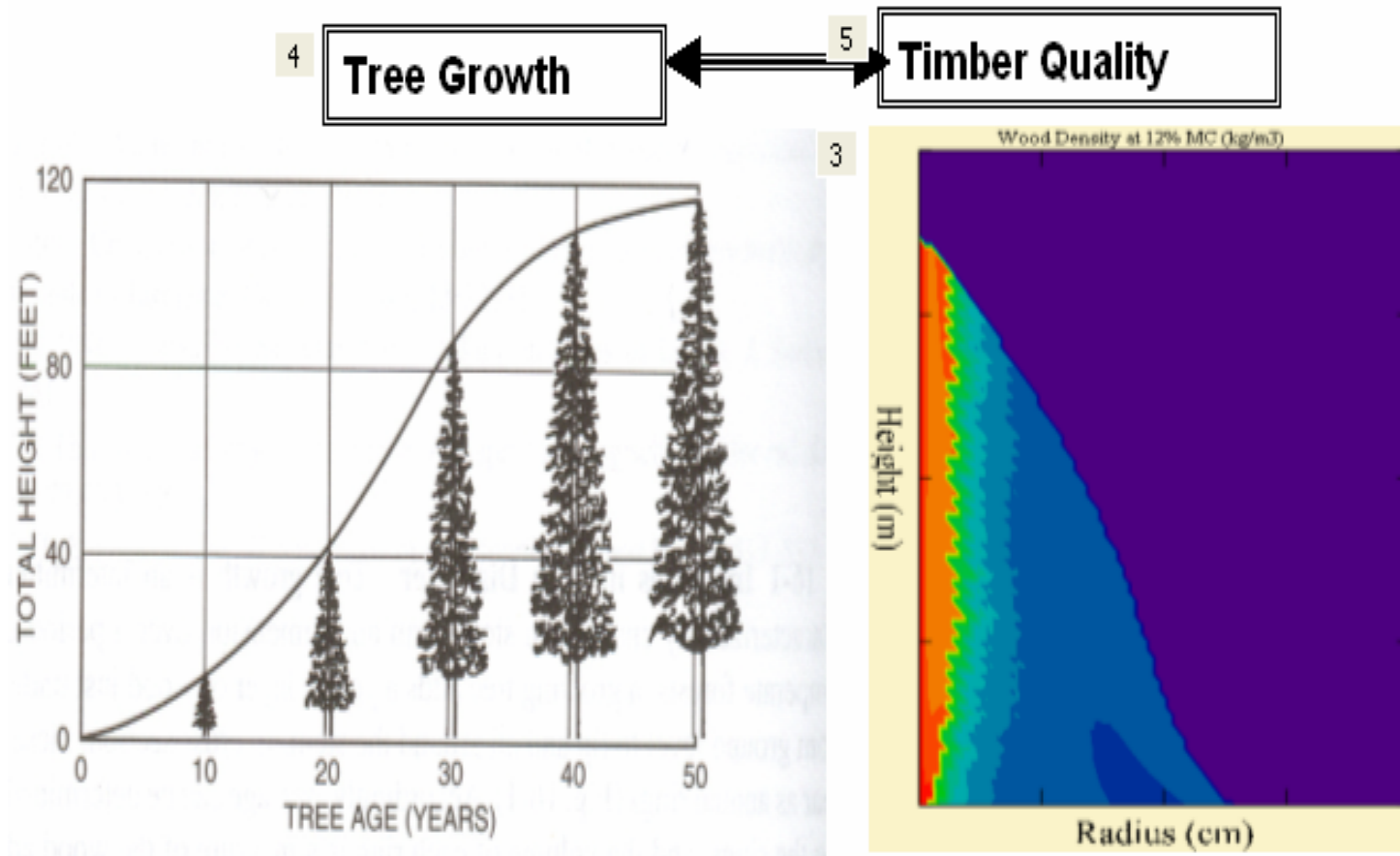


Timber Quality Models : Links to Growth Models

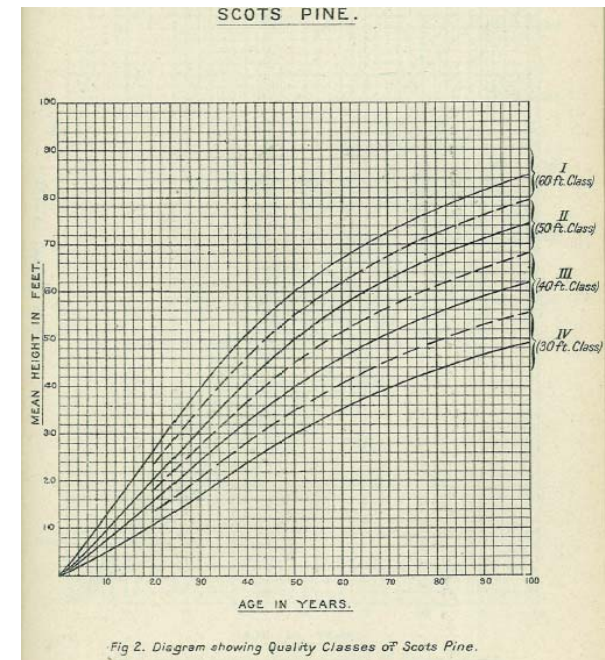
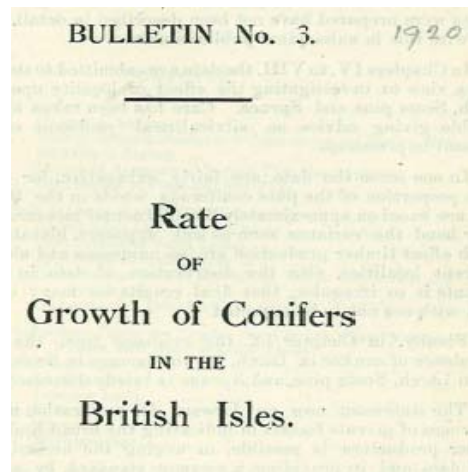
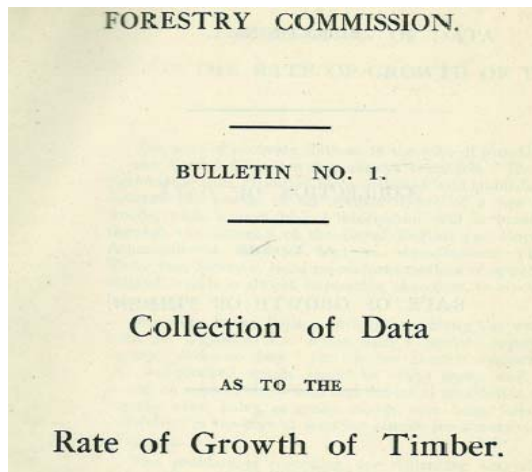
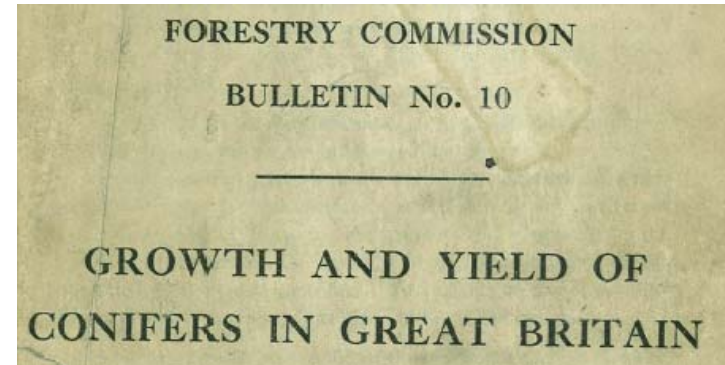


Outline of the Presentation

- Background
- Growth Modelling
- Timber quality Modelling
- Why link the two approaches
- Examples linking Growth & TQ Models
- Perspective (s)

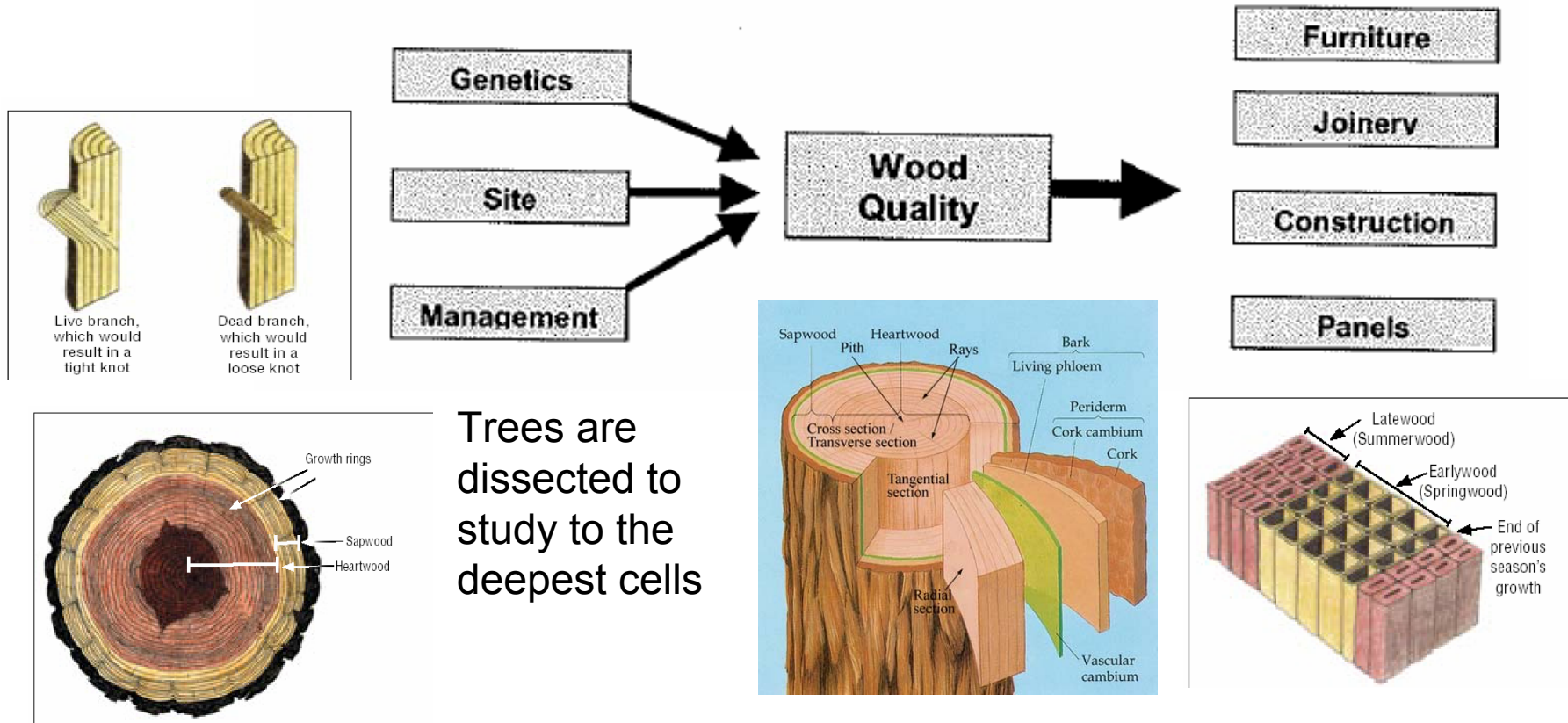
Background

- Growth & Yield modelling has been on for a long time (e.g. cf. FC Bulletins in the 1920's)
- Aim to provide quantitative information for forest resource management decision making & production forecasting



Background

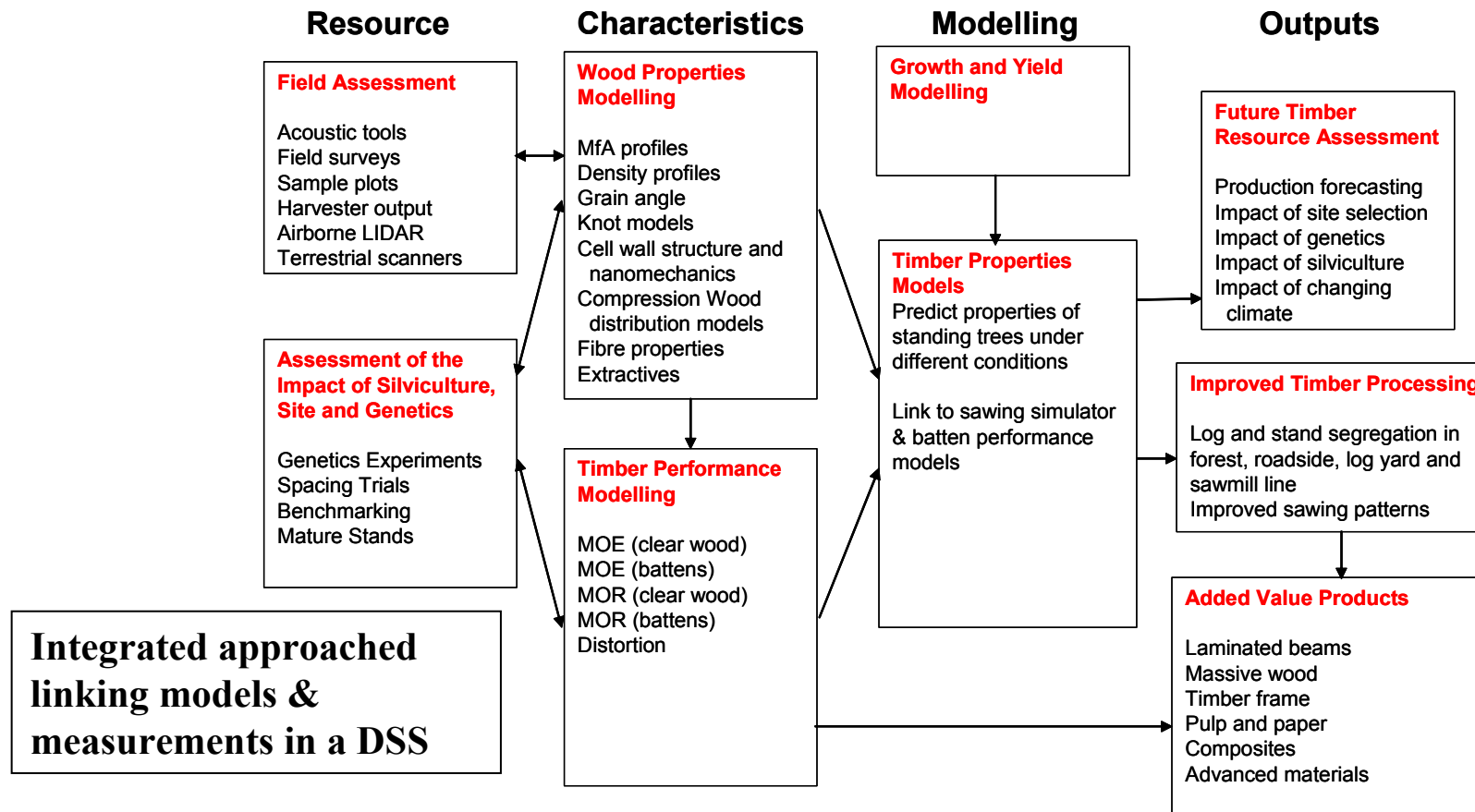
Recent industrial concerns by industry about quality of timber harvested have stimulated the need for timber quality research into the impacts of silvicultural practices, on wood quality



Why integrate modelling approaches?

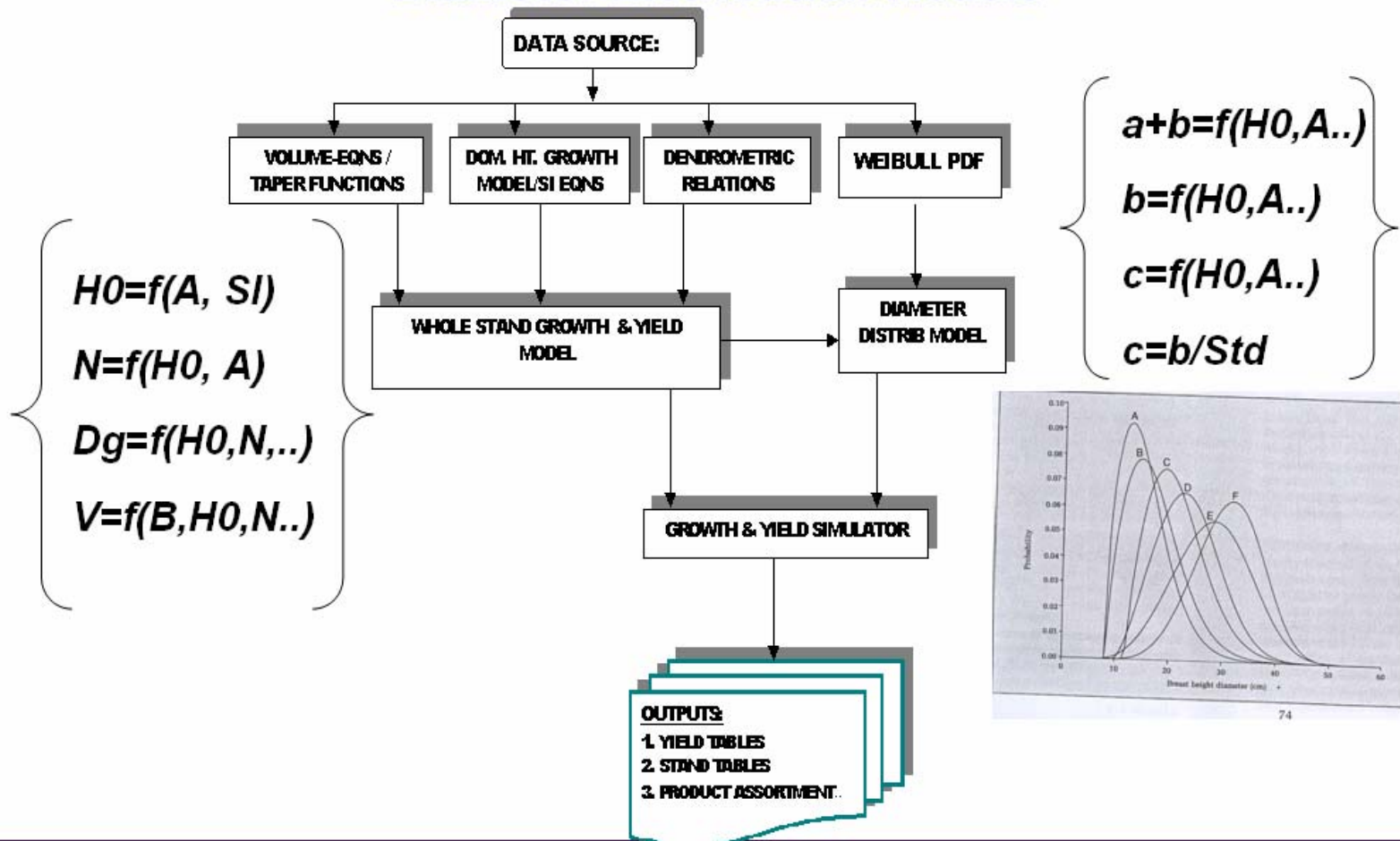
- ➔ To better satisfy multiple product demands in forestry, which are shifting from **volume-oriented forest mgt.** towards a **value-oriented forest mgt.**
- ➔ To improve forest growth modelling which focuses on **max. wood production** by incorporating timber quality modelling aspects much valued by industry.
- ➔ UK. PF will henceforth require both volume and timber quality forecasts.
- ➔ A biological link exist between tree growth & wood quality, and there is no reason why both approaches should continue to evolved independently.

TQRP: Integrated Approach

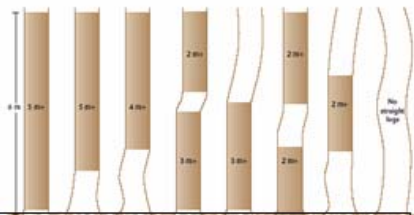


Envisaged Modelling approach: Linking models and Measurements together (courtesy of Dr John Moore)

Structure & link between Whole Stand & Diameter Distribution Models



TQ Modelling: Field Data Collection



Use of Stem Straightness Storing

Our field activities include:



Tree felling for ground Measurements



Measurement of branch sizes, and stem taper on felled tree

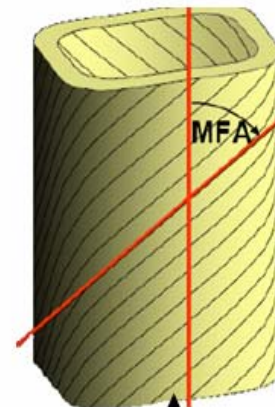
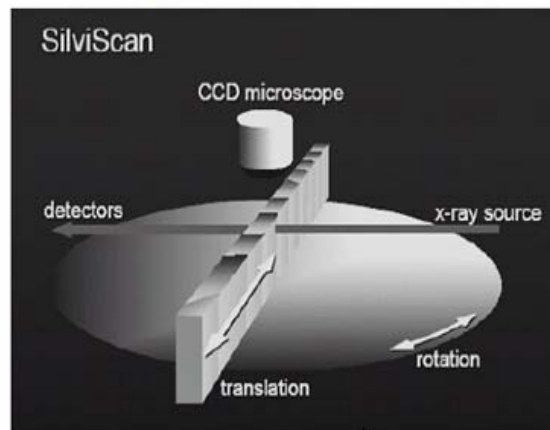


Acoustic testing on Standing Tree

Discs for Laboratory work



Laboratory Measurements



SilviScan Operation
(Evans 2001)

Microfibril Angle
(Evans 1999b in McLean 2007)



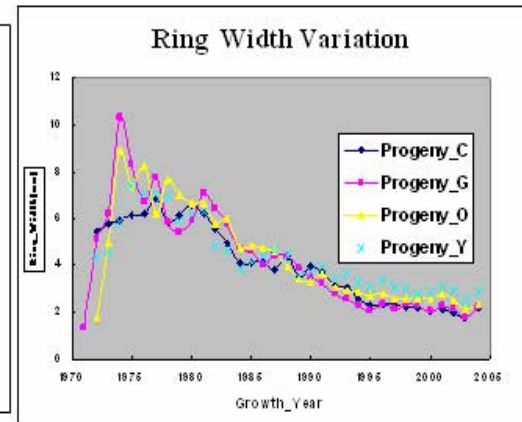
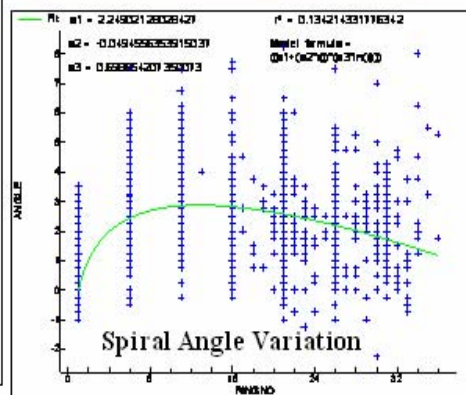
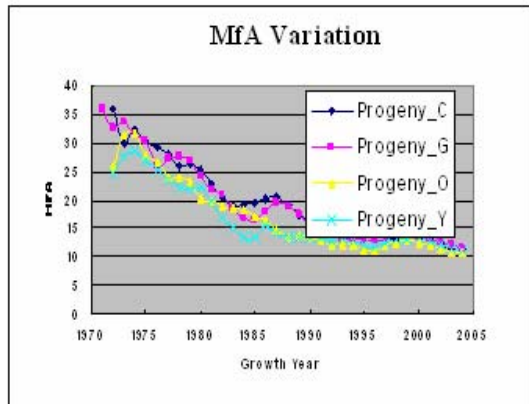
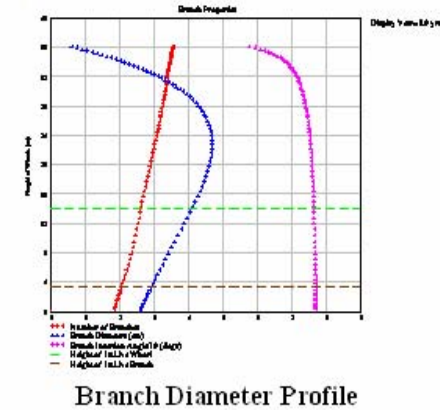
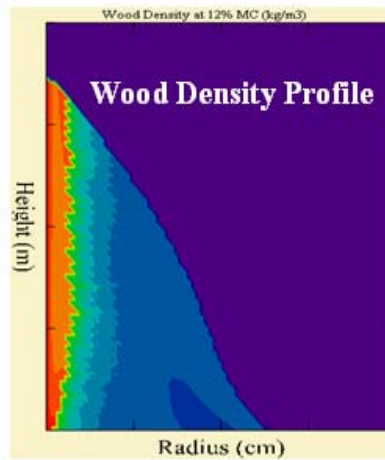
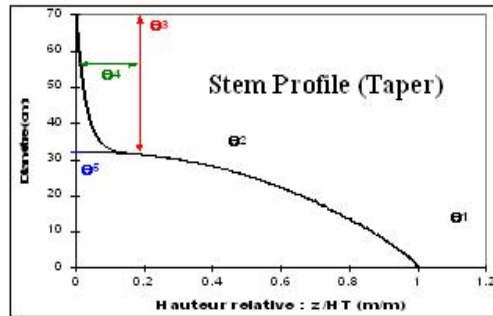
Density Measurement
with CT Scanner

Mechanically testing for
Strength & Stiffness

Grain Angle
Measurement



Some Timber Properties modelled



TMQuality Model : Links to Growth Model

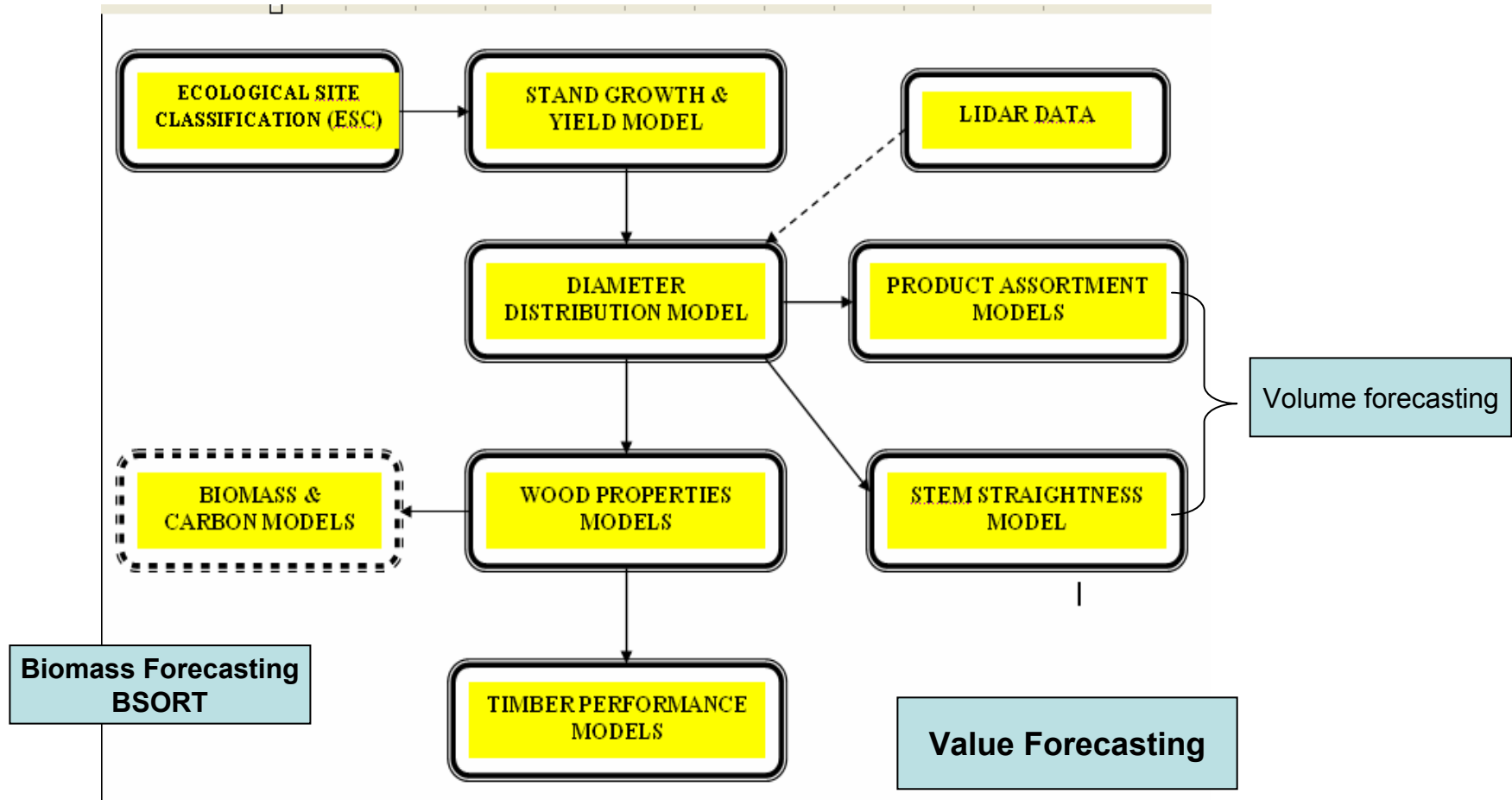
- Timber Quality Model is linked to the Growth models (**Forest YIELD Simulator**) based on Yield Models (Tables) by Edwards & Christie 1981.
- To run the model for a given stand, a yield class is specified, with a thinning regime, stand age, and initial spacing.
- Given the initial inputs, a specific **[Yield Table]** is identified & accessed; top height and mean diameter (dbh) are read from the yield table, and mean tree height is derived from top height;
- These values (dbh & Ht) are then used as inputs into a taper function which specifies an average stem profile for the mean tree in the stand, which forms the basis of density profile model.

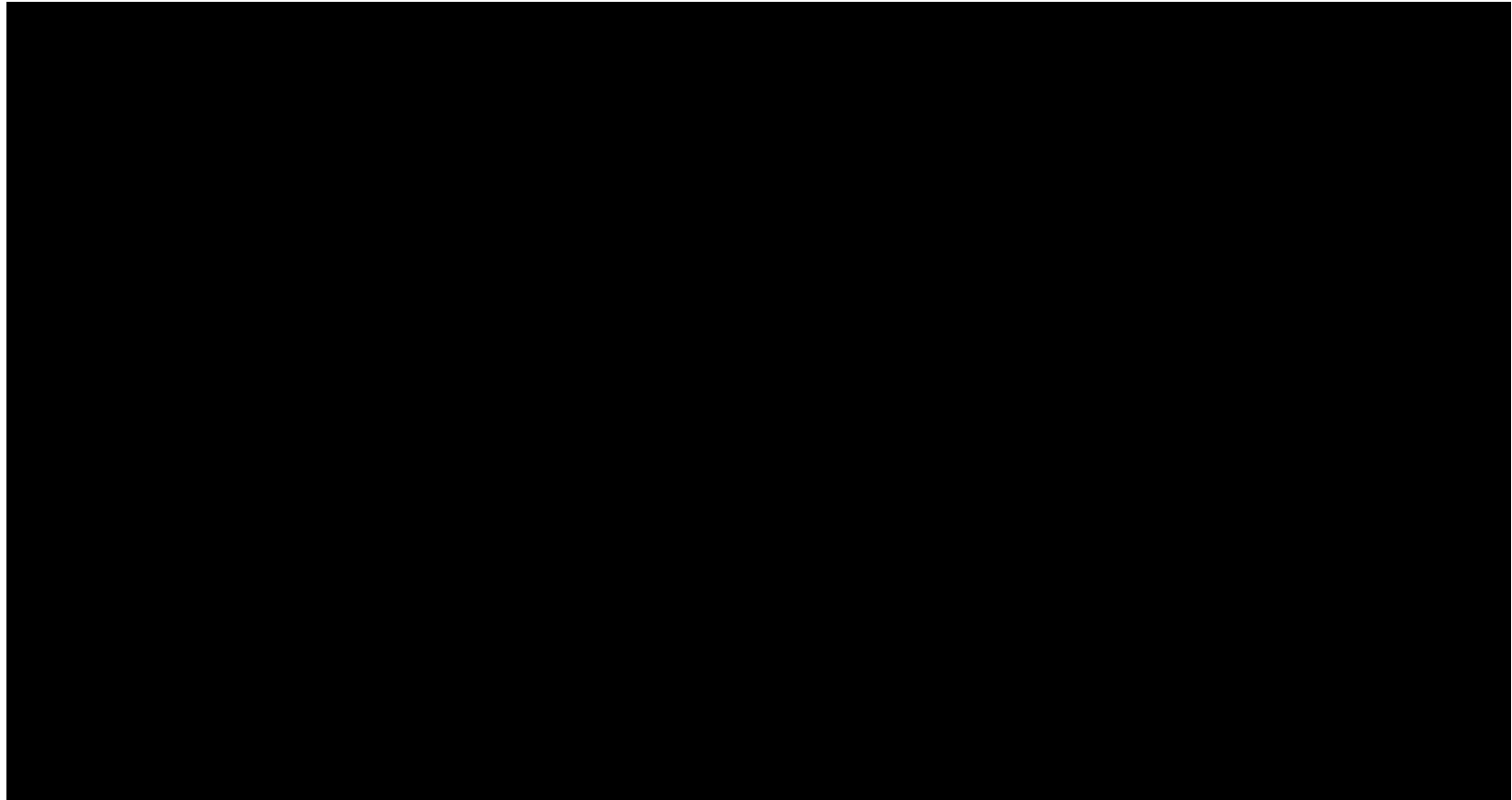


Yield Table

	0	1	2	3	4
0	0	0	0	0	0
1	19	6.9	$3.317 \cdot 10^3$	10	25
2	24	9.6	$2.215 \cdot 10^3$	13	28
3	29	12.2	$1.533 \cdot 10^3$	16	29
4	34	14.7	$1.153 \cdot 10^3$	19	31
5	39	16.9	916	22	34
6	44	19	755	24	35
7	49	20.8	635	27	36
8	54	22.4	557	29	37
9	59	23.7	503	31	38
10	64	24.8	464	33	39
11	69	25.7	433	34	40
12	74	26.5	407	36	41
13	79	27.3	386	37	41

Intergrating Modelling Approaches







Some Spreadsheet Examples

- Strategic Level (e.g. Production Forecasting)
- [Modelled Yield2 Table.xls](#)
- Operational (Stand) level
- [Product Assortment Example Recent.xls](#)
- Pre-Harvest (Product Allocation)
- [Product Allocation.xls](#)

Perspective (s)

- Improvement on the diameter distribution models (e.g. development of species-[specific models).
- Need for more dynamic models at tree-level, suitable for timber quality modelling.
- Adopt a mixed modelling/multi-level approach to address within tree and between site variations in wood quality.
- Investigate links between growth, timber models and Lidar technology.
- Validate/calibrate sub models (modules) within the timber quality model and links to growth models.

Thank You

