American Chestnut: The Past

~ 1900-1980
American Chestnut
Distribution

- Fagaceae – Beech
- Carolinian species
- Up to 25% of eastern deciduous forests

http://eppley.org/restoring-the-legendary-american-chestnut
American chestnut
Chestnuts

Chestnuts being harvested prior to the turn of the century.

Harvesting the American Chestnut prior to the turn of the century.
American chestnut

- Endemic to North America for 17-20 million years
- Pollen records in New York 30-50,000 years; Massachusetts 2,000 years
- Distribution affected by four events:
  1. Post-glacial migration
  2. Colonial clearing of forests
  3. Commercial logging
  4. Introduction of chestnut blight
Chestnut blight

- Introduced in 1904
- *Cryphonectria parasitica* (fungus)
- *(Endothia parasitica)*
Chestnut blight
Chestnut blight – North America

- 1904 – epidemic started in New York
- 1950s – spread throughout range of Chestnut
Chestnut blight introduced to Ontario in mid-1920s

By 1947 – no mature trees found
Distribution outside Ontario

- Some individuals outside range - NS, NB, QU, BC, ON
- Also outside range of chestnut blight
- These sites represent refugia for preserving diversity of species
- 2012 - Blight found in NS
American Chestnut: The Present

- Increased awareness
- Survey & assessment
- Regulatory
- Recovery strategies
  - Hypovirulence
  - Disease resistance

~ 1980-2014
Increased awareness

- Dr. Colin McKeen
- Plant pathologist - AFCC
- ~1985-2005 – tireless champion of chestnut
- Founded CCC in 1988
- Served as Chair until ~2005
- “Map & pin” approach
Survey & Assessment

- 1985 - McKeen
- 1986 - Ambrose & Aboud
- 1997 – Boland, Melzer, Mooij
- 2004 – Ambrose
- 2004 – Tindall, …, Husband, Boland
- 2013 – O’Hara
- 2014 – Husband et al - repeat survey?
Survey & Assessment

Tindall et al. - 2004

- 601 native trees
- 80% < 20 cm diameter
- 86% nonreproductive
- 25% with blight
- etc.

Repeat of 2004 survey will allow direct comparisons - in addition to new results from O’Hara.
Regulatory Developments

- 1987 – Chestnut “Threatened” (COSEWIC)
- 2004 – Chestnut “Endangered” (COSEWIC)
- 2002 - Species at Risk Act – Canada
- 2006 – Chestnut “Endangered”
- 2008 – Chestnut “Endangered”
Regulatory Developments

- Chestnut Recovery Plan
  - initiated in 2000
  - approved in 2012

- Chairs & Members
  - Ambrose, Boland, Husband, Elliott, Melzer
Chestnut – Recovery Strategies

Two recovery strategies identified:

– Hypovirulence – a biological control strategy for suppressing chestnut blight,

– Disease Resistance - using plant genetic resistance for increasing resistance in chestnut to blight.
Hypovirulence

• Based on discovery in Europe that some isolates of blight were infected by viruses – and were “hypovirulent”.
• Some trees infected by hypovirulent isolates survived blight.
• These viruses could spread to other isolates.
• Possible “biological control” strategy for blight.

“Virulent”  “Hypovirulent”
Hypovirulence – Europe

- Hypovirulence spread naturally & artificially
- Enabled recovery of *C. sativa* throughout large regions of Europe
Hypovirulence

“Arner tree”

- “Healed canker”
- Little callous
- Canker completely heals
Hypovirulence – North America

- ~1986-99 – Boland et al. examined hypovirulence.
- Surveys for viruses, controlled inoculations, RNA analyses, etc.
- Numerous viruses present – but little evidence for reduced chestnut blight or natural spread.
Chestnut blight – Possible Solutions

Two Important Discoveries:

– Hypovirulence

– Disease Resistance
Resistance to Chestnut blight

1. Possibility of aggregating minor resistance genes among remaining American chestnut

2. Possibility of interbreeding with resistant species
   - Chinese chestnut (*C. mollisima*)
   - Japanese chestnut (*C. crenata*)
   - Both interfertile with *C. dentata* but smaller trees/shrubs
Resistance to Chestnut blight

- Breeding started in USA in early 1900s
- American Chestnut Foundation (ACF) established breeding program – 1989.
- CCC started breeding program in 2001
- CCC, Dale, Galic, volunteers, et al.
Resistance to chestnut blight

http://www.me-acf.org/orchards.html
CCC members & annual evaluation of young trees for resistance to blight
American chestnut: The Future?