SELECTION SYSTEM: CONCEPT AND CHARACTER

Der Plenterwald

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Background reading:


Sources cited:


Selection system silviculture looks like this ...

With this key feature ...

Components of silvicultural systems for sustained management:

- Phase: Regeneration, Tending, Harvest
- Component treatments:
  - Natural
  - Artificial - seeding - planting
  - Release treatments
  - Pruning
  - Thinning
  - Intermediate treatments
  - Clearcutting method
  - Shelterwood method
  - Seed-tree method
  - Selection method
  - Other partial cuts
  - Two-aged methods

After Nyland et al. 1983.

... a silvicultural system for uneven-aged communities
Now differentiate some terms …

**SELECTION SYSTEM**

- a silvicultural program to create and maintain an uneven-aged stand

**SELECTION METHOD**

- the means for regenerating the mature age class in an uneven-aged stand, also realizing the yield from mature trees in the process

… integrated in time and space
Said another way, the system includes:

**SELECTION METHOD …**

- to harvest mature trees
- so we can regenerate a new age class to replace them

*Also*, we add tending of the immature age classes to …

- remove excess immature trees
- improve the quality of the residual stand
- and harvest the excess trees to realize the yield in them

To do this takes three decisions …
Uneven-aged silviculture requires three decisions:

1- Residual density and cutting cycle length
2- Residual diameter distribution and maximum DBH
3- An appropriate reproduction method

... to uniformly intersperse the age classes

... to arrange them by family groups

Resulting in selection system ...

... the only silviculture for uneven-aged communities
REGENERATE – TEND – HARVEST

When done concurrently in selection system …

… this process sustains the yield at the stand level

… leading to a new age class with each entry
… and sustained development of the residual ones
… resulting in even-flow sustained yield from a STAND

Controlling stand density, diameter distribution, and spatial arrangement …
The regulatory requirements of selection system …

Each cutting starts a new age class (the reproduction method) …
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... hopefully each age class occupies an equal area per acre

In addition, you thin the immature age classes to reduce crowding and encourage quality growth (the tending) …
The regulatory requirements of selection system …

Each cutting starts a new age class (the reproduction method) …

... hopefully each age class occupies an equal area per acre

In addition, you thin the immature age classes to reduce crowding and encourage quality growth (the tending) …

... to allocate space in a way that creates a carefully defined balance between and within different age classes

The numbers of age classes equals …

R/CC
The numbers of age classes equals …

\[ R/CC \]

Where:

R = years to grow an individual tree to maturity

CC = interval between cuttings (the cutting cycle)

… like this Plenterwald
And **balanced** across space …

Meaning …

… equal area per age class

So if each tree of the oldest age …

… occupies this amount of ground space
… we need more trees of the next youngest age to cover the same space

… and even more of them of the next youngest age class
... and many more of the youngest age class

... growing together like this

After D.M. Smith 1986
...... multiplied across greater space

... even across the area of an entire stand
Or seen from above ...

... with each age class on equivalent ground space

... even across an entire stand
This leads to some unique features of selection METHOD:

- allocate only part of the growing space to a new age class
  
  … the space previously occupied by mature trees

- but free up at least the minimum amount of site resources to insure survival and development of the new seedlings

… appropriately interspersed age classes

… and consider the ecologic impact
After Smith 1986

Increasing degree of overstory removal

Some environmental factors

Full shade  Full sunlight

Little change in the environment ...

... like this
Such that...

- Only *SOMEWHAT* increases solar energy and alters light quality
- Only *SOMEWHAT* decreases root competition and increases the available soil moisture and nutrients
- Only *SOMEWHAT* adds new amounts of dead organic matter as dead tree parts
- Only *SOMEWHAT* promotes biologic activity in the litter, thereby somewhat accelerating decomposition and nutrient release
- Only *SOMEWHAT* warms the surface layers and the air near the ground

... and the *ONLY SOMEWHAT* amount of change influences the type of species that survive and develop in a stand

... due to only limited changes in environmental conditions
Regenerating mostly shade-tolerant species …

… like sugar maple

… at least for the residual stocking commonly used with selection system cutting in the past

By contrast consider …

**SELECTIVE cutting**

… *NOT* the same as *SELECTION* cutting
**SELECTIVE** cutting means …

- creaming, culling, or high-grading

- an exploitative cutting that removes trees of only certain species or large trees of high value

... **KNOWN SILVICAL REQUIREMENTS AND SUSTAINED YIELD BEING WHOLLY OR LARGELY IGNORED**
Exploitation!

Simply extracting value ... ... uncontrolled and unpredictable

But selection system differs ...

So back to selection system ....

... and let's put together an uneven-aged stand
Remember this about uneven-aged stands …

Multiple age classes …
… all growing together

Across an entire stand …
Remember this about uneven-aged stands …

Four age classes … …intermixed like this

- Old: Tall and fat
- Middle age: Medium
- Young: Short and slender
A good correlation between tree size and tree age in managed stands …

... multiple ages
... many diameters
... variable heights

... lets us control the distribution and abundance of each age class
And the discontinuity of the upper canopy and the high degree of vertical structural diversity …

... lets us maintain good growth on trees of all ages
… and the implications

We use the diameter distribution to control …

… the numbers of trees in each age class

… the area covered by each age class

… like this

... representing a composite of those for several age classes

... with a reverse-J curve commonly used to describe the diameter distribution
But with any ecological basis?

... reminiscent of stands moving toward a steady state

That have an uneven-aged character ...

... implying an age progression

Bormann and Likens 1979

After Goff and West 1975
... this rotated-S shape attributed to old-growth stands

... becomes modified by silviculture where we periodically remove the financially mature trees (*the repro method*)

... simplified to a reverse-J distribution
And what does it represent?

How does it create a **BALANCE**?

... we allocate equivalent crown space to each age class

... with more smaller trees to fill the space allocated to those age classes
... looking like this in the forest

So by the combination of a reproduction method **plus** the tending of immature age classes ....

... you allocate equivalent ground space to EACH age class
Like this...

... even across an entire stand

... and this
But how to prepare a prescription ???

For northern hardwoods we can use the Arbogast guide for planning and controlling selection system ...

Nyland 2002

Lets apply it for managing this uneven-aged stand ....

... what we have
And transform it to this ....

... what we want

With this ....

... representing this
Can you visualize the necessary treatment?

... cross-hatched means an excess of trees per size class

OK?

... to bring it to the desired condition

What to do ...

... cut this excess

... to bring it to the desired condition
The stand analysis ...

... to bring out the “deficiencies”

<table>
<thead>
<tr>
<th>Original stand</th>
<th>Arboresal guide</th>
<th>Excess</th>
<th>Mark</th>
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<td>DA/sec</td>
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<td>24</td>
<td>.8</td>
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<tr>
<td>ALL</td>
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<td>96</td>
<td>320</td>
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</table>

... leading to a prescription ...

Leading to a prescription ...

<table>
<thead>
<tr>
<th>LST</th>
<th>SST</th>
<th>POLES</th>
<th>SAPS</th>
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<tbody>
<tr>
<td>Mark 1/6 of trees</td>
<td>Mark 1/5 of trees</td>
<td>Mark None</td>
<td>Mark None</td>
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</tbody>
</table>

MATURE ...

... the reproduction method

... what to cut to get the desired residual condition
The prescription also tells ...

... what immature trees to cut to get the desired residual condition

Priorities for cutting trees in the **TENDING** operations …

You mark to cut:

1st – Defective & diseased trees  
2nd – High risk trees that will not survive  
3rd – Low value trees of any species  
4th – Less desirable species  
5th – Excess numbers of *GOOD* trees
Improving the growing stock …

… by taking the poorest and favoring the best

And do this within limits of your plan for balancing the diameter distribution …

With this recoverable sawtimber yield …

... due to the reproduction method

... plus the tending
Ending up with this residual structure ...

...with some irregularities remaining in classes less than SST

... implemented like this
And IF at least reasonably balanced, the structure should remain stable through time ....

Given this as a residual stocking and diameter distribution ...
How did it grow afterward …

... with a 15-year cutting cycle

It seems stable ...

... but can we restructure it a second time?

Once more we must cut the excesses to balance the stand …
The second cut prescription ...

<table>
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<th>1988 standing</th>
<th>Arbogast</th>
<th>Difference</th>
<th>Cut</th>
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<td>Ft²/ac</td>
<td>No/ac</td>
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So the analysis suggests that the stand remained stable ...

... and supported a second operable cut to recreate an Arbogast structure

... even flow and sustained yield at the STAND level
After two selection system treatments …

… high quality trees of several age classes kept in balance with the others.

IN FACT …

… note the structural stability through three cutting cycles:

1st 2nd 3rd
Remember ...

A separate production function for each cohort ...

At any point in time ...

... multiple age classes ...

... each at a different stage of development
the production function for uneven-aged communities under silviculture

... consistent

... sustained

... indefinitely

Given that you recreate the balanced condition at each entry ...
Allocating equal ground space to each age class...

... through judicious cutting

Uneven-aged stands have several age classes...

... each kept in balance with the others
… so where do we go from here