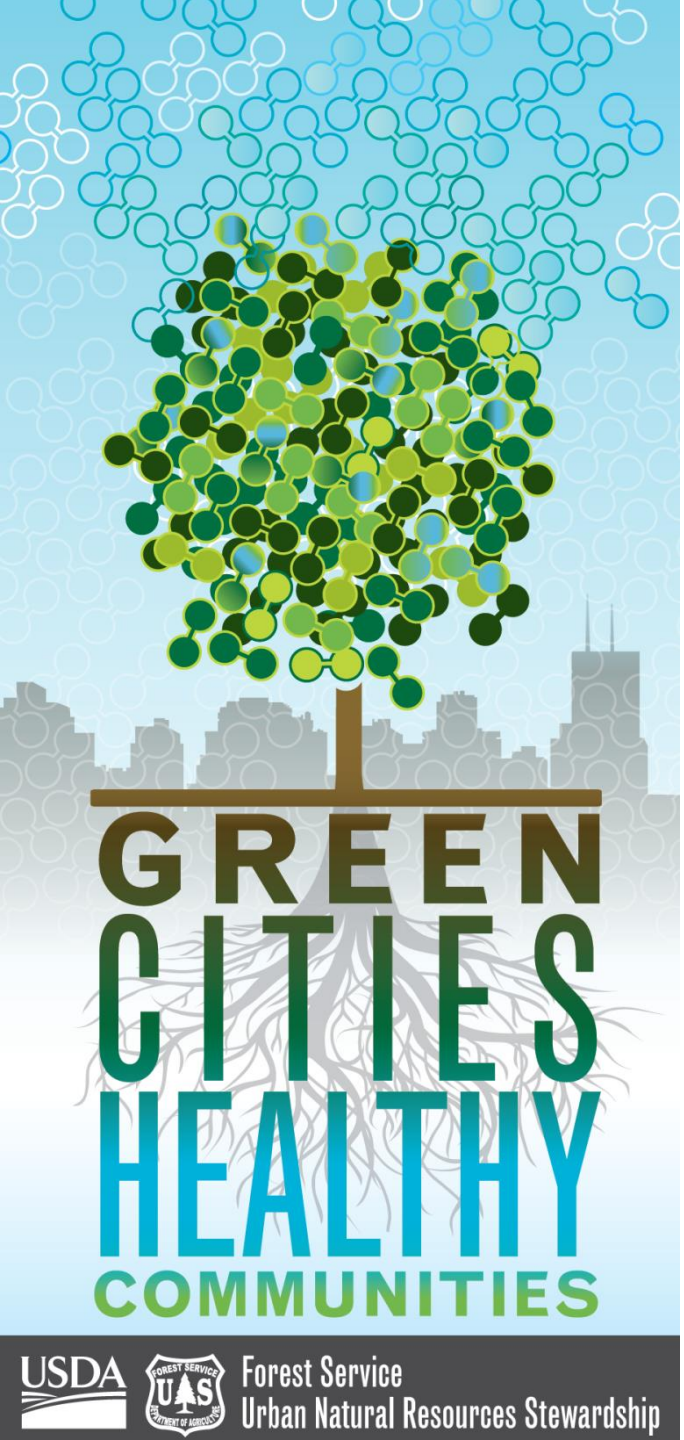

USDA Forest Service

URBAN FOREST CONNECTIONS

webinar series

Second Wednesdays | 1:00 – 2:15 pm ET

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Tree Risk Assessments: Cutting edge science meets practical applications

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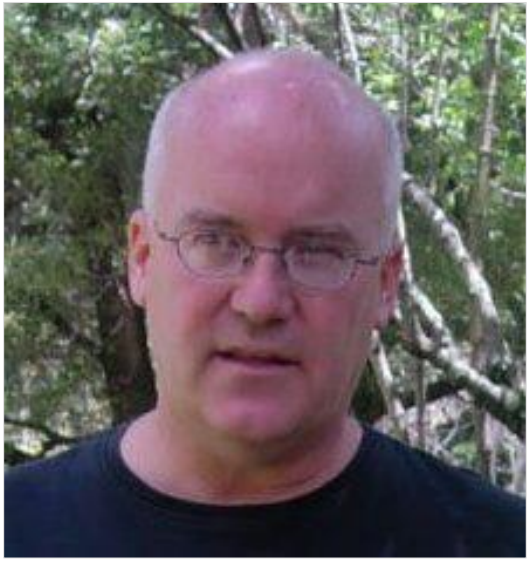

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Tree Risk Assessment

Greg Dahle
West Virginia University

Tree Risk Assessment

- ANSI A300 Part 9
- BMP

- TRAQ
  - Tree Risk Assessment Qualification
    - 2 day educational course + ½ assessment
  - Re-qualify every 5 years
    - 1 day refresher + 3 hour exam

Three Levels of Tree Risk Assessment

Level 1 - Limited visual (survey)

Level 2 – Basic (visual exam)

Level 3 - Advanced

All looking at factors that affect the likelihood and consequences of tree failure.

Many of these slides were adapted from a presentation by Dr. Tom Smiley with the Bartlett Tree Research Lab

Likelihood of Failure and Impact (Table 1)

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	*Low*	*Medium*	*High*
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Risk Rating Matrix (Table 2)

Likelihood of Failure and Impact	Consequences of Failure			
	Negligible	*Minor*	*Significant*	*Severe*
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Categorizing the Likelihood of a Failure

Within the Specified Time Frame:

- Improbable - the tree is not likely to fail even in severe weather conditions.
- Possible- failure could occur, but it is unlikely during normal weather. High wind failure.
- Probable –failure is expected under normal weather conditions.
- Imminent –failure has started or is most likely to occur in the near future, even if there is no wind or increased load.

Categorizing the Likelihood of Impacting a Target

Very Low- The chance of impacting a target is remote.

Low – It is not likely that the target will be impacted.

Medium – The target may or may not be impacted.

High - The target is likely to be impacted

Likelihood

Failure=Imminent

Impact=Medium

Likelihood of Failure and Impact (Table 1)

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	*Low*	*Medium*	*High*
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Consequences are the effects or outcome of a tree failure.

- Negligible- low value property damage. Personal injury is unlikely.
- Minor – low to moderate value property damage. Personal injury is unlikely
- Significant –moderate to high value property damage. People could be injured.
- Severe - High value property damage. One or more people could be injured or killed.

Consequences of failure = Severe

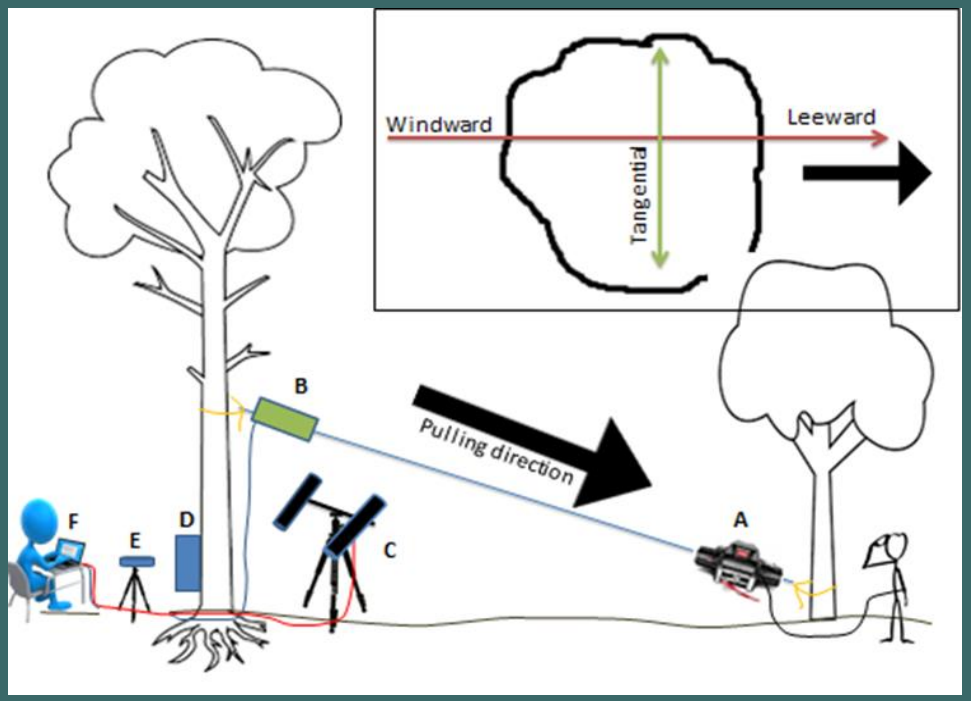
Risk Rating Matrix (Table 2)

Likelihood of Failure and Impact	Consequences of Failure			
	Negligible	*Minor*	*Significant*	*Severe*
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Digital Image Correlation

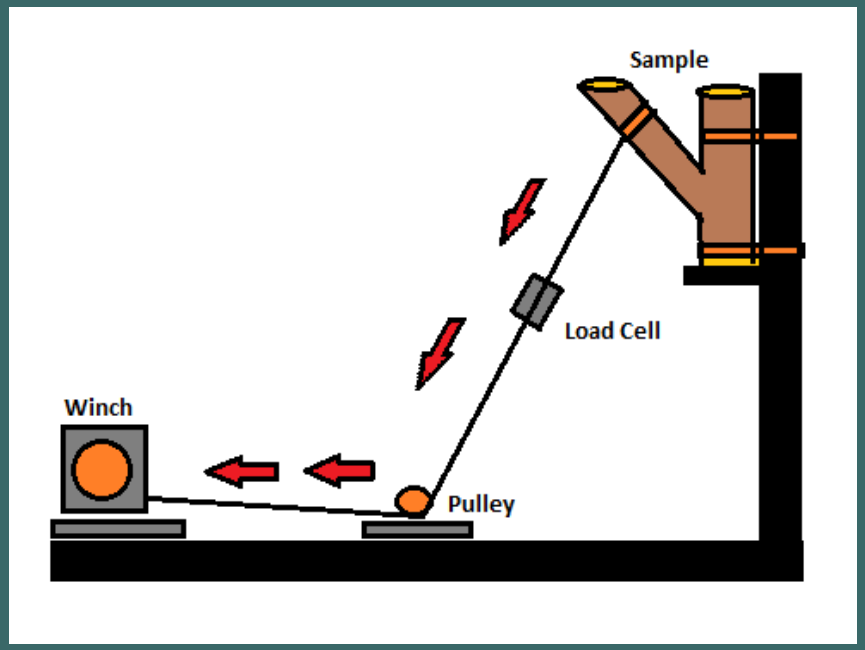
- Stereophotogemetry
- 3D strain maps
- Strain = deformation

Static Load Tests

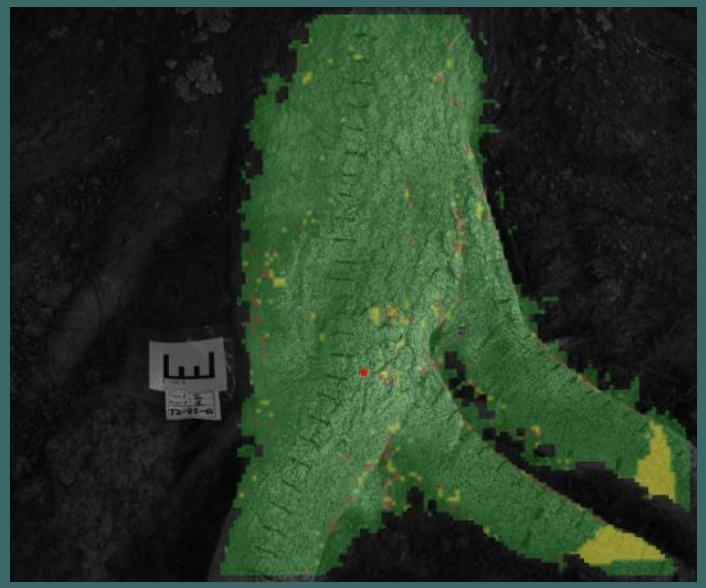


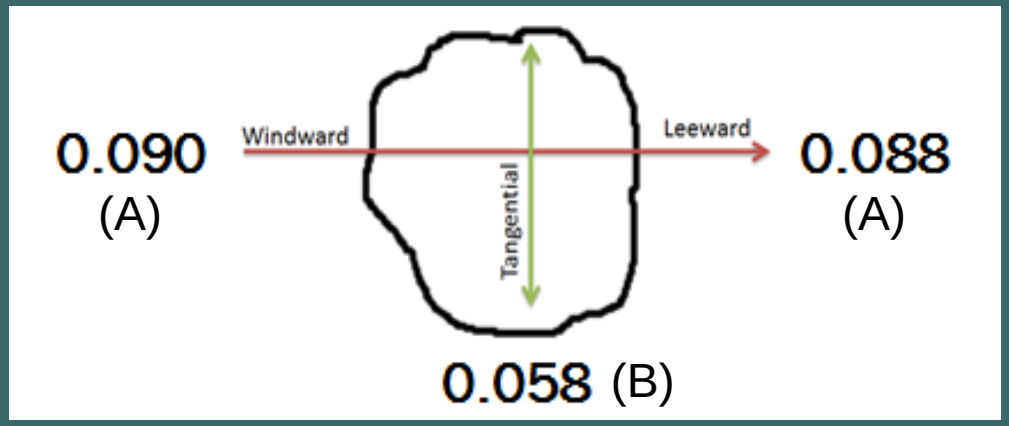
Ken Beezley,
M.S. 2016

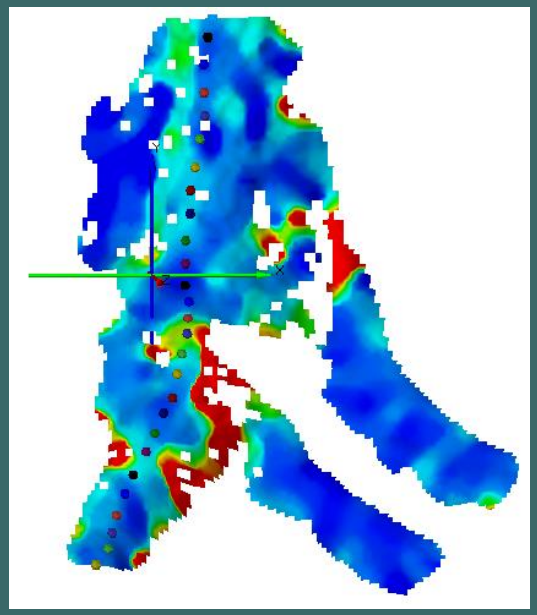
Rob Eckenrode,
M.S. 2017



Mean Strain

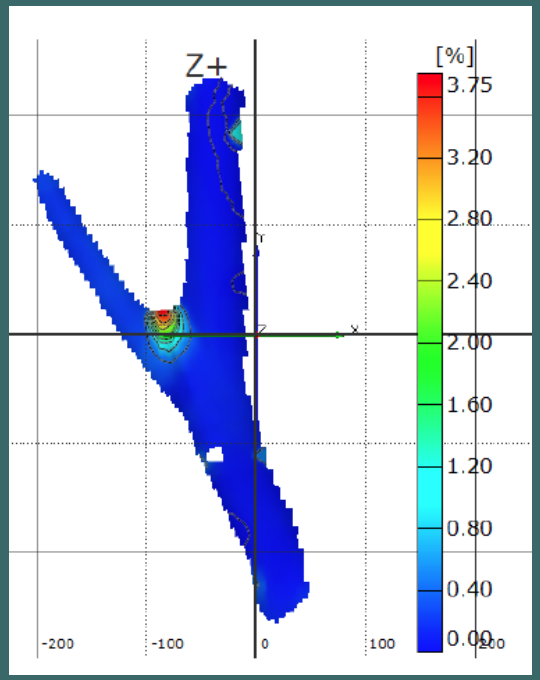






- Windward and leeward were the same
- Tangential was lower
  - Looking at torsion
- Prevailing wind important

The Lateral Branch Attachment

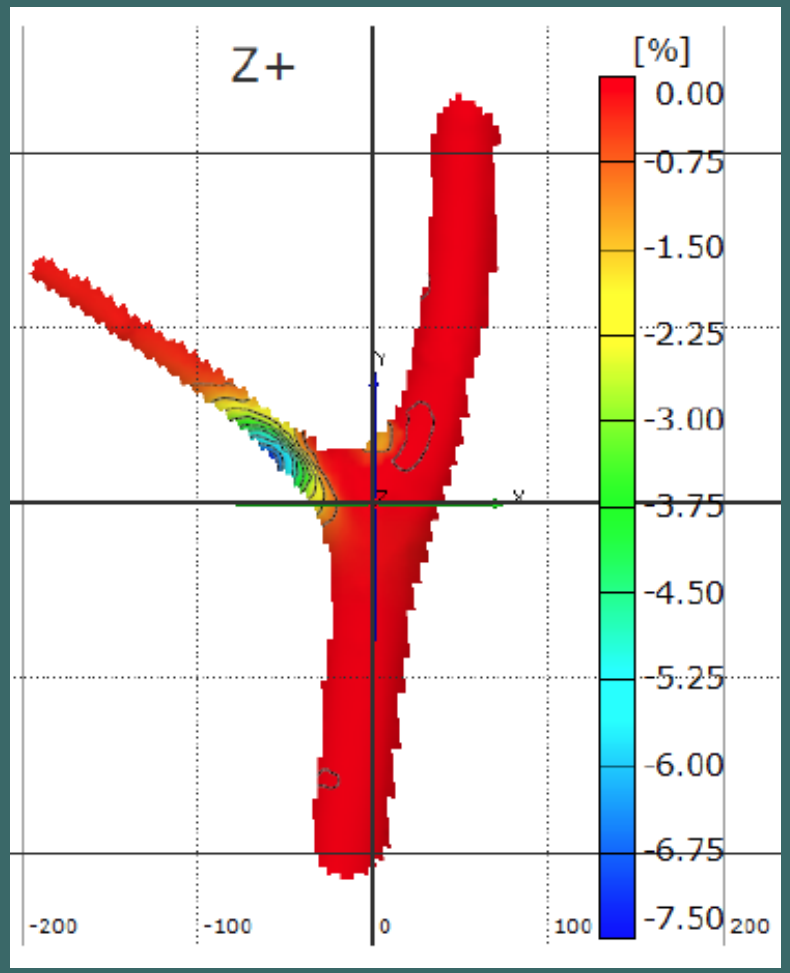


Aspect ratio varied from 0.5 to 1.0

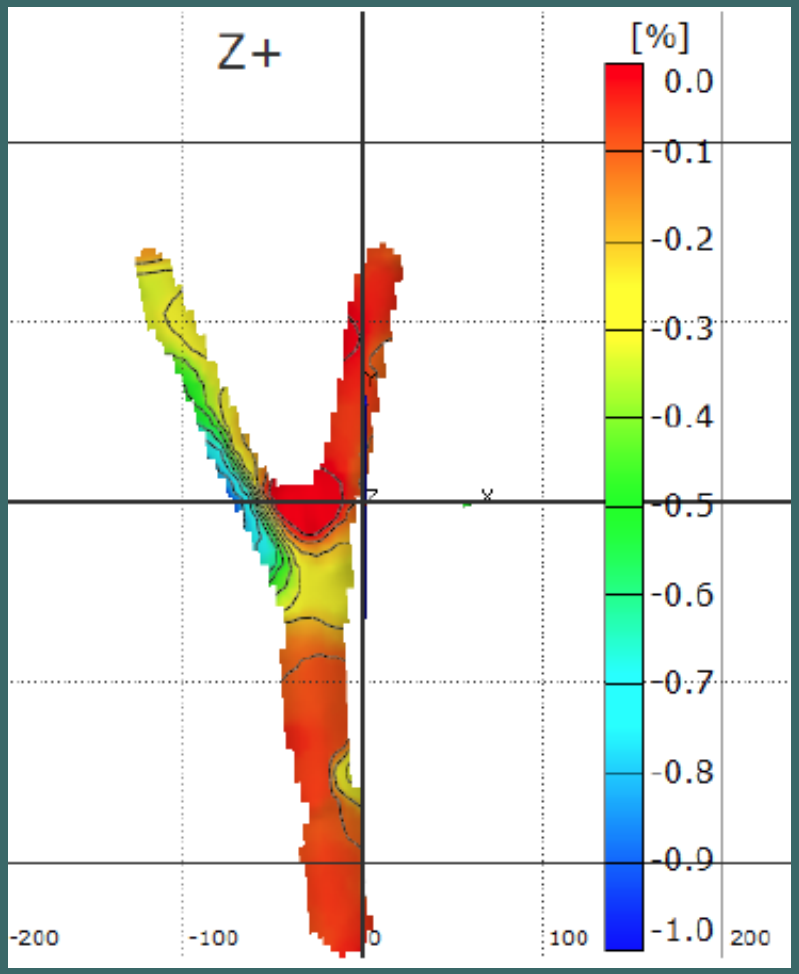
Aspect ratio = branch diameter / stem diameter

Strain moved further into stem in co-dominant

Aspect ratio = 0.6
ball & socket failure



Aspect ratio 0.8,
imbedded failure



Mapping strain and likelihood of failure

- Loads are transferred equally in line with wind direction
  - Yet torsion might be important
- Appears co-dominant begins around aspect ratio 0.8 (mechanical and hydraulic)