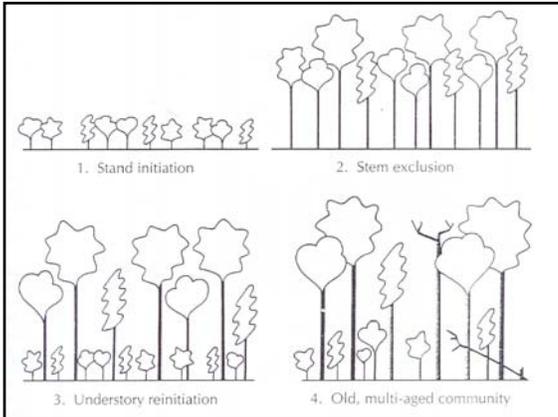


Stages of Stand Development

- Stand Initiation Stage
- Stem Exclusion Stage
- Understory Reinitiation Stage
- Complex or Old Growth Stage



Stand Development Stages

- Each phase is accompanied by changes in stand structure and species composition

Stand Initiation Phase

- Stand structure
 1. Accumulation of biomass
 2. Begin vertical stratification of tree crowns
 3. "BRUSHY" Stage
 4. Invasion continues until all growing space is occupied

Stand Initiation Phase

- Species Composition
 1. Propagules present
 2. Tolerance
 3. Longevity
 4. Growth potential
 5. Initial species composition
 6. Impact of disturbances

Stand Initiation Stage

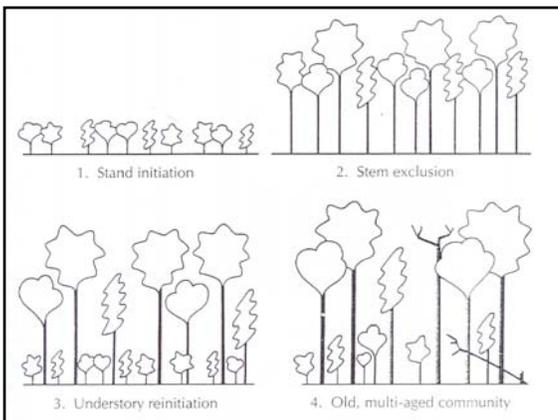
- Follows major disturbances (wind, fire, clearcuts)
- Regeneration of open space from seed, sprouts & advance regeneration
- One cohort or age class
- Stage ends when canopy becomes continuous and trees begin to compete with each other for light and canopy space

Stand Initiation Stage Management Implications

- Site Preparation to favor a certain species
- Light Tolerance
- Future species composition
- Regeneration mechanism advantage
- Density ---- too many or too few

Stages of Stand Development

- Stand Initiation Stage
- *Stem Exclusion Stage*
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Stem Exclusion Stage

- Canopy is too dense to allow new saplings to grow into the canopy
- Canopy continues to have one cohort
- Competition is intense and density-dependent “self-thinning occurs

Stem Exclusion Stage

- Crowns are small enough so that when one tree dies, the other trees are able to fill the vacated space in the canopy by expanding their crowns
- Few, if any stems are added to the population of overstory trees

Stem Exclusion Stage

- Mortality rates are high, especially in the intermediate and suppressed crown classes
- Full utilization of growing space, possibility of stagnation
- Characterized by growth, competition and mortality produced spatial adjustments

Stem Exclusion Stage

Species dominance in this stage can be attained through:

1. Inherent faster growth than competitors
2. Initially superior crown position
3. Persistence

Stem Exclusion Stage

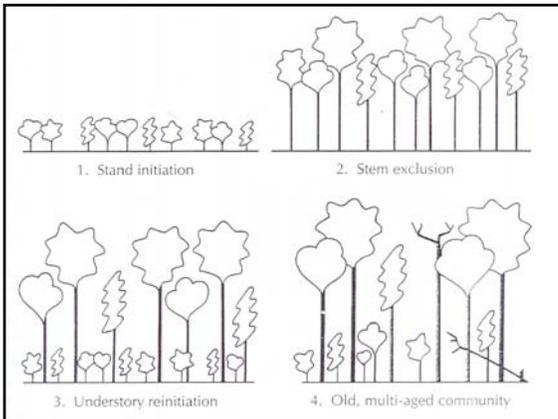
- Diameter Distribution change
- Will vary by species mixture due to canopy stratification which is based on shade tolerance, longevity, growth rate, maximum attainable size (in absence of disturbance)

Stem Exclusion Stage Silvicultural Implications

- Thinnings to shape desired future condition of the stand
- Species composition and stand structure/form
- Density/spacing arrangements

Stages of Stand Development

- Stand Initiation Stage
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Understory Reinitiation Phase

- Tree reproduction becomes re-established beneath the parent stand --- more than one cohort
- This reproduction, more than likely, becomes a major component of the new stand that develops after the next stand initiating disturbance

Understory Reinitiation Phase

- Crowns of trees are now large enough so that when one tree dies, the surrounding trees can not fill the gap --- density independent mortality
- Thus, new cohorts can eventually enter the canopy, diameter distribution becomes bimodal --- large and small peaks

Understory Reinitiation Phase

Factors that influence species composition

- **Light ---- Degree of Shade Tolerance**
- **Soil Moisture**

Understory Reinitiation Phase

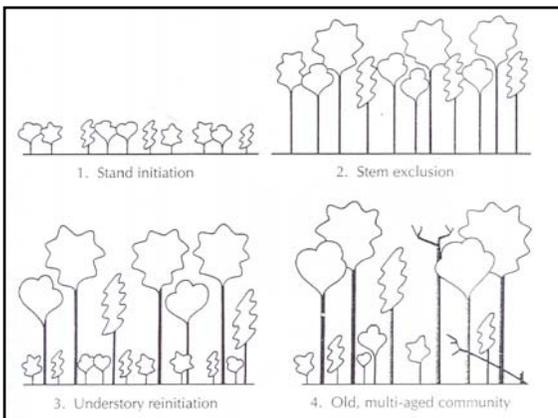
- This is also the stage where stands usually reach their economic maturity
- Characteristics ---- larger trees, fewer trees, seed is produced, large crowns, larger canopy gaps, less aggressive crown expansion --- thus more light reaching the forest floor

Understory Reinitiation Phase Silvicultural Implications

- Progression to this stage of stand development and length of this stage can be increased through silvicultural actions ----
- For oaks, this is the stage to develop advance regeneration

Stages of Stand Development

- Stand Initiation Stage
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- *Complex or Old Growth Stage*



Complex Stage (Old Growth)

DEFINED --- Natural mortality of large overstory trees produces *irregular* canopy gaps and accelerates the *recruitment* of reproduction and subcanopy trees into the overstory and main canopy. This stage marks the transition of an even-aged to an uneven-aged stand

Complex Stage

- The stated durations for the four stages of development assume that no significant stand scale disturbances occur.
- Actual durations of stages of development vary with species composition, site productivity and other factors.

Development of Uneven-Aged Stands

- Complex Stage vs. Old Growth Terminology ----

Generally, all old growth stands are complex, BUT not all complex stands are old growth.

Development of Uneven-Aged Stands

- Definitions of old growth are usually based on overstory age, stand disturbance history (comparison) and structural characteristics such as presence of old trees, woody debris, snags, etc.
- Various definitions assume that human influence has been minimal

Development of Uneven-Aged Stands

- However, older second growth forests (managed or unmanaged) may have complex structures w/o meeting the strict definition of old growth.

Development of Uneven-Aged Stands

- Multi-aged population, reverse J-shape
- Result of stand maturation (overmature?)
- Gap formation and filling
- Gaps become more numerous until the stand forms a mosaic of old trees & gaps filled with younger trees of various ages and species

Development of Uneven-Aged Stands

- As trees refill gaps, stand diameter frequency distributions change from:
 - bell-shaped to
 - irregular shaped to
 - reverse J-shaped

Development of Uneven-Aged Stands

- Probability is low of reaching *old growth* or uneven-aged stand because of frequency of stand initiating disturbances
- Probability of reaching *complex stage* is greater when disturbance is incomplete.

Complex Stage

- Incomplete stand-scale disturbance
- Eliminates only a portion of the overstory
- Significant number of trees standing
- Does not return to stand initiation stage
- Events that cause mosaics of younger trees developing in large canopy openings interspersed with older trees.

Development of Complex Stage (Silvicultural Implications)

- A few examples:
 - High-grading
 - Heavily thinned stands
 - Low Density Shelterwoods
 - Intentional Creation of Two-aged Stands
 - Group Selection & perhaps Single-tree Selection

Complex Stage Summary

- Primary concern is to ensure younger trees or smaller size classes do not lose vigor from high or side shade before overstory density is reduced.
- Midstory control and low thinnings???
- Managing spatial distribution, cutting in all size classes
- Most growth is in largest size classes

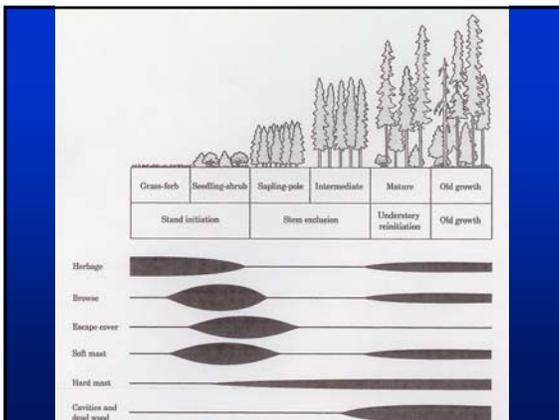
Developing Wildlife Habitat Components through Silviculture

Developing Wildlife Habitat Components

- Accomplished by controlling stand structure and forest structure
- Stand structure --- ages, sizes and density within a stand
- Forest structure --- sizes and spatial arrangement of stands within the forest

Developing Wildlife Habitat Components

- Browse
- Herbaceous Vegetation (herbage)
- Hard and Soft Mast
- Shelter / Cover
- *All occur at different stages of stand development*



Developing Wildlife Habitat Components

Importance of Vertical Stand Structure

- Birds --- feeding and nesting
- Less diversity with single-aged, single-species stands, more in older, mixed-species stands
- Through silvicultural treatment can create “older stages” of canopy structure. How?

Developing Wildlife Habitat Components

Importance of Modifying Stand Structure

- Species Composition
- Sizes and Spatial Arrangements
- Edge vs Interior
- Corridors

Developing Wildlife Habitat Components

Summary

- Wildlife Travel and Move
- Create Diversity of Vertical & Horizontal Habitat Structure
- Delineation of stands of different characters to compose the entire forest habitat

Developing Wildlife Habitat Components

Summary

- Habitat Diversity is the KEY, through manipulation of different stand structures, both horizontal and vertical structure.
