Level of overstorey retention

- Effects on light and regeneration

Phil Comeau
University of Alberta, Edmonton, Canada
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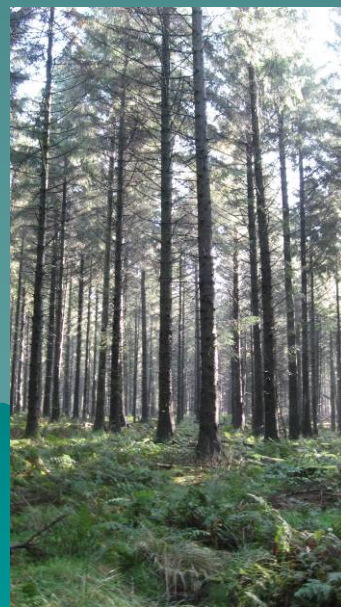
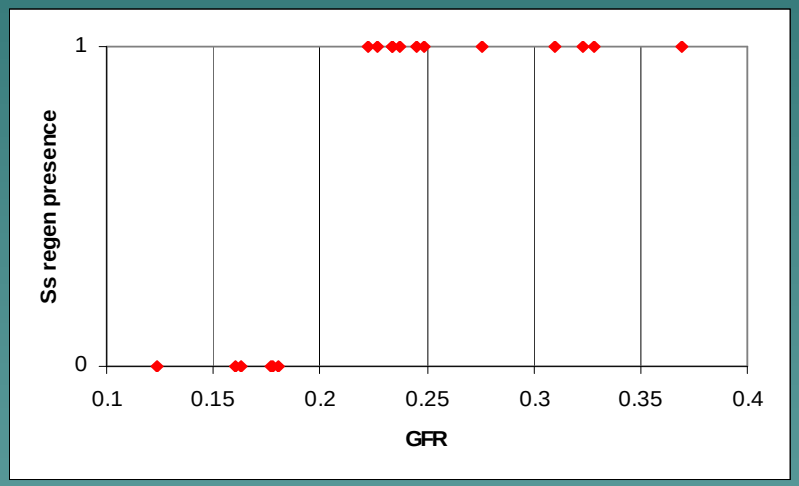
Sophie Hale and Gary Kerr
Forest Research

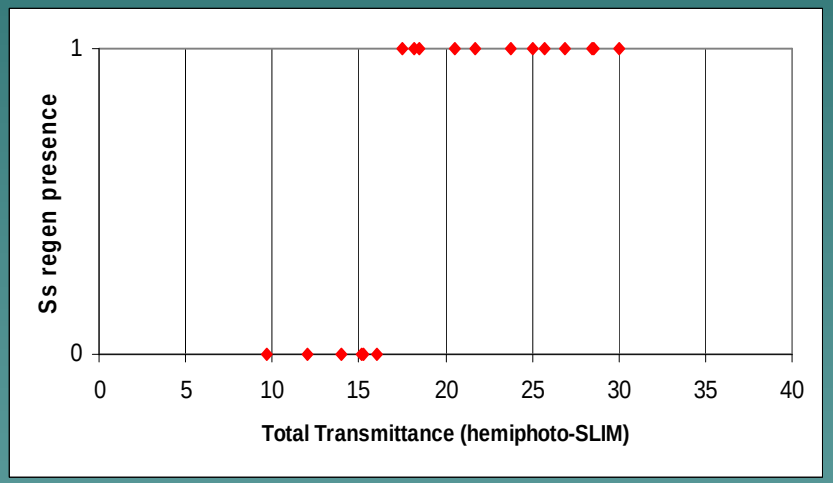


Factors influencing regeneration establishment and survival

- Seedbed
- Light
- Soil moisture
- Browsing
- Insect damage
- Vegetation
- ….
- (See Hale 2004 FCIN63)

Regeneration and light

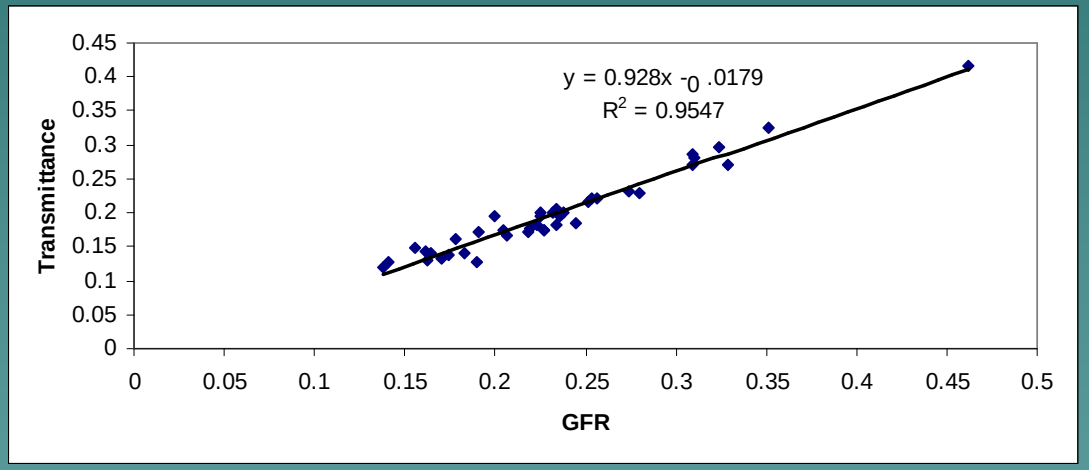




No Sitka spruce regeneration observed at GFR<0.22 or T <17 (18 stands observed [Phil Comeau unpubl.])

Shelterwoods would require GFR>0.22; Transformation t
requires higher gfr (>0.25?)

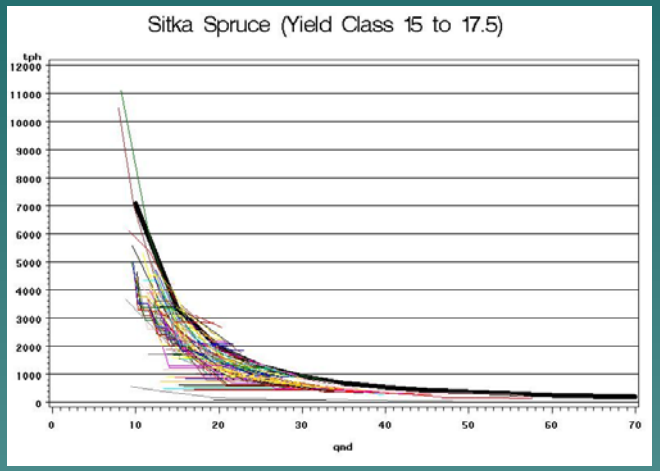
Transmittance (fraction of full sunlight) over the growing season is related to GFR

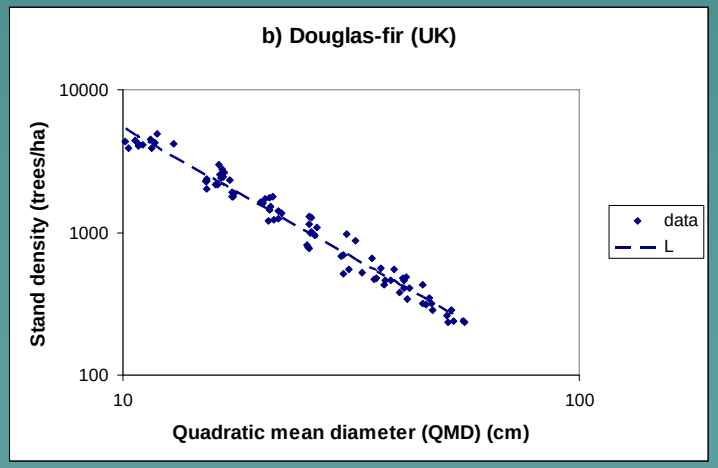


Effects of overstorey density on light

- Light measurement requires specialized equipment and appropriate measurement conditions
- Many studies indicate that stand characteristics such as basal area (Hale 2003), SDI (Vales and Bunnell 1988), Relative Density (Comeau and Heineman 2003) can be used to predict light levels (eg.)

SDI and Density-Size Relationships





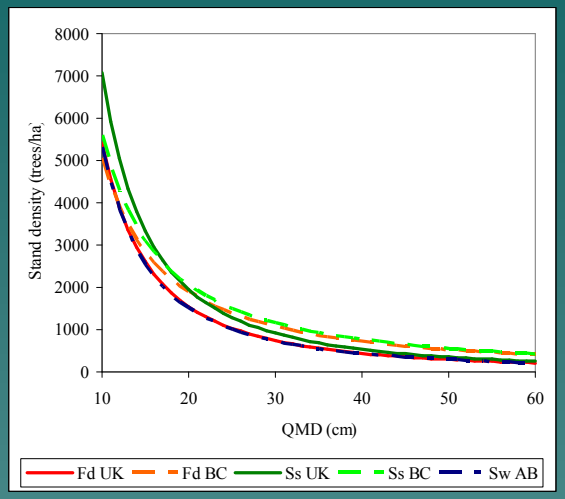
- Reinecke (1933) observed arelationship between stand density (#/ha) and quadratic mean diameter (DBHq)
- General relationship was:
  $\text{Log}(N) = a - 1.605 \log(DBHq)$
- Stand density index references all stands to 25 cm DBHq base :
  $SDI = N * (DBHq/25)^{1.6}$
- If basal area were constant across the DBHq range then the exponent would be 2.0
- Literature indicates that the exponent may vary from 1.6

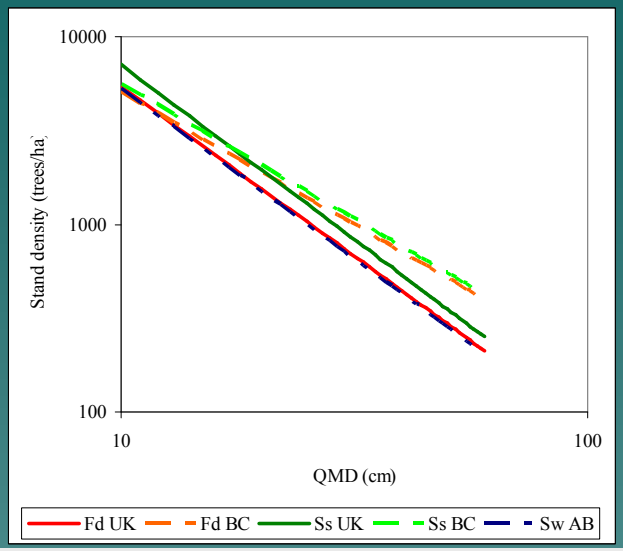
Datasets

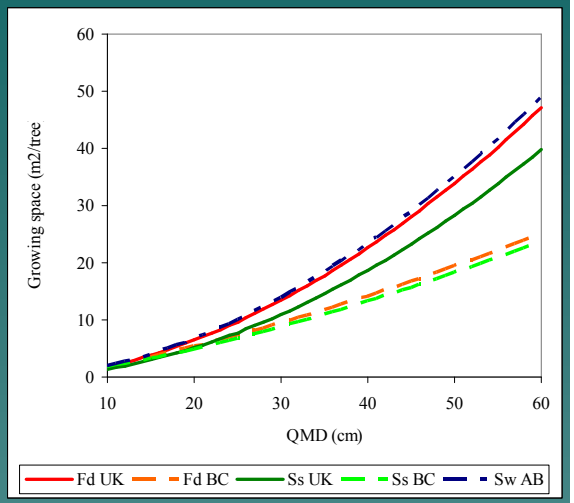
- Forest Research – biometrics data (plots larger than 0.07 ha)
  - 2800 measurements from 499 Sitka spruce and
  - 834 measurements from 112 Douglas-fir stands
- BC Ministry of Forests, Inventory Branch
  - 20 Sitka spruce (69 measurements in total) 389 Douglas-fir stands (567 measurements in total)
- Alberta Department of Sustainable Resource Development,
  - 146 white spruce plots with 473 measurements

- For all, sorted data into 5 cm diameter classes and yield classes of 5 m – then selected upper 10% of data points in each “cell”
- Natural log transformation of data and fit linear models on log transformed data (required to deal with heteroscedacity of variance).

Density-Size models for Sitka spruce and Douglas-fir in Britain and B.C.



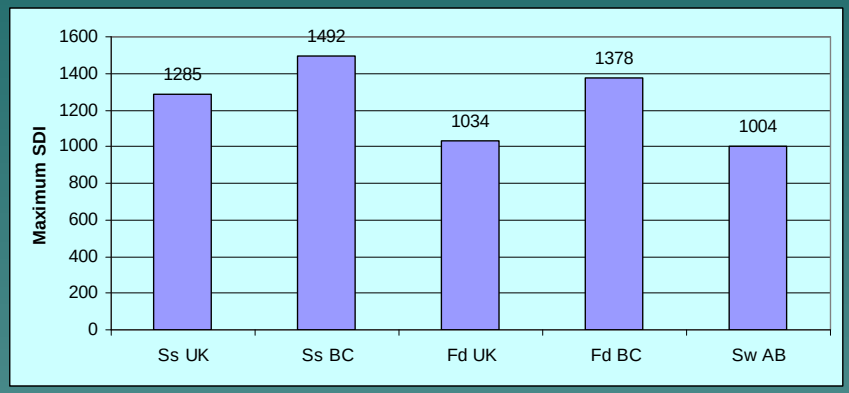


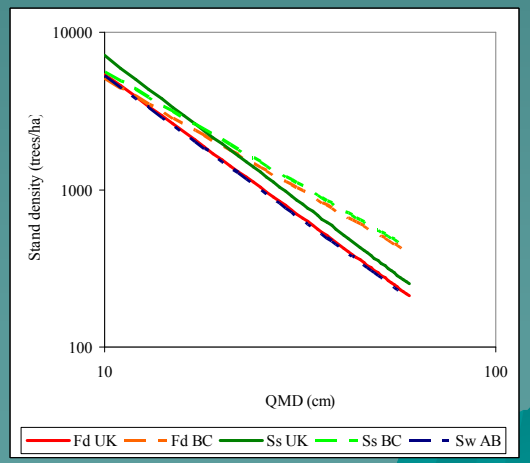


Species	Location	a	Lower 95% cl	Upper 95% cl	b	Lower 95% cl	Upper 95% cl	c
Sitka spruce	UK	14.0650	13.7455	14.3844	-1.8626	-1.9249	-1.8003	-0.31829
Sitka spruce	BC	11.9427	11.5381	12.3473	-1.4399	-1.5448	-1.3350	ns
Douglas-fir	UK	12.7606	12.5402	12.9809	-1.8080	-1.8760	-1.7390	ns
Douglas-fir	BC	11.7874	11.3648	12.2100	-1.4163	-1.5458	-1.2869	ns
white spruce	AB	12.7655	12.2945	13.2366	-1.8187	-1.9750	-1.6624	ns

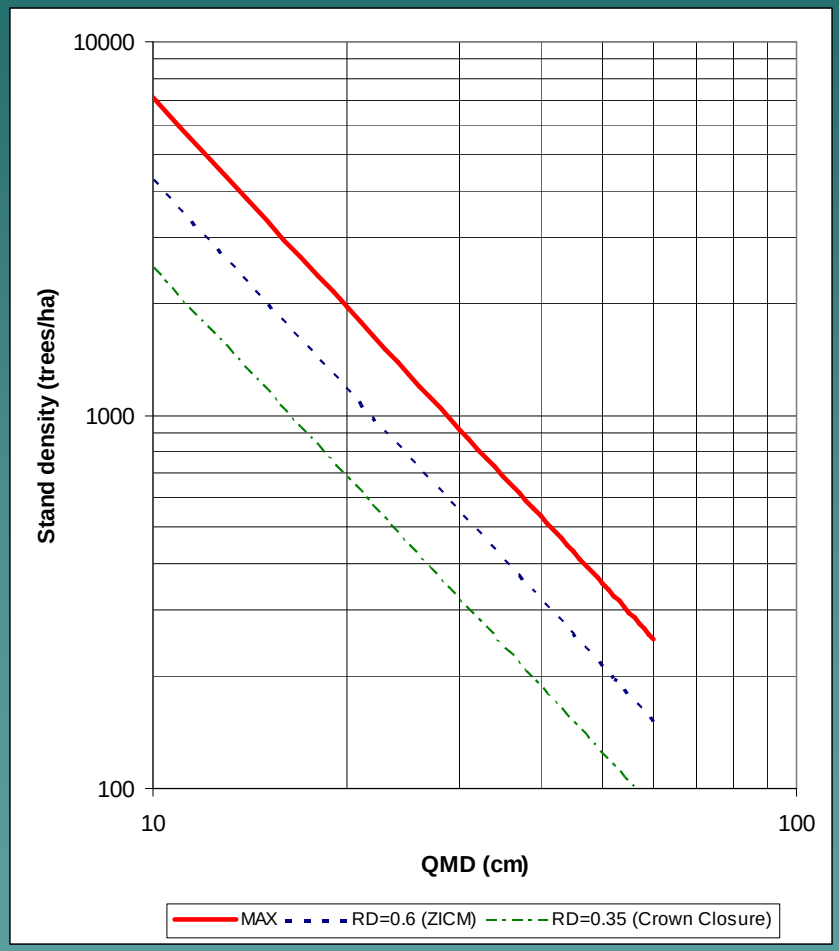
Revised SDI equations

- SDI=N * (QMD/25)^{b}
- Sitka spruce
  - Britain b= 1.8626
  - Canada b= 1.4399
- Douglas-fir
  - Britain b= 1.8080
  - Canada b= 1.4163
- White spruce
  - Canada b= 1.8187





Stand Density Management Diagram - Sitka spruce



Zone of imminent competition mortality (ZIC