The Craft of Tree Felling







Alan Hale

August 2019



Outline

Felling in the Direction of Slight Lean

Facing Issues

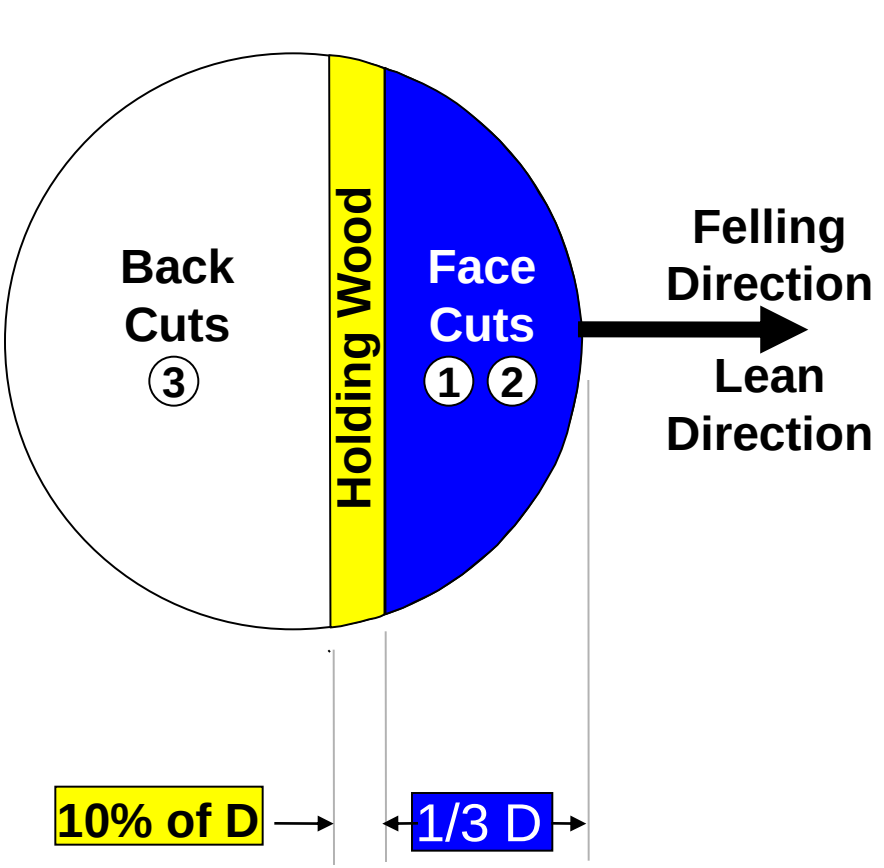
Felling Difficult Trees

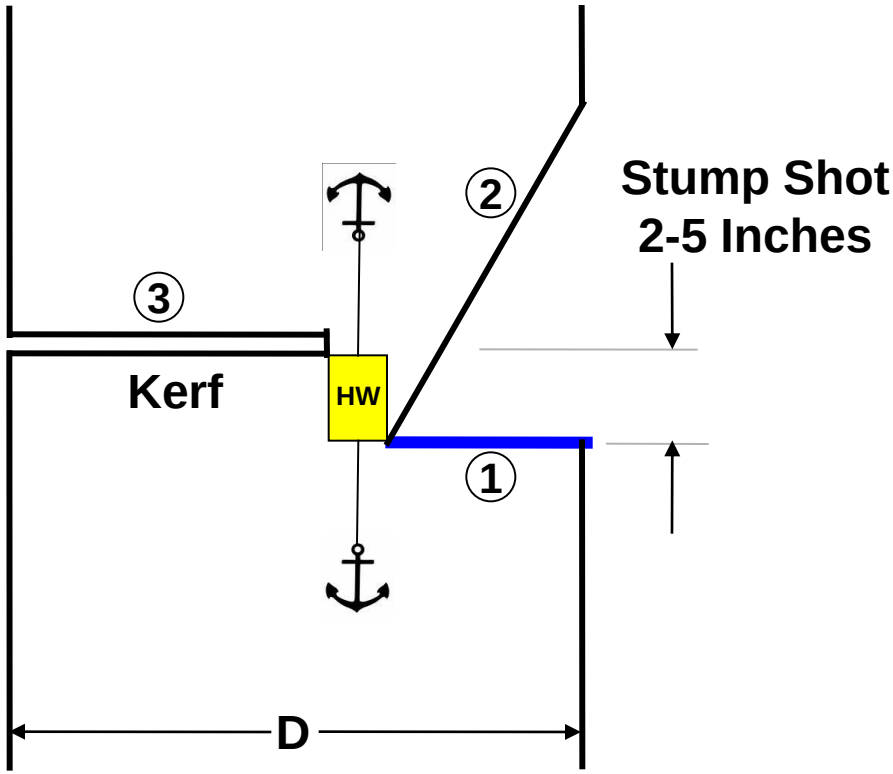
Sizeup

- Search for overhead hazards
  - Debris falling from above causes over one-half of all felling accidents
  - Practice watching overhead while cutting
  - Occasionally glance at the saw, kerf, and top of the tree
- Check for snags (standing dead or dying tree)
  - Snags may fall at any time due to wind or vibration from a felled tree
  - Cut any snags in the felling area first
- Swamp out the base
  - Remove all material that could cause sawyers to lose their balance
  - Many fatalities have occurred because the sawyer could not move far enough away from the stump to avoid being struck or pinned
- Assess the tree's lean
  - The tree has two natural leans: head lean and side lean
  - Project a vertical line from the center of the tree's stump
  - Use two different locations at right angles to each other
- Check for soundness of the holding wood
  - Bore a hole with a cordless electric drill or the chain saw
  - Evaluate the wood quality from:
    - Color of the sawdust and
    - Ease of penetration

Felling In The Direction Of Slight Lean

(Conventional Face Cut)

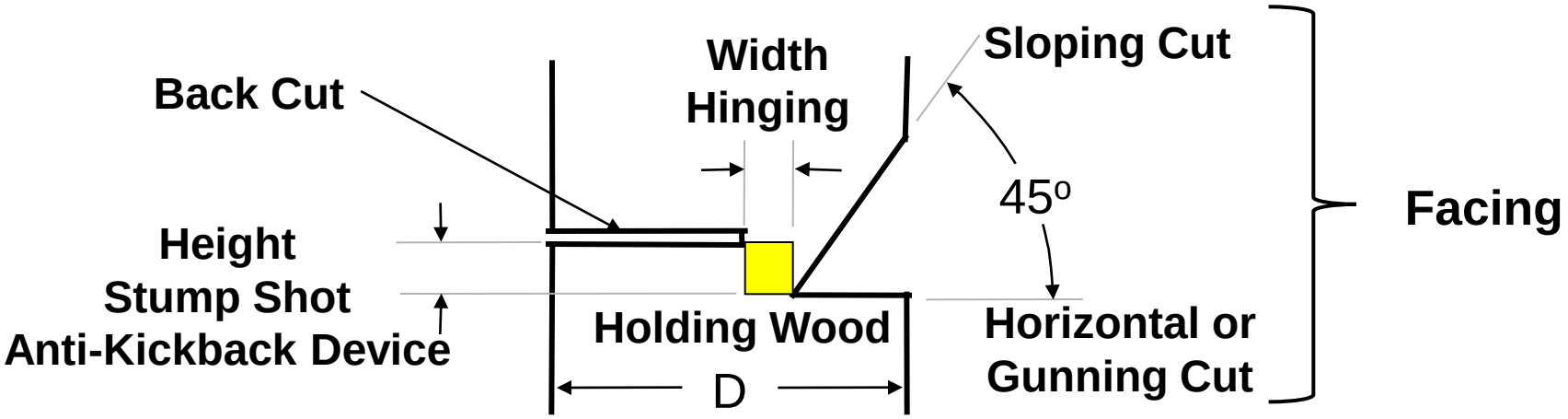




Execute the cuts standing or on one knee with the saw at waist level

Holding Wood or Hinge Wood (HW) } **Vertically oriented wood connecting the stump to the tree**

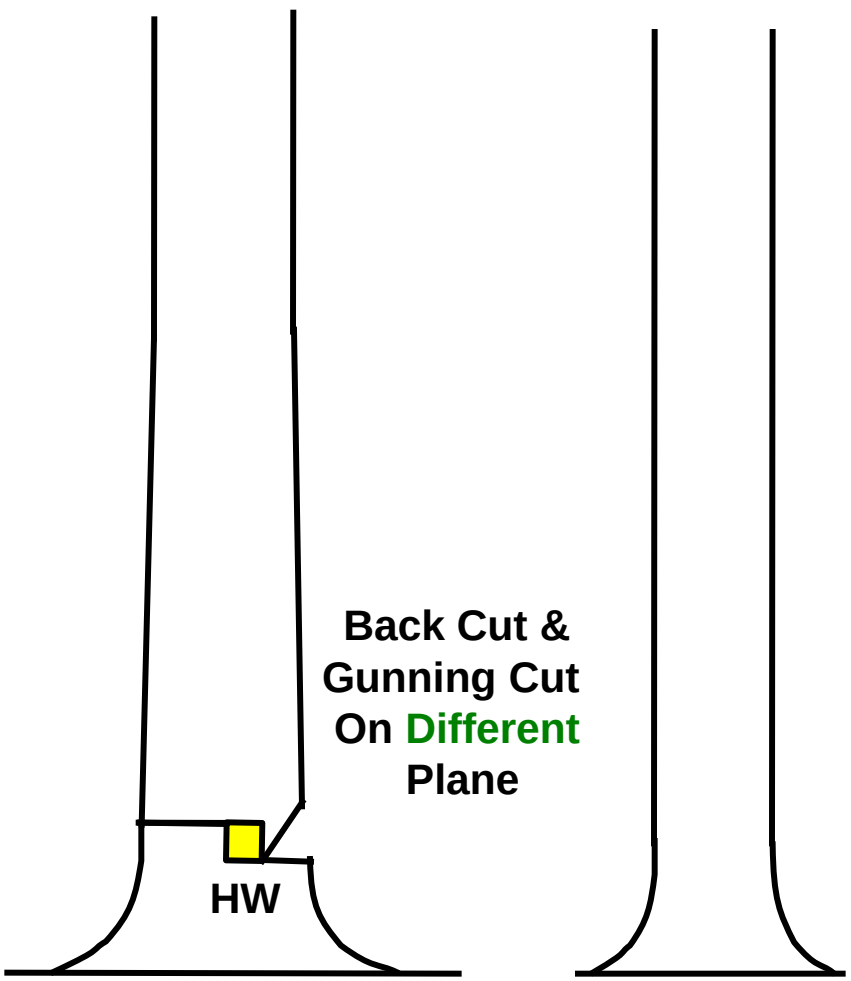
Felling Mechanics

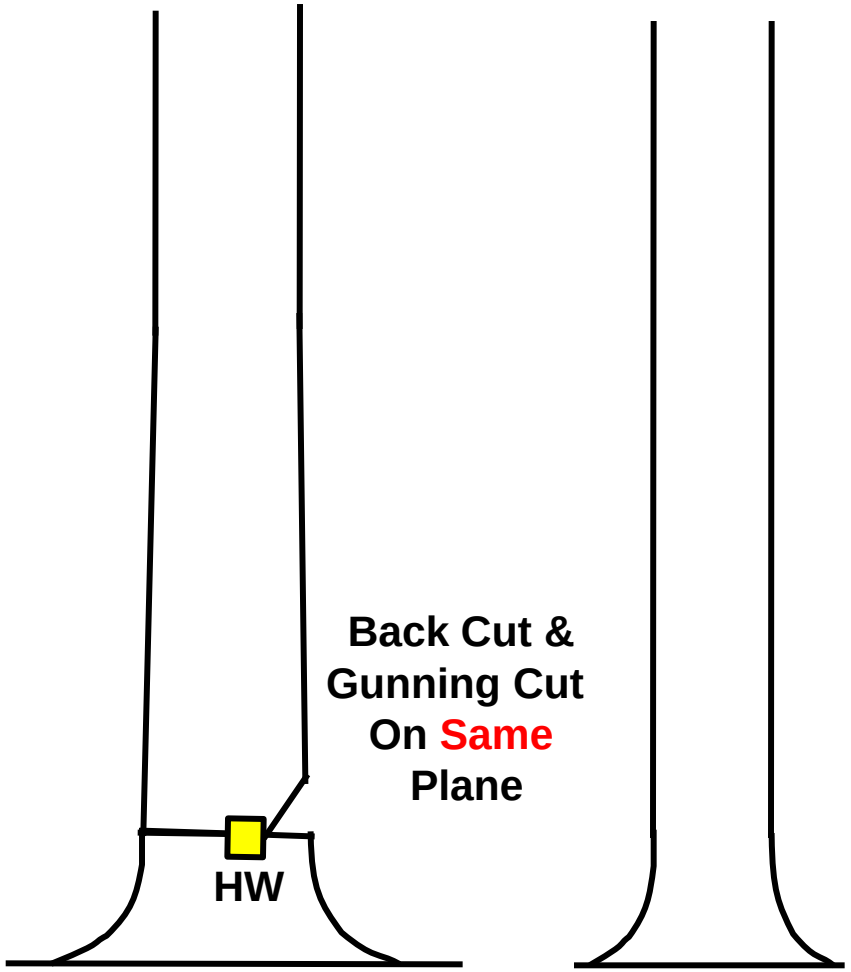


- Height of holding wood -- stump shot or anti-kickback device
  - Prevents kickback from tree rotating about its center of mass
  - Prevents kickback when striking another tree in standing timber
- Width of holding wood – tree hinged to the stump while falling
  - Controls the direction and fall of the tree
  - Without holding wood the tree is unguided during the fall
- Holding wood severed when the two face cuts meet
  - Face should not close until the tree
    - Fully committed to the fall
    - Falling in the desired direction
  - Improper facing (face cut too shallow, etc.)
    - Holding wood breaks early (unguided fall)
    - Loss of tree placement control

Significance of Stump Shot

View One of Five



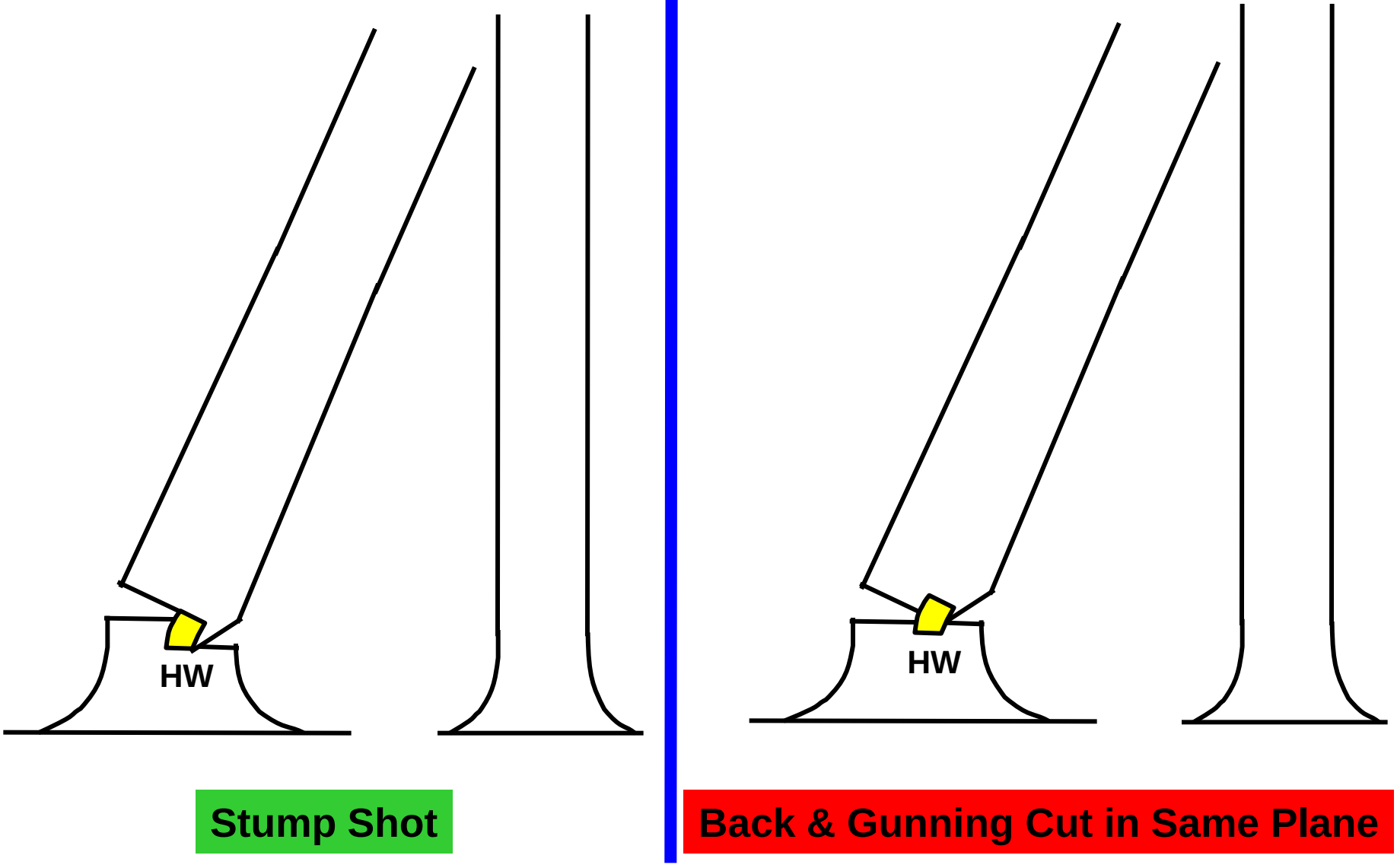


Stump Shot

Back & Gunning Cut in Same Plane

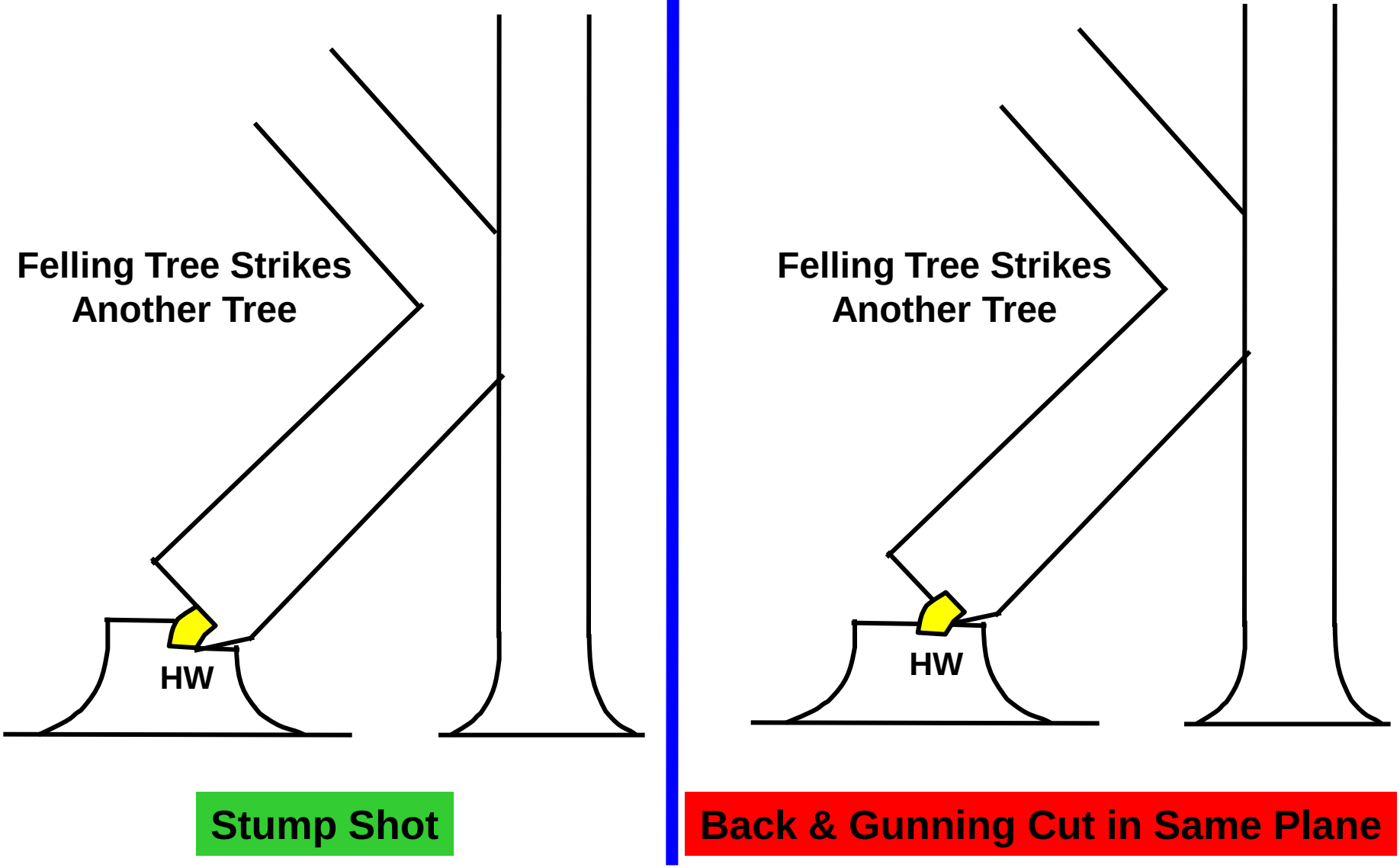
Significance of Stump Shot

View Two of Five



Significance of Stump Shot

View Three of Five

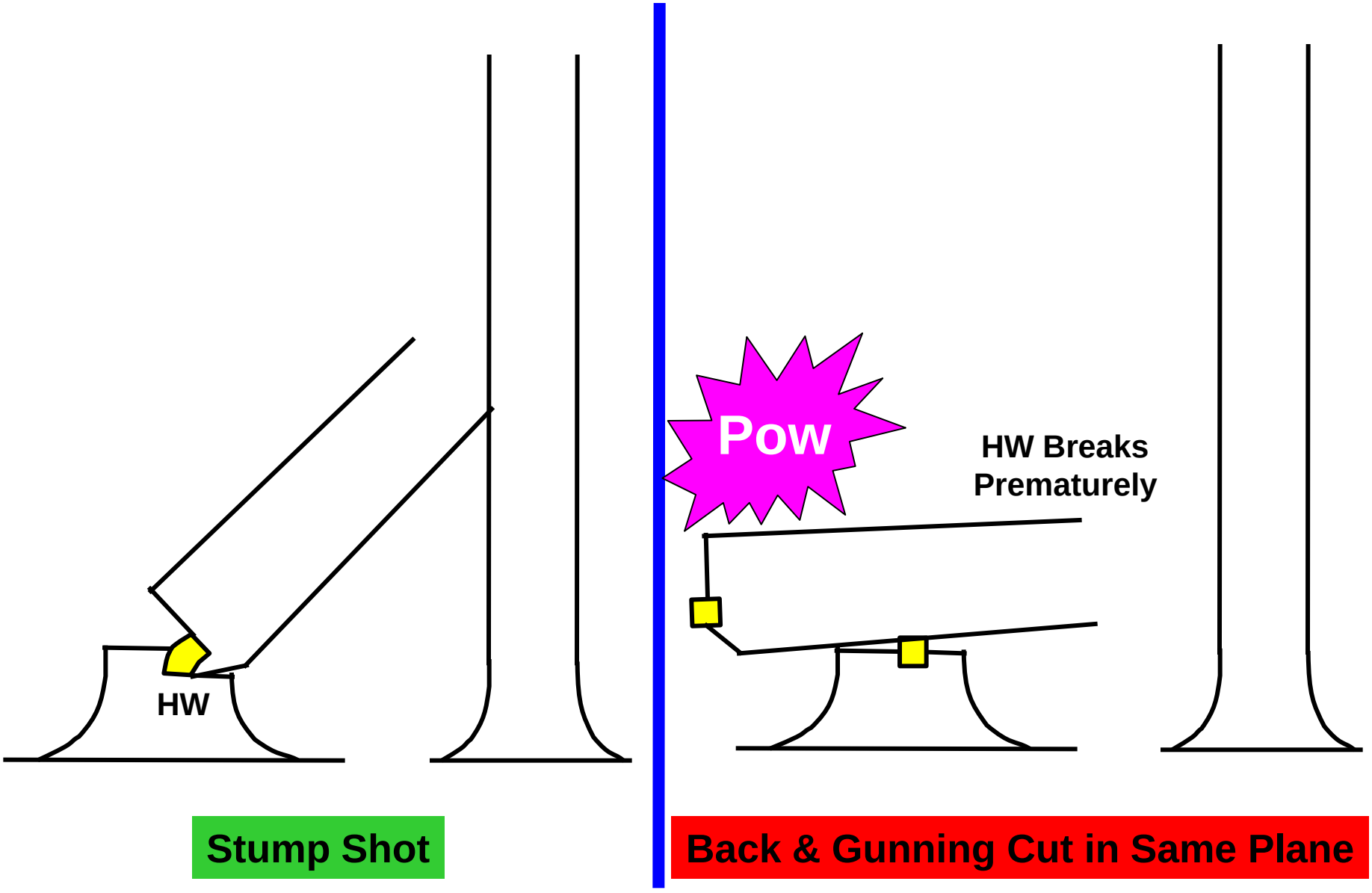


Stump Shot

Back & Gunning Cut in Same Plane

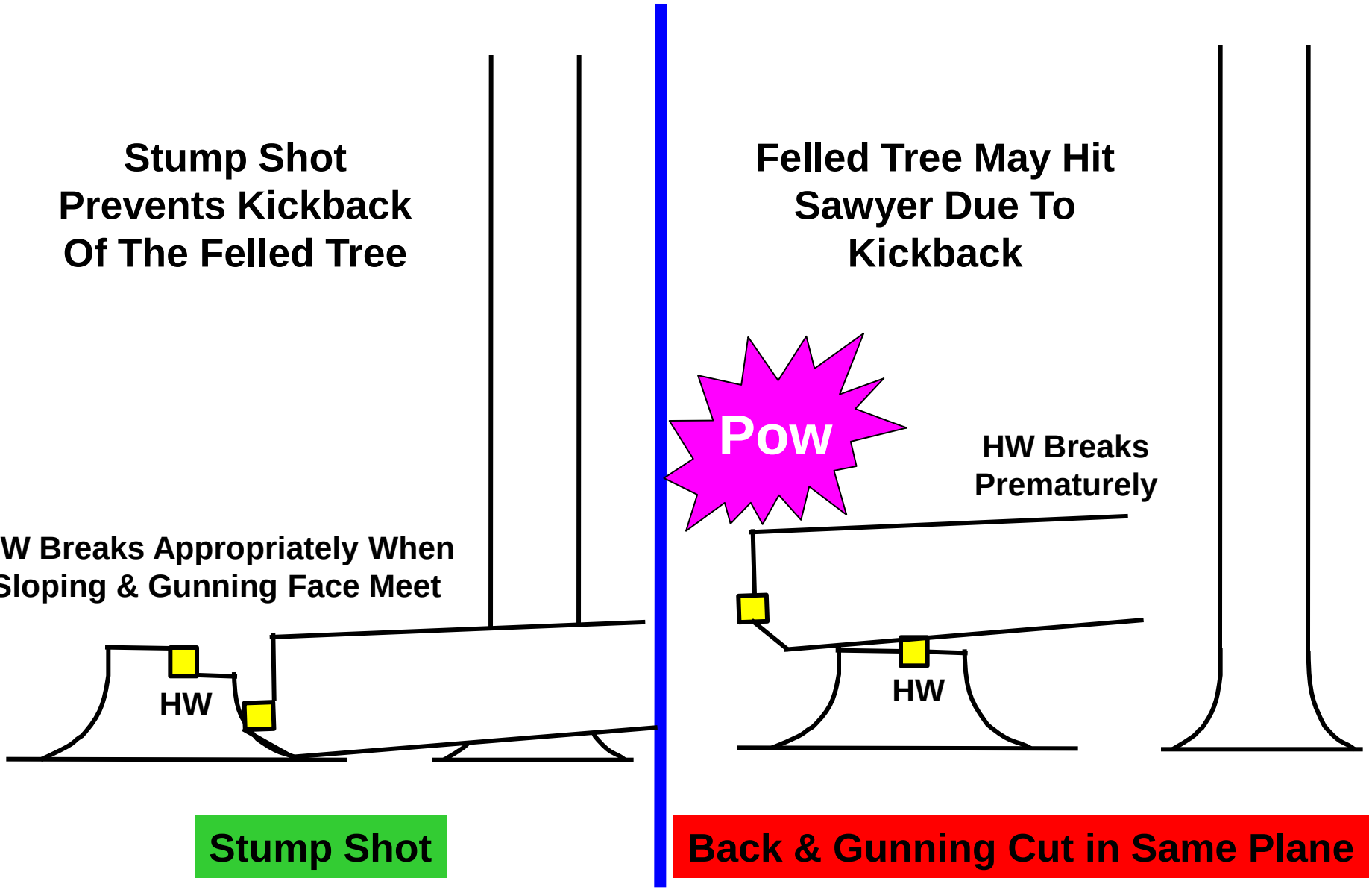
Significance of Stump Shot

View Four of Five

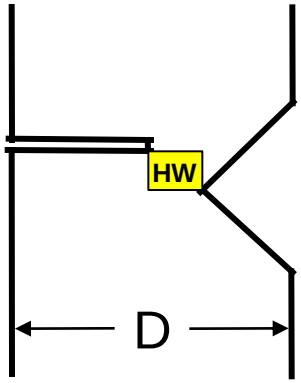


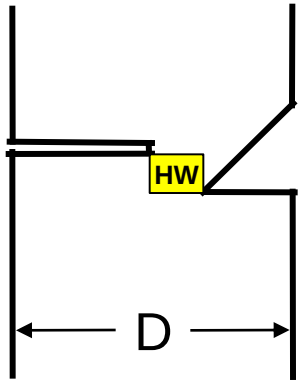
Significance of Stump Shot

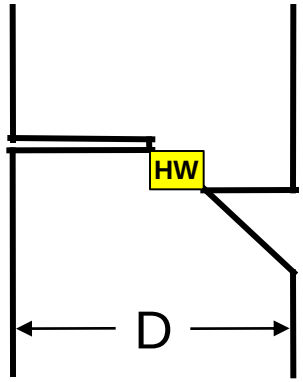
View Five of Five



Three Kinds of Faces



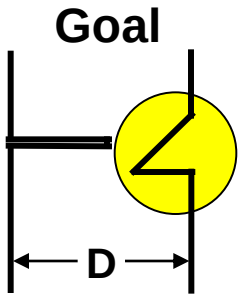




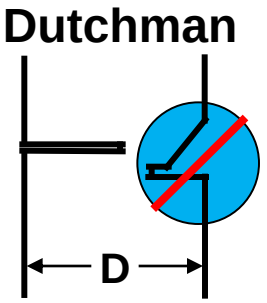
	Open Face	Conventional Face	Humboldt Face
Total Angle	70º to 90º	45º	45º
Depth	1/3 of D	1/3 of D	1/3 of D
Face Closure	Tree Hits Ground	Middle of Fall	Middle of Fall
Back Cut	2-5 inches Above Face Intersection	2-5 inches Above Gunning Cut	2-5 inches Above Gunning Cut
Comments	Greatest Control Provided by Hinge Wood	Greatest Accuracy in Constructing the Face Cuts	Greatest Saving of Lumber

Facing The Tree

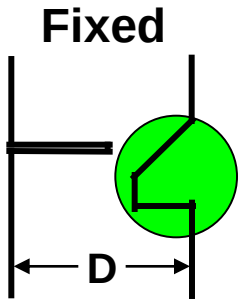
(Conventional Face Cut)



- Always mark the location of holding wood before making face cuts!

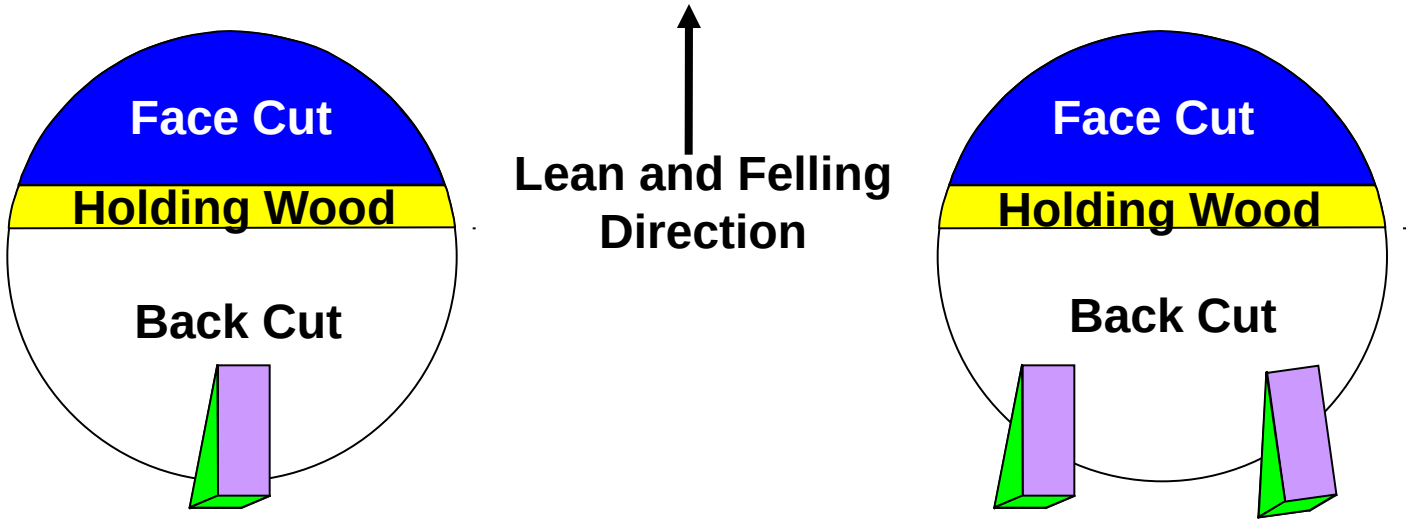


- Sloping cut
  - Sloping cut is at a 45º angle to the horizontal (goal)
  - End with the saw blade horizontal
- Gunning cut
  - Set your dogs on the bottom-face corner of the rectangle
  - Make the gunning cut (dictates the direction of tree fall)
  - Difficult to make the gunning and sloping cut meet
    - Sight down the kerf of the sloping cut
    - Set a straight stick out of the kerf to sight



- Check
  - The sloping and gunning cuts must not overlap (Dutchman)
  - Re-cut the sloping cut to correct misalignment
  - The face cuts must be cleaned out to prevent premature face closure
  - Verify that the re-cuts do not alter the felling direction
  - If the re-cuts will cause the face to extend too far into the tree, end the sloping cut directly over the gunning cut (fixed)

Back Cut With A Slight Lean in the Felling Direction

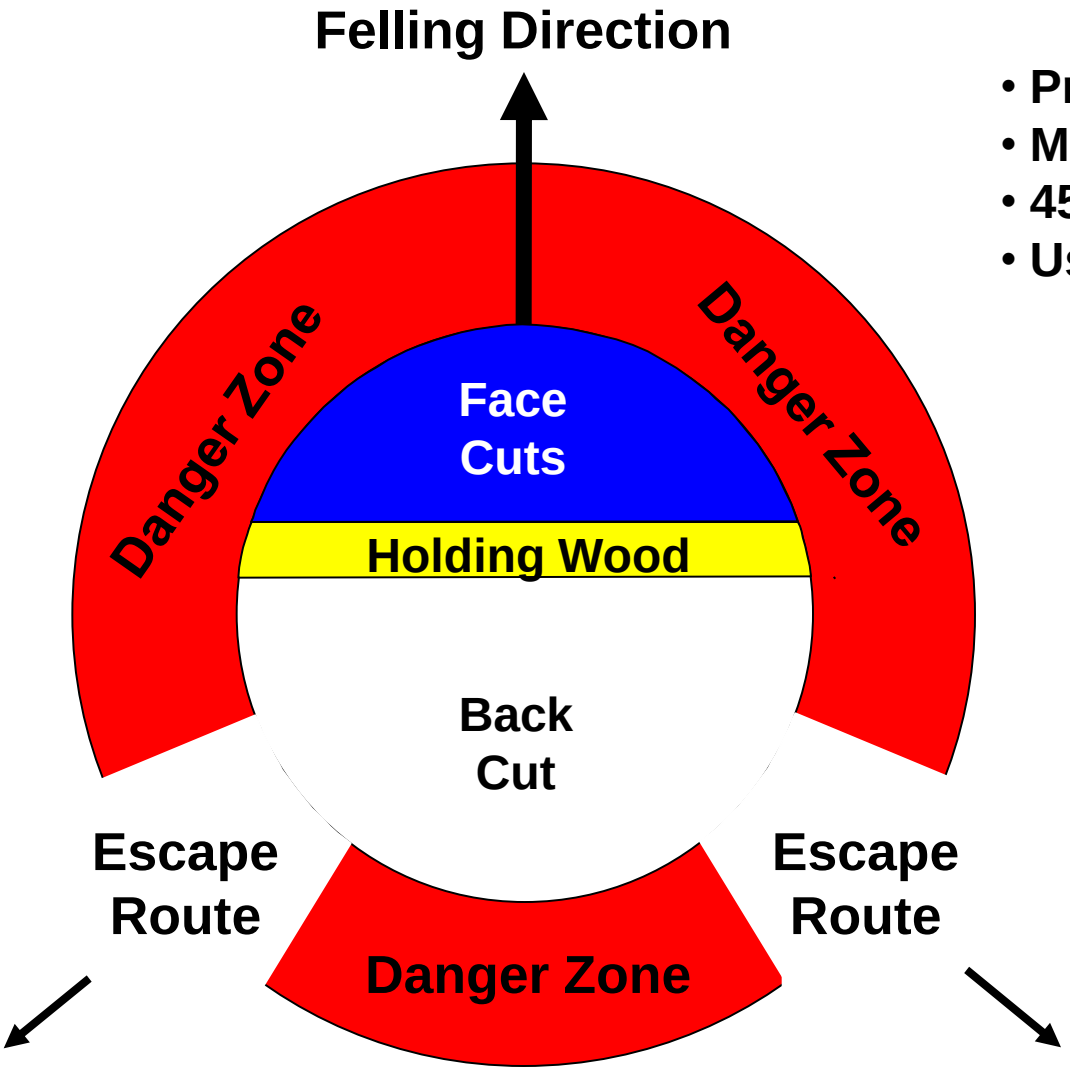


Wind Reduces Stability

Stable Configuration

- Back cuts 2-5 inches above and parallel to the gunning face cuts
- Remove bark around wedges to improve lifting effectiveness
- A single wedge with wind can sever holding wood (rocking action)
- Do not drive the wedges hard (create heavy leaner)
- Every 3-6 inches of back cut re-tighten the wedges (use an ax)
- Wedges are used (in general) to prevent the tree from sit-back due to
  - Incorrect estimate of lean
  - Strong winds
  - Felling the tree in a different direction from the tree's natural lean

Escape Routes

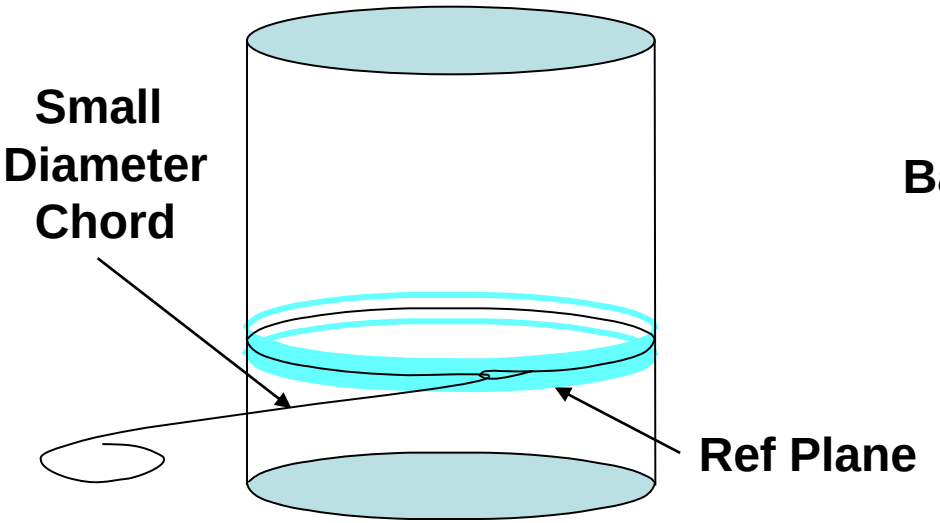


Escape Route

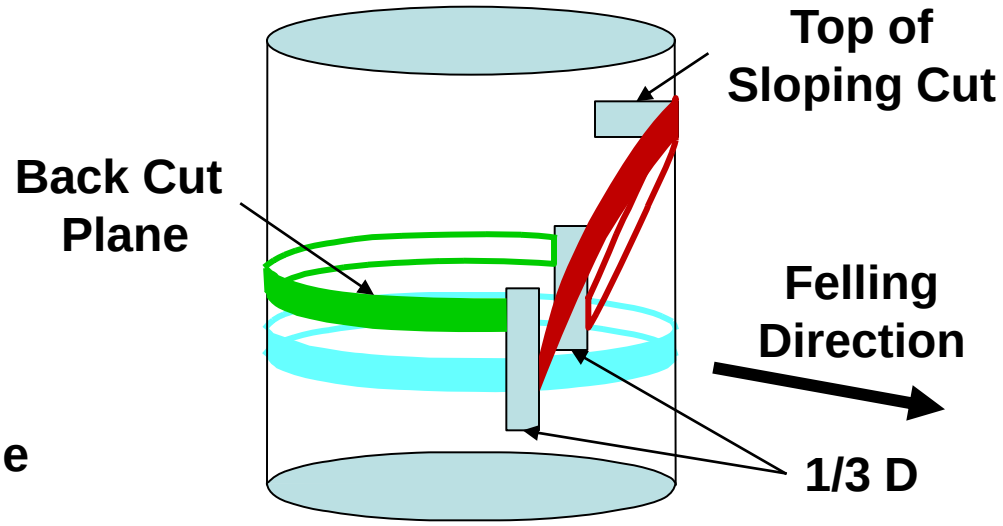
- Prepare two escape routes
- Minimum of 20 feet from stump
- 45º to the sides and back
- Use large tree or rock for protection

Never Attempt to Escape Directly Behind the Tree

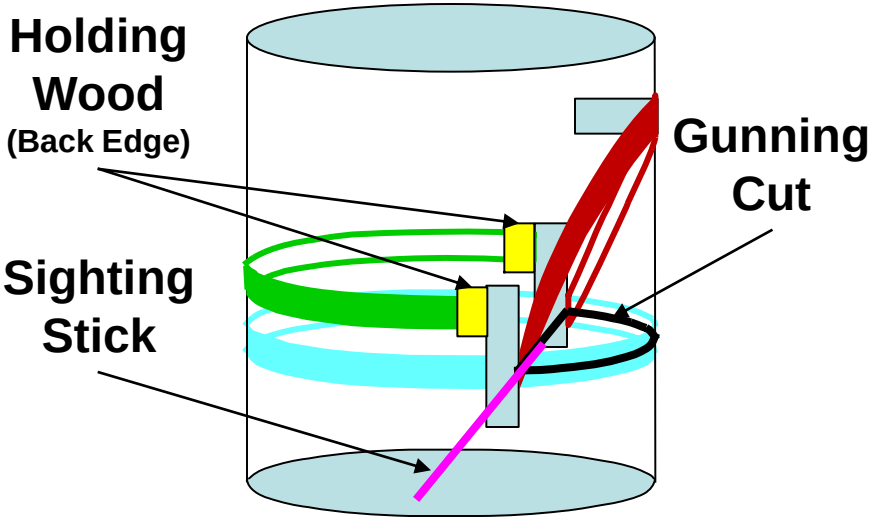
Markup Before Cutting



Mark Horizontal Plane



Mark 1/3 D, Sloping, & Back Cut Plane



Insert Sighting Stick Into Kerf

- Mark & paint horizontal ref plane
- Identify felling direction
- Mark 1/3 diameter edges
- Mark top of sloping cut
- Paint sloping cut (optional)
- Mark & paint horizontal back cut plane
- Mark sloping cut
- Make gunning cut
- Mark holding wood (back edge)
- Make back cuts

Felling The Tree

(Summarize)

- **Mark cut locations with surveyors' paint (visually plan felling approach)**
- **Face the tree (two planar cuts)**
  - **Select a face cut type: open, conventional, Humboldt**
  - **Always located on the desired felling direction side of the tree**
  - **Check face location with a horizontal line centered and perpendicular to the intersecting face cuts**
  - **Re-cut if necessary**
- **Execute the back cut (minimum of one cut)**
  - **Most are on the same plane**
  - **2-5 inches above the face intersection cuts (establish stump shot)**
  - **Maintain holding wood (hinge wood)**
  - **Use wedges, jacks, and special back cuts to correct for lean**

Outline

Felling in the Direction of Slight Lean

Facing Issues

Felling Difficult Trees

Improper Facing Issues

- **Barber-chair split**
  - **No face cuts (only back cut)**
  - **Kerf face (saw blade thickness)**
  - **Face cut < 1/3 the tree diameter**
- **Felling control lost**
  - **Dutchman cut across the entire face**
  - **Sloping and gunning angle too shallow**
- **Felling direction altered**
  - **Vertically angled face cut**
  - **Dutchman cut only on one side**
  - **Face not cleared out on one side**

No Face Cuts (Only Back Cut)

(Improper Facing – Barber-chair Split)

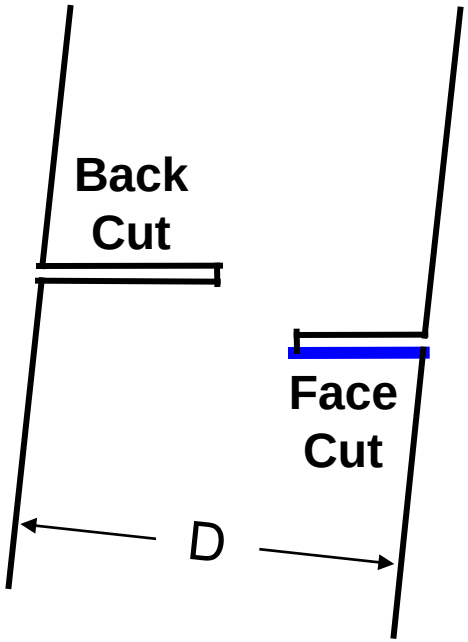
No Face Cuts **Barber-Chair Split**

- **The back cut progresses without facing**
- **Eventually the tree falls faster than the back cut progress**
- **Tree will always barber-chair split**
- **Tree kick back extremely dangerous to the sawyer**
- **Quality of the wood greatly reduced due to the vertical split**

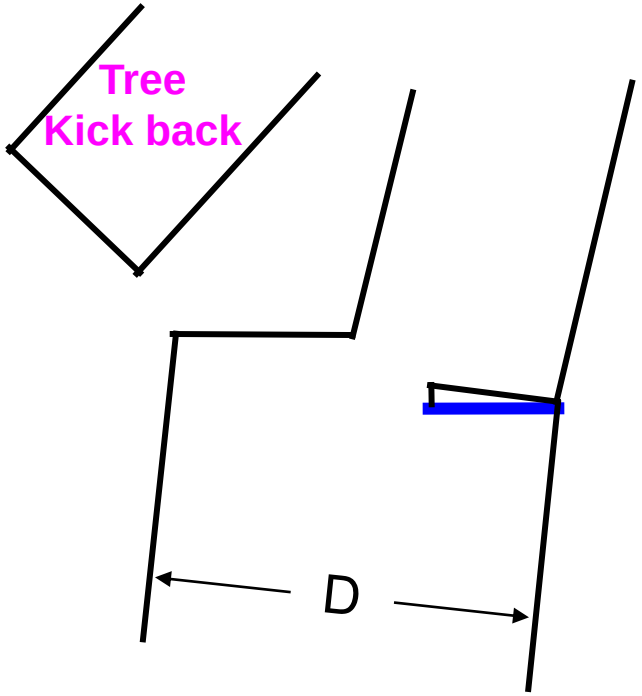
Any Tree Can Be Felled Without Facing – Costly And Dangerous

Kerf Face (Saw Blade Thick)

(Improper Facing – Barber-chair Split)



Shallow Face Cut

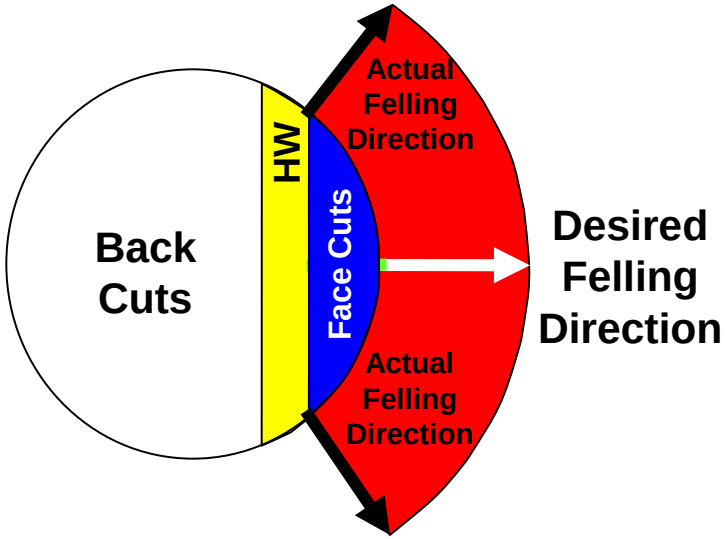


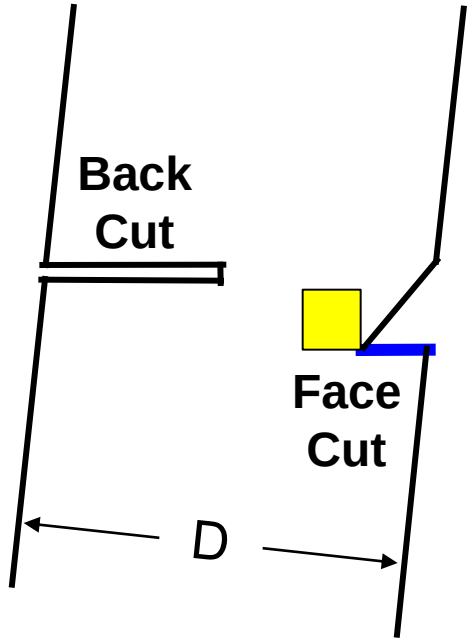
Barber-Chair Split

- **Face closes quickly**
- **Tree falls much faster than the back cut progress**
- **Tree will always barber-chair split**
- **Tree kick back extremely dangerous to the sawyer**
- **Quality of the wood greatly reduced due to the vertical split**

Face Cut < 1/3 The Tree Diameter

(Improper Facing – Barber-chair Split)



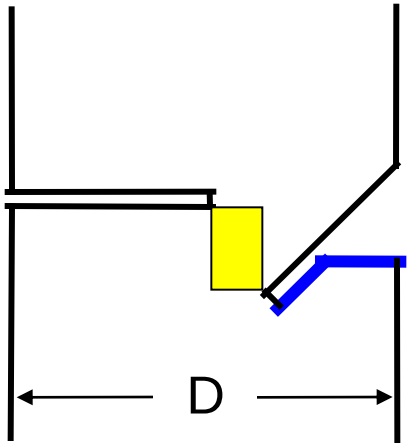


Facing Cut Too Shallow

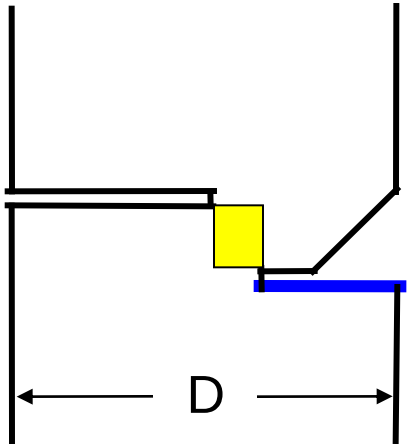
- **Small face opening is ineffective at directing the tree**
- **Holding wood is either broken or torn out**
- **Loss of control early in the felling process**
- **Tree likely to barber-chair**

Dutchman Cut Across The Entire Face

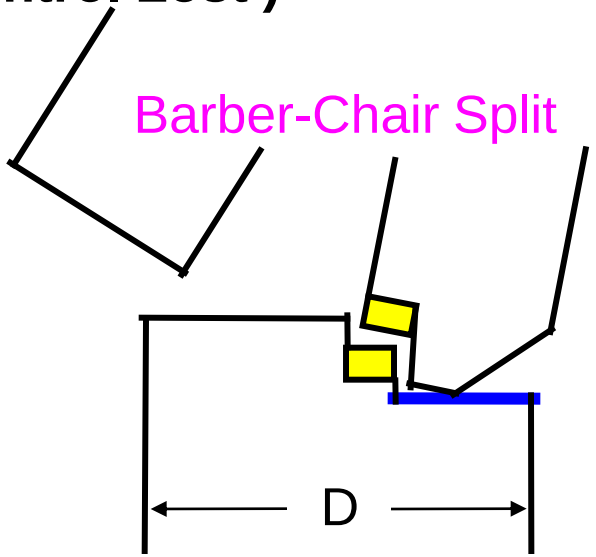
(Improper Facing – Felling Control Lost)



Sloping Face Dutchman



Gunning Face Dutchman

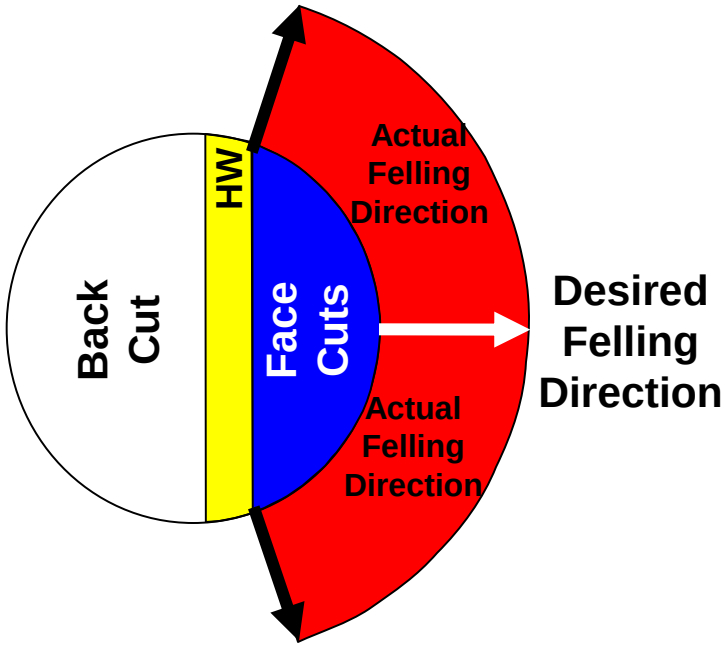


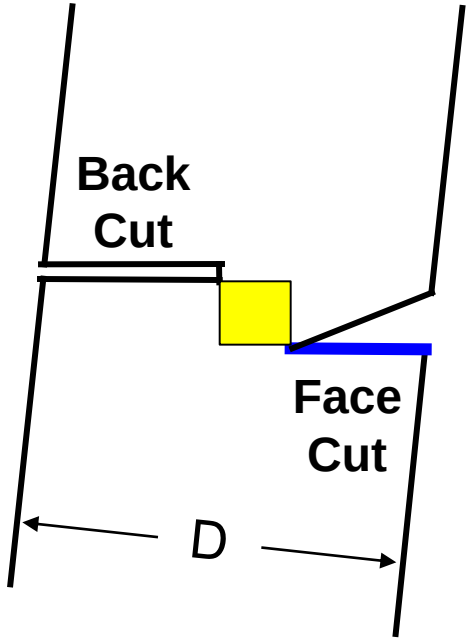
Result of the Dutchman

- **Dutchman definition**
  - **One of the face cuts extends beyond the other face cut**
  - **Face within a face**
- **Dutchman tree felling mechanics**
  - **Dutchman closes**
    - **Tree splits vertically (barber-chair)**

Sloping & Gunning Angle Too Shallow

(Improper Facing – Felling Control Lost)



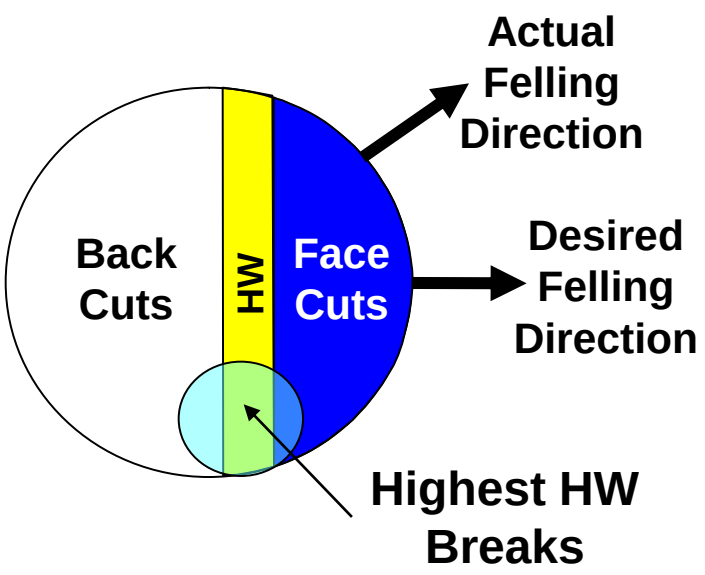


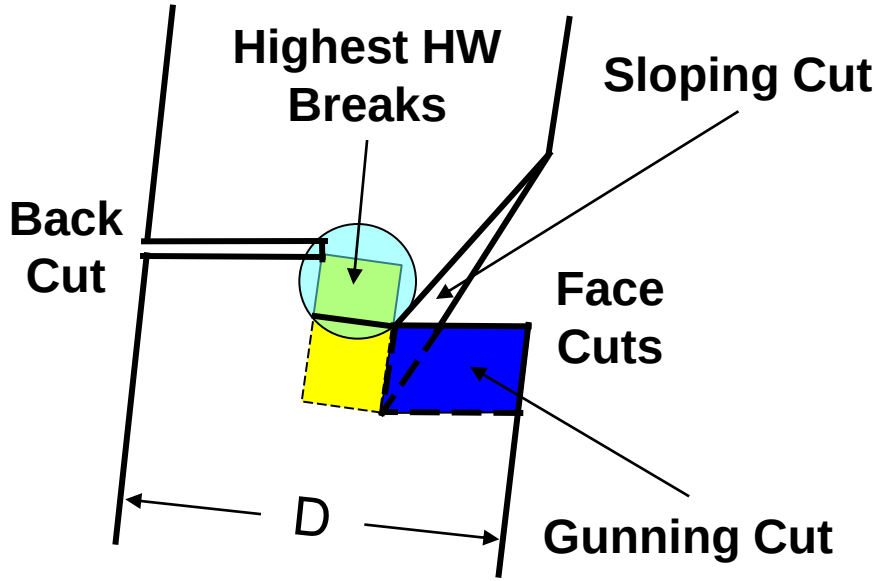
Facing Angle Too Small

- **Face closes prematurely**
- **HW is broken or barber-chair (very similar to a Dutchman cut)**
- **Tree could jump off of the stump when HW is broken**
- **Loss of control early in the felling process**

Vertically Angled Face Cut

(Improper Facing – Felling Direction Altered)



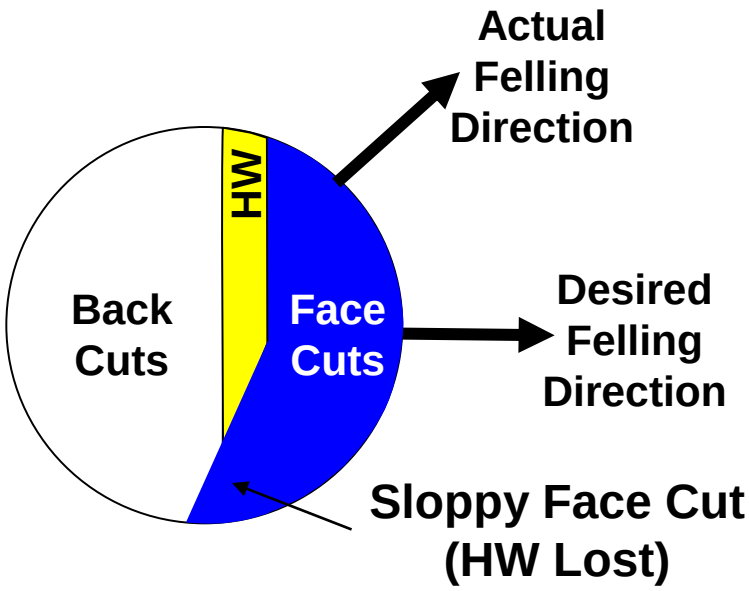


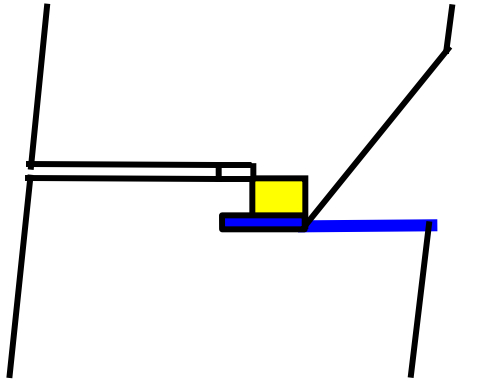
Sloped Face Cuts

- The highest part of the face closes first
  - Pivots the tree toward the open part of the face
  - The highest HW breaks behind the closed faces
- The HW behind the lower part of the face
  - Continues to hold
  - Pulls the tree to the longer HW
- Loss of felling control

Dutchman Cut Only On One Side

(Improper Facing – Felling Direction Altered)



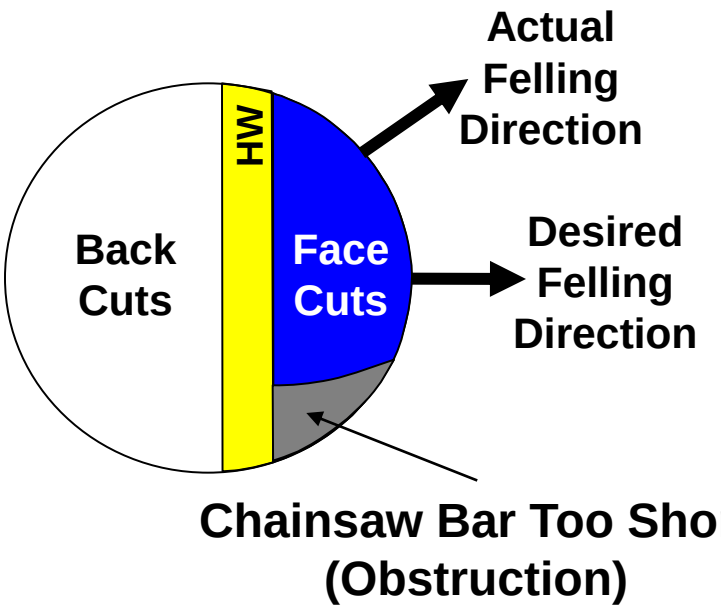


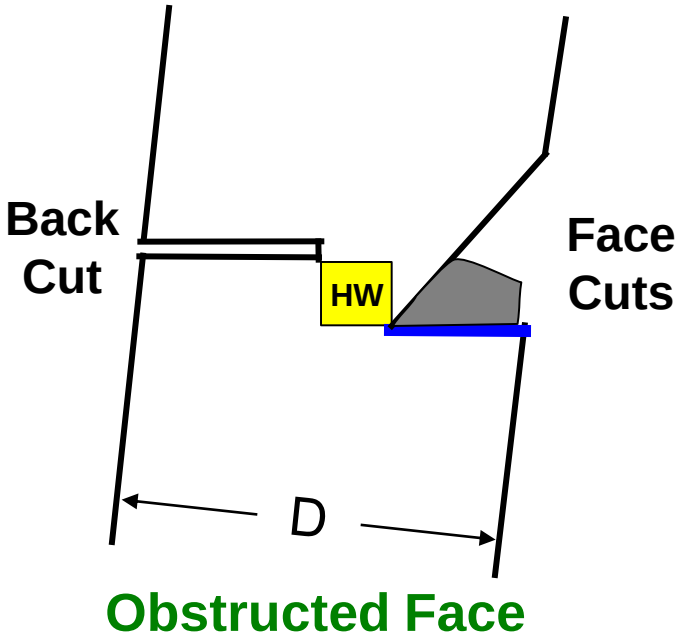
HW Cut On One Side

- **Felling process unconstrained by the side of the tree with no HW**
- **The HW side of the tree secures the tree to the stump**
  - **Pulls (pivots) the tree to the HW side of the tree**
  - **HW is eventually broken when the face cuts close**
- **Tree does not fall in the desired direction (loss of felling control)**
- **Used for felling trees in a direction different from natural lean**
  - **Concept behind swing Dutchman**

Face Not Cleared Out On One Side

(Improper Facing – Felling Direction Altered)





- One side of the face closes on the obstruction
- The hw behind the obstruction is broken
- The HW on the other side of the tree pulls the tree in that direction
- But tree does not fall in the desired direction (loss of felling control)
- Used for felling trees in a direction different form natural lean
  - Concept behind step Dutchman

Outline

Felling in the Direction of Slight Lean

Facing Issues

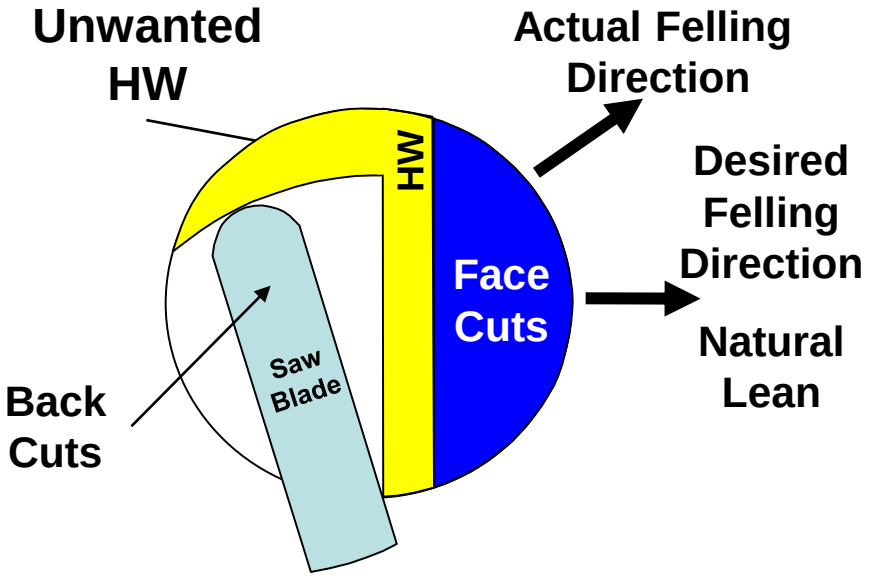
Felling Difficult Trees

Significance of Tree Diameter

Moderate To Large Diameter Trees

Chainsaw bar too short to reach completely across the stump

Difficult to execute back cut fast enough to prevent loss of control or barber-chair

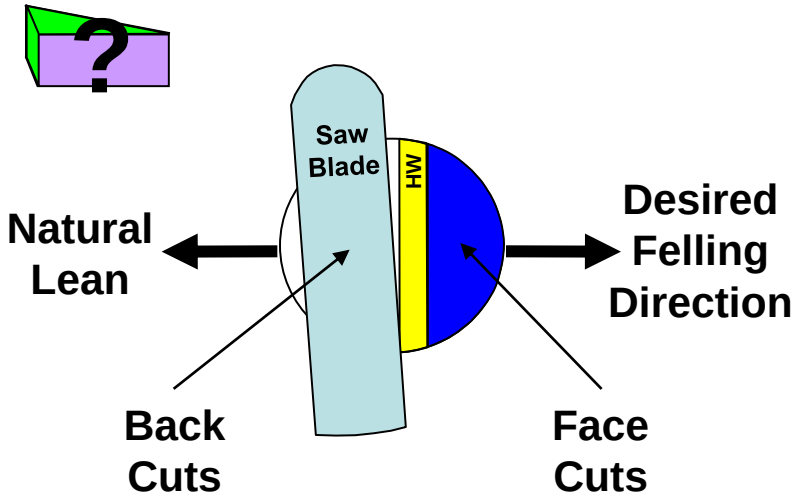


Chainsaw Blade Too Short

Small Diameter Trees

Not enough room for chainsaw bar and wedges in the kerf

Difficult to prevent sit-back



No Room For Wedges

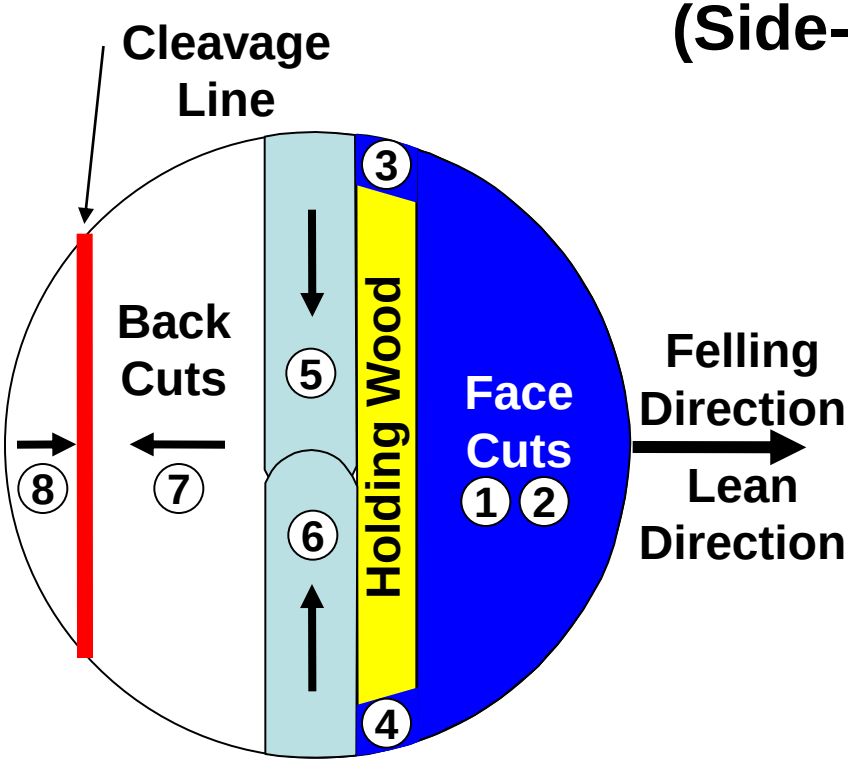
Felling Difficult Trees

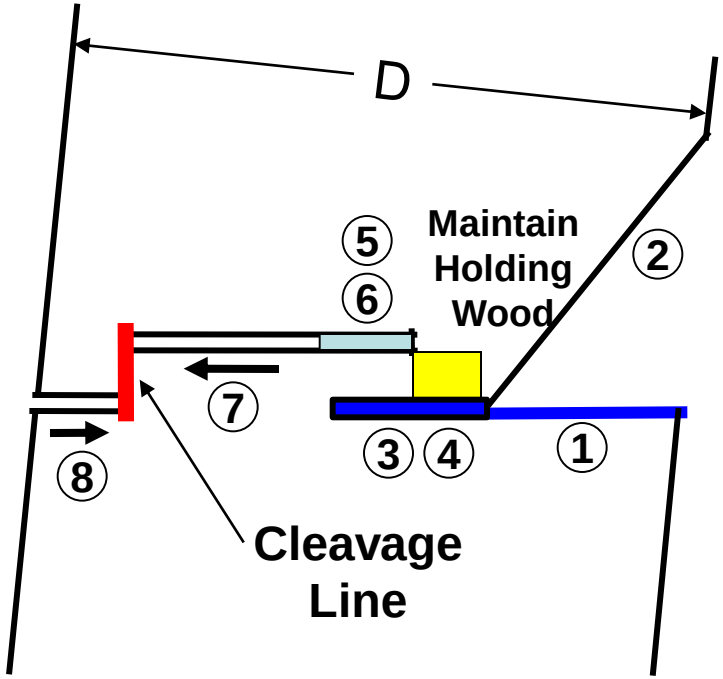
(Moderate to Large Diameter)

- Head Lean Heavy
- Opposite of Head Lean Slight
- Opposite of Head Lean Heavy

Head Lean Heavy

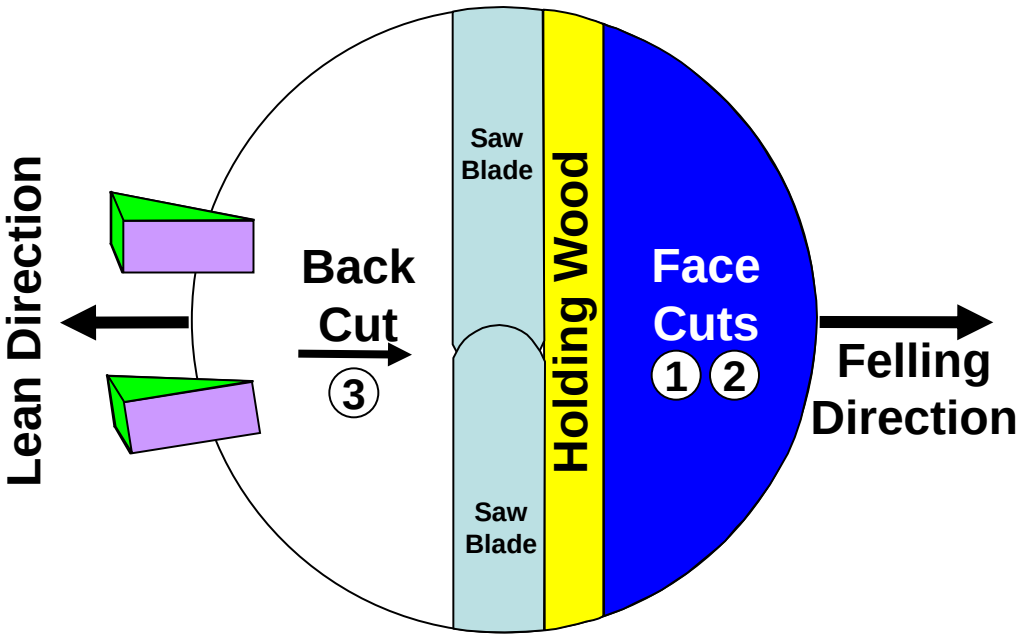
(Side-boring)

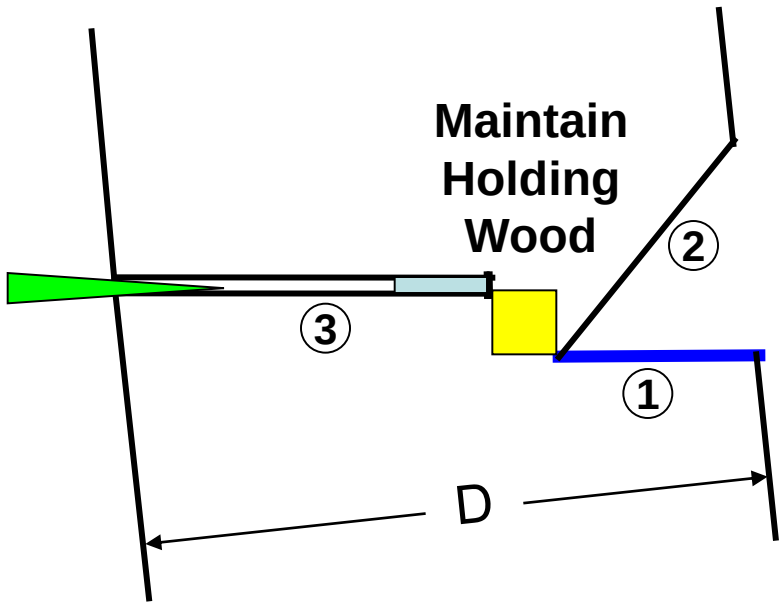




- Face the tree in the felling direction (1 & 2)
- Clip outside holding wood on each side to prevent side scarring (3 & 4)
- Bar is pushed straight in on both sides (5 & 6) (leave holding wood)
- Continue the back cut in the opposite direction of the face (7)
  - Stop the back cut short of the tree falling
  - Remove the saw blade before the back wood is severed
- The trigger cut (8) (made in the felling direction)
  - Releases the tree to fall without pinching the saw blade
  - Allows sawyer and saw blade to readily escape the falling tree

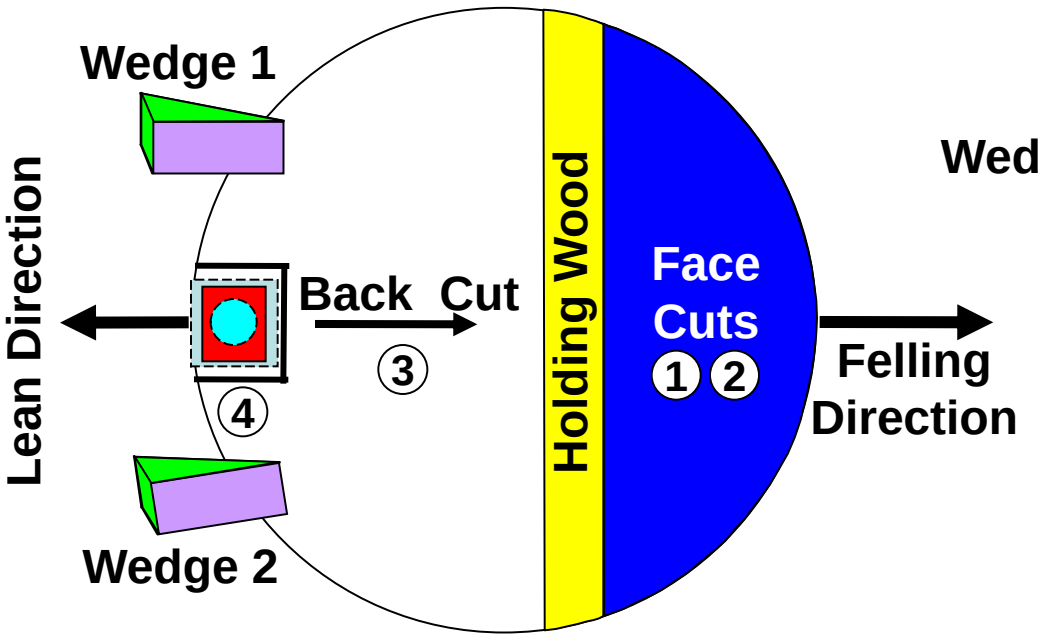
Opposite of Head Lean Slight

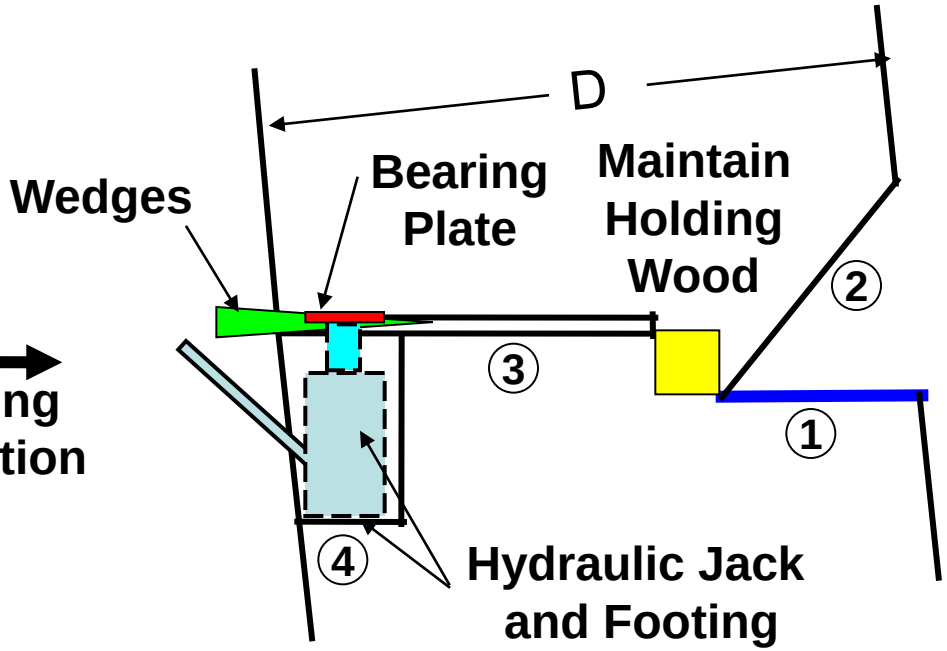




- Face the tree in the felling direction (1 & 2)
- Start the back cut (3)
- Insert two wedges when room is available
- Remove bark around the wedges to improve lifting efficiency
- Drive wedges alternatively until they are tight
- Re-tighten the wedges every 3-6 inches of back cut
- Continue the process until tree tips forward (do not cut holding wood)

Opposite of Head Lean Heavy





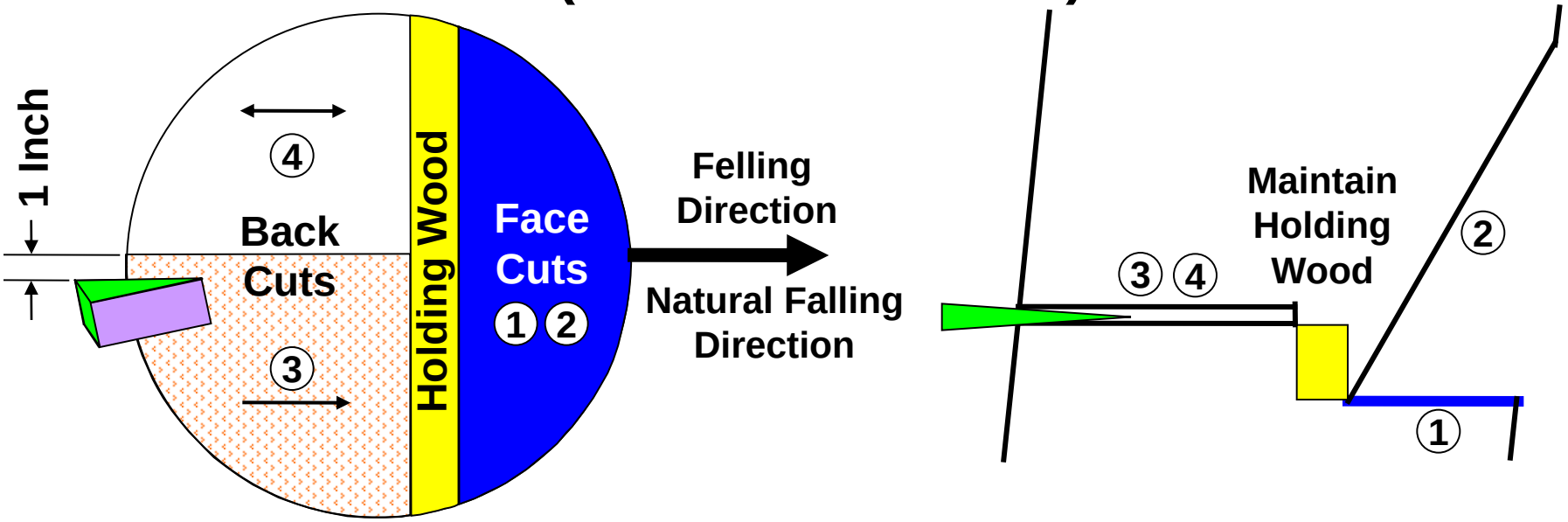
- Face the tree in the felling direction (1 & 2)
- Start the back cut (3)
- Cut the hydraulic jack footing (4) (measure down from the back cut)
- Remove bark around the wedge locations to improve lifting efficiency
- Insert hydraulic jack with bearing plate & two wedges for lifting stability
- Raise the jack and re-tighten the wedges (every 3-6 inches of back cut)
- Multiple jacks may be necessary (always use wedges for stability)
- Continue the process until tree tips forward (do not cut holding wood)

Felling Small Diameter Trees

- **Head Lean**
  - **Divided back cut**
- **Opposite Head Lean**
  - **Back cut first**
- **Head or Back Lean**
  - **Slot through holding wood**

Head Lean -- Small Diameter Tree

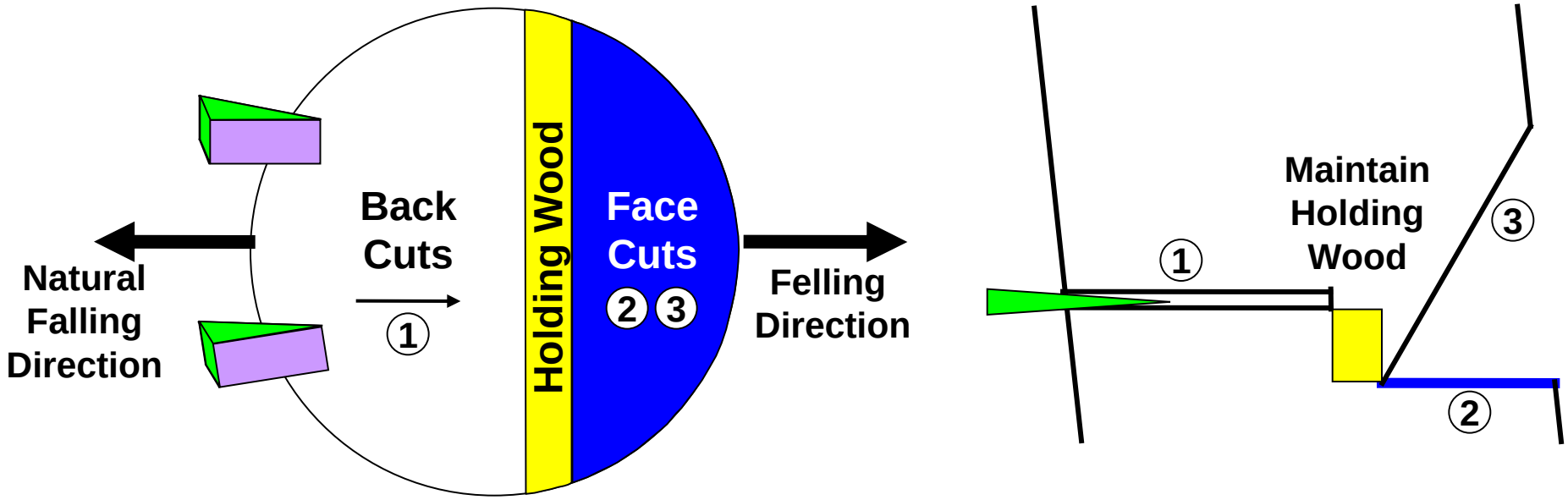
(Divided Back Cut)



- Face the tree in the felling direction (1 & 2)
- Cut half of the total back cut (3)
  - Watch out for saw kickback
  - Maintain holding wood (HW)
- Place a small wedge in the kerf
  - Located at least one inch from the remaining back cut
  - Wedge will prevent the tree from setting back (wind)
- Finish with back cut (4) (watch out for saw kickback and maintain HW)
  - Head lean slight – normal back cut (back of tree to HW)
  - Head lean heavy – side-boring back cut (HW to back of tree)

Opposite Head Lean -- Small Diameter Tree

(Back Cut First)

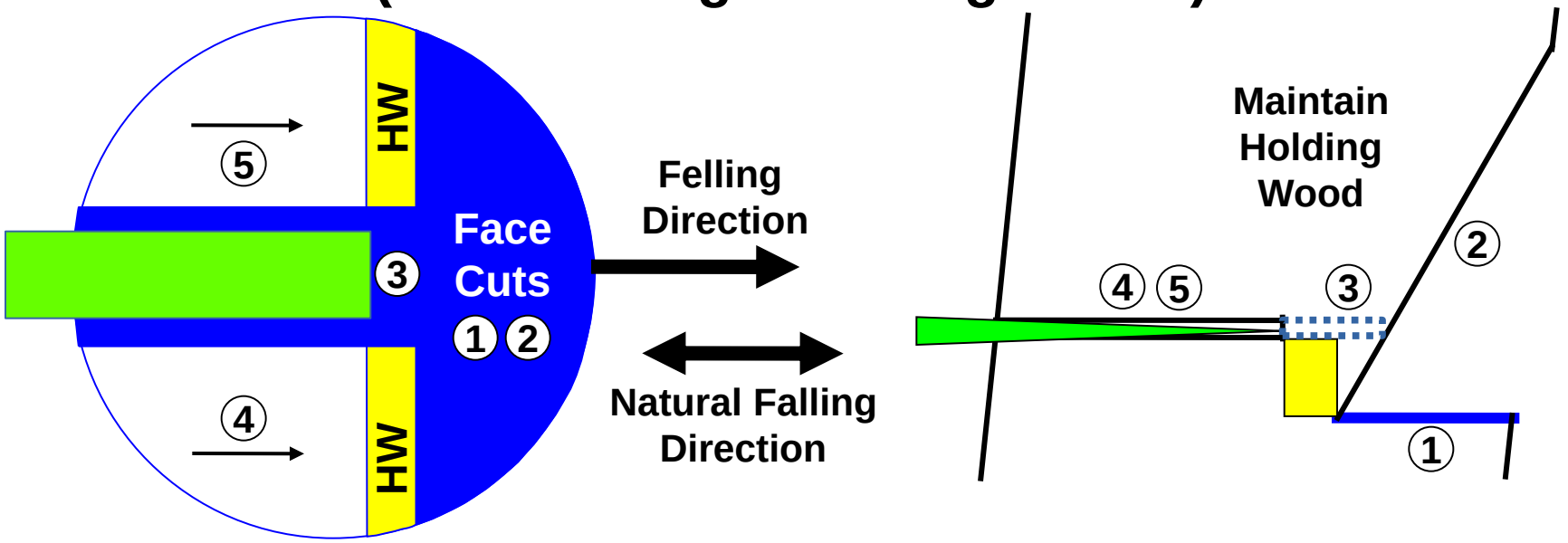


The Order Of The Cuts Is Different, But The Theory Is The Same

- Complete the back cut first (1)
  - Not enough space available for both the saw blade and wedges
  - Maintain holding wood (HW)
- Insert two wedges into the kerf and drive them in tight
- Complete the face cuts (2 & 3)
- Alternately drive the wedges until enough lift is achieved to fell the tree

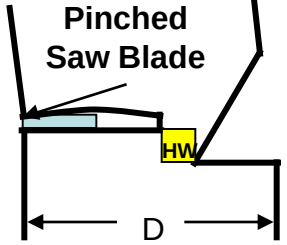
Slight Head or Back Lean

(Slot Through Holding Wood)



- **Face the tree in the felling direction (1 & 2)**
- **Cut slot through center holding wood to place wedge (3)**
  - **Top of holding wood**
  - **Bottom of holding wood**

Tree Sit-Back



Tree shifts in an unexpected direction

Proper cutting techniques almost always eliminate sit-backs

- Use wedges at the earliest possible moment during the back cut
    - If the tree sits back wedges prevent the bar from being pinched
    - Holding wood prevents the tree from falling backwards
- If chain saw bar becomes pinched (continue with an alternate chain saw)

Solutions to the sit-back (assume wedges were used)

- Attempt to lift the tree with wedges
    - Chop bark away from wedges to improve lifting efficiency
    - Alternate between two or more wedges to accelerate the process
- Use a driving tree (sit-back tree may fall in any direction)
- Reface the sit-back tree in the direction of lean
    - Second face located
        - One tree diameter above the first face
        - In the direction of lean
    - Only fell a sit-back in the direction of lean
- Get help (heavy equipment, explosives, etc.)

Conclusions

- **Always be willing and able to walk away after assessing the tree's lean, quality of holding wood, felling difficulty, and risk to people or property**

- **Perform a postmortem on the stump of each felled tree to evaluate what went right and what went wrong**

- **Choose a back cut type consistent with the length and width of the chainsaw bar**

- **Mark up the tree in accordance with lean and falling direction like an artist marks up a canvas before painting**

- **Through understanding of the principles associated with holding wood, stump shot, and types of back cuts allow on-the-fly cutting modifications for additional constraints**

References

Jepson, Jeff; To Fell A Tree—A Complete Guide to Successful Tree Felling and Woodcutting Methods

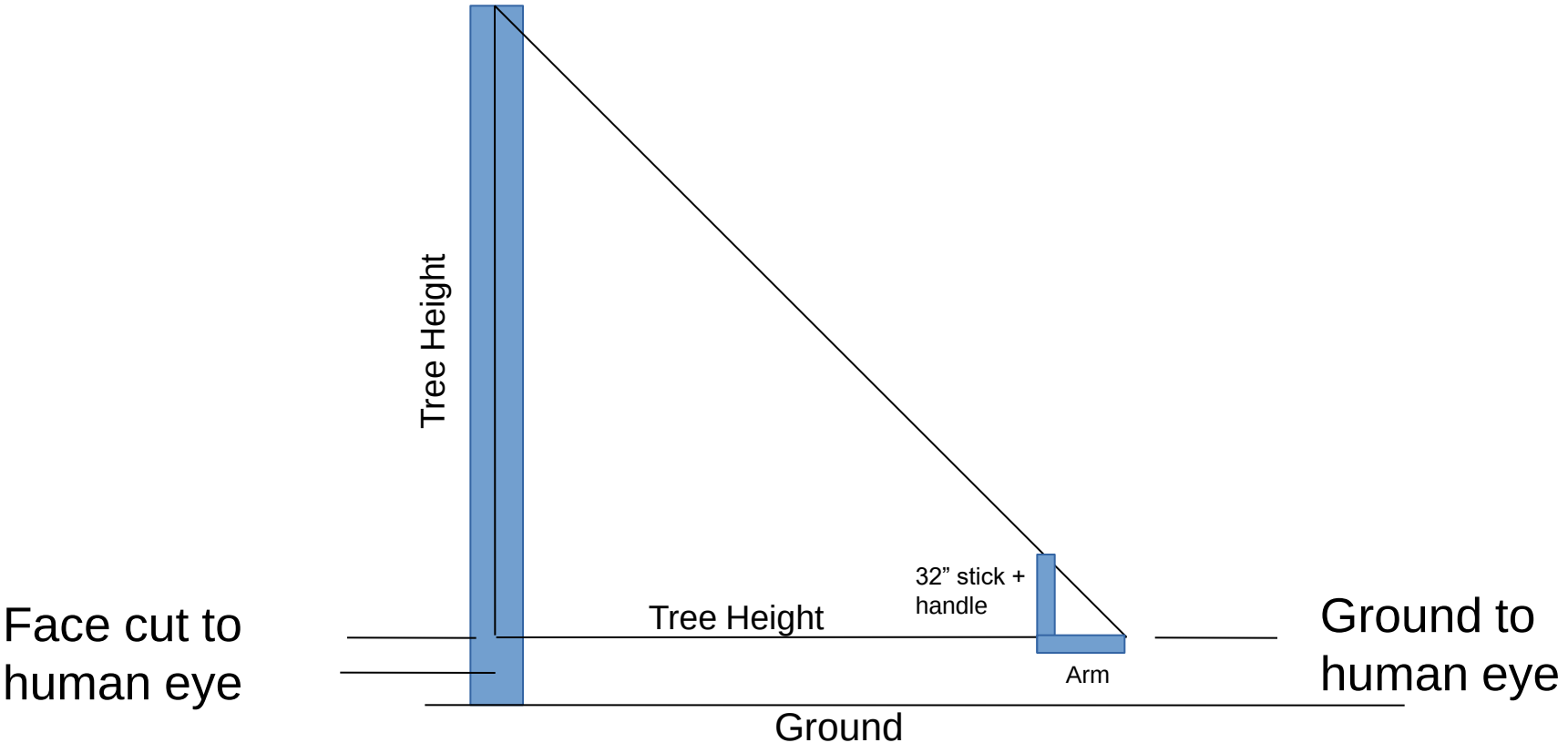
Dent, Douglas D., Professional Timber Falling (A Procedural Approach), 1974

http://www.osha.gov/SLTC/etools/logging/mainpage.html

National Wildfire Coordinating Group, Wildland Fire Chain Saws (S-212), 2004

Estimate Tree Height

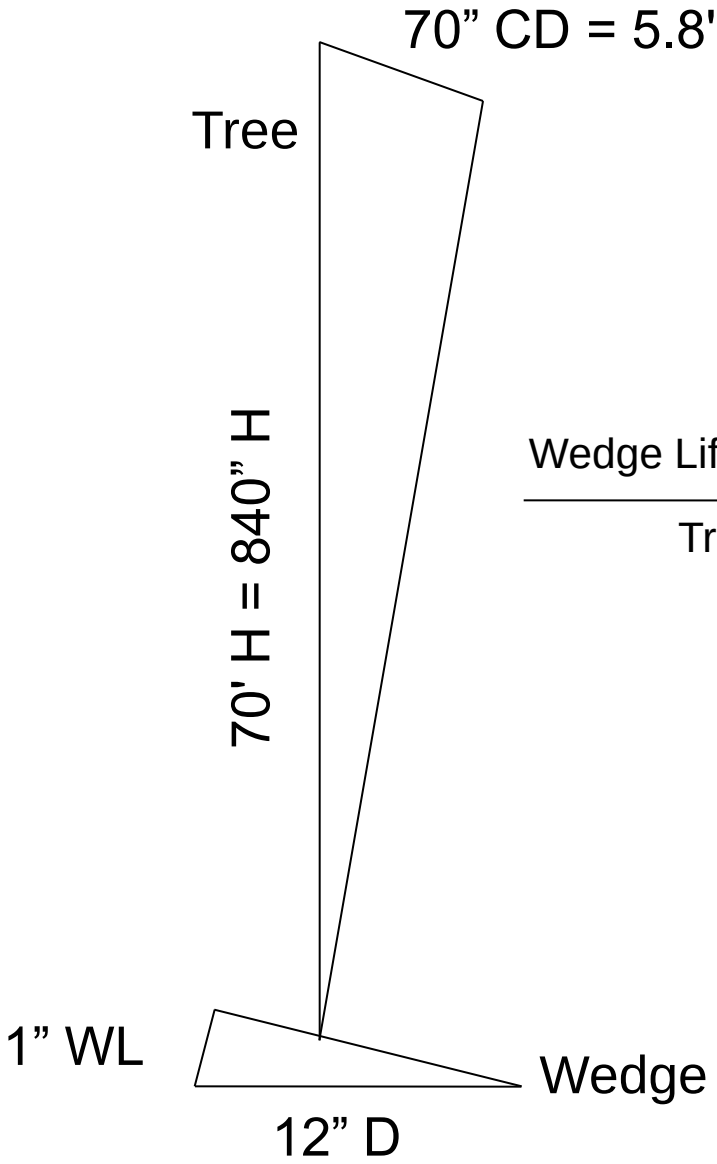
Utilizing Similar Triangles



Add distance from face cut to human eye

Estimate Crown Displacement

Utilizing Similar Triangles



$$\frac{\text{Wedge Lift (in) x Tree Height (in)}}{\text{Tree Diameter (in)}} = \text{Crown Displacement (in)}$$

$$\frac{\text{WL (in) x H (in)}}{\text{D (in)}} = \text{CD (in)}$$

$$\frac{\text{1 (in) x 840 (in)}}{\text{12 (in)}} = \text{70 (in) = 5.8 (ft)}$$