The Morton Arboretum

# Removal pruning cuts on branches that lack branch collars


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# When branch collars are present…

… a review

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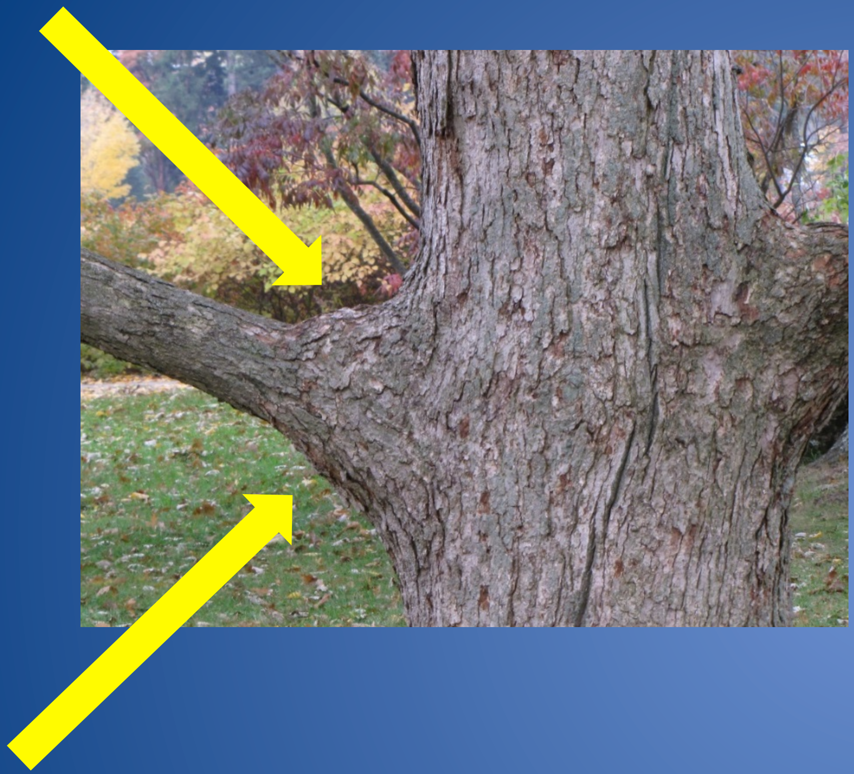

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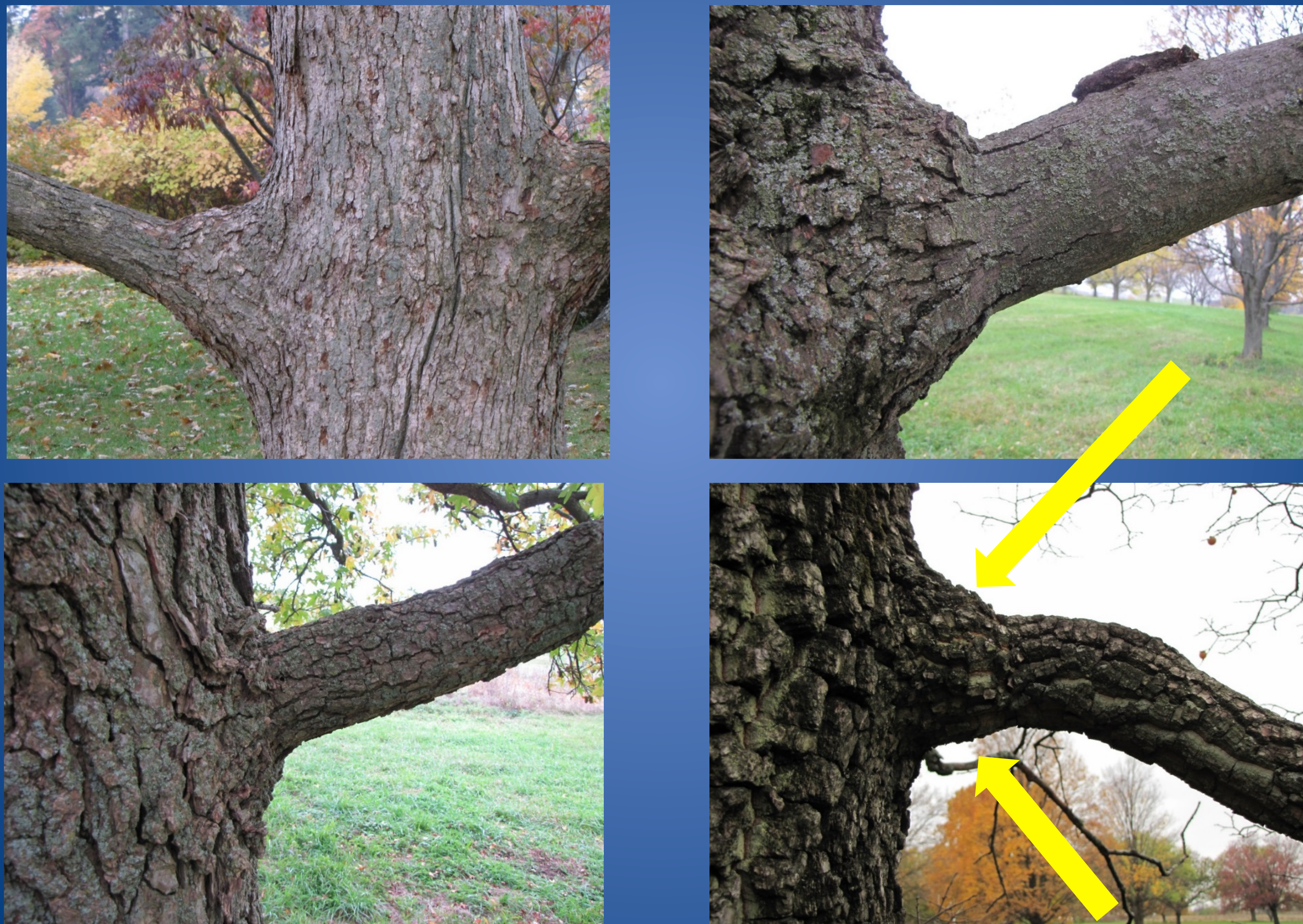
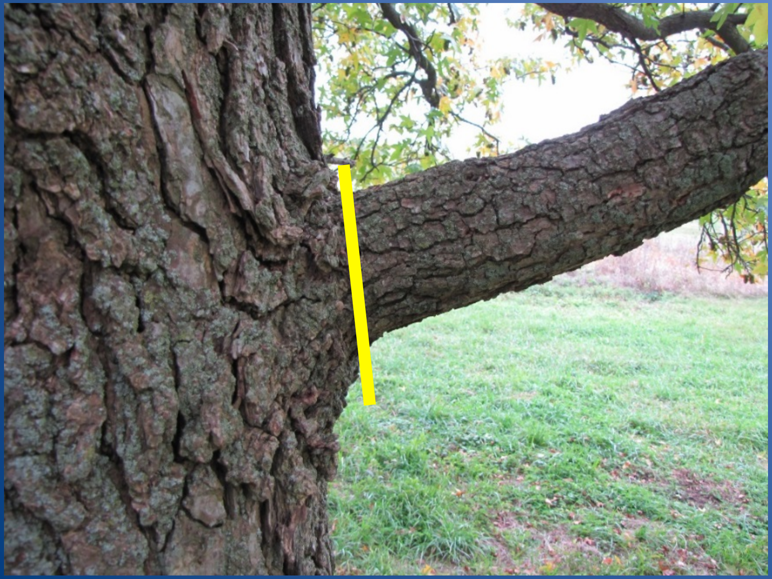


# Natural target pruning

- Removal of branch just beyond the visible collar
- Typically (but not always) perpendicular to branch axis

# When branch collars are present…






# Tree response to natural target pruning

- Branch protection zone
  - Chemical defense to slow decay progression

Notice the cone-shaped area attenuating dysfunctional wood

# Tree response to natural target pruning

- Branch protection zone
  - Chemical defense
- **Barrier zone**
  - **Wall 4 in CODIT Model**

# Tree response to natural target pruning

Woundwood formation

- Post-injury growth response to close over the wound
- Complete closure (occlusion) reduces the amount of oxygen available for decay causing organisms
- Increased strength for mechanical support

But what about when there is no branch collar present?

But what about when there is no branch collar present?

# Research questions

- Was there a difference between cut angle treatments in amount of dysfunctional wood (decay + discolored wood) or wound closure?
- Was there a relationship between other variables (cut size, aspect ratio, sprouting) and the amount of dysfunctional wood or wound closure?

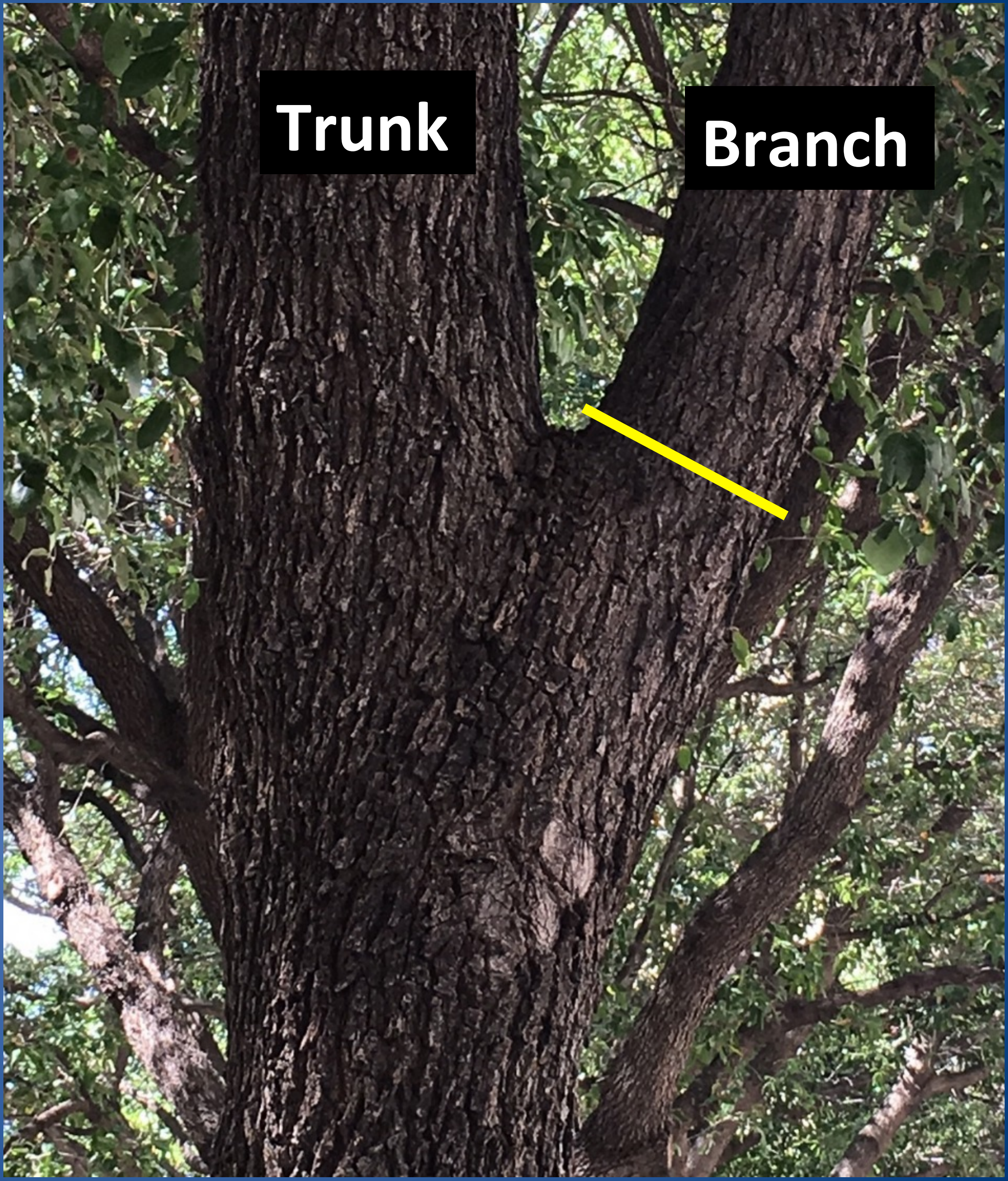
# This study

- Live oak (*Quercus virginiana*) (N=102 from 36 trees)
- Red maple (*Acer rubrum*) (N=90 from 40 trees)

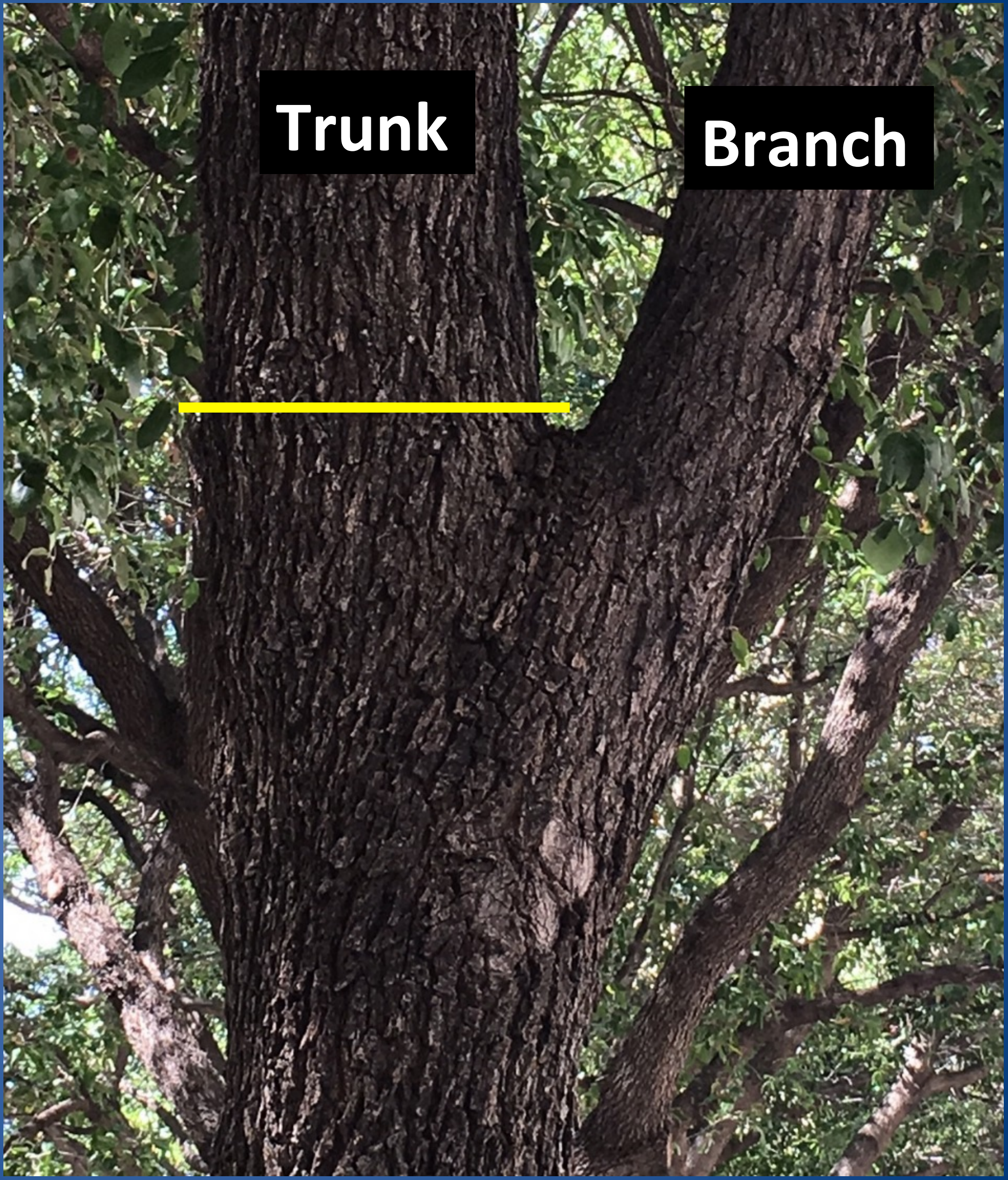
- 2 removal pruning cut angles:
  - Perpendicular to branch axis
  - 45 degrees to branch bark ridge

Branch base diameter

Size range:
Oaks: 3.0-12.4 cm
Maples: 3.2-13.5 cm

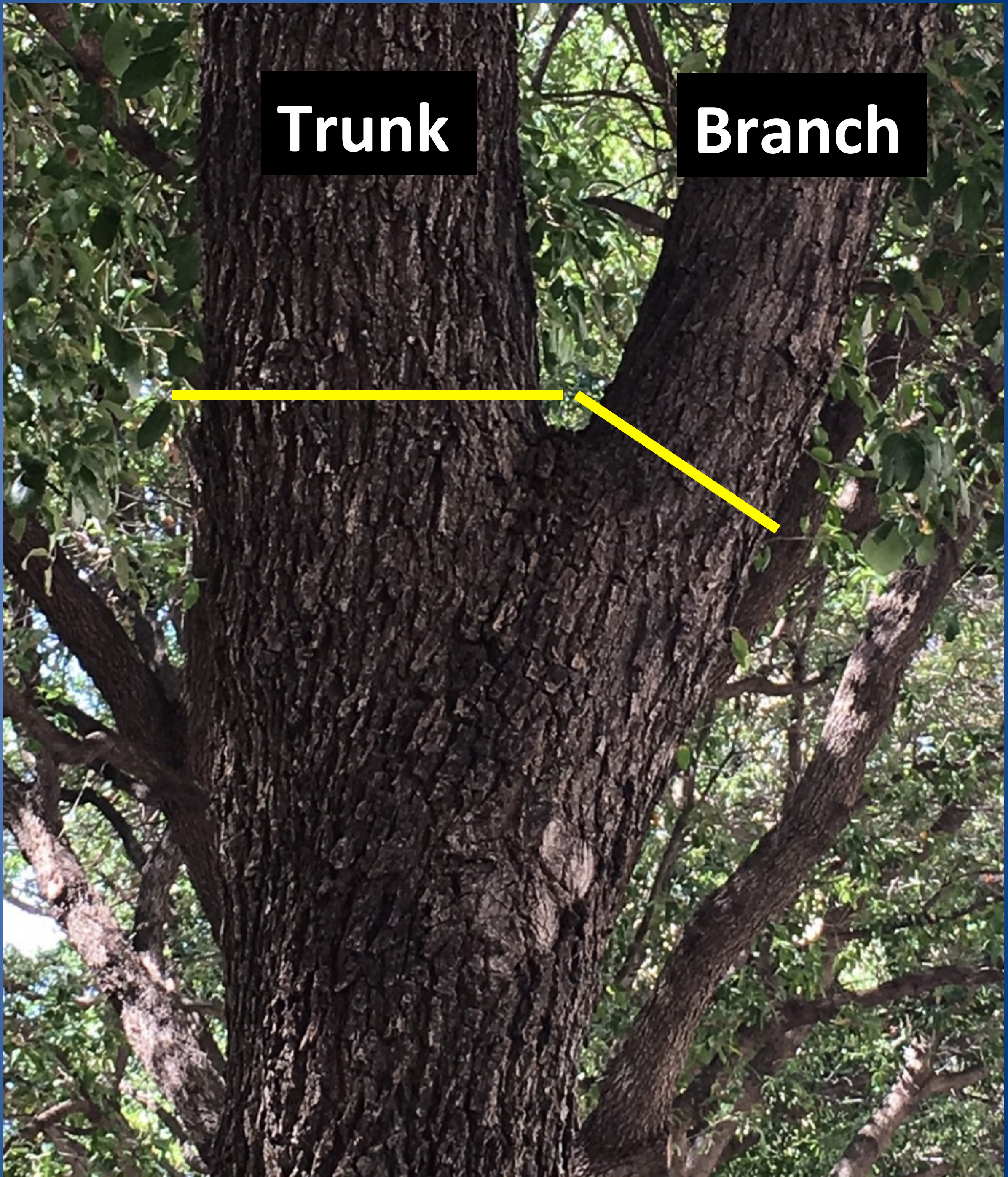


Trunk diameter measured just above the branch



Aspect ratio =
Branch base diameter/
Trunk diameter

Aspect ratio range:
Red maple: 0.42-0.99
Live oak: 0.21-0.95



Applied pruning treatments in November 2012

# Perpendicular to longitudinal branch axis

- Minimizes cut surface area
- Just beyond apex of branch bark ridge

# 45 degree angle from branch bark ridge

- Larger cut surface area
- Bottom of cut closer to trunk

# NOT FLUSH CUTS!

Did not cut into trunk wood

# 1 year later

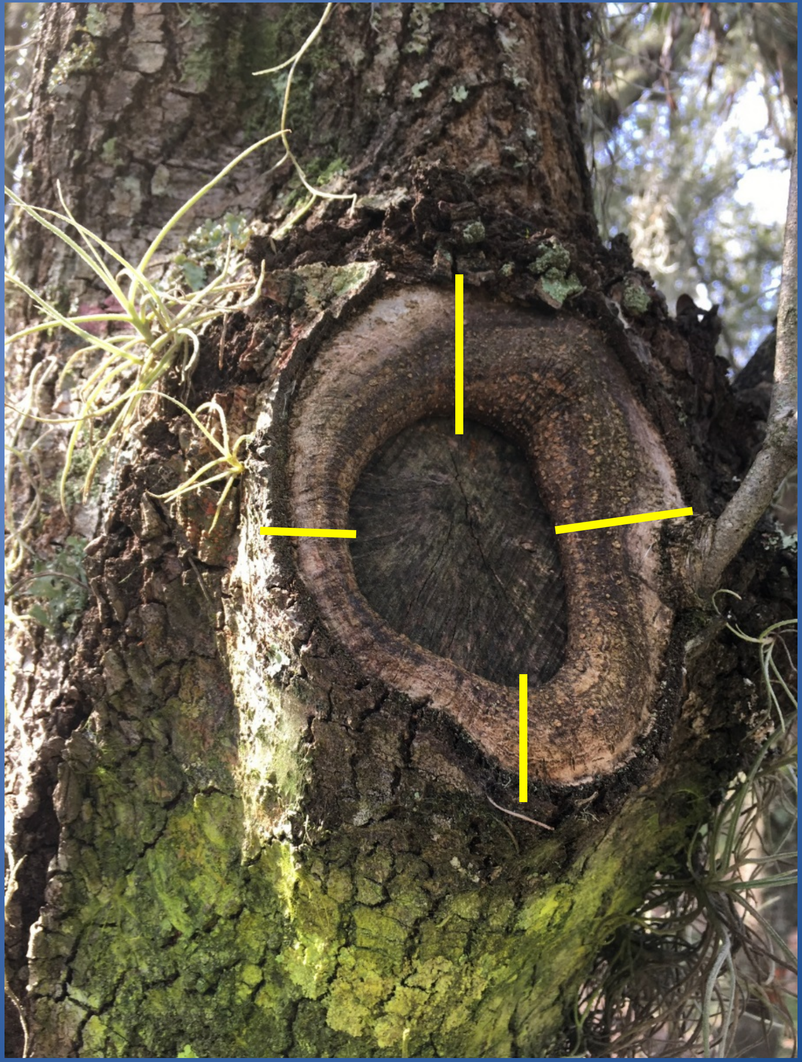
# 3 years later – right before harvest

Photo: Ed Gilman

# Harvested in November 2015

# Post harvest and dissection measurements

- Woundwood thickness on top, bottom, and sides prior to dissection



# Post harvest and dissection measurements

- Area of wound exposure remaining

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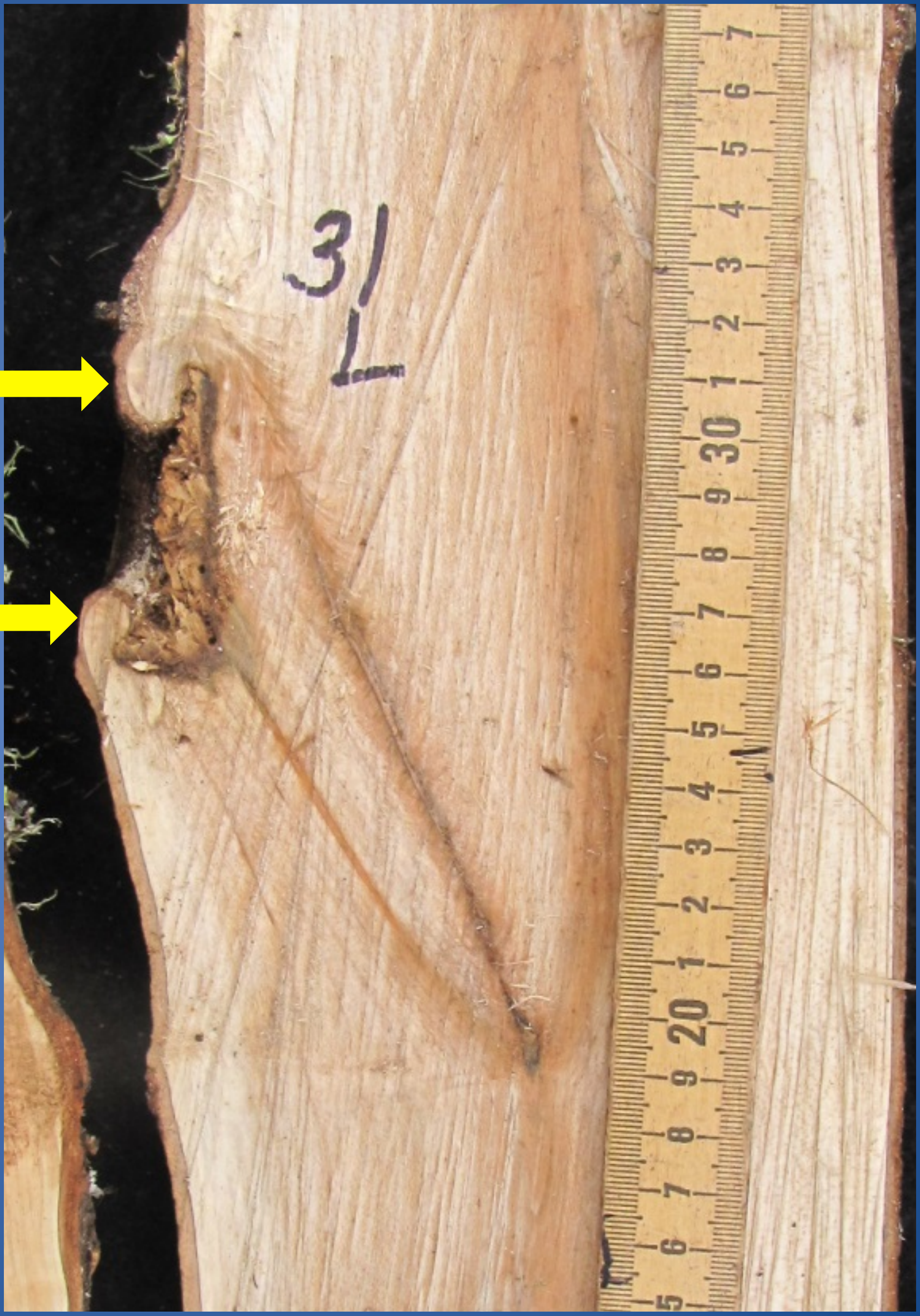
- **Percent closure = (cut area - area of opening/cut area)*100**

# Post harvest and dissection measurements

- Number and diameter of sprouts
- Distance to edge of wound

# Dissection cuts made to expose branch and trunk pith

Noted if woundwound was closed over or not



Woundwood closure over pruning cut

# Post harvest and dissection measurements

- Depth of dysfunctional wood

# Post harvest and dissection measurements

- Traced perimeter of dysfunctional wood and calculated area
  - ImageJ software

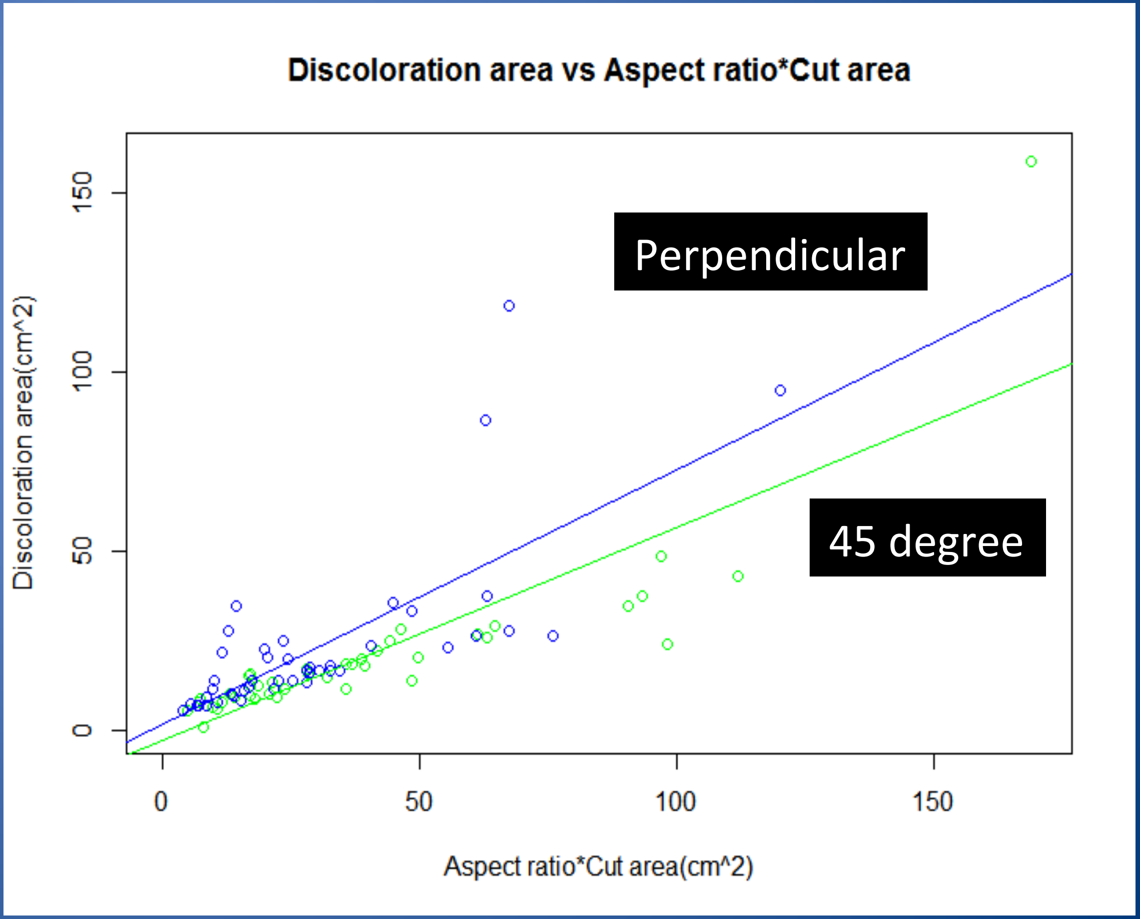
# Results…

# Red maple – Dysfunctional wood

**Aspect ratio*Cut area was best predictor of increased dysfunctional wood area**

P-value < 0.001

Puts cut size on a "weighted scale"




R-squared = 0.6369

# Aspect ratio

Small (.35)

Large (.95)

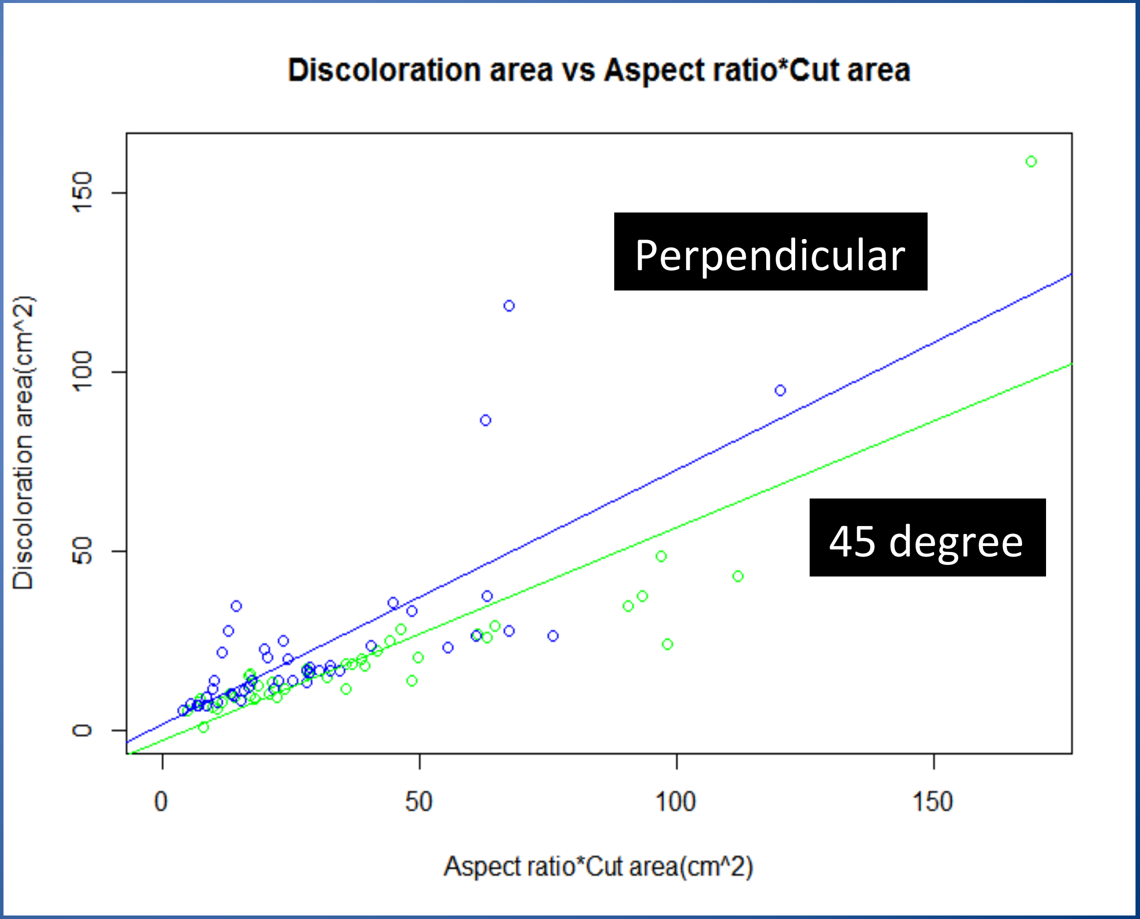
# Red maple – Dysfunctional wood

Aspect ratio*Cut area was best predictor of increased dysfunctional wood area

P-value < 0.001

**Both cut angles increased; perpendicular did more so**

P-value = 0.0076




R-squared = 0.6369

# Live oak – Dysfunctional wood

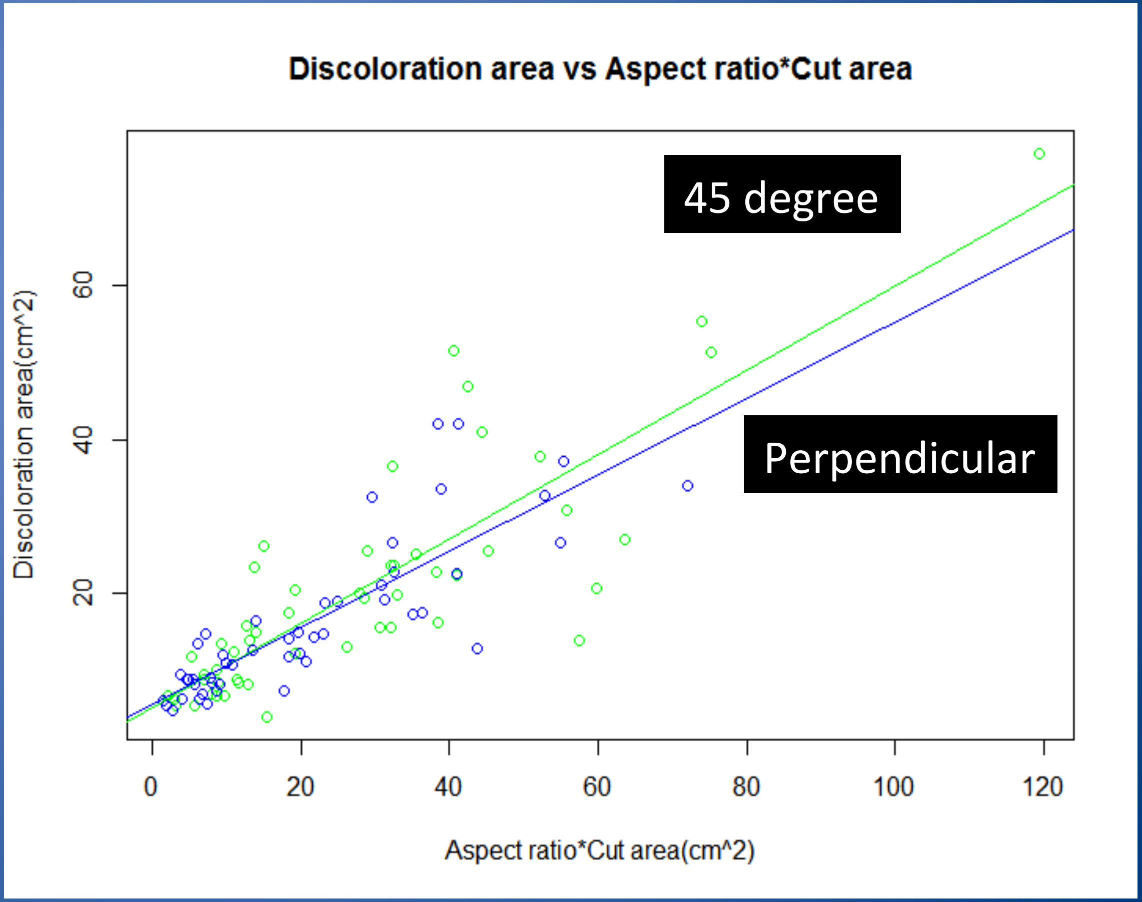
**Aspect ratio*Cut area was best predictor of increased dysfunctional wood area**

P-value < 0.001

Cut type was not significant

P-value = 0.577

R-squared = 0.7199



# Complete wound closure

- Live Oaks:
  - 4 of the 45 degree from BBR
  - 2 of the perpendicular to branch axis


- Maples:
  - 4 of the 45 degree from BBR
  - 6 of the perpendicular to branch axis

# Red maple – percent closure

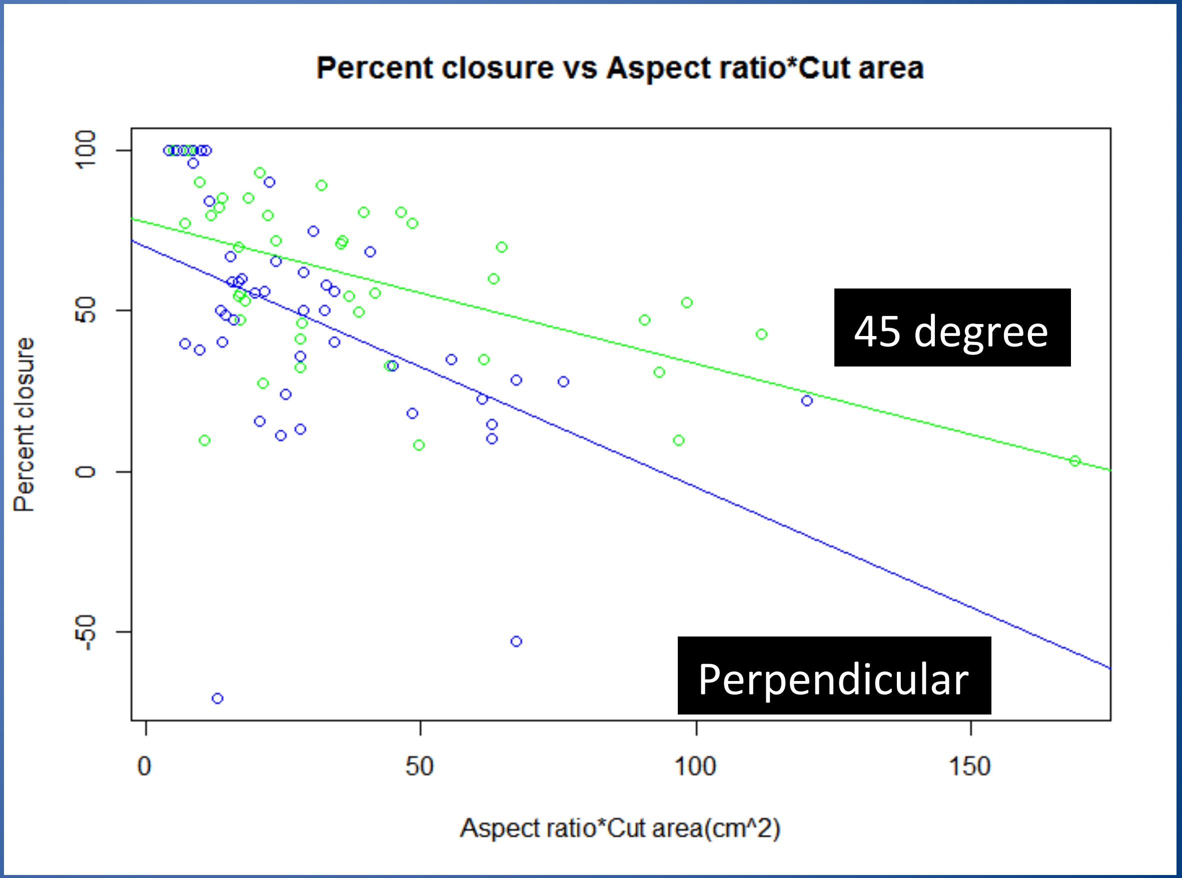
Aspect ratio*Cut area was best predictor of percent wound closure

P-value < 0.001

Both cut angles decreased; perpendicular did more so

P-value < 0.005

R-squared = 0.274



# Red maple – percent closure

Aspect ratio*Cut area was best predictor of percent wound closure
P-value < 0.001

Both cut angles decreased; perpendicular did more so
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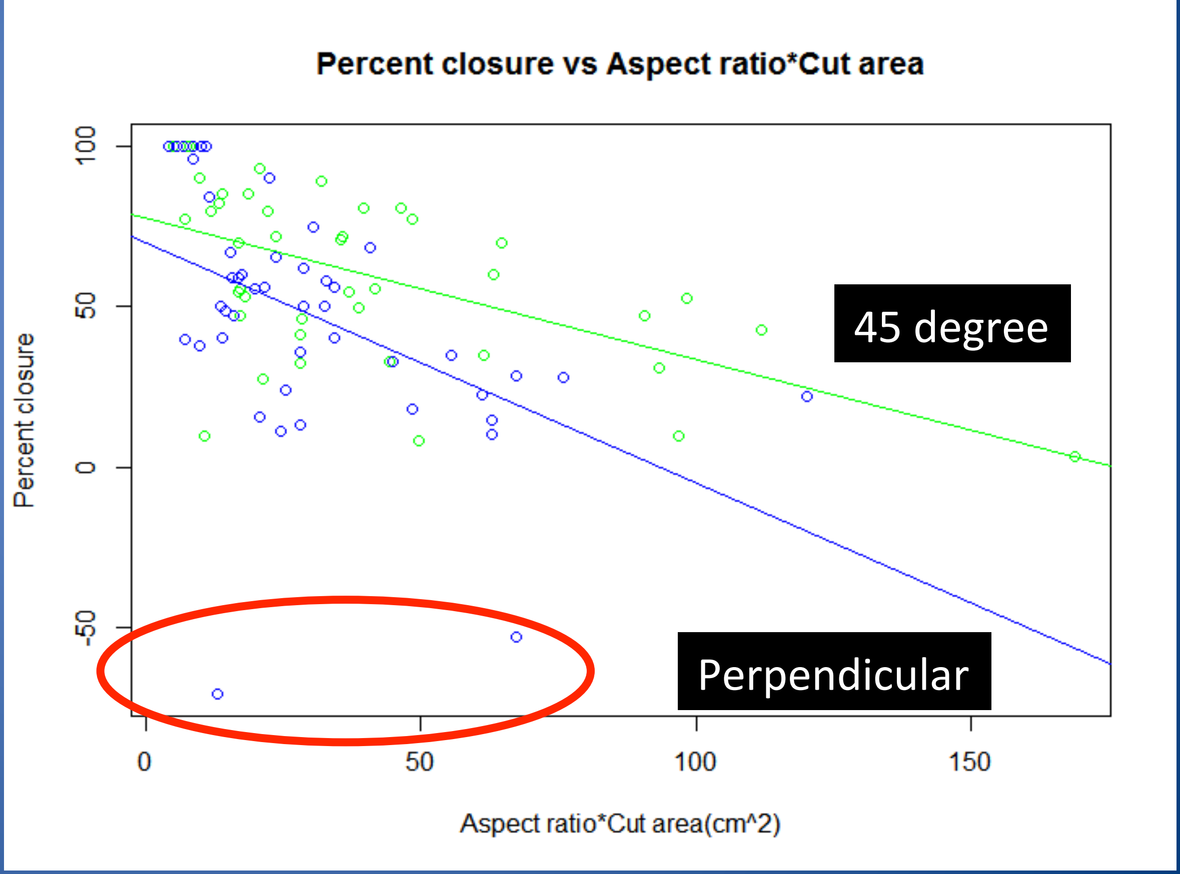


R-squared = 0.274

# Cambium dieback at branch base


# Barrier zones


# Live oak – percent closure

- Cut angle, cut size, aspect ratio, and all interactions were not significant (P-value >0.05)

# Other observations…

Dysfunctional wood often asymmetric, with more below pith

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- Restricted through the compacted xylem

Dysfunctional wood often asymmetric, with more below pith

- Restricted through the compacted xylem
- Non-functional vascular tissue

# Summary

- As the variable 'cut size*aspect ratio' increased, so did the area of dysfunctional wood in both red maple and live oak
  - For red maple, this relationship was greater for cuts perpendicular to branch axis than those 45 degrees to BBR
  - Cut angle was not significant for live oak

# Summary

- As the variable ‘cut size*aspect ratio’ increased, so did the area of dysfunctional wood in both red maple and live oak
  - For red maple, this relationship was greater for cuts perpendicular to branch axis than those 45 degrees to BBR
  - Cut angle was not significant for live oak
- **As the variable ‘cut size*aspect ratio’ increased, percent wound closure decreased for red maple, and the difference was greater for perpendicular cuts. None of the measured variables affected percent closure in live oak.**

# Summary

**Findings support pruning recommendations to:**

1. **Minimize size and aspect ratio of removal cuts**

2. **Make removal cut at an angle closer to parallel with trunk (e.g. 45 degrees to BBR) than perpendicular to branch axis (red maple).**

# Acknowledgements


Tree FUND

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Marvin Lo


Thank you!


I give up!
I RETIRE!!!