Hogs and Hams

Harvard University

Old Dominion University

Ships
Hogs and Hams

Harvard University

Old Dominion University

What do they have in common?

Ships
ZUNI PINE BARRENS
A Cooperative Conservation Project

ZUNI PINE BARRENS
Blackwater Ecological Preserve

Antioch Pines Natural Area Preserve
From Harvard Yard to Zuni-
The ecology and history of Virginia’s rarest ecosystem

Lytton John Musselman

1 November 2005
---Longleaf pine

---Naval stores industry

---Botanical history

---Management and current research
The Zuni Pine Barrens Preserve is located in Isle of Wight County, Virginia, near the village of Zuni.
Blackwater Ecologic Preserve, 1985, 319 acres

Deeded to ODU by the Union Camp Corporation
Antioch Pines North, 1995, 400 acres

Purchased by the state
Antioch Pines South, purchased by the state in 2004, 484 acres

Total acreage of the Zuni Pine Barrens Natural Area is about 1000
Longleaf on marine derived soils

From: Early-Looking for Longleaf

Geologically, most of the preserve is derived from marine terraces with deposition of deep mineral sands
Longleaf on marine derived soils

Clay lens

From: Early-Looking for Longleaf
I The Longleaf Pine Ecosystem
Original Extent of Longleaf Pine

- Longleaf pine
- Longleaf pine—shortleaf pine—loblolly pine—hardwoods transition areas

From: Frost in Early-Looking for Longleaf
The Longleaf Pine Ecosystem

• Originally covered 93 000 000 acres

• Only 3 000 000 remain

• Perhaps 200 000 acres in Virginia originally

• High biodiversity, among the highest in terms of species per unit area
The Longleaf Pine Ecosystem

• Many endemics

• Dependent on regular, cool fires

• Keystone species is longleaf pine, *Pinus palustris*
Pinus palustris—Unique life history
Seeds germinate in December

Two year old tree
Seedlings are adapted to fire in contrast to other pines which have fire adapted cones.

*Pinus serotina*  
*Pinus palustris*
Comparison of cone types

*Pinus serotina*, serotinous cones

*Pinus palustris*, open cone
*Pinus palustris*-Unique life history
Remains in grass stage for five years

Two years

Five years
Seedlings adapted to regular cool fires
Flames move toward the ends of needles, protecting the terminal bud.
In flames, tips of needles are singed, bud is protected.
Fireproof bark develops as stem elongates.
After bolting, the bud is above the flames.
Demise of the longleaf ecosystem in Virginia

Longleaf met its fate through

• Fire suppression
• Cutting
• Invasive species
Invasive Species

Introduced by Spanish in the 1500’s
By 1800 an estimated 10-50,000 hogs in each of the settled counties in the longleaf region
Feral hogs devoured longleaf seedlings at the rate of several hundred per day!

There are records of hog roundups with thousands of animals driven into Norfolk to be made into salt pork.
Effect of hogs on longleaf reproduction

<table>
<thead>
<tr>
<th></th>
<th>Number of longleaf seedlings per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenced</td>
<td>6440</td>
</tr>
<tr>
<td>Unfenced</td>
<td>8</td>
</tr>
</tbody>
</table>

From: Frost in Early-Looking for Longleaf
II The Naval Stores Industry
The Naval Stores Industry

• Naval stores—products obtained from resinous conifers (longleaf provides the highest quality) Essential for wooden ships

• One of the oldest industries (Noah’s ark)

• A primary goal of English exploration of North America (Swedish monopoly)

• Availability of longleaf pine is one of the major reasons Hampton Roads became a shipbuilding center (largely forgotten today)
The Naval Stores Industry

- Tar kilns or tarkels  The oldest method of Obtaining naval stores
- Boxing  Introduced about 1700
- Steam distillation  About 1830. (Pitch Kettle Road, Suffolk)
- Herty cups  Introduced about 1900
Branches piled with leaves and dirt on top

The basic tar kiln has not changed over millennia

Barrel to collect resin

There are at least five tarkel (tar kiln) sites at the preserve
The Naval Stores Industry

A simple type of tarkel

From: Early-Looking for Longleaf
Pinus nigra forest, Cyprus,
A fire maintained community

The Naval Stores Industry
The Naval Stores Industry
The Naval Stores Industry

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The Naval Stores Industry

Tools

Box and face

Dip iron
Resin was scooped from the box under the face, put into a bucket and transported to the still.
The Naval Stores Industry

The industry is still active in many parts of the world

*Pinus caribea* grown for oleoresin in Sri Lanka
The Naval Stores Industry
--just history in Virginia

Large turpentine stump at Preserve

Box scars
Healed boxing scar, Gates County, North Carolina

This is the record longleaf for North Carolina
The Naval Stores Industry

Wood grew into cavity once boxing and facing stopped.
300 rings—though tree is older because sapwood has decayed
The Naval Stores Industry
Turpentine stumps and tarkels are archeological treasures

If the tree was boxed in 1750, it germinated in 1450

and was cut in ??
Turpentine stumps are destroyed by burning, tarkels by plowing

Both are being protected at the preserve
The Naval Stores Industry

• Tar kilns or tarkels  The oldest method of obtaining naval stores

• Boxing  Introduced about 1700

• Steam distillation  About 1830. (Pitch Kettle Road, Suffolk)

• Herty cups  Introduced about 1900
The Naval Stores Industry

By the advent of the Herty cup, turpentining was no longer a viable industry in Virginia.

*Pinus elliottii*, slash pine, south Georgia.
Because of the higher ratio of heartwood to sapwood, longleaf is one of the strongest pines. The long bole and hard wood made it desirable for masts on sailing ships.
The Naval Stores Industry

Production of naval stores in southeastern Virginia. From sixth census, 1840

<table>
<thead>
<tr>
<th>County</th>
<th>Barrels of tar, pitch, turpentine, rosin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isle of Wight</td>
<td>934</td>
</tr>
<tr>
<td>Nansemond</td>
<td>2,253</td>
</tr>
<tr>
<td>Southampton</td>
<td>1,238</td>
</tr>
<tr>
<td>Surrey</td>
<td>40</td>
</tr>
<tr>
<td>Sussex</td>
<td>547</td>
</tr>
</tbody>
</table>

From: Frost and Musselman, 1987
The Naval Stores Industry

Production of naval stores in southeastern Virginia. From sixth census, 1840

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Assuming 250 barrels per crop (10 500 faces on 5 000 trees on 200 acres), Southampton County had at least 1 000 acres of turpentine orchards requiring 25 000 longleaf pines

Adapted from: Butler, 1998
Naval stores are not listed in later censuses suggesting demise of the industry due to extirpation of remaining trees
W W Ashe, pioneer North Carolina botanist noted that essentially all longleaf had been removed from Virginia about 1850

Because of this, little attention is now paid to the role of longleaf in the history and development of Hampton Roads
III Botanical History of the Zuni Pine Barrens
Botanical History of the Zuni Pine Barrens

Botanical History of the Zuni Pine Barrens

From 1937 to 1941, Fernald published on his botanical research in southeastern Virginia.

One of the areas he explored is now the Blackwater Ecologic Preserve.

We are fortunate to have his observations of 70 years ago to compare with today.
Botanical History of the Zuni Pine Barrens

In 1939, Fernald wrote “. . . In the pine barrens south of Zuni, we were startled and grieved to hear Mrs. Correll announce: ‘Why there’s Long-leaf Pine right there!’ And there it was. . . . great columnar young pines . . . plenty of old fruiting trees . . .”
Botanical History of the Zuni Pine Barrens

Some of the plants mentioned by Fernald did not appear in the preserve until after several prescribed burns.

Without Fernald’s records, we would not know the full efficacy of the fires.
Botanical History of the Zuni Pine Barrens

... for example, white fringed orchid appeared in 1990, noted for the first time since Fernald’s record

Platanthera (=Habenaria) blephariglottis
Botanical History of the Zuni Pine Barrens

... and *Zygadenus glaberrimus*, also noted by Fernald, flowered in 2004
Botanical History of the Zuni Pine Barrens

*Sarracenia flava*, recorded by Fernald but no longer extant at Zuni
IV Maintenance and Restoration of the Zuni Pine Barrens
Regular burning is essential to restore and maintain the longleaf pine system

“No flame, no gain”
Effect of fire on community structure and composition
Burned since 1984

Unburned since 1984
Increased light penetration

Burned since 1984

Unburned since 1984
Bilayered vegetation

Multilayered vegetation

Burned since 1984

Unburned since 1984
Greater diversity of shrubs and herbaceous plants

Burned since 1984

Unburned since 1984
Five months after the fire
Examples of fire dependent plants

*Calopogon pallidus*
Examples of fire dependent plants

*Polygononella polygama*
Examples of fire dependent plants

Zornia bracteata
Examples of fire dependent plants

*Pyxidanthera barbulata*
Examples of fire dependent plants

Pyxidanthera barbulata

Preliminary work suggests smoke enhances germination
Examples of fire dependent plants

*Sarracenia purpurea*
Examples of fire dependent plants

In December 2004, hundreds of longleaf seeds germinated, the first seed rain in three decades
Maintenance and Restoration of the Zuni Pine Barrens

Management plan funded by the Virginia Nature Conservancy
Maintenance and Restoration of the Zuni Pine Barrens

The management plan established burn units and an interval for burning.

At least one unit will be burned each year.

In areas where there is no longleaf, seedlings from Virginia progeny are being planted.
Maintenance and Restoration of the Zuni Pine Barrens

Prescribed burning conducted by the Natural Heritage staff of Department of Conservation and Recreation

in collaboration with Virginia Department of Forestry
Some Current ODU Plant Research at Zuni

Floral and seed biology of *Pyxidanthera barbulata*

Floral biology of *Hexastylis virginica*
Some Current ODU Plant Research at Zuni

Seed bank in a seasonally flooded pocosin

Smoke induced germination

Jay Bolin

Kushan Tennakoon and Jay Bolin