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Silviculture Prescription
South River 2016

Massachusetts Department of Conservation and Recreation
Bureau of Forestry

Western Connecticut Valley
South River State Forest
Conway, MA

Prepared by:

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Approved by:

Management Forestry
Program Supervisor  Date: December 15,2016
William N. Hill, CF

Overview:

The South River State Forest is located in the town of Conway along the Deerfield River south of Bardwell Ferry. It was transferred to DCR (DEM) in 1965 as part of a land swap with a major utility company and prior to that it was held in private ownership. The forest was managed for timber, fuelwood and Christmas trees in cooperation with the Commonwealth of Massachusetts Forestry program which provided management services to the previous landowner since the 1950's. This site was selected for a vegetation management project in order to continue with projects that were started over fifty years ago and complies with the DCR Management Guidelines for Woodlands. The Ecosystem Services section of these guidelines provides a number of goals that would be met by this forest management project including the protection of forest productivity with the state of the art sustainable forestry, sustainable production of renewable wood products and the ecological restoration of degraded natural community types.

The project area contains red pine and Norway spruce plantations that are declining in health and vigor. Hemlock trees are showing advanced signs of Hemlock Wooly Adelgid and Hemlock Elongated Scale infestation which will quickly kill the host trees. Emerald Ash Borer has been found nearby forested areas.

This forest is even-aged in structure as a result of past historical use for pasture. A conversion to an all-aged structure is prescribed in this project to increase the number of age classes represented in the forest and increase the resiliency to catastrophic natural events such as hurricanes and tornadoes. It is with these reasons in mind that a variety of silvicultural techniques can be demonstrated and applied to restore plantations to native species, salvage dead and dying trees, create new age classes, control invasive species and provide benefits to wildlife.

The South River State Forest is an isolated 450 acre block of forestland with no developed facilities. This project was chosen for forest management with the following goals in mind:

1. Meets DCR guidelines for management in designated woodlands.
2. Increase forest diversity by removing non-native plantations.
3. Diversify even-aged structure towards a multiple age forest structure.
4. Ability to serve as a demonstration area for sound silvicultural principles.
5. Opportunity to repair and maintain access infrastructure.
6. Demonstrate Best Management Practices applied to timber harvesting.
7. Provide access control against illegal vehicle usage.
8. Implement strategy for Climate Change by manipulating species composition.
9. Salvage White ash being impacted by Emerald Ash Borer.

1. Site Data

A. Hydrology and watershed: The South River State Forest lies in the watershed of the Deerfield River. The western boundary is bordered by the Bear River which is also a tributary of the Deerfield River. Many small seeps form seasonal channels which run freely in the spring and dry out during the summer and fall. Drainages tend to form deep gullies as they drop onto the steeper slopes leading to the Deerfield and Bear Rivers.

B. Soils/Geology and landforms: The soil types range from the Merrimac sandy loams on the lower benches and terraces above the Deerfield River, progress to the well-drained and productive Shelburne series loams on the lower and mid slopes and finally to the Westminster stony loams on the upper slopes. The Merrimac sandy loams are well drained and currently support the red and white pine stands. The Norway spruce stand is in part of this soil type and also on the edge of the Colrain soil type, which is a well- drained productive soil similar to the Shelburne series. The sugar maple and northern hardwood types are on the Shelburne soils and the Westminster soils support a mix of hemlock, northern hardwoods and a small inclusion of white pine. These soils are stony, shallow and droughty under most conditions. The project area sits on a shelf above the Deerfield River and the topography is mostly gently sloping benches with a gradual rise to a low hill on the southerly side. Several short sections towards the top of the hill are steep and rock outcrops are present.

C. Site Productivity: Analysis of the Soil Conservation Service Franklin County Soils Survey and the DCR Forest Complexity Layer illustrate the correlation between site quality and past land use. The same soils that support productive agricultural use will also support productive tree growth but may have access limitations due to soil structure. The plantations are a low complexity forest due to simple species composition and even-aged structure. The hardwood stands have developed on the richer mesic sites and have a higher site index for tree growth resulting in higher productivity and complexity ratings. Past use appears to have focused intensive agricultural use on the flat to gently sloping benches that run parallel to the Deerfield and Bear Rivers. Mid-slope sections appear to have been used for pasture due to rocks and degree of slope. The most productive areas appear to be of the Shelburne and Colrain series of soils which are currently occupied by the Sugar maple and Northern hardwood types. The presence of Blue cohosh (*Caulophyllum* family Berberidaceae) and Maidenhair fern (*Adiantum* spp.), found in rich, moist, well-drained areas such as those on the Colrain and Shelburne soils, are indicators of high site productivity.

D Cultural and Archaeological Features

The DCR archaeologist reviewed the project area and noted that previous archaeological surveys showed no pre-contact sites within the proposed harvest area. Historic period sites include cellar holes, wells, stone walls, and potentially other associated structures. All features will be clearly flagged and protected during harvesting activities. Small existing landings along the main forest road will be utilized when possible to minimize soil disturbance. Harvesting activities will be carried out during periods of stable soil conditions to minimize sub-surface disturbance and limit any possible disturbance to historical sites.

2. Stand Data:

A. Forest Stand Description and Attributes

The project area is approximately 100 acres in size and is comprised of 6 different forest types.

Forest type 1 (20 acres): **White pine** (Pinus strobus) is the dominant overstory species with red maple (Acer rubrum), white ash (Fraxinus americana) and black birch (Betula lenta) as minor associate species. Understory conditions currently favor shade tolerant species such as beech (Fagus americana) and sugar maple (Acer saccharum) with other species such as white ash and black birch present along the sunlit edges of the forest type. Inventory data shows a quadratic mean diameter (QMD) of 16.7", which indicates a stand of large diameter trees with an absence of small and midsize stems. The forest canopy is dominated by large diameter white pine trees, many of them poorly-formed due to past damage from white-pine weevils. These insect pests feed on the terminal leader and often result in trunks with multiple stems. Associate species are a mixture of maple, birch, oak and hemlock with hemock and beech dominating. Forest floor conditions are mostly shaded with gaps present where overstory trees have died. There is approximately 258 cubic feet of coarse woody debris on the forest floor with occasional large White pine stems. It appears that past storm events have toppled some of the standing dead trees adding to the coarse woody debris.

Overstory Vegetation

Volume

Spp	Spp Code	Sawlog Bf/Acre	Pulp Cords/Acre	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
EWP	1	23,081	0.61	2.7	392,369	10.3	73
HEM	3	486	1.64	1	8,260	27.9	12
SM	6	253			4,294		
RM	7	1,073	1.31	1.5	18,237	22.3	10
WB	11	505			8,588		
YB	12	116		1	1,967		2
BB	13	758			12,883		
ABE	14	0			0		
NRO	16	253			4,294		
Total		26,523	3.56		450,893	60.5	97

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total BA/Acre	% BA/ac by Spp	QMD	Rel Density	% AGS
EWP	1	65.2	124.6	74%	18.7	41.6	99%
HEM	3	18.4	12.3	7%	11.1	5.6	75%
SM	6	1	1.5	1%	16.5	0	100%
RM	7	14.8	15.4	9%	13.8	12.1	70%
WB	11	2.1	3.1	2%	16.5	0	100%
YB	12	2.4	1.5	1%	10.9	1.3	100%
BB	13	5.2	7.7	5%	16.5	0	80%
ABE	14	1	1.5	1%	16.5	0	100%
NRO	16	1	1.5	1%	16.5	0	100%
Total		111	169.2	100%	16.7	61	94%
				Median Stand Diameter ->>	22.7	67	***<<- Estimated Relative Density Density***

White Pine - Understory Information

Species		RM	WA	SM	BB	HY	WP	RO	BE	WB	NS		
Stems/Acre		428	42		150		214	128	450				

Ground Cover Species- White Pine Stand						
Species:	Ferns	Canada	Virginia	Barberry	Starflower	Club moss
		Mayflower	Creeper			
% cover	10	20	10	10	10	10
Species:	Sol.	Partridge	Indian	Witch		
	Seal	Berry	Cucumber	Hazel		
% Cover	10	10	10	10		

Forest type 2 (3.0 acres) consists of 2 small diameter **red pine** (Pinus resinosa) plantations approximately 50 years old that are in poor health and showing signs of heavy mortality. This forest type is adjacent to the white pine stands and is found on similar soil types and terrain. The trees are approximately 60' in height with median stand diameter of 10.9" with a very high relative stand density of 97%. There are no signs of past treatment and this is supported by the large amount of stems per acre and small, poorly-formed crowns. Understory vegetation is limited to shade tolerant beech with other less shade tolerant species such as black birch, yellow birch and ash growing along the edges of the stand and in any gaps created by mortality in the overstory. There is approximately 358 cubic feet of coarse woody debris present on the forest floor, mostly from dead trees that have fallen to the forest floor. The forest canopy reflects the high density of the stand and tree response to lack of growing space. Small canopies with very few live branches and spindly stems translate into poorly developed root structure and are highly susceptible to windthrow, more so when the stand is thinned or opened drastically. Current mortality indicates that this stand is beyond any chance of treating due to the advanced state of decay.

Overstory Information

Volume

Spp	Spp Code	Sawlog Bf/Acre	Pulp Cords/Acre	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
RP	2	9,870	22.86	1.7	34,545	80.0	21
Total		9,870	22.86		34,545	80.0	21

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total BA/Acre	% BA/ac by Spp	QMD	Rel Density	% AGS
RP	2	334.4	188.0	100%	10.2	97.2	89%
Total		334.4	188.0	100%	10.2	97	89%
				Median Stand Diameter ->>	**10.9**	97	***<<-Estimated Relative Density***

Red Pine Understory Information

Tree Species		RM	WA	SM	BB	HY	WP	RO	BE	WB	NS
Stems/Acre		780	360	180	120	60	120	60			

Ground Cover Species- Red Pine Stand

Species:	Ferns	Canada Mayflower	Virginia Creeper	Barberry	Honeysuckle
% cover:	20	20	10	10	10

Forest type 3 (3.0 acres) consists of 2 **Norway spruce** (Picea abies) plantations. One is a small diameter pole-sized stand that was planted on 6'x6' grid and has too many stems competing for available growing space. It may have been planted for Christmas trees as the number of trees per acre suggests a maximum yield per acre. A stand density of 83% indicates lack of crown spacing and this is evident in field observations which small live crowns. Spruce tends to be more tolerant than red pine in terms of shade tolerance and response to thinning. The live crowns are small but in many cases more developed than the red pine. Portions of this stand are being encroached on by native White pine, Northern red oak and Black cherry. It also appears that a row of White cedar and Douglas fir (Pseudotsuga mensiesii) were also planted perhaps for Christmas trees and ornamental stock. The second stand is larger in diameter but appears to have had some past harvesting activity and sufficient mortality to allow native species such as Eastern hemlock (Tsuga canadensis) and Black birch(Betula lenta) grow into the stand. Tree health and vigor appears to be showing signs of decline. Soils and terrain are the same as the white and red pine stands. There is approximately 220 cubic feet of coarse woody debris present on the forest floor.

Overstory Vegetation

Volume

Spp	Spp Code	Sawlog Bf/Acre	Pulp Cords/Acre	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
SPRUCE	5	9,056	26.89	1.7	,056	6.9	5
Total		9,056	26.89		,056	6.9	5

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total BA/Acre	% BA/ac by Spp	QMD	Rel Density	% AGS
SPRUCE	5	337.2	210	100%	10.7	82.7	90%
Total		337.2	210	100%	10.7	83	90%
				Median Stand Diameter ->>	11.4	83	*<<Estimated Relative Density*

Norway Spruce - Understory Vegetation

Tree Species		RM	WA	SM	BB	HY	WP	RO	BE	WB	NS	HK
Stems/Acre		450			150			450				

Ground Cover Species - Norway Spruce Type						
Species:	Ferns	Partridge berry	Grass	Rubus sp.	Starflower	Bittersweet
% Cover	10	10	10	10	10	10

Forest type 4 (15.0 acres). **Sugar Maple**. This type consists of large diameter even-aged sugar maples with associate species of Black birch, White ash, Northern red oak (Quercus rubra) and bitternut hickory (Carya cordiformis). The soils found here are moderately drained stony loams with slopes up to 30%. These are some of the best growing sites on the forest and it is evident from the tree form, size and overall vigor. The landform is a mixture of rock outcrops and gentle slopes with scattered wet seeps and drainages. There is some White ash mortality that occurred several years ago and is present in the form of dead large diameter stems scattered on the forest floor and still standing throughout the forest type. Openings created by these gaps in the canopy have been invaded by wild grape. A past timber harvest was conducted here approximately 35 to 45 years ago to remove poor-quality stems and increase the growing space for the high-quality residual trees. This type is well-stocked with full canopy closure and very little vegetation in the understory consisting mostly of beech, grape and suppressed sugar maple. Ground cover species such as Blue cohosh (Caulophyllum thalictroides) and Maidenhair fern (Adiantum sp.) are found scattered throughout the stand in addition to large amounts of native wild grapevine. Invasive species such as Japanese barberry (Berberis thunbergii) and Oriental bittersweet (Celastrus orbiculatus) are also in the stand. There is approximately 355 cubic feet of coarse woody debris on the forest floor. It should be noted that a recent plant inventory (summer 2016) by the NHESP confirmed the presence of a plant species of Special Concern and their recommendations have been incorporated into the prescription section.

Overstory Information

Volume

Spp	Spp Code	Sawlog Bf/Acre	Pulp Cords/ Acre	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
HEM	**3**	**297**			**11,897**		
SM	**6**	**9,763**	**2.29**	**1.6**	**390,505**	**91.5**	**186**
RM	**7**	**223**			**8,923**		
WA	**8**	**951**		**2.2**	**38,042**		**9**
YB	**12**	**149**			**5,949**		
BB	**13**	**1,109**		**2.0**	**44,372**		**13**

ABE	**14**	**0**			**0**		
HICKORY	**28**	**149**			**5,949**		
Total		**12,641**	**2.29**		**505,637**	**91.5**	**207**

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total BA/Acre	% BA/ac by Spp	QMD	Rel Density	% AGS
HEM	**3**	**2.5**	**3.6**	**3%**	**16.5**	**0.0**	**100%**
SM	**6**	**61.4**	**86.1**	**77%**	**16.0**	**66.9**	**95%**
RM	**7**	**1.2**	**1.8**	**2%**	**16.5**	**0.0**	**100 %**
WA	**8**	**1.6**	**6.1**	**5%**	**26.3**	**4.5**	**90%**
YB	**12**	**0.8**	**1.2**	**1%**	**16.5**	**0.0**	**100%**
BB	**13**	**2.9**	**7.3**	**7%**	**21.3**	**5.5**	**100%**
ABE	**14**	**0.4**	**0.6**	**1%**	**16.5**	**0.0**	**0%**
HICKORY	**28**	**1.2**	**1.8**	**2%**	**16.5**	**0.0**	**100%**
Total		**72.1**	**111.5**	**97%**	**16.8**	**77**	**92%**
				Median Stand Diameter ->>	**20.5**	**86**	***<<- Estimated Relative Density***

Sugar Maple Understory Information

Tree Species		RM	WA	SM	BB	HY	WP	RO	BE	WB	NS	HK	BA	
Stems/acre				5664	8	167		8	238				26	

Ground Cover Species – Sugar Maple						
Species:	Ferns	Clubmoss	Trilium	Solomon	Canada	Blue
				Seal	Mayflower	Cohosh
% Cover:	25	10	10	10	10	10
Species:	Grass	Partridge	Indian	Rubus sp.	Virginia	
		Berry	Cucumber		Creeper	
% Cover:	10	10	10	10	10	

Forest type 5 (25.0 acres) is an even-aged **Northern Hardwood** stand consisting of Black and Yellow birch (Betula alleghaniensis), Sugar maple, Black cherry (Prunus serotina), Red maple and White ash. Scattered eastern hemlock, white pine , quaking aspen (Populous tremoides) and Northern red oak (Quercus rubra) are also found in this forest type. Inventory data shows a well-stocked stand with the average diameter of the overstory trees in the 16.8" range with tree heights of 70 to 90'. The soils and topography is similar to the sugar maple forest type only better drained and stonier. Tree health and vigor appears to be good with the exception of the hemlock which is suffering from one or more insect infestations including Hemlock Wooly Adelgid. This type has full canopy closure and very little regeneration present in the understory. Wild grape and beech are present in the understory in addition to all the invasive species found in the other forest types. There is approximately 408 cubic feet of coarse woody debris present on the forest floor.

Overstory Information

Volume

Spp	Spp Code	Sawlog Bf/Acre	Pulp Cords/Acre	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
HEM	3	11,375	9.34	2.4	125,127	102.8	32
SM	6	743	1.11		8,171	12.2	
RM	7	509		1.0	5,601		6
WA	8	0			0		
BB	13	2,971	2.99		32,682	32.9	
NRO	16	0	0.70		0	7.7	
Total		15,598	14.14		171,581	155.6	37

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total BA/Acre	% BA/ac by Spp	QMD	Rel Density	% AGS
HEM	3	114.3	106.7	55%	13.1	49.4	81%
SM	6	19.2	13.3	7%	11.3	10.8	50%
RM	7	31.4	20.0	10%	10.8	16.3	67%
WA	8	8.3	6.7	3%	12.2	0.0	100%
BB	13	25.6	40.0	21%	16.9	30.9	83%
NRO	16	13.3	6.7	3%	9.6	6.1	100%
Total		212.1	193.3	100%	12.9	114	79%
				Median Stand Diameter ->>	15.2	118	***<<- Estimated Relative Density***

Understory Information

Northern Hardwood		RM	WA	SM	BB	HY	WP	RO	BE	WB	NS	HK	BA	YB
Stems/Acre		103	65	956		113		140	590			10	20	10

Ground Cover Species - Northern Hardwoods						
Species:	Ferns	Clubmoss	Trilium	Solomon	Canada	Yew
				Seal	Mayflower	
% Cover:	10	10	10	10	10	10
Species:	Grass	Partridge	Indian	Rubus sp.	Virginia	
		Berry	Cucumber		Creeper	
% Cover:	10	10	10	10	10	

Forest type 6 (29 acres) is an even-aged **Hemlock- Hardwood** stand that has similar species as the northern hardwood type with a larger component of Eastern hemlock. It is found on the northern facing slopes of the forest and extend from the top of the ridges down to the lower slopes along the Deerfield River. This particular forest type is approximately 10-14" average diameter with a closed canopy. The soils are stony loams and are rockier with poorer drainage than the better soils found in the Sugar maple types. Tree health and vigor are variable here as the hemlocks are being attacked by the same insects found in the other types where hemlock is a component. The dead and dying hemlocks are allowing sunlight to reach the forest floor and begin the regeneration process. There appears to have been little previous silvicultural treatment in this forest type and it should be noted that barberry and grape will become a major problem with obtaining desirable regeneration unless treated. Understory vegetation is limited to shade tolerant species such as hemlock and beech with club moss and various ferns present for ground cover. There is approximately 243 cubic feet of coarse woody debris present on the forest floor.

Overstory Information

Volume

Spp	Spp Code	Sawlog Bf/Acre	Pulp Cords/Acre	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
HEM	**3**	**11,375**	**9.34**	**2.4**	**125,127**	**102.8**	**32**
SM	**6**	**743**	**1.11**		**8,171**	**12.2**	
RM	**7**	**509**		**1.0**	**5,601**		**6**
WA	**8**	**0**			**0**		
BB	**13**	**2,971**	**2.99**		**32,682**	**32.9**	
NRO	**16**	**0**	**0.70**		**0**	**7.7**	
Total		**15,598**	**14.14**		**171,581**	**155.6**	**37**

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total BA/Acre	% BA/ac by Spp	QMD	Rel Density	% AGS
HEM	3	114.3	106.7	55%	13.1	49.4	81%
SM	6	19.2	13.3	7%	11.3	10.8	50%
RM	7	31.4	20.0	10%	10.8	16.3	67%
WA	8	8.3	6.7	3%	12.2	0.0	100%
BB	13	25.6	40.0	21%	16.9	30.9	83%
NRO	16	13.3	6.7	3%	9.6	6.1	100%
Total		212.1	193.3	100%	12.9	114	79%
				Median Stand Diameter ->>	15.2	118	*<<- Estimated Relative Density*

Hemlock Hardwoods Understory Information

Hemlock Hardwood		RM	WA	SM	BB	HY	WP	RO	BE	WB	NS	HK
Stems/Acre		100						400	200			

Ground Cover Species -Hemlock hardwoods					
Species:	Ferns	Partridge berry	Clubmoss	Canada Mayflower	Maple Leaf Viburnum
% Cover:	10	10	10	10	10

B. Wildlife Habitat Conditions: The forest is predominately even-aged with minimal breaks in the forest canopy. The opening created during the previous harvest adjacent to the American chestnut planting is one of the few early successional openings on the forest. Northern red oak, American beech and bitternut hickory are found in the hardwood types and provide hard mast. Scattered Black cherry provides a source of soft mast in addition to the wild grape found throughout the forest. Live and dead cavity trees, which provide sources of food for birds, perches for birds of prey, den and nesting sites for various mammals and birds, are present in all stands with inventory data showing approximately 8-10 trees per acre. Coarse woody debris found on the forest floor and providing both a food source and habitat for a variety of species, is present in volumes from 220 to 408 cubic feet per acre.

C. Recreation and Aesthetic Considerations
The proposed project area is not located near any scenic byways and but is located near the Mahican-Mohawk trail which follows portions of the Deerfield River. This forest has no visitor facilities. The main entrance to the forest is an old farm road which is also a main snowmobile corridor maintained by the Conway Snowmobile Club. This road will be protected with buffers according to Chapter 132 and logging slash will also be treated according to the slash laws which prescribe allowable heights and distances. Buffers will not be used in the red pine stands due to the heavy mortality present in the stand and the overall hazard that would be presented should any residual trees be left behind. The American Chestnut Foundation, in cooperation with the Massachusetts DCR, has established an American chestnut seed orchard adjacent to the sale area which is being used to grow Chestnut Bight- resistant trees for eventual transplanting to the forests of Massachusetts. This area will be protected from harvesting activities.

The local snowmobile club has an authorized trail over the main access road and on another secondary access road which they maintain on a regular basis. Hikers, snowshoers, mountain bikers, horse-back riders and cross-country skiers also utilize these maintained trails. The westerly portions of the trail/road system are poorly drained and subject to frequent damage from use during periods of wet weather. Hunters and birdwatchers also frequent the area. This forest is closed to ATV/off road vehicle use and has no other authorized roads or trails.

D. Forest Protection Concerns: ***Sugar maple borer*** (*Glycobius speciosus*), a native insect, is present on the forest as evidenced by the tell-tale scars on the stems of the affected trees. The main hosts are weakened Sugar maple trees that are suppressed and already stressed. Heavy infestations will damage the tree and cause substantial structural damage. Mitigation for this insect includes thinning to promote good overall health and vigor of the stand. ***Emerald Ash Borer*** (*Agrilus plannipennis*), a non-native insect, is present in western Massachusetts and is expected to impact all of the state in the very near future. It bores into the host tree and the larvae kill the tree by tunneling under the bark and disrupting the flow of nutrients. Current strategy to slow the spread of this insect is to limit the movement of ash logs and firewood to quarantine zones and during periods when the insect is dormant. There are plans to introduce insects that will feed on the Emerald Ash Borer but there are no plans for eradication due to the size of the population. **Black Knot** (*Apiosporina morbosa*) is found on Black cherry and is caused by a fungus that infects the twigs and stem of the host tree. It will eventually kill the host tree. ***Hemlock Wooly Adelgid*** (*Adelges tsugae*) is a non-native insect that infects Eastern hemlock. This insect has been found in the project area and causes mortality by feeding on the needles. *Beech Bark disease (Nectria coccinea)* is an insect/disease complex that can cause mortality on American beech. There are no treatments for this disease other than to remove the diseased trees and favor any resistant individuals. ***Grape vine*** *(Vitis species)* is a native woody vine that causes tree mortality by strangling the tree crowns. It is one of the most important protection issues on the forest as it is highly invasive and will crowd out and kill most tree species. It grows very well on the better growing sites currently occupied by the Sugar

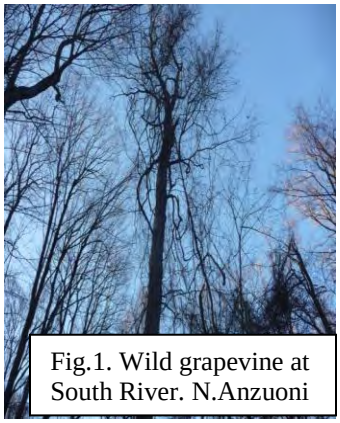


Fig.1. Wild grapevine at South River. N.Anzuoni

maple and northern hardwoods. ***Oriental Bittersweet*** *(Celastrus orbiculatus Thnb.)* is an invasive woody vine that will climb into the forest canopy and strangle smaller trees.

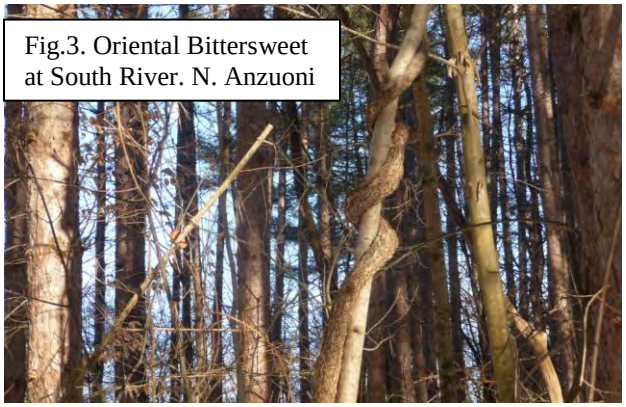


Fig.3. Oriental Bittersweet at South River. N. Anzuoni

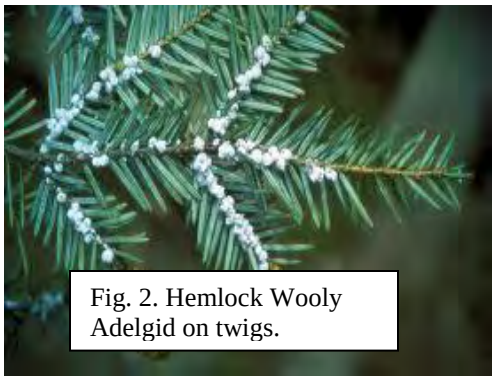


Fig. 2. Hemlock Wooly Adelgid on twigs.

Aesthetic, Recreation, Wetlands, Cultural, Rare Species and Wildlife Considerations:

Wetlands: The project area is near the Deerfield River and has several small streams that flow northerly into the river. These streams are well defined drainages with deep channels. Filter strips will be used to protect the stream and banks from harvesting impacts. Vernal pools are present on the forest and near the proposed harvest area and these will be avoided by any harvesting activities. There are multiple stream crossings on the main access road and these will be crossed by existing permanent culverts. All regulations under Chapter 132 Forest Cutting Practices Act will be followed and the Massachusetts Forestry Best management Practices will also be used as a guideline.

Rare and Endangered Species: The Natural Heritage and Endangered Species Program (NHESP) has identified the presence of plant species of Special Concern in Stand Type 4 – Sugar Maple. This stand will be delineated based on a recently conducted plant survey (summer 2016) and approximately 50% of the stand will not be harvested in order to reduce any impact to the species of Special Concern. Silvicultural treatments along the edge of the delineated line will be reduced in intensity in order to alleviate any potential impacts due to increased sunlight on the forest floor in the area not treated. The NHESP may issue written recommendations which will become part of this document and also included in the Forest Cutting Plan.

3. Evaluation of Data and Projected Results

A. Objectives of Forest Management

- Demonstrate use of silvicultural practices to convert an even-aged forest structure to multi-aged forest.

- Decrease large diameter White ash component due to to minimize overall affects from the spread of Emerald Ash Borer. EAB prefers large diameter trees for egg laying sites and by shifting the diameter range of white ash into the lower range it would limit the overall population of the insect.
- Increase plant species diversity by allowing more light to reach the forest floor and allow species that are less shade tolerant to regenerate.
- Create vertical structural diversity by varying age classes throughout the forest.
- Establish a network of skid roads and trails to facilitate future access to the forest.
- Repair existing forest road system to control erosion.
- Demonstrate use of Best Management Practices to conduct sustainable forestry operations on state lands.
- Maintain Coarse Woody Debris levels to agency guidelines.
- Remove non-native plantations in favor of a native ecosystem.

B. Silvicultural Prescription

- *Stand 1, White Pine,* will be treated using the Irregular Shelterwood System. This is a hybrid silvicultural system which exhibits characteristics of both even and uneven aged stands by replicating natural small-scale disturbance in the forest. The dominant overstory will be white pine with gaps of varying size up to 1/3 acre created to allow desirable hardwoods such as black and yellow birch, red oak and hickory to regenerate. Areas between the gaps will be thinned to increase growing space for the preferred crop trees.
- *Stand 2, Red Pine,* will be treated using an even-aged Overstory Removal (Clearcut) in which all stems of the overstory are removed in one harvest. The exception will be to leave any desirable hardwood species that appear windfirm and will contribute desirable regeneration. These stands are relatively small and surrounded by trees of desirable species in adjacent stands which will seed in the harvest area. The option of planting trees to restock the area will be an option in the future. Stock of desirable native species such as red oak will be considered.
- *Stand 3, Norway spruce*, will be treated with an intermediate harvest in the form of a commercial thinning. This treatment will remove approximately twenty five percent of the overstory and retain the highest quality trees for future crop trees. Criteria for this will include crown size, percent live crown remaining (higher numbers desired), stem development and overall tree health and vigor. The stand near the powerlines will be left with a higher residual density to the north and west to protect it from the prevailing winds. The second part of this stand near the white pine will be removed in order to favor the northern hardwoods and oak.
- *Stand 4, Sugar Maple,* will be treated with the uneven aged Individual Tree/Small Group Selection regeneration method. This type of silviculture will mimic a small scale natural disturbance regime and keep opening sizes limited to ¼ acre or less. Preferred and expected regeneration species will be Sugar maple. Herbicide treatment will be needed to prevent American beech from dominating the understory and also to control small amounts of Oriental bittersweet and Japanese barberry also in the understory. Herbicide treatment will also be needed to keep grapevine from invading the site and choking out the desirable regeneration. It is already present in the stand in both the understory and overstory. The preferred residual trees will be

large diameter sugar maple with a large well-developed crown and root system. This stand has been surveyed for a NHESP species of Special Concern and based upon these results approximately 65% will not be harvested. The invasive species and wild grape will still be treated in this area.

- *Stand 5, Northern Hardwoods*, will be treated with the uneven aged group selection regeneration method. Small openings up to 1/3 acre will created throughout the stand. These openings will mimic small-scale natural disturbance and allow favorable conditions to regenerate a range of desirable species such as sugar maple, black birch, yellow birch, black cherry and red oak. Areas between the openings will be thinned to provide growing space for desirable crop trees. Understory beech will be treated to prevent it from over taking the stand.
- *Stand 6, Hemlock Hardwoods*, will be treated with the uneven aged Group Selection regeneration method similar to the Northern hardwoods – Stand 5. Small openings up to 1/3 acre will be created throughout the stand. The goal is to increase the hardwood component with northern red oak, sugar maple and black birch as the preferred species. Anchor openings adjacent to preferred crop trees for seed retention, near aggregates of desirable advanced regeneration, near large diameter white ash, in areas of high mortality or low quality. The openings will mimic small-scale natural disturbance and create a variable range of conditions favorable for regeneration of desirable species. Areas between the openings will be thinned to release crop trees and remove hemlock infected by Wooly Adelgid.
- Evaluate success of previous treatments when re-entering the stand and intervene if regeneration goals are not being met. This would be defined as the treated areas occupied by undesirable vegetation such as diseased beech, grape vine and invasive non-native vegetation and insufficient stocking of desirable regeneration.
- Use herbicide treatments when needed to control undesirable competing understory vegetation such as beech and any invasive species.. Beech trees that appear unaffected by Beech Bark disease will be retained in order to increase the overall resistance of the species to the disease and retain the abundant hard mast food source produced by beech. These treatments would be done post-harvest.
- Mechanically or with herbicide treat the harvest area to remove non-native invasive species and control grape vine. These treatments should be be done pre-harvest or during the harvesting operation.

C. Short and Long Term Desired Conditions

Short Term Desired Conditions

- Creation of 1/3 acre group openings in northern hardwoods.
- Increased growing space for Norway spruce residual trees.
- Establishment of forwarder/skid road network.
- Stabilization of existing woods road.
- Establishment of landing areas.
- Retention/creation of dead and live snags.
- Retention of large diameter coarse woody debris by leaving top wood and cull sections of trees in the forest.

- Initiation of desirable regeneration by creation of favorable seed germination sites. This will result from increased sunlight reaching the forest floor and scarification by mechanical disturbance.
- Removal of large white ash trees.
- Control of native grape vine populations.
- Removal of invasive species.
- Create system of permanent landings. These may be permanently maintained as grassy openings.

Long Term Desired Conditions

- Creation of multiple age-classes. The forest canopy will begin to have a ragged appearance as the younger trees become established. Large trees that are in the un-harvested areas and retained large trees in the harvest area will maintain the tall canopy but it will be much more irregular. The stand will eventually differentiate into three or more distinct canopy layers that will be perpetuated over time. It should be apparent that large White ash are missing from the main canopy but will be represented in the regeneration and mid-stratum layers until they eventually reach maturity.
- Control of invasive and non-desirable species. This will be an ongoing activity with a combination of mechanical methods and herbicides as needed. The end result will be an irregular distribution of desirable native tree species regeneration based on their proximity to the group openings. It would be expected to see more shade tolerant species in the less disturbed areas and the less shade tolerant species near the center of the group openings and in some cases along the skid trails. Beech will be a minor understory component and any non-native barberry will be absent from the stand.
- Successful regeneration of desirable species such as Sugar maple, Black birch, Yellow birch, Northern red oak and hickory.
- Stable forwarder/skid roads. Roads should be covered with native vegetation and resistant to erosion.
- Continued live and dead snag presence. Residual live snags will die and become standing dead snags and begin to decay.
- Continued presence of large diameter coarse woody debris. This will be a result of large standing snags, pieces of live snags and dead snags falling to the ground.

D. Logging System requirements: A cut-to-length harvester and forwarder will be required to operate in the project area. Hand falling with a chainsaw will be needed on some of the larger diameter trees and the material will be transported to the landing with a forwarder. A wheeled or tracked skidder or bulldozer with a winch will be permitted on the hillside area due to slope limitations of the cut-to-length harvester. The trees would be limbed in place and the stems would be pulled

Fig.4 Wheeled forwarder.

to the nearest main forwarder road to be bucked into logs and forwarded to the landing

4. Prescription Documentation

A. Marking instructions:

- Follow DCR Bureau of Forestry Guidelines for product marking.
- Delineate sale boundary with two diagonal red painted stripes and flagging.
- Delineate filter strips/wetland areas with two diagonal red painted stripes and flagging.
- Mark forwarder roads with orange flagging and vertical orange paint stripes.
- Mark trees to be removed with blue paint at breast height and stump level on two opposite sides.
- Retain 2-3 cords of down coarse woody material in all stands.
- Retain 3-5 stems per acre of good quality productive sources of hard mast such as oak and hickory.

Red pine (overstory removal) stands will be marked based on the following guidelines:

1. Remove all overstory Red pine stems.
2. Retain any acceptable hardwood trees (Black cherry, Sugar maple, Black or Yellow birch, Hickory or Red Oak) in the overstory that appear windfirm.

White pine (irregular shelterwood): stands will be marked based on the following guidelines:

1. Remove diseased trees of all species.
2. Leave all acceptable hardwood species in the overstory.
3. Remove all poorly formed stems in the understory.
4. Target range of 60 to 70% residual overstory.
5. Retain 3-6 large dead trees or live cavity trees per acre.
6. Create small gaps which can be expanded during the next entry into the stand.

Norway spruce (commercial thinning): stands will be marked based on the following guidelines:

1. Remove poorly formed stems
2. Remove poorly formed crowns.
3. Remove approximately 25-30% of basal area.
4. Favor any well-formed acceptable hardwood species such as sugar maple, red oak, yellow birch and black birch.

Sugar maple/northern hardwood/hemlock hardwood (selection harvest /improvement) stands will be marked based on the following guidelines:

1. Remove poorly formed stems from the understory.
2. Remove approximately 25-30% of the overstory basal area in thinned areas..
3. Retain 3-6 large dead trees or live cavity trees per acre.
4. Group openings not to exceed one third acre if deemed appropriate.
5. Work in all size classes.
6. Remove hemlock trees with signs of Hemlock Wooly Adelgid.
7. Remove ash trees greater than 12” in diameter at breast height.
8. Retain any beech that appear free from scale/disease and are of good form.

5. Sale Layout and Harvesting Limitations

Landings: The use of forwarders will allow smaller landings to be utilized. A previous harvest stacked the cut logs along the main forest road and some of those road side landings will be used. New landings will be created as needed, particularly towards the center portion of the sale near the American chestnut orchard.

Forwarder/Skid trails: Road construction will be kept to a minimum with the current forest road improved as needed to allow the use of forwarders. Secondary trails will be unimproved and in most cases brushed out as needed to allow use. A dozer may be required to construct forwarder trails in some of the rocky sections. Gravel will be brought in to stabilize the forest road as needed.

Wetland and Stream crossings: The project area has many springs, seeps and streams that can be crossed at existing culverts on the forest road. Topographical limitations favor travel parallel to these drainages and should result in minimal new crossings. These would be done with temporary wood panel bridges that would be removed upon completion of the project.

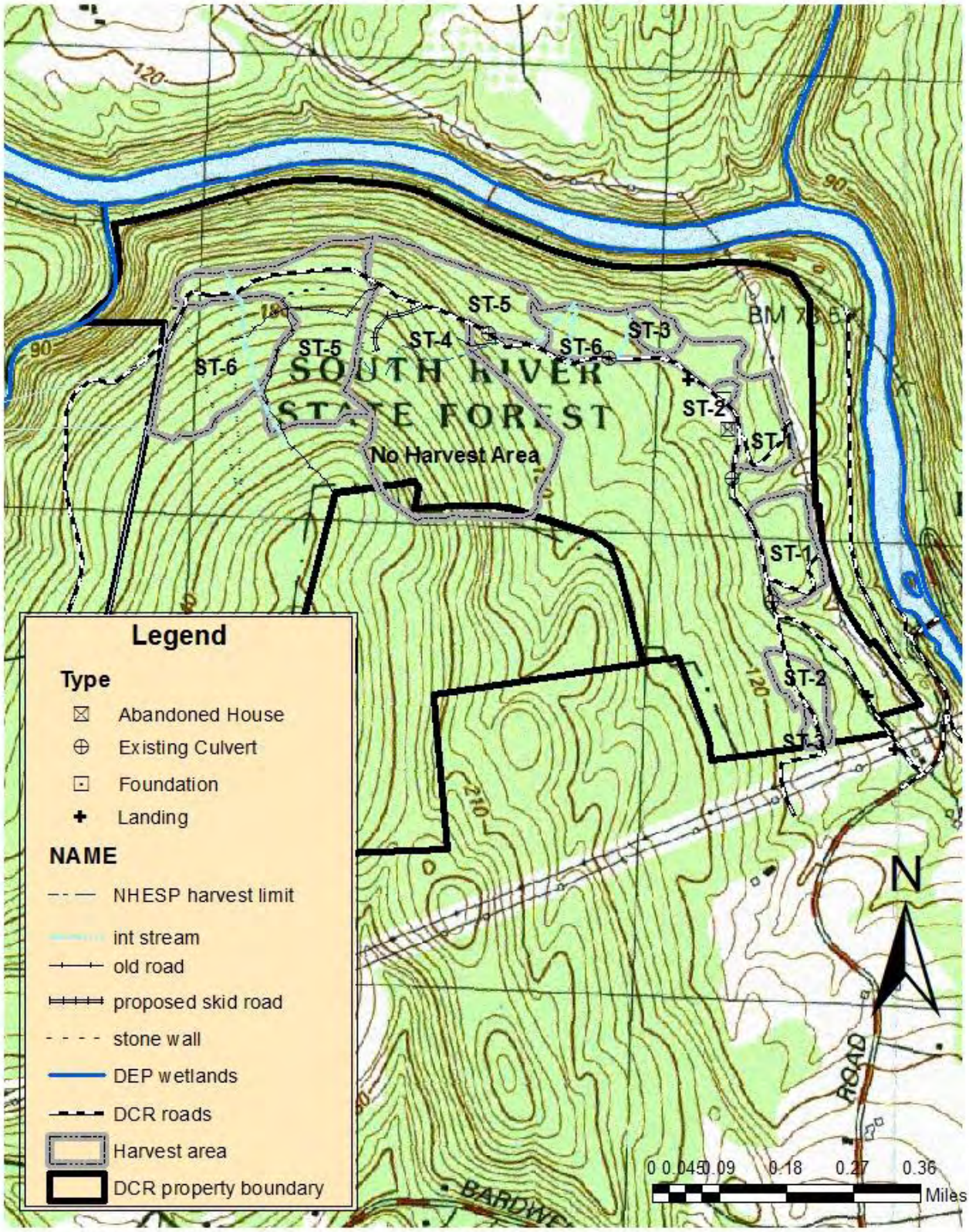
Excluded areas: Seeps and any sections of steep slopes not accessible from the top or bottom will be excluded. The project area will be limited to the areas above the steep slope leading down to the Deerfield River.

Erosion control/site restoration/sedimentation control: Standard Best Management Practices will be used to stabilize landings, skid trails and forwarder roads. This may include seeding, mulch, water bars, dry or frozen ground conditions and use of low-ground pressure equipment. Access control will be important to prevent unauthorized motor vehicles from driving on closed roads and trails and causing ruts and erosion.

In-Kind services: These will include installation of at least one steel pipe gate to prevent access beyond the chestnut orchard. Other improvements may consist of gravel, road grading, replacement culverts, bridges and geotextile fabric on the main road as needed.

Future silvicultural treatments: It is expected that no further commercial entries into the treated stand occur for a minimum of 10 to 15 years. The red pine stands will not need any treatments for at least 30 years and the spruce stand could be thinned or regenerated by a shelterwood harvest over the next 15 to 20 years. The stands treated with the selection system are being shifted to an all-aged stand with another entry not needed for another 20 to 30 years. Pre-commercial work should be considered an ongoing project if any control of grapevine is expected. This can be done in conjunction with treatment for invasive species which should also be an activity that could be done independent of any harvesting projects.

South River State Forest Type Map
Conway, MA



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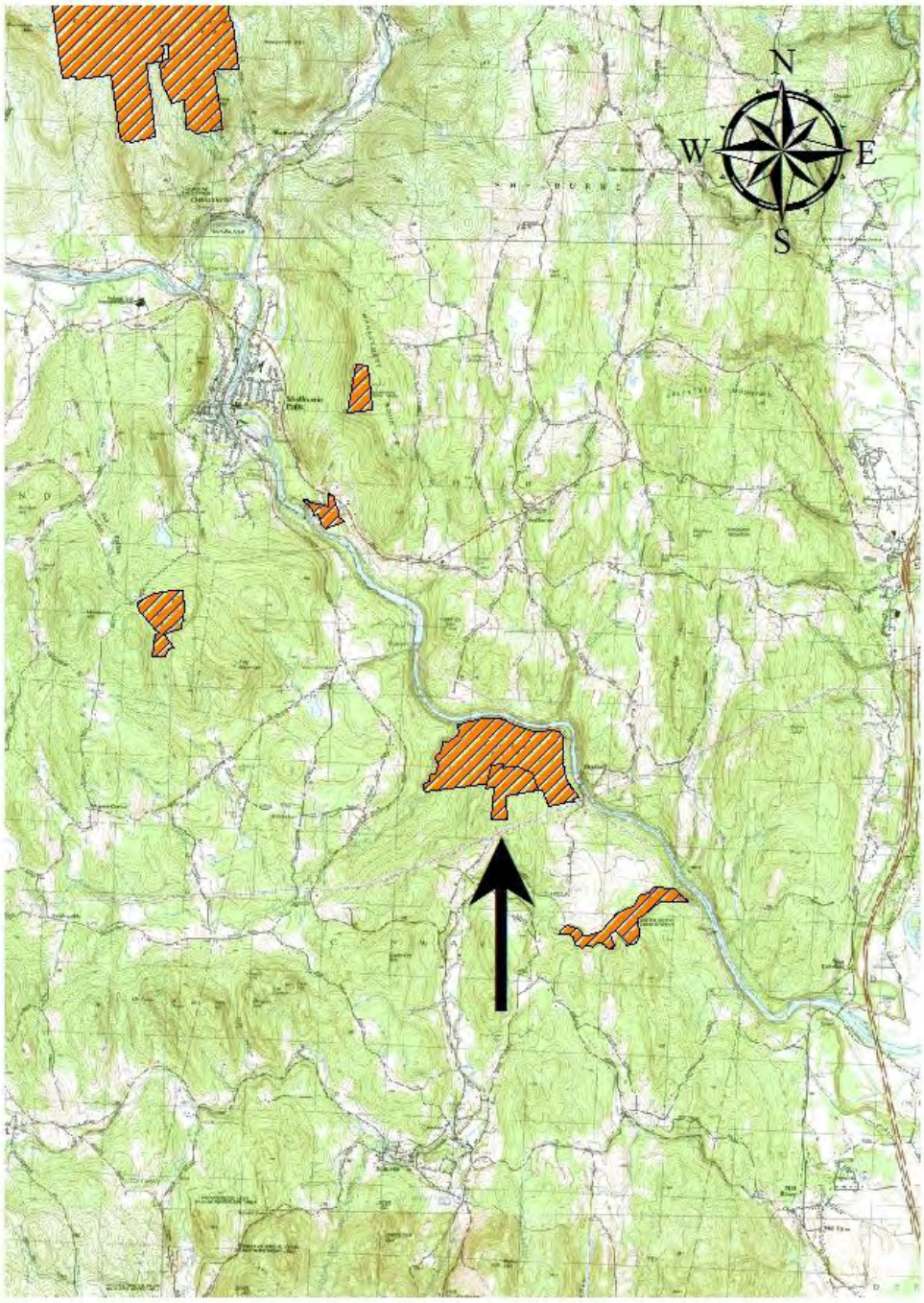
South River State Forest Locus Map
Conway, MA



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