Vegetation and Fuel Monitoring Protocols for the
Long Island Pine Barrens Fire Management Demonstration Site Project
Adapted from the UMass Project "Managing Fuels in Northeastern Barrens"

Plot Selection, location, and timing: (Each "plot" represents a point that will serve as the starting point for the individual transects and plots described below).

Equipment

1. map of forest with plots and stands labeled
2. handheld computer with ArcPad and GPS unit plug-in
3. Desktop/laptop computer with ArcView/ArcMap
4. Tape or other object
5. Chaining pin
6. Flagging (bright color)

Methods

1. Stand divisions were based upon the approximate dominant vegetation types and structure of the forest (see map "National Fire Plan Demonstration Site Vegetation Community Types"). Aerial imagery, 2.4 meter multi-spectral satellite imagery and ground surveys (walk through) were used to make this assessment.

2. Treatments were assigned within these community types as listed in the table labeled "Generalized Preliminary Treatment Plan" and mapped according to prescribed fire and mechanical treatments.

3. For pre-treatment monitoring: Each contiguous area of the dominant vegetation types received a GIS grid of points offset by 100 feet from any other point and at least 75 feet from any perimeter of the unit.

4. For post treatment monitoring: Each contiguous area of treatment within the dominant vegetation types will receive a GIS grid of points offset by 100 feet from any other point and at least 75 feet from any perimeter of the unit.

5. Variable numbers of points depending on unit size and relative homogeneity were randomly selected from the grid (using either a random number table or calculator function), then located in the field using GPS. When the GPS indicates that you are nearby the plot (within approximately 50') have any additional monitoring staff wait outside the area until plot center and transect bearing have been determined. Try to avoid trampling of fuels during the location process. When the GPS indicates the point has been reached in the field, the exact point will be selected by an individual closing his eyes, spinning several times, and tossing an object over his shoulder(ex. transect tape). A pin marking the start point will be inserted where the object lands (pin inserted into start of tape wherever it lands.) Use the GPS unit to record plot center. Record plot number, row and point number, and UTM on datasheets. Tie a piece of flagging on nearest live vegetation and record stand#, plot#, UTM, observers, and date.

6. Pre-treatment monitoring will take place during the growing season.

7. Post-treatment monitoring will take place during the growing season and vary at intervals relative to the indicator measured (For example, timing might be weeks (for fuel sampling), months (for seedlings) or years (saplings) post-treatment).

Downed Woody Fuels Transect

Equipment

1. 100' measuring tape
2. yard stick, marked in feet and inches
3. chaining pins (2)
4. go-no-go gauge with increments that correspond to time lag classes
5. compass
6. clipboard, pencils, calculator, fieldsheets (TNC dwf fieldsheet)
7. camera

After locating plot center:

1. Attach a measuring tape to a pin at the point that has been located as described above.

2. Look at the second hand of a watch. Sampling plane will extend 50 feet in a direction at which the second hand points multiplied by 6.

a. example: Your second hand is on the 3. 3 X 6 = 18 degrees. Your transect should run at a bearing of 18 degrees.
b. example: Your second hand is on the 10. 10 X 6 = 60. Your transect should run at a bearing of 60 degrees.
c. example: Your second hand is on the 47. 47 X 6 = 282. Your transect should run at a bearing of 282 degrees.

3. Have the other monitors follow into the area, staying away from the direction of the transect bearing.

4. extend the measuring tape for 50 feet in a straight line following the above calculated bearing. The tape should lie as close to the ground as possible and vegetation surrounding the plane should be disturbed as little as possible. While laying the tape walk (disturb) only one side of the tape, measurements will be taken along the opposite side.

5. Along the sampling plane:

between zero feet and fifty feet:

1. count all intersections between the sampling plane and any dead, unrooted woody material larger than 1 inch in diameter and below nine feet high. Intersections should be divided into size classes:

i. 1-3 inch diameter
ii. 3+ inch diameter

2. for all intersections with pieces larger than 3 inches, measure actual diameter where intersected, perpendicular to the center axis of the piece and record as either sound or rotten

3. dig into litter along the ground and record intersections of wood within the litter as well as those above it

*** Do not measure any rooted plant material live or dead*** Use a yard stick to run systematically down the transect detecting intersections with downed woody fuels *** "The center of a piece of fuel must cross transect line to count as "in"

at 0-1 ft, 10-11 ft, 20-21 ft, 30-31 ft, and 40-41 ft:

While progressing down the transect counting 100 and 1000hr fuels, stop at the above locations to:

1. measure the greatest depth of the litter layer that intersects the sampling plane in the one-foot section.

2. measure the highest dead, unrooted woody fuel (slash) that intersects the sampling plane in the one-foot section.

3. measure the height of the tallest dead, rooted shrub that intersects the sampling plane in the one-foot section.

4. measure the height of the tallest live shrub or tree shorter than nine feet that intersects the sampling plane in the one-foot section.

Photo Monitoring

Take two photos of the downed woody fuel transect line from 50ft looking back towards 0ft, take another two from 0ft looking towards 50ft. One photo should include a person within the frame, the second photo should be the vegetation only. Record photo numbers from the camera onto the datasheet.

Roll up the measuring tape and return to 0 feet, and proceed with:

Variable Radius Plot at that point:

Equipment:

1. 100' measuring tapes, marked in feet and tenths on one side, meters on the other
2. DBH tape
3. spherical densiometer concave
4. clinometer
5. Cruise-all
6. compass
7. clipboard, pencils, calculator
8. blank fieldsheets (TNC Variable Radius), BAF limiting distance factors

1. Use the densiometer to measure percent cover of all vegetation above waist height four times: while facing North, East, South, and West while centered on 0 point.

2. If this is the first plot in a stand, Determine basal area factor using a Cruz-all with either a 5,10 or 20 ft^2/acre BAF depending on the characteristics of the stand, so that at least five- ten stems are sampled. A consistent factor must be used in each stand.

3. Using previously determined consistent Cruz-all BAF factor for the stand (see #2), Record species and dbh of each stem "in" the variable plot using 0 point as variable plot center. If a tree is borderline, according to the Cruz-all measure the diameter of the tree and the distance from plot center (0 point) to the middle of the tree. Multiply the diameter of the tree by the BAF limiting distance factor to determine if the tree is "in". If the distance of the tree is less than the calculated distance, the tree is "in" and recorded on the datasheet. If the actual distance is more than the calculated distance, the tree is "out" and not recorded.

4. Record if the stem is live or dead, crown position class, defoliation rating (for tree oaks only), note signs of insect or previous fire damage to tree. For oak trees, estimate defoliation index: 1 = light (0-25% defoliated), 2 = moderate (26-50% defoliated), 3 = heavy (51-75% defoliated), and 4 = severe (76-100% defoliated).

5. Take photos of the area while standing over the 0ft point, two photos looking in each direction: North, East, South, and West, one with a person in the photo, one with the vegetation only.

6. Use the clinometer to measure the average percent slope surrounding the plot.

7. Make note of any species encountered not noted in the plot. Make note of fire scars, cut stumps, and other evidence of disturbance.

8. Sample 40x40cm^2 Harvest Plots and conduct Scrub Oak 1x1m Tally (see next two pages).

9. Use the GPS unit to locate the next selected plot starting point, and repeat protocols.

40x40cm^2 Harvest Plot

Equipment

1. go-no-go gauge with increments that correspond to time lag classes
2. compass
3. map of Forest with plots and vegetation types labeled
4. pruning shears
5. marker for paper bags
6. paper bags for vegetation samples – 2 large grocery bags, 2 small sandwich bags7. 40cm X 40cm (1600cm^2) frame made from 1/2" PVC pipes

Field Procedures

1. Once the monitoring point is located, throw an object over your shoulder and place a square frame of PVC pipe with internal dimensions of 40cm by 40cm flush on the litter surface. Harvest all fuel (except scrub oak) from the 40 X 40 cm^2 quadrat:

Use PAPER grocery bags. LABEL each bag Date, Stand #, plot #, site, UTMs, contents, harvesters (crew members)

2) First find the base of all live vegetation- if it is outside the unit, pull whole stem outside, if the base is inside the unit, pull whole stem inside the unit. Clip from the outside of the square.

3) Except for scrub oak (ignore), cut all stems at the humus (duff) surface and separate into three bags:

a. low shrubs, standing live
b. low shrubs, standing dead
c. herbs, live

4)Then pick up all the downed woody stems and put in separate bag.

5) Litter: along the edges pull half the litter in, pull half the litter out . Place all litter, including downed wood, in a separate bag. Take litter down to fermentation layer, not the duff!

Notes:

*Stems rooted inside the frame are considered "in," (and are collected) as are any branches or foliage of those stems.
*Stems rooted outside the frame are considered "out," (and are not collected) as are any branches or foliage of those stems.
*Downed (unrooted) woody fuels that cross the plane of the frame are cut where they cross; the portions inside the frame are "in," those outside of it are "out."

1x1m^2 Scrub Oak Biomass Plot

Equipment

1. scrub oak go-no-go gauge with increments of 1/4 cm, up to 3 cm
2. compass
3. map of forest with plots and vegetation types labeled
4. blank fieldsheets(SO_1x1m_calculation_TNCversion), clipboard, pencils
5. 1m x 1m frame made from 1/2" PVC pipes
6. Spreadsheet template for calculating fuel loads.

Procedure

1. Once the monitoring point is located, throw an object over your shoulder and place a square frame of PVC pipe with internal dimensions of 1m x 1m flush on the litter surface.

2. Measure and record the basal diameters of all scrub oak stems (at approximately 5cm height on stem) rooted within the frame to the nearest 0.25cm, keeping separate tallies for live and dead stems.

3. In the laboratory, enter all data for live stems into a spreadsheet.

4. Using allometric equations estimate the dry weight of live scrub oak fuels in each time-lag class (1-, 10-, and 100-hr fuels).

5. Combine these data with those from the 40cm x 40cm plots to determine the total shrub and litter mass by fuel size class.

Office Procedures for 40x40cm Harvest plots:

Equipment

1)drying oven
2) scale with at least 0.1g accuracy
3) labsheets for recording weights in the lab
4) Spreadsheet template for calculating fuel loads.
5) newspaper sheets
6) plastic or aluminum trays
7) marker
8) Datasheet

Procedure

1. Dry samples in a convection oven at 70° C for at least 48-72 hours. Remove bags from drying oven, write a "bag #" and record weight of the each bag to the nearest 10^{th} of a gram and time of observation. Return in 1.5-2 hrs (or more) and weigh the bags again. If the bags have not decreased in weight 0.5 – 1 gram or more, the contents of the bag have reached their oven dry weight and can be recorded.

2. Once dried, separate contents of each bag on newspapers being careful not to loose any material and weigh by category. Place tray on scale and tare. Prior to adding material from the newspaper, the scale should read 0.0g.

a. Separate live leaves from live wood, weigh wood by diameter class (same as dead wood--see below)
b. live foliage/leaves
c. live herbs
d. non-woody dead material (litter)
e. dead wood, by diameter class (corresponding to 1-, 10-, and 100-hr time lag classes of fuels)

- 0-1/4" diameter
- 1/4-1" diameter
- 1-3" diameter
- >3" diameter

3. Record weights to the nearest 0.1g on the labsheet.

Notes: Throw out any rocks from samples. Acorns and caps count as 1 hr woody fuels. Open pine cones with a lot of air count as 1 hr woody fuels, closed denser pine cones count as 10hr woody fuels. If a stick changes diameter size class, break/cut at size class change and weigh separately. Pine bark chunks will count as 1 or 10hr woody fuels depending upon size and thickness. Weigh the remaining "dust" with the leaf litter.

4. Record all samples from each stand on one datasheet (each stand should have its own data sheets). On the datasheet record stand number, sorter, date harvested, plot #, UTM, and contents of each bag in each category. After completing bags and labsheets for a stand enter data into excel workbook that will calculate fuel weights for you from data of dry weights from 40x40 sampling..

5. If you do not use the workbook, convert the fuel weights from g/40x40 to tons/acre.

Downed Woody Fuels Fieldsheet

Location: Date:
Stand #: Crew:
Length of transects:

Plot number	UTM	#100hr intersections	1000hr intersections' diameters (in; sound or rotten?)	depths measured at:	litter depth (in)	slash depth (in)	dead standing depth (in)	live standing depth (in)	Photo (#)
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					
				0-1 ft					0'-50'
				10-11 ft					
				20-21 ft					50'-0'
				30-31 ft					
				40-41 ft					

Observers ______________ Variable Plot Inventory Form Date ___________

Stand #_______________ Cruz-all factor _______ Page ___ of ___

Pt	Slope	Tree	Species	DBH	L/D	crown	Oak	Crown		notes: insect/disease damage,
#	%	#	**	Inches		position	Defoliation	Closure	fire?	invasives, etc.
						(Class*)	Rating***	(# points)	Y/N	Photo- N E S W
								N E S W		

* Crown Classes: Dominant (D) Co-dominant (C) Intermediate (I) Understory (U)

** Species Codes: Pitch Pine (PP) White Oak (WO) Black or Scarlet Oak (BSO) Sassafrass (SF)

***Tree Oak Defoliation Rating: Low, Moderate, High, Severe

Scrub Oak 1x1m Survey Fieldsheet

Location ________ ________________ Date ________________ Crew ________________

Stand # ________ ________________ Treatment ________________ ________________

Plot		1	2	3	4	5	6	7	8	9	10	11	12	13
Number		1/4 cm	1/2 cm	3/4 cm	1 cm	1 1/4 cm	1 1/2 cm	1 3/4 cm	2 cm	2 1/4 cm	2 1/2 cm	2 3/4 cm	3 cm	>3cm
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
	Live													
	Dead													
totals	Live													
	Dead													