THE CONCEPT AND APPLICATION OF GROWTH BASAL AREA: A FORESTLAND STOCKABILITY INDEX (METRIC)
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ABSTRACT

Growth Basal Area (GBA) identifies site potential for stockability which can be used to prescribe thinning and predict subsequent diameter growth. It also indexes different productivity levels within a site index (SI) class, and is a means for identifying them in the field, shown as SI-GBA.

Stockability, site potential, productivity, site class
STAND DENISTY: measure of trees on a site… BA/H, SPH, RD, SDI.

STOCKING: percent of land area occupied by trees - % stocked.

STOCKABILITY: site potential for growing trees.
COMMON STAND DENSITY MEASURES:

1. Stand density index (SDI).
2. Relative density (RD).
4. Tree area ratio (TAR).
5. Normal yield tables (BA/Ha).
All are RELATIVE indexes:

A stand is compared to:

- Maximum stand density (SDI, RD),
- No competition (CCF),
- Tree diameter/spacing ratio (TAR),
- Average density (Normal tables).

None directly measure tree response to stand density.
PROPOSAL: index different stand densities by diameter growth rate.

USE to Identify different site potentials for stockability.

ADDS tree growth performance to SDI, RD, CCF, TAR, and Normal yield tables.
GROWTH BASAL AREA (GBA) is that basal area at which dominant trees grow at 25 mm/dec. in diameter.

“G” = GROWTH rate of 25 mm/dec. as an index of competition.

“BA” = BASAL AREA, a variable quantity used to express stand density of different sites (stockability).
CONCEPT SIMILAR TO SI:

“SI” is height of dominants at index age, i.e. age 100.

Trees can be taller or shorter than SI as a function of age, i.e. 60 or 120 yrs.

BA/Ha can be greater or less than GBA as a function of stand density.
Diameter growth is a direct and inverse function of stand density.
From 7500 SPH to 700 SPH
From 44 sqM/Ha to 9 sqM/Ha
From 15mm/dec to 90mm/dec.

6-fold increase with 5-fold decrease in SPH
SHELTERWOOD REMOVAL
From 20mm/dec to 115mm/dec.
at age 160 and 120 cm diameter.
Same 115mm/dec at age 30 and 20 cm diameter.
The diameter growth/stand density relationship is predictable.

Curves for pine and fir show the relationship.

They are on the GBA slide rule.
Frank Ronco’s pine thinning data on the pine curve.
Walt Dahm’s LPSIM simulation model data on the pine curve.
GBA can be combined with SI.
Written as SI-GBA.
SI
INDEXES HEIGHT
GROWTH

"G" OF
GBA INDEXES
DIAMETER
GROWTH

"BA" OF GBA INDEXES STOCKABILITY
“SI” indexes height growth. “G” of GBA indexes diameter growth. “BA” of GBA indexes stand density.

Missing data are tree height and dbh for calculating stand growth.

Example: SI 30/GBA 30.
When GBA is combined with SI:

1. It indicates different stockability levels and thus productivity classes within a SI, and

2. Provides a means for identifying these in the field.

On a SI increment core, measure last 10-years growth, swing a prism for BA/Ha, convert to GBA.
PONDEROSA PINE: SI/GBA

N = 129

Y = 41.08 + 2.94X
NORMAL R = 0.75
DOUGLAS-FIR: SI/GBA

$N = 106$

$Y = -3.20 + 1.91X$

$R = 0.64$

GROWTH BASAL AREA ($m^2$/HA)

SITE INDEX AGE 100 (m)
RELATIONSHIP OF DIAMETER GROWTH TO HEIGHT GROWTH

**Height**: Starts early, ends early.
- Uses stored food reserves.
- Uses different site factors.

**Diameter**: Ends with growing factors.
- Uses photosynthetic food.
- Sensitive to weather and density.
Douglas-fir SI 22m compared across three forest types and to ponderosa pine.

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SI = m @ age 100
GBA = m^2 per Ha
CM = m^3 per Ha per Year
Pine, Douglas-fir and grand fir – how do they compare?
USES OF GBA:

- Estimate diameter growth after thinning.
- Prescribe thinning for desired growth.
- Determine optimum stocking for thinning.
- Refine site productivity estimates.
- Evaluate species suitability for a site.
Summary

1. GBA is a site-specific index of stockability.
2. GBA uses tree diameter growth as an index of competition.
3. GBA can be used to prescribe stand treatment.
4. GBA, used with SI, indicates different productivity levels.
REFERENCES
