

- Better material with significant gains in key traits is now available

Seed orchard material

FC ID No	Stem Diam	Density	Straightness	Branching
NT11	18	-10	9	
A12	19	-11	8	
A13	21	-12	9	
A14	21	-8	5	

Full sibling material

ID No.	Diameter	Density	Straightness	Branching	Acoustic Value
psiPF65TE	7	4	30	12	-
psiPF66TE	12	0	16	0	-
psiPF69TE	17	-9	34	19	4
psiPF75TE	17	-9	34	19	4
psiPF79TE	3	11	16	8	-
psiPF80TE	16	1	36	14	3
psiPF81TE	10	3	25	12	0

The figures relate to the percentage gain or loss compared to unimproved QCI

Enhancing the Crown Jewels

CONIFER BREEDING
CO-OPERATIVE

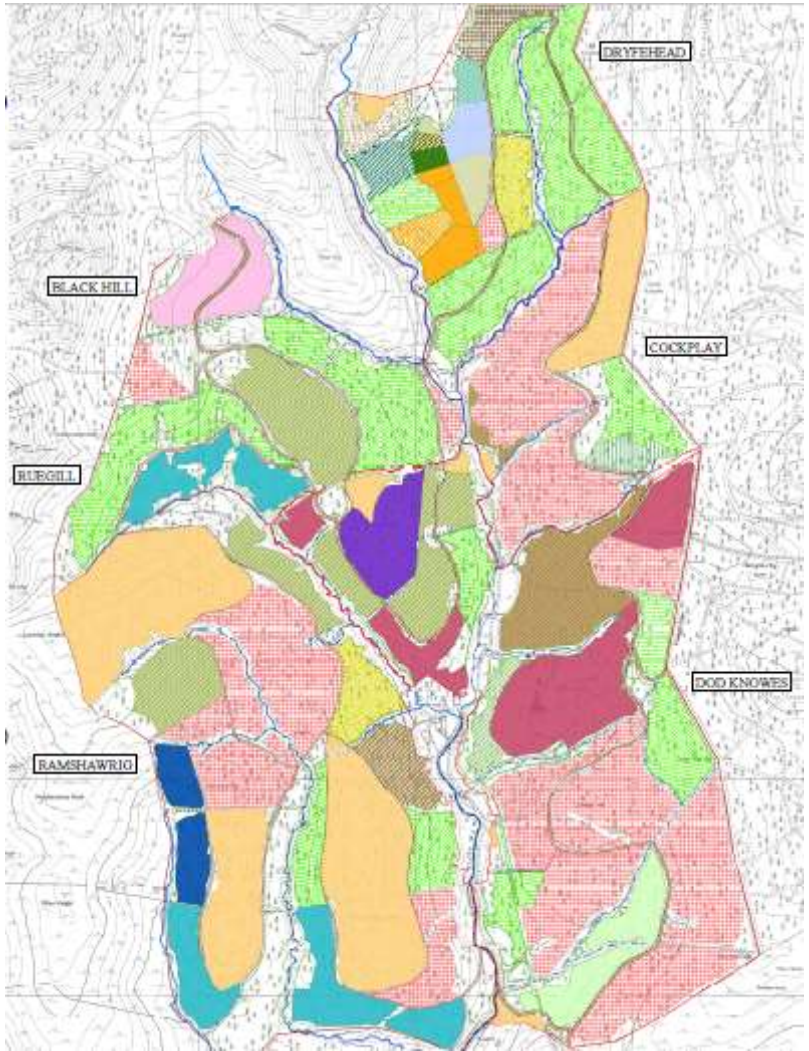
Genetic Diversity:

An interesting debate!

- QCI seed was often collected from a narrow base
- Often the easiest trees to collect from – but not always the best trees

Vs

- The plus trees were collected from a wide geographical area
- Use them wisely to give genetic variation over the forest.



Understanding the Crown Jewels

CONIFER BREEDING
CO-OPERATIVE

DNA fingerprinting using micro-satellite technology

- Allows us and you to know what you are getting

Acoustic Velocity

- Allows us to look at stiffness and thus an important quality trait

Genomics

- ‘Sitka Spruced’ - the industry and Conifer Co-op sponsored research project involving Oxford and Edinburgh Universities
- Looking to develop Genomic Prediction (GP) for Sitka
- GP can be used to predict traits such as productivity, resistance to insect pests and tolerance to climate change.

Extending the Crown Jewels

CONIFER BREEDING
CO-OPERATIVE

Having started on Sitka the Co-op is now working on:

- Norway Spruce
- Western Red Cedar
- Western Hemlock
- Douglas fir

- The Co-op is looking for plus trees for all of the species to set up seed orchards and clone banks
- The landrace plus trees will be compared to alternatives such as seed orchard material from Europe and Scandinavia
- The aim is to deliver improvements in quality and productivity faster than they have been able to do for Sitka.

What does all this mean?

CONIFER BREEDING
CO-OPERATIVE

What does all this mean?

CONIFER BREEDING
CO-OPERATIVE

- Timber value enhanced
  - Chipwood/fuelwood value compared to Sawlogs is a £30-£40/t deficit
  - So, grow trees that can maximise sawlog content
- Stronger resilience
  - Better understanding of genetics
  - Shorter rotations available
  - Better timber from alternative species on the right site.

Contact Us

CONIFER BREEDING
CO-OPERATIVE

info@conifercoop.co.uk

www.coniferbreedingcoop.co.uk

Full Members are:

- Maelor Forest Nurseries
- Tilhill Forestry
- Forestry Commission
- Forestart
- Scottish Woodlands Ltd
- Alba Trees plc
- Christie Elite Nursery

Remember:

Good quality is always required

Key attributes are:

- **Straightness of stem**
- **Small Knots and Horizontal Branching**
- **Stiffness**

Paul Mclean
Forest Research

Forest Research

Quality and Quantity

Paul McLean

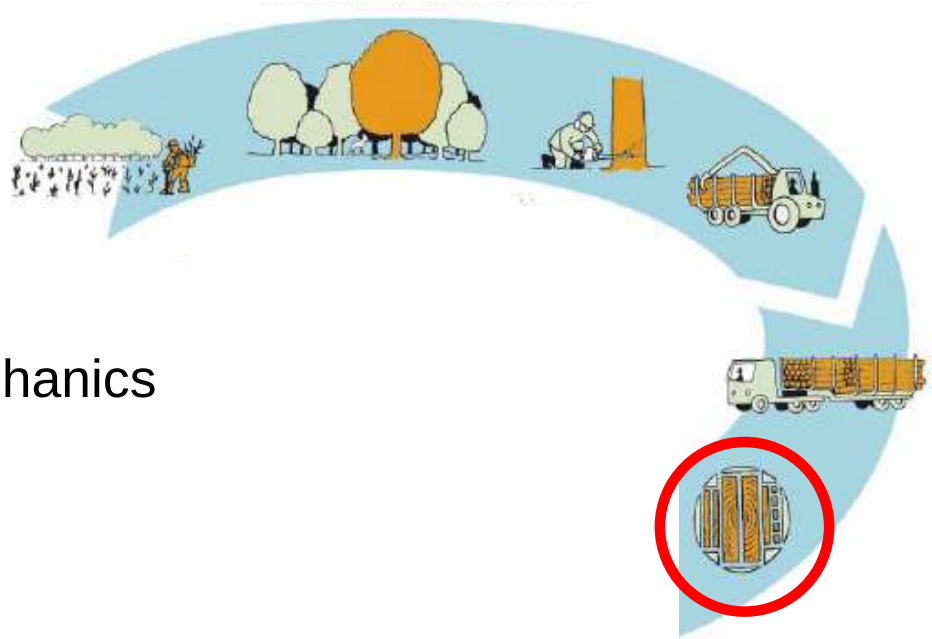
Confor Stage
Royal Welsh Show
24th July 2018

Tree and Wood Properties

www.forestry.gov.uk/fr/timberproperties

Growing forest products

- Silviculture
- Environment
- Genetics
- Tree physiology & biomechanics
- Raw material segregation
- Economics



Providing Decision Support: Primary processors, Forest owners, Researchers

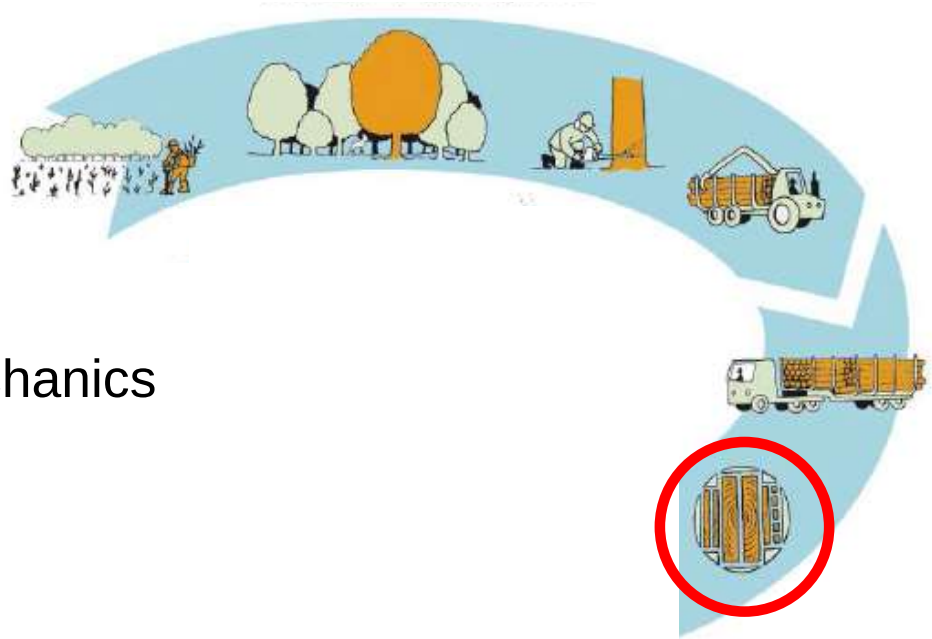



Tree and Wood Properties

www.forestry.gov.uk/fr/timberproperties

Growing forest products

- Silviculture
- Environment
- Genetics
- Tree physiology & biomechanics
- Raw material segregation
- Economics



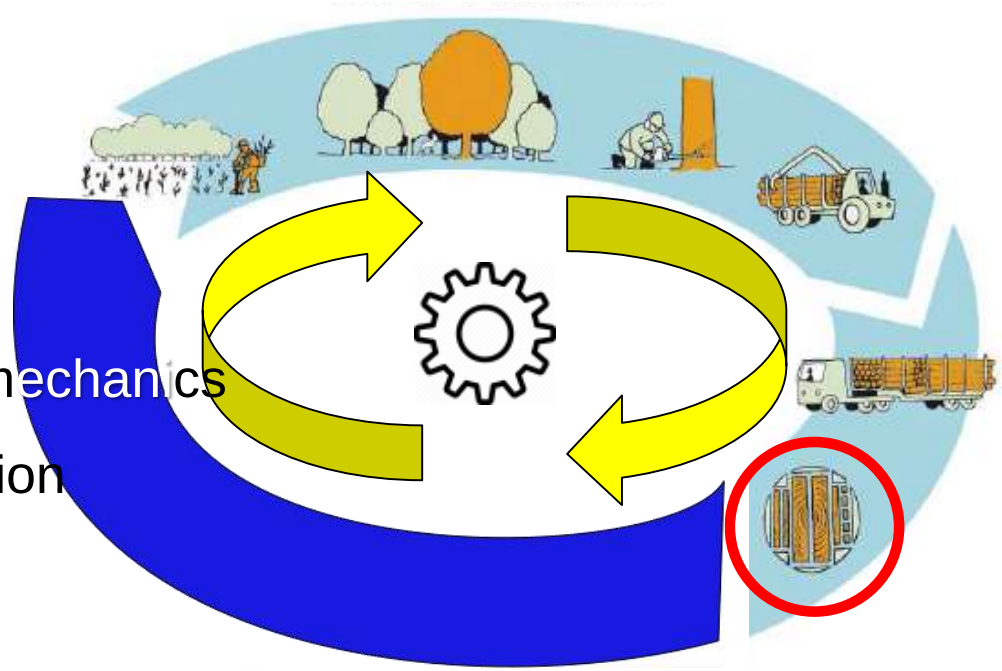
Providing Decision Support: Primary processors, Forest owners, Researchers

Tree and Wood Properties

www.forestry.gov.uk/fr/timberproperties

Growing forest products

- Silviculture
- Environment
- Genetics
- Tree physiology & biomechanics
- Raw material segregation
- Economics



Providing Decision Support: Primary processors, Forest owners, Researchers

Welsh timber testing

Forestry Commission

Research Note

Timber properties of noble fir, Norway spruce, western red cedar and western hemlock grown in Great Britain

David Gil-Moreno, Dan Ridley-Ellis and Paul McLean December 2016

The softwood processing sector in Great Britain has been built around the use of a very small number of timber-producing species – predominantly Sitka spruce. The recent increase in outbreaks of host-specific tree pests and diseases has led to an interest in diversification, through planting a wider range of tree species, to mitigate any risk to the softwood resource. However, there is a lack of evidence about how this diversification will impact on the future merchantability of timber. This Research Note investigates the structural timber properties of noble fir, Norway spruce, western red cedar and western hemlock grown in Great Britain and compares the results with published values for British-grown Sitka spruce. The study was carried out using timber from even-aged plantations growing in a range of latitudes representative of productive conifer forests. Twenty-seven trees per species were felled, processed into structural-sized battens, kiln dried and destructively tested in a laboratory according to current European standards. Characteristic values of mechanical properties and density were determined and indicative yields for different strength classes were calculated. The results showed that all of the species investigated can produce structural timber, but that western red cedar has the least desirable properties for this purpose. Some further work is under way in order to investigate the effect of rotation length on the timber properties of these species.

FCRN026 1 Forest Research

Outline

- What wood properties are important for sawn timber?

- Are we concerned about trees growing faster?

Outline

- What wood properties are important for sawn timber?

- Are we concerned about trees growing faster?

This is the bit where I'll talk about Llangoed

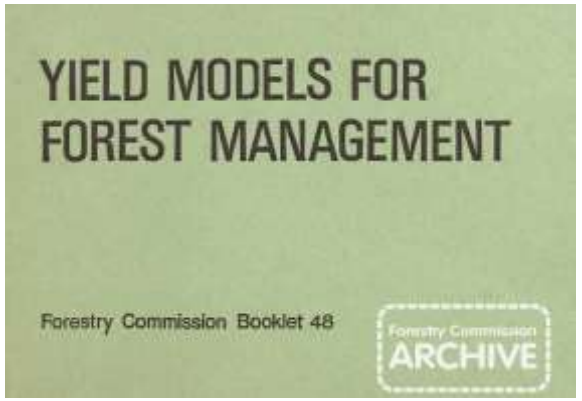
Important for Sawn Timber

Quality

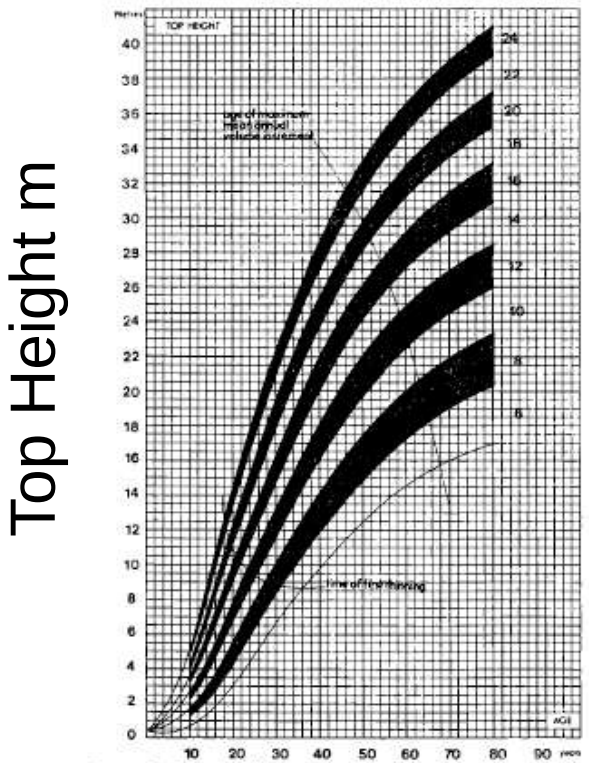
Properties important for sawn timber

Bending strength
Bending stiffness
Wood density
Knots

Quantity



YC = Yield Class



YC 24

YC 6

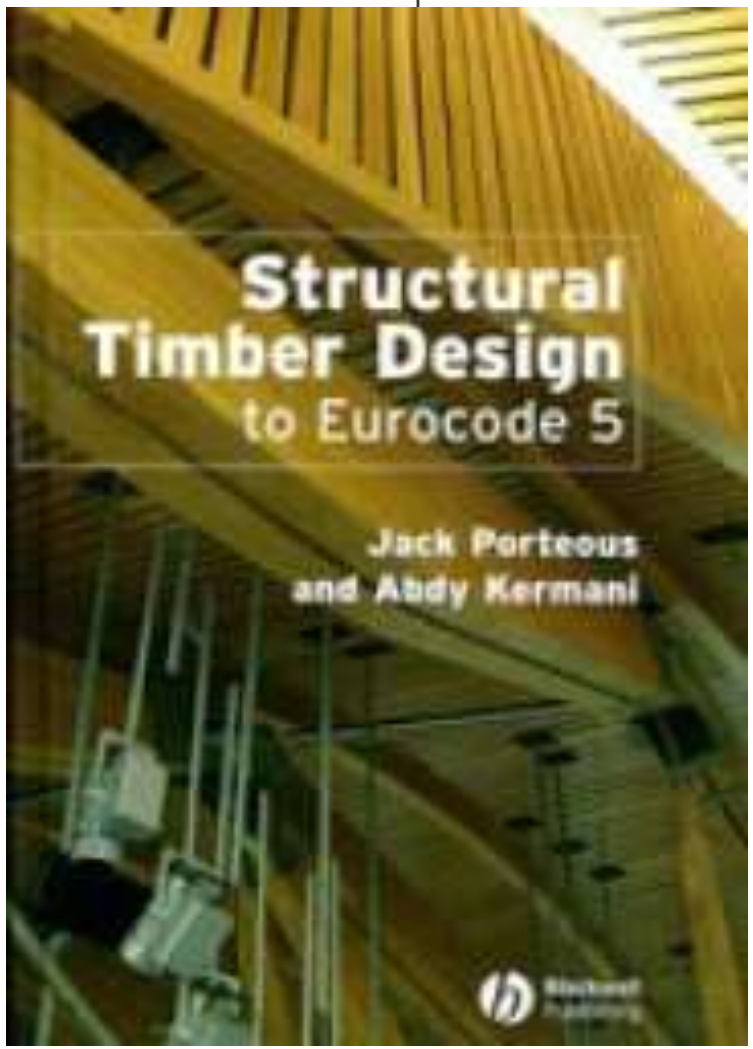
Quality - Timber Grade

BRITISH STANDARD | BS EN 338:2009

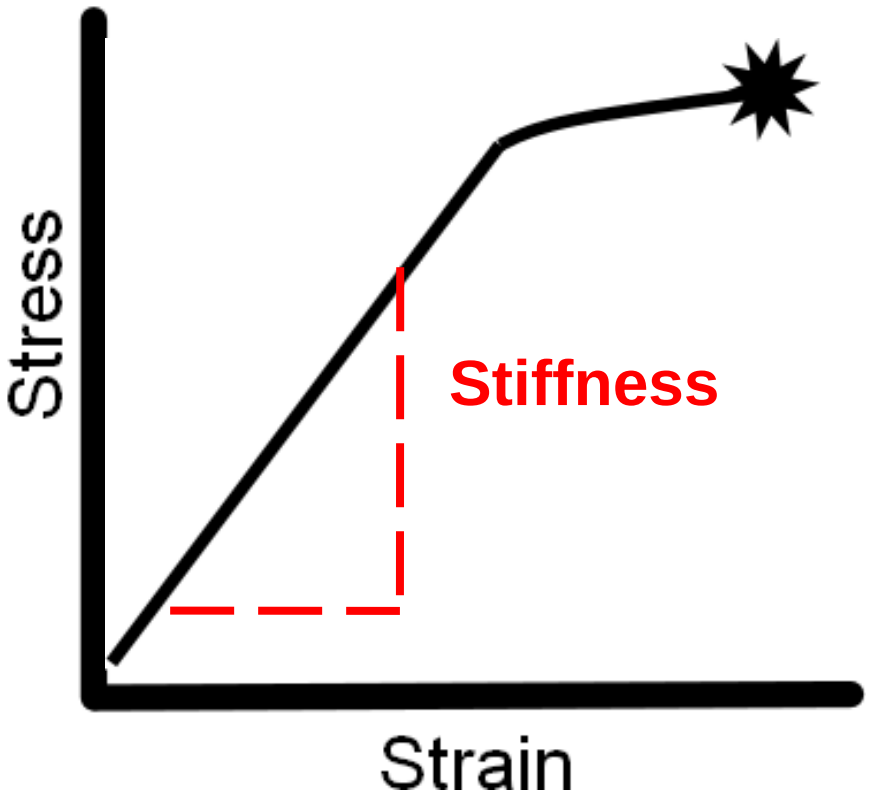
Strength

Stiffness

Density

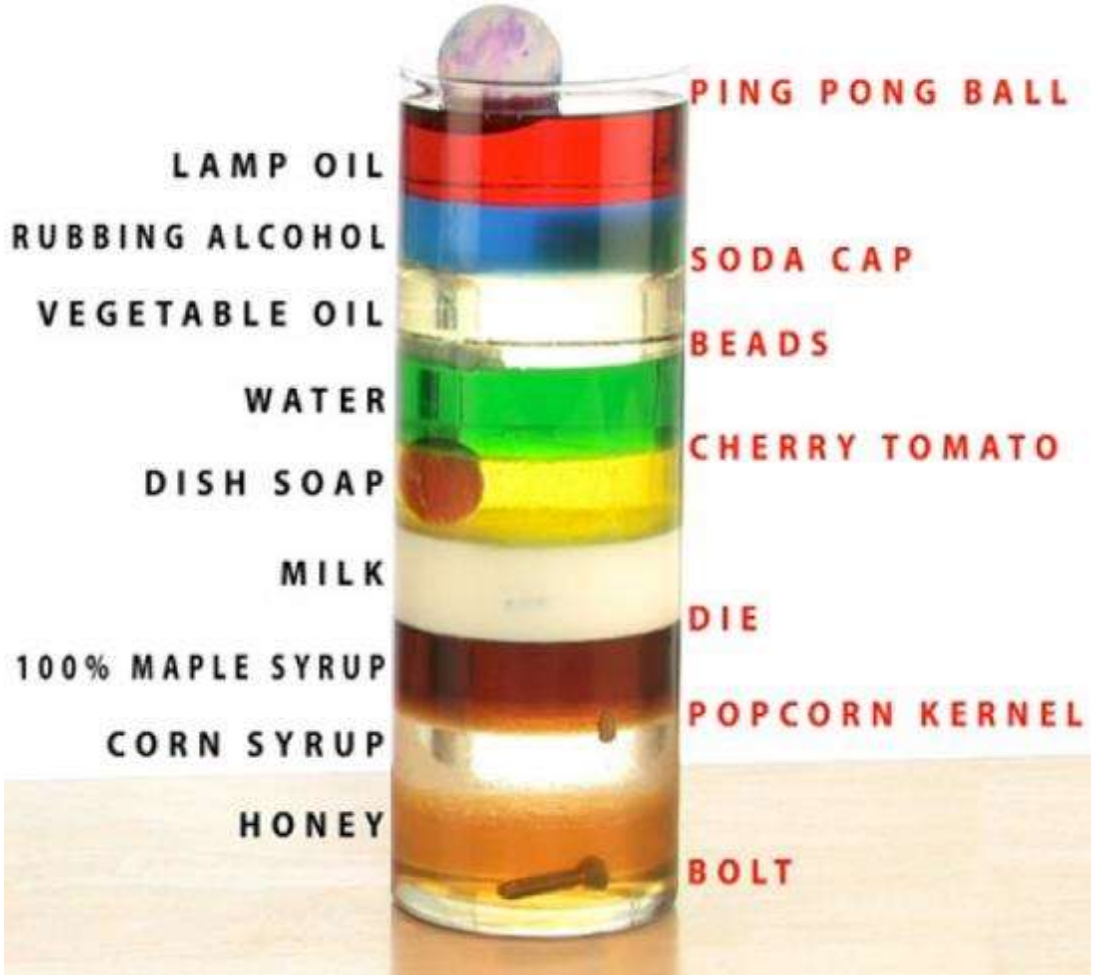


Strength vs Stiffness



Edinburgh Napier UNIVERSITY

Density



http://www.stevespanglerscience.com/lab/experiments/density-tower-magic-with-science

Quality - Timber Grade

BRITISH STANDARD

BS EN 338:2009

Structural timber — Strength classes

		Softwood species											
		C14	C16	C18	C20	C22	C24	C27	C30	C35	C40	C45	C50
Strength properties (in N/mm^2)													
Bending	$f_{m,k}$	14	16	18	20	22	24	27	30	35	40	45	50
Tension parallel	$f_{t,0,k}$	8	10	11	12	13	14	16	18	21	24	27	30
Tension perpendicular	$f_{t,90,k}$	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
Compression parallel	$f_{c,0,k}$	16	17	18	19	20	21	22	23	25	26	27	29
Compression perpendicular	$f_{c,90,k}$	2,0	2,2	2,2	2,3	2,4	2,5	2,6	2,7	2,8	2,9	3,1	3,2
Shear	$f_{v,k}$	3,0	3,2	3,4	3,6	3,8	4,0	4,0	4,0	4,0	4,0	4,0	4,0
Stiffness properties (in kN/mm^2)													
Mean modulus of elasticity parallel	$E_{0,mean}$	7	8	9	9,5	10	11	11,5	12	13	14	15	16
5 % modulus of elasticity parallel	$E_{0,05}$	4,7	5,4	6,0	6,4	6,7	7,4	7,7	8,0	8,7	9,4	10,0	10,7
Mean modulus of elasticity perpendicular	$E_{90,mean}$	0,23	0,27	0,30	0,32	0,33	0,37	0,38	0,40	0,43	0,47	0,50	0,53
Mean shear modulus	G_{mean}	0,44	0,5	0,56	0,59	0,63	0,69	0,72	0,75	0,81	0,88	0,94	1,00
Density (in kg/m^3)													
Density	ρ_k	290	310	320	330	340	350	370	380	400	420	440	460
Mean density	ρ_{mean}	350	370	380	390	410	420	460	460	480	500	520	550

Quality - Timber Grade

BRITISH STANDARD

BS EN 338:2009

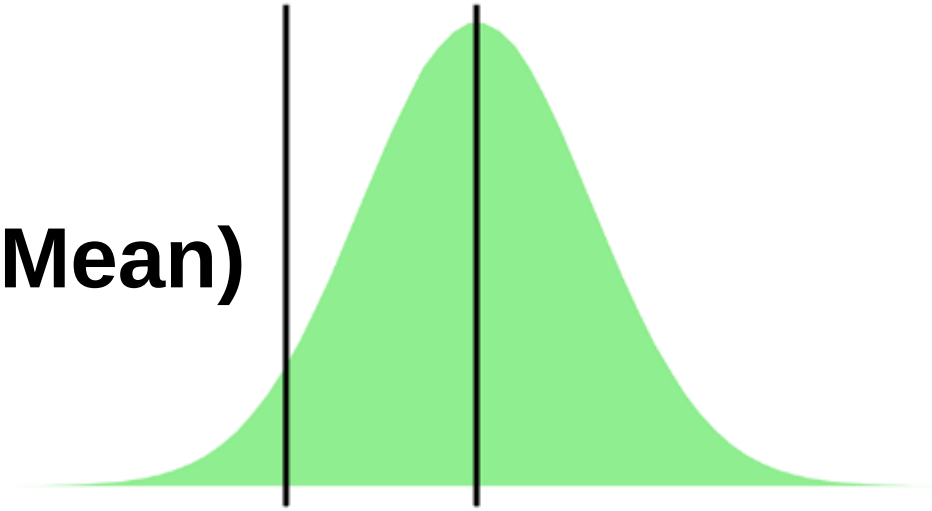
Structural timber — Strength classes

Wood property	Characteristic value					
	C14	C16	C18	C20	C22	C24
Strength	14	16	18	20	22	24
Stiffness	7	8	9	9.5	10	11
Density	290	310	320	330	340	350

BRITISH STANDARD | BS EN 338:2009

Strength (5th Percentile)

Stiffness (Mean)



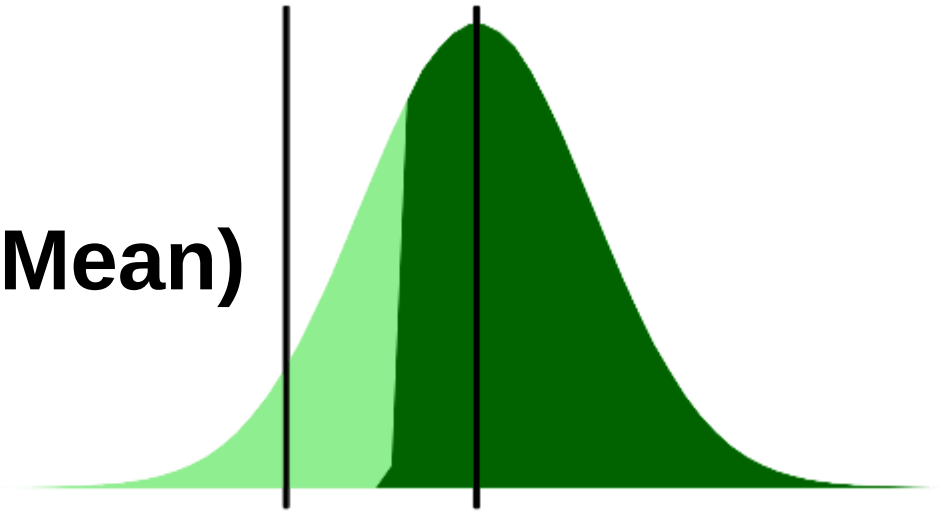
Density (5th Percentile)

Timber Grading

BRITISH STANDARD | BS EN 338:2009

Strength (5th Percentile)

Stiffness (Mean)

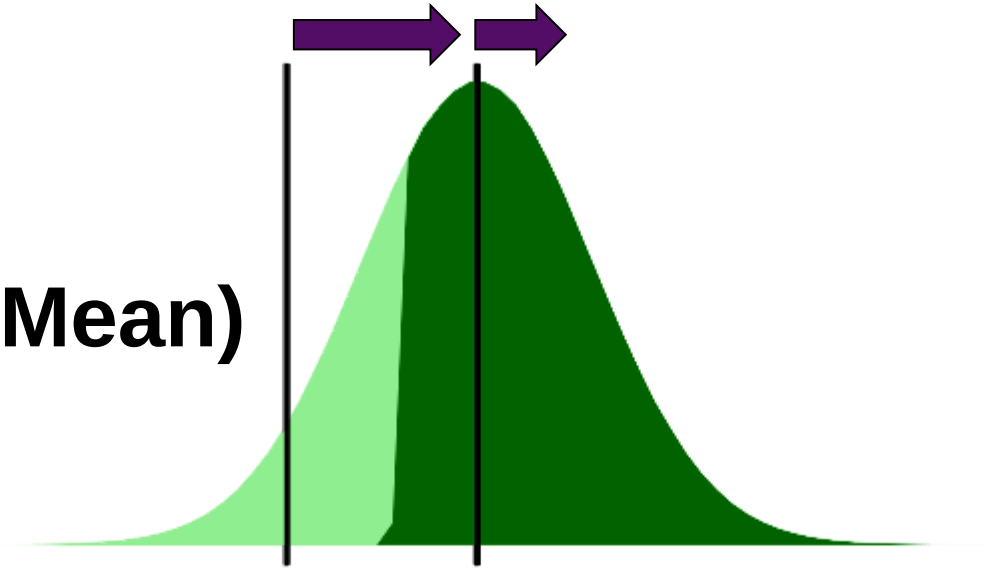


Density (5th Percentile)

BRITISH STANDARD | BS EN 338:2009

Strength (5th Percentile)

Stiffness (Mean)



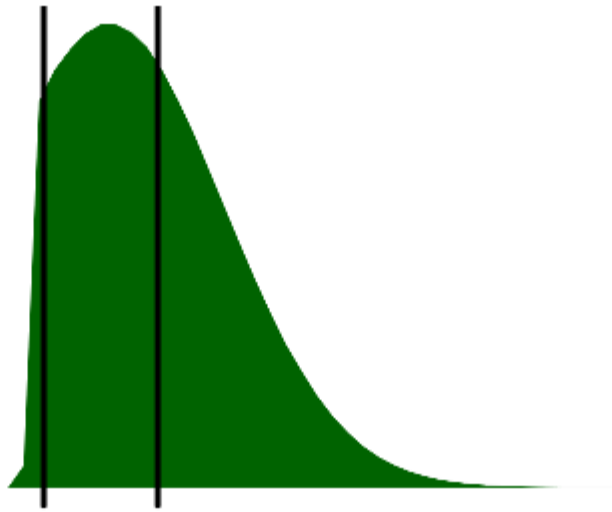
Density (5th Percentile)

Timber Grading

BRITISH STANDARD | BS EN 338:2009

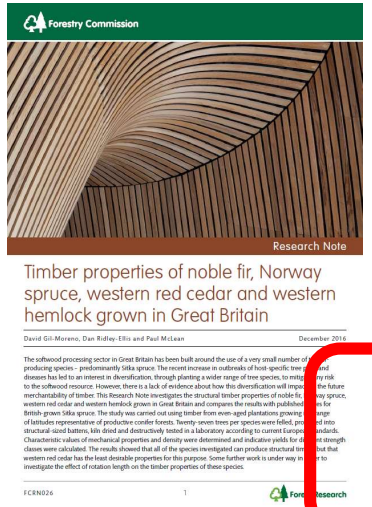
Strength (5th Percentile)

Stiffness (Mean)



Density (5th Percentile)

Timber mechanical properties


Forestry Commission

Research Note

Timber properties of noble fir, Norway spruce, western red cedar and western hemlock grown in Great Britain

David Gil-Moreno, Dan Ridley-Ellis and Paul McLean December 2016

The softwood processing sector in Great Britain has been built around the use of a very small number of ... producing species – predominantly Sitka spruce. The recent increase in outbreaks of host-specific tree ... and diseases has led to an interest in diversification, through planting a wider range of tree species, to mitig... risk to the softwood resource. However, there is a lack of evidence about how this diversification will impac... the future merchantability of timber. This Research Note investigates the structural timber properties of noble fir, ...way spruce, western red cedar and western hemlock grown in Great Britain and compares the results with published ...es for British-grown Sitka spruce. The study was carried out using timber from even-aged plantations growing ... range of latitudes representative of productive conifer forests. Twenty-seven trees per species were felled, pro... into structural-sized battens, kiln dried and destructively tested in a laboratory according to current Europe... standards. Characteristic values of mechanical properties and density were determined and indicative yields for di... strength classes were calculated. The results showed that all of the species investigated can produce structural tim... but that western red cedar has the least desirable properties for this purpose. Some further work is under way ... to investigate the effect of rotation length on the timber properties of these species.

FCRN026 1 Forest Research

	Sitka spruce	Norway spruce	Western hemlock	Noble fir	Western red cedar
Number of pieces	955	128	138	126	115
Means age of sample (years)	Not known	19.3 (8.4)	18.6 (9.4)	15.0 (8.4)	19.0 (9.4)
Mean stiffness ($kN\ mm^{-2}$)	8.30 C16	8.55 (1.68) C18	8.33 (2.04) C16	7.71 (2.27) C16	7.44 (1.66) C14
Mean density ($kg\ m^{-3}$)	387	378 (37)	444 (39)	358 (37)	365 (30)
5th percentile density ($kg\ m^{-3}$)	330 C20	345 C22	385 C30	324 C18	318 C16
Mean strength ($N\ mm^{-2}$)	32.7	31.1 (9.0)	34.5 (10.7)	31.1 (13.1)	30.1 (8.0)
5th percentile strength ($N\ mm^{-2}$)	19.6 C18	19.1 C18	18.2 C18	14.8 C14	16.3 C16
Strength class	C16	C18	C16	C14	C14

Timber Grading British Conifers

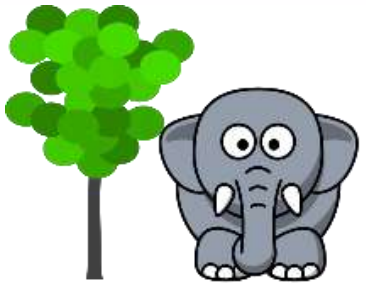
	C14	C16	C18	C20	C22	C24
Sitka spruce	100%	100%	92%	75%	58%	30%
Norway spruce	100%	100%	100%	81%	62%	30%
Western hemlock	100%	100%	95%	81%	67%	40%
Noble fir	100%	96%	77%	62%	49%	30%
Western red cedar	100%	94%	56%	38%	25%	11%

SIRT
Strategic Integrated Research in Timber

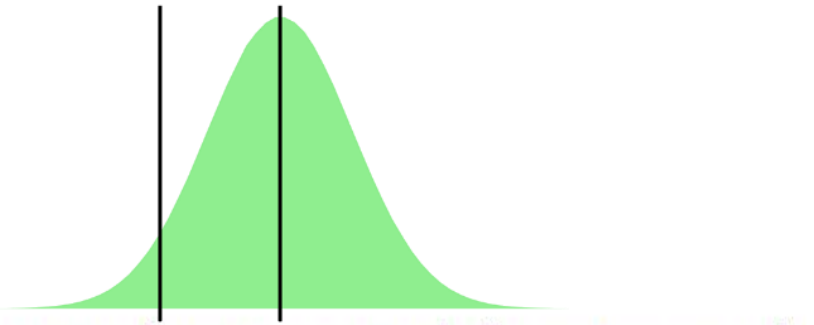
David Gil-Moreno
PhD

Edinburgh Napier UNIVERSITY

Timber grading



- What you need to know:
  - We are obviously interested in volume
  - The main wood property that will affect **current** value is stiffness
  - Density is not the same thing as stiffness
  - Single values do not mean much, we work with populations



A Word About Replication

325 million people

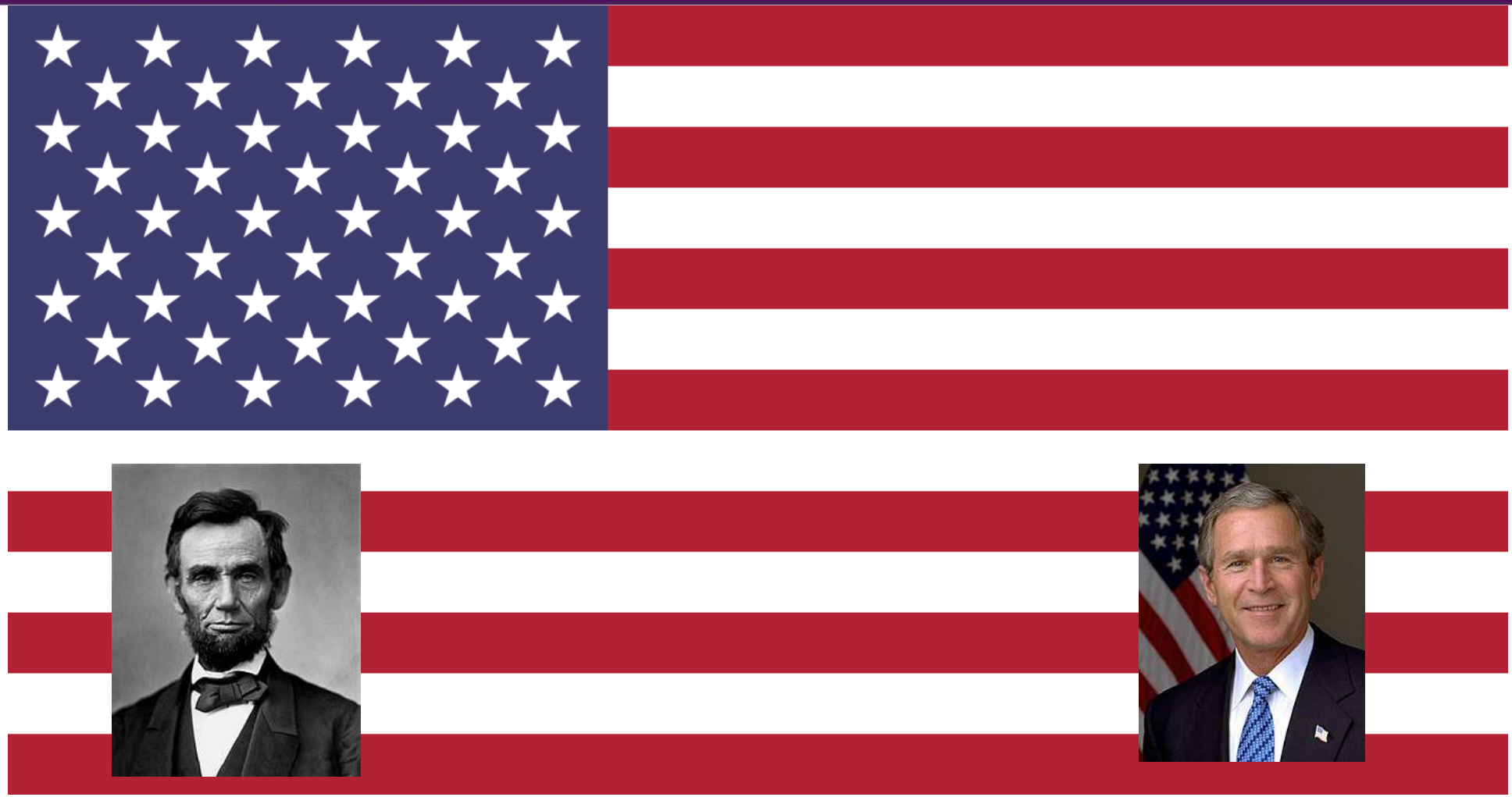
A Word About Replication

= 325 million people?

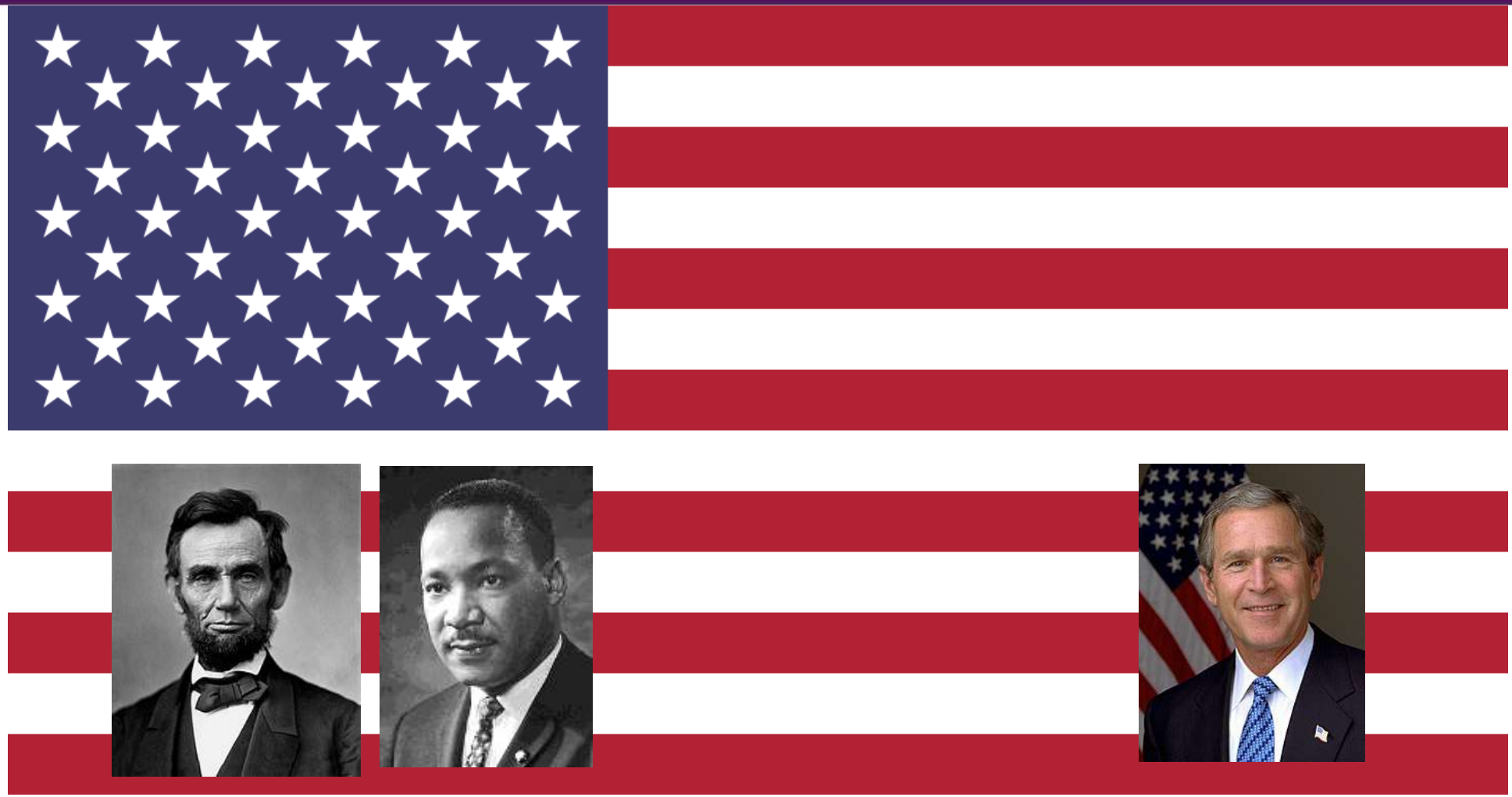
A Word About Replication

= 325 million people?

A Word About Replication



A Word About Replication



= 325 million people?

A Word About Replication

= 325 million people?

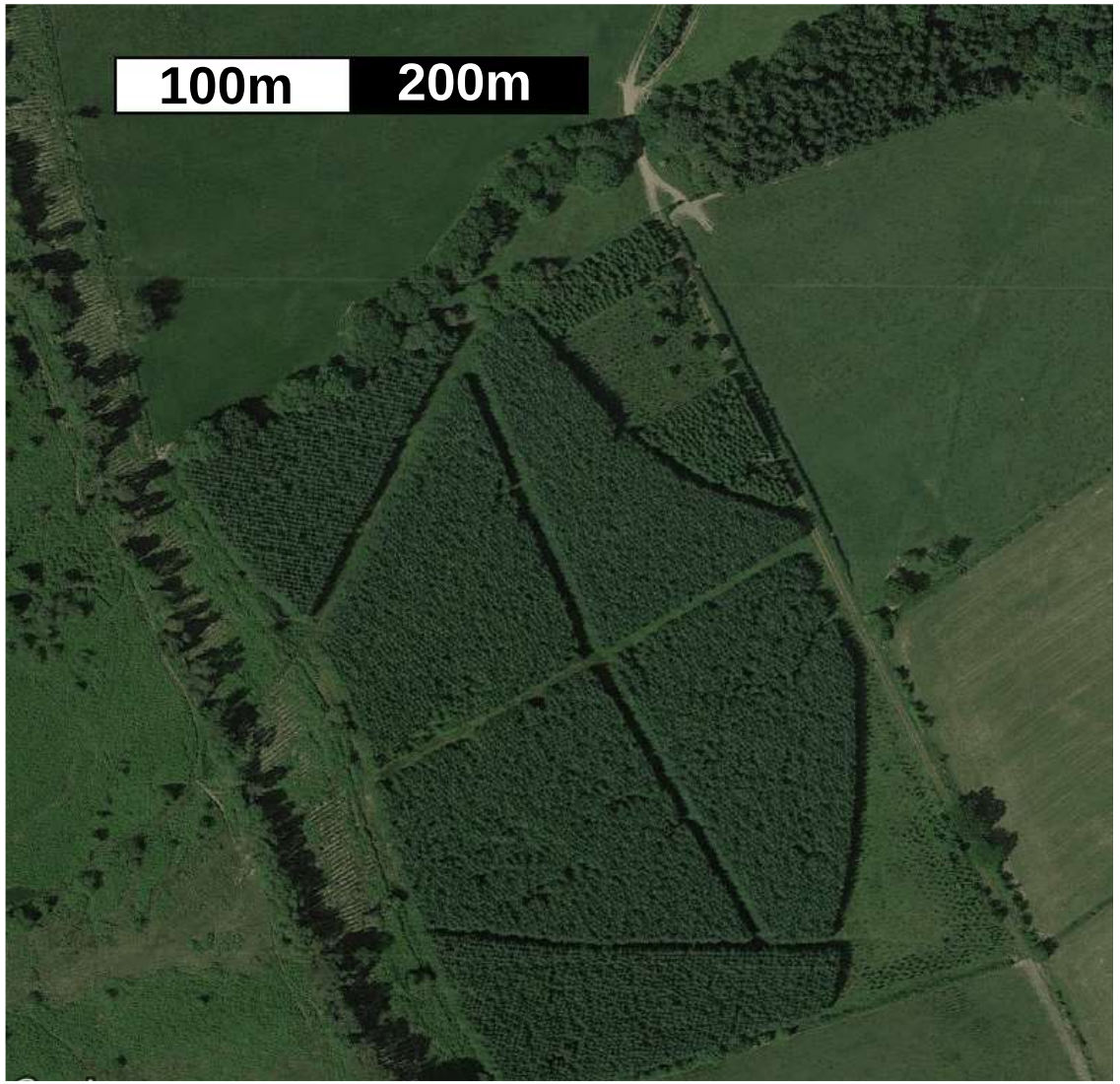
A Word About Replication

= 325 million people?

A Word About Replication

= 325 million people?

Llangoed - Local Hero

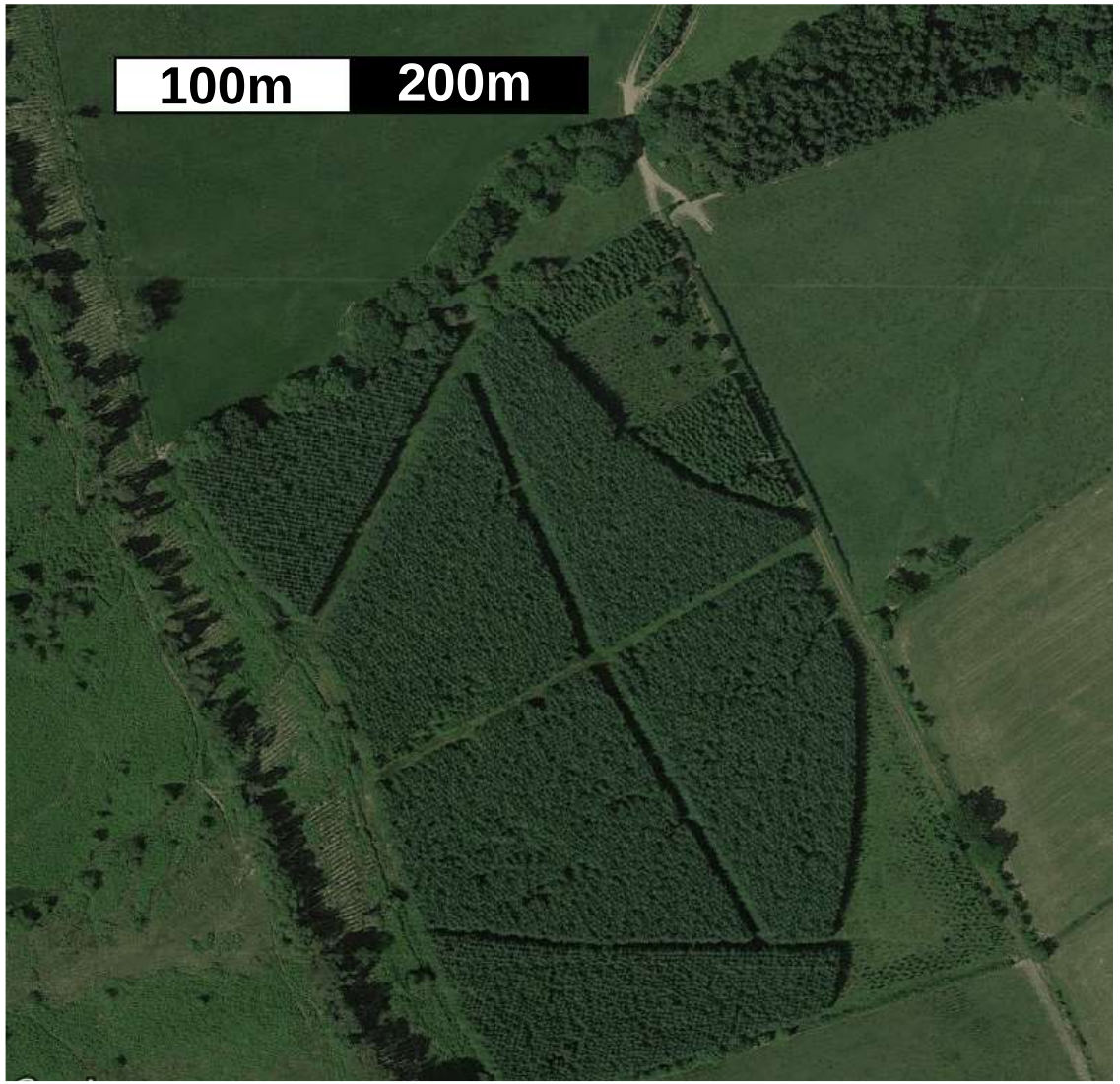


Llangoed - Local Hero

Elevation 300m

Planted 2002

Seed orchard material



Llangoed - Local Hero

Elevation 300m

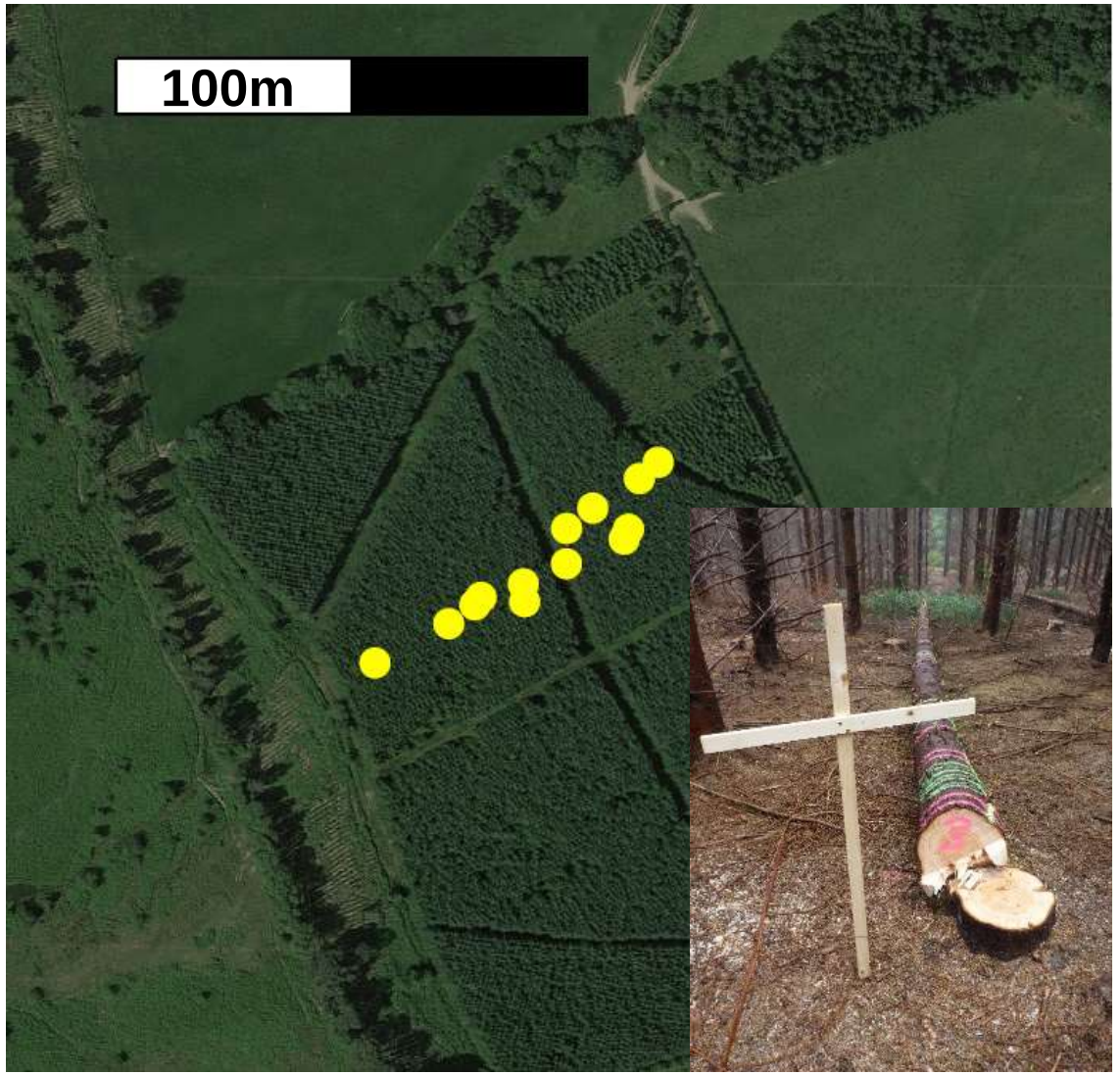
Planted 2002

Seed orchard material

13 stems sampled

Growth measured

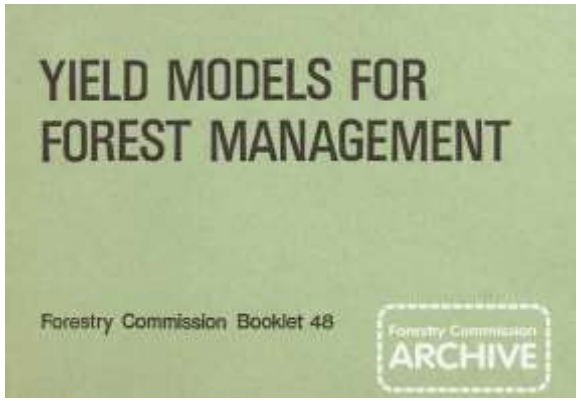
Mechanical properties tested



A Word About Replication

13 Trees ≠1.7 Billion Trees

Exhibit 1 – Quantity



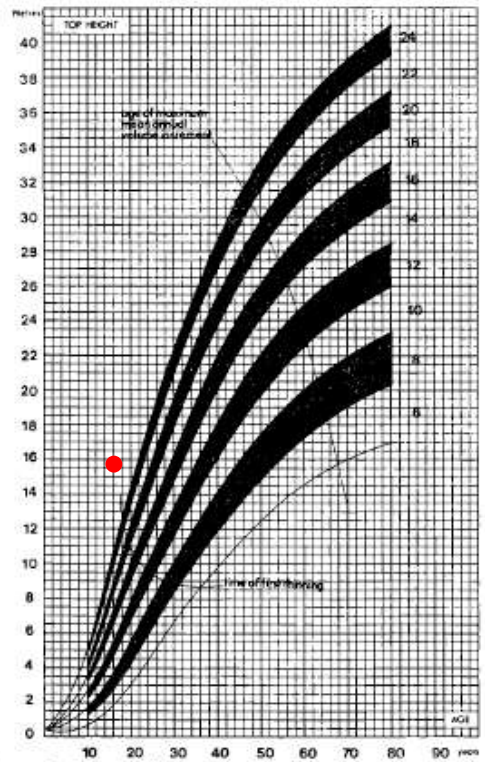
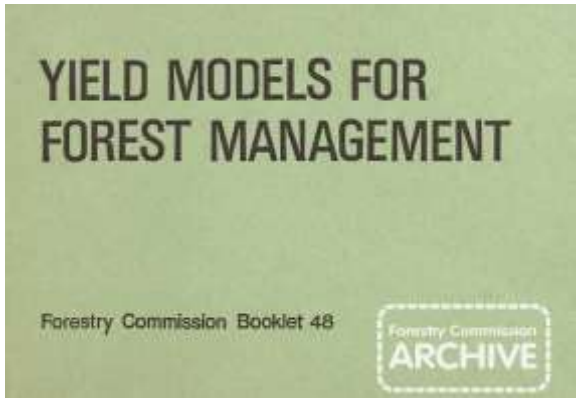


FIGURE 5 General Yield Class Curves for Sitka Spruce

Exhibit 1 – Quantity



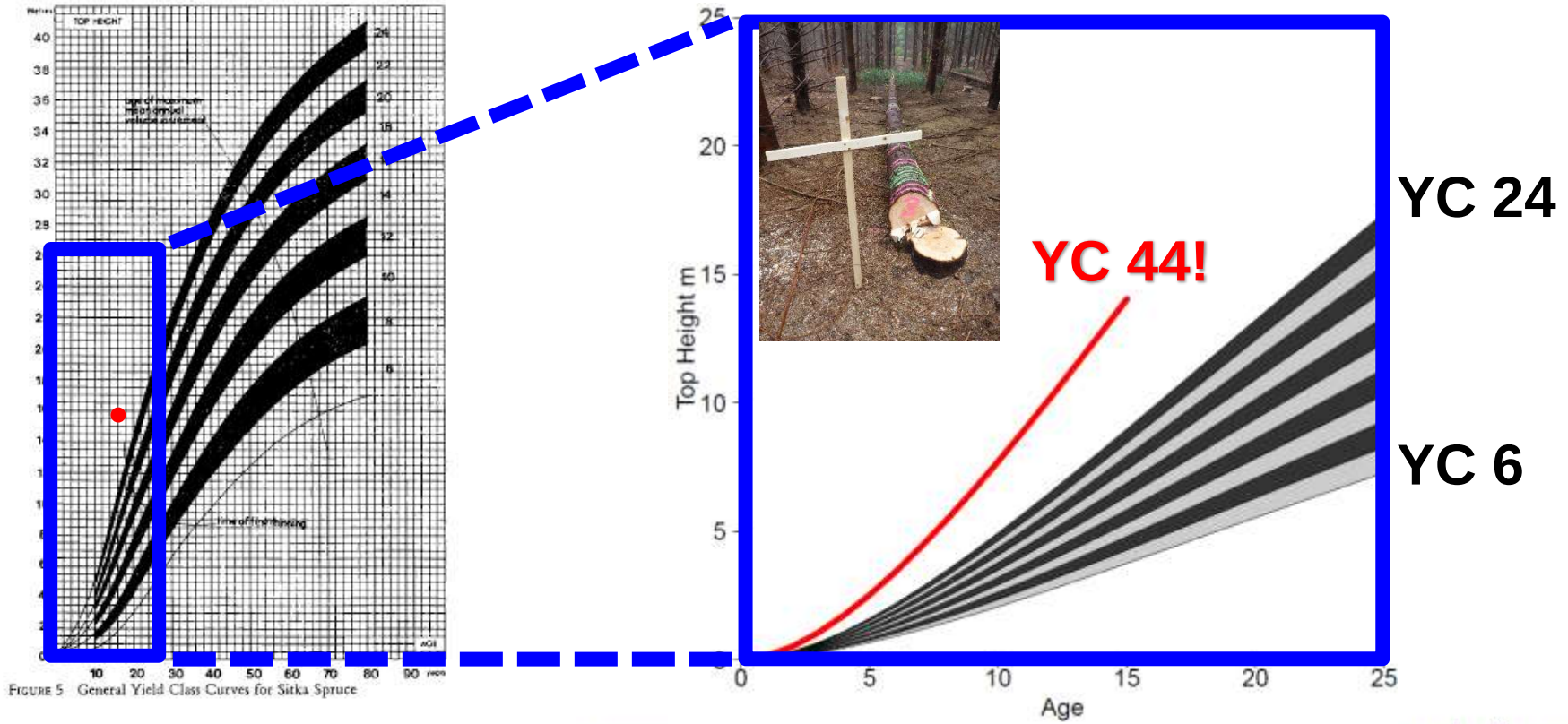


Exhibit 2 – Quality

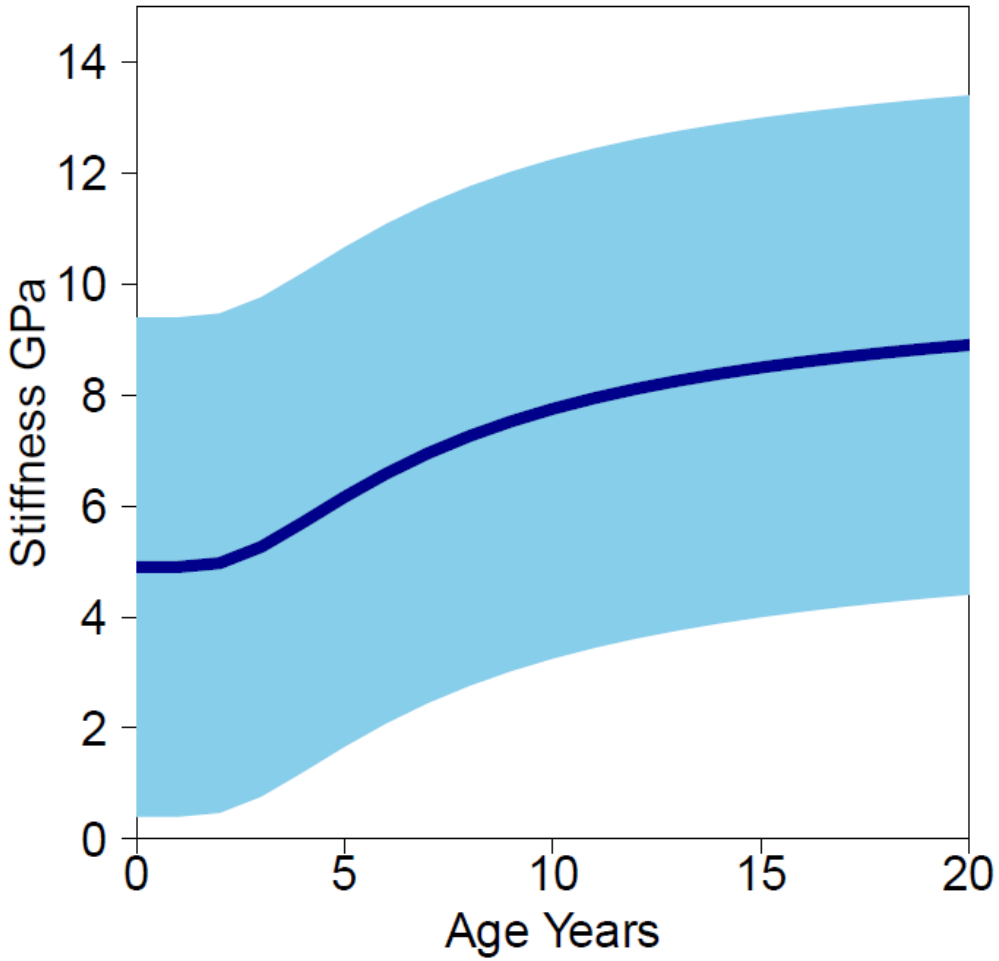


Exhibit 2 – Quality

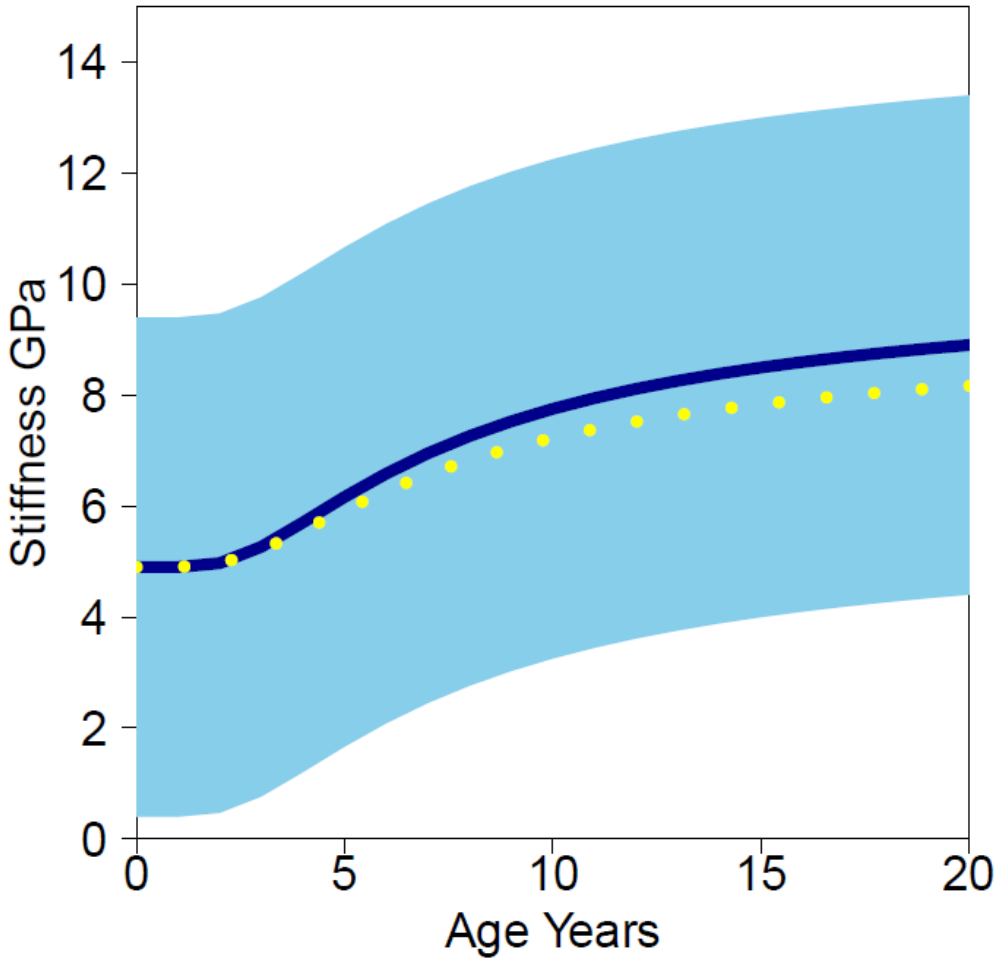


Exhibit 2 – Quality

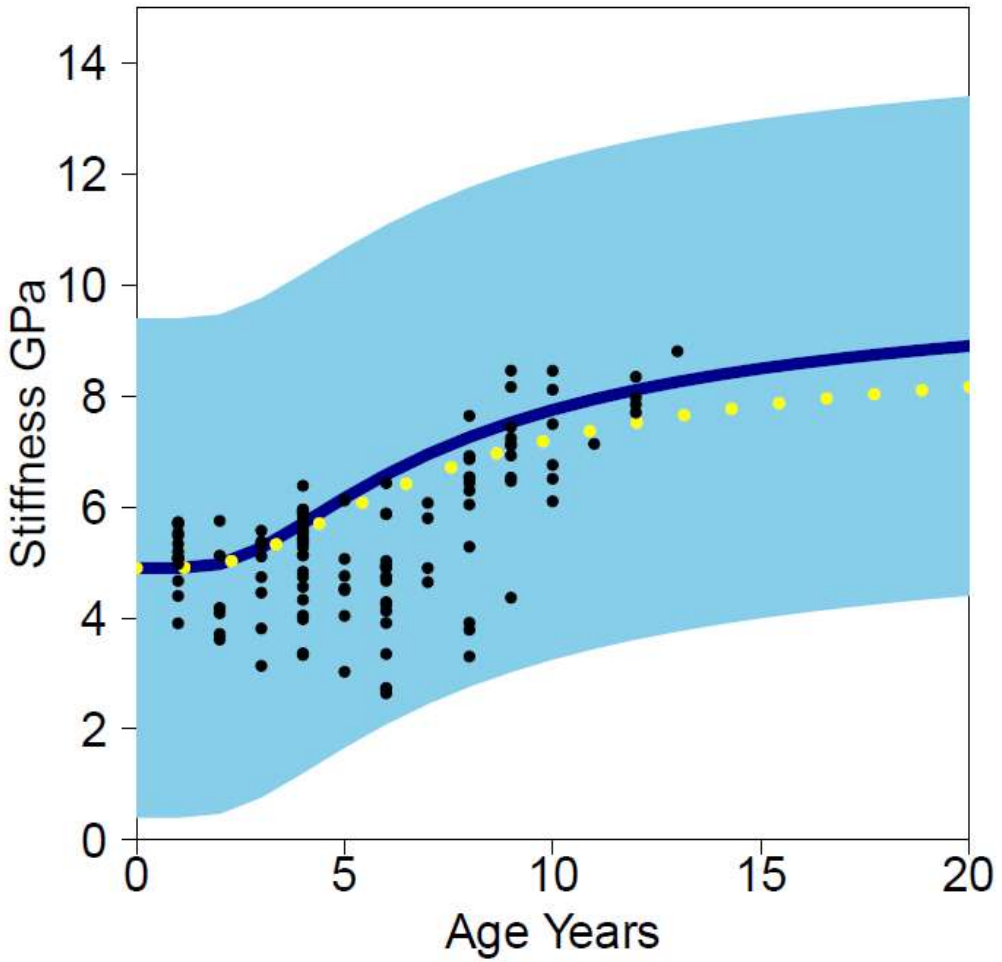


Exhibit 2 – Quality

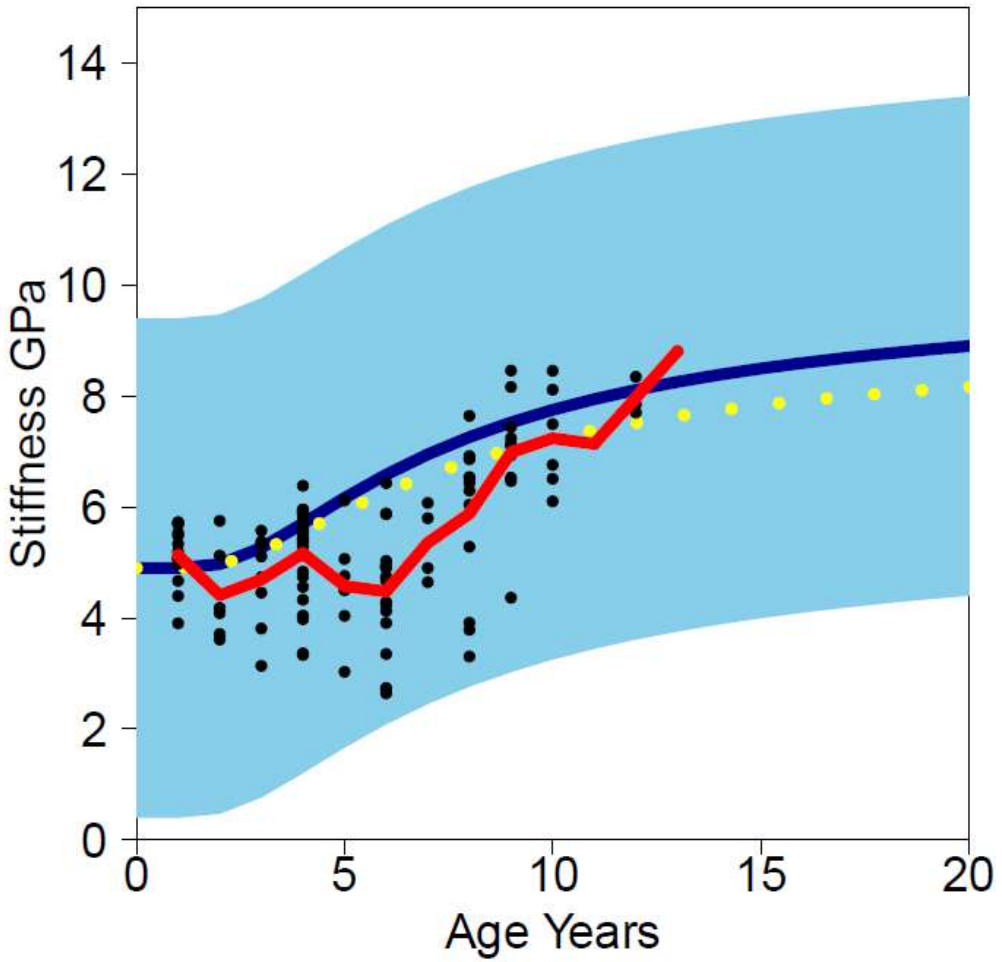
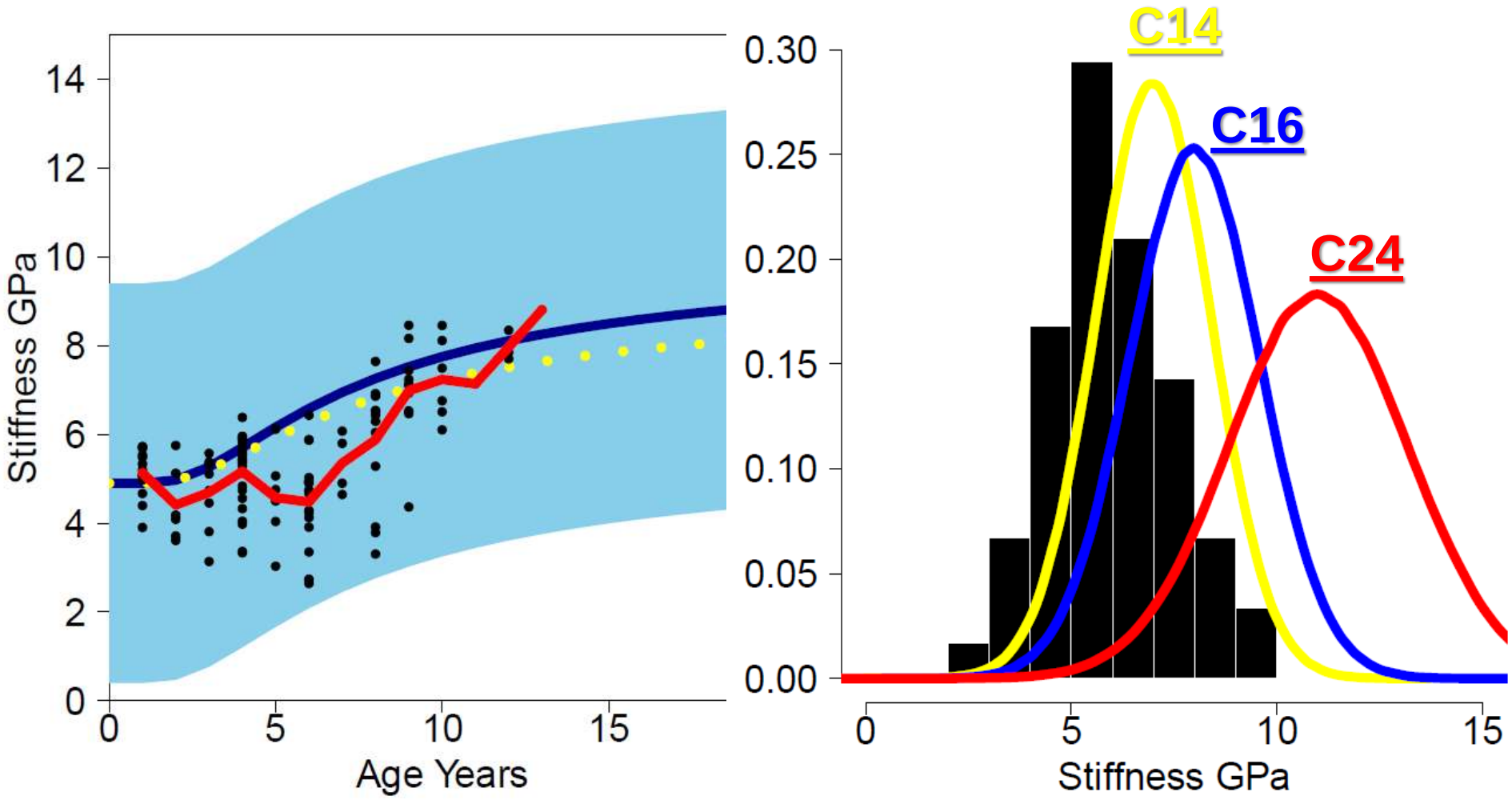


Exhibit 2 – Quality



Recap

- Quantity is up – double YC 24
- Quality – needs compared to a control **on site**
  - Within range, bit lower than average
  - More time required
  - More sites required
  - 13 Trees ≠1.7 Billion Trees

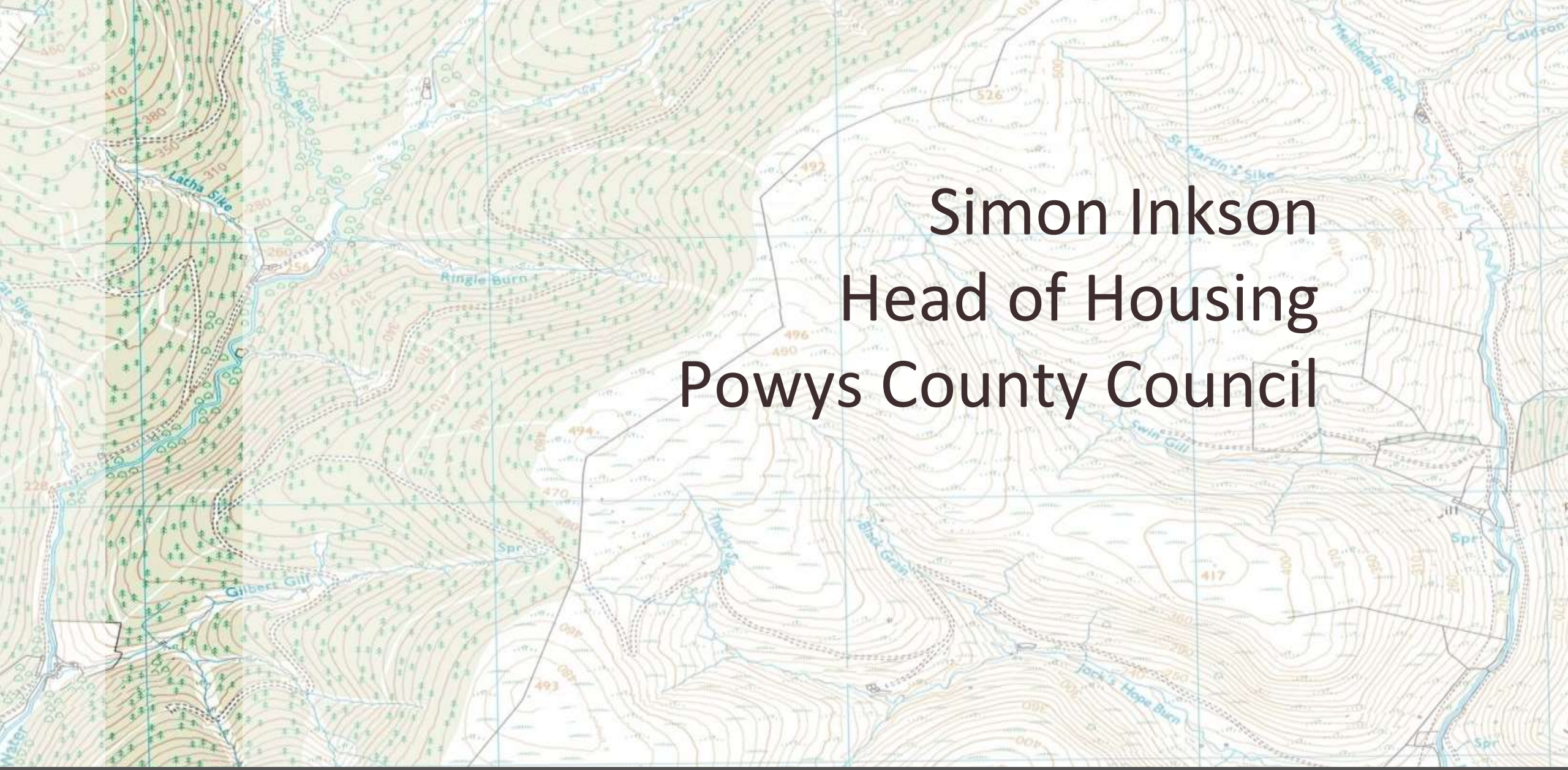
Exhibit 3 – Sitka spruced

https://www.forestry.gov.uk/fr/sitkaspruced

BBSRC bioscience for the future

THE UNIVERSITY OF EDINBURGH

UNIVERSITY OF OXFORD

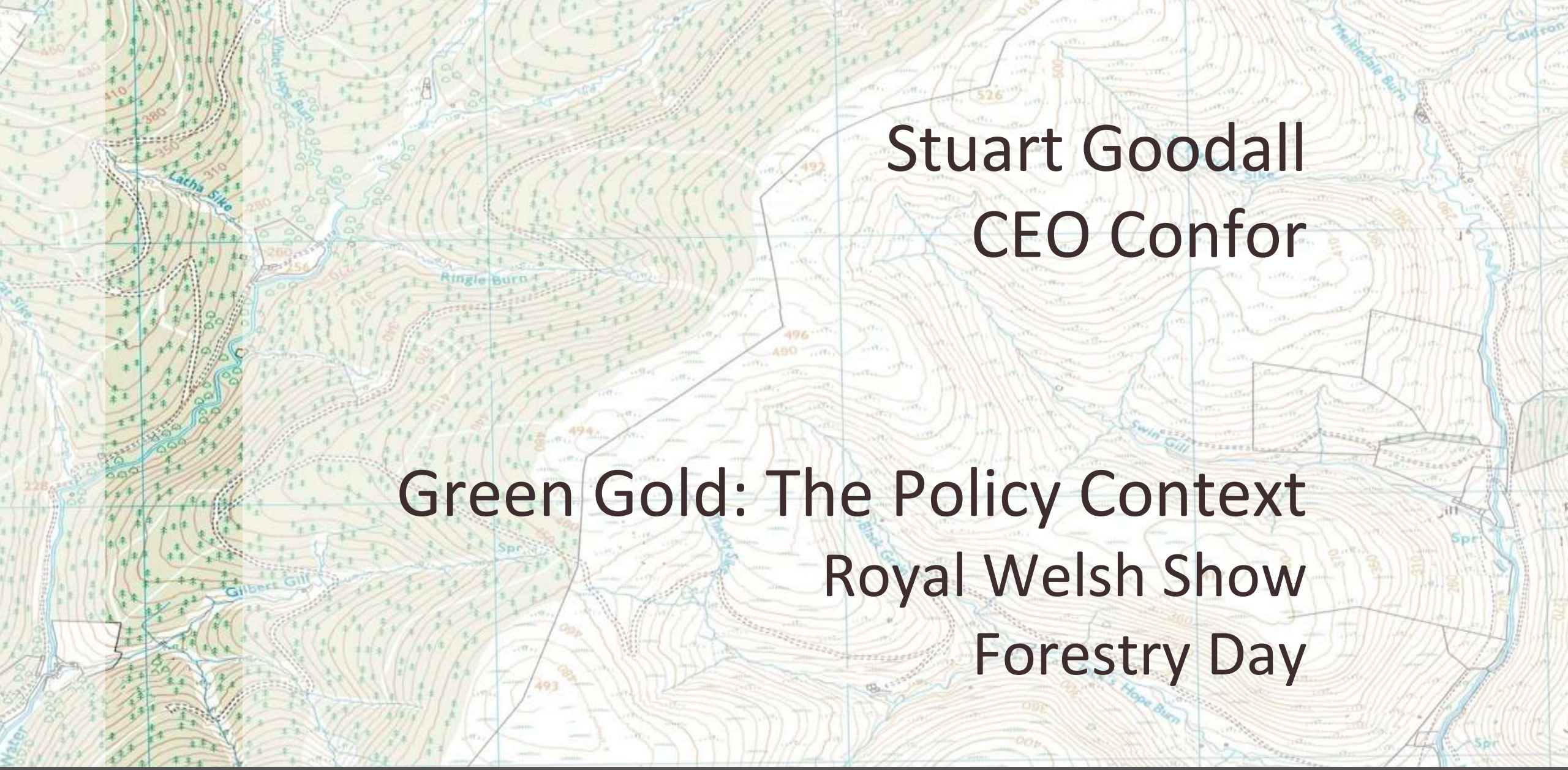


Simon Inkson
Head of Housing
Powys County Council

Yn agored a blaengar - Open and enterprising

Prosiect Tai o Bren Cynhenid

The Home-Grown Homes Project



Stuart Goodall
CEO Confor

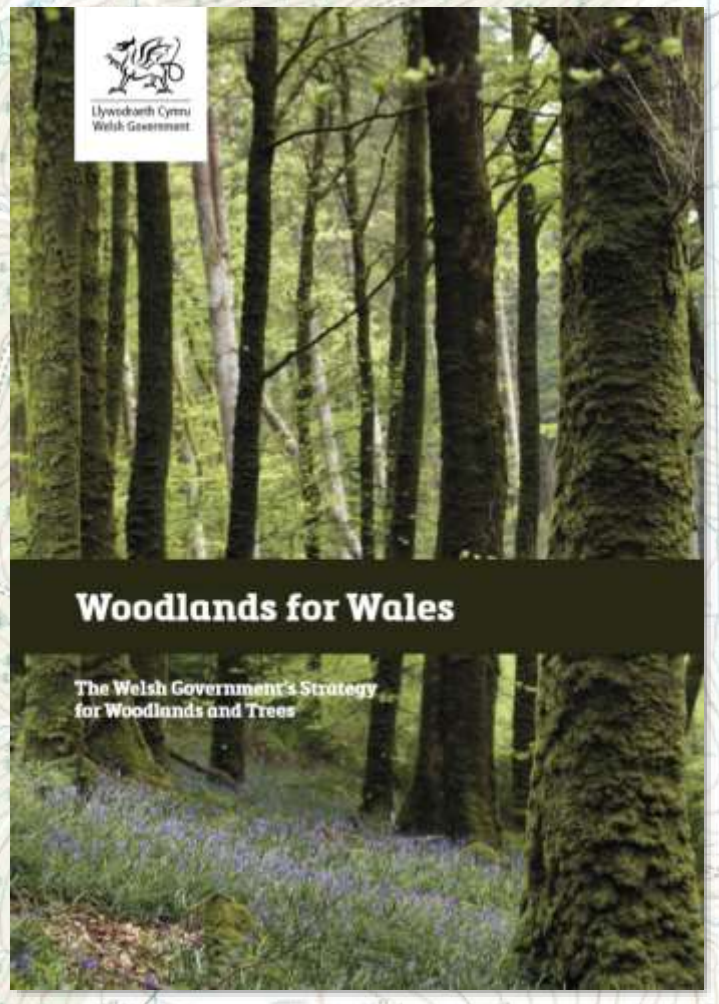
Green Gold: The Policy Context

Royal Welsh Show
Forestry Day

1. Policy context
2. Confor's Planting in Wales Campaign
3. Over to you…

Policy Context

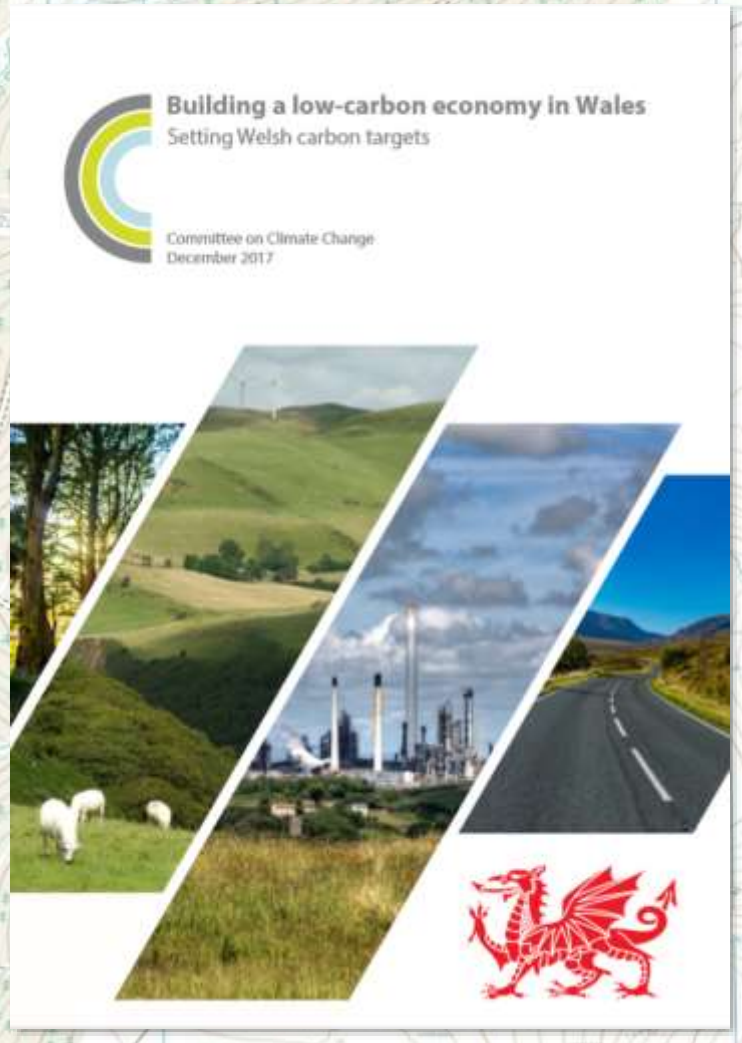
Woodland for Wales Strategy



- Welcome commitment to planting 2000ha/year by 2020
- Welcome inclusion of dedicated chapter 5 on timber
- Overall, too many aims, too few targets

Policy Context

Climate change



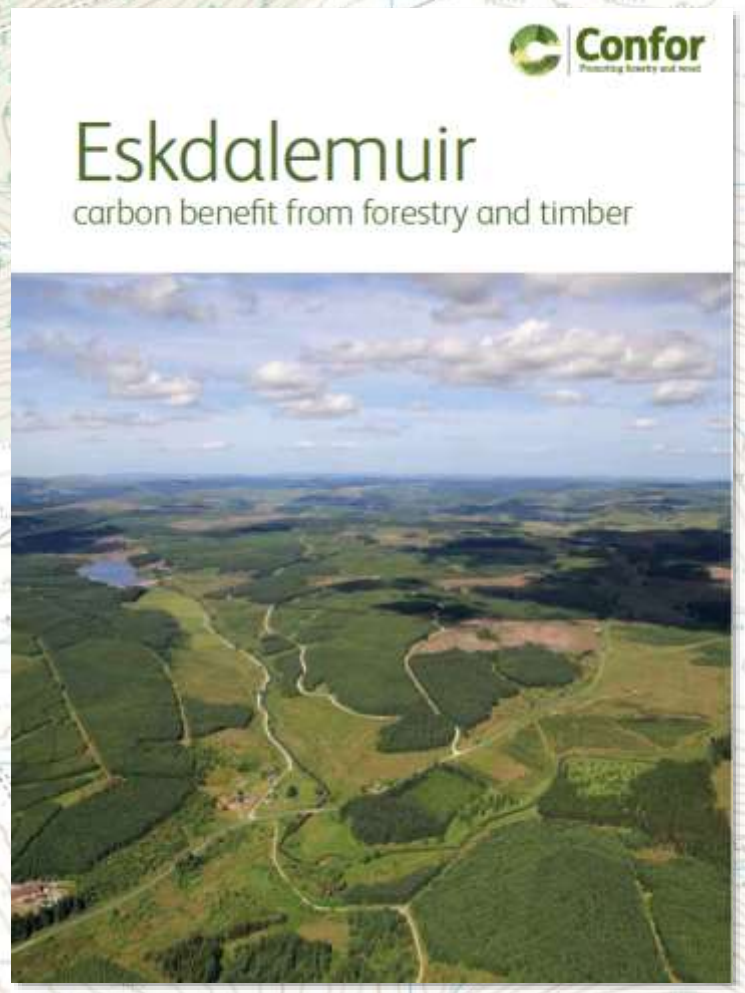
- Target: 4000ha new woodland per year
- Actual: substantially less than 1000ha per year since 1989

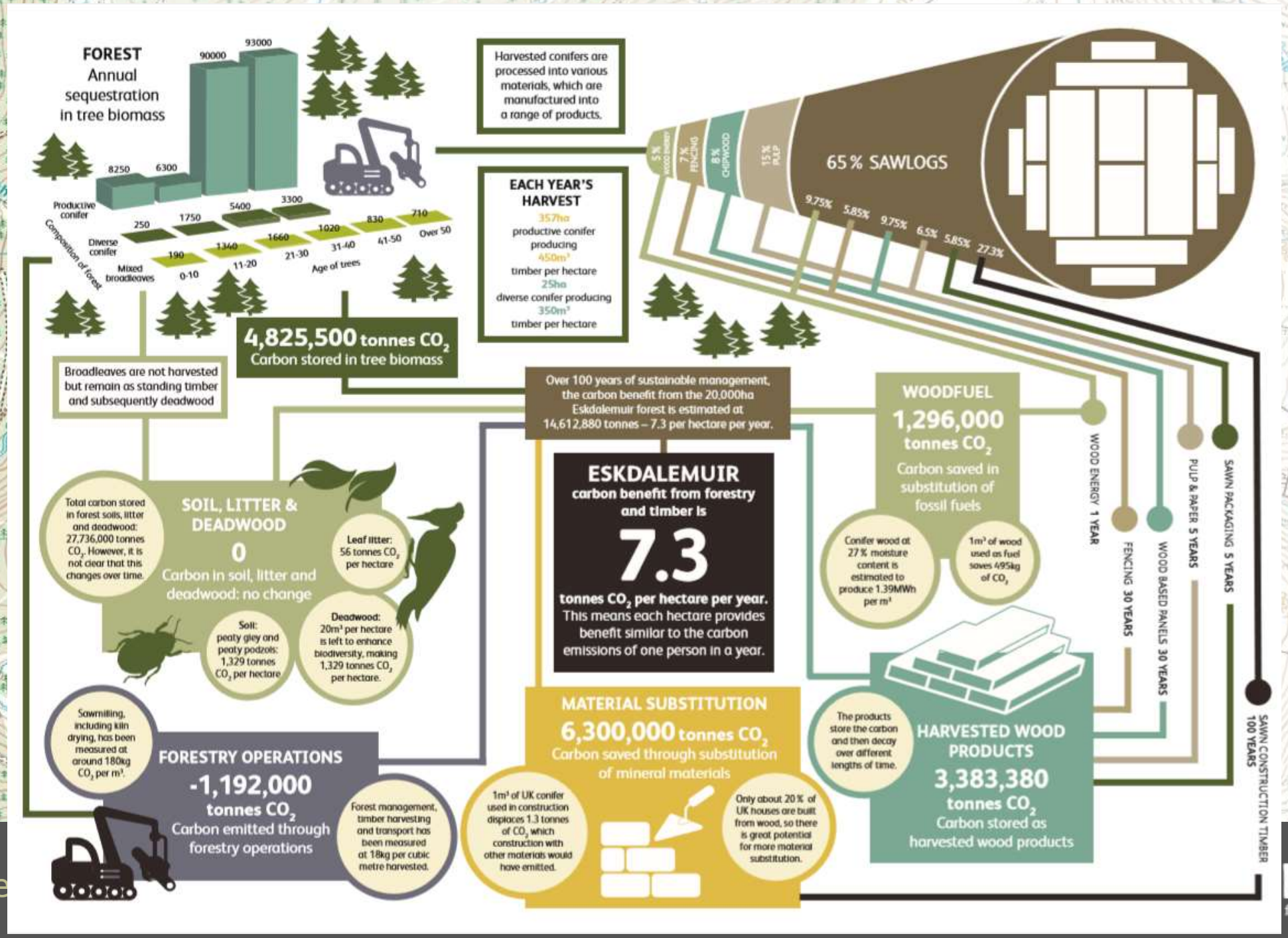
Policy Context

Climate change

Policy Context

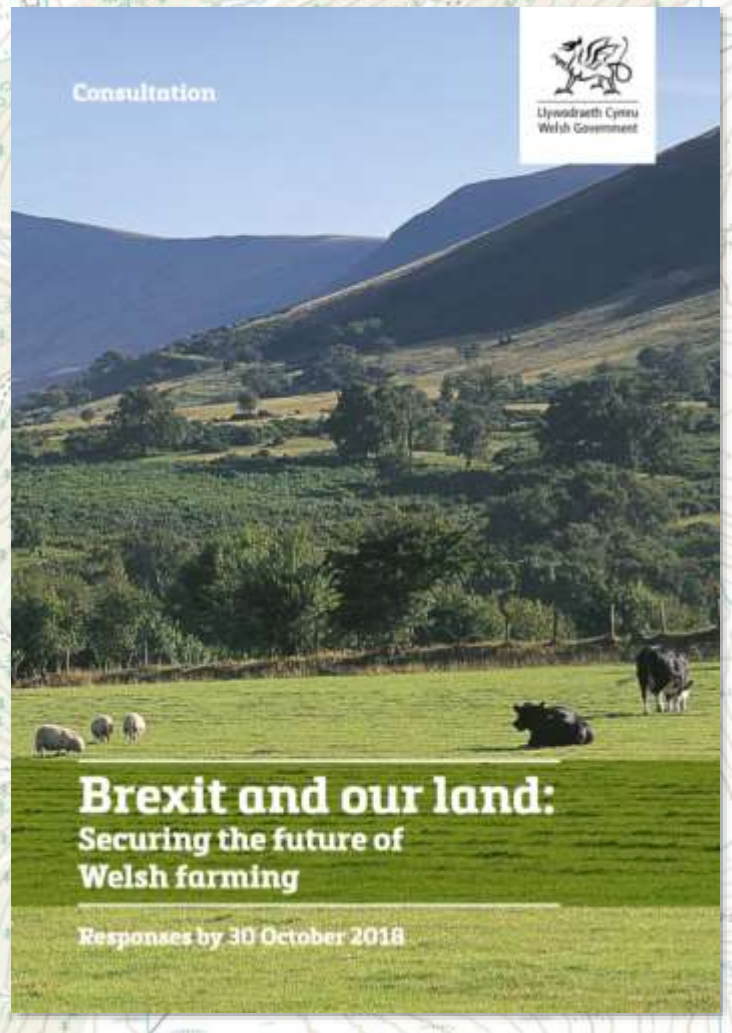
Climate change




FOREST
Annual sequestration in tree biomass
Productive conifer
Diverse conifer
Mixed broadleaves
Composition of forest
Age of trees
0-10
11-20
21-30
31-40
41-50
Over 50
8250
6300
90000
93000
250
1750
5400
3300
190
1340
1660
1020
830
710
Harvested conifers are processed into various materials, which are manufactured into a range of products.
EACH YEAR'S HARVEST
357ha
productive conifer producing
450m³
timber per hectare
25ha
diverse conifer producing
350m³
timber per hectare
5% WOOD ENERGY
7% FENCING
8% CHIPWOOD
15% PULP
65% SAWLOGS
9.75%
5.85%
9.75%
6.5%
5.85%
27.3%
4,825,500 tonnes CO2
Carbon stored in tree biomass
Broadleaves are not harvested but remain as standing timber and subsequently deadwood
Over 100 years of sustainable management, the carbon benefit from the 20,000ha Eskdalemuir forest is estimated at 14,612,880 tonnes – 7.3 per hectare per year.
ESKDALEMUIR
carbon benefit from forestry and timber is
7.3
tonnes CO2 per hectare per year.
This means each hectare provides benefit similar to the carbon emissions of one person in a year.
WOODFUEL
1,296,000 tonnes CO2
Carbon saved in substitution of fossil fuels
Conifer wood at 27% moisture content is estimated to produce 1.39MWh per m³
1m³ of wood used as fuel saves 495kg of CO2
WOOD ENERGY 1 YEAR
FENCING 30 YEARS
WOOD BASED PANELS 30 YEARS
PULP & PAPER 5 YEARS
SAWN PACKAGING 5 YEARS
SAWN CONSTRUCTION TIMBER 100 YEARS
Total carbon stored in forest soils, litter and deadwood: 27,736,000 tonnes CO2. However, it is not clear that this changes over time.
SOIL, LITTER & DEADWOOD
0
Carbon in soil, litter and deadwood: no change
Leaf litter: 56 tonnes CO2 per hectare
Soil: peaty gley and peaty podzols: 1,329 tonnes CO2 per hectare
Deadwood: 20m³ per hectare is left to enhance biodiversity, making 1,329 tonnes CO2 per hectare.
Sawmilling, including kiln drying, has been measured at around 180kg CO2 per m³.
FORESTRY OPERATIONS
-1,192,000 tonnes CO2
Carbon emitted through forestry operations
Forest management, timber harvesting and transport has been measured at 18kg per cubic metre harvested.
MATERIAL SUBSTITUTION
6,300,000 tonnes CO2
Carbon saved through substitution of mineral materials
1m³ of UK conifer used in construction displaces 1.3 tonnes of CO2 which construction with other materials would have emitted.
Only about 20% of UK houses are built from wood, so there is great potential for more material substitution.
The products store the carbon and then decay over different lengths of time.
HARVESTED WOOD PRODUCTS
3,383,380 tonnes CO2
Carbon stored as harvested wood products

Policy Context

Brexit



- Welcome ‘Land use’ not ‘farm’ policy
- Welcome recognition of timber as a crop
- Concern that ‘additionality’ will prevent productive forestry being funded

Planting in Wales Campaign

- Raising the presence of forestry in the media
- Assisting applicants to plant trees to reduce opposition through pro-active engagement
- Removing barriers to planting

Forestry in the media

Planting in Wales Campaign

4

COUNTRY&FARMING

More trees are needed to save Wales' woodlands

into the woods

Martin Bishop

More focus on forestry sector needed to show farmers the long-term benefits

@forestsandwood

Confor
Promoting forestry and wood

Planting in Wales Campaign

Stakeholder engagement

GUIDANCE NOTE

Confor

Stakeholder engagement

Stakeholder Engagement: the process of involving people in the decisions that affect them.
Consult: To have regard for a person's feelings or interests in making plans or decisions.

	Planning or developing activities e.g. new planting, revision of management plans, significant felling.	Management of existing activities e.g. access and forest management interactions.	Tackling problems e.g. timber transport disruption, fly tipping, unauthorised mountain bike trails.
WHEN?			
WHO?	• Neighbours • Community (community council, development trust, user groups) • Clients / agents • Legal interests e.g. wayleaves • Special interest groups • NRW & statutory consultees • National NGOs • Vociferous distractors	• Neighbours • Community (community council, development trust, user groups, local schools) • Clients / agents • Legal interests e.g. wayleaves • Special interest groups	• Neighbours • Community (community council, development trust, user groups) • Local authority • Local councillors, AM's, MPs
HOW?	• Site visits • Small informal / formal meetings with key stakeholders • Telephone contact with key stakeholders • Attend meetings of relevant local groups • Website • Advertisements / articles in local press • Interactive workshop / event • Leaflet drop to all households	• Establish a forestry contact within Community council or similar • Advisory committee • Attendance at suitable local events e.g. shows, galas, etc. • Newsletters • Annual surgery • Annual meeting with key stakeholders • Notice board at forest gate • Website	• Site visits • Small informal / formal meetings with key stakeholders • Awareness raising via local press • Attend meetings of relevant local groups

LESSONS LEARNT

- One size does not fit all – it's about the right thing at the right time. Knowing what works takes time.
- Speaking to people in advance of an activity rather than after can identify issues before they arise.
- Style and tone are as important as what is said / done.
- Make yourself known and available to stakeholders / communities as this can help avoid problems escalating.
- Listening skills are essential. Often foresters want to solve problems and take action, when just listening works.
- Take time to understand the problem. It may not be what you first think.
- Face-to-face always works better in difficult situations.
- Avoid 'town hall' style public meetings.
- Visual aids (but not just maps) and 'active' feedback sessions work well.
- Admit mistakes, rectify and move on.

HELPFUL RESOURCES

- NRW webpage on use felling activities
- WG classic pages
- Forest Research
- The Timber Transport Forum
- Confor helplines
- Grassr Woodland Creation Opportunities Map
- Ancient Woodland Inventory

Confor
Promoting forestry and wood

Planting in Wales Campaign

Stakeholder engagement

Planting in Wales Campaign

Removing barriers to planting

1. Timber production missing from Glastir scoring
2. Large areas under designations assumed unavailable
3. Lack of public funding
4. Slow and inefficient process to confirm permission to plant

Working together – Confor and you

Confor
Promoting forestry and wood