

**WDSC 422 Final Project**  
**Harvest Planning for a University Forest Tract**  
Harvesting Forest Products, Fall Semester 2015

Attached are maps for a portion of the West Virginia University Research Forest in Monongalia County, West Virginia. A timber sale is being considered for a 67 acre-tract marked on the map which is located approximately 15 miles northeast of Morgantown, WV (see attached maps).

The area is primarily on a northeast-facing slope with an average slope of about 15-25%. The predominant species for this area are yellow-poplar, red oak, and black cherry. A pre-sale cruise has been performed on the tract (attached).

Provide your client a comprehensive harvest plan for this timber sale. Please note and consider the following points:

- (1) Study the topo maps, identify boundaries and SMZs, and find out soil types and conditions.
- (2) Make sure you know where the current roads are located and accurately reflect their location on any maps you create or new skid trails or plans you suggest.
- (3) Current access to the tract is through the road mentioned previously. Give consideration to oncoming traffic.
- (4) All operations must comply fully with the most recent version of West Virginia Silvicultural Best Management Practices for Controlling Soil Erosion and Sedimentation from Logging Operations.
- (5) What maintenance, if any, will the access road leading to the existing road require for use? If used, what maintenance will skid roads on the tract require?
- (6) Recommend the type of harvest you would conduct in the tract based on the cruising data, a visual reconnaissance (if applicable), and your own judgment.
- (7) Suggest where you would place any logging decks and the direction of skidding to each deck.
- (8) If possible, using GIS to create a map of the site that includes locations of all skid roads, landings, and haul roads that will be needed to harvest the tract. You need to measure the distances of skid and haul roads. If assuming the landing is ¼-acre in size, calculate the costs of road and landing construction based on the unit building costs listed in Tables 1-4.
- (9) Complete a Timbering Operation Notification Form (attached) pertaining to the harvest on this site.

Please provide me a detailed report that outlines a harvesting plan for this tract with selected attachments. Please consider each of the steps in Shaffer's publication on harvest planning. Use GIS to produce the maps and conduct some basic analysis. This report is due at the beginning of lab next week.

You should use this web link to download the related shape files and other support data and document for this project; <http://www.wdscapps.caf.wvu.edu/jxwang/courses/wdsc422.html>.

Table 1. Building costs of skid road, haul road, and landing.

	Unit cost
Skid road	\$1000/mile
Haul road	\$1500/mile
Landing	\$500 per 1/4-acre

Table 2. Harvesting Function Production.

Harvesting systems	MBF/PMH
Chainsaw	2.2
Cable Skidder	1.8
Feller-Buncher	7.6
Grapple Skidder	3.1
Harvester	7.4
Forwarder	5.2

Table 3. Trucking Costs.

Function	\$/Mile
Load and Haul	0.65

Table 4. Harvesting costs.

Harvesting systems	Unit cost (\$/MBF)
Manual (chainsaw and cable skidder)	30
Mechanized (feller-buncher and grapple skidder)	50
Trucking and hauling (100 miles)	65

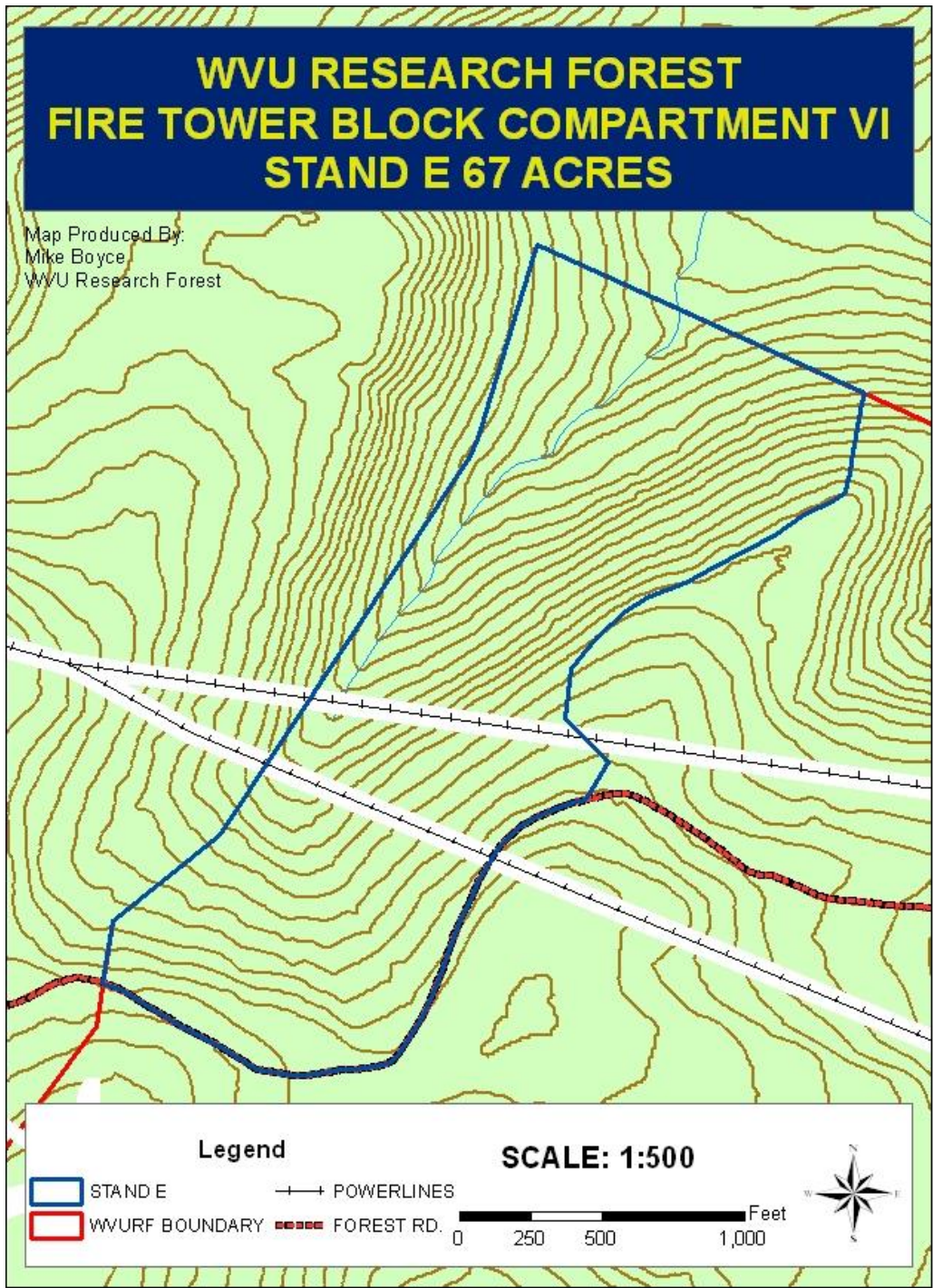


Figure 1. Topographic map of the tract and WVU Research Forest.


## Instructions WDSC 422 Final Project

Please follow the instructions to finish the lab. Feel free to ask if you have any questions.

### Step 1. Data preparation


1. First, you need to create a folder on your computer where your outputs will be saved.
2. Download the spatial data for lab 13 from the class website:  
<http://www.wdscapps.caf.wvu.edu/jxwang/courses/wdsc422.html> and save to your folder.
3. Unzip the downloaded file. You will get a folder named “WDSC422\_SpatialData”.

### Step 2. Add spatial data to ArcMap

1. Open ArcMap and press the “Add Data” button , go to the directory you created and add the following files from the “WDSC422\_SpatialData” folder:
  - Harv\_Bound.shp - Harvest tract boundary;
  - roads\_general.shp - County roads;
  - WVU\_resfor\_soil.shp - Soil type data;
  - wvu\_for\_Topo.jp2 - Topographic map.
2. Click the legend of “Harv\_Bound”, and change the filled type of polygon as “Hollow”. You can also increase the “Outline Width” to “2” and change outline color to Red or other colors. Click “OK”. Follow the same procedures to make “WVU\_resfor\_soil” layer the filled type to “Hollow” and “Outline Width” to “2”.
3. Right click “Harv\_Bound” and select “Zoom To Layer”.
4. Right click “WVU\_resfor\_soil” and select “properties” from the dropdown menu. In the pop up window, click “Labels” and change Label field to “MUSYM”. Check the “Label features in this layer” and Click “OK”. Now, you’ll find the soil type in the harvest tract.
5. Don’t close ArcMap. We will use it later.

### Step 3. Create a landing and a skid trails shapefiles

Let’s create a landing shapefile first. The same procedures will be applied to skid trails shapefile.

1. Open ArcCatalog  (or click “windows”->”Catalog”), and find your own folder on the catalog list.
2. RightClick on you folder and select ”New”->”Shapefile”, then the “Create New Shapefile” window will pop up.
3. Change the name to “Landing” and Feature Type to “Polygon”.
4. Click “Edit” button and browse to Projected Coordinate Systems-> Utm-> Nad 1983-> NAD 1983 UTM Zone 17N, then click”OK”->”OK”.
5. Now the landing shapefile has been created. Repeat the above procedures from 2 to 4 to create another skid trails shapefile. Keep in mind that the name should be “SkidTrails” and Feature Type is set to “Polyline”. The others are the same.

### Step 4. Delineate Landing and skid trails

1. Right Click “Harv\_Bound” and choose “Zoom to Layer”, you will see a bigger tract boundary.


2. Add "Editor Toolbar". If you can't see this Editor toolbar, go to the menu "Customize" -> "Toolbars" -> check the "Editor".
3. Click "Editor" on the Toolbar, and select "Start Editing". Under "Editor" -> "Editing Windows" -> "Create Features", select "Landing" to make it the layer to edit.
4. Now we are ready to delineate the landing location. Make sure the target is set to "Landing". Click the "Polygon" in the "construction tools" window below the "Create Features" window and draw a landing on the tract. Remember that you have to click at least three points to draw a polygon. When you are done, double click it. Your landing is highlighted.
5. Click "Save Edits" first at the drop down menu of Editor and then "Stop Editing". The landing shapefile is done.
6. To delineate the skidding trails, you can repeat the above procedures from 4 to 6. At this time, the target should be "SkidTrails" in procedure 4 and select "line" in procedure 5. After you finished the skid trail shapefile, you can also change the feature/legend if you need. For instance, increasing the line weight to "2".

### **Step 5. Save your ArcMap documents**

To save your ArcMap file, go to the top menu "File" -> "Save As", change the directory to your own folder and save your file as: **yourname.mxd**.

### **Step 6. Calculate landing area and skid trails distance**

Suppose that you are still at step 4 now (make sure you have Stop Editing: "Editor" -> "Stop Editing").

1. To calculate the landing area, in the table of contents window, right click "Landing" -> "Open Attribute Table", click "Table Options"  -> "Add Field". Give the name "area" and Type "float". Leave the "precision" and "Scale" as default. Click OK. Now you add a field to the table.
2. Right click the new field "area" and choose "Calculate geometry". In the properties, select "area". Click OK. Your results will be shown in the table.
3. Repeat procedure 1 to create a field named "length" with "float" type for "SkidTrails" layer. To calculate the skid trails distance, Click the new field "length" and choose "Calculate geometry". In the properties, select "length". Click OK. Unit: meters.
4. Now, it is the time to save your work, click "Save."

### **Step 7. Create your map and output**

1. Now go to the top menu "View" -> "Layout View". A very simple map is generated, but not complete. We need to add some basic elements on the map such as title, legend, north arrow, and scale bar.
2. Click "Insert" and add Title, Legend, North Arrow, and Scale bar.
3. When you are done, click "File" -> "Export Map", you can save your map in the format of .jpg, .gif, etc.
4. Save your work and close the project.

## Report Format

Cover Sheet (Project title, your name, WVU address, date)

Table of Contents

### 1. Harvest Area Description

- a. Land Owner - Name, Address, Contact Person, Phone Number, etc.
- b. Location - Address or Lat/Long, Reference Map, Watershed(Huc12 number and name)
- c. Harvest Area Attributes - Soils with erodability info, slope range, species present, area to be harvested in acres or hectares.
- d. Harvest & Harvest System-Harvest Type, Volume that will be removed, Harvest contractor info (Name, Address, Phone, etc.), Equipment to be used, Harvest schedule, Product info (where it is going and which routes will be used to transport products).

### 2. Operational Considerations

- e. BMPs - Description of best management practices that will be employed, location and sizes of SMZ's (include operations that will be allowed inside the SMZ's), any other environmental considerations and methods needed to mitigate potential impacts. Include justification of the methods that you are utilizing.
- f. Roads -Preliminary road lines (if necessary), Road maintenance plans(what activities and how often)
- g. Designated Skid Trails – Indicate the total length, maximum and average slope of designated skid trails, area impacted by skid trails.
- h. Landing Locations - Text description of where landings will be placed and which areas of the harvest unit will be accessed from them.
- i. Seasonal/Wet operation restrictions - Describe any operational restrictions that will be placed on the site due to the time of year or prolonged precipitation.
- j. Powerline Protection - Describe how work conditions will be adjusted to avoid/protect powerlines (if present).
- k. Product Specifications - Describe the product specifications that will be used to define product sorts.
- l. Detailed Harvest Map - This map should show the locations of landings, SMZ's, designated skid paths, stream crossings, culverts, etc. This map should have a title, north arrow, scalebar, legend that clearly describes all symbols, date, and name of preparer.
- m. Harvest Schedule - This should be a Gantt that depicts the schedule of the harvest from move in through the completion of hauling and sale closeout.

### 3. Cost Analysis and Financial Projections

- n. Equipment Costs - provide cost calculations for each piece of equipment
- o. Operational Costs - Building of roads, skid trails and landings, road maintenance, etc.
- p. System Configuration - Describe the system that will be used, numbers of each type of equipment and justifications for this configuration.
- q. Production Estimates - based on the decided system configuration, how much wood will be produced per day and/or week, what is the daily and/or weekly revenue and profit/loss.
- r. Summary-Summarize the financial opportunity that you see for this operation

Appendix 1. Completed Timbering Operation Notification Form