

Cooperative Ecosystem Studies Units

Scope of Work

Understanding Oak Regeneration and Growth Across Light and Woody Competition Gradients at Naval Support Activity Crane, Crane, Indiana

References: Sikes Act (P.L. 86-797 § 103, as amended and extended); 16 USC 670c-1.

Background:

Naval Support Activity (NSA) Crane is a 62,467 acre (97.6 square miles) contiguous block of land, except for 461 acres at the Glendora Test Facility in Sullivan County. Approximately 83 percent (51,578 acres) of the installation is classified as Central Hardwoods Forest consisting primarily of oak-hickory and mixed hardwoods. Changes in disturbance regimes have negatively affected regeneration of oak-hickory forest, which over time; alter forest species composition and habitat. These changes have the potential to affect the federally threatened Indiana bat (*Myotis sodalist*) as well as several state listed flora and fauna species listed by the Indiana Department of Natural Resources (INDNR) as endangered, rare, or species of concern. The conservation of these rare species is an important component of the Integrated Natural Resource Management Plan (INRMP). As part of the installation INRMP, NSA Crane has committed to working with the US Fish and Wildlife Service (USFWS) and Indiana Department of Natural Resources (INDNR) to preserve habitat for listed species on the installation.

In 2013, a Cooperative Agreement was executed through the Cooperative Ecosystem Studies Unit (CESU) to study the oak regeneration using a concept of expanding gaps to increase oak regeneration along south facing slopes. The goal of the study was to evaluate optimal lighting conditions on the forest floor to encourage oak regeneration while limiting sunlight that would otherwise encourage rapid growing full-sun species such as tulip poplar (*Liriodendron tulipifera*).

Purpose:

Naval Facilities Engineering Command (NAVFAC) plans to expand upon the 2013 research to study natural oak regeneration and the use of supplemental plantings. This study will evaluate oak species viability and success using a combination of factors and management techniques to include: varying light gradients; controlling species competition; and the use shelterwood, canopy gaps, and regeneration openings.

Project Location:

Naval Support Activity (NSA) Crane is located within Martin, Greene, and Lawrence Counties, in southwest Indiana. The installation is approximately 25 miles southwest of Bloomington, Indiana, 71 miles southwest of Indianapolis, Indiana, and 75 miles northwest of Louisville, Kentucky.

Military Mission Benefits:

NSA Crane's mission to provide shore support to fleet, fighter, and family to enable Commanders to focus on their mission. To accomplish this mission, NSA Crane must maintain a

functional ecosystem consistent with stewardship and legal requirements outlined in the Installation INRMP.

Period of Performance:

The period of performance covered by this Agreement is for one year beginning the date this Agreement is awarded. The Government may award up to four additional option years by modification to the Agreement unless terminated by written notification from either Party. The total duration of the Agreement, including award of any option years, shall not exceed 5-years.

Base Award: 2019-2020

Option Year 1: 2020-2021

Option Year 2: 2021-2022

Option Year 3: 2022-2023

Option Year 4: 2023-2024

The Government may, at its sole discretion, exercise the option years to renew the services set forth in this Agreement. Any requirement for the payment or obligation of funds, under the terms of this Agreement, shall be subject to the availability of appropriated funds, and no provision herein shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act, 31 USC §1341 et seq. Nothing in this Agreement shall be construed as implying that Congress will, at a later time, appropriate funds sufficient to meet deficiencies.

Cooperator Deliverables/Responsibilities:

The Cooperator will evaluate oak species viability and success using a combination of factors and management techniques to include: varying light gradients; controlling species competition; and the use shelterwood, canopy gaps, and regeneration openings. Specific Cooperator responsibilities and required deliverables are outlined below.

Base Award: 2019-2020

The Cooperator, in cooperation with the Navy, will select a minimum of eight (8) stands from mature oak-dominated forests scheduled for harvest. Prior to timber harvest activities taking place, the Cooperator will establish all study plots in mesic habitats. To study natural oak regeneration from the existing seed bank, the Cooperator will establish a minimum of 12 study plots consisting of four replicates of three different treatments: a) two-stage expanding group shelterwood, b) three-stage expanding group shelterwood, and c) unharvested control. To study oak regeneration using supplemented plantings, the Cooperator will establish a minimum of four under-planting/enrichment planting study plots. The boundaries of each study plot will be marked for easy identification in the field and delineated using a sub-meter accurate Global Positioning System (GPS). The Cooperator will be responsible for maintaining study plot markings in the field throughout the study period.

The Cooperator will conduct baseline surveys, prior to any timber harvest activities, detailing the forested community within each study plot. Baseline surveys are to be completed during the spring-summer 2020. Forest canopy and sub-canopy will be surveyed using a minimum of 20 randomly designated points selected from intersections on a 165-foot-by-165-foot grid. The Cooperator will identify all tree and shrub species at each point and at a minimum collect the following data: tree size (Diameter at Breast Height), tree grade, light infiltration, tree regeneration, and general site condition within each stand. The

herbaceous community will be characterized using 1/10-acre sub-plots at each point. At a minimum, the Cooperator will identify all herbaceous species and document percent cover.

At the end of the first year, the Cooperator will provide a digital summary report, which will include at a minimum: description of the work completed and a summary of results. The report will include a table of contents, purpose/objectives, study plot description, describe methods, provide the results and any analysis, make recommendations for follow-on work, and list literature cited and provide any references. GPS location data will be depicted on maps/figures and the Geographic Information System (GIS) shapefile data provided to installation staff.

Option Year 1: 2020-2021

The Navy will coordinate and manage timber harvest activities while adhering to all Indiana bat guidelines. Harvests of all sites will be conducted between November 2020 and March 2021.

After the timber harvests are completed, the Navy may utilize prescribed fire to aid in oak regeneration and prepare the sites; however, the use of prescribed fire is contingent on several factors to include weather and may not be employed as part of this study. If prescribed fire is utilized, the Navy will coordinate and manage all controlled burn activities. Prior to prescribed fire implementation, the Cooperator will document fuel characteristics. During and after the prescribed burn, the Cooperator will measure fire intensity with the goal of documenting fire temperature and duration. The Cooperator will record pre-burn and post-burn data in a format that is compatible with ESRI ArcView GIS platform for use by NSA Crane Forestry Staff.

The Cooperator will maintain field markings delineating the study plot boundaries, as necessary, so that all plots are clearly identifiable in the field.

The Cooperator will prepare the Natural oak regeneration study sites by removing any remaining understory and mid-story plants. The Cooperator will treat stems of non-oak species with an application of herbicide to prevent re-sprouting. In addition, the Cooperator will also treat any invasive species with herbicide and/or remove species pursuant to current best management practices. The Cooperator will coordinate herbicide applications with the NSA Crane Integrated Pest Management Coordinator (IPMC). The IPMC will review certification and license documents, monitor application of herbicides to ensure they abide by label requirements, inspect herbicide application materiel, ensure proper reporting of herbicide applications, and ensure the application and use of herbicides abides by applicable laws and regulations.

The Cooperator will prepare all plots to be used for supplemental tree plantings prior to planting. This includes removal of any remaining woody understory and mid-story plants within each study plot to allow light to reach the planted seedlings. The Cooperator will treat stems of non-oak species with an application of herbicide to prevent re-sprouting. In addition, the Cooperator will also treat any invasive species with herbicide and/or remove species pursuant to current best management practices. The Cooperator will coordinate herbicide applications with the NSA Crane Integrated Pest Management Coordinator (IPMC) who will: review certification and license documents, monitor application of herbicides to ensure they abide by label requirements, inspect herbicide application materiel, ensure proper reporting of herbicide applications, and ensure the application and use of herbicides abides by applicable laws and regulations.

Within the Tree planting study plots, the Cooperator will plant white oak (*Quercus alba*) seedlings obtained from Indiana and/or other approved southern states. Tree seedlings will be planted during the early spring (April-May) across a variety of light levels. The Cooperator will record height, root collar diameter, and number of major lateral roots of each tree at the time of planting. The Cooperator will utilize herbicides and/or mechanical methods to control weed species at the time of planting and throughout the study to suppress woody and herbaceous competition around all planted seedlings. The Cooperator will document the survival and growth response of the planted seedlings to various silvicultural treatments across a variety of light gradients. No less than 300 oak seedlings will be planted on a 7-foot-by-7-foot spacing at each of the planted study plot sites.

At the end of Option Year 1, the Cooperator will provide a digital summary report, which will include at a minimum: description of the work completed and a summary of results. The report will include a table of contents, purpose/objectives, study plot description, describe methods, provide the results and any analysis, make recommendations for follow-on work, and list literature cited and provide any references. GPS location data will be depicted on maps/figures and the Geographic Information System (GIS) shapefile data provided to installation staff.

Option Year 2: 2021-2022

Within each planted tree study plot, the Cooperator will collect growth and survival data of all planted oaks. In addition, the Cooperator will utilize mechanical and chemical means as appropriate to limit woody shrubs and herbaceous plants around the planted seedlings. Control efforts to limit woody shrubs and herbaceous plants will be conducted at least 2-times during each growing season. Any herbicide applications will be coordinated with the NSA Crane IPMC. The Cooperator will maintain field marking delineating the study plot boundaries, as necessary, so that plots are clearly identifiable in the field.

Within each natural regeneration study plot, the Cooperator will conduct fine scale transect surveys (a minimum of eight (8)) to quantify oak regeneration. Along each transect all woody regeneration will be documented within 3.3-foot-by-3.3-foot quadrants. This sampling should focus on the transition areas where differences in tree seedling regeneration is predicted to be the most notable.

At the end of Option Year 2, the Cooperator will provide a digital summary report, which will include at a minimum: description of the work completed and a summary of results. The report will include a table of contents, purpose/objectives, study plot description, describe methods, provide the results and any analysis, make recommendations for follow-on work, and list literature cited and provide any references. GPS location data will be depicted on maps/figures and the Geographic Information System (GIS) shapefile data provided to installation staff.

Option Year 3: 2022-2023

Within each planted tree study plot, the Cooperator will collect growth and survival data of all planted oaks. In addition, the Cooperator will utilize mechanical and chemical means as appropriate to limit woody shrubs and herbaceous plants around the planted seedlings. Control efforts to limit woody shrubs and herbaceous plants will be conducted at least 2-times during each growing season. Any herbicide applications will be coordinated with the NSA Crane IPMC.

The Cooperator will maintain field marking delineating the study plot boundaries, as necessary, so that plots are clearly identifiable in the field.

Within each natural regeneration study plot, the Cooperator will conduct fine scale transect surveys (a minimum of eight (8)) to quantify oak regeneration. Along each transect all woody regeneration will be documented within 3.3-foot-by-3.3-foot quadrants. This sampling should focus on the transition areas where differences in tree seedling regeneration is predicted to be the most notable.

At the end of Option Year 3, the Cooperator will provide a digital summary report, which will include at a minimum: description of the work completed and a summary of results. The report will include a table of contents, purpose/objectives, study plot description, describe methods, provide the results and any analysis, make recommendations for follow-on work, and list literature cited and provide any references. GPS location data will be depicted on maps/figures and the Geographic Information System (GIS) shapefile data provided to installation staff.

Option Year 4: 2023-2024

Within each planted tree study plot, the Cooperator will collect growth and survival data of all planted oaks. In addition, the Cooperator will utilize mechanical and chemical means as appropriate to limit woody shrubs and herbaceous plants around the planted seedlings. Control efforts to limit woody shrubs and herbaceous plants will be conducted at least 2-times during each growing season. Any herbicide applications will be coordinated with the NSA Crane IPMC. The Cooperator will maintain field marking delineating the study plot boundaries, as necessary, so that plots are clearly identifiable in the field.

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At the end of Option Year 4, the Cooperator will provide a digital summary report, which will include at a minimum: description of the work completed and a summary of results. The report will include a table of contents, purpose/objectives, study plot description, describe methods, provide the results and any analysis, make recommendations for follow-on work, and list literature cited and provide any references. GPS location data will be depicted on maps/figures and the Geographic Information System (GIS) shapefile data provided to installation staff. In addition, the Cooperator will prepare a technical fact sheet that can be used by installation foresters and distributed to local forestry offices and landowners to promote oak regeneration.

Summary of all Deliverables

- At the end of the base year award and option years 1-4, the Cooperator will provide a digital summary report, which will include at a minimum: description of the work completed and a summary of results. The report will contain a table of contents, purpose/objectives, study plot description, describe methods, provide the results and any analysis, make recommendations for follow-on work, and list literature cited and provide any references. GPS location data

will be depicted on maps/figures and the Geographic Information System (GIS) shapefile data provided to installation staff.

- The Cooperator will prepare a technical fact sheet that will be used by installation foresters and distributed to local forestry offices and landowners to promote oak regeneration.

Substantial Government Participation

- The Navy will coordinate base access for Cooperating partner and delivery vendors.
- NSA Crane foresters will assist the Cooperators with study site selection, participation in study design, assist with surveys, and review Cooperator Reports.
- NSA Crane Integrated Pest Management Coordinator will review certification and license documents, monitor application of herbicides to ensure they abide by label requirements, inspect herbicide application materiel, and ensure proper reporting of herbicide applications and abide by applicable laws and regulations.
- NSA Crane foresters will mark and manage all timber harvests.
- If prescribed fire is used, the NSA Crane Prescribed Fire Manager will oversee and coordinate the burn.
- The Navy will review proposed plant lists for approval prior to purchase/planting.

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