

A dramatic landscape featuring a large, billowing plume of orange and grey smoke or ash rising from a forest. The foreground is dominated by tall, thin, dead trees with bare branches, some showing signs of fire damage. A few living green trees are scattered throughout. The background shows a hazy, forested valley under a cloudy sky. The overall scene suggests a wildfire or volcanic eruption.

# Fuel's Measurement Techniques



# Unit 2

# Objectives

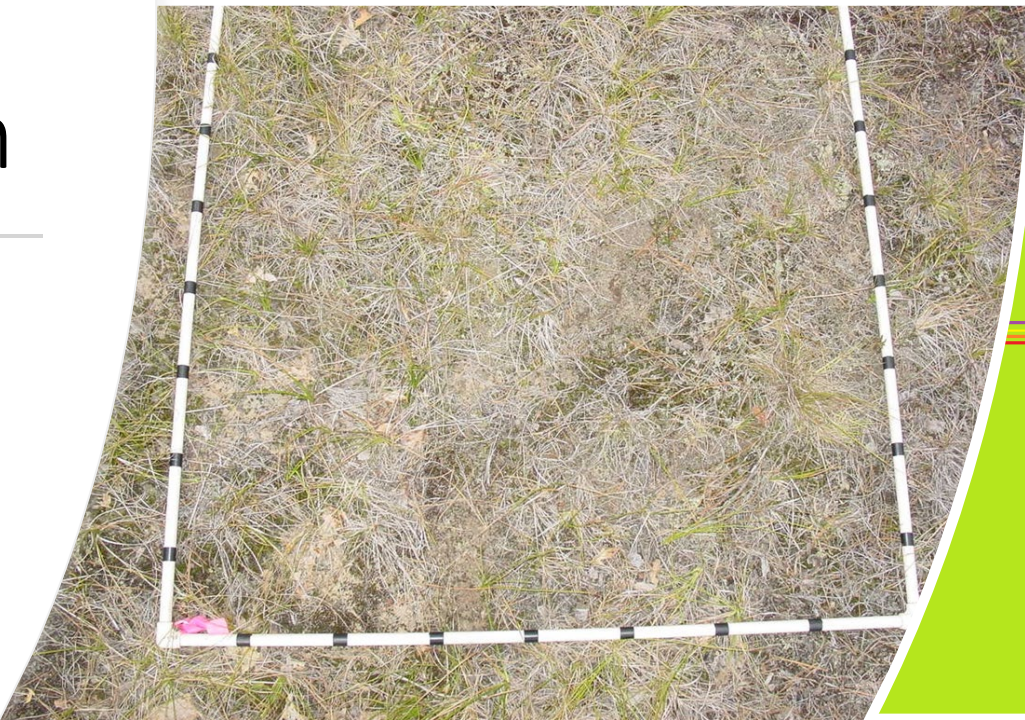
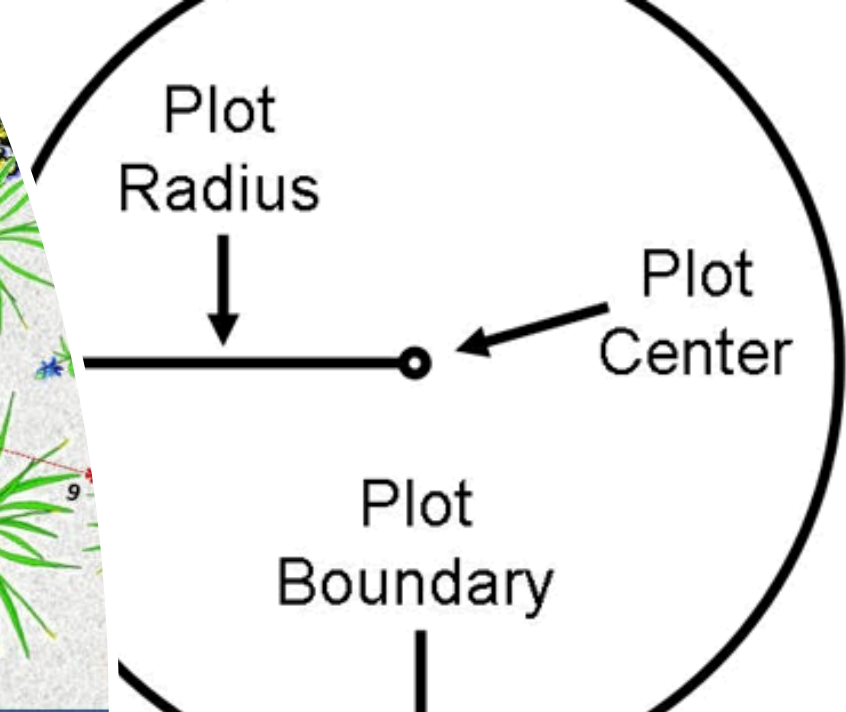
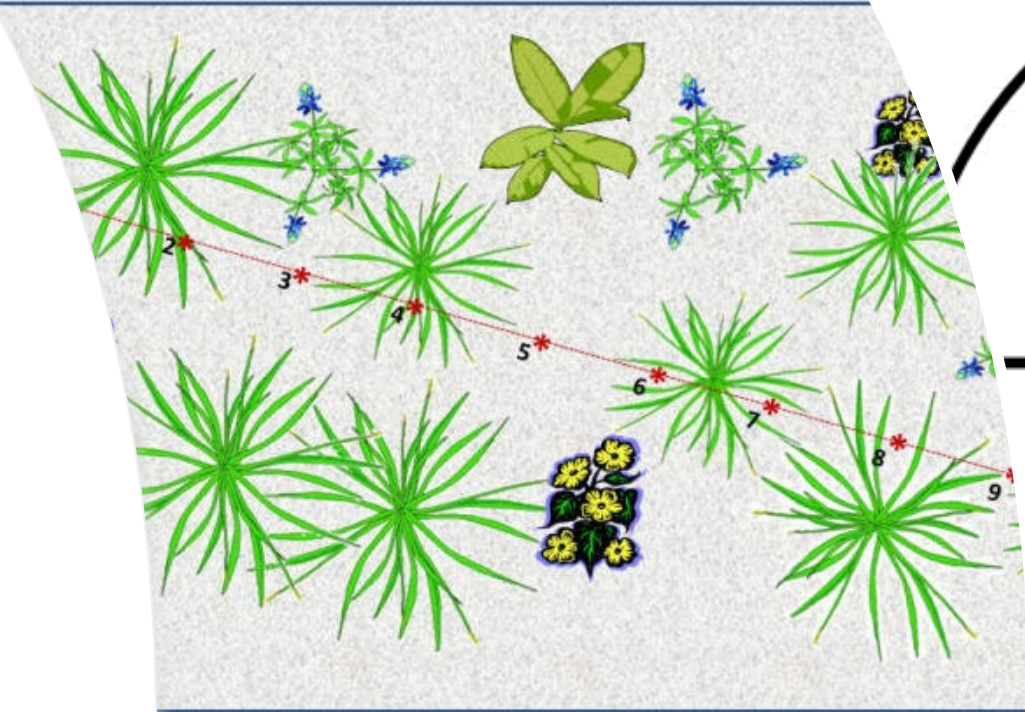
There are endless ways to design your fuels plots.

- Plot and transect design.
  - Plot establishment and Scheduling
  - Examples
- 

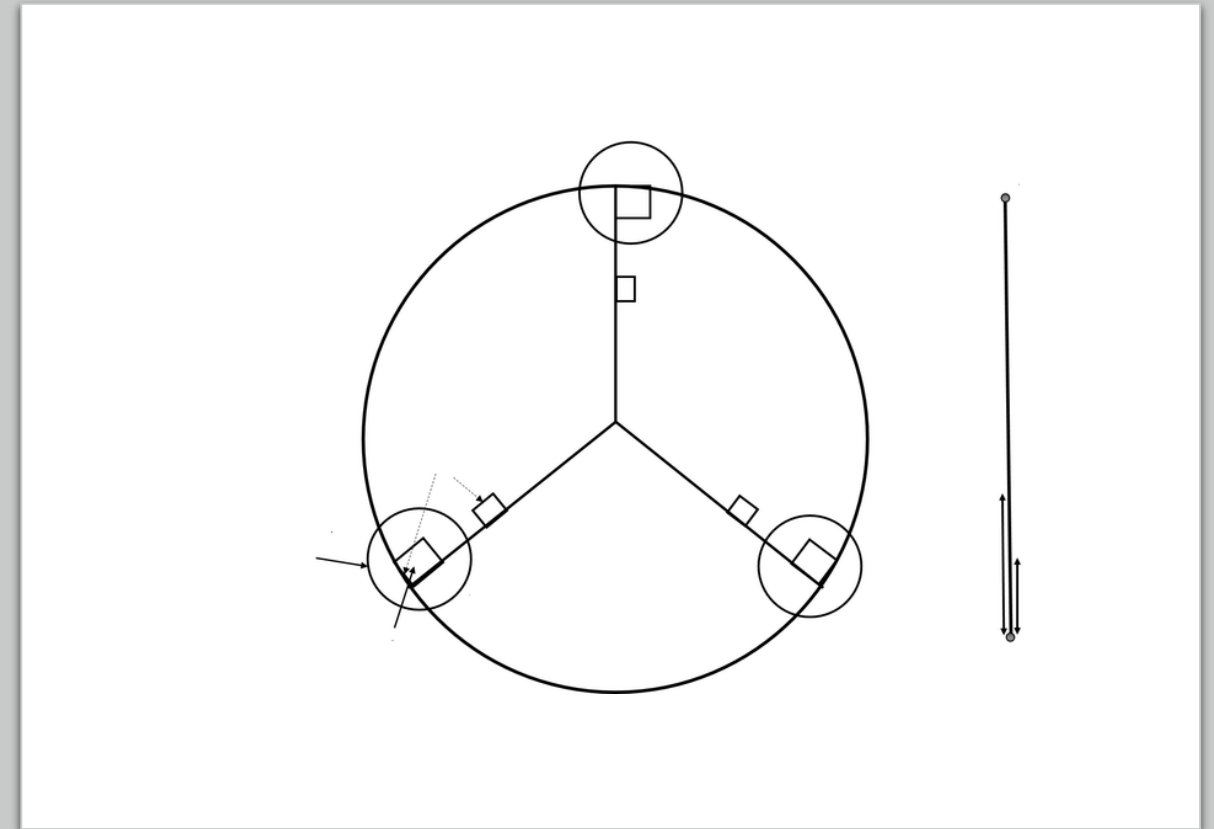
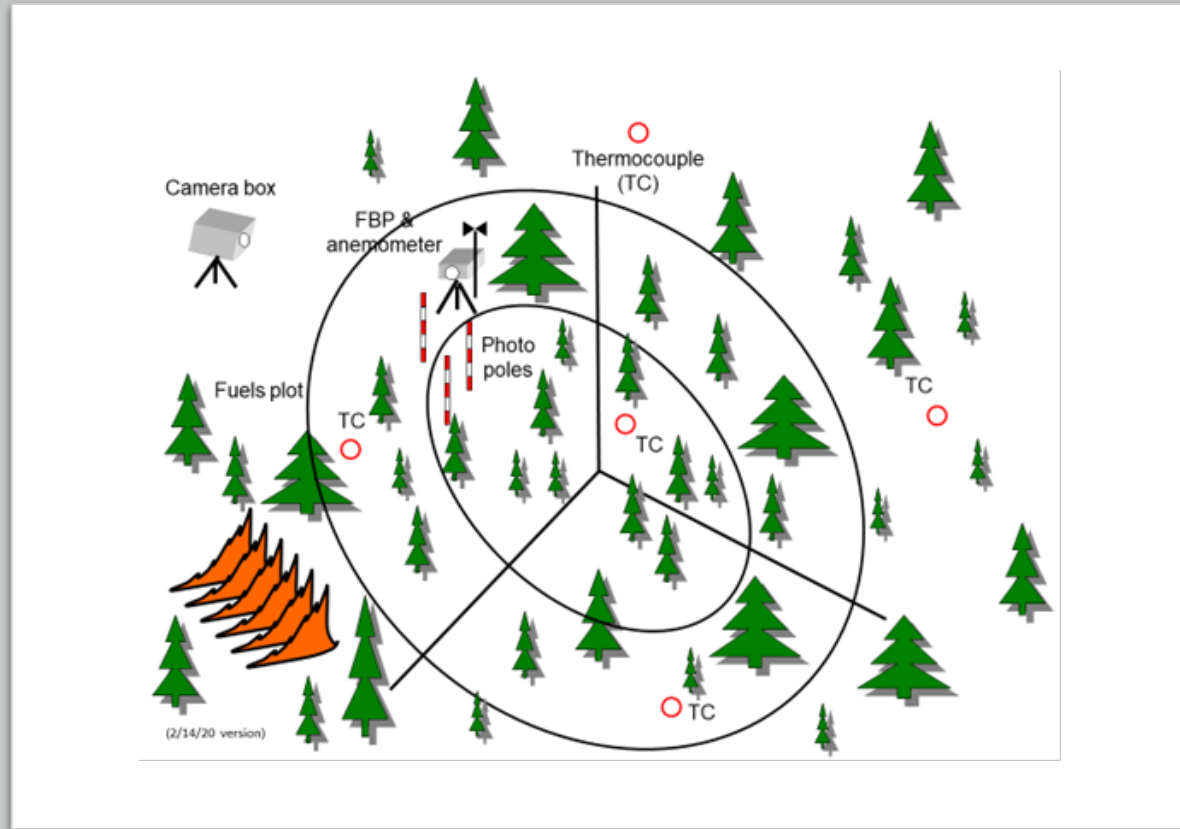




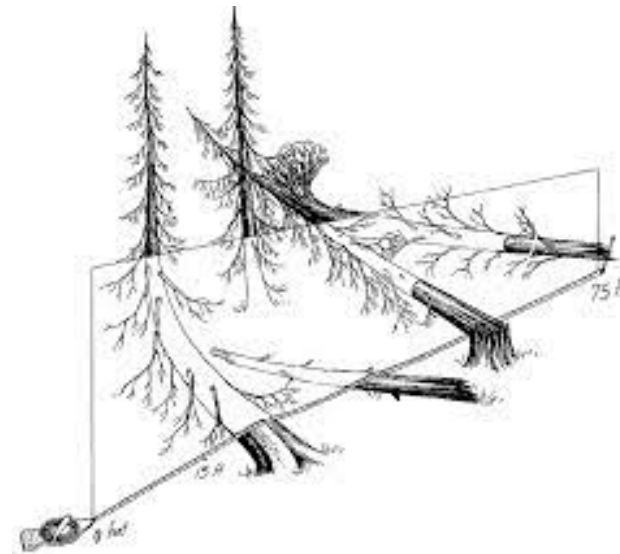
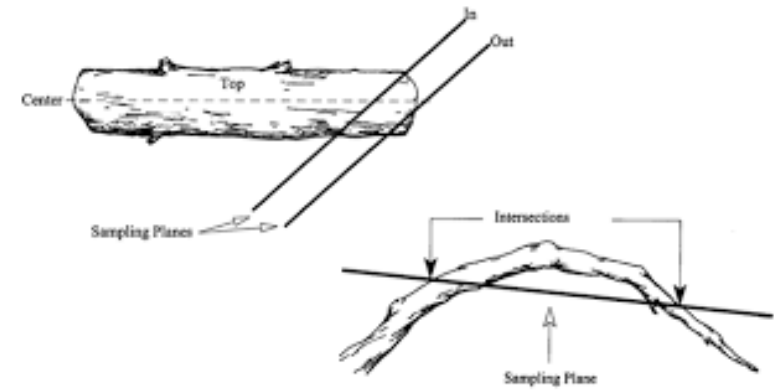
# Plot and Transect Design



# Measuring Corse Woody Fuels



# Classic Brown's Transect Design

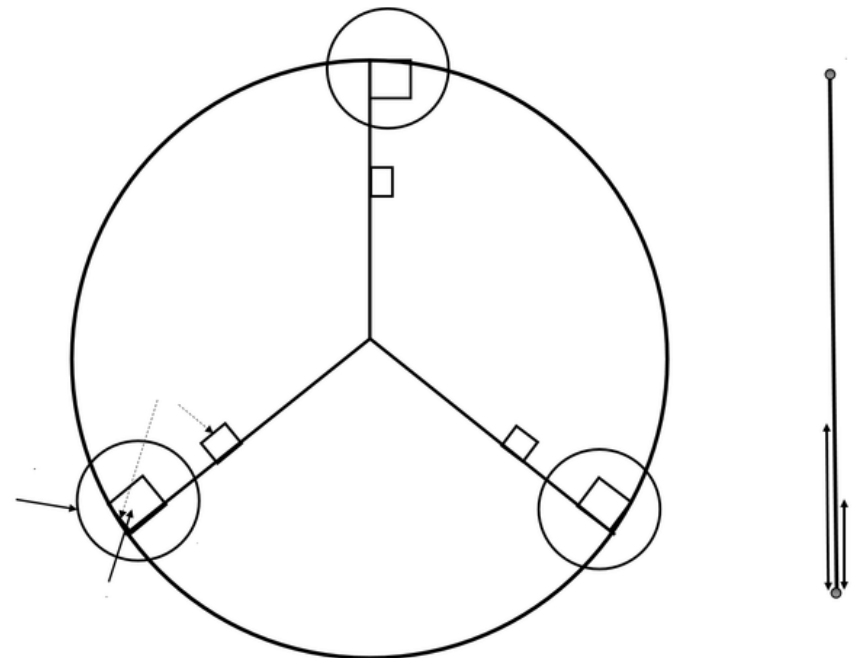
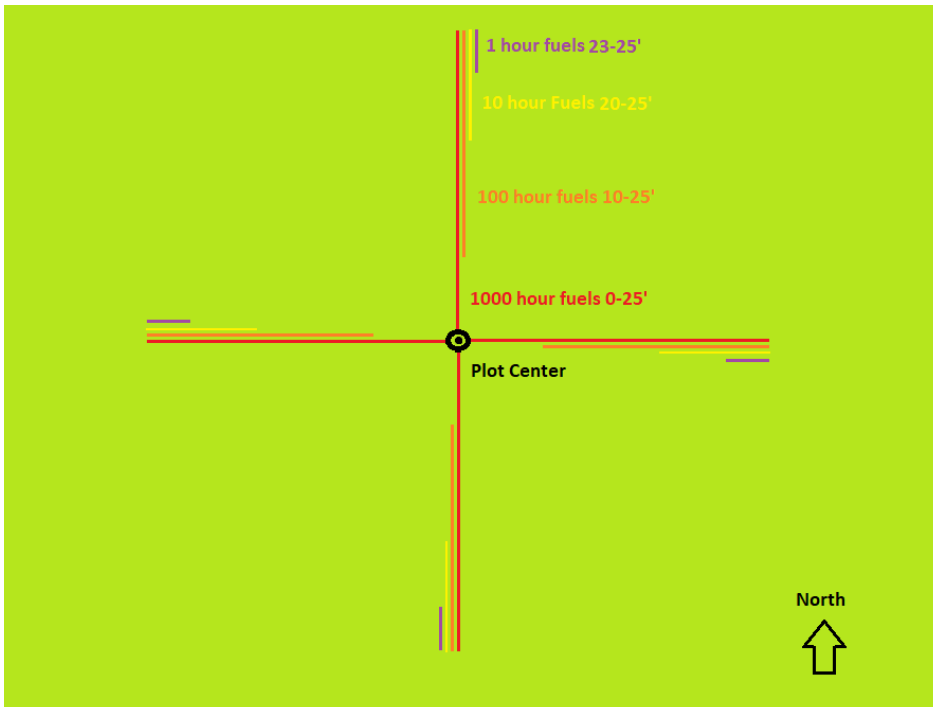


# Pros and Cons of Each Type

**Pros:** Can give better coverage  
**Cons:** Usually take longer

**Pros:** Faster  
**Cons:** Less coverage

This is a good time to talk about the number of plots per project or acre.

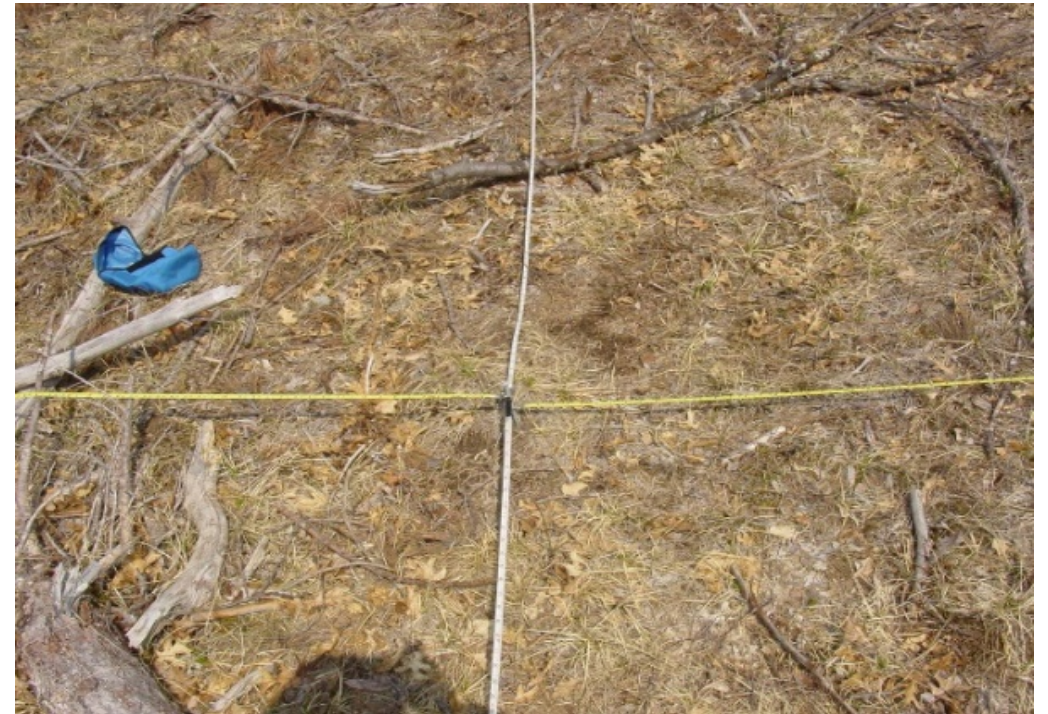


# Brown's Transects

## Before leaving the office:

- Establish your sampling grid based on desired percent of stand sampled. It is very important to know the location of a starting point. All other plot locations will be referenced from the first plot.
- Make enough copies of plot data sheets.
- Fill in header information on plot data sheets with as much information as possible (compartment and stand numbers, fire history).
- If you using a compass with declination make a note of declination used on plot data sheets.
- Make sure GPS datum is forest standard or make note of one used if unsure.
- Double check equipment list.

Lay out of four transects at  $120^\circ$  or  $90^\circ$  angles.



**A**fter arriving at plot center, record the coordinates in D° MM.MMM' lat/long with the Datum set to WGS84 on the GPS. Also note the stand and compartment information (Figure 1).

**I**nstall the 1<sup>st</sup> transect to the north by extending the measuring tape out to 25'.

**I**ndicate the "Burn Status" to show if it is a pre-burn or post-burn measurement.

**P**lace a permanent marker (stake, wire flag) at plot center. Measuring tapes should be laid out in the four Cardinal directions from plot center.

**R**ecord the length of transects for time lag fuels, and the azimuth and slope for each transect.

Transect lengths Downed material	Diameter of debris		
	0-0.25 in	0.25-1 in	>3 in
Standard Plots	23-25'	20-25'	10-25'
Continuous heavy slash	24-25'	22-25'	15-25'
Grass Openings	23-25'	20-25'	10-25'

**R**ecord the number of intercepts for each time lag fuel class.

For the 1000+ fuels, a diameter and species is recorded for each intercept. The 1000+ fuels are also classified as "sound" or "rotten" and recorded in the appropriate column. If a species cannot be identified, note pine or hardwood.

**T**ally.

Record the number of intercepts using a "dot / box method" for speed. Each dot is 1 intercept and each line connecting a dot is 1 intercept. So a box with an X in it is 10 intercepts. Then document the total in the smaller space below.

**T**ally rules for fuel classes:

1. Only **downed, dead woody material** from trees and shrubs on the litter layer are recorded. Do not record:  
*Leaves cones bark flakes needles grass forbs undisturbed stumps dead stems or branches still attached to standing trees or shrubs*
2. Only record the 1-, 10-, and 100-hr fuels along the prescribed length of the transect (1-hr from 0-3').
3. If a piece intersects the tape measure more than once, count all intercepts.
4. If the end of a piece intersects the taper, only record it if the central axis is crossed.
5. Estimate the diameter of rotten logs that fallen apart by visualizing a cylinder to contain the material.
6. Downed material can be sample up to any height, so be sure to look up from the ground. An upper cutoff of 6' can be used; adjust as necessary in heavy slash.
7. Record diameters of 1000+ fuels to the nearest whole inch.

Plot ID: \_\_\_\_\_  
 Coordinates: \_\_\_\_\_ B/C (Circle One) Date: \_\_\_\_/\_\_\_\_/\_\_\_\_  
 Burn Unit: \_\_\_\_\_ Recorders: \_\_\_\_\_  
 Burn Status: Circle one and indicate number of times treated, e.g., 01-yr01, 02-yr01  
 00-PRE \_\_\_ Post \_\_\_ -yr01 \_\_\_ -yr02 \_\_\_ -yr05 \_\_\_ -yr10 \_\_\_ -yr20 Other: \_\_\_-yr; \_\_\_-mo \_\_\_

Transect lengths, in feet: 0-.025" 0.25-1" 1-3" 3+s 3+r

Transect 1 Azimuth °	# of intercepts			Diameter (in)		Litter and Duff Depths (in)				
	0-.25" (1-hr)	.25-1" (10hr)	1-3" (100hr)	3+s (1000hr)	3+r	Litter (L, D)		Duff (L, D)		
Slope %										
	13	7	3			1	1.5	.25	25	
						5			30	
						10			35	
						15			40	
						20			45	

Litter and duff are also recorded at set intervals along the length of each transect (Figure 4).

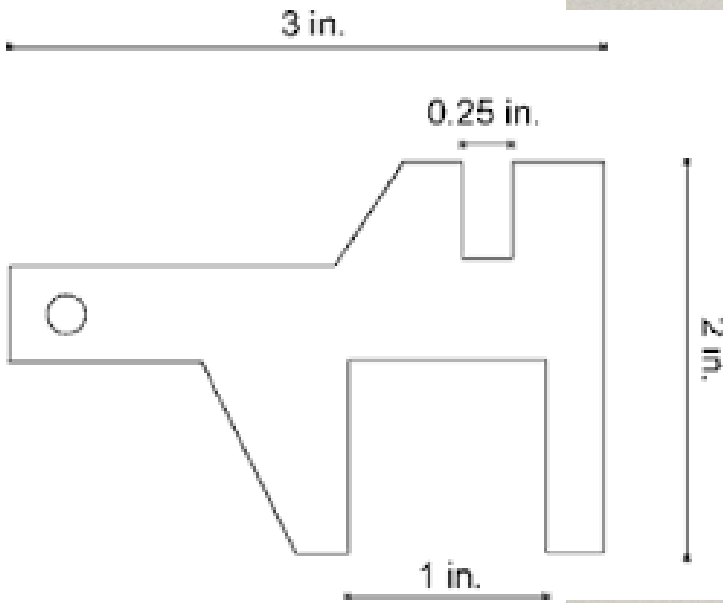
The first measurement is taken 5 feet from the plot center and the next at the 15' mark. Additional measurements can be taken every 5 feet, ending at the 25' mark if you need additional data.

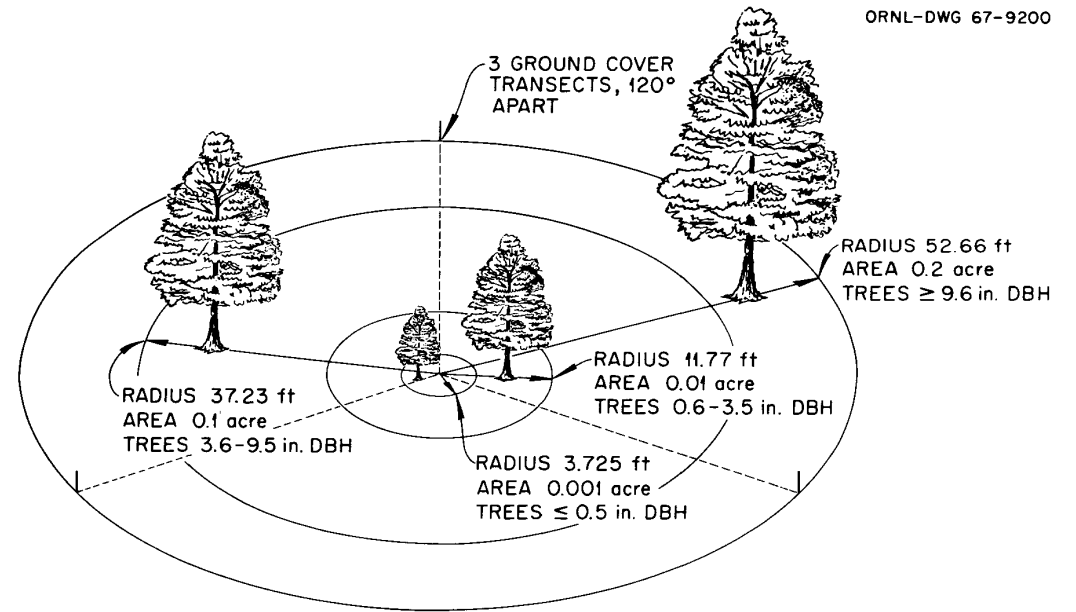
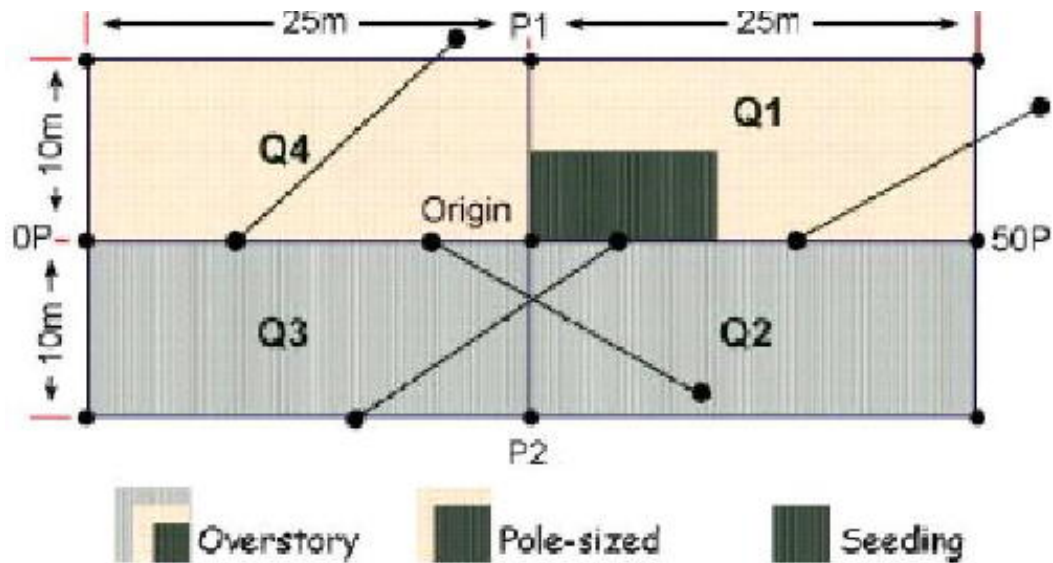
**T**ally rules for litter and duff:

1. Record duff and litter measurements after fuel intercepts have been tallied.
2. Record both litter and duff to the nearest .25 inch.
3. Litter is still recognizable as its former self before death (it still looks like a needle).
4. Duff is the decomposed litter (it is no longer recognizable as a needle).
5. When stumps, logs and trees occur at the points of measurement, offset 1' perpendicularly to the right.
6. Measure through rotten logs whose central axis is in the duff layer.



# Helpful tools to measure fuels



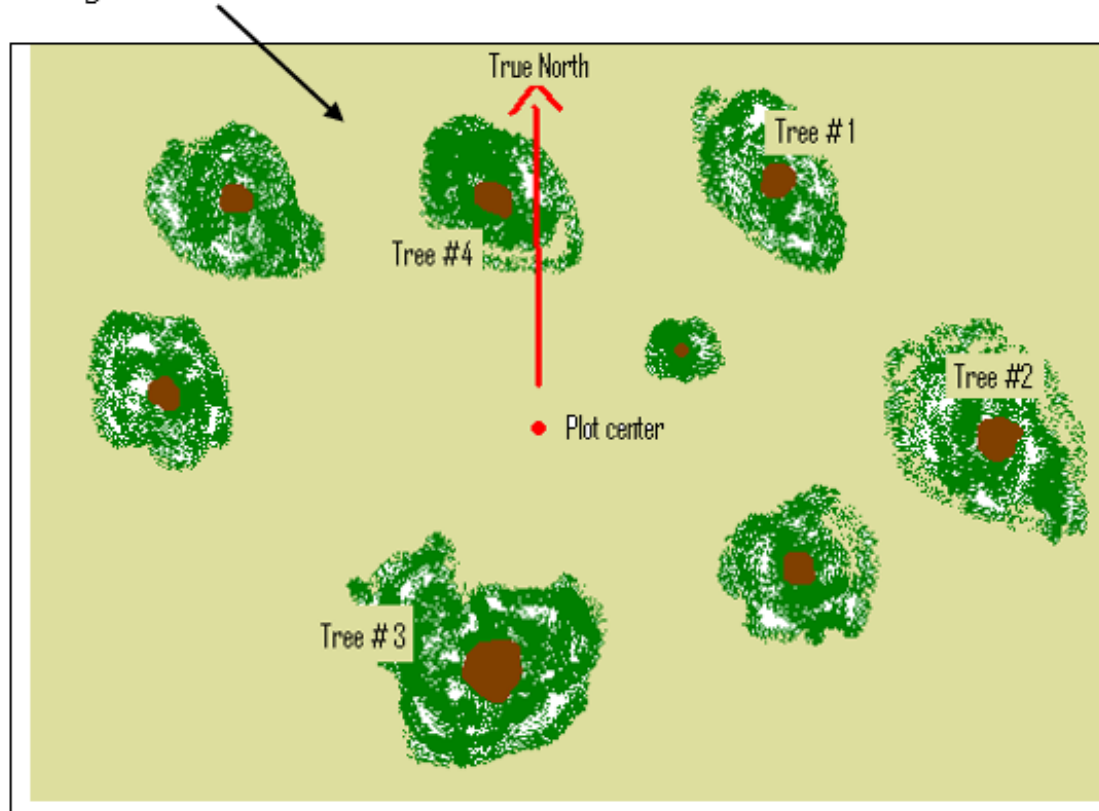


# MEASURING OVERSTORY

**T**o sample the overstory using a 20 basal area prism, start by facing north and hold the prism over the plot center.

1. Start in a clockwise direction looking at each tree through the prism, if the offset overlaps then record the tree (See figure 1 for more information).
2. Record DBH and species for all tallied trees.
3. Estimate height of char along trunk (Char is the black staining on the trunk that rubs off)
4. Estimate percentage of crown scorch on the tree bole (look at browned needles, curled leaves and burned buds and twigs).

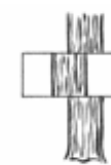
**T**ree mortality monitoring starts from the center of the plot. A 20 BA prism is used to determine the trees that will be measured. The measurements start at true north and then proceeds in a clockwise manner numbering each tree "from north" that the prism identifies as a large enough tree.



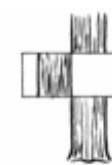
- 1) Mark a spot on the ground and keep the prism over that spot – move yourself around the prism.
- 2) Hold the prism at arms length.
- 3) Move in a complete circle around the prism, looking at every tree through the prism. Count all the trees that are "in" and every second tree that is "borderline."
- 4) Multiply the count by the factor of your prism.



Out – do not count



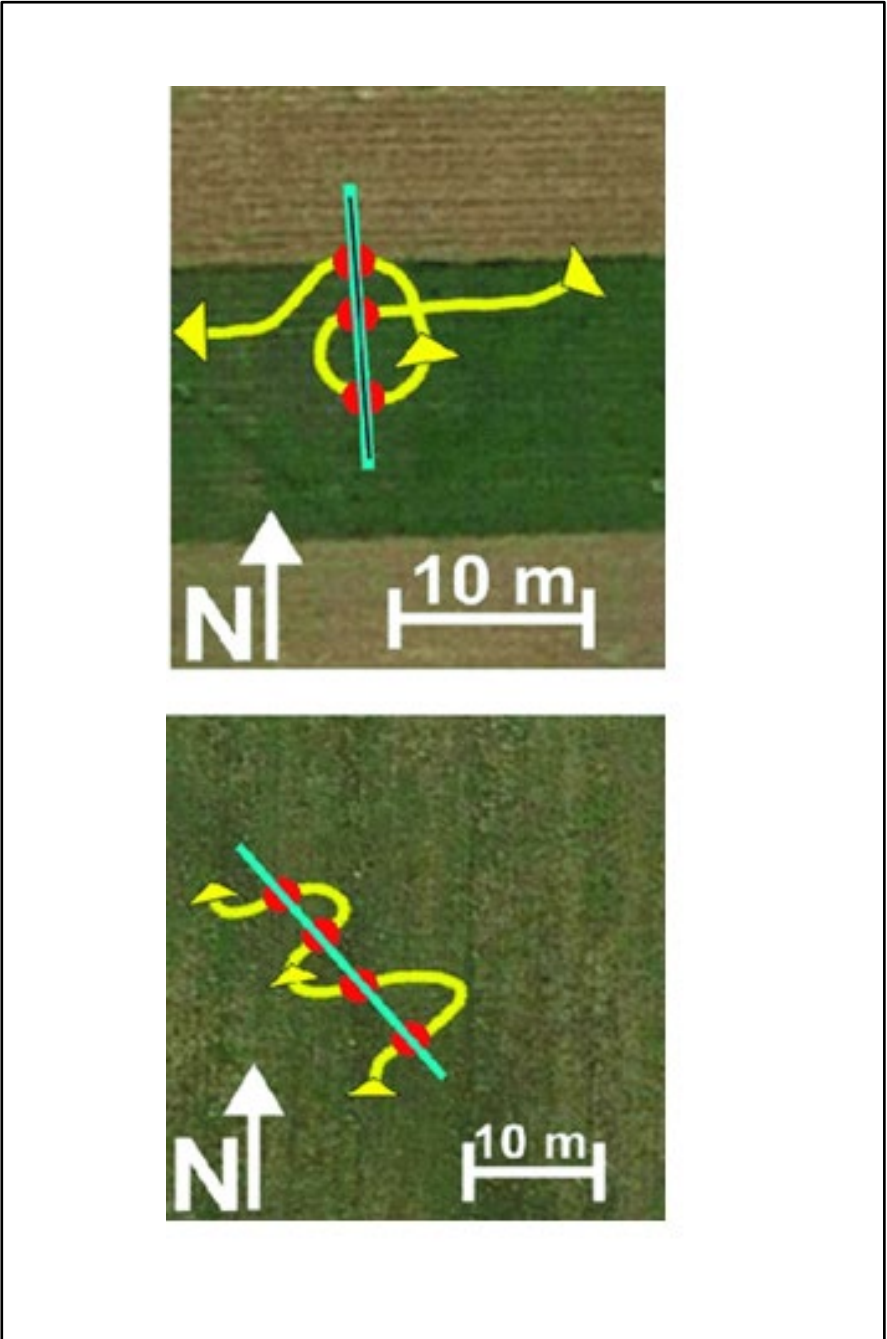
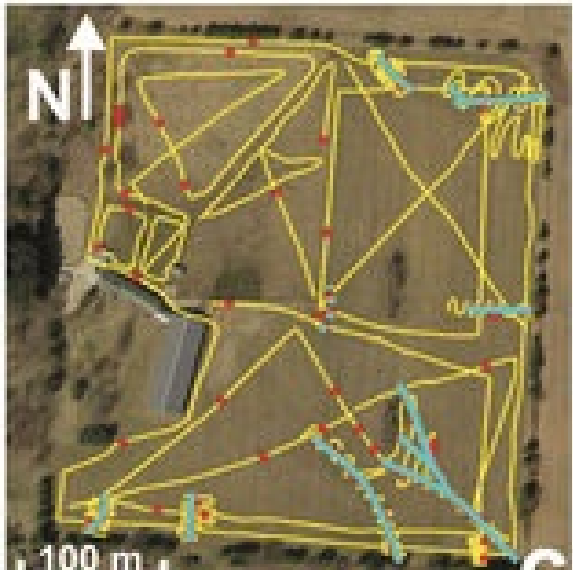
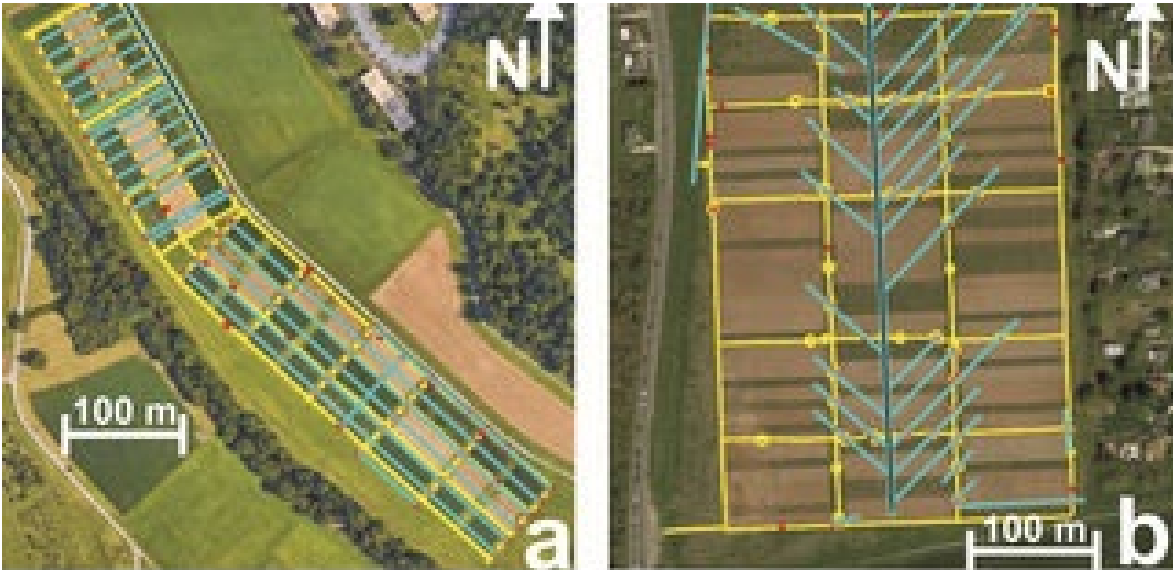
In - count



Borderline – count every 2<sup>nd</sup> tree



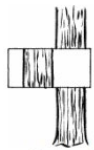
Alternative Transects designs



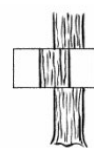
# Helpful tools to measure overstory



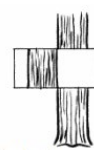
- 1) Mark a spot on the ground and keep the prism over that spot – move yourself around the prism.
- 2) Hold the prism at arms length.
- 3) Move in a complete circle around the prism, looking at every tree through the prism. Count all the trees that are "in" and every second tree that is "borderline."
- 4) Multiply the count by the factor of your prism.



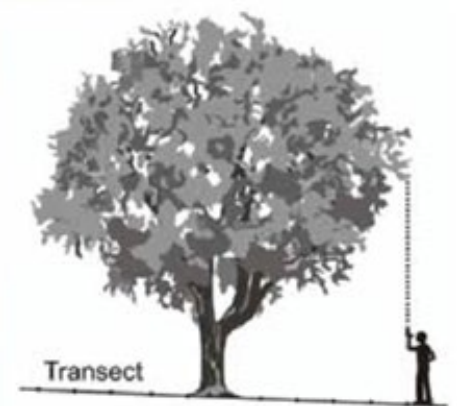
Out – do not count



In - count



Borderline – count every 2<sup>nd</sup> tree



# Quadrats

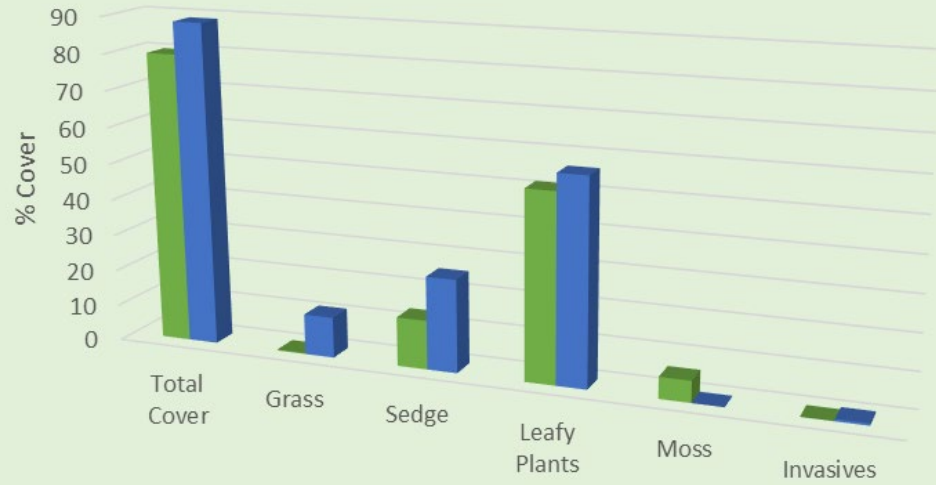
PreBurn 2003



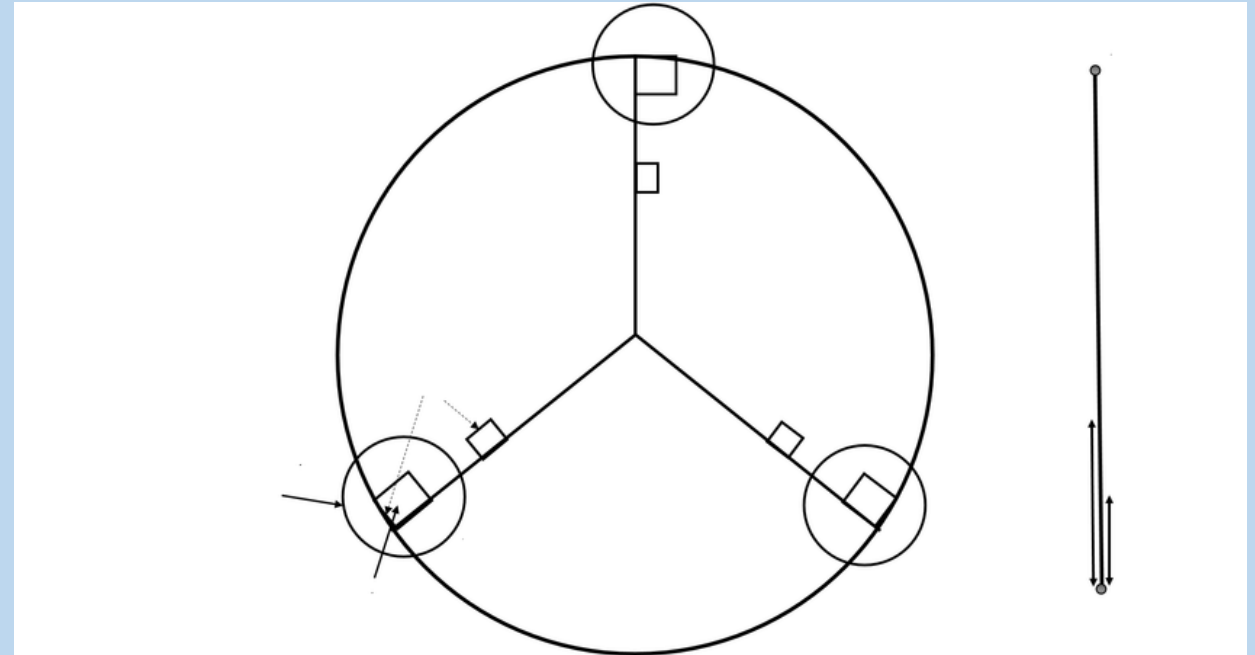
Post Burn (3 burn entries) 2019



Memorable North Rx Vegetation Cover



	Total Cover	Grass	Sedge	Leafy Plants	Moss	Invasives
■ PreBurn	79.9	0.25	13.5	51.6	5.9	0
■ PostBurn	88.75	11.25	25.6	56.3	0	0.6



# PHOTO PLOTS:

Start from the center of the plot and set the camera 3 feet above the ground facing true north.

Use the dry erase board to include the **project name**, **date**, **plot #**, **Pre or Post** and **direction** and position the board in the lower corner of the photo or edit the photo on your tablet.

Get at least 2/3 of the photo with the surface fuels and the remaining 1/3 can be above the horizon.



Pre Burn

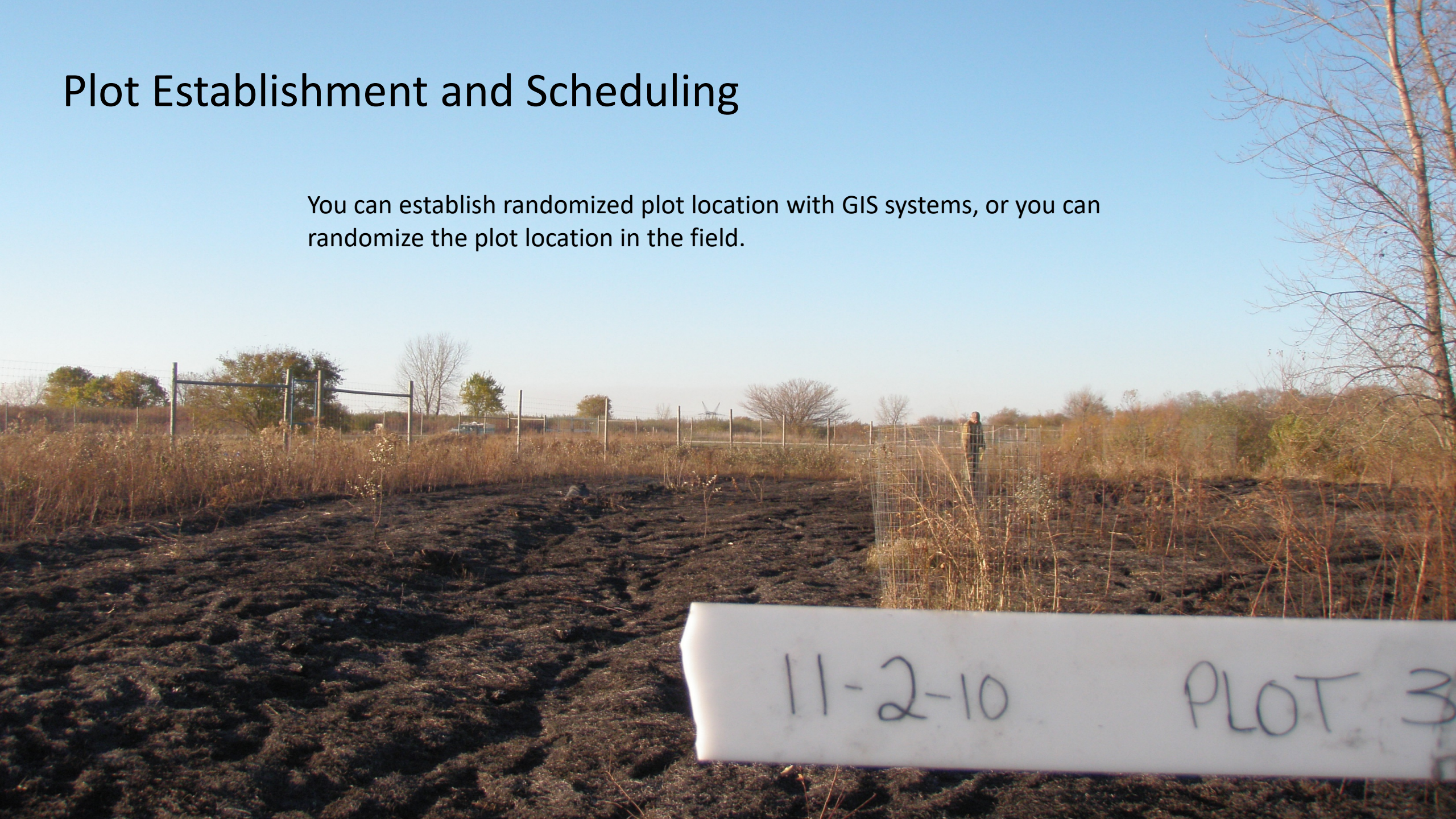


Post Burn



# Plot Establishment and Scheduling

You can establish randomized plot location with GIS systems, or you can randomize the plot location in the field.





# Set up your cruise in the Plot Hound online platform



## Create

Instructions

Preferred confidence\*  
0.9

Estimated variation\*  
0.35

Preferred error\*  
0.1

Grid type\*  
Rectangle

Stand Inner Buffer (feet)\*  
0  
Inside perimeter stand buffer, plots will not be placed in this area

Cruise Protocol\*  
Southern\_Protocol  
Specifies the data fields collected.

Sampling method\*  
1/5 acres

Merch Spec\*  
Merch Specs for Charlie Demo Consultancy

Cruiser  
Charlie Wade

Contractor  
-----

Plots file  
Choose File No file chosen

Create

## Preview

Based on the statistical parameters we recommend you install 35 plots

38 plots per stand

1 plot per 6.713 acres

Rotate Grid 45 degrees

X axis spacing 396 feet

Y axis spacing 792 feet

Create Grid



## RANDOMIZING IN THE FIELD

---

# Scheduling

**Table 5. Grassland plot RS variables to be monitored pre- and postburn.**

RS Variables	PRE	Immediate Postburn	Year-1+
Herbaceous Cover (FMH-16)	n	Optional	n
Burn Severity (FMH-22)		n	
Photographs (FMH-23)	n		n

**Table 6. Brush plot RS variables to be monitored pre- and postburn.**

RS Variables	PRE	Immediate Postburn	Year-1+
Herbaceous Cover (FMH-16)	n	Optional	n
Shrub Density (FMH-17)	n	Optional	n
Burn Severity (FMH-22)		n	
Photographs (FMH-23)	n		n

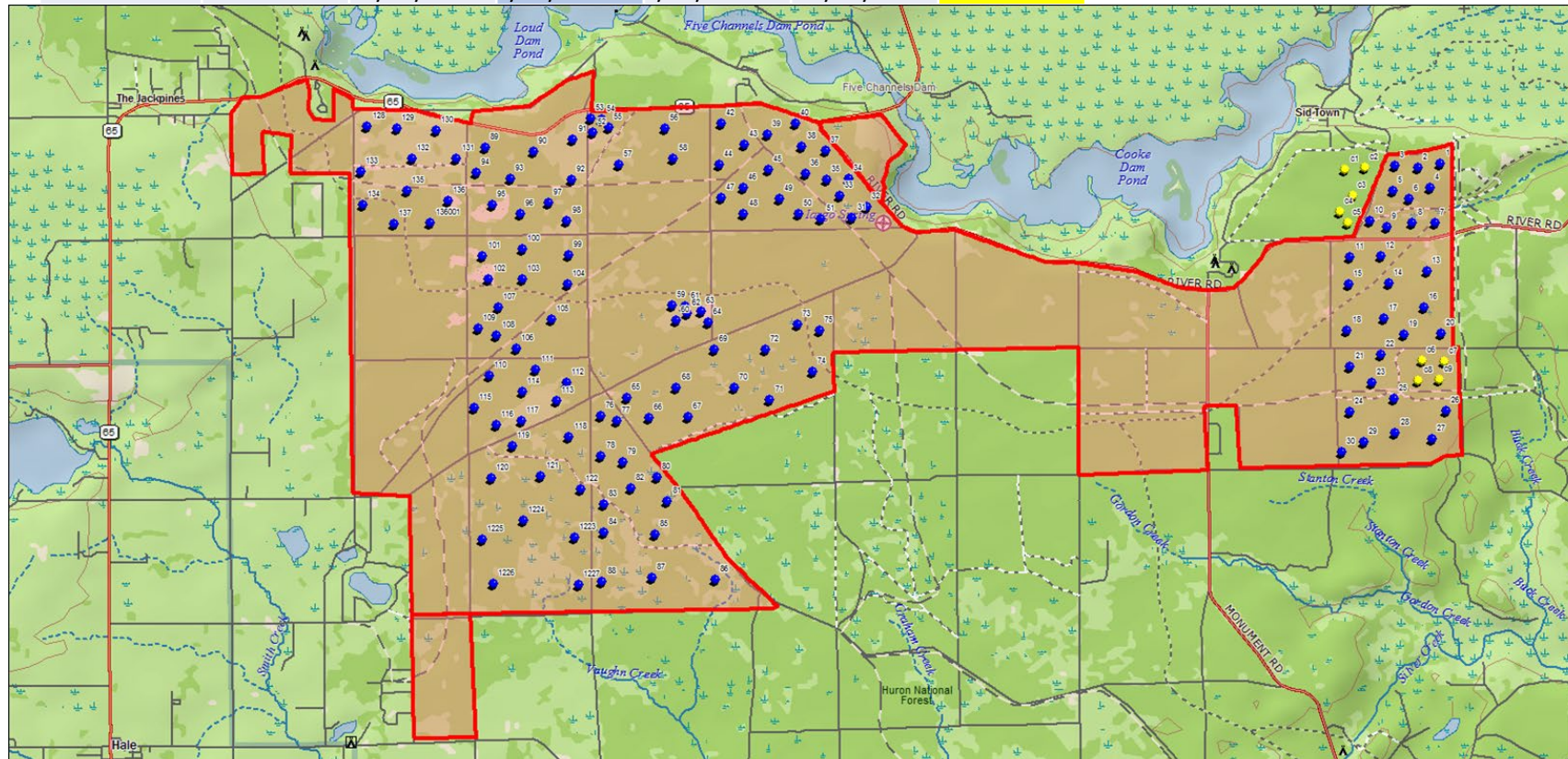
**Table 7. Forest plot RS variables to be monitored pre- and postburn.**

RS Variables	Data Sheet(s)	PRE	Immediate Postburn	Year 1	Year 2+
Tree Density	Overstory (FMH-8)	n		n	n
	Pole (FMH-9)	n	Optional	n	n
	Seedling (FMH-10)	n	n	n	n
DBH/DRC	Overstory (FMH-8)	n		Optional	n
	Pole (FMH-9)	n		Optional	n
Live/ Dead	Overstory (FMH-8, FMH-20)	n	n	n	n
	Pole (FMH-9, FMH-20)	n	Optional	n	n
Fuel Load	(FMH-19)	n	n	n	n
Herbaceous/Shrub	Cover (FMH-15 or FMH-16)	n	Optional	n	n
	Density (FMH-17)	n	Optional	n	n
Burn Severity	(FMH-21 or FMH-22)		n		
Photographs	(FMH-23)	n	n	n	n
% Crown Scorch	Overstory (FMH-20)		n		
	Pole (FMH-20)		Optional		
Scorch Height	Overstory (FMH-20)		n		
	Pole (FMH-20)		Optional		
Char Height	Overstory (FMH-20)		Optional		
	Pole (FMH-20)		Optional		

# Plot Measurement Schedule and Frequency

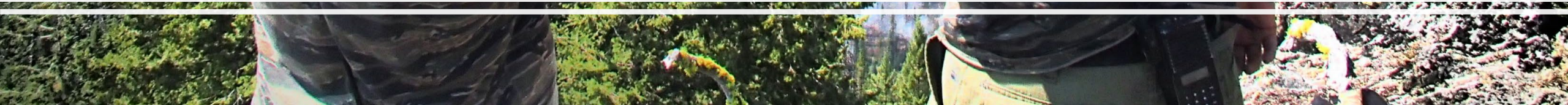
Burn Name	Primary Fuel Type	Pre-Burn Date	Last Burn Date	Mortality Study Date	Post-Burn Date	Next Measurement
Brittle Block 01	Red Pine Aspen	9/25/2008	4/28/2009	9/12/2010 6/06/2014	9/12/2010 6/06/2014	Year 2017
Brittle Block 09	Red Pine / Jack pine	5/7/2005	4/17/2008	06/24/09	6/24/2009	Year 2014
Brittle Block 10	Red Pine/ Jack pine	4/13/2014	4/28/2014	5/8/2014	5/8/2014	Year 2017
Brittle Block 12	Red Pine	09/28/06	4/24/2007	8/20/2009	08/20/09	Year 2015

- How many acres/plot?
- Control plots?
- Seasonality?
- Duration of the monitoring (how many years after the treatment?)



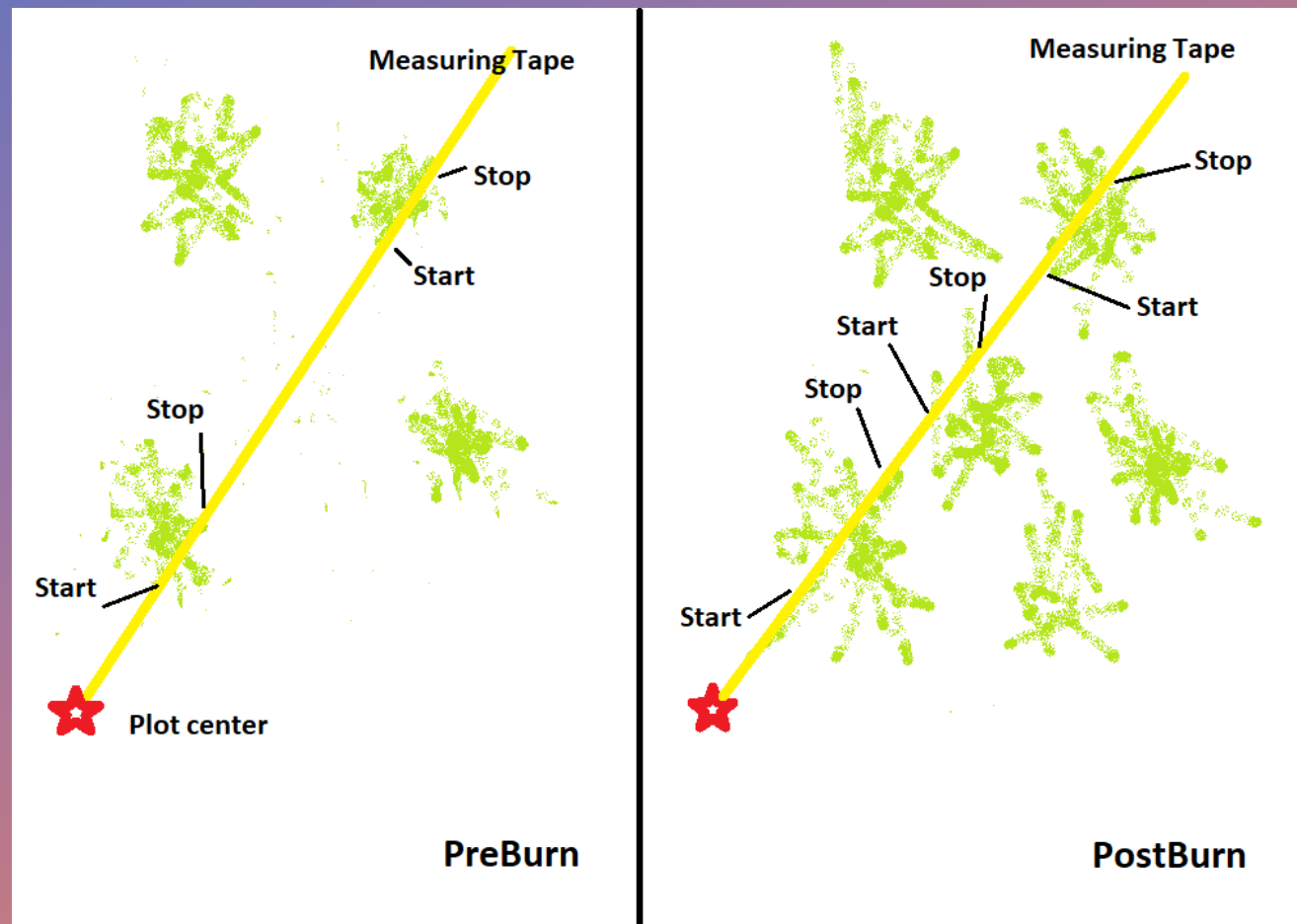


Examples



Example:

The goal of the prescribed burn could be “restore fire adapted ecosystem and the objective could be “increase warm season grasses by 30%.



You would want to develop protocols that could measure the % cover of warm season grasses.

# Example: Decreasing woody encroachment.

## Mortality

Strata	Pre-Burn	Post-Burn
Overstory	0.02%	0.03%
Sapling	0	76.4%
Seedling	0	98.1%



Questions?

