

An aerial photograph of a forest landscape. A river flows through the upper left portion of the image. The foreground is dominated by a large, weathered tree trunk that has been cut and lies horizontally across the frame. The surrounding forest consists of various types of trees, some green and some bare, suggesting a late autumn or winter setting. The ground is covered with fallen leaves and some snow patches.

**Department of Agriculture,  
Conservation & Forestry**

**Maine Forest Service**

**NERCOFE 2014 Workshop**

**University of Maine**

**March 10 -11, 2014**





**“GIS/GPS Technology for Foresters”**  
**Regulatory Compliance**

Presented by:

**Tom Whitworth**

**Regional Enforcement Coordinator  
Forest Policy & Management Division**





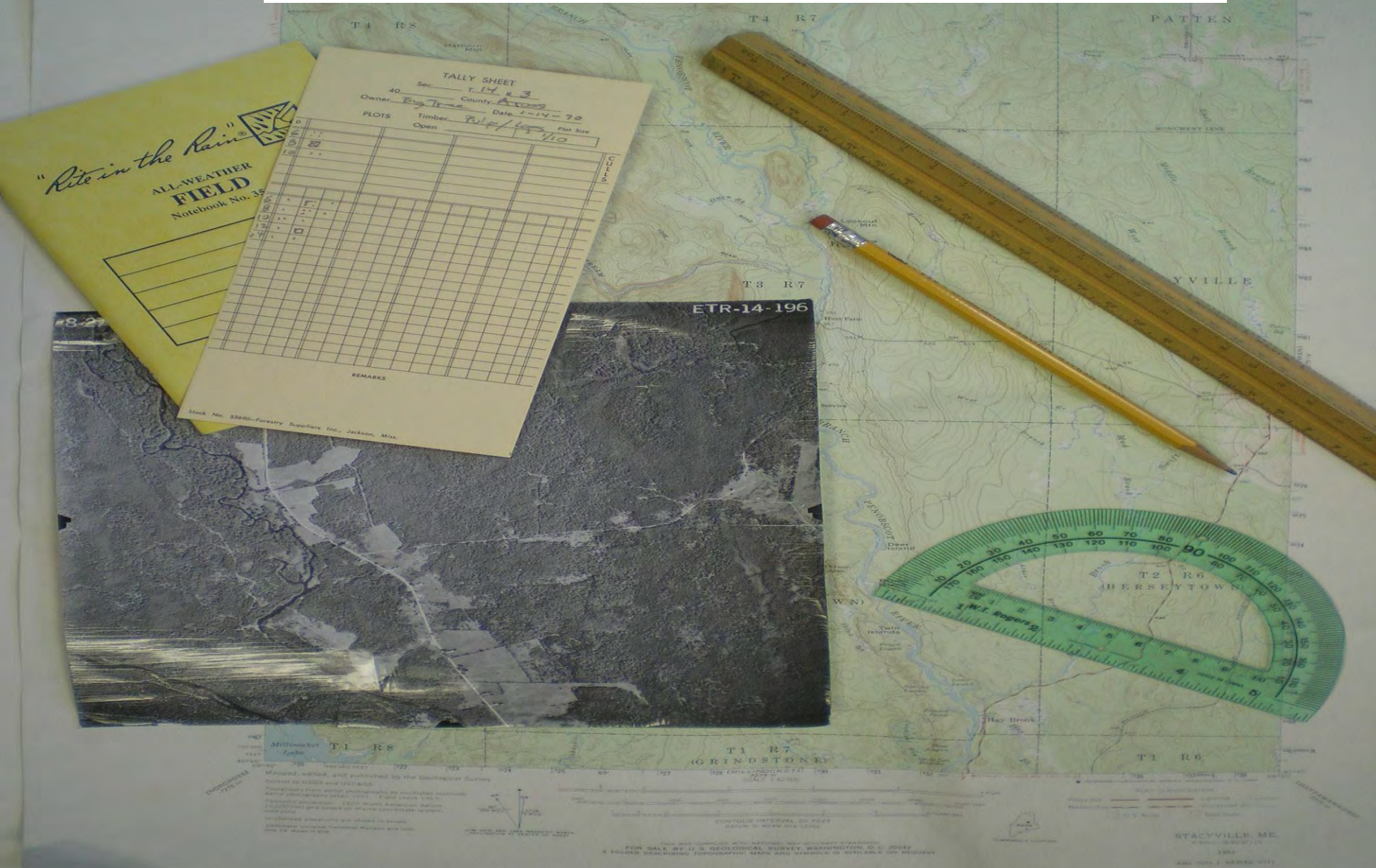
**THE VIEW OF THE WORLD BEFORE  
GPS & GIS ?**

# The First GPS Unit





# The First GIS System





# Match the GPS unit to the job!



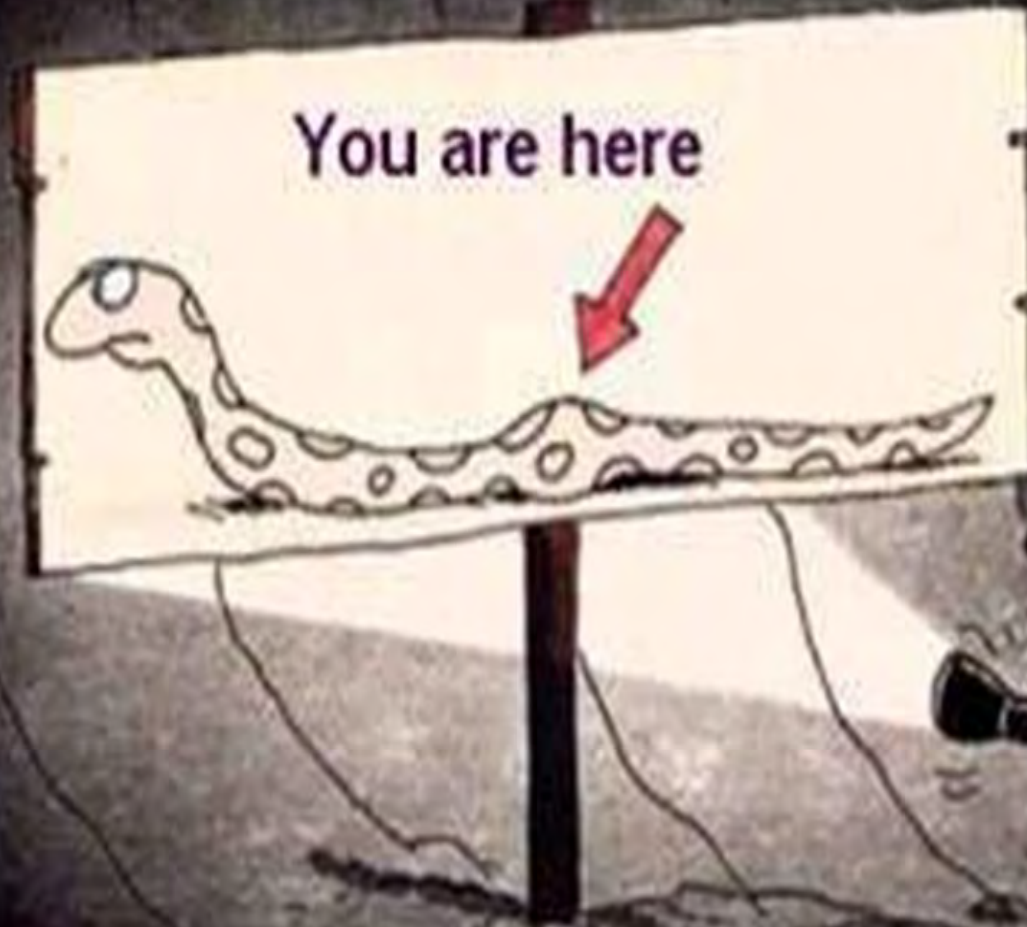


# Maine Forest Service GPS Units



**Garmin and Trimble**





**GPS work great when they have power.**



# **GPS ACCURACY**

**(with selective availability deactivated)**

**Trimble:** up to sub-meter accuracy  
**(with differential correction)**

**Garmin:** 10-15 meter accuracy

**All GPS measurements done by the MFS  
for distances are ground verified.**



# **GPS Data Processing**

# **GIS Mapping**

- GPS Pathfinder**
- ArcMap and ArcView**
- Delorme XMap**
- Terrain Navigator**

**MFS maps are constructed by:**

**Gregory Miller**

**GIS Programmer Analyst**



# GPS Data Collection

- **Best Management Practices Monitoring**
- **Timber Harvest Operations Monitoring**  
(Multi-Resource Harvest Assessment)
  
- **Chapter 20: Forest Practices Act**
- **Chapter 21: Statewide Standards for Harvesting Activities in Shoreland Areas**
- **Chapter 23: Liquidation Harvesting**
- **Chapter 27: Timber Harvesting and Related Activities in Unorganized Areas**



# Using Photo Imagery for the Location of Harvested Areas.





An aerial photograph of a lush green agricultural field. A light-colored road or path runs diagonally from the bottom left towards the center. A narrow, light-colored ditch or canal runs horizontally across the middle of the field. The vegetation is dense and vibrant green.

## **Time Specific Imagery Sources**

**Google Earth**

**Maine Ortho-Imagery**

**National Agricultural Imagery Program**



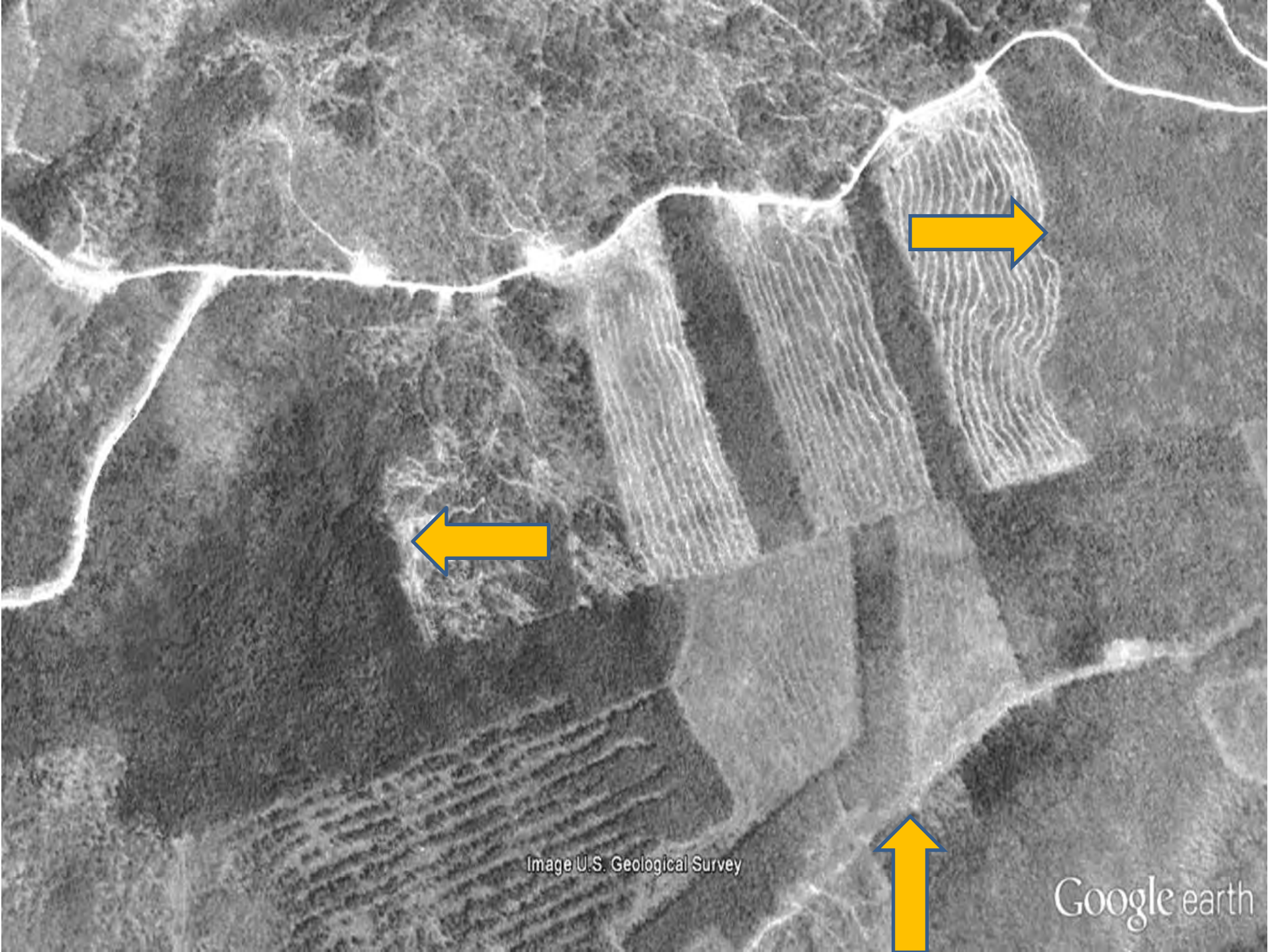


Image U.S. Geological Survey

Google earth



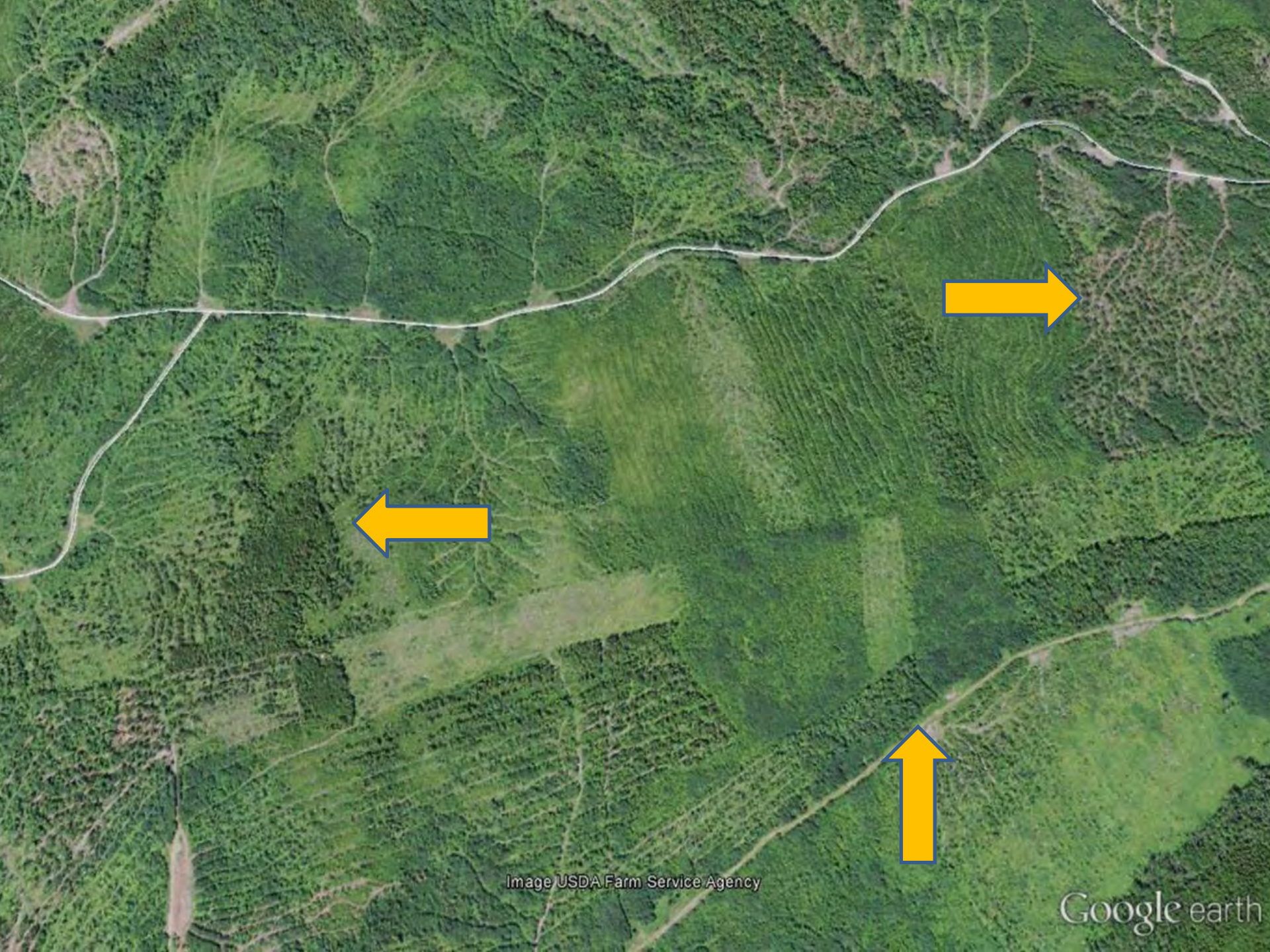


Image USDA Farm Service Agency

Google earth





**Maine Forest Service  
Chapter 20 Rules  
Forest Regeneration and Clearcutting  
(FPA)**

**Compliance Cruise**



# Investigations Require Data Collection





# GPS Data Files

Property boundary

Harvest area

Log yard

Separation Zone

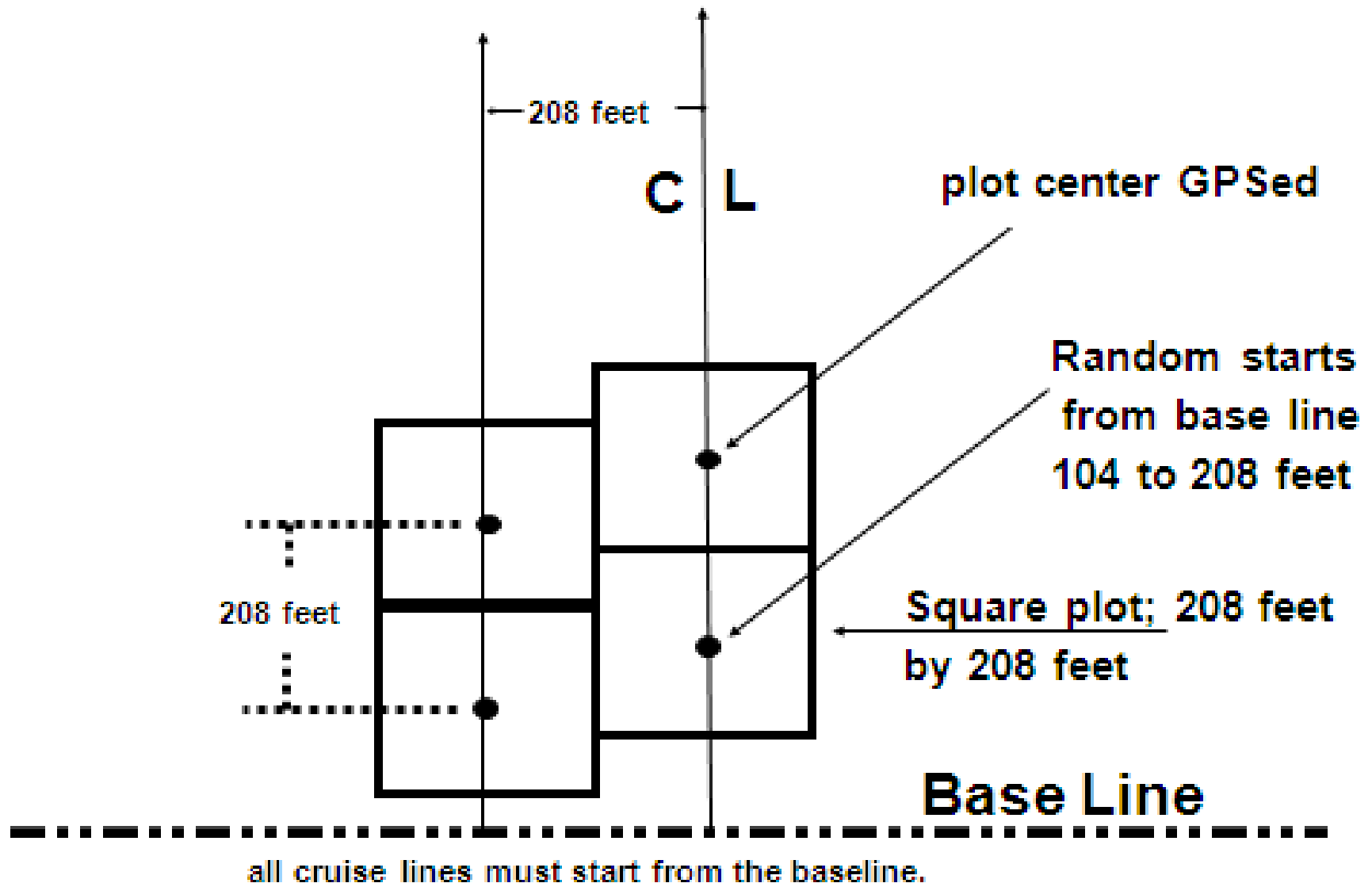
Plot Center

Road

Plot Information

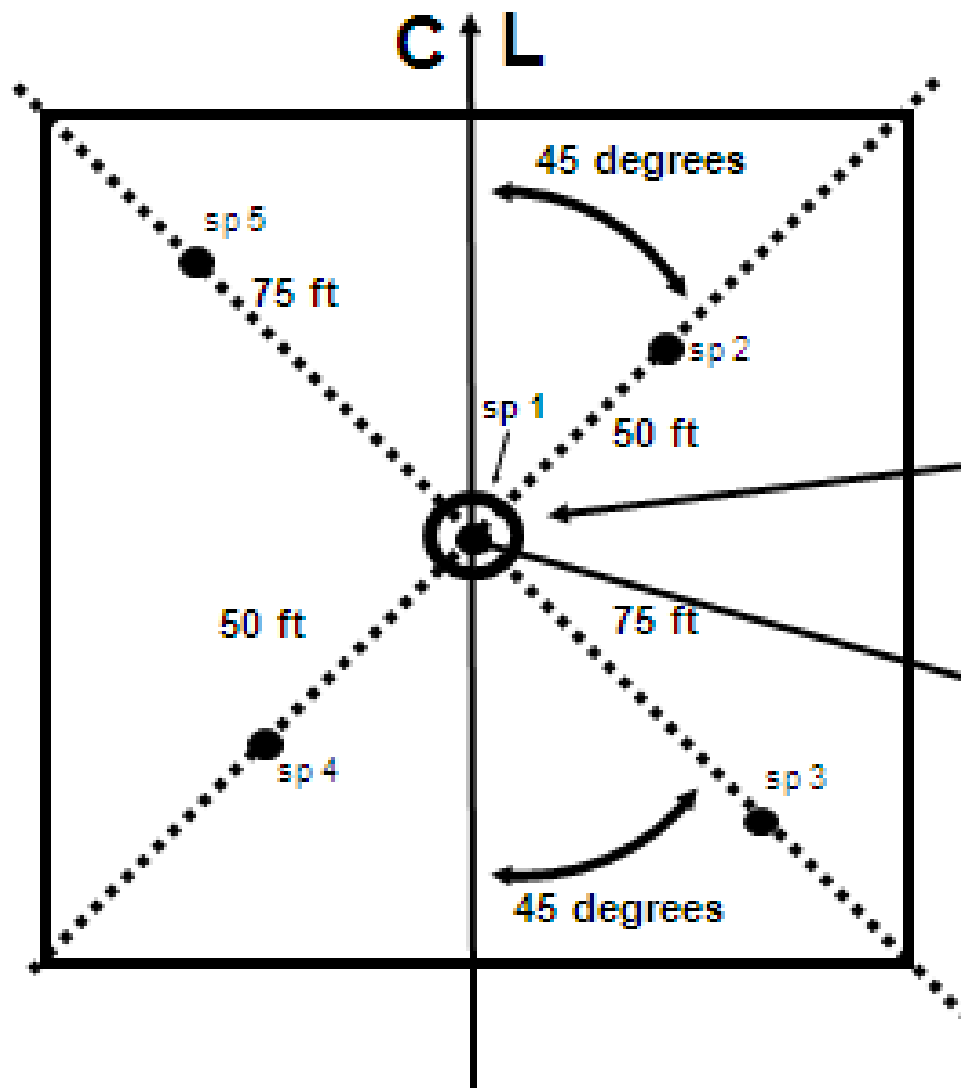
- Basal Area
- OSR
- Separation Zone

# One acre Quadrat Layout





# One Acre Quadrat Plot Layout with Satellite Plots



- 1/150 fixed radius satellite plot
- 5 factor prism plot

The center measurement is both a prism and fixed radius satellite plot

Quadrat plot center GPS'd.

Satellite plots should be recorded in a clockwise pattern.

# Quadrat Plot Measurements

Basal Area	Overstory Removal	Separation (Category 2 & 3)	zone Clear cuts)
BAF 5	9.61 ft. radius satellite plot	BAF 5	9.61 ft. radius satellite plot
Measure AGS > 4.5" DBH	Measure AGS 3 ft. Softwood 5 ft. Hardwood (max. 5 stems/ satellite plot)	Measure AGS > 1" DBH of which 40 BA must be AGS > 4.5" DBH	Measure AGS 10 ft. Softwood 20 ft. Hardwood (max. 3 stems/ satellite plot)
If BA = 30+ Not Clear Cut	If 15+ stems on 5 satellite plots (= 450 stems/acre) Not Clear Cut	If BA = 60+ Acceptable Separation Zone Not Clear Cut	If 10+ stems on 5 satellite plots (= 300 trees/acre) Acceptable Separation Zone Not Clear Cut



**Basal Area:** BAF 5 prism, measure all acceptable growing stock (AGS) trees > 4.5 in. DBH.

**BA 30+ = non-clear cut** (prism measurement at the center of the plot only).

**OSR:** 1/150 acre sub-plots (9.61 ft. fixed radius) with a total of 5 sub-plots/acre.

- Measure AGS trees that are 3 ft. softwoods and/or 5 ft. hardwoods.
- Maximum tally of 5 stems/sub-plot with a maximum total tally of 15 stems/plot.

**15 stems tallied on 5 subplots = 450 stems/acre**  
**(overstory removal)**

**Separation Zone Category 1: 30+ sq. ft. BA or OSR**

**Separation Zone Category 2 & 3 clear cuts:**

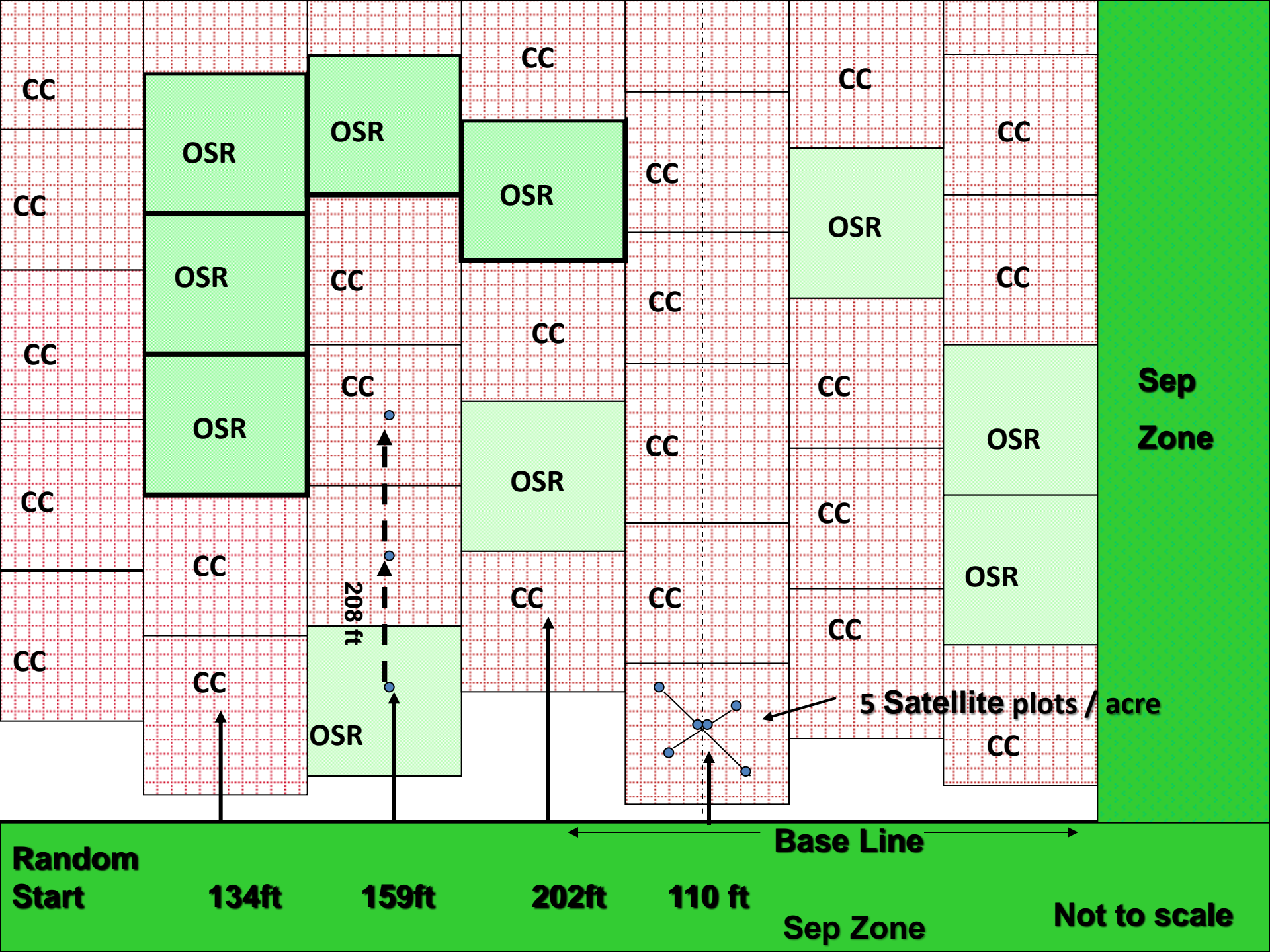
**Basal Area 60+ sq. ft. of AGS for trees >1 inch DBH  
(at least 40 sq. ft. of the BA measured must be >  
4.5 inches DBH). OR**

**1/150 acre sub-plots (9.61 ft. fixed radius) with a  
total of 5 sub-plots/acre.**

- Measure AGS trees that are 10 ft. softwoods  
and/or 20 ft. hardwoods.**
- Maximum tally of 3 stems/sub-plot with a total  
tally of 10 stems/plot.**

**10 stems tallied on 5 sub-plots = 300 trees/acre  
(valid separation zone)**





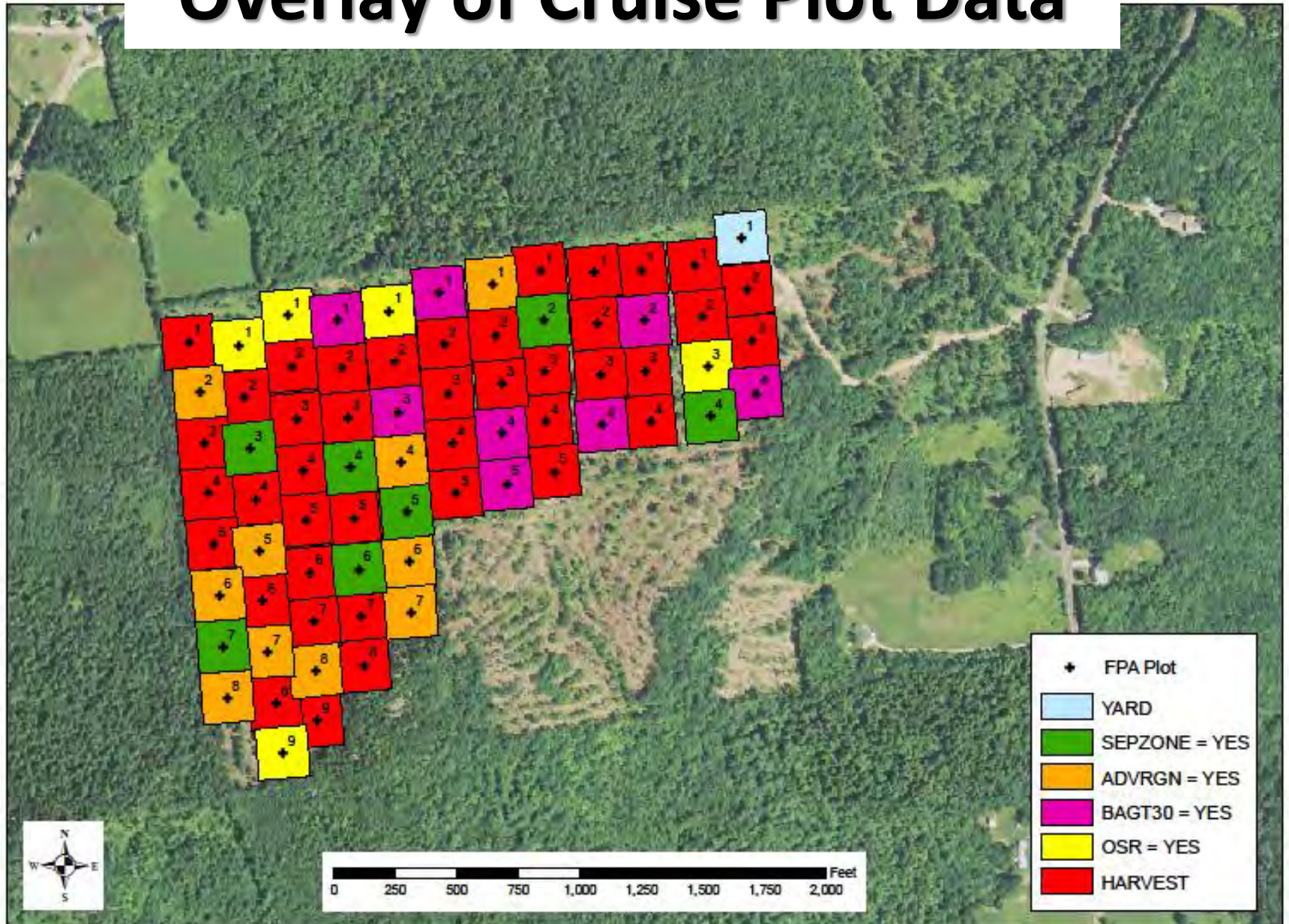
# Photo of Harvest Area



UDA - FSA NAIP True color 1m Leaf-on acquired 7/16/2011



# Overlay of Cruise Plot Data



UDA - FSA NAIP True color 1m Leaf-on acquired 7/16/2011



# Quadrat Plot Tally Sheet

Crew	

Date
Case #
Line #
Bearing
Random start number

Determining the existence of a clearcut							Separation Zone for Cat 2 & 3														
Plot #	# trees and BA AGS > 4.5" (5 BAF)	SP 1	SP 2	SP 3	SP 4	SP 5	Acceptable OSR = Maximum Tally of 5 AGS per SP & 15+ AGS on 3+SP's	(a)	(b)	(c)	(d)	(a+c)	(c+d)	(a+b+c+d)	SP 1	SP 2	SP 3	SP 4	SP 5	Maximum Tally 3 AGS per SP Grand Total 10+ AGS on 4+ SP's = Y	
		OSR 9.61' FRP S3'H5'	OSR 9.61' FRP S3'H5'	OSR 9.61' FRP S3'H5'	OSR 9.61' FRP S3'H5'	OSR 9.61' FRP S3'H5'		# trees and BA AGS >1" and <4.5" (5 BAF)	# trees and BA NOT AGS >1" and <4.5" (5 BAF)	# trees and BA AGS >4.5" (5 BAF)	# trees and BA NOT AGS >4.5" (5 BAF)	Total BA ALL AGS (must be > 40 BA)	Total BA ALL TREES > 4.5" (must be > 40 BA)	Total BA required >60 (5 BAF)	# of AGS S10' H20' FRP	# of AGS S10' H20' FRP	# of AGS S10' H20' FRP	# of AGS S10' H20' FRP	# of AGS S10' H20' FRP		
	/						Y N	/	/	/	/	Y N	Y N	Y N							Y N
	/						Y N	/	/	/	/	Y N	Y N	Y N							Y N
	/						Y N	/	/	/	/	Y N	Y N	Y N							Y N
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There is only 1 - BAF 5 - Variable Radius Point on the Quadrat Plot and this is taken at the quadrat center.  
 When measuring BA in a Separation Zone, plot must have all 3 Y s (YES) to be acceptable.  
 There are 5 - 1/150th acre circular fixed radius satellite plots (FRP) in the Quadrat Plot.  
 Remember to assess trees at the time of harvest not the day you are cruising.  
 Enter results of each plot on the tally sheet.  
 Only the center satellite plot (SP 1) is GPSed.  
 Limiting distance factor for 5 BAF is 3.89 (DBH x 3.89=HLD)

Distance between Quadrat Plot centers is 208 feet.  
 The last Quadrat Plot on a line must fit entirely on the lot. If it does not, do not sample last Quadrat Plot.





**Some Clear Cuts are Easily Identified!**





**Not All Clear Cuts are Treeless**





**When In Doubt ... Do Some Sampling**





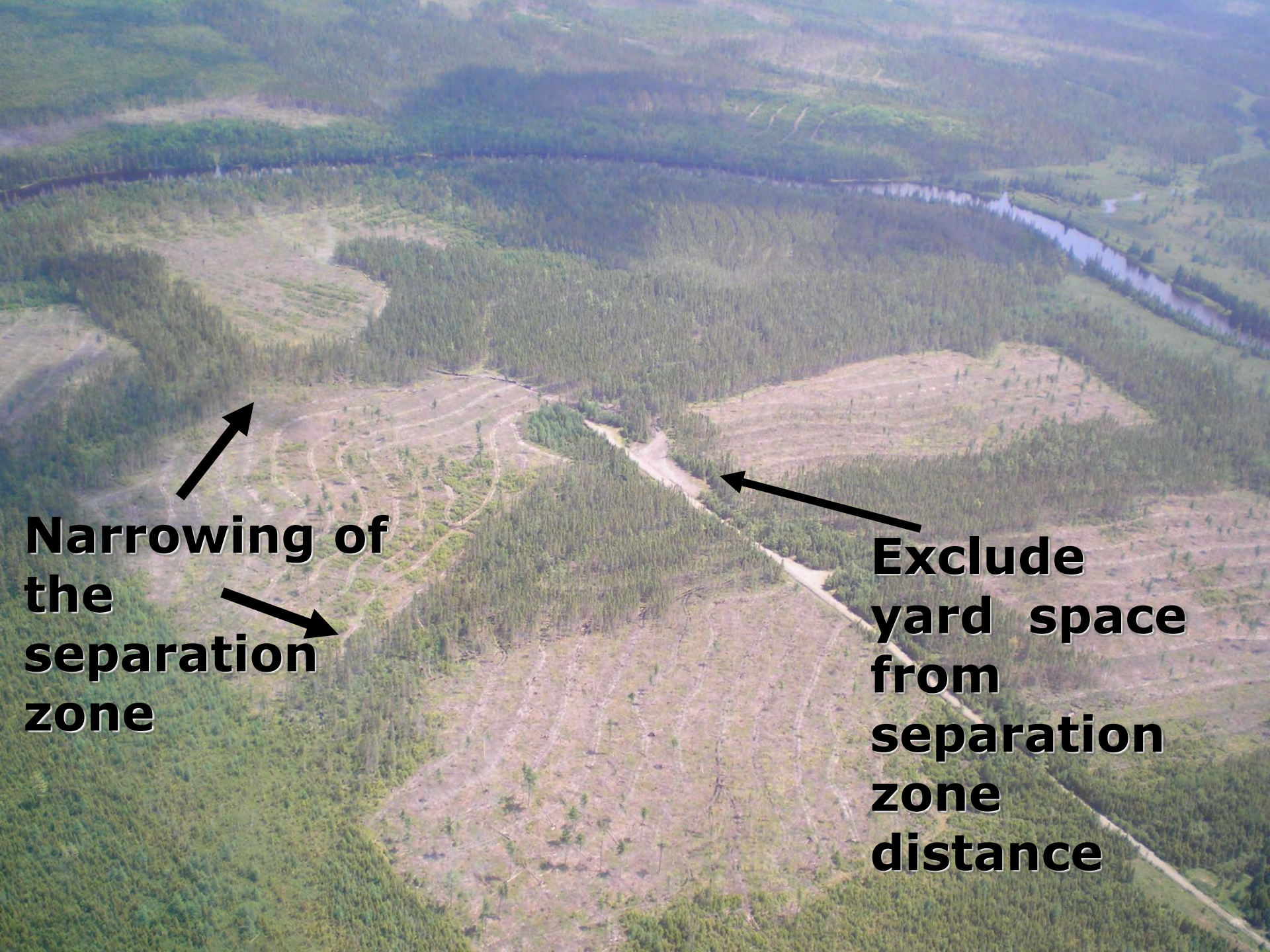
## **Residual Trees and Trail Spacing**





**Separation Zone Composition for Clear Cuts**





**Narrowing of  
the  
separation  
zone**

**Exclude  
yard space  
from  
separation  
zone  
distance**





**Document with Data, Photos and Site Visits**

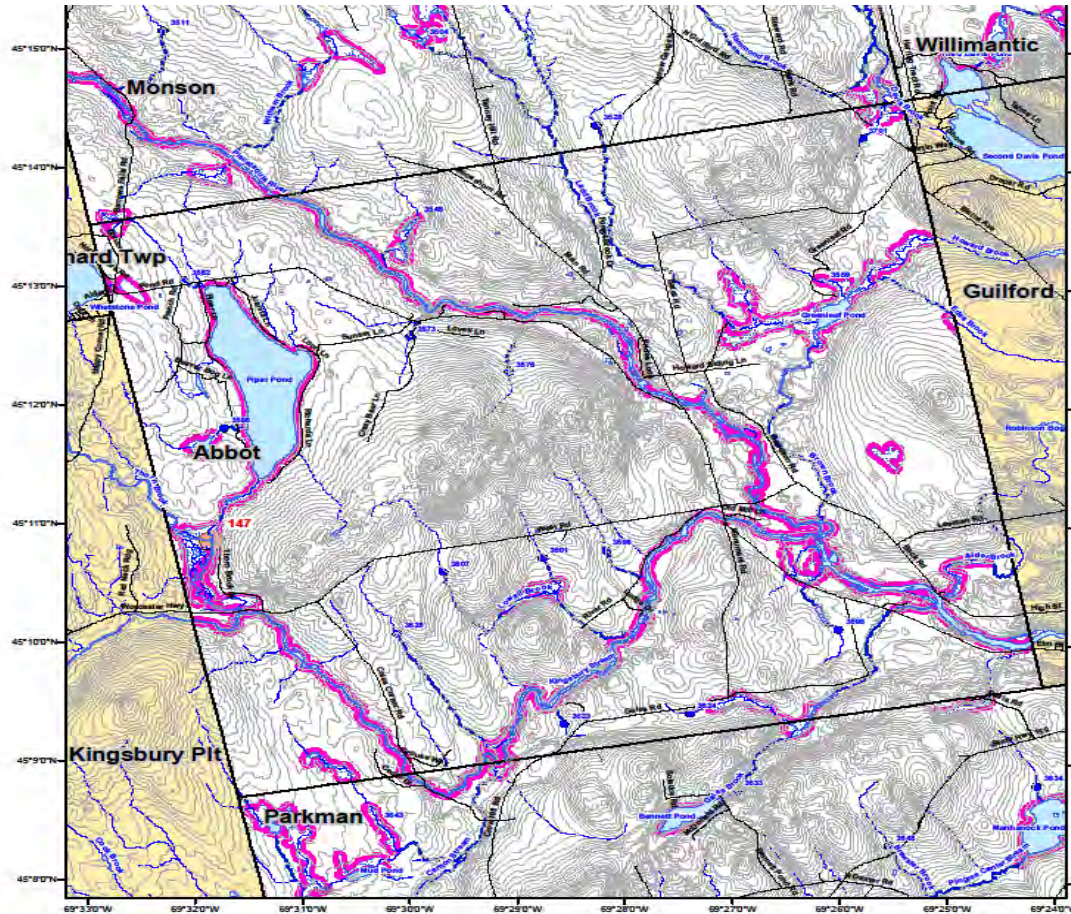


# State of Maine Resource Sites

- **Dept. of Agric., Conservation and Forestry**
  - Statewide Standards Maps
  - LUPC Land Use Guidance Maps
  - Forest Management Plan Review (MNAP data)
- **MEGIS (Maine Office of GIS)**
  - Maine Ortho-Imagery and Base Map Viewer
  - LUPC Zoning and Parcel Viewer
  - Maine Natural Areas Program Data Checker
  - Beginning with Habitat Map Viewer
  - National Agriculture Imagery Program (NAIP)



# Statewide Standards for Shoreland Areas



**This map is ADVISORY, for planning purposes only. Actual ground conditions and water body locations determine where and how MFS timber harvesting rules apply. Contact the MFS for additional information/assistance from a MFS Forester.**

## Abbot

### Wetlands

- Non-forested Wetlands Greater Than 10 acres (Aquatic, Palustrine)
- Emergent or Marine Wetlands

\*See MFS Rule - Chapter 21 for additional information.

### Maine Forest Service

For additional information, please contact the MFS at:  
 1-207-287-2791 or 1-800-367-8223 (in-State)  
 Email us at: [forestmf@maine.gov](mailto:forestmf@maine.gov)  
 or on the web at: [www.maineforestservice.gov](http://www.maineforestservice.gov)

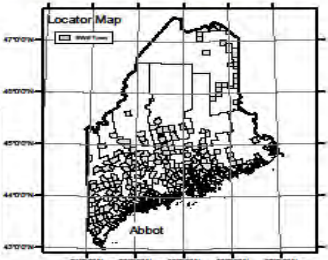
### Drainage Points

- 1254 100 Acre Drainage Point (part of the 75 ft buffer) (1254 = ID Number (location info))
- 25 25 Square Mile Drainage Point (part of the 25 ft buffer) (50 ID Number (location info))
- Essential Wildlife Habitat (Swamp Term, Riparian Term, Flapjacking)
- Towns that do not fall under the Shoreland Standards Rules (Other standards apply)

### Buffers

- 250 Foot Buffer Zones (Great Ponds, Non-forested Wetlands greater than 10 acres, Shrub below the 25 square mile drainage point, Tidal Waters, Coastal Wetlands, Riparian Wetlands (Swamp Term, Riparian Term, Flapjacking))
- 75 Foot Buffer Zones (Shrub below the 25 square drainage point and the 25 square mile drainage point)
- Shoreline Integrity (Shrub existing less than 200 acres, ponds and Non-forested Wetlands greater than 0.5 acres and less than 10 acres)

*Shoreline Integrity also applies to UNMAPPED streams & wetlands.*



© 2013, Esri/USGS Topo. Field Map September 2013 11 x 17 inch

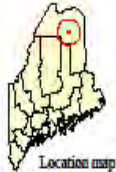


# Land Use Guidance Map

## Nashville Pitt.

T12 R6 WELS

Aroostook County



Maine Department of Conservation  
 LAND USE REGULATION COMMISSION  
 Augusta, Maine 04333-0022  
 (207) 287-2631  
 TTY (207) 287-2213  
<http://www.state.me.us/doc/lurc>

### Legend

#### Development Subdistricts

- D-CI Commercial/Industrial
- D-RS Residential

#### Protection Subdistricts

- P-FP Flood Prone
- P-FW Fish and Wildlife
- P-GP Great Pond
- P-SL1 250 feet Shoreland - Major
- P-SL2 75 feet Shoreland - Minor
- P-WL1 Wetlands - Significant
- P-WL2 Wetlands - Scrub-shrub
- P-WL3 Wetlands - Forested

#### Management Subdistricts

- M-GN General

#### Water body

- Improved road
- Unimproved road
- Trail

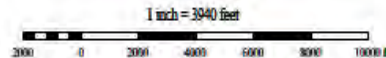
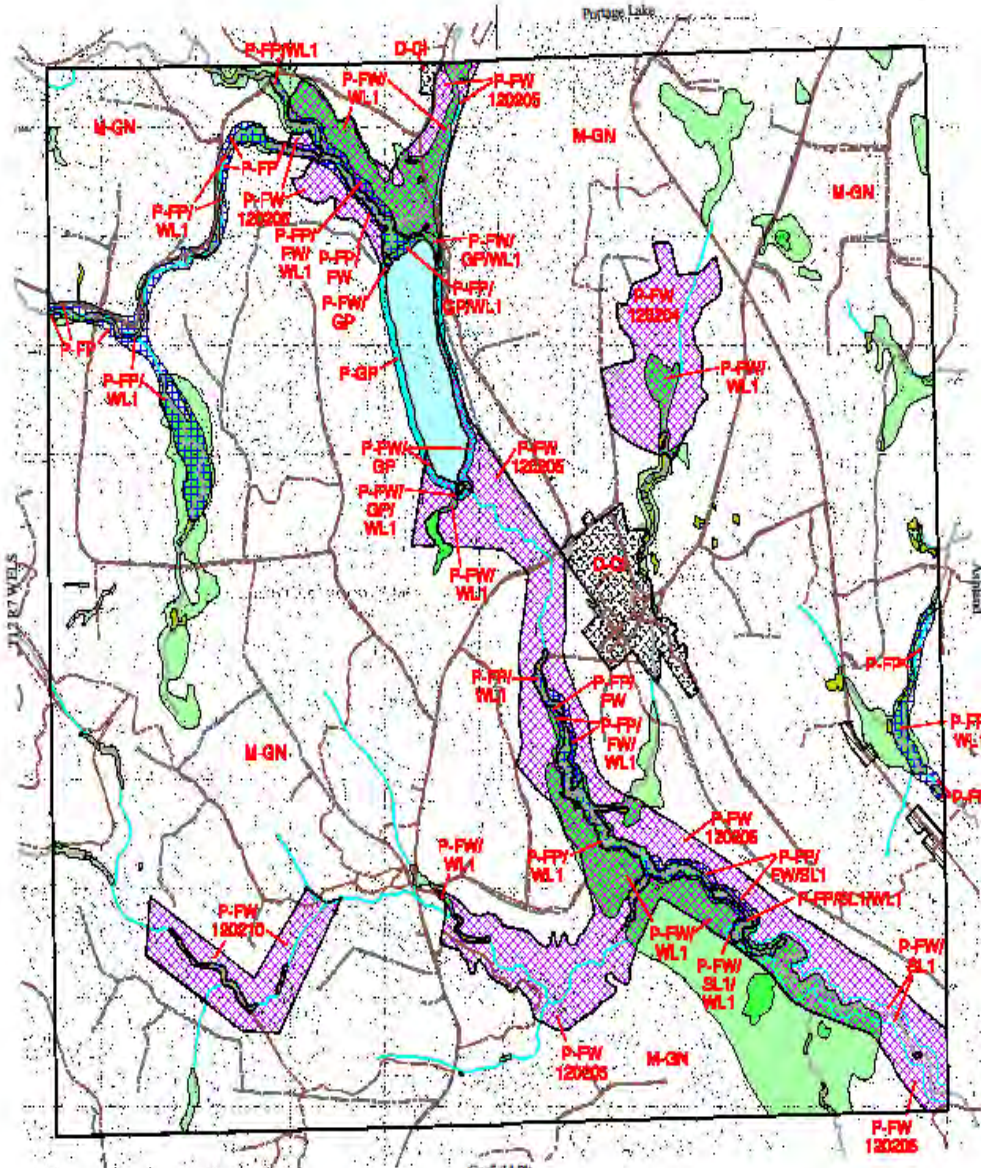
Areas designated as two or more protection zones are annotated with each zone, e.g. P-FP/FW/WL1, P-FD/SL1, etc., where necessary

or Subdistrict boundary  
 Zoning amendment

Topographic base, roads and trails from U.S. Geological Survey 7.5-minute map series

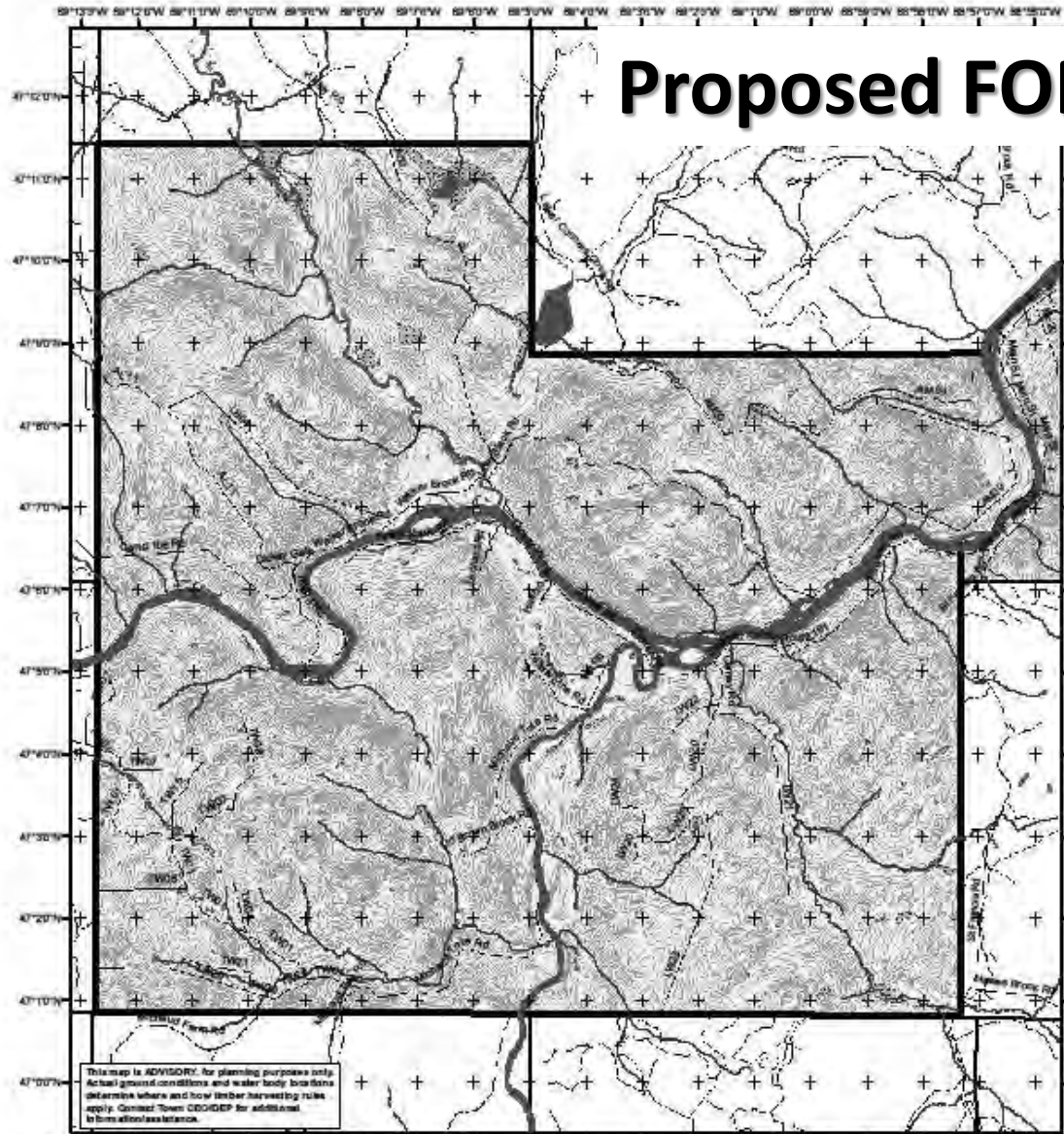
For the purpose of simplicity, this map does not show the Wetland Protection Subdistricts for areas identified pursuant to Section 10.16.K.2 such as beds of rivers, lakes, and other water bodies, and freshwater wetlands within 25 feet of stream channels, which are nevertheless within P-WL Subdistricts.

This map is a reduced version of the official Land Use Guidance Map. It is not certified to be a true and correct copy. Full size official LURC Land Use Guidance Maps are available from the Commission at its Augusta office. Potential applicants unsure of their zoning should request a full size map from the Augusta office.





# Proposed FON map



This map is **ADVISORY** for planning purposes only. Actual ground conditions and water body locations determine where and how timber harvest by rules apply. Contact Town CDD/DEP for additional information/assistance.

LO Last Name \_\_\_\_\_  
 LO First Name \_\_\_\_\_  
 Prepared By \_\_\_\_\_  
 FON# \_\_\_\_\_  
 Date \_\_\_\_\_

## Forest Operation Notification & Harvest Location Map

### Allagash

Department of Agriculture, Conservation and Forestry  
 Maine Forest Service  
 Forest Policy & Management  
 January 2014

- Roads**
- (dotted) Road
  - (solid) Road
- Contours**
- 50 ft
  - 20 ft
- Utilities**
- Electric
  - Gas
  - Sewer

- Freshwater Wetlands**
- (dotted) Wetland
- Hydrology**
- Pond or Lake
  - River
  - Estuary
- Streams**
- Stream
  - Stream/Intake
  - Stream/Reserve

- Town Status**
- FON Town (TownMDEP Standards Rules do not apply (TownMDEP Standards apply))
  - StreamMDEP Standards Rules Apply of 10/10/03-10/10/03 (no road Town)
  - Outside Town

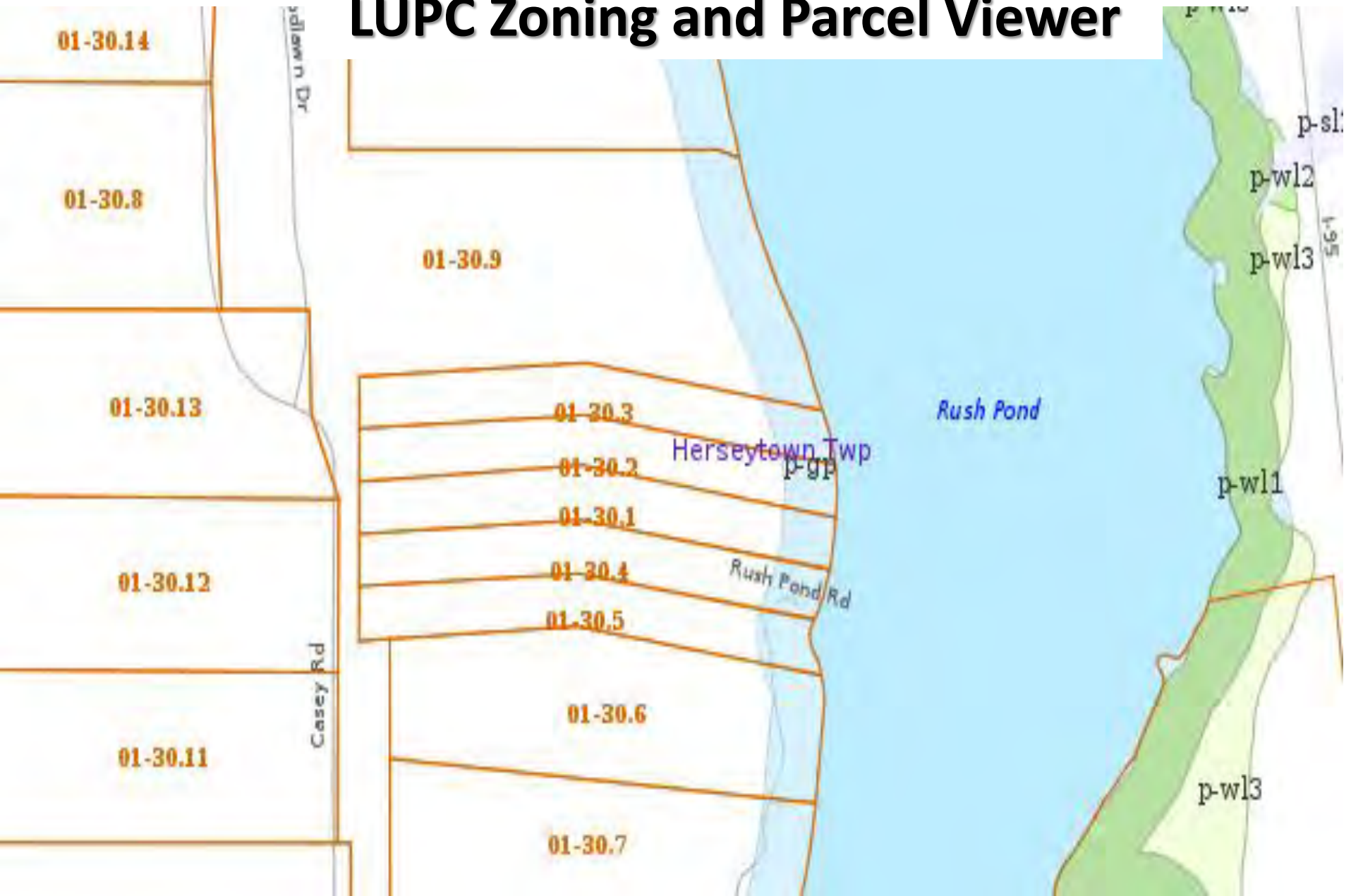
Not a legal survey map



For additional information, please contact the LPO at 1-800-287-2734 or 1-800-287-2123 (toll-free).  
 Email: lpo@maine.gov  
 Or visit us on the web at www.maine.gov/dep

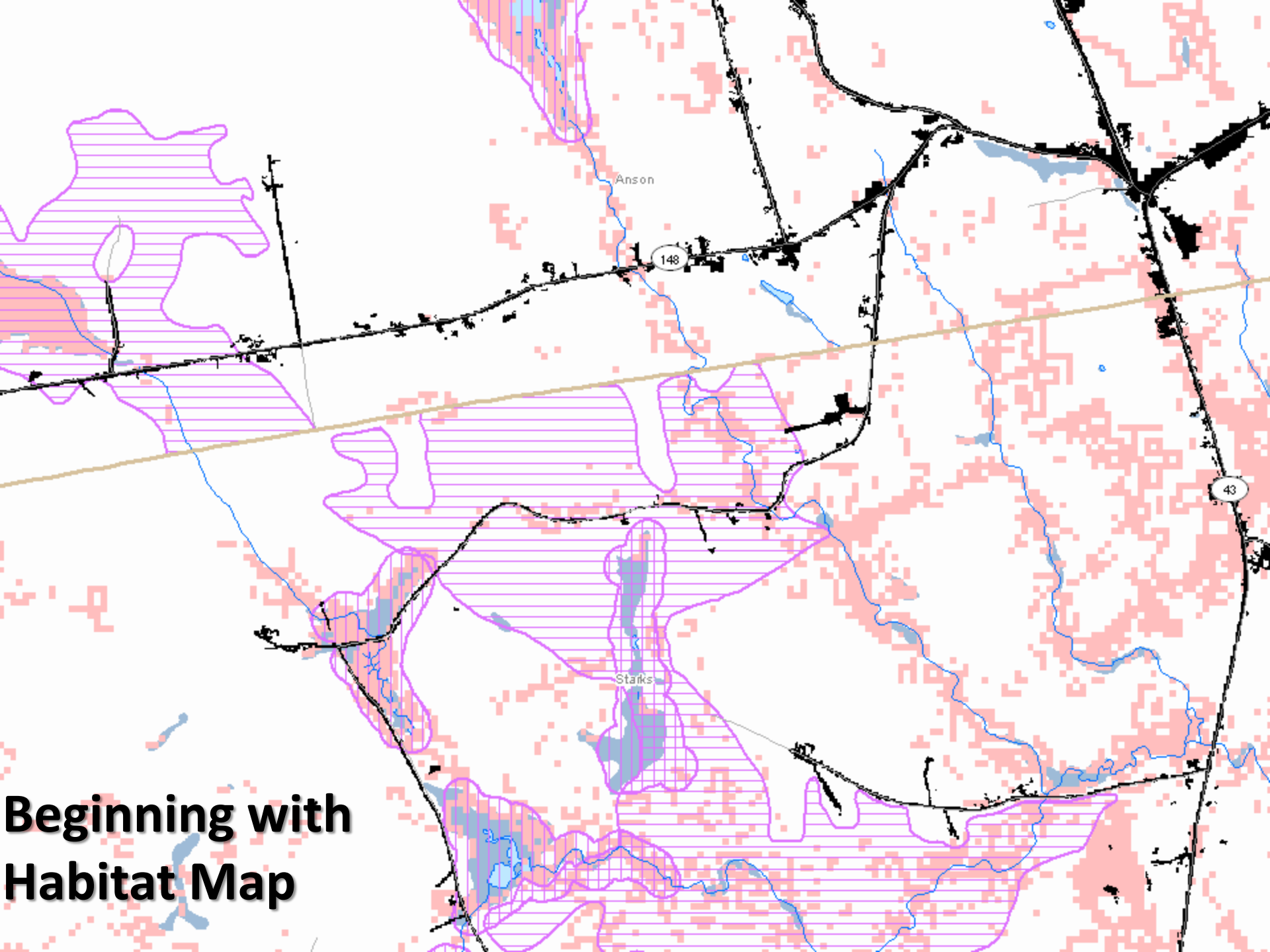


# LUPC Zoning and Parcel Viewer





# Beginning with Habitat Map





# LINKS

[www.maineforestservice.gov](http://www.maineforestservice.gov)

[www.maine.gov/dacf/](http://www.maine.gov/dacf/)

[www.maine.gov/dacf/mfs](http://www.maine.gov/dacf/mfs)

[www.maine.gov/dacf/lupc](http://www.maine.gov/dacf/lupc)

[www.maine.gov/dacf/mnap](http://www.maine.gov/dacf/mnap)

[www.megis.maine.gov](http://www.megis.maine.gov)



**WELL, I KNOW THAT  
WE'RE NOT IN  
JACKMAN ANYMORE !**





**A Bad Day Fishing is Better than Any Day at Work!**

