

Adaptive Management Consultancy Case Study Brief

Title of Consultancy: Management of Shrub Habitats to Support High Priority Species

Problem Statement:

Shrub communities provide critical habitat for regionally declining Neotropical migrants and New England cottontail, a Candidate Species with very limited distribution. Shrublands have been identified as priority habitat for many refuges in the Northeast, and they also harbor the highest density of non-native invasive plants on many Refuges. The ability of invasive plant species to quickly colonize these habitats, and their tenacious character once established, has hampered our ability to meet habitat objectives for our trust resources. Lacking knowledge regarding successful and efficient techniques for managing shrubs with invasive plants or how to create new native shrublands, many biologists and managers choose to maintain the status quo.

This postponement of needed management is costly in two ways:

- It ties up limited staff and funds for labor-intensive practices that produce little resource value (e.g. mowing of fields annually to prevent invasion)
- It prevents creation of new shrublands using silvicultural practices or natural succession
- Potential negative impacts to trust resources, including but not limited to:
 - not providing higher value shrub habitat to migratory birds and NEC
 - not increasing acres of a limited habitat for declining Trust Species
 - decreased biological integrity and diversity from increasing invasive composition
 - decreased nutritional value of forage available to migratory birds and NEC as native shrubs shift to invasive shrubs

Goals of Adaptive Management Consultancy:

The goal of this workshop is to develop a structured decision making framework which Refuges can use to test different management alternatives. The objectives of the consultancy are to:

- **Identify best management practices** for converting grassland or forested habitats to native shrubs.
- **Identify species/habitat relationship and ecological variables** that will influence successful implementation of management practices.
- **Identify monitoring matrices and develop standardized protocols** to evaluate success of management alternatives given scientific uncertainties related to shrub management. Develop and prioritize monitoring options within a variable budget (most critical → least critical indicators; pertinence, time and labor intensiveness)
- **Discuss scientific uncertainties** related to shrub management and suggest approaches to address these uncertainties. Some questions include:
 - How do we prioritize where to manage shrublands to maximize resource value? How do we prioritize which invasive species to manage and determine what species or threshold we can live with?
 - What is the role of invasive plant in NEC habitat? How do we ensure genetic diversity and population viability of NEC?
 - As shrub communities shift to invasive species, do invasive fruits provide sufficient nutritional requirements needed for migratory songbirds to survive migration? Do invasive plants provide nutritional winter browse for NEC? How do invasive fruits/twigs

(honeysuckle, buckthorn, barberry, bittersweet, rose) differ from native (Viburnum, Virginia creeper, bayberry, cherry) in nutritional value (fat, carbohydrates, protein content)?

Current Management:

Rachel Carson: Our current management for New England cottontail currently consists of creating a 20 acre block of habitat at the Spurwink River using old field succession and planting of native shrubs. We hand remove a small portion of invasive plants, however do not remove many as we don't know how it would impact NEC. Our current occupied patches are managed in a hands-off approach as we don't want to remove cover from occupied habitats (they are too small to rotationally manage).

The Refuge has other areas we would like to either create NEC travel corridors along the borders of salt marshes to connect small patches, hydro-axe older alder areas to maintain NEC, or harvest forests to create shrublands. Uncertainty about habitat and rabbit response hampers our ability to manage and prioritize management.

For this process we would like to accomplish the following:

- 1) Establish a travel corridor for NEC with an area which has been previously managed as field.
- 2) Apply silviculture to a young forest stand to create additional shrublands adjacent to occupied cottontail habitat.

Parker River: Located on a barrier island, we have 300 acres of self-sustaining maritime shrublands, most of which host an understory of bush honeysuckle and glossy buckthorn. We have conducted some selective targeting of certain invasive plants within the shrub community, but have not conducted large-scale management to restore invasive shrublands to natives. In addition to uncertainties about best management practices, we're also concerned with negative impacts to migratory birds that use these shrubs. We also manage six grassland units ranging from 10 to 25 acres in size. The grasslands are maintained through annual mowing, and support mainly bobolinks and savannah sparrows with the occasional meadowlark. We recently completed a site capacity assessment of our grassland units, and found the majority of them to be increasingly dominated by non-native forbes and both native and invasive shrub species. We would like to let some of these fields revert to shrub communities. For this adaptive management project, we will be restoring a 10-acre area abutting an impoundment. The site is relatively dry and is over 70 percent woody vegetation. Monotypic stands of glossy buckthorn are crowding out vegetation.

Great Meadows: At Great Meadows Refuge, we have over 20 species of non-native invasive upland plants, many of which are thriving in old field habitats. The Refuge is comprised of most wetland habitat (and spans large stretches of the Concord and Sudbury Rivers) and old field habitat is *not* a priority habitat. Most fields (there are about 10) are less than 15 acres in size, are surrounded by forest, wetland, or development, and provide little benefit to nesting or migrating birds. Despite this, we continue to manage these areas as fields with mechanical equipment in an effort to keep non-native invasive species from increasing. Fields are mowed or hydroaxed every 1-3 years, depending on weather, staff availability, and an annual assessment of the degree of non-native invasive species infestation. Selective herbicide application has been conducted to varying degrees in some of the fields, but little progress has been made at reducing non-native invasive species. Uncertainty regarding the best approach to minimize non-native species while encouraging native shrubland growth has prevented us from establishing potentially important habitat for neotropical migrants along these river corridors. For this adaptive management approach, we propose to target a 10-acre old field that is very long and narrow (about 150m wide). It is infested with at least 10 different non-native invasive species. It is mostly upland habitat but is adjacent to a forest edge that borders the Sudbury River floodplain.

Rhode Island: The Rhode Island Complex includes five coastal refuges which contain maritime shrub habitat. Our management priority has been providing high quality stop over habitat for migratory and wintering birds. One of these refuges, Ninigret NWR, also has confirmed a remnant population of New England Cottontail. This refuge is the site of a historic Naval Airbase where asphalt runways and taxiways have now been removed, and the gravelly nutrient poor strips have been left to revert to shrub dominated uplands. Adjacent areas include old fields that are heavily invaded by invasive species, including Oriental Bittersweet, Morrow's and Japanese Honeysuckle and Multiflora Rose. For this consultancy we have selected a 14 acre area that includes 6 acres of old runway and 8 adjacent acres of old field. As this area fills in with shrubs it will connect an approximately 30 acre mature shrub land to 40 additional acres of shrub dominated habitat where the NEC were documented. Past management in the area has included hydro-ax mowing and selective herbicide applications.

Management Objectives

The following objectives for shrub management were developed jointly by Parker River Refuge, Rachel Carson Refuge, Eastern Massachusetts Refuge Complex and Rhode Island Refuge Complex and modeled after regional and Refuge management plans. We included both "end" objectives (the target resources of concern) and "mean" objectives (habitat attributes required by the resources of concern).

1. Provide habitat for high priority fall migrating landbirds
 - Minimum patch size
 - Shrub plant community composition and diversity that provide berries throughout the entire songbird migration period
 - Maximum acceptable percentage of non-native species (need threshold or criteria for initiating management)
 - Optimal structure and density to provide cover
 - Optimal age class to maximize berry production and patch size for long term maintenance of shrubland mosaic
2. Provide shrub habitat for a sustainable population of New England cottontail
 - Patch size a minimum of 10 hectares or adequate travel corridors if smaller patches are managed
 - Over 50,000 stems / hectare
 - Optimal structure and species composition to provide winter cover and high quality food sources throughout the year
3. Preserve and restore native biodiversity and ecological integrity of the shrub community.
 - Maximum acceptable percentage of non-native species and species composition.

Management Prescriptions

Shrub management can be generally divided into four scenarios:

- **Converting field/grassland to shrubland**
- **Converting forest to shrubland**
- Converting invasive shrubland to native shrubland
- Maintaining high quality existing native shrubland

For the purposes of this workshop, the refuges will select management actions in the first two scenarios.

Each Refuge will starting the management prescription on either be a field or forest patch at the first stage.¹ We have identified potential management prescriptions below but look forward to feedback from the consultancy on these and other potential management schemes. Management tools in green are common to all Refuges, tools in red will differentiate among the different alternatives. These tools are further described in Appendix A. Table 1 details management prescription by Refuge.

Fall migrating birds or New England cottontail: transition field to shrub (assumption is that field habitat has invasives, or will in the near future).

- Step 1: EXHAUST INVASIVE SEED BANK (if necessary), or at least work to get below a certain percentage threshold (we don't know what the threshold is)
 - BURN or MOW
 - growing season burn best for controlling invasive shrubs, but not practical (unlikely to get prescription approved, lots of nesting birds this time of year)
 - what about a late spring burn (when woody invasives are budding and more vulnerable) – should knock back woody invasives, but maybe not herbaceous invasives
 - mowing is a good option if burning is not an option, or if burning will be logistically difficult
 - APPLY HERBICIDE (optional – use or non-use will distinguish two treatments)
 - Follow up application within same growing season
 - *Probably* foliar spraying with triclopyr
- Step 2: SELECTIVELY REMOVE persistent invasive species
 - handpulling or mechanically pulling every year, selective cutting of vines, use of high BTU propane torch
 - herbicide every couple of years? How long before plants produce berries?
 - time of year dictated by species
- Step 3: PLANT desired species (optional – this could also distinguish treatments)
 - propagate seeds in greenhouse and then plant?
 - purchase native nursery stock
 - scarify seeds and directly spread? Rototill patches?
 - Transplant mature native shrubs from adjacent shrublands to 'jump start' restoration
 - Plant early spring and fall, 10-15 different tree/shrub species – cherries, bayberries, juniper, aspen, birch, viburnums
- Step 4: Manipulate existing native vegetation to produce additional cover, stem density or berry production (optional – this could also distinguish treatments)
 - fertilize plants
 - top shrubs or small trees to produce multi-stemmed structure
 - low intensity burn

New England cottontail: transition young forest to shrub or thicket

¹ Note: If the chosen management unit is an invasive infested shrubland, it could be mowed entirely initially, resulting in field habitat as the starting point.

- Step 1: Apply silvicultural methods (clear cut or group selection (>0.8 ha) to set back succession)
- Step 2: Remove invasive plants which grow back into treatment area
- Step 3: Treat area (cutting, low intensity early spring burn, girdle) to promote multi-stemmed coppice growth or root suckering where appropriate species composition exists.
- Step 4: Monitor area and establish rotation for management.

Monitoring Metrics

Monitoring metrics still need to be determined and standardized across refuges that have common objectives. The following metrics may be used to assess progress toward meeting objectives for both fall migrating birds and New England cottontail, and to compare differences among various management regimes. We need assistance in determining what to measure, what is feasible to monitor and how to prioritize given limited budget.

- **Vegetation response** (in relation to age class)
 - *Patch size* -- GPS
 - >25 acres for NEC
 - >25 acres migratory birds?
 - *Vegetation composition* could be measured with transects
 - Species richness/diversity - % cover/ belt transects
 - Percent invasive plants - % cover/ belt transects
 - *Vegetation structure*
 - Density –stem count or density boards
 - Canopy cover -- % canopy, height
 - Thick understory – density board, photoplot
 - *Biomass* of high quality food supply throughout season
 - Berry (migratory food) – need suggestions
 - Twigs (winter food)
- Response of **migratory birds**
 - *Species richness* – point count/ transects/ mistnets/ spot mapping during migration and nesting
 - *Abundance* -- point count/ transects/ mistnets/ spot mapping
 - *Duration of stay and weight gain*
 - *Presence/absence* –presence of tracks, pellets, twig browse, late winter occupancy
 - *Abundance* -- # tracks, pellets, twig browse, runs?
 - *Adequacy of habitat* – browse (i.e. has high quality food been expended and bark being consumed?)

Potential metrics if intensive studies were possible

 - *Body condition*
 - *Winter survival* mark and recaptur

Table 1. Management prescriptions by Refuge

	Rachel Carson – conversion of forest to shrubland	Rachel Carson – corridor establishment	Parker River	Great Meadows NWR	Rhode Island
Year 1	Select area with the existing conditions that are likely to favor the establishment of intolerant native tree and shrub species, providing dense hardwood regrowth. Draft prescription for forestry operations	Stop mowing area, remove invasive shrub seedlings by hand	Selectively apply Triclopyr to reduce woody invasive plants.	Exhaust invasive seed bank using broadcast herbicide application, timing and chemicals still need to be determined.	Selective removal of non-native invasive plants using a combination of mechanical, hand removal and herbicide (triclopyr) application
	Survey area, locate company to complete harvest to specifications	Plant native shrubs in the fall (either purchase, salvage or propagate)	Fall prescribed burn (or selective mowing) to remove biomass and promote germination in Year 2	Maybe combine mechanical stressors (mowing) with herbicide application if appropriate for certain species	Selective removal of tree species if warranted to promote shrub dominated habitat
		Evaluate winter cover	Collect and propagate native seeds in greenhouse? Combine with outreach efforts? Fields are valued by birders for visibility for grassland birds.	Extensive outreach (and inreach) efforts – the field we are targeting is along a busy commuter road in a community that <i>really</i> places a high value on open fields as important habitat and viewing vistas.	
Year 2	Harvest area in winter	Remove invasive seedlings in spring Plant native shrubs in spring (either purchase, salvage or propagate) if necessary	Summer/Fall-- Selectively remove invasive woody plants using mowing, drip torch, or herbicide	Likely will need to repeat broadcast herbicide application, at least in some portions of the area; use more selective application if year 1 was very successful	Select removal of invasive woody shrubs and vines that persist and foliar treatment of seedlings if necessary.
	Remove any invasive plants	Evaluate winter cover	Collect and scarify native seeds. Rototill patches and broadcast spread.	Combine mechanical approaches to further stress and selectively remove some species as appropriate	Transplant native mature shrubs to restoration area to promote diversity if warranted.
Year 3	Evaluate progress	Early spring, low intensity burn	Selectively treat invasive woody plants as needed	Selectively treat woody plants as needed	
		Remove invasive shrub cover once native shrub cover is	Plant propagated shrub saplings.	Collect and scarify native seeds, rototill and do broadcast spreading	

		established. Continue removal of invasives as required.			
Year 4	Treat area to promote dense vegetative structure (low intensity burn)?		Continue to selectively treat invasive woody plants every 1-2 years	Continue to selectively treat invasive woody plants every 1-2 years	
				Note: We are open to considering prescribed fire if it is more efficient than herbicide and mechanical stress. <i>I think</i> it may be more work for less result though, and we non-native invasive species that thrive with fire are present at our site	