

Managing Fuels in Northeastern Barrens

FINAL REPORT

Joint Fire Sciences Program Project No. 01C-3-1-05

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Project Goals and Accomplishments

Fire-dependent barrens of the Northeast are important habitat for numerous rare, threatened, and endangered species, and are, at the same time, represent the most dangerous wildland fuel type in the region. As such, fire in barrens poses a significant wildland-urban interface risk in this densely populated area. Barrens occur throughout the northeastern and mid-Atlantic states on drought-prone soils, and are dominated by pitch pine, scrub oak, various tree oak species, and several ericaceous shrub species. Fire behavior in barrens vegetation is comparable to southern rough of the Southeast and chaparral of the West. We addressed Tasks 1, 2, and 3 of the Joint Fire Science Program 2001-03 Request For Proposals as they relate to managing northeastern barrens fuel types.

Our first objective (Task 1) was to establish two demonstration sites where barrens fuels are managed using innovative combinations of overstory thinning, mechanical treatment of shrub fuels, sheep grazing and prescribed fire to reduce fuel loads, wildfire intensity and wildland-urban interface risk, and to improve wildlife habitat. We targeted the general public and land managers of the region with interpretive signs, brochures, a four-day field tour, a website, and two workshops for practitioners.

We expanded our original goal of two demonstration sites (at Cape Cod and Martha's Vineyard) to four taking advantage of additional funding from cooperators. At Montague, Massachusetts, we evaluated the effectiveness of brush cutting and prescribed fire at different times in the year in reducing fire hazard and restoring and maintaining habitat for rare Lepidoptera, and game and non-game species of wildlife. Funding from the Massachusetts Division of Fisheries and Wildlife allowed us to evaluate the effectiveness of thinning mature pitch pine stands to reduce the risk of crown fire. We used methods developed at the Missoula Fire Lab (Joe Scott and Elizabeth Reinhardt) to characterize canopy bulk density of pitch pine stands before and after thinning, and to develop models to predict crowing index. At the Sarnoff Preserve in eastern Long Island, we took advantage of a National Fire Plan grant to the Long Island Chapter of The Nature Conservancy and its cooperators to establish a fourth demonstration area. Initial brush cutting in 2005 was preceded by an intensive inventory of fuels on the 350 acre site. Ongoing inventories of fuels and initial prescribed burns in 2006 document the effectiveness of fuels management in this ongoing project.

Our second objective (Task 2) was to assess the effectiveness of combinations of treatments (mowing, prescribed burning, thinning and grazing) in reducing fuel loads and fire intensity in barrens.

This work built upon a now 21-year study examining individual treatments (mowing or burning during the dormant or growing seasons with treatments at 1-, 2-, 3- or 4-year intervals) in barrens vegetation at Cape Cod National Seashore (CCNS). We took advantage of new work on Martha's Vineyard, with its primary goal the establishment of fire breaks (i.e. fuel-free zones) around the perimeter of the Manuel F. Correllus State Forest (MFCSF). We combined JFSP and Commonwealth of Massachusetts funding to establish treatments combining thinning of pitch pine overstories, mechanical treatment of brush cutting, grazing and prescribed fire to evaluate the best methods for altering fuel bed structure while maintaining barrens attributes associated with rare species habitats. We established 27, 0.5-acre plots in pitch pine, scrub oak, and oak

woodland vegetation and treated these plots with combinations of the above treatments. At Montague, we sampled fuels in untreated scrub oak fuels, and in similar areas treated with dormant- and growing-season prescribed fire, and growing-season brush cutting followed by prescribed fire. We then developed a protocol for developing custom fuel models which formed the basis for a two-day workshop including teaching fuel sampling techniques and custom fuel model development. The workshop, held in Amherst in June, 2006, was attended by more than 40 practitioners. Managers from more than a half dozen barrens areas in New England provided updates on work that they have been doing at their home sites.

Our third objective (Task 3) was to revise, test, and refine custom BEHAVE fuel models for both unaltered and managed barrens fuels.

We had previously developed custom fuel models for several barrens areas in the Northeast, but testing had been limited. The CCNS fire management plan has identified refining and testing of custom fuel models as an information need. Ongoing work at CCNS (National Park Service) and MFCSF (Massachusetts Department of Environmental Management) provided us with the background, framework and agency support to make significant contributions to resource managers' understanding of fire behavior and fuel modification techniques. Nine additional research plots were established at CCNS with the specific goal of combining brush cutting and prescribed fire – both implemented during the growing season – to compare this management regime with previous work which had focused separately on cutting and burning. Plots first cut in July 2003 were burned in August 2003 after pre- and post-treatment fuel sampling. Plots were again burned in April 2004 and 2006 to document the effectiveness of the fuels treatments. Similar pre- and post-treatment fuel inventories were used to develop custom fuel models. Fire behavior documented during these prescribed burns was compared with behavior predicted by the models. Validation of these models demonstrated that they accurately predict observed fire behavior (Norton-Jensen 2005; Patterson and Clarke in press). This work provides barrens managers with methods for effective fuel management without having to burn untreated fuels or to conduct prescribed burns on every treatment unit in order to reduce wildfire hazard. Our 2004 field tour to Montague, Martha's Vineyard, and Cape Cod National Seashore provided more than 50 participants with an opportunity to see, first hand, a variety of on-going fuels management practices. The methods used for sampling fuels, developing custom fuel models, and documenting the effectiveness of treatments served as the basis for our 2005 and 2006 workshops on Cape Cod and at Amherst.

Summary of Results

and

Products for Practitioners

The results of our research and our efforts to convey what we have learned to managers and the public are summarized in detail on our Web Site, which was launched in March, 2005. Products of our work including workshop agendas, theses, project completion reports and general references on pine barrens ecology and management are found by following the "Publications" tab on the Web Site home page. The following highlights our more significant findings and provides links to detailed discussions of our accomplishments as they appear in a variety of outlets and formats, all contained in, or with links from, the Web Site.

Task 1 (demonstrating fuels management techniques): We established four rather than two primary demonstration sites, and our Web Site: “Managing Fuels in Northeastern Barrens Fuels”

<http://www.umass.edu/nrc/nebarrensfuels/index.html>

provides links to detailed descriptions of the work done and accomplishments achieved at these four sites. Links to 15 additional northeastern barrens sites are provided. During the course of our work we established contact with and/or visited managers at each of these 19 sites. Details on fuels management practices at the 15 satellite sites varies depending upon the activities involved and our ability to document their effectiveness. A detailed description of work at the Albany Pine Bush, which has one of the longest histories of prescribed fire management in the Northeast, is provided through the cooperation of The Nature Conservancy and the Albany Pine Bush Preserve Commission. Transfer of knowledge gained and available as a result of the establishment of these demonstration sites was made available to managers and the general public through the Web Site and through a variety of field tours, workshops, brochures and public presentations. A **field guide** for our 2004 field tour is available at:

http://www.umass.edu/nrc/nebarrensfuels/publications/pdfs/June_%202004_Field_Guide.pdf

Brochures describing the Cape Cod and Martha’s Vineyard demonstration sites are at:

Cape Cod:

http://www.umass.edu/nrc/nebarrensfuels/ma_barrens/cape_cod/Cape%20Cod%20brochure.pdf

Martha’s Vineyard:

http://www.umass.edu/nrc/nebarrensfuels/ma_barrens/vineyard/MFCSF_brochure_7-26-05.pdf

We conducted more than 100 prescribed burns in barrens during the four-year project and used each of these to train and inform participants about barrens fire behavior, fuels management, and safe operating procedures. We made three-to-four formal presentations per year to public and academic audiences and made site visits with and provided consultation to managers at several barrens areas including the Sarnoff Preserve on Long Island, the Ossipee Barrens in New Hampshire, the Sam's Point Dwarf Pine Ridge Preserve in the Shawangunk Mountains in New York, the Massachusetts Military Reservation (Sandwich, MA), and the New Jersey Pine Barrens. We were active participants in, and contributors to, a sandplains ecosystem workshop held at The Ecosystem Center, Woods Hole Oceanographic Institute in December, 2003. Proceedings of that workshop are currently in press in the journal *Biological Conservation*. A paper describing our work at Martha’s Vineyard is in press in the *Proceedings of the 23rd Tall Timbers Fire Ecology Conference*. Our work characterizing canopy fuels and managing fuels to mitigate crown fire hazard is in press in the *Northern Journal of Applied Forestry*.

Tasks 2 (assessing effectiveness) and 3 (revise, test, and refine custom BEHAVE fuel models): When we began working in northeastern barrens in the mid 1980’s; fuels management consisted of occasional dormant season prescribed burns. Managers relied heavily on prevention and early detection to combat the threat of wildfires. We soon learned that burning in the spring when fire hazard, generally, is highest in the Northeast and spotting potential is high, had its limitations. In this project we evaluated a variety of fuels management techniques, applied at different times of the year, as alternatives to the exclusive use of prescribed fire during the growing season. Our work over the years, now demonstrated at our four demonstration sites, has shown that mechanical pretreatment of fuels to reduce fuel depth followed by growing season

burning and/or in combination with additional burning, brush cutting and/or grazing is safer and more efficient and cost effective than prevention alone or reliance on dormant-season treatments. We have effectively demonstrated that custom fuel models can accurately predict prescribed fire behavior in managed and unmanaged fuels. The results of our work clearly show that custom fuel models (and observed fire behavior) are especially sensitive to alterations in fuel bed depth. Reducing fuel bed depth (through mechanical treatments prior to prescribed burning) is more effective in reducing fire behavior than reducing fuels alone. (Reburns of areas treated with prescribed fire alone have greater fire intensity, rates of spread and spotting potential than do prescribed burns which follow mechanical treatments). Although it is impractical to test, directly, the effectiveness of thinning pitch pine on crown fire behavior (i.e. we can not demonstrate the control situation of crown fire in untreated stands), our models strongly suggest that reducing stand basal area to 20-30 ft²/acre substantially increases the wind speed at which crown fires might be expected to initiate (Duvneck and Patterson in press). The techniques we developed at Montague and Martha's Vineyard for managing fuels while conserving rare species are now widely employed in northeastern barrens (see work at Ossipee, Waterboro, Albany, and Long Island described at the links at our Web Site). Results of our research are described in detail on our Web Site and in the following project completion reports and theses:

For Cape Cod National Seashore:

["The Effects of Brush Cutting and Burning on Fuel Beds and Fire Behavior in Pine-Oak Forests of Cape Cod National Seashore" \(Norton-Jensen 2005\)](#)

For Martha's Vineyard:

["Wildland Fuel Management Options for the Central Plains of Martha's Vineyard: Impacts on Fuel Loads, Fire Behavior and Rare Plant and Insect Species" \(Patterson, Clarke, Haggerty, et al. May 2005\)](#)

["Distribution of Rare Plants on the Central Plain of Martha's Vineyard: Implications for Conservation and Management" \(Clarke MS thesis 2006\)](#)

["Land Management Implications for *Hemileuca maia* \(Lepidoptera: Saturniidae\) Habitat at Manuel F. Correllus State Forest, Martha's Vineyard, Massachusetts" \(Haggerty MS thesis 2006\)](#)

For Montague:

["Characterizing Canopy Fuels as They Affect Fire Behavior in Pitch Pine," Master's Thesis by Matthew Duvneck](#)

Future Work

Management is ongoing at the Montague, Cape Cod, New York and Martha's Vineyard Demonstration sites. Research at these sites will focus on documenting rates of recovery in fuel load and depth following our 2003-2006 management efforts. As an example, we resampled fuels on all 27 research plots at Martha's Vineyard in August 2007. A primary goal is to determine return intervals required to maintain reduced fire hazard conditions while preserving species diversity of the site. Also, approximately 110 acres of closed-canopy, mature pitch pine are currently being thinned at Montague. Implementing guidelines developed during the study, commercial thinning to decrease wildfire risk and promote T&E species will, for the first time in three years, provide a profit to the Commonwealth. An application to the NRCS "WHIP" program may provide an opportunity to expand post-treatment management to the entire 1000-acre Montague Plains Wildlife Management Area.

Deliverables Crosswalk Table

Proposed:	Delivered:	Status
Website	http://www.umass.edu/nrc/nebarrensfuels/index.html	done
Trail-map/guide	Cape Cod: http://www.umass.edu/nrc/nebarrensfuels/ma_barrens/cape_cod/Cape%20Cod%20brochure.pdf Martha's Vineyard: http://www.umass.edu/nrc/nebarrensfuels/ma_barrens/vineyard/MFCSF_brochure_7-26-05.pdf	done
Conference/field day	Four-day field tour (2004), plus two-day (2005) and three-day workshops (2006)	done
Interpretive signs	Replaced by brochures and web site descriptions at suggestion of landowners.	revised - done
Management guide for agency/landowner use	Detailed management plan for Montague completed, demonstration of success of techniques on Web Site: http://www.umass.edu/nrc/nebarrensfuels/management/index.html	done
Published papers	Several published or in press. See narrative above and Publications section of Web Site: http://www.umass.edu/nrc/nebarrensfuels/publications/index.html	done
BEHAVE custom fuel models	Protocol for fuels sampling and model development including spread sheets and example models at: Custom Fuel Models: http://www.umass.edu/nrc/nebarrensfuels/management/index.html#cfm Methods: http://www.umass.edu/nrc/nebarrensfuels/methods/index.html	done
Final Project Report	This report	done