A brief introduction to general terms and concepts related to the forestry learning objectives and relationship to special issue topic “Water Resources Management: Local Control and Local Solutions” for 2021
What is Forestry?

The profession embracing the science, art, and practice of creating, managing, using, and conserving forests and associated resources for human benefit and in a sustainable manner to meet desired goals, needs, and values.

Society of American Foresters – The Dictionary of Forestry
Forestry Learning Objectives

Tree Physiology & Identification – 20 pts
Forest Ecology – 20 pts
Sustainable Forest Management – 40 pts
Trees: Renewable Resource – 20 pts
Tree Physiology & Identification

- **Growth cycle:**
  - Height growth governed by temperature & photoperiod
  - Diameter growth governed by spacing
  - Root growth generally occurs when soil temp 32+
  - All governed by soil quality & available water

- **Life cycle:**
  - Flower/cone
  - Seed
  - Seedling (less than 1” dia at base & up to 3-ft tall)
  - Sapling (small: 1” to 3” dia at base and up to 10-ft tall; large: 3” to 5” dbh)
  - Pole (small – 5 to 8” dbh; large 8 to 12” dbh)
  - Sawtimber (over 12” dbh)
  - Old age
  - Death & decay
Tree Physiology

Tree cookie parts:

- Outer bark (protection)
- Phloem (move sugars from leaves to stems & roots)
- Cambium (meristematic cells dividing to form xylem & phloem during growing season)
- Xylem (moves water & nutrients to leaves)
- Heartwood (nonliving cells providing mechanical support)
- Pith (1st year of growth, usually soft tissue)
SIMPLIFIED EQUATION
for
PHOTOSYNTHESIS

CHLOROPHYLL (in sunlight)
carbon dioxide + water → glucose + oxygen + water

$6\text{CO}_2\,^{16} + 12\text{H}_2\text{O}^{18} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6\,^{16} + 6\text{O}_2\,^{18} + 6\text{H}_2\text{O}^{16}$

[ $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ does not account for the source of the $6\text{O}_2$. ]

Increased carbon dioxide allows plants to photosynthesize more and use less water. However, warmer temperatures drive plants to use more water and photosynthesize less.
Tree, Shrub & Woody Vine Identification

- Identify common Virginia species with or without a key (full common name):
  - VDOF’s *Common Native Trees of Virginia*
  - VDOF’s *Common Native Shrubs and Woody Vines of Virginia*

- Note: The keys noted above are the only source material for tree, shrub & woody vine identification questions at the Local, District and State competitions.
Dichotomous Identification Keys

Paired Choices:

1. if not this trait
1. then some other trait

Example:

1. plants with leaves present
1. plants with leaves absent
Typical Key to Genera

A. Plants with leaves present
   B. Plants with needle-like, scale-like, or awl-shaped leaves
   B. Plants with broad leaves
      C. Leaves opposite or whorled
         D. Leaves simple
         D. Leaves compound
      C. Leaves alternate
         E. Leaves simple
         E. Leaves compound

A. Plants with leaves absent
   F. Leaf-scars opposite or whorled
   F. Leaf-scars alternate
Forest Ecology

- Canopy crown classes
  - Dominant – sunlight from above & sides
  - Co-dominant – sunlight from above
  - Intermediate – no direct sunlight
- Understory crown class
  - Suppressed (overtopped by crown canopy)
- Ground layers
  - Herbaceous vegetation (including grasses & ferns) and forest regeneration
  - Litter – forest floor surface not in advanced state of decomposition
  - Duff – partially decomposed organic material beneath litter & above soil
  - Soil – unconsolidated mineral or organic material that serves as natural medium for plant growth
Forest Ecology

- Abiotic factors (nonliving parts)
  - Climate: temperature, light, air & moisture
  - Edaphic: soil texture, structure, depth, moisture-holding capacity, drainage, chemical/nutrient & topographic position
  - Pyric: lightning induced wild fires & prescribed burns

- Biotic factors (living parts)
  - Interaction between plants
  - Animals & birds
  - Insects & disease
  - Fungi

- Anthropogenic
  - Influence of humans alone
Forest Ecology

Approximate percent Forest Acreage for Basic Timber Types in Virginia by Physiographic Province

<table>
<thead>
<tr>
<th>Physiographic Province</th>
<th>White pine</th>
<th>Hemlock</th>
<th>Loblolly</th>
<th>Shortleaf</th>
<th>Oak</th>
<th>Pine</th>
<th>Oak</th>
<th>Hickory</th>
<th>Oak</th>
<th>Gum</th>
<th>Elm</th>
<th>Ash</th>
<th>Beech</th>
<th>Birch</th>
<th>Maple</th>
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<tbody>
<tr>
<td>Tidewater</td>
<td>0</td>
<td>35.72</td>
<td>16.72</td>
<td>37.00</td>
<td>8.18</td>
<td>2.38</td>
<td>0.13</td>
<td>8.07</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
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<tr>
<td>Piedmont</td>
<td>0.44</td>
<td>26.24</td>
<td>11.66</td>
<td>57.68</td>
<td>1.57</td>
<td>2.41</td>
<td>0.59</td>
<td>0.27</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blue Ridge</td>
<td>4.14</td>
<td>8.18</td>
<td>10.72</td>
<td>75.97</td>
<td>0.13</td>
<td>0.59</td>
<td>0.53</td>
<td>1.46</td>
<td>8.07</td>
<td>8.07</td>
<td>8.07</td>
<td>8.07</td>
<td>8.07</td>
<td>8.07</td>
<td>8.07</td>
</tr>
<tr>
<td>Ridge and Valley</td>
<td>1.46</td>
<td>4.00</td>
<td>7.76</td>
<td>84.78</td>
<td>0</td>
<td>0.53</td>
<td>0.13</td>
<td>0.13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Appalachian Plateau</td>
<td>0.70</td>
<td>0.70</td>
<td>2.95</td>
<td>87.45</td>
<td>0</td>
<td>0.13</td>
<td>8.07</td>
<td>8.07</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>
Sustainable Forest Management

- **Silviculture systems:**
  - Clear-cutting – even-aged stand final harvest with regeneration either natural or planted/seeded
  - Seed tree method – even-aged or two-aged stands with regeneration that requires little or no shade
  - Shelterwood – even-aged or two-aged stands with regeneration that requires partial sunlight or shade
  - Selection – uneven-aged stand
Sustainable Forest Management

- **Silviculture treatments:**
  - **Planting** – a reforestation method
  - **Coppice** – regeneration from stump sprouts or root suckers in hardwood stands
  - **Weeding** – release treatment in stands not past sapling stage that eliminates or suppresses undesirable trees regardless of crown position
  - **Thinning** – reduce stand density/improve forest health
    - Pre-commercial thinning (PCT) – reduce stocking rate
    - Commercial thinning – reduce stocking with revenue
  - **Prescribed burning** – controlled fire under specified conditions to achieve planned stand condition objectives
  - **Harvesting** – final cut in the rotation
Sustainable Forest Management

- Forest health & management issues
  - Biodiversity
  - Forest fragmentation
  - Forest health – stand density conditions
  - Invasive species – insects & plants negatively impacting forest stands
- Air quality
- Aesthetics
- Fire – natural and prescribed
- Global warming – temperature & precipitation changes impact stand types
- Recreation – minimizing environmental impacts
Sustainable Forest Management

- Sustainability:
  - Forest management practices & decisions
    - Economic
    - Social
    - Ecological
  - Forest policy
    - Land use zoning
    - Taxation
    - Incentive programs
  - Science & technology utilization
Sustainable Forest Management
Collecting Plot Data

- Biltmore stick -
  - DBH – 2” class
  - Merchantable height – minimum 1 log then in half-log increments to 8” top (DIB) or 1st major defect
  - See National 4-H Forestry Invitational Handbook for use of Biltmore stick & tree measurement standards
### Example: 1/10 ac Plot Data with Biltmore stick

#### Sustainable Forest Management

### Calculate the summation data at the bottom of the 1/10 acre plot table.

<table>
<thead>
<tr>
<th>Tree #</th>
<th>Species</th>
<th>DBH</th>
<th># Logs</th>
<th>Bd-Ft Vol/tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pignut Hickory</td>
<td>14</td>
<td>1 ½</td>
<td>105</td>
</tr>
<tr>
<td>2</td>
<td>Pignut Hickory</td>
<td>16</td>
<td>2</td>
<td>180</td>
</tr>
<tr>
<td>3</td>
<td>White Oak</td>
<td>14</td>
<td>1</td>
<td>78</td>
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<tr>
<td>4</td>
<td>White Oak</td>
<td>18</td>
<td>1 ½</td>
<td>184</td>
</tr>
<tr>
<td>5</td>
<td>White Oak</td>
<td>16</td>
<td>1 ½</td>
<td>143</td>
</tr>
<tr>
<td>6</td>
<td>White Oak</td>
<td>18</td>
<td>1 ½</td>
<td>184</td>
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<td>7</td>
<td>White Oak</td>
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<td>2</td>
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<td>8</td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># Trees/Ac = 70</td>
<td></td>
<td>Ave DBH = 16</td>
<td>Bd-Ft Vol/Ac = 10,540</td>
<td></td>
</tr>
</tbody>
</table>
Sustainable Forest Management

Based on the plot data what is the stand stocking condition?

FOREST STOCKING GUIDE
VA Envirothon

NUMBER OF TREES PER ACRE

AVERAGE DBH (Trees 10 inches & greater in plot)
Sustainable Forest Management
Prism Plots

- Basal area (BA): cross-sectional area at DBH
  - Ex: 10 BAF prism – each tree “countable” represents 10 sq-ft of basal area per acre
- Strong linkage between site-index (SI), tree height at age 50 (for a specific species on a given site), and BA
  - Rule of thumb: If BA is 20 over SI cut back to 10 under SI for a stand improvement cut
Trees – A Renewable Resource Policy Issues

- Urban forestry
  - Value, health & survival
- Forest products
  - Wood, paper & residue reconfiguration
- Ecosystem Services (who pays?)
  - Air quality
  - Water quality & quantity
  - Wildlife habitat
  - Recreation/health
Special Issue Topic – 2021
Water Resources Management: Local Control and Local Solutions

- Note: it is not often the Special Issue Topic is directly related to the Forestry section of the Envirotech test. So here are some thoughts on the subject related to the Topic’s key objectives:

- Understanding how groundwater and surface water systems function
  - Some terms to be familiar with: topography (drainage configuration) and geology to include karst, aquifer, aquitard and aquiclude
Understanding the importance of water quality and quantity as a foundation in a healthy ecosystem

- Consider some issues: land use – urban (storm water runoff), agriculture, forest (both managed and unmanaged), riparian buffers

- Understanding a variety of water *quality* indicators in different landscapes.
  - Consider: water chemistry, physical conditions and macroinvertebrates
Special Issue Topic – 2021
Water Resources Management: Local Control and Local Solutions

• Understanding a variety of water *quantity* indicators in different landscapes.
  • Consider: land use options that impact infiltration, options utilizing water uptake (agriculture, forests & industry) and options that require supplemental water (suburban lawns, golf courses, irrigation of crops)

• Understanding how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife.
  • BMP utilization applicable for all land uses
  • Management of water withdrawal – reservoirs, rivers & wells
  • Management of runoff & wastewater (renovation) before return to a natural system
Special Issue Topic – 2021
Water Resources Management: Local Control and Local Solutions

- Understanding the differences of local, regional, and national systems that manage natural resources and the importance of each in water resources
  - Consider: Scaling up the actions from local to regional to national levels

- Understanding the social, economic, political impacts of natural resources management and decision making
  - Many stakeholders & conflicting viewpoints – an educational opportunity with compromises based on science
Thanks for Reviewing!

Now is the time for questions, concerns, comments or anything else you would like to know about the Forestry test. Ask away – Contact for Coaches & S&WCD Educators only: jonsrockett@aol.com