

Please do not copy without permission

Pollination Problems for Southern Ontario's Rare Trees

Peter G. Kevan

University of Guelph

13 February, 2009



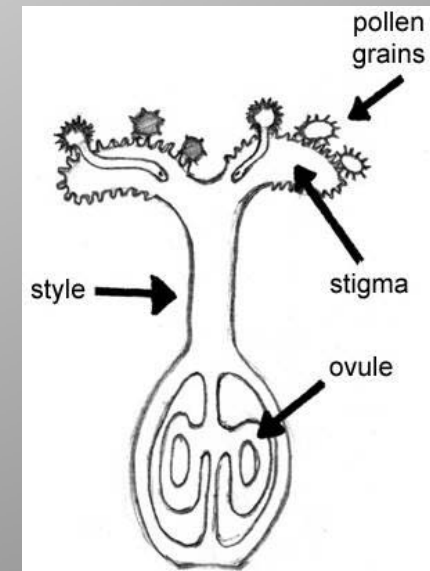
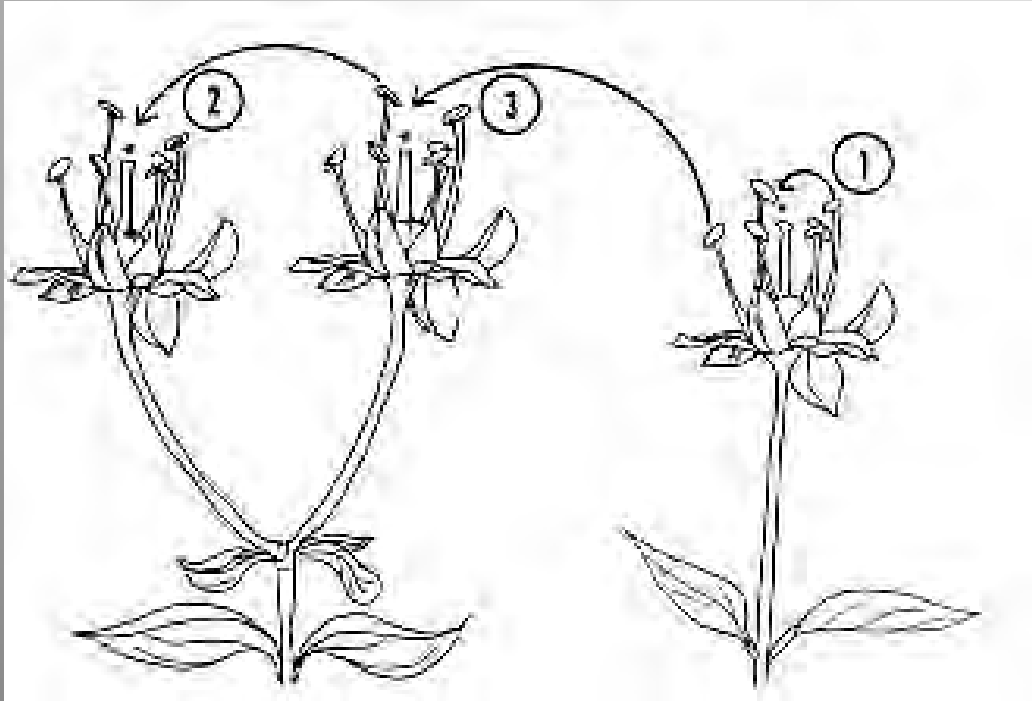
Please do not copy without permission

What is Pollination?

- Transfer of pollen

1. Self-pollination (autogamy)
2. Self-pollination (geitonogamy)
3. Cross-pollination (xenogamy)

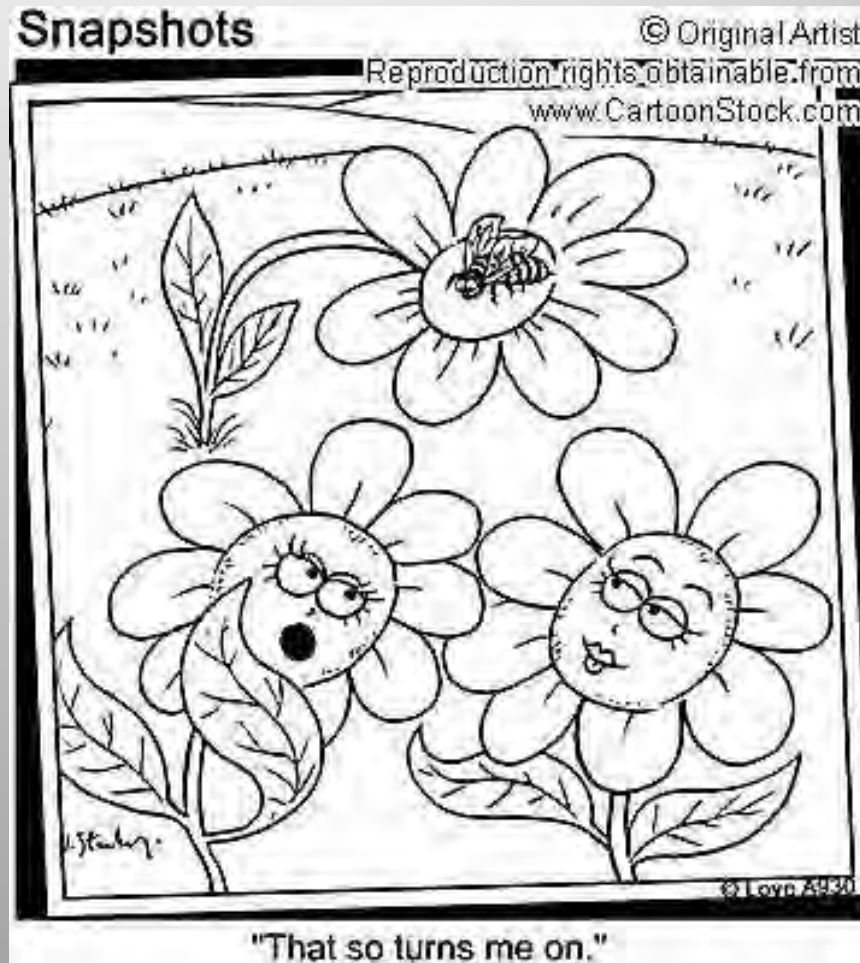
Prelude to fertilization ... seeds & fruits



Please do not copy without permission

What is Pollination?

- Plant Sex!



Please do not copy without permission

Problems in Pollination

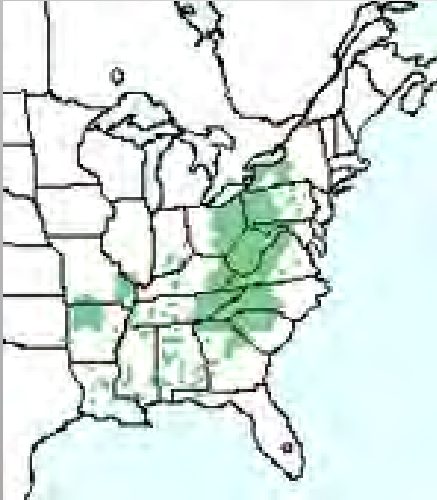
- 1. Too few pollinators
- 2. Mates too few or far away
- 3. Competition too stiff

- Conservation & Species Recovery Strategies must provides ways for plants to have sex!
 - No sex, no reproduction ... aging, sterile, plants!

Please do not copy without permission

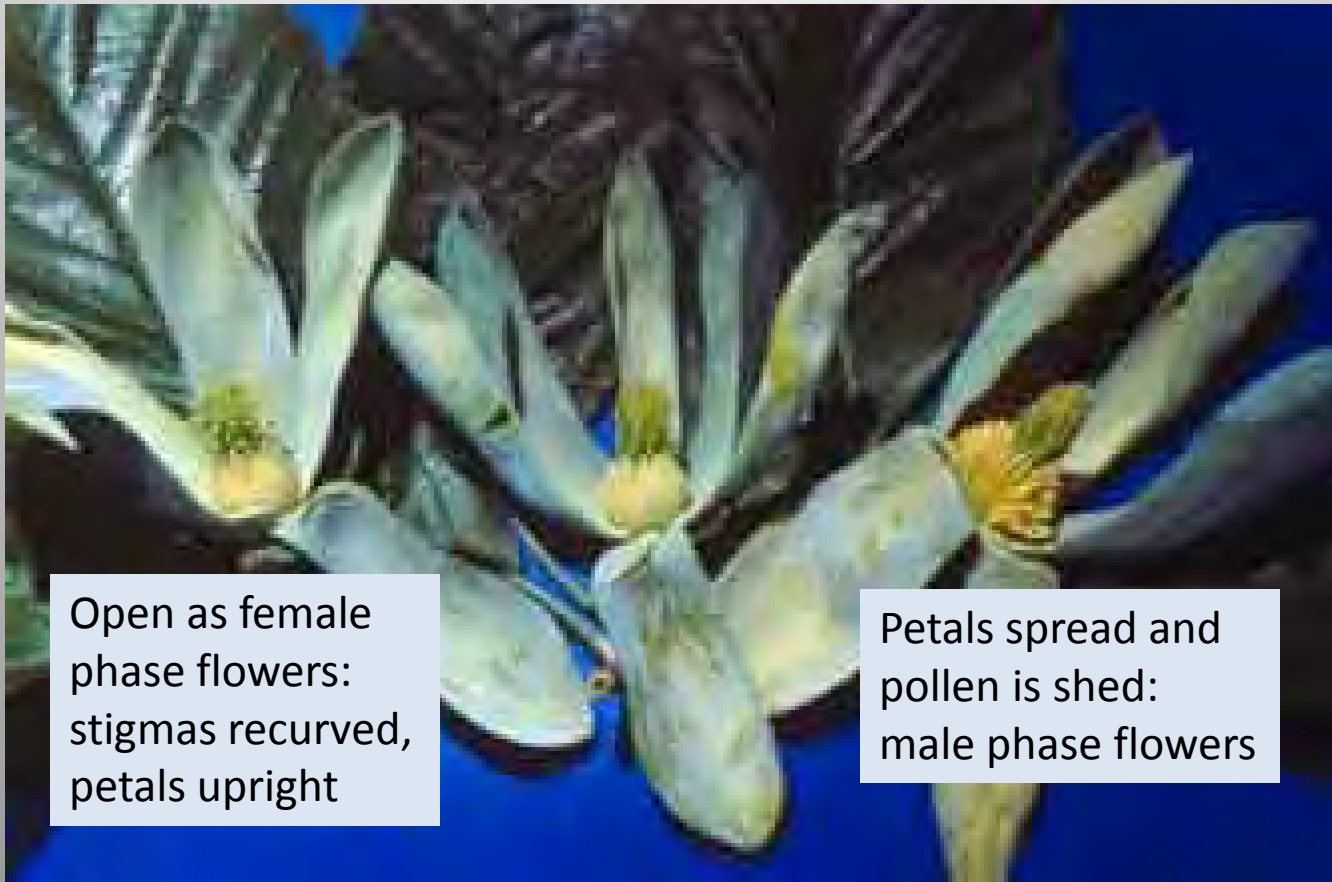
Cucumber Tree (*Magnolia acuminata*)

Magnoliaceae, magnolias



Please do not copy without permission

Cucumber Tree (*Magnolia acuminata*)



Open as female
phase flowers:
stigmas recurved,
petals upright

Petals spread and
pollen is shed:
male phase flowers

Please do not copy without permission

Cucumber Tree (*Magnolia acuminata*)



Please do not copy without permission

Cucumber Tree's Sexual Problems

- 1. Self-incompatible (must cross-pollinate for fruit and seeds to be produced)
- 2. Trees mostly isolated
- 3. Pollinating beetles seems scarce on flowers
- 4. Seeds dispersal
 - by birds



Please do not copy without permission

Kentucky Coffee Tree (*Gymnocladus dioica*)

Fabaceae (Leguminosea) Pea Family



Valued ornamental, large
shade tree

Please do not copy without permission

Kentucky Coffee Tree

(*Gymnocladus dioica*)

- **Dioecious:**
- Male & Female Trees

Stigma

Pollen



Pollination seems
at night:
Moths with tubular
tongues take nectar
from tubular flowers

Please do not copy without permission

Kentucky Coffee Tree

(*Gymnocladus dioica*)



Female trees produce pods: cut down by squirrels or fall



Pods open,
greenish/reddish jelly
Hard, hard seeds

Please do not copy without permission

Kentucky Coffee Tree

(*Gymnocladus dioica*)

- Seeds are very hard, scarify with file and they germinate well



- Grow well from root-stock, clones

Please do not copy without permission

Kentucky Coffee Tree's Sexual Problems

- 1. Plants are of two sexes (dioecious) so must cross pollinate
- 2. Trees form isolated unisexual clones too far apart for pollinators to carry pollen from male to female flowers



Please do not copy without permission

Pawpaw (*Asimina triloba*)

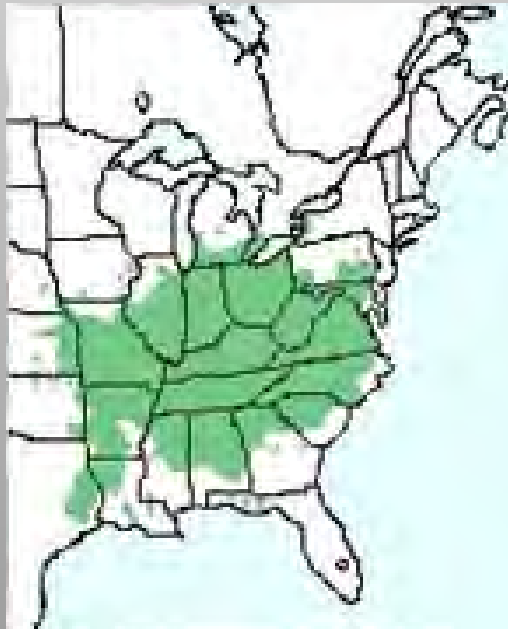
Annonaceae, custard apples



Little known fruit tree in Ontario

Grows in clay, wet places

Tropical family



Clonal form of small trees

Please do not copy without permission

Pawpaw (*Asimina triloba*)

- Stinky flowers

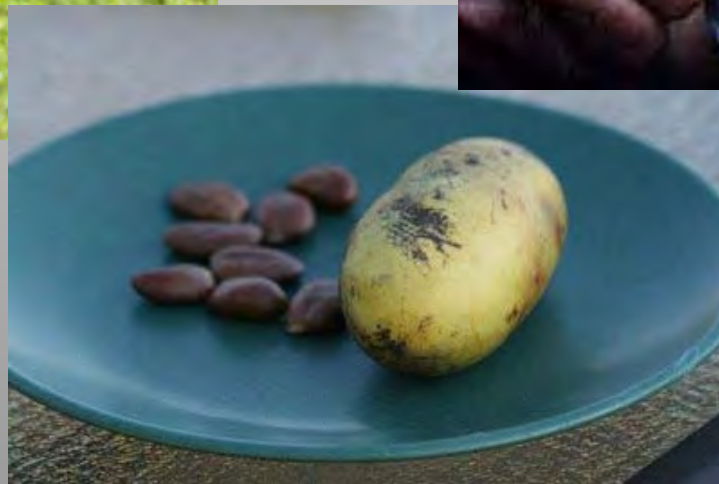


- Pollination by Flies and Beetles
- Corpse in pawpaw stand to harbour pollinators!

Please do not copy without permission

Pawpaw (*Asimina triloba*)

- Tropical like fruit, banana-like taste & many seeds



Please do not copy without permission

Pawpaw's Sexual Problems

- 1. Self-incompatible (must cross-pollinate for fruit and seeds to be produced)
- 2. Can form large, intra-sterile, clones
- 3. Populations are few and isolated
- 4. Fruit and seed dispersers probably large and medium-sized mammals

Pollinators not likely a problem
(filth flies and beetles)



Please do not copy without permission

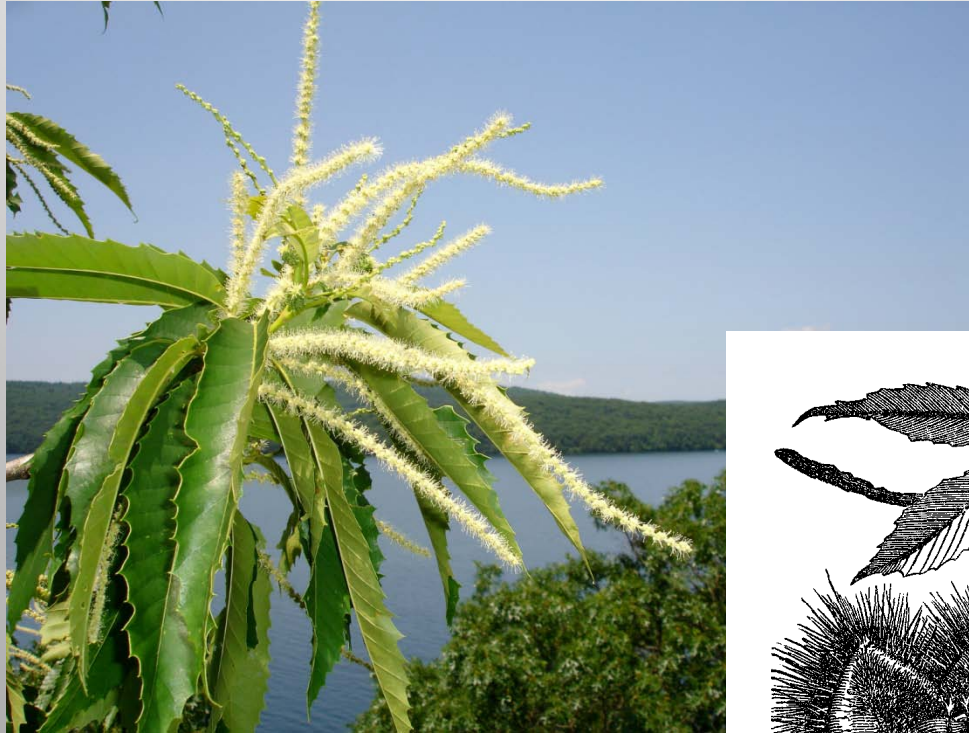
American Chestnut (*Castanea dentata*)

Fagaceae, beeches



Please do not copy without permission

American Chestnut (*Castanea dentata*)



Male flowers

Female flowers



Castanea dentata.

Please do not copy without permission

American Chestnut (*Castanea dentata*)



Sterile, seedless hulls in most Ontario trees

Cross pollination: seeds



Please do not copy without permission

American Chestnut's Sexual Problems

- 1. Self-incompatible (must cross-pollinate for fruit and seeds to be produced: some self-fertile trees thought to exist)
- 2. Remaining plants isolated (some unhealthy, blighted) ... potential mates are too far apart
- 3. Pollinators likely
 small bees & wind together



Please do not copy without permission

Red Mulberry (*Morus rubra*)

- The most endangered tree in Canada



Please do not copy without permission

Red Mulberry's Sexual Problems

- Competition from introduced & easily dispersed White Mulberry (*Morus alba*)
 - For rearing silk worms, favoured ornamental, hedge-row tree, etc.
- Both species wind pollinated, but White Mulberry more common
- Pollen from White Mulberry fertilizes Red Mulberry, hybridization occurs (introgression)
- Red Mulberry ceases to exist!



Please do not copy without permission

Red Mulberry (*Morus rubra*)

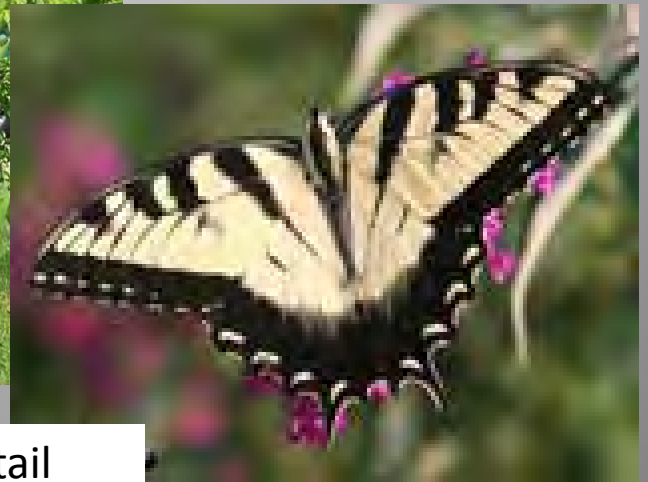
- Dioecious (trees of separate sexes)
- Pollinated by wind



Please do not copy without permission

Hop Tree (*Ptelea trifoliata*)

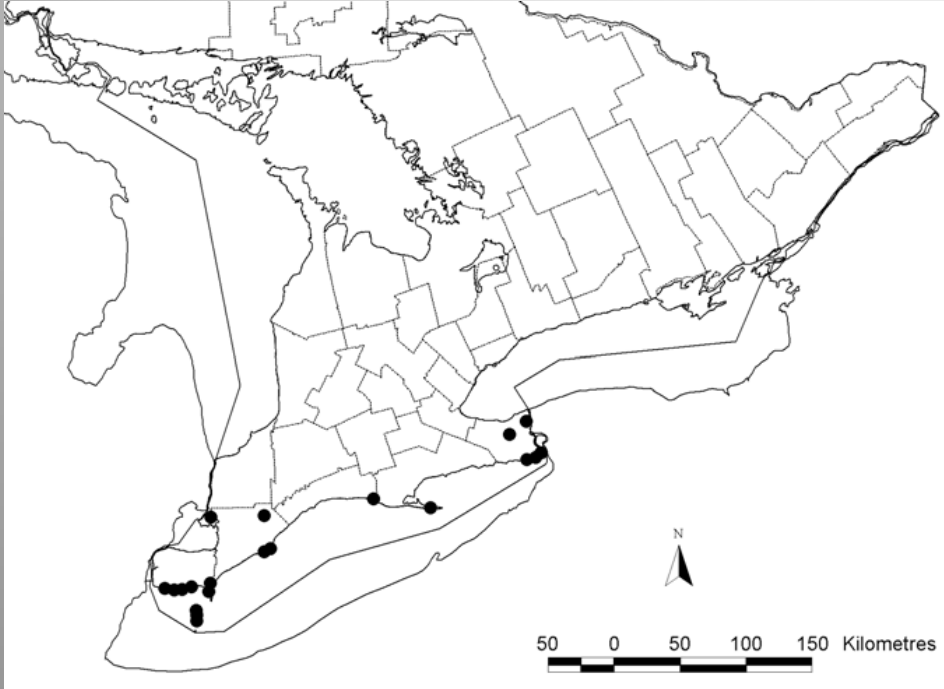
Rutaceae (citrus family)



Host for Giant Swallowtail

Please do not copy without permission

Hop Tree (*Ptelea trifoliata*)



Only along Lake Erie shore

Shiny leaves,
look like poison ivy



Please do not copy without permission

Hop Tree (*Ptelea trifoliata*)



Male inflorescence

Dioecious:

Male & Female Trees



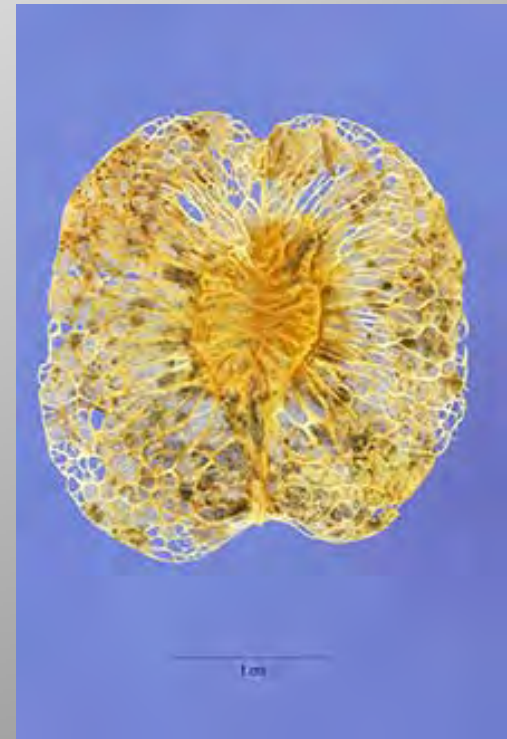
Female inflorescence

Please do not copy without permission

Hop Tree (*Ptelea trifoliata*)



Fruits dry out & rattle,
then dispersed on wind:
Skittering across the snow in
winter



Reddish bark:
Contrast against snow

Please do not copy without permission

Hop Tree's Sexual Problems

- 1. Grows along the shore in dense stands in some places
- 2. Trees of both sexes are equally common
- 3. Lots of pollinators of lots of kinds (Flies, Bees, Beetles)
- 4. Sets lots of seeds
- 5. NO SEXUAL PROBLEMS!

Hop tree is rare, but grows well where it is planted (even Montreal, Ottawa, etc).

Why is its distribution so localized?

Please do not copy without permission

Conclusion

- 1. There is no single explanation for the sexual problems of our rarer trees
- 2. The problems come in combinations
 - Too few pollinators
 - Mates too few or far away
 - Health
 - Populations too small, inbreeding depression
 - Competition too stiff, invasion, hybridization (introgression)

Conservation & Species Recovery Strategies
must provides ways for plants to have sex!

**No sex, no reproduction ... aging, sterile, plants!
Extinction!**