

Incremental Silviculture for Coastal BC

- Ralph Winter
- Stand Management Officer
- Resource Practices Branch
- February 22, 2012

Objectives



- Provide an overview of incremental silviculture
- Decision making framework for investments
- Determining management unit objectives
- Carrying out treatments consistent with objectives



Overview

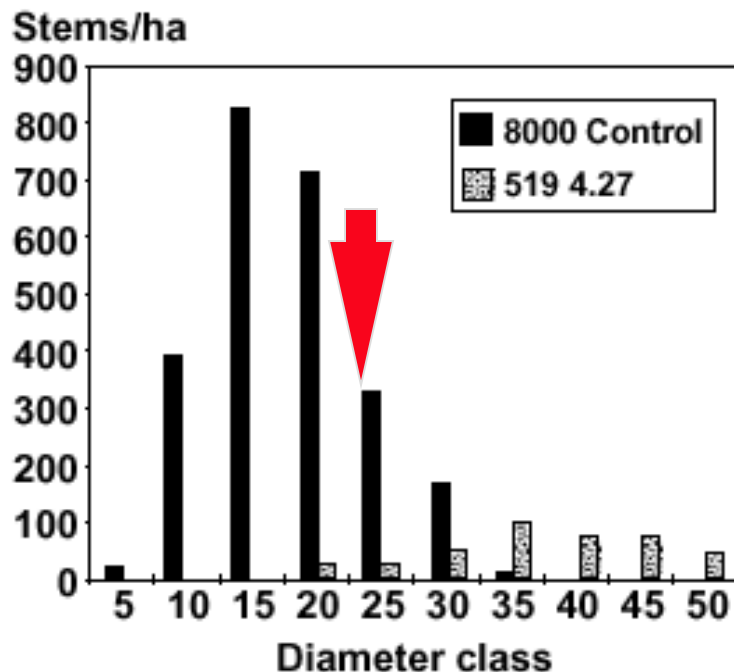
- Over 100 years of research throughout North America, New Zealand and Europe
- When properly done, at the right time and on the right sites, incremental silviculture can be a key tool for improving *merchantable* volume, value and habitat.
- The decisions for what, when, where and why to treat must be driven by forest level analysis and strategies, not just stand-level financial analysis on individual treatments.
- See Baskerville, Weetman etc
- To be effective, treatments must be properly integrated, timed and *properly supervised*.

100 years of research in North America, NZ and Europe helps inform the impact of treatments

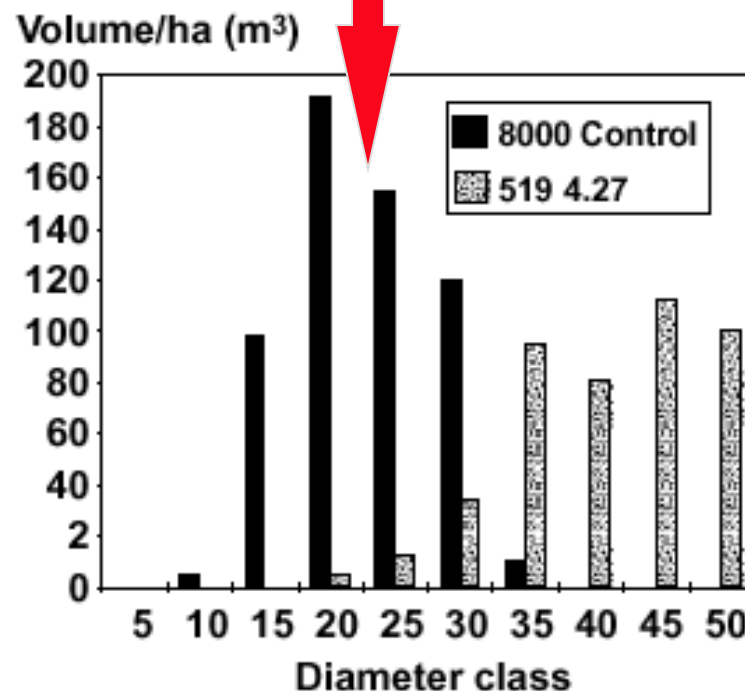


Pre-commercial Hw Thinning Trial, Olympia Peninsula, Wash. (Site Index 36 m; 38 year results)

Stand table at 26.8 m
Control vs 519 sph pct spacing



Stock Table at 26.8m
Control vs 519 sph pct spacing

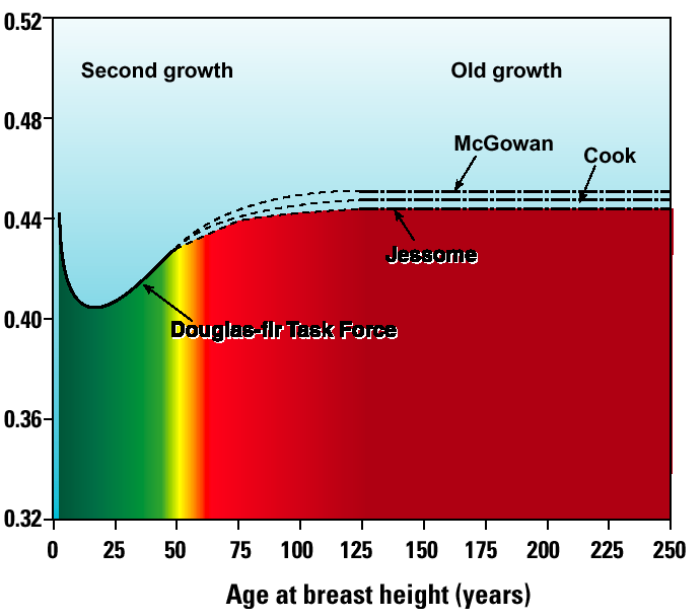


Total Vol.

575 cu. m/ha
440 cu.m/ha

Vol.25cm

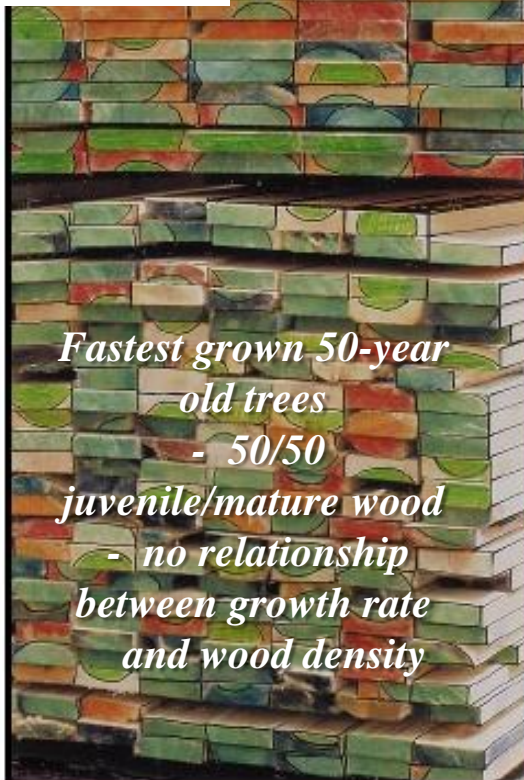
135 cu.m/ha
425 cu.m/ha



30 years of Wood Quality Studies



- Ministry has funded wood quality studies to provide information and guide stand density decision making
- Important to determine mgmt objectives
- link management practices to produce the range of desired forest products.



*Fastest grown 50-year
old trees
- 50/50
juvenile/mature wood
- no relationship
between growth rate
and wood density*

Foresters need to consider basic tree biology, **rotation lengths**, intended products and grading rules related to **piece size**.

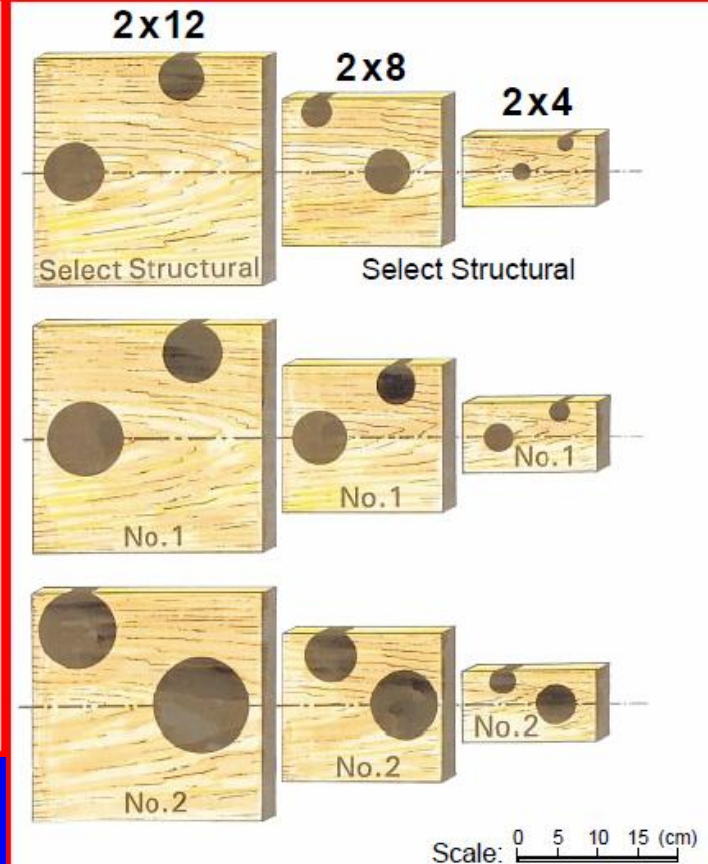
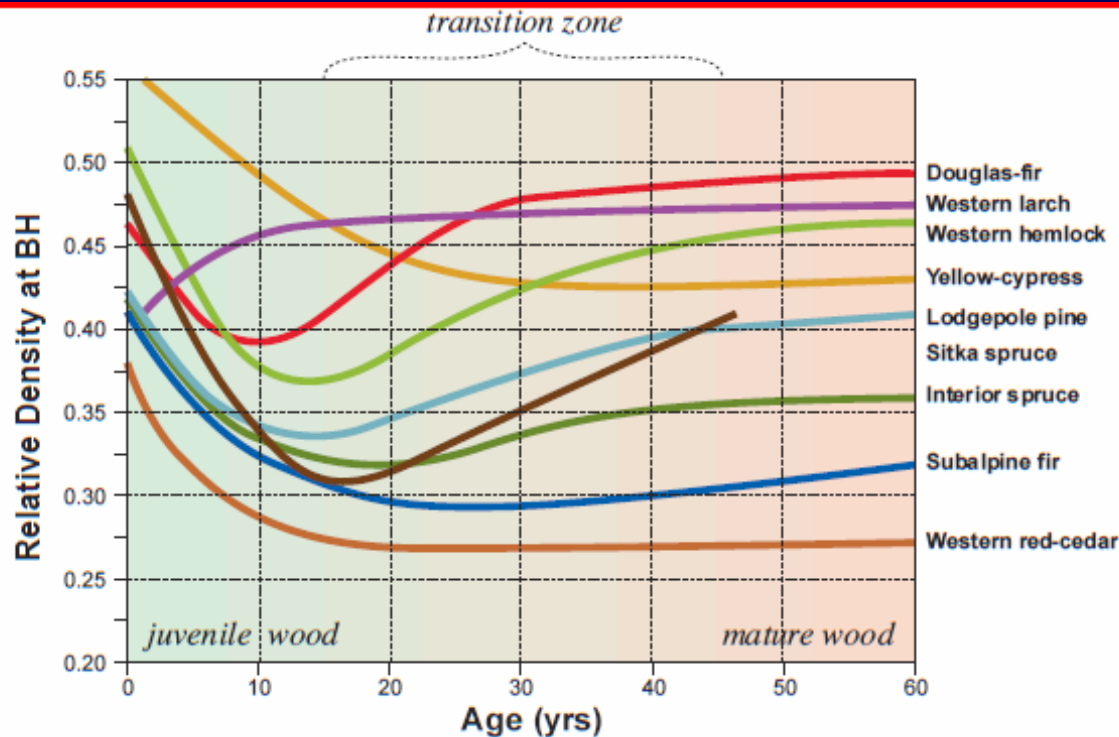


Figure 11. Maximum knot sizes allowed on the edge and on the centre-line of 2x4, 2x8 and 2x12 lumber

See "A discussion of wood properties and their practical implications" <http://www.laszlojozsa.com/documents/SP-34.pdf>

<http://www.for.gov.bc.ca/hfp/training/00005/wdqual.htm>



- Foresters need to balance merch volume, piece size, knot size, and value objectives for the mgmt unit
- incremental silviculture can be strategically used to manipulate tree size and quality, rotation length/ harvest timing.
- See info sources at
- <http://www.for.gov.bc.ca/hfp/training/00005/wdqual.htm>

Walking the talk – support your local timber supply



Arrowsmith TSA – Timber Supply Analysis Report

When future stand volumes are increased by 10%, the long-term harvest level increases by 11.3% to 590,000 cubic metres annually. When they are reduced by 10%, the harvest level falls by 11.3% to 470,000 m³/year.

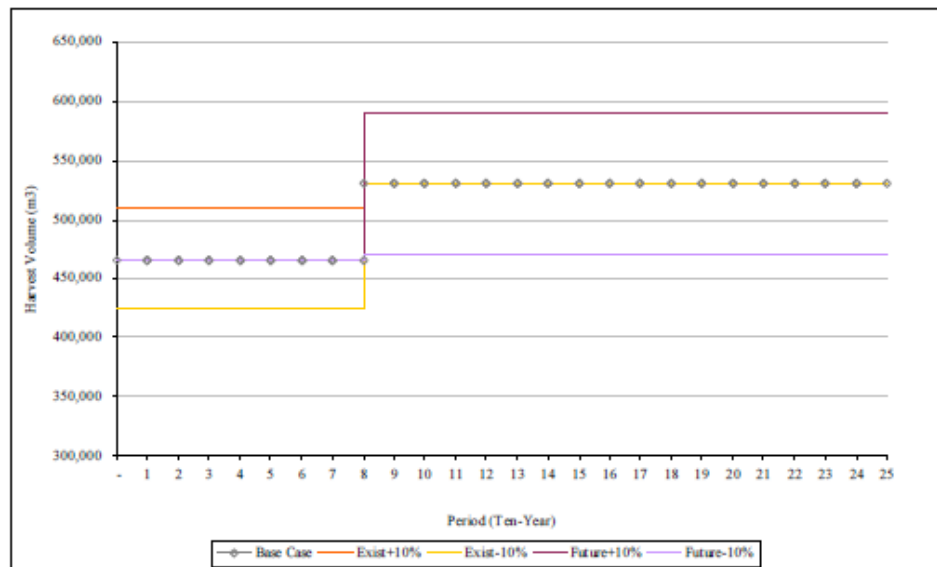


Figure 17. Harvest Level Sensitivity to Yield Forecast Uncertainty

7.4 Uncertainty in Minimum Harvest Ages

The minimum harvest age was established for each yield curve as the youngest age at which it meets all three of the following criteria:

- Minimum volume per hectare of 300 m³/hectare;
- Minimum QMD of 25 centimeters; and
- Within 90% of maximum MAI.

- TSR analysis provide key context and information on minimum volume, piece size and harvest age.
- Ensure that timber supply assumptions and practices are properly modelled
- Ensure assumed forest conditions delivered through consistent harvesting and silviculture practices

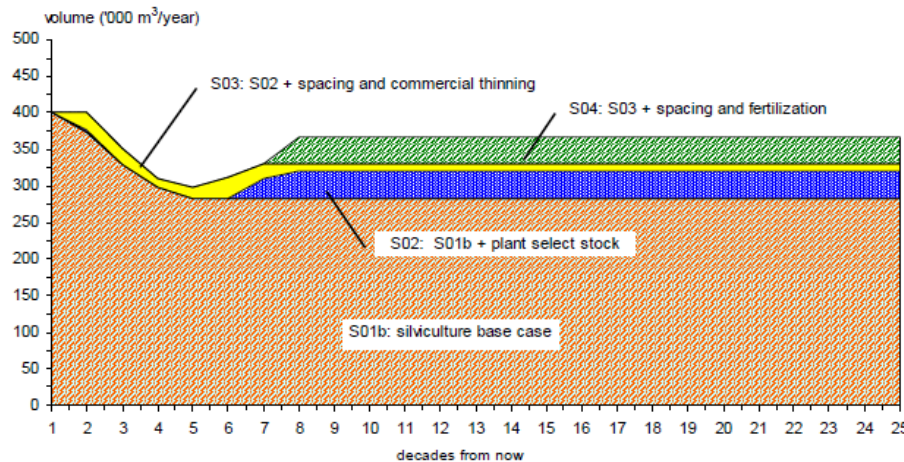
Silviculture Strategies



28% increase in
harvest in long term

Figure S-1 shows the impact of intensification of management on timber supply. In the long term, planting select stock will increase harvest levels by 13%, and spacing and fertilization increase the harvest level by 11%. Commercial thinning contributes 4% to the long-term cut but has a larger impact (up to 10%) in the short term and early mid term.

Figure S-1. Impact of planting select stock, commercial thinning, spacing and fertilization on the forecast harvest



- Developed for most mgmt units in BC.
- Are forward looking and define mgmt objectives and assumptions.
- Define the types of regimes and harvesting needed to achieve desired goals.
- Provide context and priority for incremental treatment investments.



Key Points

- “Does incremental silviculture pay?” ----is dependent on the mgmt unit inventory, objectives, assumptions, growth and yield models and the silviculture treatments.
- We must continually check, validate and refine these.
See Baskerville
- *Well managed basic silviculture may be all that is needed in some areas.*
- In specific coastal mgmt units, the availability of operable and merchantable sized, commercially valuable timber is a critical issue
- Incremental silviculture may be necessary to help achieve desired objectives.

Decision Framework and Process

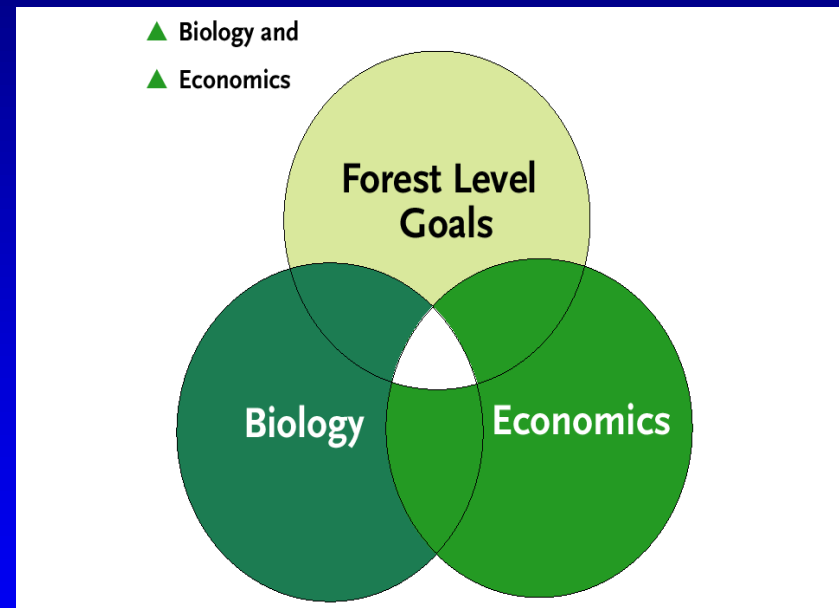


Forest level: Management Unit (TFL/TSA)

- set management objectives for MU
- set assumptions relative to objectives
- develop incremental silviculture strategy
- develop regimes to meet mgmt objectives

Stand level:

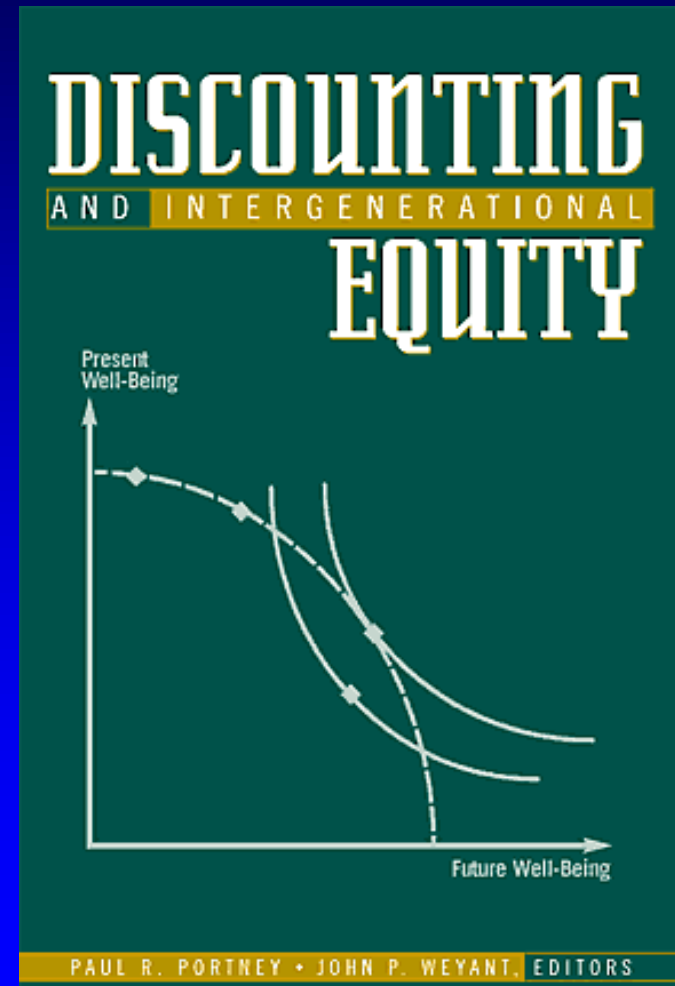
- carry out stand level analyses to rank regimes
- ranking will be affected by analysis assumptions
- incorporate other stand management objectives



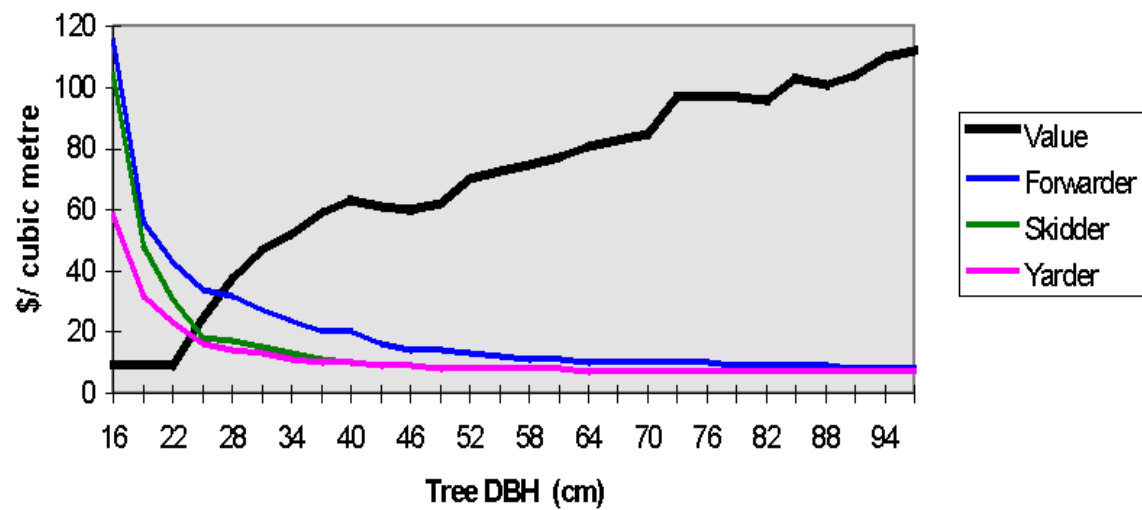
Assumptions used in stand level analyses impact interpretations and conclusions



- discount rate (2,3,6%)
- future values/costs
- *bucking and sawing patterns*
- Milling efficiencies
- Site productivity and Modelling assumptions



Impact of Piece size on: Harvesting costs and product value



Data suggests the marginal log piece size on the coast is roughly 25-28 cm depending on equipment

For each mgmt unit- we need to be real about harvest operability & utilization



- What is the actual extracted merch volume --- what is really left as waste (12.5, 17.5 cm or 22.5 cm)
- This significantly impacts stand and forest level analysis

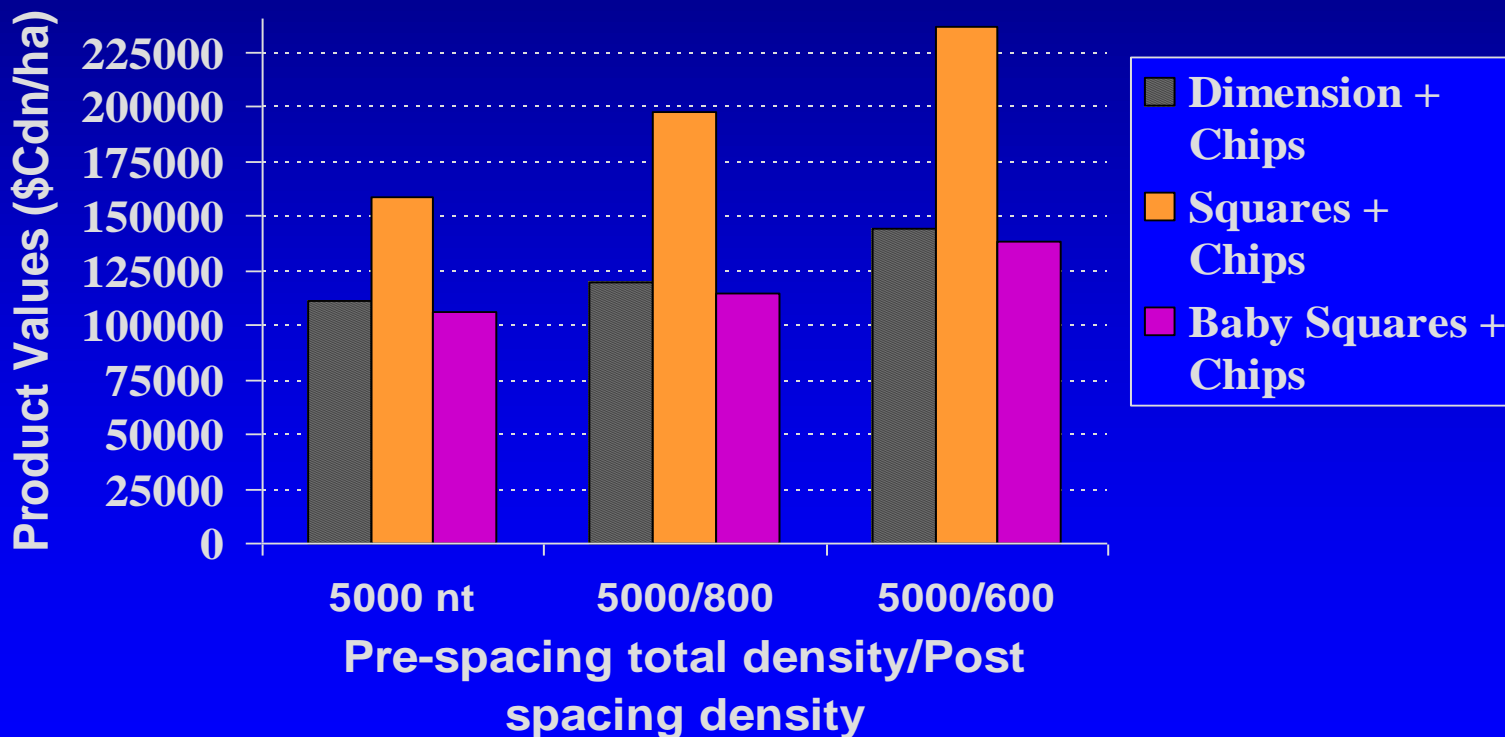


- *On coast 18% waste, 12% avoidable,*
- *average 86 m³/ha waste.*
- *Up to 25% avoidable waste and >200 m³/ha*

Assumptions used in analyses impact interpretations and conclusions



- *bucking and sawing patterns*



Impact of Piece size on Mill Productivity



Sawmill Productivity

	Sawmill A	Sawmill B	Increase
Log mix	6–13 in. (15–33 cm)	6–22 in. (15–56 cm)	
Average log diameter	7.5 in. (19.0 cm)	9.4 in. (24.0 cm)	
Volume consumed (MCCF)	76	90	
Output (Mfbm)	51.5	65.7	28%
Lumber recovery factor	6.8	7.2	6%

Only a **5 cm** shift in piece size

128 piles of lumber instead of 100 piles in same shift

Assumptions about treatment timing/practices impact interpretations and conclusions



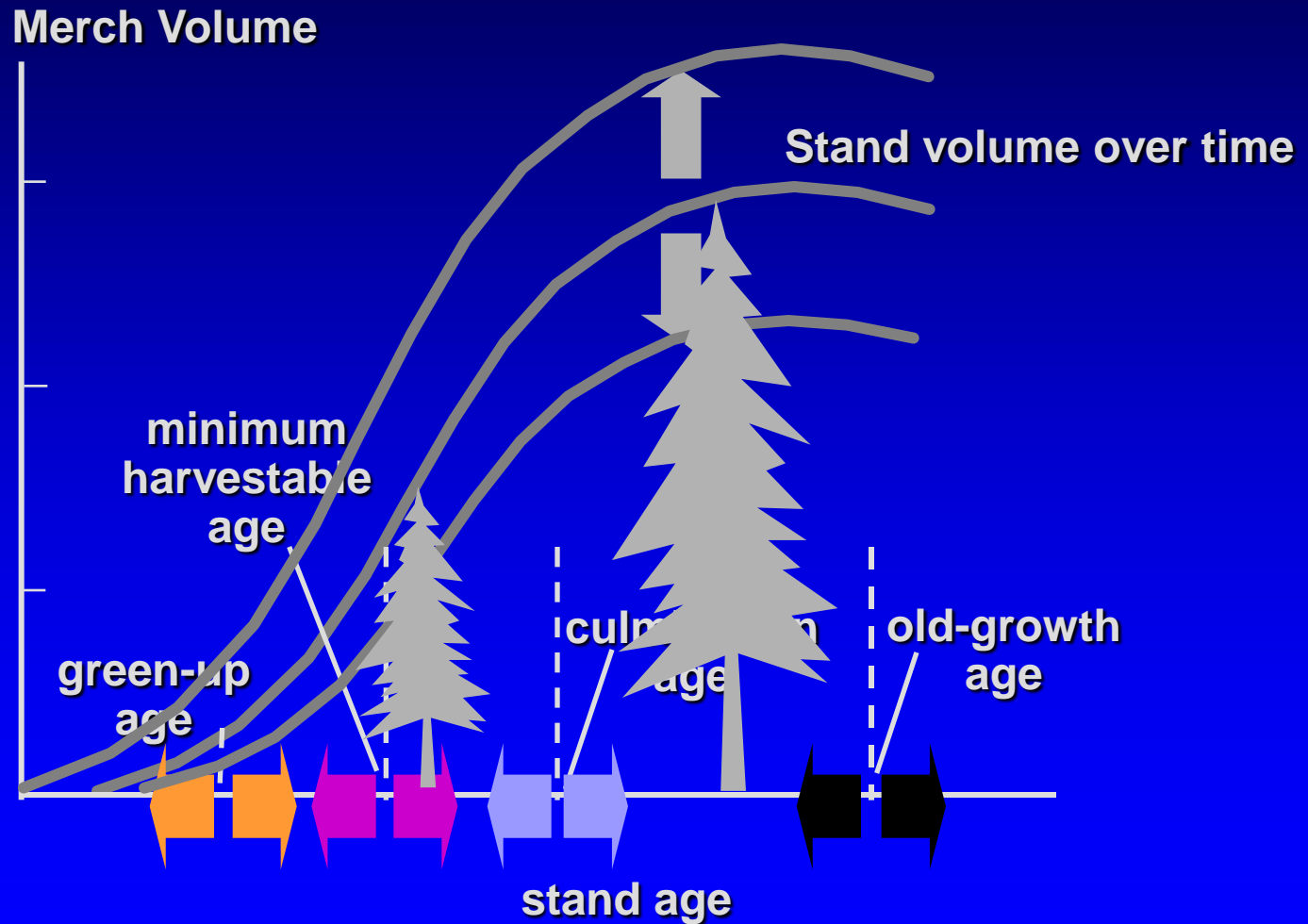
- Models are constructed based on past practices.
- Important to understand the assumptions of treatment conditions, *treatment timing* and stand conditions being modelled...
- Need to understand where we are deviating from them
- Important to understand limitations and applicability of models to different situations
 - When to use TASS, TIPSYP, PROGNOISIS or VDYP
 - Mixed species stands
 - All aged stands
- 30 years ago, 50% planting, 50% survival and limited brushing, and poor timing
- Now 82% planting, 93% survival and strategic brushing and very good timing
- Dramatically improved growth on young forests.

Assumptions used in models and modelling impact interpretations and conclusions



- A few years ago ...Fraser TSA second growth had a site index of 15-22 metres.
- Now ...site indices are about 28 metres. 60-80% increase in stand volumes
- Need to ensure we use appropriate model assumptions
- For each mgmt unit, need to have appropriate assumptions of growth and yield, silviculture practices, harvesting costs, and log values

Silviculture affects conditions produced at the stand level



Effect of Spacing on timber supply



- Done to promote faster growth, and larger trees of uniform size and shape – making trees of desired merchantable size available sooner...not just chainsaw effect
- Spacing can shift stand value by focusing growth on trees of higher value (ie Douglas fir) and reducing the densities of excess lower value trees (ie Hemlock)...(40%)
- Spacing can significantly reduce subsequent CT, harvesting costs
- – see following example from FII study from eastern Canada.
- http://www.forestresearch.ca/education/Doug_Pitt_-_Presentation_-_Sept_30-09.pdf

Preliminary Results: PCT had large effects on harvesting and wood handling efficiency...



26-43% gain in productivity



25-44% gain in loading rate



**19-28% reduction in direct costs;
\$2 to \$4/m³, or \$700 to \$1500 per ha**



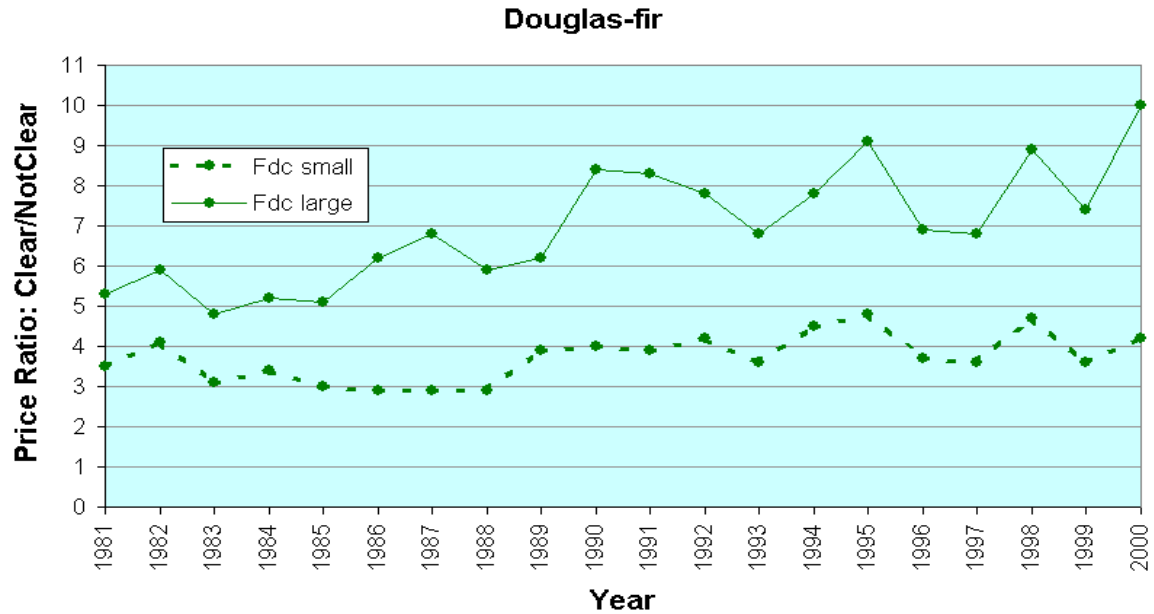
21-33% gain in productivity

Effect of Fertilization on timber supply



- A large-scale forest fertilization program may help meet objectives to improve forest level volumes.
- 30 m³/ha for Fdc
- In most cases the yield and value benefits of fertilization at the stand level are maximized by combining nutrient additions with managed stand densities with room for crown expansion

Pruning



- 4-10 more value in clear lumber
- Higher values in larger dimensions
- Stand value gains of 60% are possible in Coastal Douglas fir
- Premium grades don't reduce in value in market down turns as dramatically as commodity grades

Strategic application of spacing, fertilizing and commercial thinning



- Manage species diversity and increase the production of high value stands.
- Grade values can be significantly different. $H = \$123$, $J = \$58$ and $U = \$43/m^3$ for fir
- Higher proportion of sawlog vs pulp grades of wood.
- large diameter logs can be sawn into large timbers and boards to sequestered $C02e$ off-site for 70-100 years
- Pulp logs produce products that have only 1-6 year off-site $C02e$ storage

Incremental treatments can have significant impacts where the objective is to achieve a certain technical rotation



- Modelled effects on technical rotation length in Interior Spruce
Fertilization @ 13, 18, 23, and 28 years
- Time to attain minimum operability (150 m³/ha)
 - Unthinned/unfertilized – 44 years
 - Thinned (1600 sph) – 40 years
 - Thinned + fertilized – 33 years
- Merchantable harvest volume of 38-year-old stand (25 years in future)
 - Unthinned/unfertilized – 94 m³/ha
 - Thinned (1600 sph) – 130 m³/ha (+38%)
 - Thinned + fertilized – 195 m³/ha (+107%)

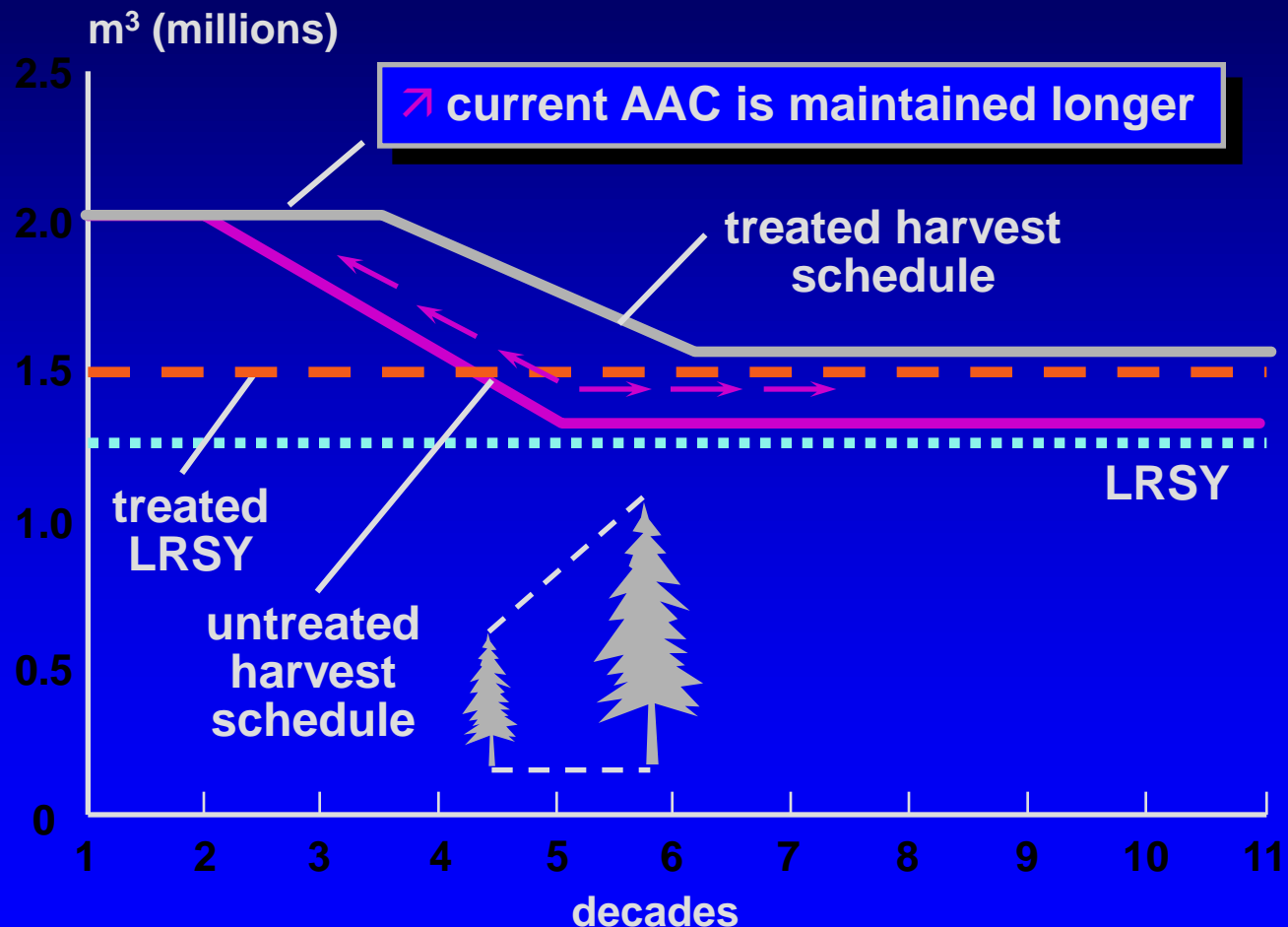
Selective Spacing and pruning provides opportunities for



- Fire proofing, reducing fire hazard/protecting local communities.
- Reducing future fire hazards and CO₂e emissions
- Habitat for specific wildlife



Harvesting and Silviculture affects conditions produced at the forest level



Every management unit is different



- Each management unit has unique
 - Management objectives /constraints and assumptions
 - Forest inventory conditions
 - Types of silviculture and growth and yield that are applicable to the area
- There is no one solution to solve mgmt unit issues
- In the past 10 years BC has done extensive silviculture strategy analysis. See <http://www.for.gov.bc.ca/hfp/silstrat/index.htm>
- As conditions (economic operability), objectives (EBM) and emphasis (timber or habitat) these strategies need to be refined

Silviculture is used to manage stands for timber and non timber objectives

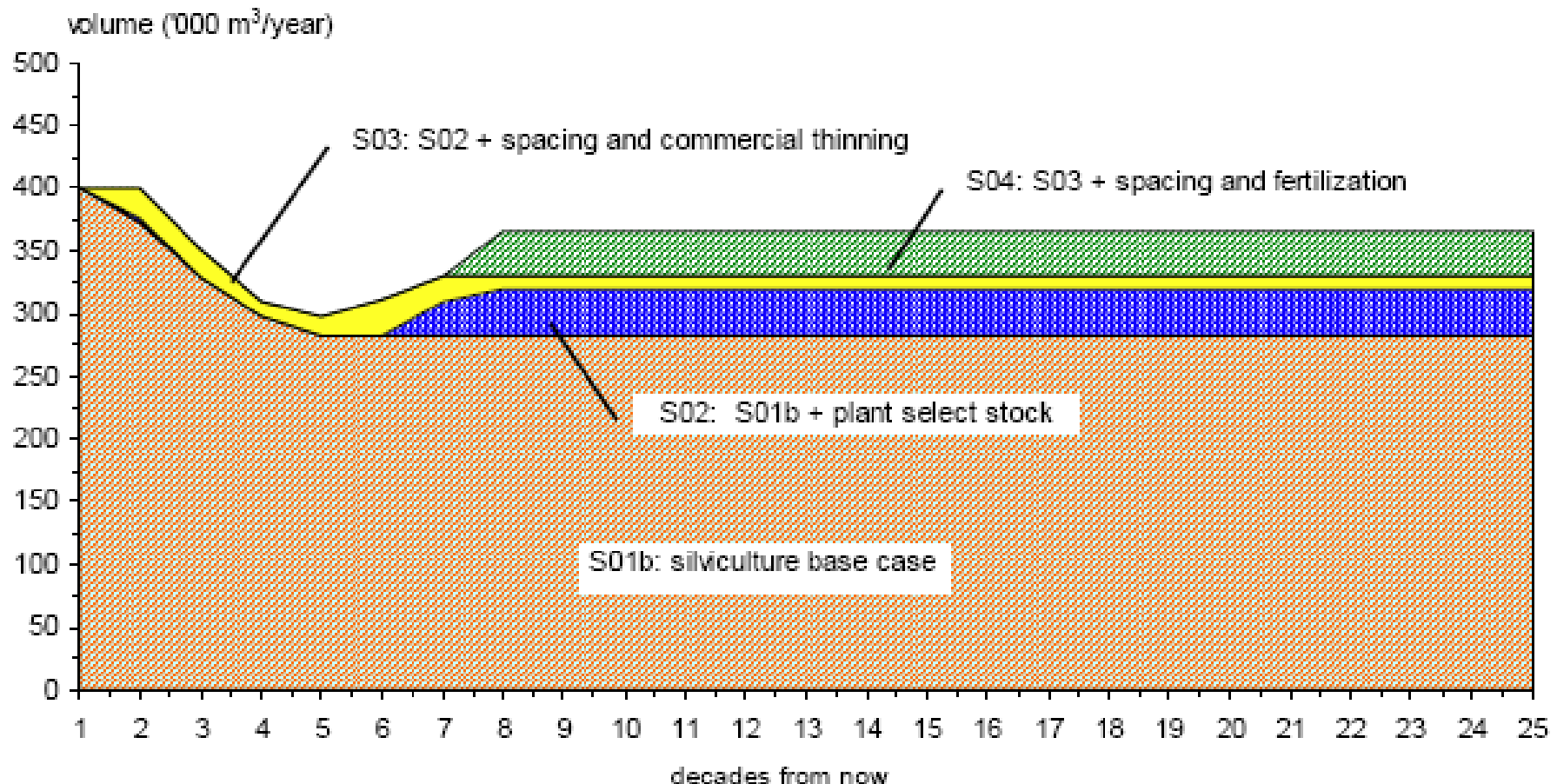


- To have a viable timber supply, we need to manage non timber objectives.
- Strategic planning is key to understanding how forest level values are flowed out over time, ...
- ***Narrow stand level analysis will not provide the understanding or solutions to forest level issues***
- Incremental investments can improve availability of operable timber in constrained areas

Arrowsmith TSA



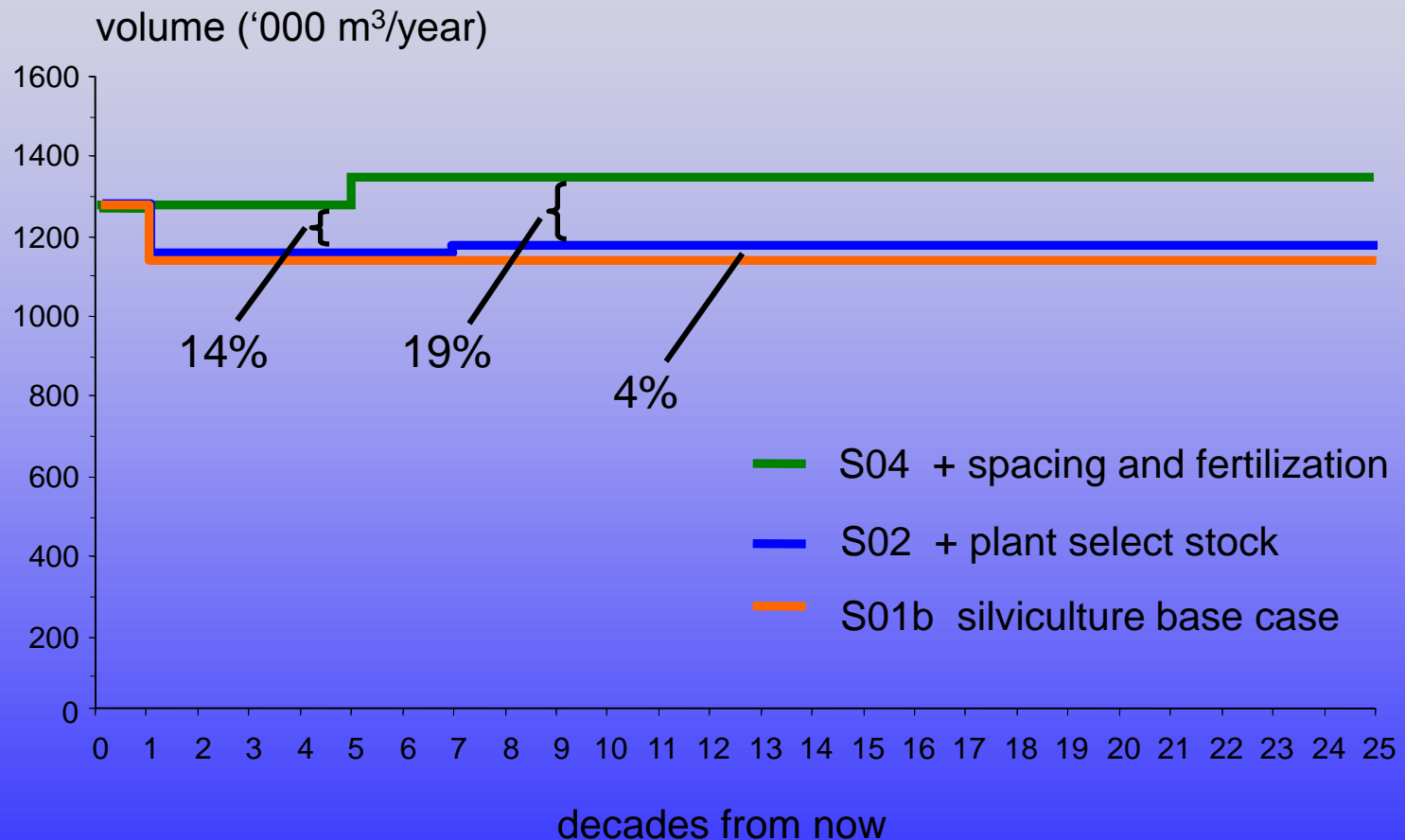
Figure S-1. Impact of planting select stock, commercial thinning, spacing and fertilization on the forecast harvest



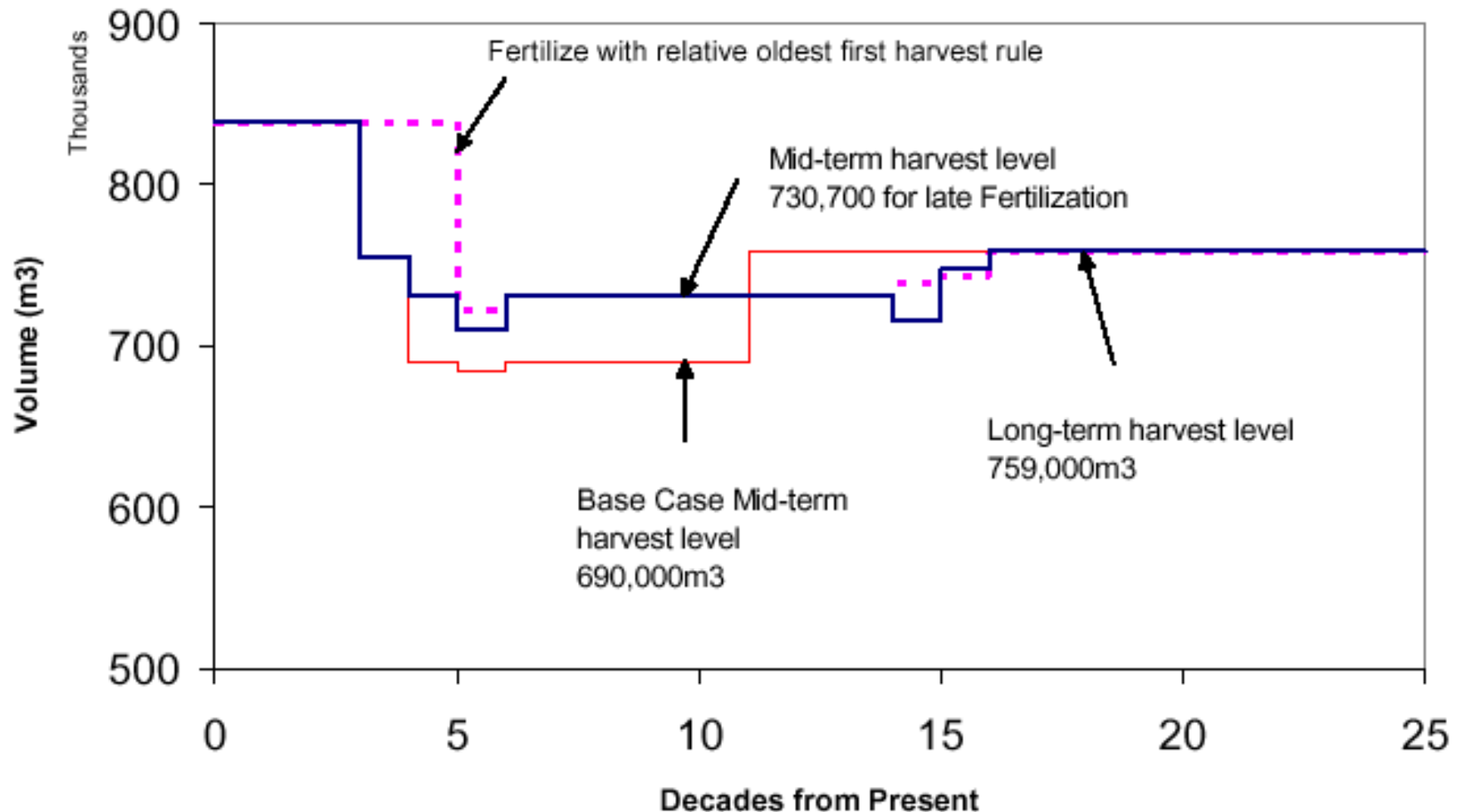
Fraser TSA



Objective: Maximize volume production



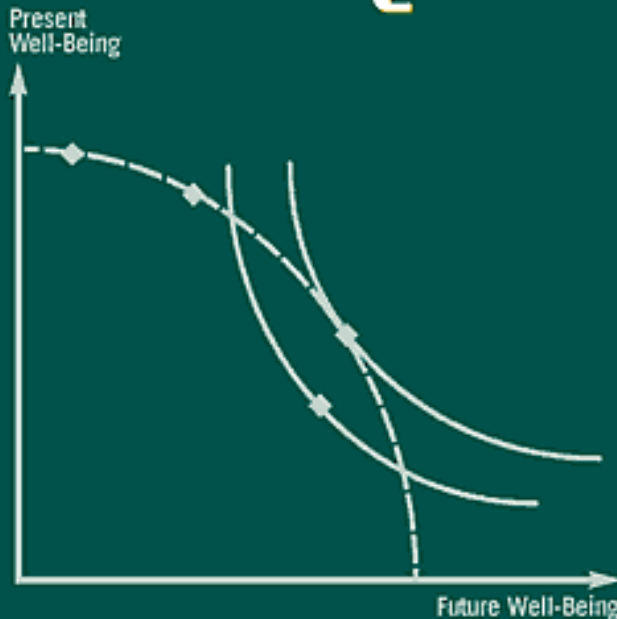
ACE affect - key issue is to do the *right harvesting practices* and incremental activities now to manage short and mid term harvest levels



Key learning's from strategies



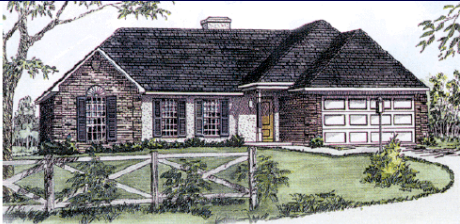
DISCOUNTING AND INTERGENERATIONAL EQUITY



PAUL R. PORTNEY • JOHN P. WEYANT, EDITORS

- Differences in opinion on incremental silviculture are very often due to
 - Lack of clearly defined and agreed on objectives
 - assumptions on how much to discount the future (2, 4, 6 or 8%)
 - perspectives on intergenerational equity

Key learning's from the strategies



Plan : 1105

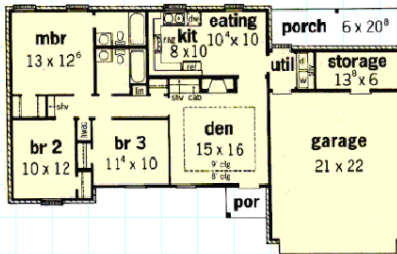
Width: 60'-10" Depth: 34'-10"
Ceiling Heights: 8' Main
Main Roof Pitch: 8 in 12.

Features:

3 Bedrooms, 2 Baths
Raised Ceiling in Den
Covered Front & Rear Porch
Fireplace & Built-ins in Den
Open Kitchen/Eating Area
Elegant Brck & Stucco Exterior
Large Storage Area
Living Area: 1121 sq. ft.
Total Area: 1736 sq. ft..

Price Code A

5 sets \$400



- *there is no one solution*
- the right silviculture regime depends on the forest, the inventory, the mgmt objectives and assumptions
- You need consistent harvesting and silviculture actions guided by the strategy if you are going to achieve the desired forest objectives



Conclusion

- In some coastal management units there are significant harvest constraints. In some areas, logging of the old growth on the top of mountains or remote areas is too expensive.
- In 2010 - 44% of the coastal harvest was in immature stands. 80% of fir harvesting was in immature stands.
- In some units, harvesting of managed second growth stands – “have saved our Bacon” or enabled significant harvesting
- There can be positive impacts to future timber supply, communities and revenue if incremental treatments are done strategically
- Coastal foresters need to work together to refine management unit objectives and plans and select the right balance of basic and incremental silviculture

A photograph of a dense forest with many tall, slender trees. Sunlight filters through the canopy, creating a dappled light effect on the forest floor. The ground is covered with green ferns and other low-lying vegetation. A large, moss-covered tree stump is visible in the lower right foreground.

Thanks to the CSC for the
opportunity to speak to you