“Shadows and light: tree retention effects on understory light and boreal mixedwood management”

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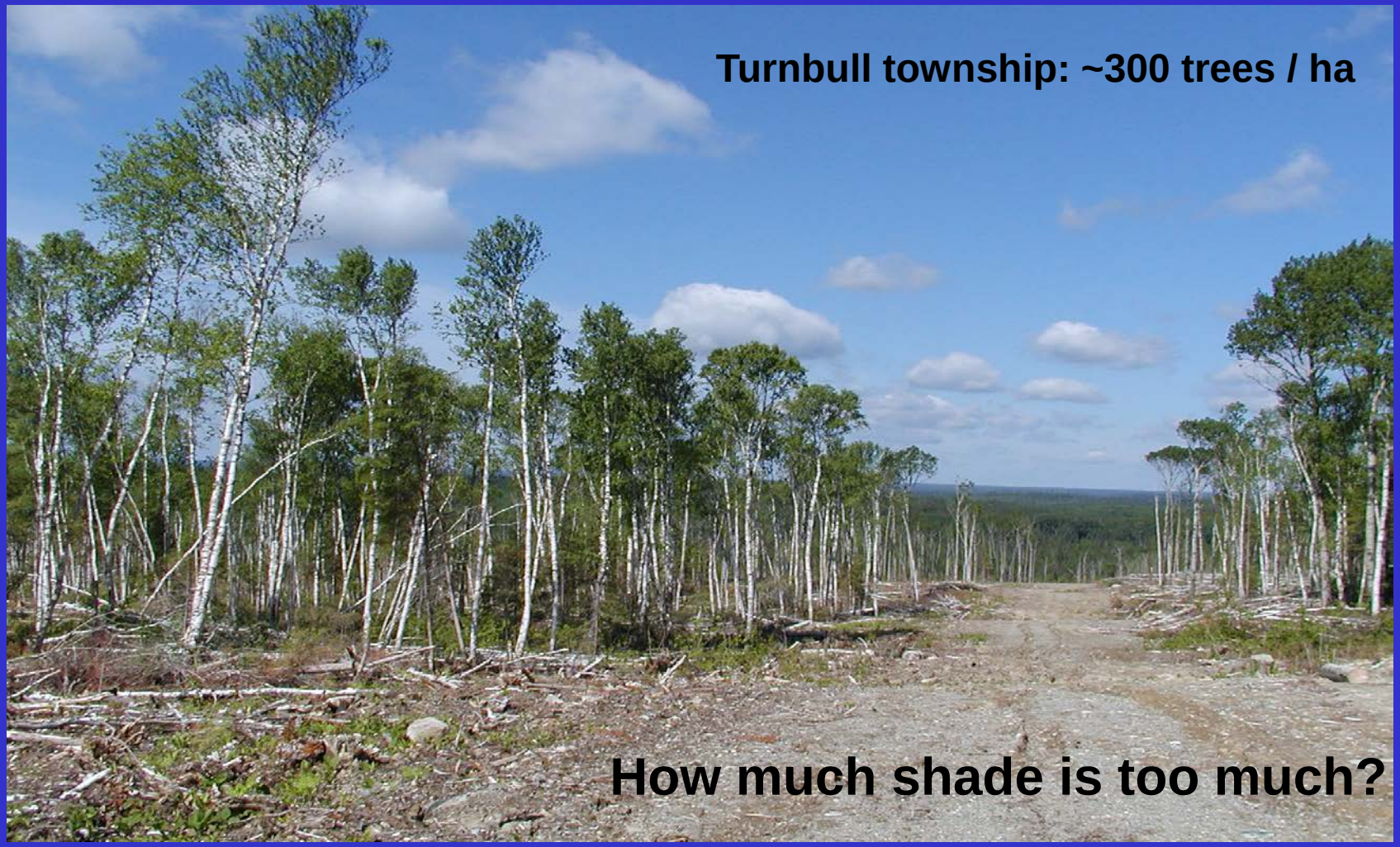
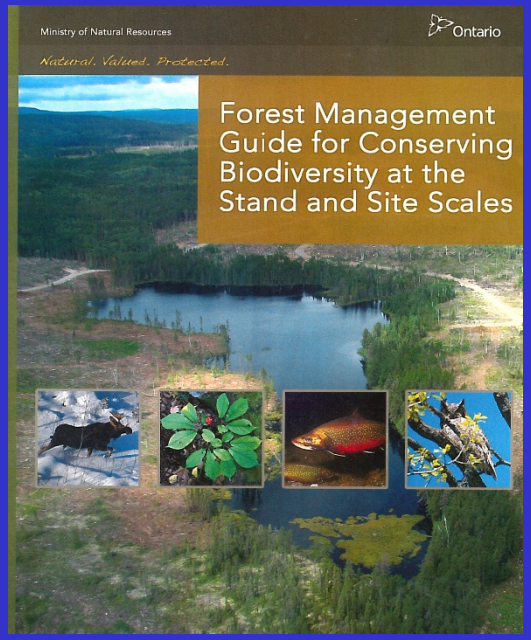
Ontario Forest Research Institute
OFRI · IRFO

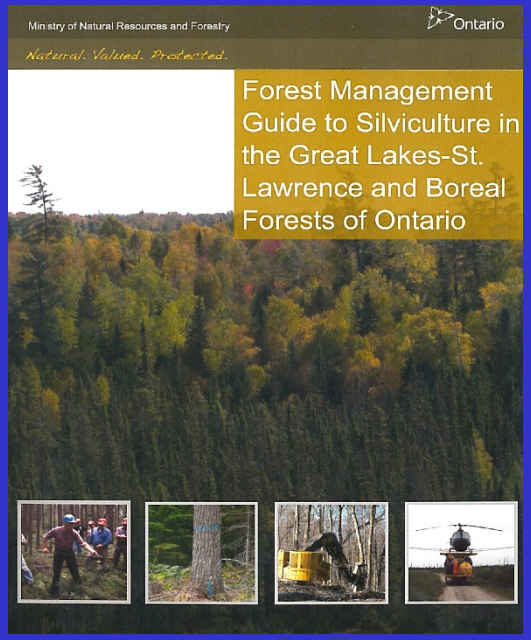
Increased incidence of boreal mixedwood cutovers with high residual densities - How will this impact regeneration?

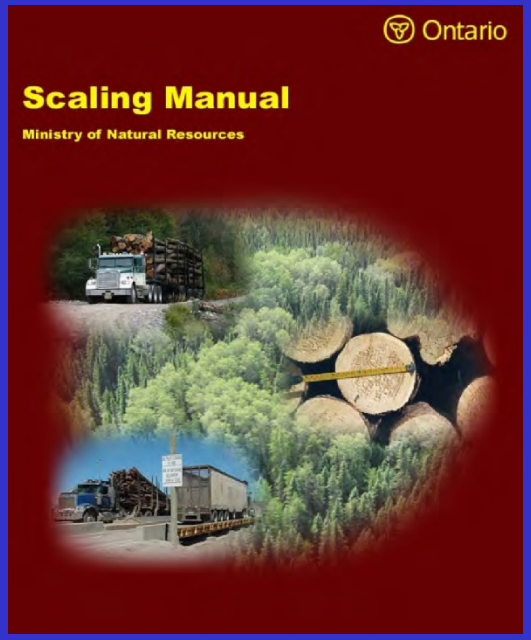


Merchantable, but unmarketable hardwood fibre left uncut

OMNRF policy and guides implications







"minimum average of 25 well-spaced trees/ha of which 6 must be large-diameter, live, high-quality cavity trees…"

"..19 others: snags, dying trees, and living trees > 10 cm dbh and > 3 m in height…"

Post-harvest understory light

- *Clearcut >70%*
- *Shelterwood 70% to 30%*
- *Selection <30%*

Species silviculture guidelines based on probability of success and light environment created.

Leaving stems of merchantable size during harvest is considered a wasteful practice

Method, sampling, and analytical approach

Measure species, live/dead, dbh, and height of retained canopy trees in 14 m radius, circular plots (trees ≥10 cm dbh, ≥3m height).

Hemispherical canopy photographs to estimate GLI, i.e., growing season light availability as percent of full sunlight transmitted through the overstorey canopy.

Develop simple models to predict understory light levels from residual stand composition, basal area, and density.

Use published literature and OMNR silviculture guide to identify residual stand conditions that favour regeneration of desired tree species.

OMNRF districts/areas sampled in NE and NW region

455 sample plots in 25 recent “clearcuts”

and

28 plots in 3 undisturbed intolerant hardwood stands.

(2010-2012)

Hemispherical, or “fish-eye”, canopy photographs provide estimates of understorey light.

Understorey vegetation, trees <10 cm dbh, < 3m height removed to estimate transmittance through “acceptable” residual trees

Examples of cutovers sampled with residual density

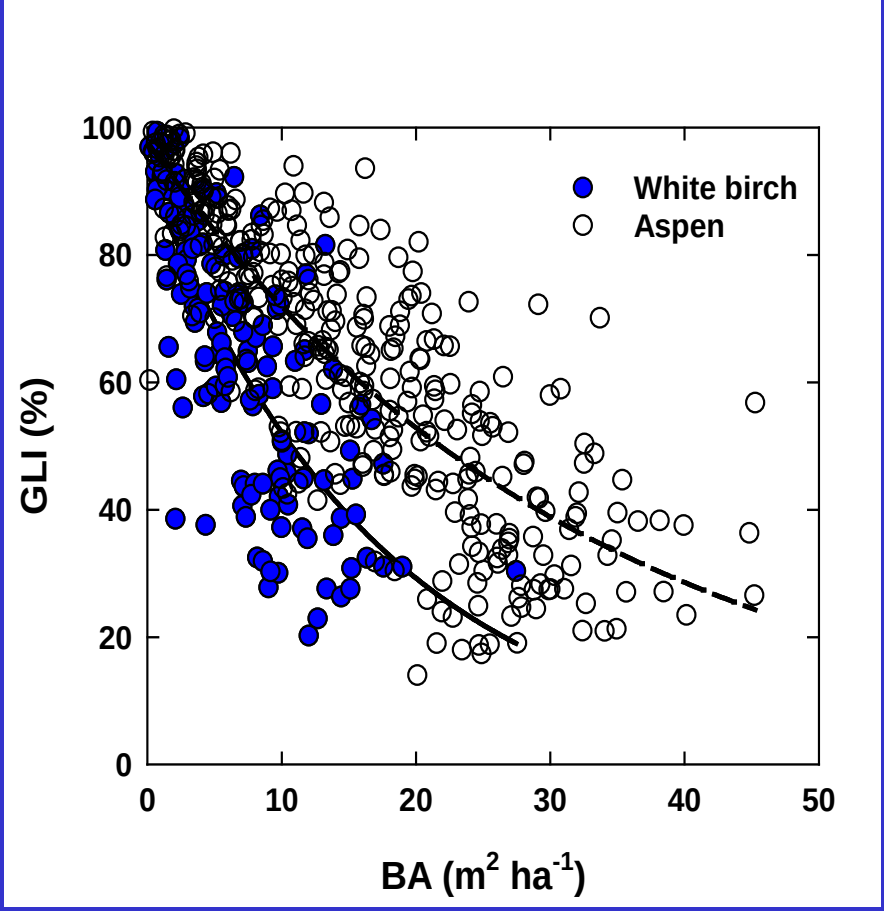
Variability in species composition and spatial distribution

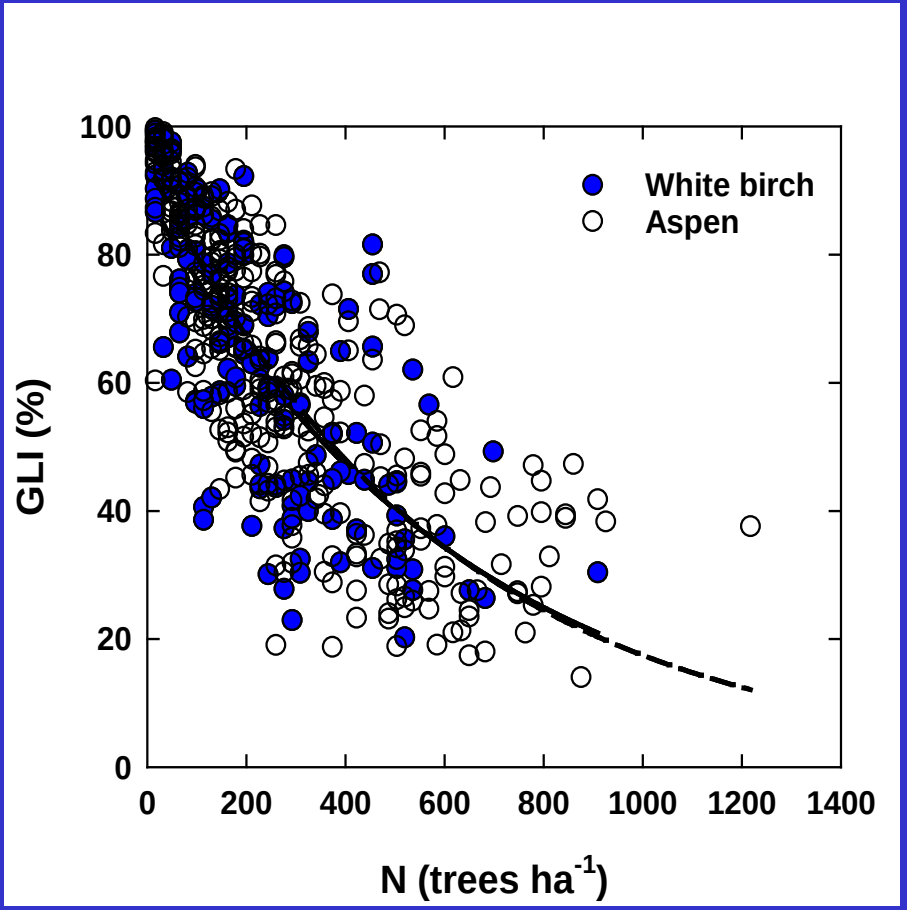
Number of plots by post-harvest species composition and region

Type	NE	NW	Total
Po	171	107	278
Pod	25	27	52
Pol	5	4	9
Bw	34	79	113
Bwd	12	13	25
Bwl	3	3	6
Total	250	233	483

* Based on basal area of living trees >10 cm dbh and >3 m height

Relationship of understorey light (GLI) with residual basal area (BA) and density (N) for aspen and birch dominated stands.*

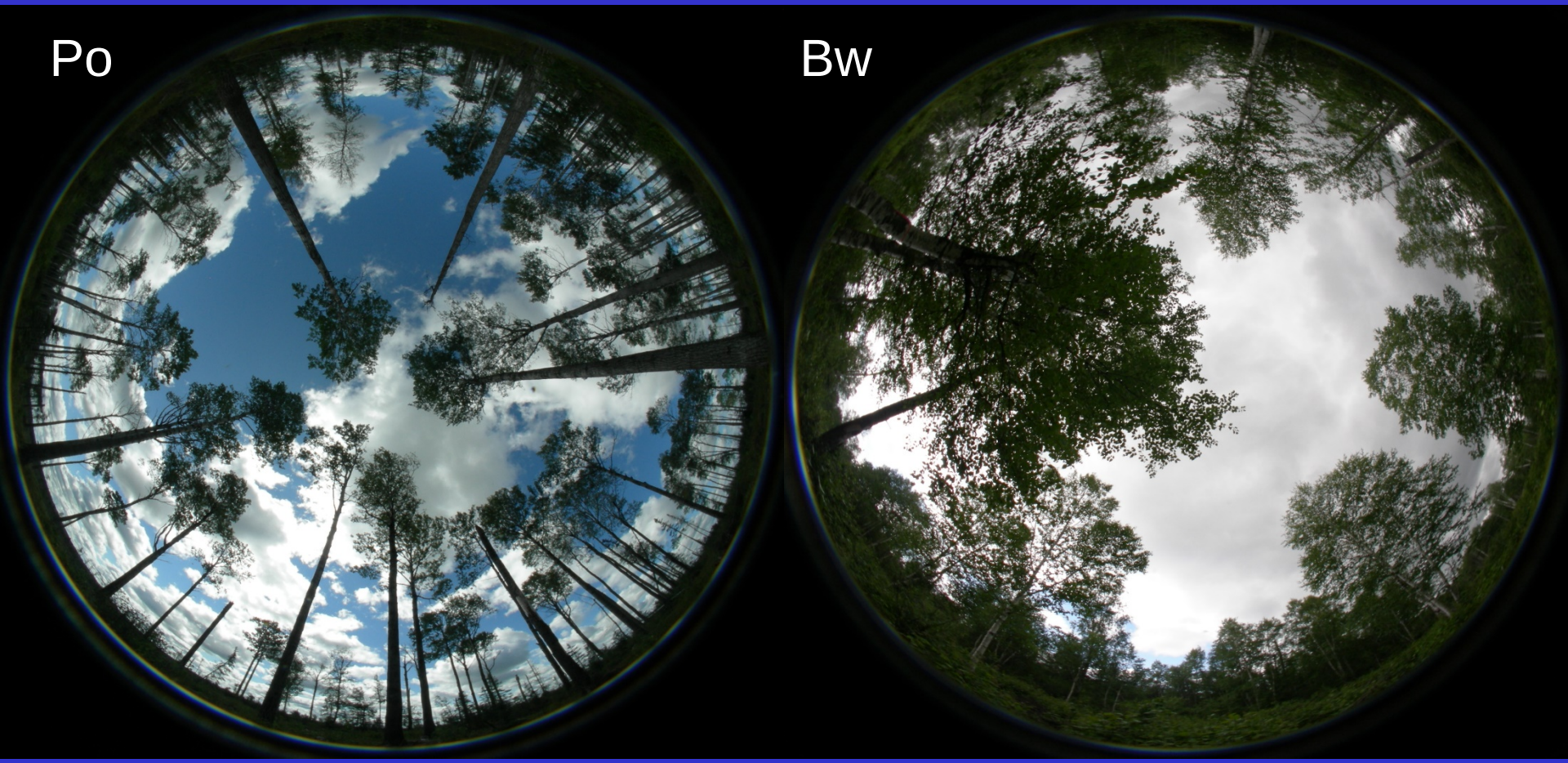




*BA and N refer to living trees only. Bw (n=144) Po (n=339)

Species differences in crown geometry, crown openness (CO) and mode of vegetative reproduction influence GLI

- Smaller, porous crown, dispersed Po vs. Larger, denser crown, aggregated Bw



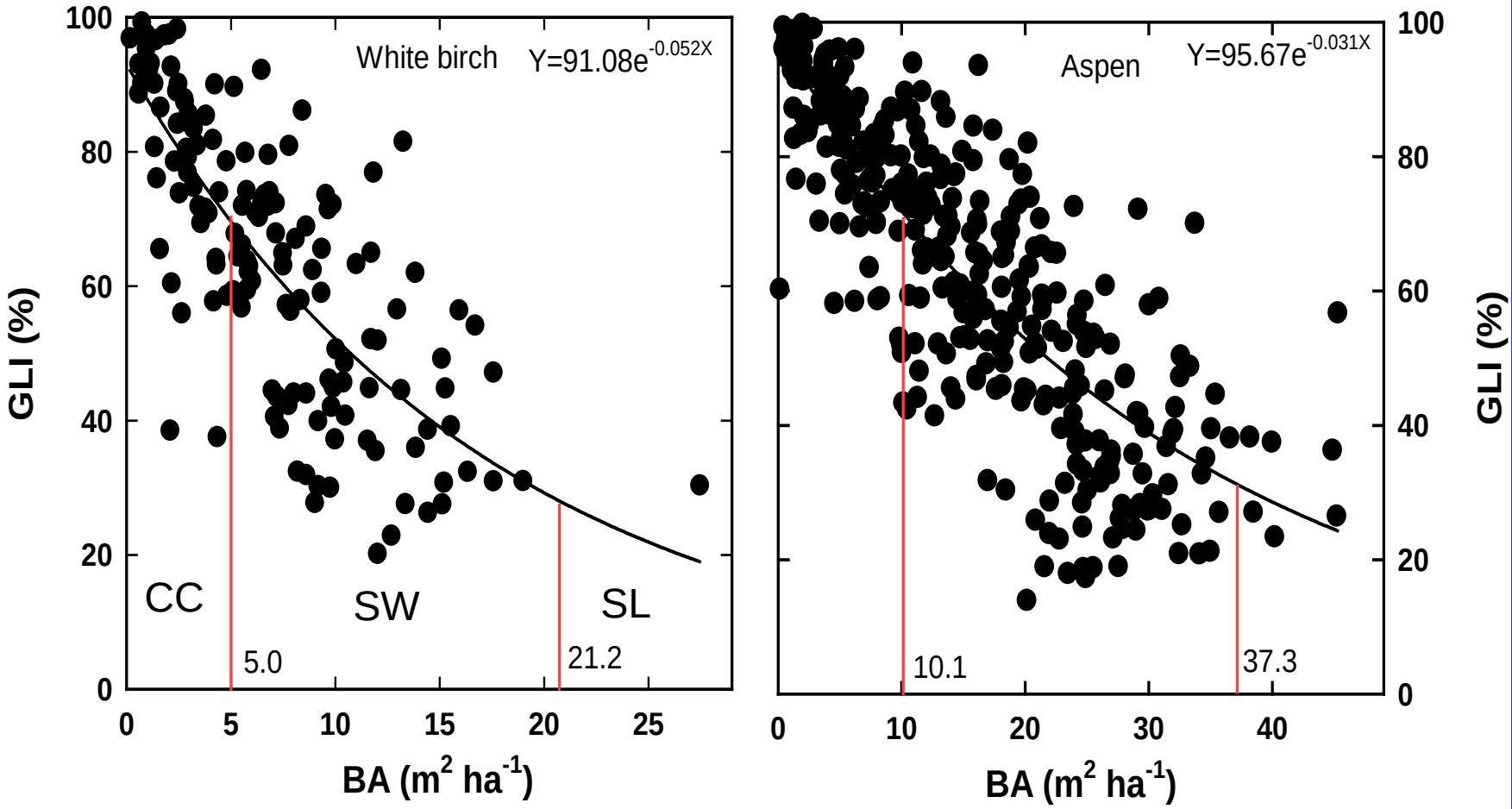
CO: 15-20%
0.5% stems aggregated

CO: 5-12%
35.5% stems aggregated

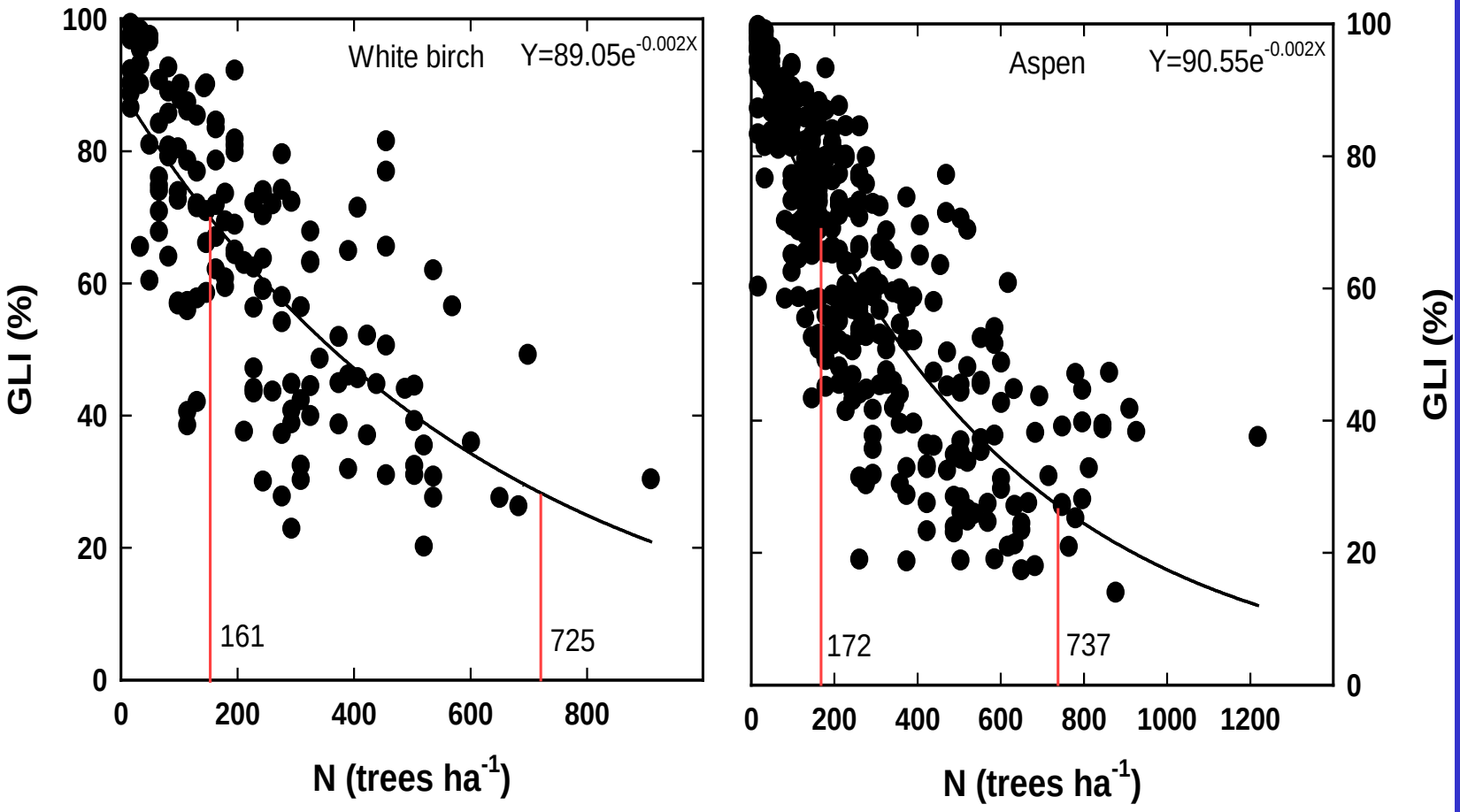
Limitations and caveats

1. Models predict average initial understory light conditions beneath canopies with no understory vegetation. Conditions will change over time with crown expansion and mortality of canopy trees, regrowth of understory.
2. No quantification of spatial distribution, stand age, or site effects
3. Apply only to stands where excessive retention resulted from poor hardwood markets, i.e., no intentional systematic pattern of harvest was used.

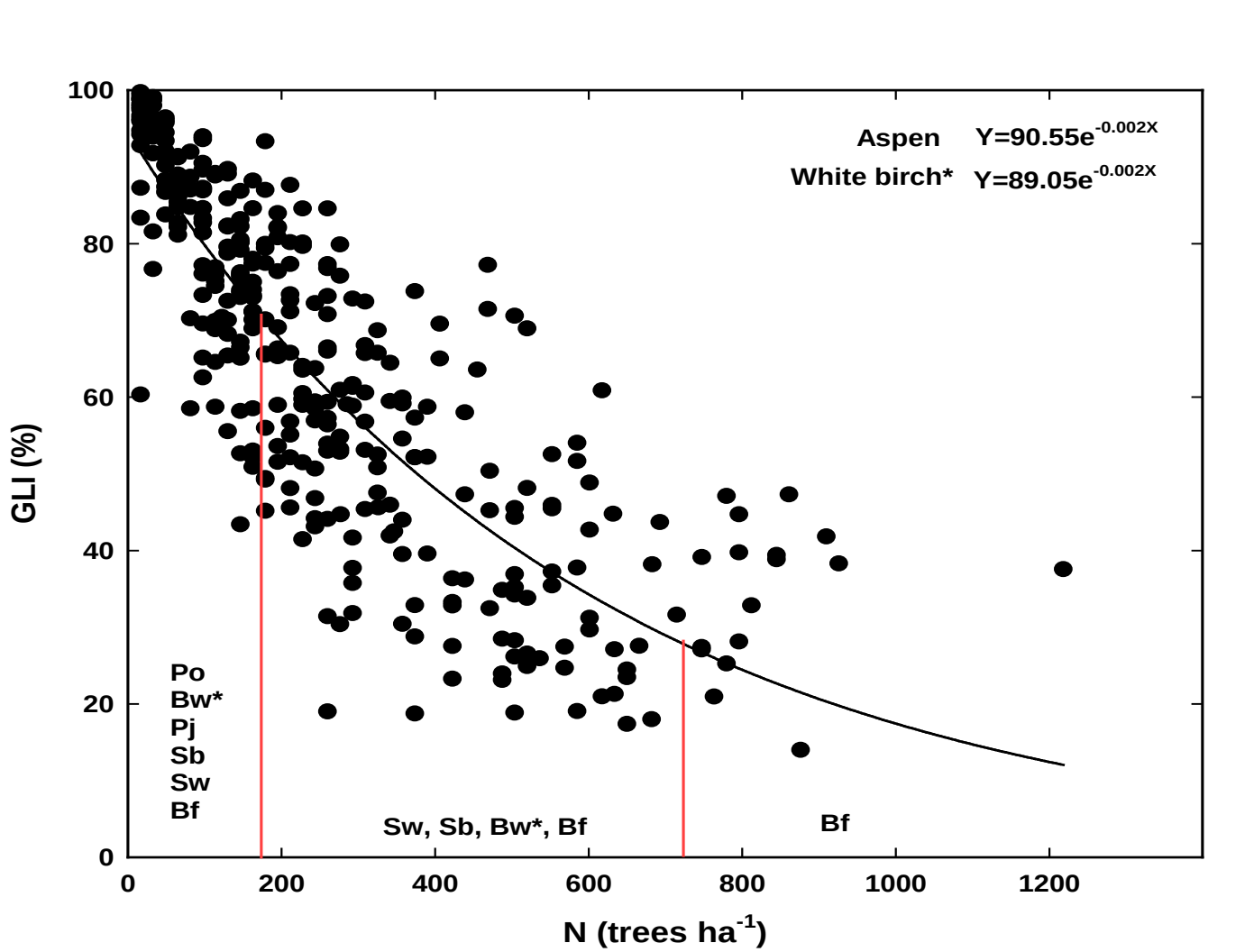
Residual basal area thresholds for silviculture systems



Residual stand density thresholds for silviculture systems



Identify residual density ranges associated with high probability of success for species regeneration



Ecological and operational benefits of residual canopy and partial harvesting of boreal mixedwoods

- Multiple, natural successional pathways of mixedwoods cannot be recreated using even-aged management.

- Partial shade and shelterwoods have some advantages for regeneration of mid and shade tolerant conifer species.

- Non-marketable trees have value: Wildlife trees, future inputs of dead wood, etc.

- Biodiversity conservation, ecosystem function, and resilience

Thanks to all who contributed!

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