Formative pruning: research and practical experience

Dr. Ed Gilman
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University of Florida

Definitions


leader

Reduction cut: removes larger and retains smaller

Removal cut: removes small and retains larger

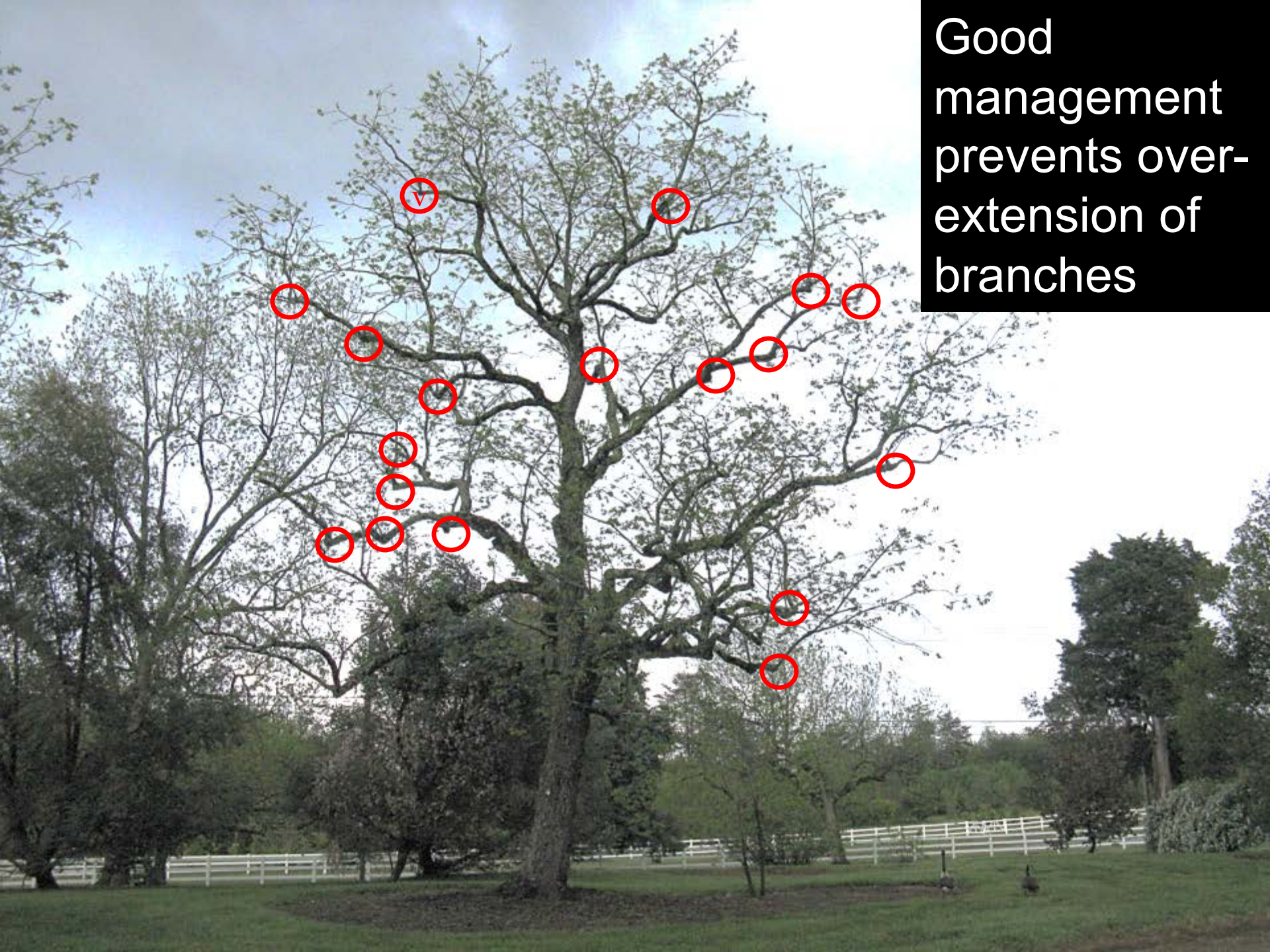
Small aspect ratio (1/2): strong union

Small aspect ratio (1/2): strong union

Large aspect ratio (4/5): not as strong


Interior branches: non-pruning zone

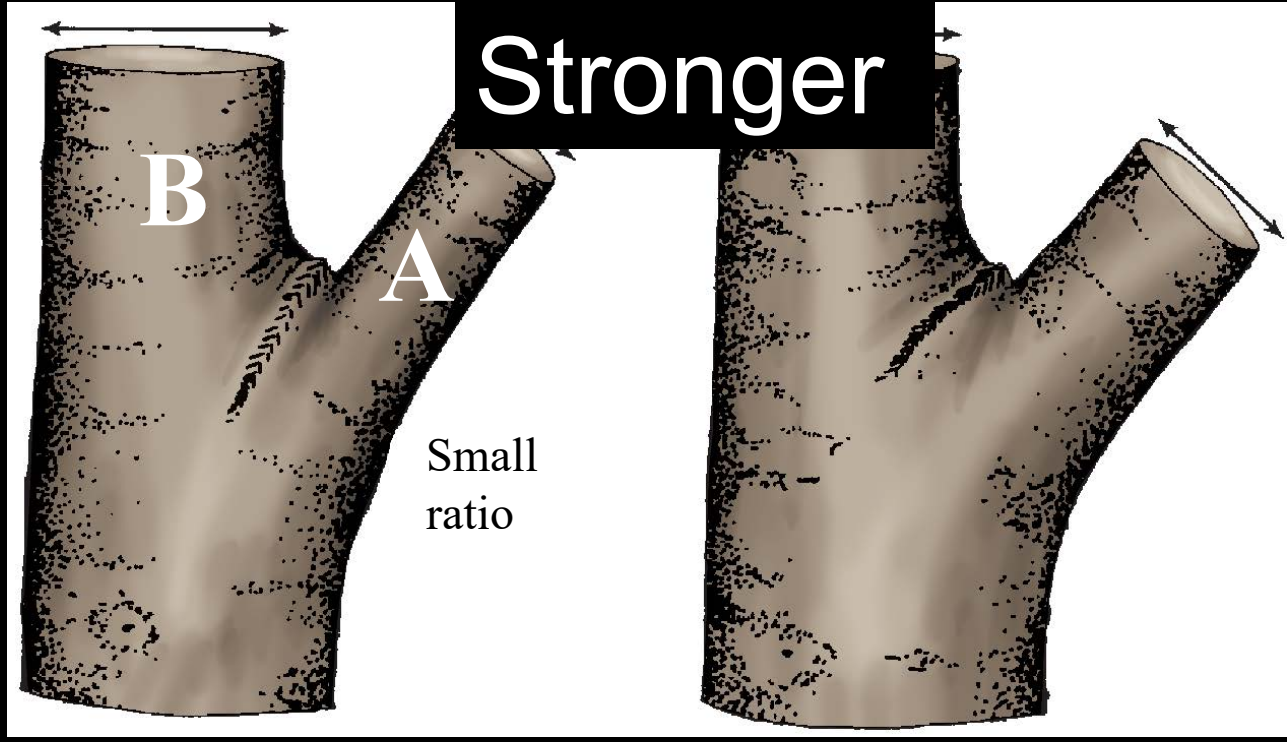

Peripheral (exterior) branches: pruning zone

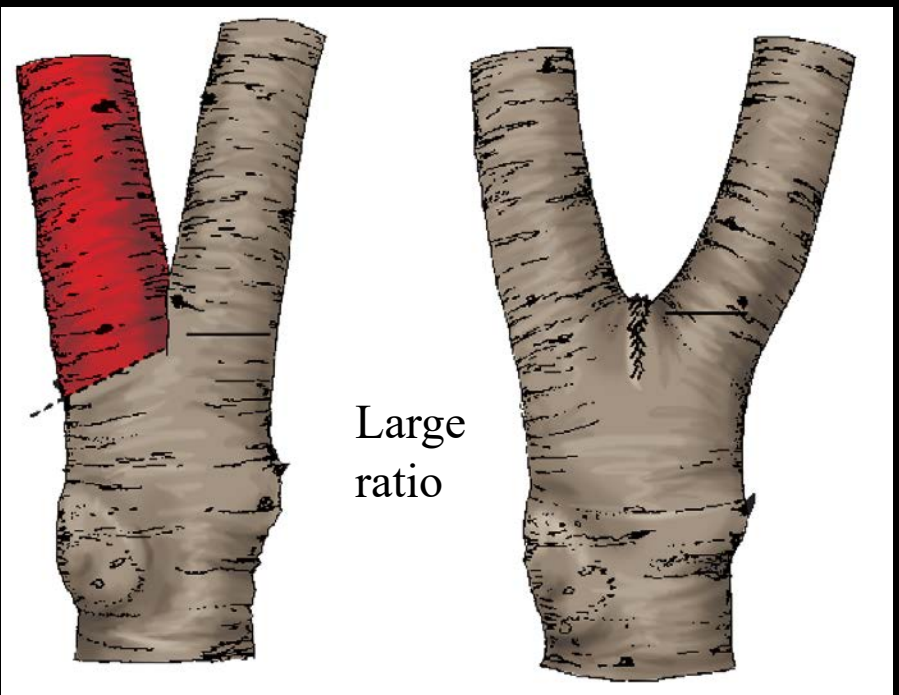

Good management prevents over-extension of branches

Aspect ratio

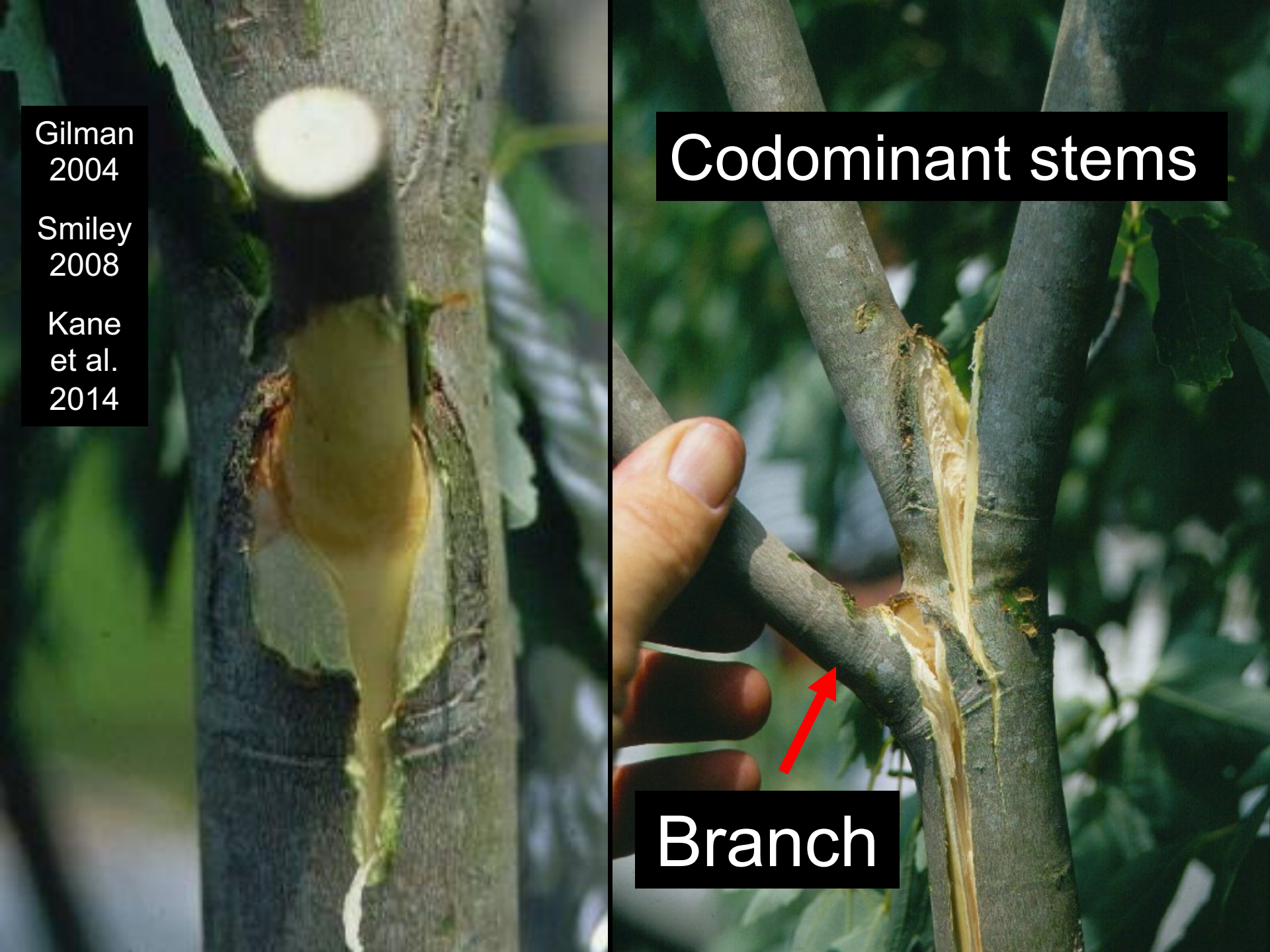
Weaker

Stronger

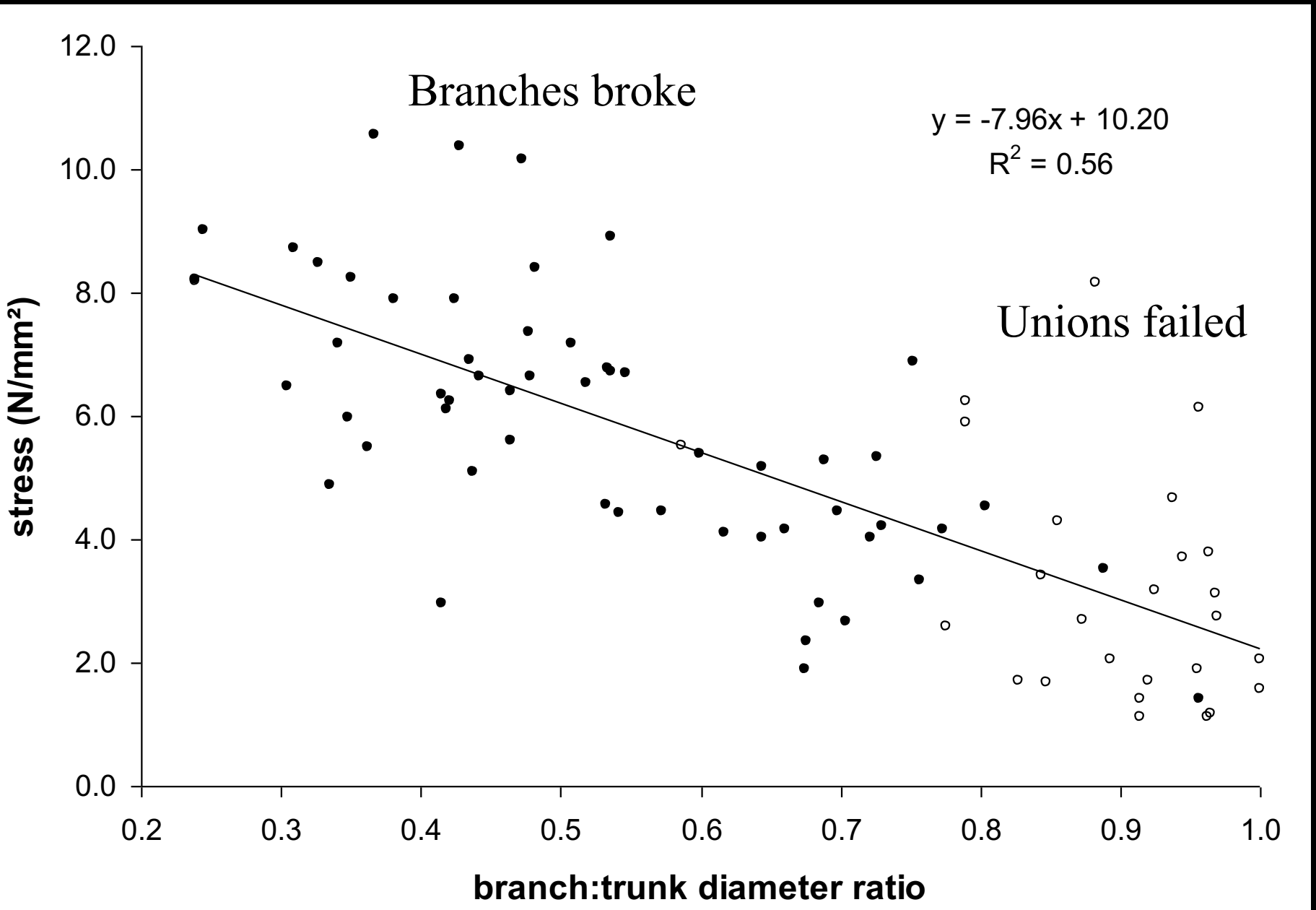




Videos- no time today


Gilman 2004
Smiley 2008
Kane et al. 2014
Codominant stems
Branch

Stress required to separate branch from trunk (Gilman 2004)



Unions are the most interesting part of a tree

700+ year old
Quercus

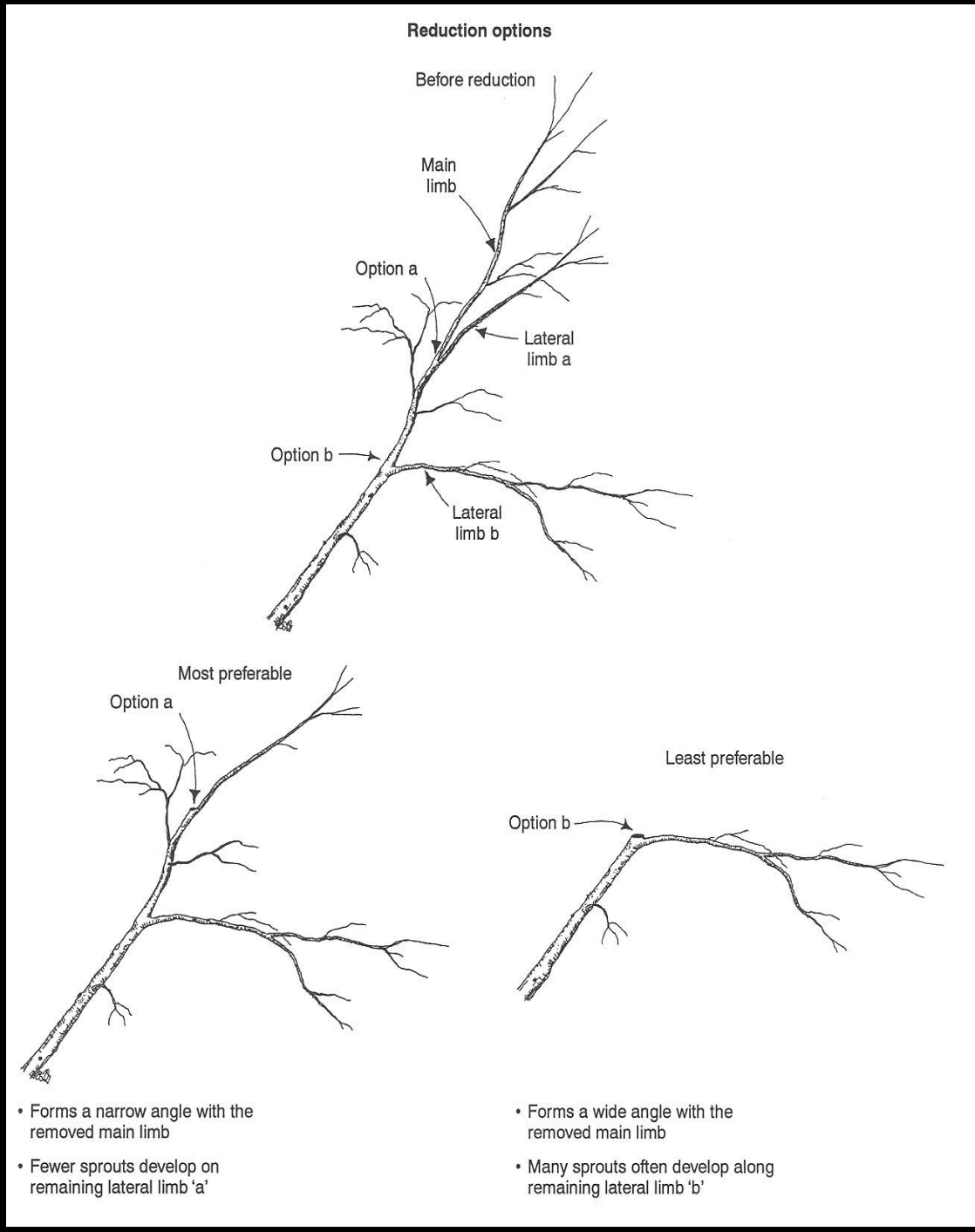
This pruning is coming to arboriculture

Photos: Brian Kemp


P P
2P 1P
P 2P
1P


POST

What is the impact of dosage?



Applying a pruning dose

We quantified amount of foliage removed (pruned) from the tree in two ways:

1) Ratio of stem cross-section area (basal area) removed to basal area of pruned stem

2) Visual estimate by two people

Quercus virginiana Highrise®

- May 2005: reduced one co-dominant stem on 48 trees

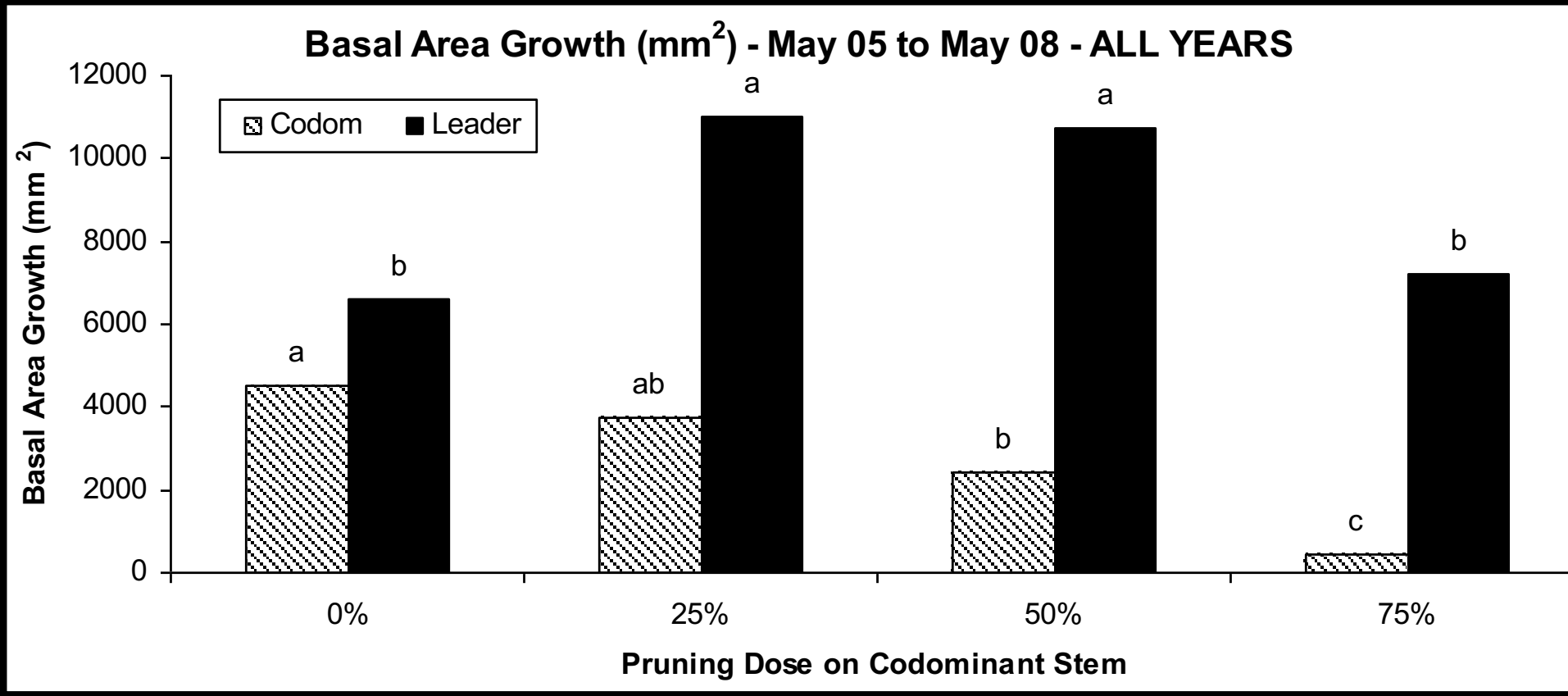
Reduction doses on pruned codominant stem

- 0% foliage removed
- 25% foliage removed
- 50% foliage removed
- 75% foliage removed

We measured % stem cross-sectional area removed

$$\frac{60}{130} = 46\%$$

Over 3 years, pruned codom. stem reduced its growth rate and increased growth to the leader



Describe what was done here

Large aspect ratio

- System:
- Objective:
- Cut location:
- Cut type:
- Cut number/diameter:

Photo series Brian Kempf and Ed Gilman

Describe what was done here

Large aspect ratio

- System: natural
- Objective: subordinate all stems competing with the leader
- Cut location: aspect ratio > 1/2
- Cut type: reduction
- Cut number/diameter: ½ inch

Photo series Brian Kempf and Ed Gilman

One half-inch reduction cut

Large aspect ratio

2 years later

Photo series Brian Kempf and Ed Gilman

Large aspect ratio

2 years later


5 years after initial pruning
Small aspect ratio


5 years after initial pruning
Small aspect ratio

5 years after initial pruning

2:14

1/4

Quercus

Location of cuts

It takes a few seconds to determine which branches are to be pruned: the ones larger than half trunk diameter

Quercus

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Quercus

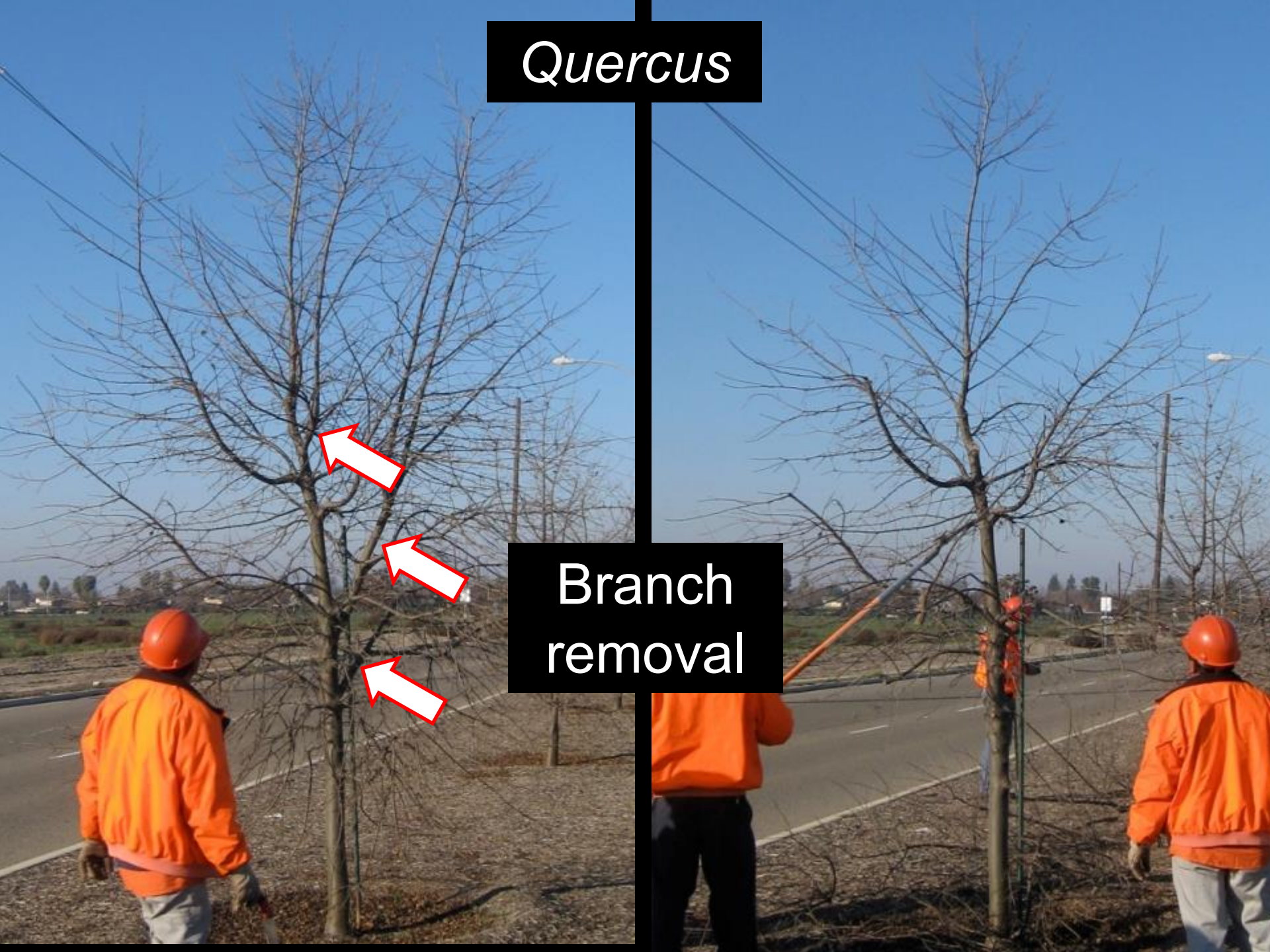
Location of cuts

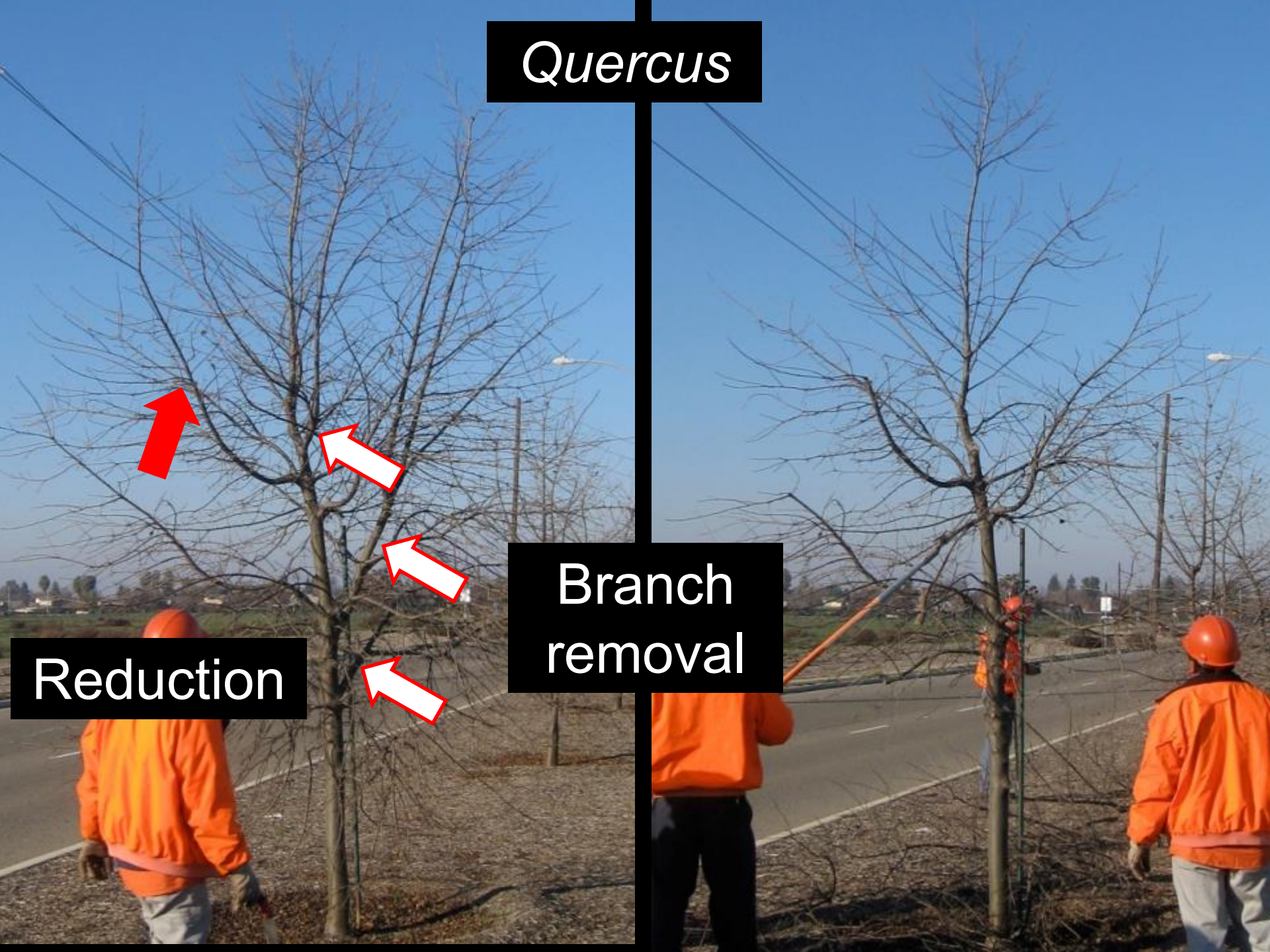
It takes a few seconds to determine which branches are to be pruned: the ones larger than half trunk diameter

Quercus

What would you do?

Remove them?
Reduce them?
Do nothing?


Quercus
Branch removal


Quercus
Reduction
Branch removal

Quercus

Quercus


Three
years
later

We developed a prescription

- System: natural
- Objective: improve branch architecture; provide 5’ clearance
- Location: branches with aspect ratios > 1/2
- Cut type/amount: 3 removal cuts 1.5 to 2.5“ diameter at trunk; reduction cut 1 to 1.5” diameter

No tree or group of trees should be pruned without a prescription

- System: natural
- Objective: improve branch architecture; provide 5’ clearance
- Location: branches with aspect ratios > 1/2
- Cut type/amount: 3 removal cuts 1.5 to 2.5“ diameter at trunk; reduction cut 1 to 1.5” diameter

Prune at planting!

Many failures and interfering limbs were on the tree when it was planted.

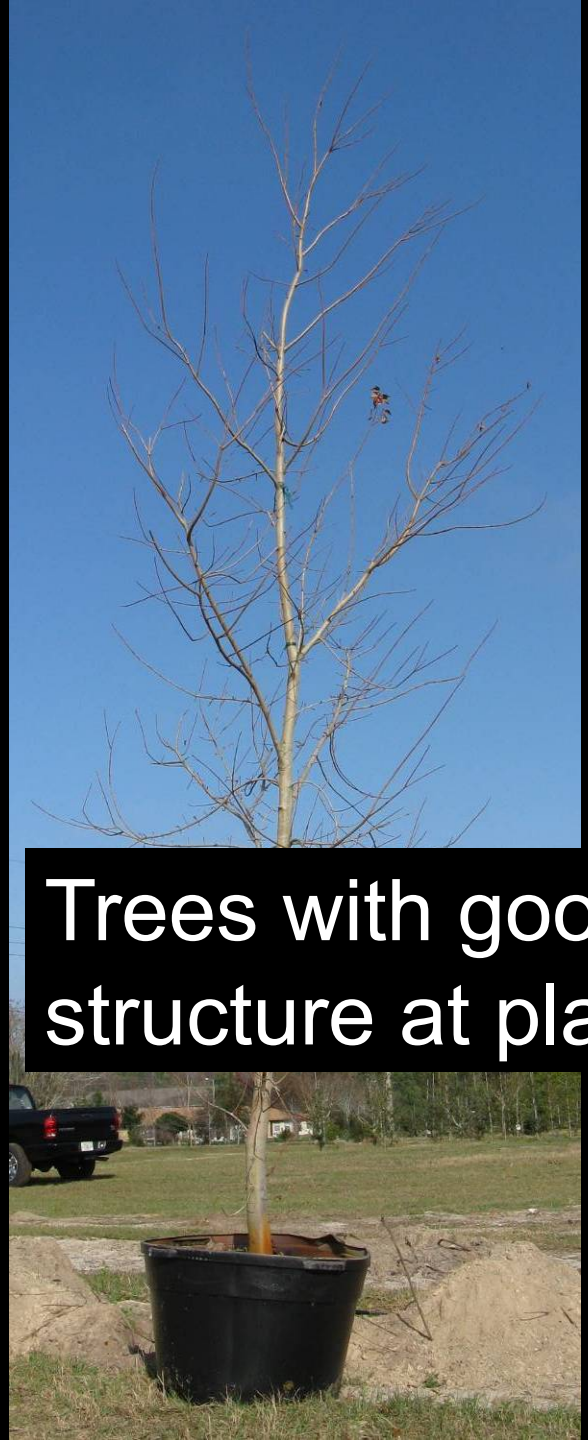
Prune at planting

Here’s why

Prune at planting

Here’s why

Branch architecture at planting may not be ideal



Acer

Trees with good structure at planting

Good quality nursery tree with leader to the top of the crown

Good quality nursery tree with leader to the top of the crown

Good quality nursery tree with leader to the top of the crown

Same photograph shrunk a bit smaller

Weak structure several years later, without pruning

Weak structure that could have been prevented by pruning at planting

Acer


Acer

Why does this happen?
Not pruned at planting

Acer

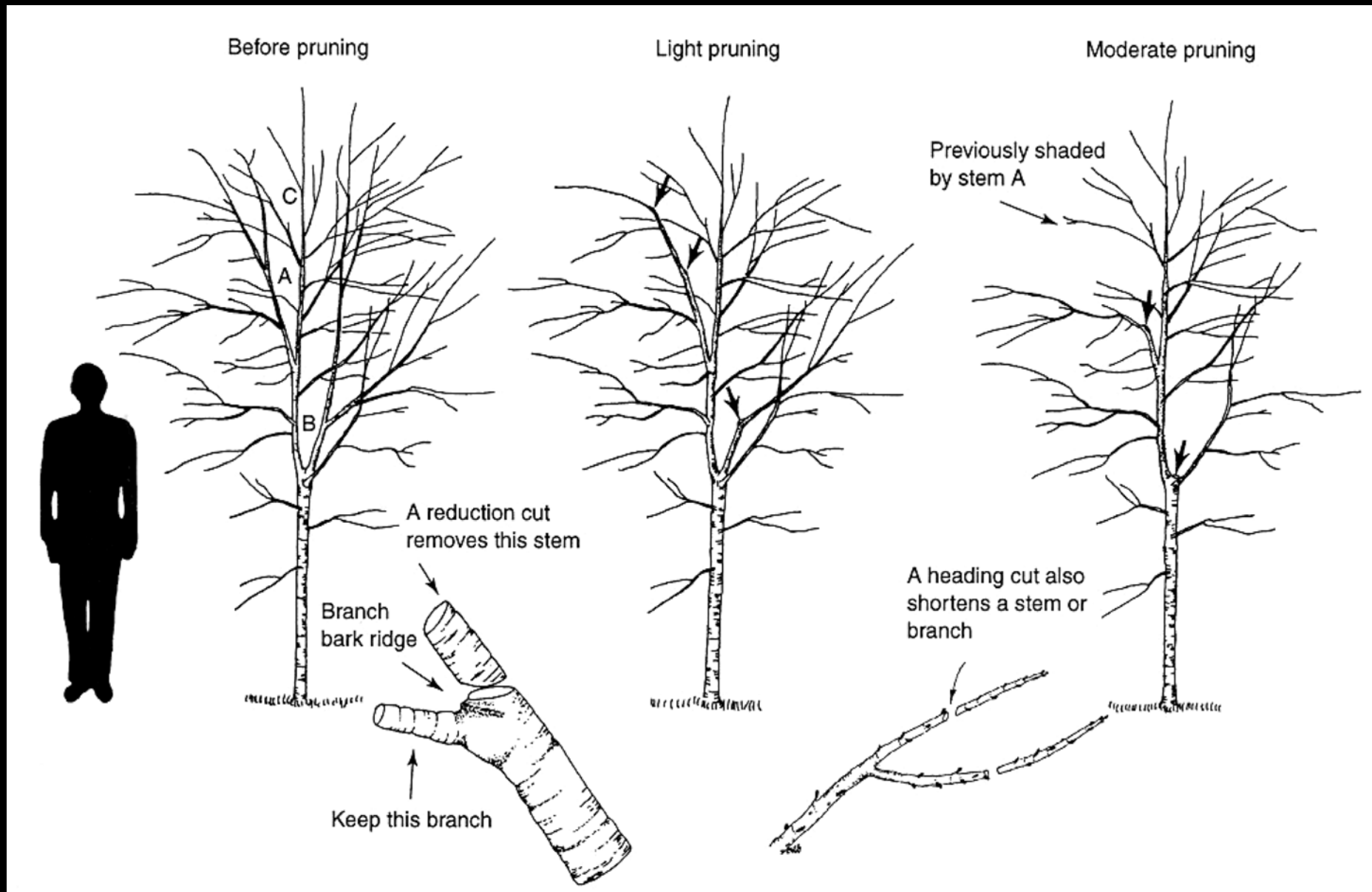
Why does this happen?
Nursery crown outline

Ten years later

Quercus

Suppress or reduce competing stems

1) Where is leader. 2) where is competition. 3) where to cut competition



What would you do?

Acer

What would you do?

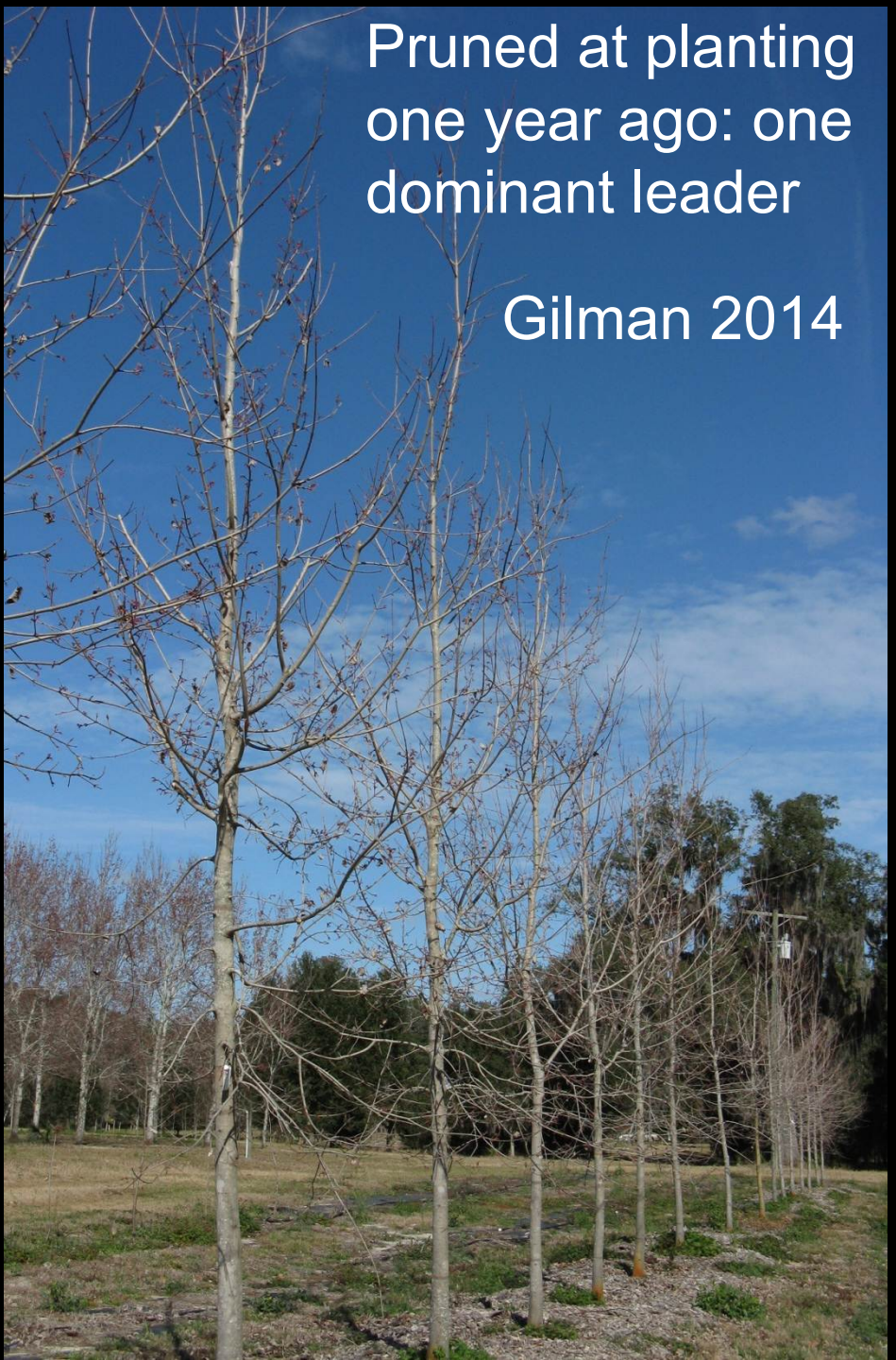
Quercus

What would you do?

Acer


Before


After


Pruned at planting one year ago: one dominant leader
Gilman 2014


Not pruned at planting: more than one leader

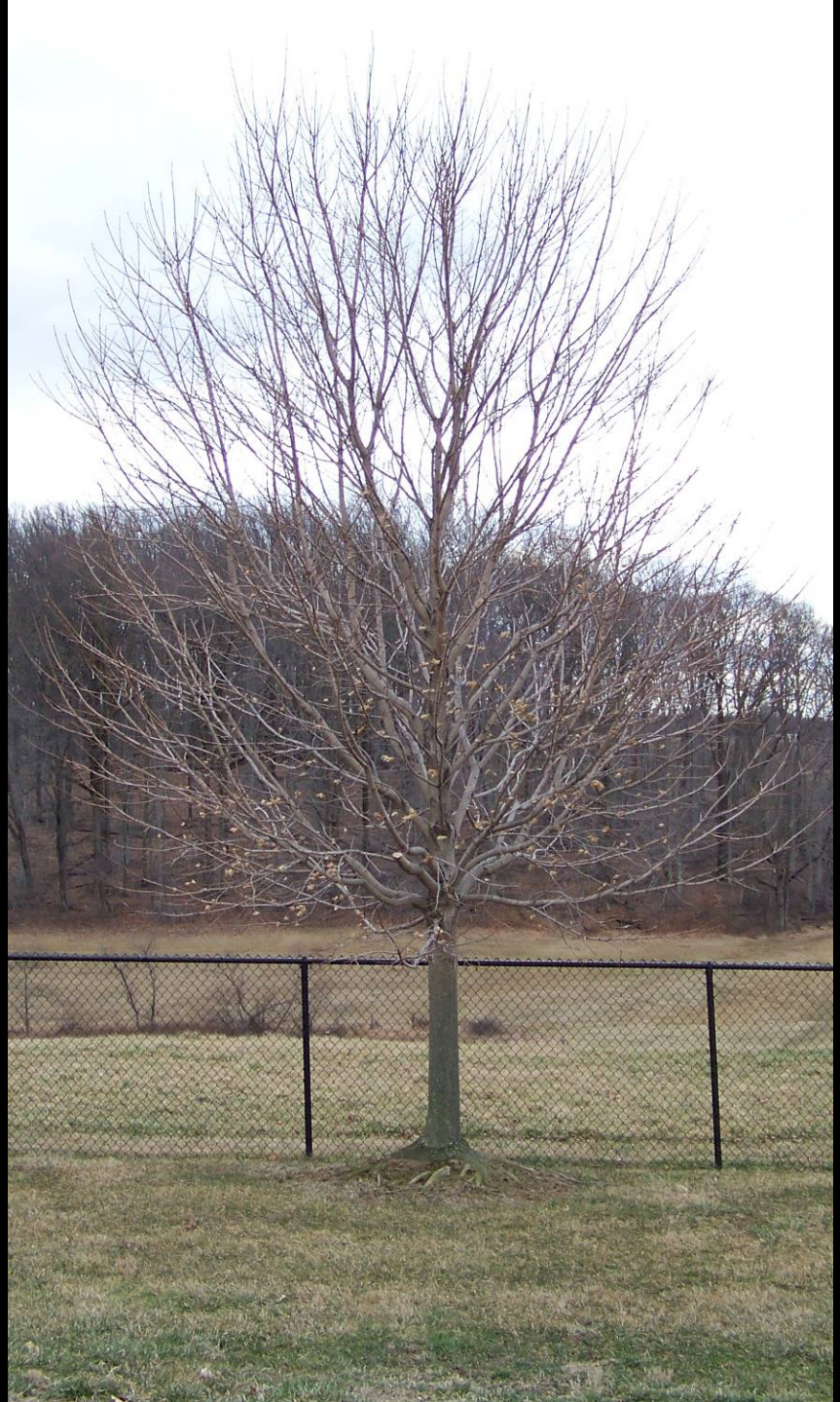
One year later

Four years later


Gleditsia
E 8
E 6

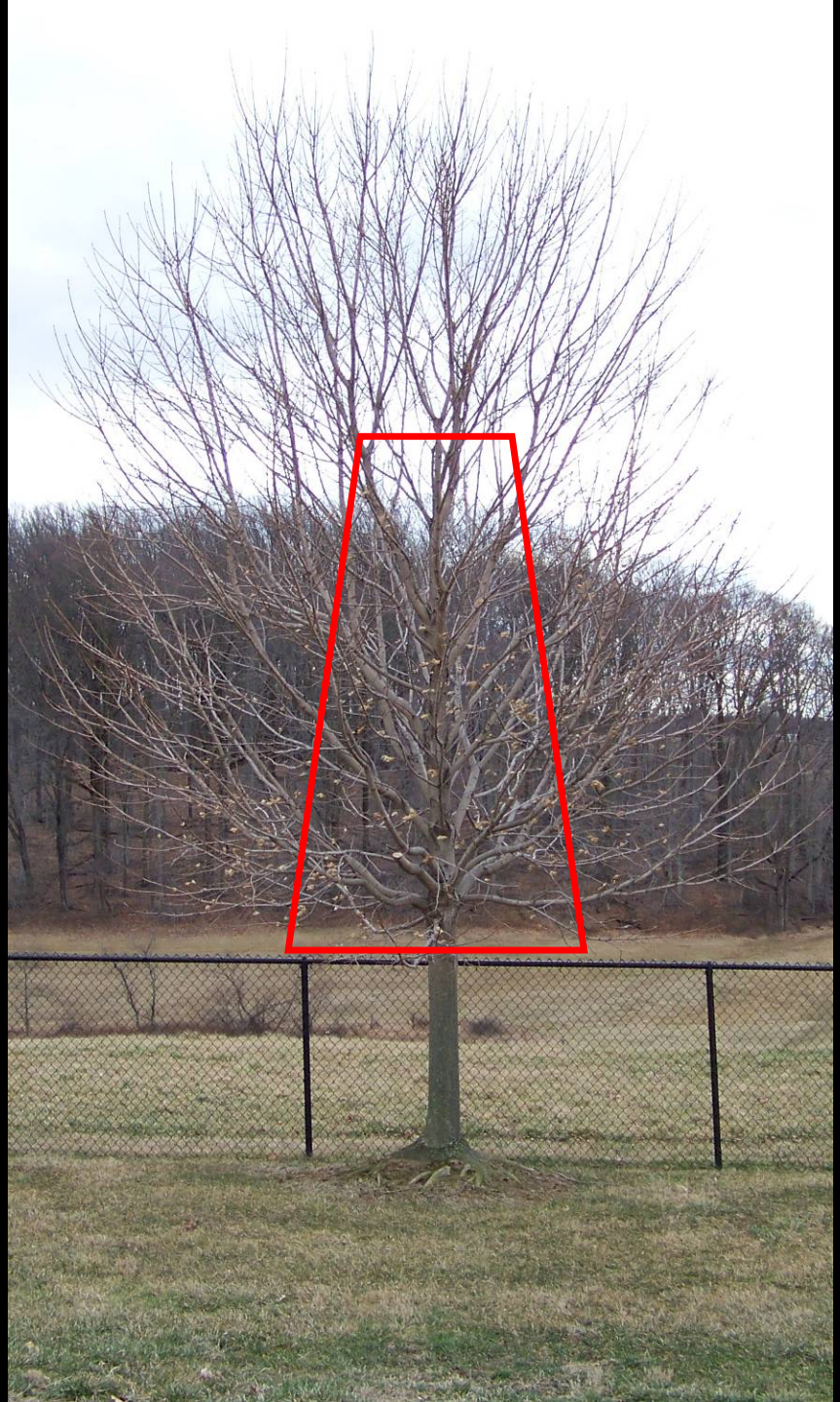
2:23

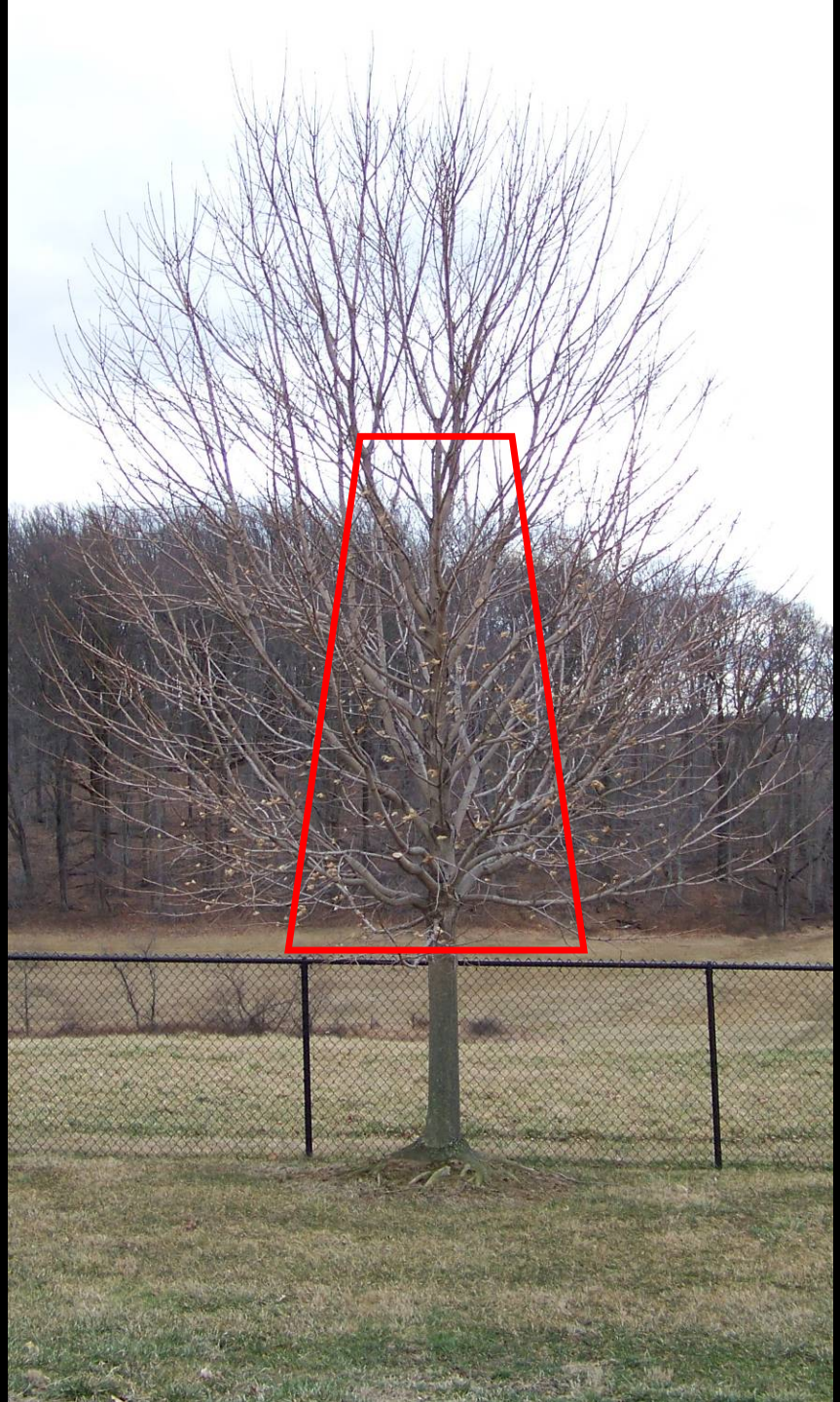
1/2



Acer

Acer

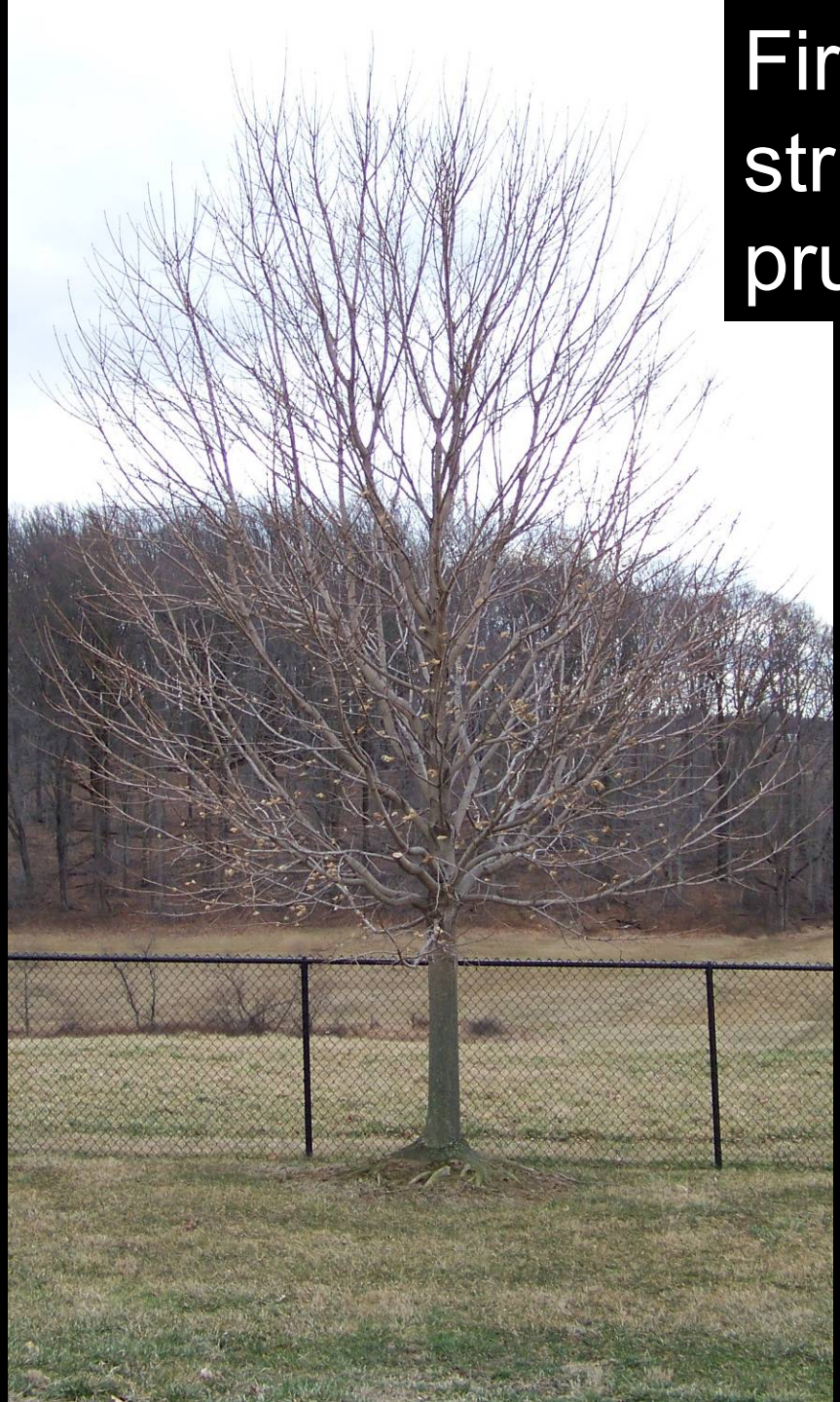




Acer

First structural pruning

Acer




Acer

Acer

Acer


Acer


One year later


Acer

three years after first pruning

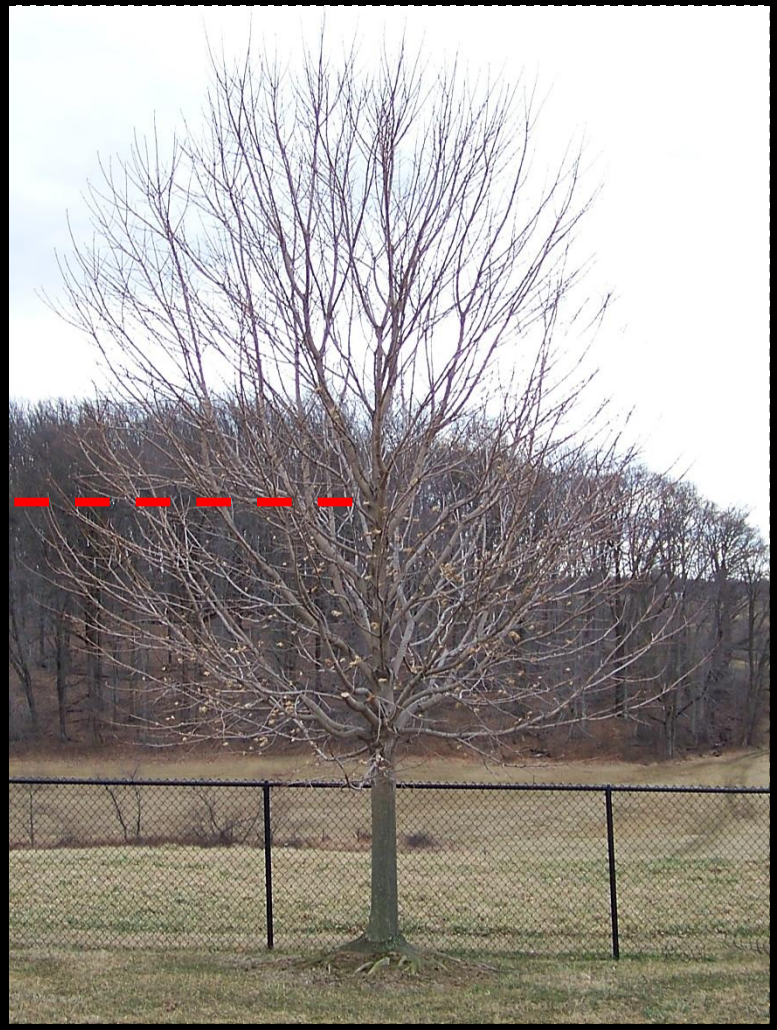
Acer


Another
2 years


Acer

6 years later with 2 prunings

Acer



Liquidambar

What would you do?

Liquidambar

Wind study: Effects of pruning on trees in wind up to 120 mph

Dr. Ed Gilman
Environmental Horticulture Department
University of Florida
http://hort.ufl.edu/woody

Dr. Forrest Masters
Civil and Environmental Engineering Department
Florida International University
Now at University of Florida

We had some fun blowing 20’ tall trees

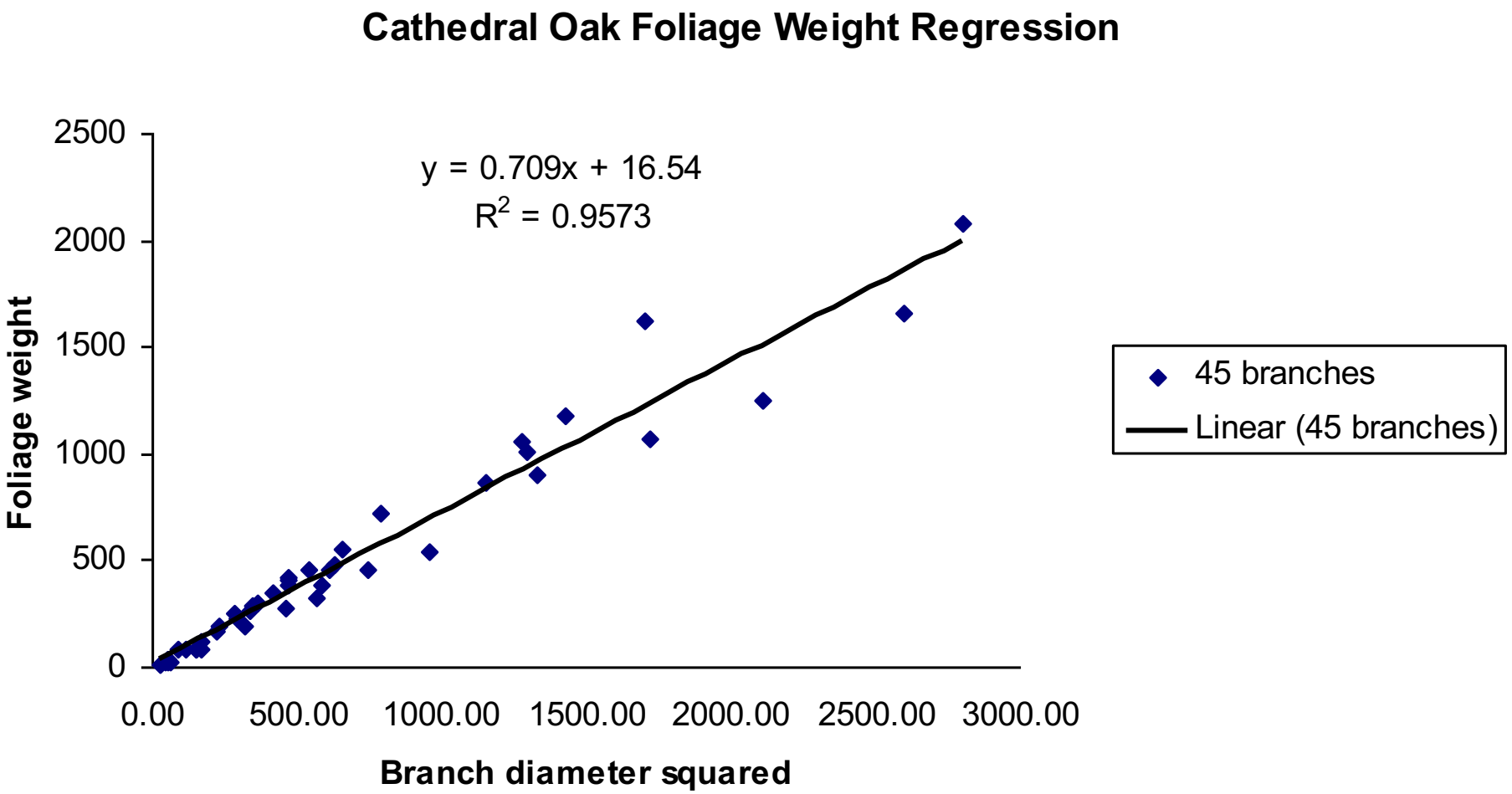
5 trees
not pruned

5 trees
raised

5 Thinned

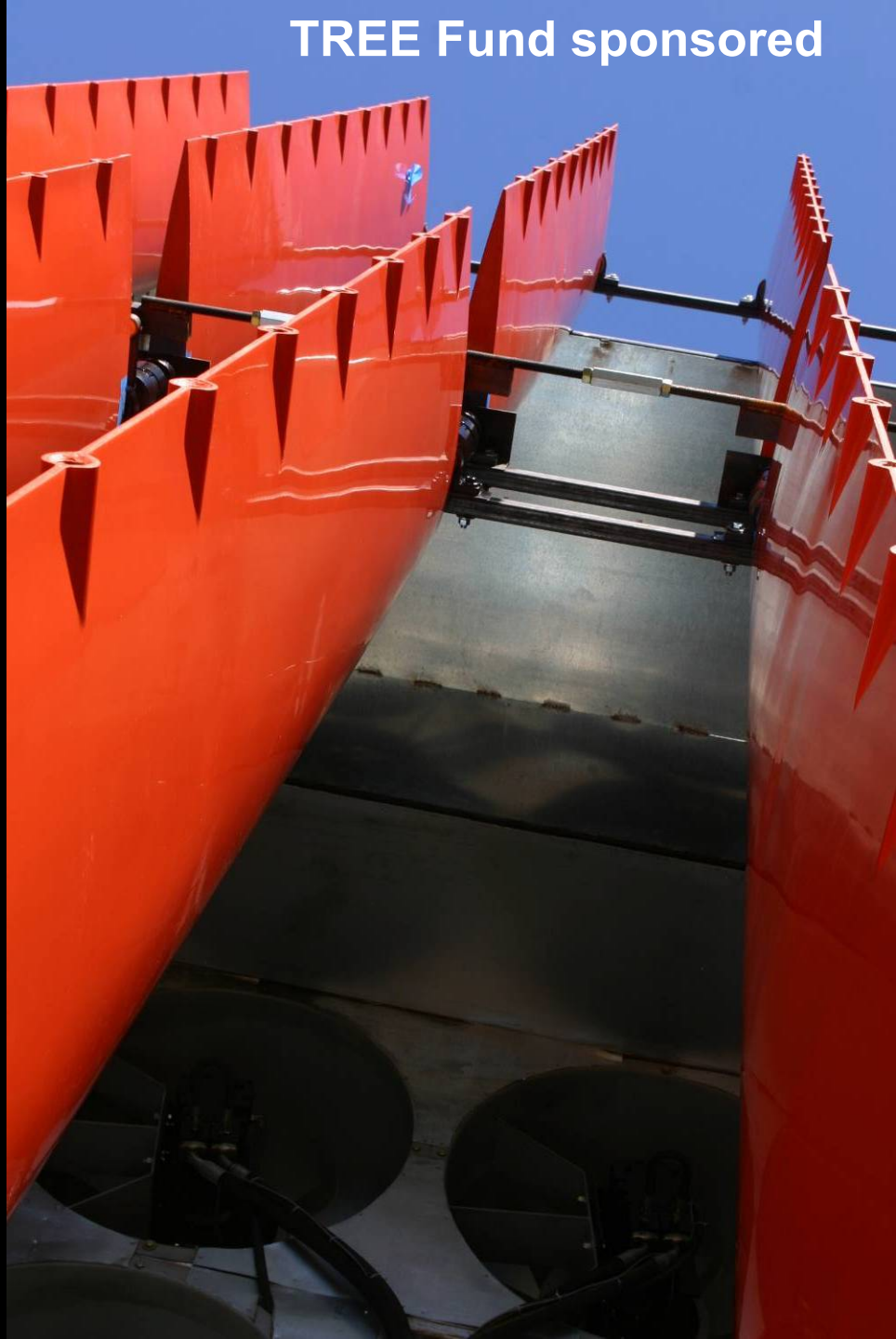
5 trees
reduced

Relationship between branch diameter and foliage weight



So we knew that so many inches of branch diameter removed 33% of foliage


CAUTION
HIGH WINDS
STAY CLEAR

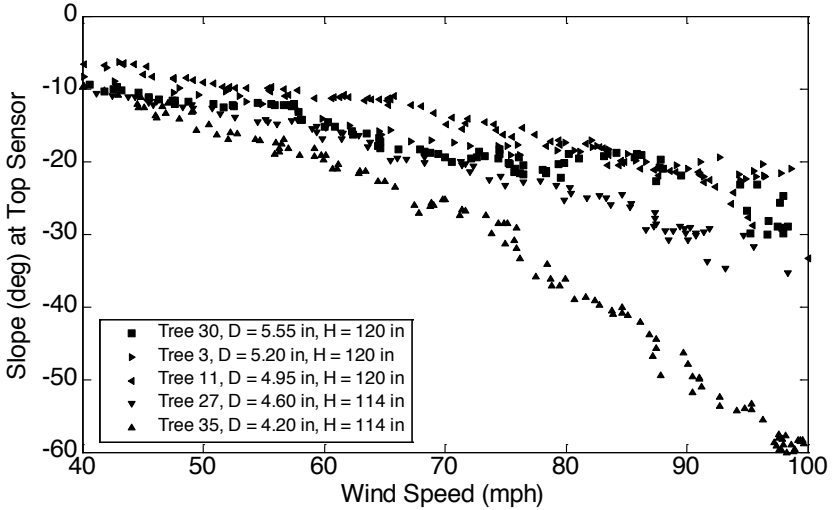

TREE Fund sponsored

Largest portable wind tunnel in the world

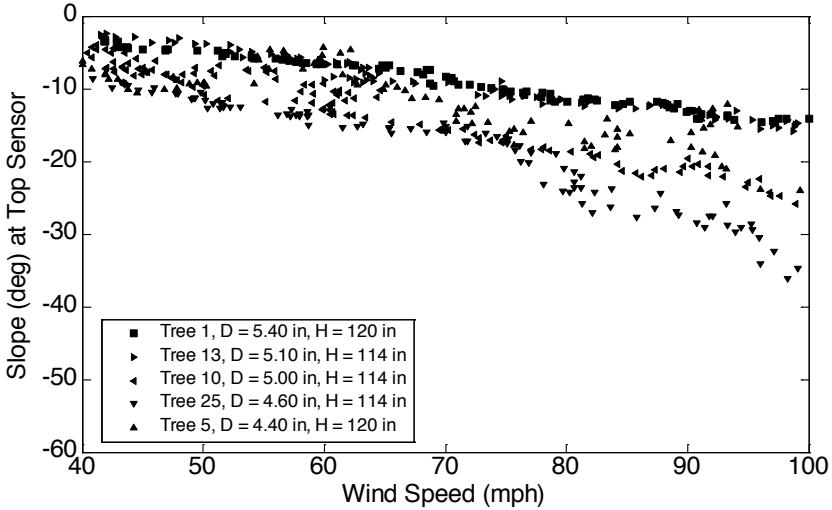
Largest portable wind tunnel in the world


$500,000 machine

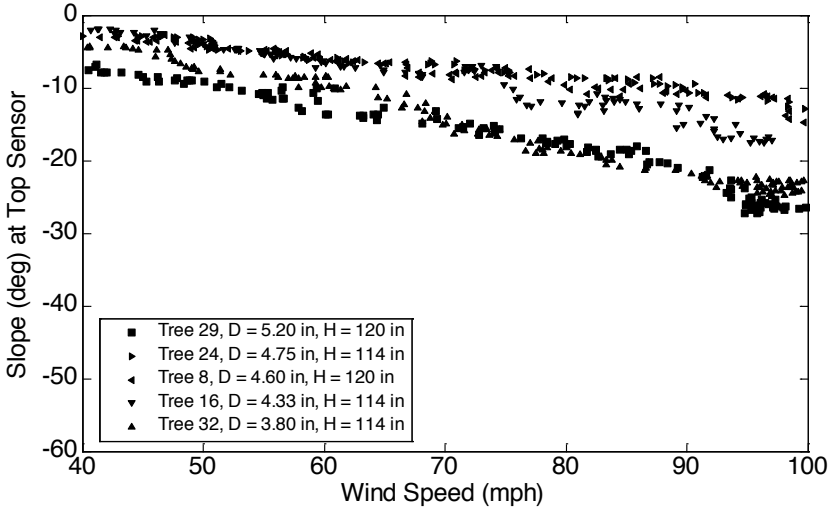
Not pruned



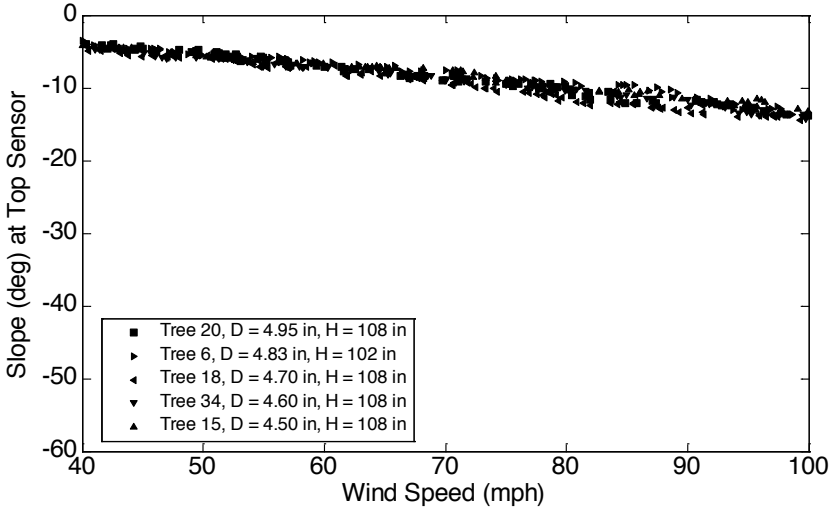
Raised



Thinned



Reduced



Not pruned

Reducing

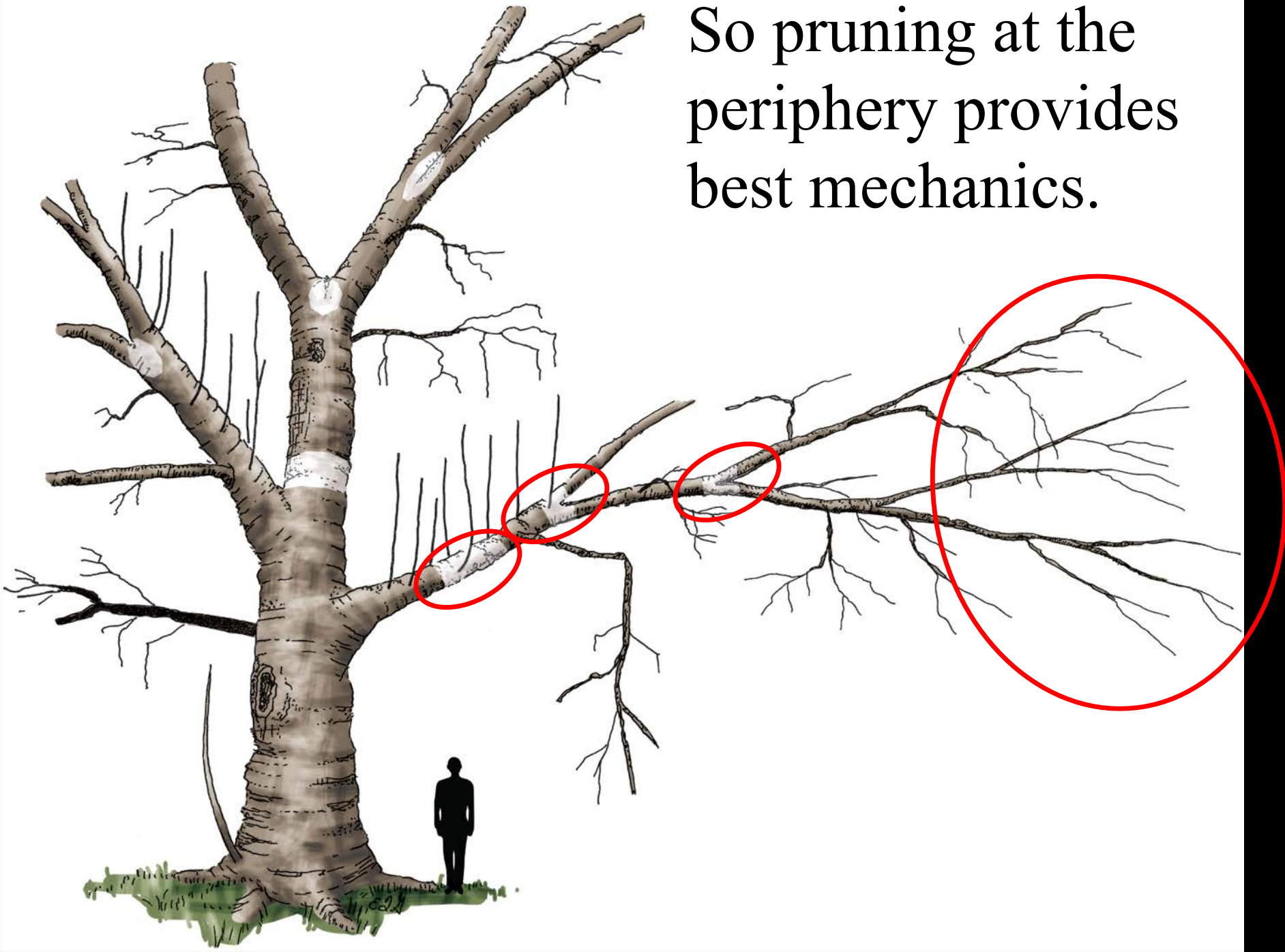
2:32

3/4

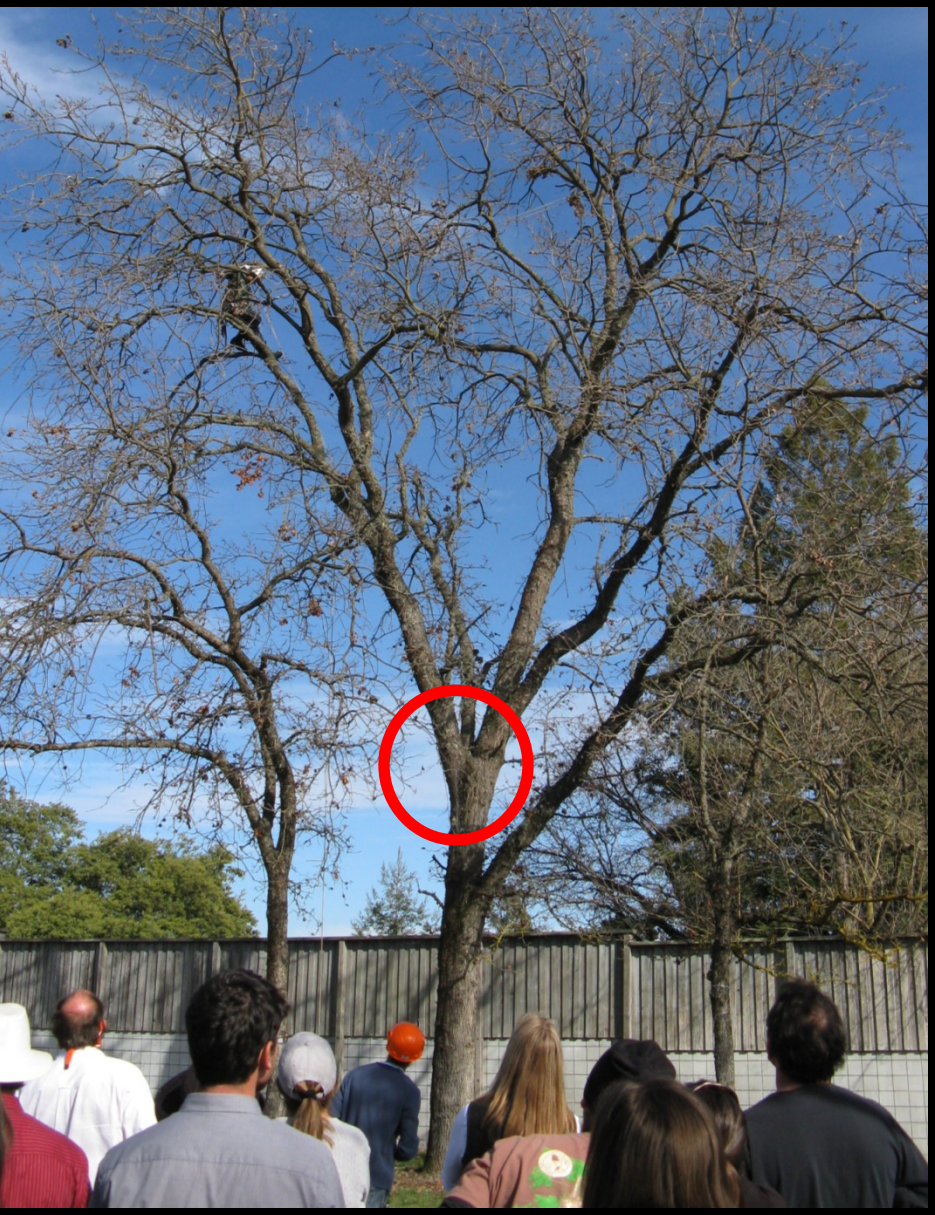
Overextended branches

Florida champion *Quercus virginiana*

So pruning at the periphery provides best mechanics.



Aspect ratio = 1; with crack



2012

- System:
- Objective:
- Location:
- Cut type:
- Amount:

2012

- System: natural
- Objective: ?
- Location:
- Cut type:
- Amount:

2012

- System: natural
- Objective: reduce risk
- Location: ?
- Cut type:
- Amount:

2012

- System: natural
- Objective: reduce risk
- Location: 2-3 largest
- Cut type: ?
- Amount:

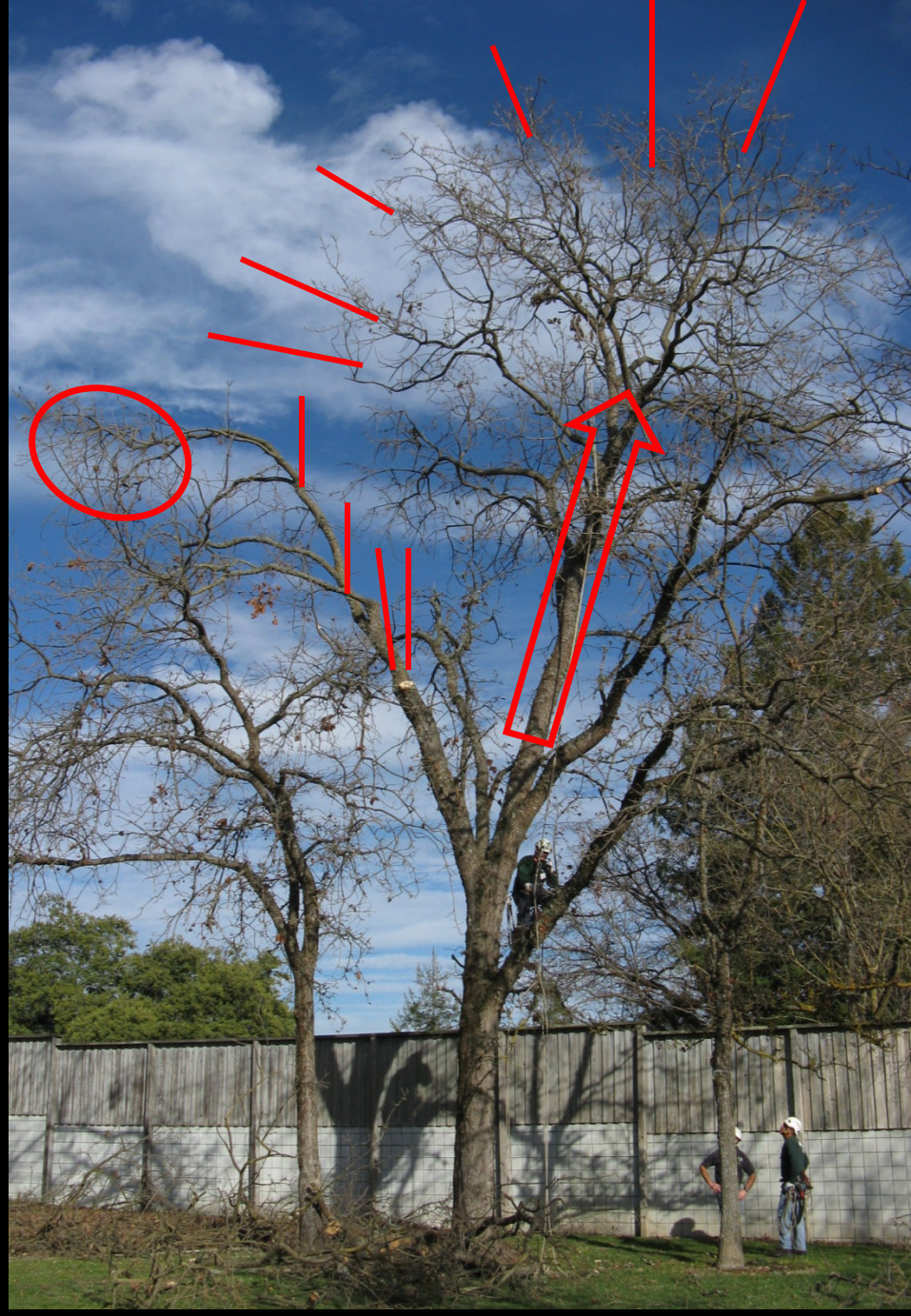
2012

- System: natural
- Objective: reduce risk
- Location: 2-3 largest
- Cut type: reduction
- Amount: ?

Risk reduced

Risk reduced

Risk reduced



2014

2017

2012

2017

2019

2017

Before pruning

Mark working the tips

Before pruning

After pruning

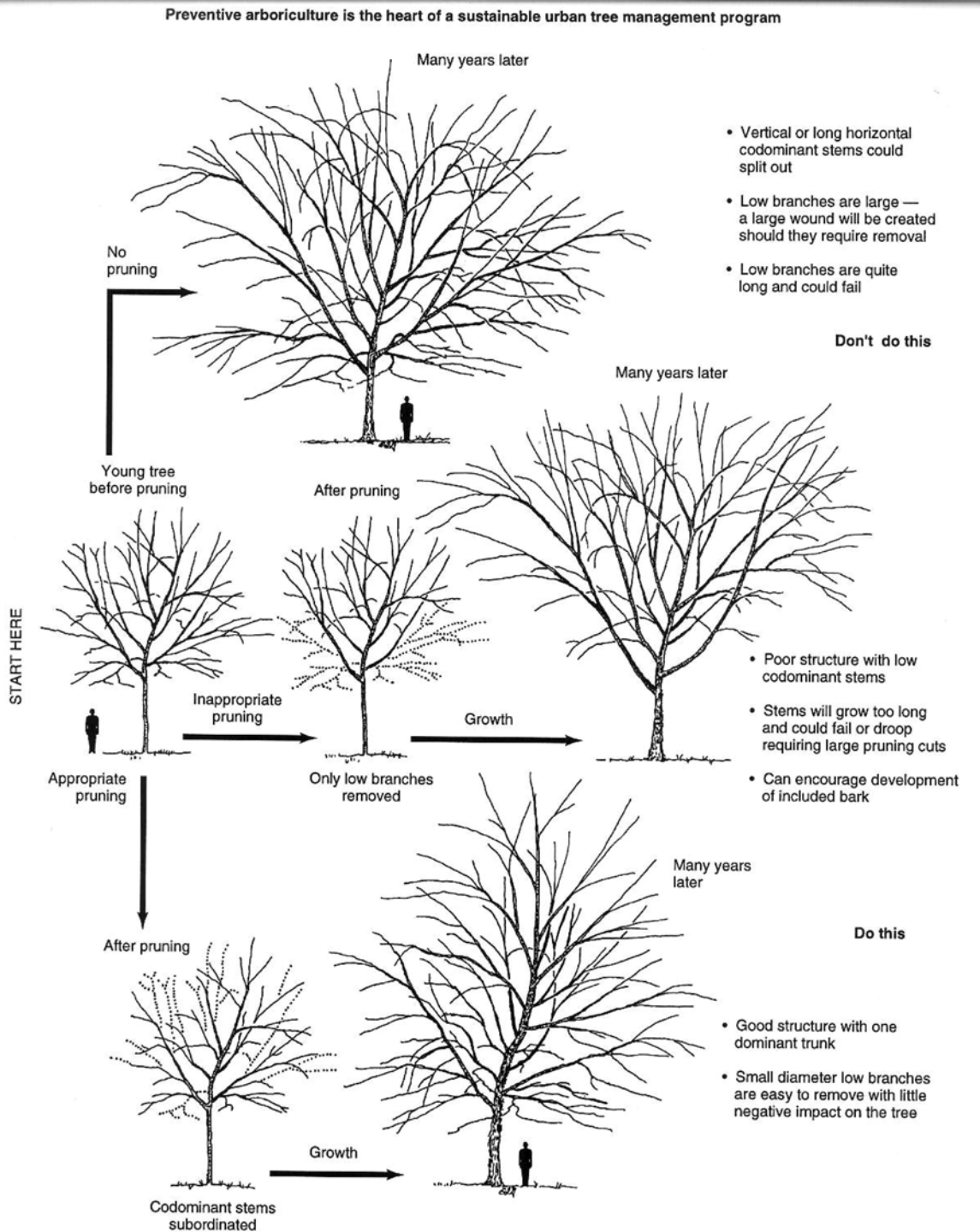
2012

2019

Summary of today

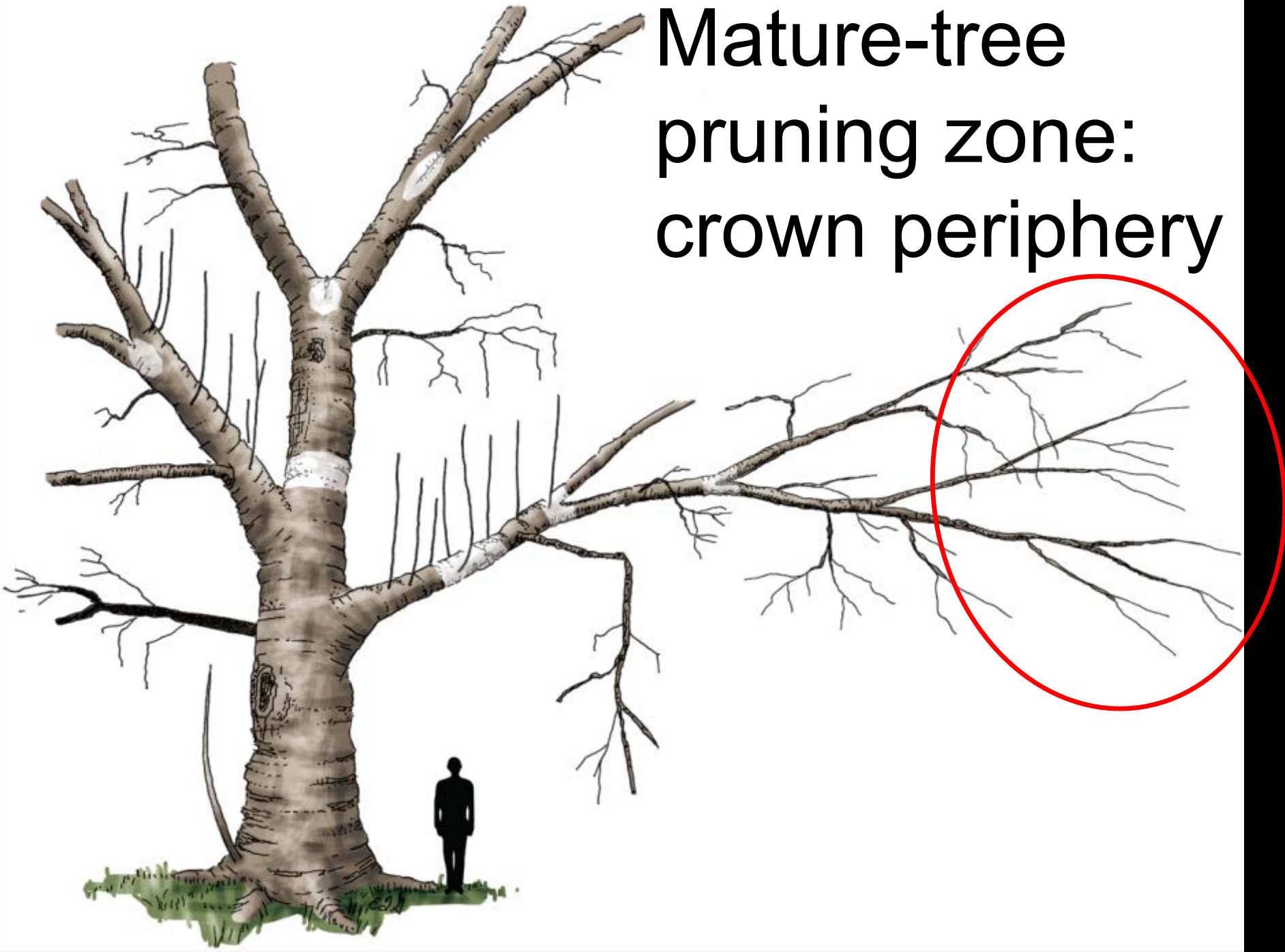
Typical management world-wide

Better management



Small aspect ratio (1/2): strong union

Mature-tree pruning zone: crown periphery



Specification outline – whether talking to crew or customer

- System:
- Objective:
- Cut type:
- Cut location:
- Cut number/diameter:

Thank you

Ed Gilman