Bottomland Ecology & Floodplain Development

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What Should You Gain From The Bottomland Hardwood Discussion

• Recognize LANDFORMS
  a. Creation and Dynamics
  b. Species Associations
• Roles of WATER in bottomlands
• Impacts of SOIL
• SPECIES Relationships
• Constant change and dynamics

Alluvial Sites, or The Fluvial Setting

• Wide range of geomorphological settings upon which vegetation patterns may be overlaid
• Different landforms support different vegetation
  – Active processes
  – Physical characteristics
The Fluvial Setting, cont...

- Terraces
- The Floodplain
- Features of the Channel

Hydrologic Influence

- Of “singular importance” to bottomland systems:

  **Water**
  - Ecological limiting factor
  - Medium for biogeochemical processes
  - Force that controls erosion & sedimentation events
  
  [Hupp 2000]

  - “Slight hydrological changes may result in only loosely predictable, yet often substantial responses” (Mitsch & Gosselink 1993)

- Floodplains are regularly inundated for months each year (during the wet period)

  - Prolonged saturation
  - Physical damage
  - Erosion of substrate
  - Deposition of new sediments
  - Duration and Frequency
  - Flowing or Standing Water
  - Seasonal Timing

- Disturbance highly variable on the landscape
Species vary in susceptibility and tolerance to hydrologic disturbance

Variations in floodplain forest composition are influenced by varying severity of flooding
- Mortality
- Extreme stress
- Altering conditions for establishment

Repeated disturbance (periodic flooding) can also impede succession

Geomorphic Influence

Fluvial landforms (floodplains) are dynamic features
- Constantly eroding
- Constantly aggrading

Meandering streams and rivers migrate
- Creates a heterogeneous landscape

Floodplains tend to act as net storage basins for sediment during periods of high or rising sea level

Floodplains aggrade in two ways
- Lateral accretion (point-bar extension)
- Vertical accretion
Floodplains aggrade in two ways:

- Lateral accretion (point-bar extension)
  - An episodic process
  - Occurs during high flows
  - Results in ridge & swale topography

USACE

- Vertical accretion
  - Also episodic
  - Facilitated by reduction in flow velocity

Both enhance heterogeneity across the landscape
**Features of Modern Floodplains**

- River Channel
- Direction of Meander Movement
- Natural Levee
- Point Bar Deposits
- Back Swamps
- Channel Fill Deposits
- Ridge
- Swale Deposits
- Overflow Channel

**Vegetative Patterns**

- Likelihood of a particular species occupying a given landform is a function of:
  - The suitability of the site for germination
  - The environmental conditions that permit persistence until reproductive age

**Vegetative Patterns cont...**

- Spatial distribution (pattern) of a species is limited by:
  - Species ability to survive or tolerate local conditions (disturbance, stress regimes)
  - Competitive and facilitative influences

Species grow where they can compete successfully and tolerate local conditions, **NOT** where they grow best.
Bottomland Forests

• Bottomland forests are some of the most productive and diverse ecosystems in the United States

• Myriad of different species with different site requirements and growth habits makes management extremely complex and variable

Bottomland Hardwoods

The silviculture is similar to upland forests except for:

• Flooding that is largely, unpredictable and uncontrollable, and

• Site/Species relationships

Bottomland Hardwoods

• Water Impacts
  Depth
  Frequency
  Duration
  Seasonal Timing
Bottomland Hardwoods

- Site/Species Relationships
  - Landform
  - Soil Drainage
  - Soil Texture
  - Deposition

Patterns of Deposition

Fig. 4. Patterns of deposition within an alluvial stream valley.

Relatively minor changes in topography are important!

Generalized Cross-section of a stream bottom and which species have the competitive advantage.
Relatively minor changes in topography are important!

Rivers often rise in winter months putting the forest under water.

Generalized Cross-section of a stream bottom and which species have the competitive advantage.

Relatively minor changes in topography are important!

Areas dry out at different rates due to soils and topography.

Generalized Cross-section of a stream bottom and which species have the competitive advantage.
Bottomland Landforms
Classification - terminology

Gulf Coastal and Mississippi Alluvial Plains
- Major Bottoms
- Minor Bottoms

Atlantic Coastal Plain
- Red River Bottoms
- Black River Bottoms

Mississippi Alluvial Valley and Gulf Coastal Plain
- Classified as either:
  - Minor Bottoms have soils of local origin, example: Wolf River (Ames Plantation)
  - Major Bottoms have soils that were transported for hundreds of miles that vary in mineralogy, example: Mississippi River

Atlantic Coastal Plain
- Red River Bottoms originate from sediments from the mountains and upper Piedmont
- Black River Bottoms originate in the lower Piedmont or the Coastal Plain
- Muck Swamps are highly organic areas where there is standing water for 10-12 months a year.
Species Composition in the Atlantic Coastal Plain

Red River Bottoms
- Sycamore
- Cottonwood
- Sweetgum
- Oaks
- Ash

Black River Bottoms
- Red Maple
- Ash
- Swamp Black Gum
- Water/Willow Oaks
- Elms/Hackberry

Major and Minor Bottoms
Landform and Species
Schematics

Major Bottoms
- **Bars and Fronts** --- willow, elm, cottonwood, sycamore
- **Flats** --- Nuttall oak, green ash, sugarberry, elm, red maple
- **Slough** --- overcup oak, water hickory
- **Swamp** --- water tupelo, bald cypress
- **Ridge** --- sweetgum, green ash, hickory, water/willow oaks
Minor Bottoms

- **Bar** --- river birch
- **Levee** --- beech, sycamore, sweetgum, sycamore, yellow-poplar, oaks
- **Flat** --- sweetgum, oaks, hickories, blackgum
- **Slough** --- bald cypress, swamp tupelo
- **Terrace** --- white oaks, red oaks, hickory, yellow-poplar, sweetgum, loblolly pine
**Bottomland Hardwoods Summary**

- Know your sites
- Know the hydrology
- Know the ecological requirements of the species
- **INTEGRATE** ---- Match the species to the site conditions

**Bottomland Systems are Dynamic!**

Rapid change is part of the system. Sites and soils are in a constant state of change because of deposition and erosion. This in turn is reflected in the vegetational composition.