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Grow Resilient Oak-Hickory (GROH) Forests Practices:
Practices for the Partnerships for Climate-Smart Commodities Project in Southern New England

The purpose of the Grow Resilient Oak-Hickory Forests (GROH Forests) Program is to pay foresters, and loggers to implement forestry practices to increase forests' adaptability to climate change. These practices aim to address common forest health and growth issues found in Southern New England forests by implementing practices that increase a forest's resistance and resilience to disturbances that will become more severe with climate change. Simultaneously, these practices will encourage the production of higher quality timber to be used in long-lasting wood products that can be used as a substitute for more carbon-intensive materials. A side benefit of these practices will be improved and diversified habitat across the forested landscape.

This grant is for non-commercial practices only and is meant to enable good practices that would not be viable without outside subsidy.

The following is a list of proposed practices for the GROH Forests program. The purpose of this document is to give landowners and foresters broad sets of conditions to look for that are suboptimal for climate adaptation. Within each condition, we have provided examples of stands and issues that we believe to be widespread across the landscape, and treatments that can address these issues. We encourage foresters to look for stands that fit one of these conditions, but we have also provided an option for landowners and foresters to propose their own issues and proposed treatments, in the case that they do not fall into one of these categories.

Condition 1:
Understocked stands without sufficient regeneration

Example 1.1:
Stands scheduled for a regeneration treatment in which regeneration of desirable tree species will be inhibited by extreme deer browsing pressure. New generations of desired tree species cannot become established without intervention and much growing space will not be used efficiently.

Treatment 1.1:
Install slash walls to prevent browsing access for whitetail deer. Utilize slash to create a wall 10' high by 20' wide encircling the target area of regeneration (10'x10' minimum). Should take

place in concert with regeneration treatments that provide light to the understory and seed sources[1].

Purpose of Treatment 1.1 and intended outcome:

Exclude deer from the regeneration area and allow seedlings or vegetative sprouts of desirable tree species to grow above browse height. This will facilitate the use of growing space that would previously be under-utilized due to severe browsing pressure, while diversifying the composition and age structure of the stand.

Example 1.2:

Stands in which the highest quality trees were previously removed (diameter limit harvest or "high grading"). The overall health of the canopy is compromised, making the stand more susceptible to disturbances. The remaining low quality canopy trees can inhibit establishment and growth of regeneration, or take up growing space of healthier trees.

Treatment 1.2:

Expand existing harvest gaps by removing unacceptable growing stock (UGS) in dominant and codominant canopy positions to release seedlings and saplings of desirable species that are already present ("advance regeneration") or allow for establishment of new regeneration. Post-treatment stand should be at the B or C line. Note: UGS trees with particular value for wildlife (i.e. cavity trees, exceptional mast producers) should be retained. Aim for minimum 5 snags per acre greater than 10 inches DBH (if present), 1-3 cavity trees >18 inch DBH per acre, and 4 cavity trees 12-18 inch DBH per acre if retaining such trees does not inhibit regeneration.

Purpose of Treatment 1.2 and intended outcome:

Facilitating regeneration will diversify the species composition and age class structure of the stand, making it more resilient to disturbances. Favoring acceptable growing stock (AGS) and new regeneration by removing UGS will increase production of long-lived wood products, with resulting improvements in carbon storage in the long-term.

[1] For more information on slash walls: https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/a/9250/files/2020/04/Slash-wall-costs-and-methods-presentation-2019-SAF-conference.pdf

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Condition 2:
Species-poor even-aged stands

Example 2.1:
Stand has been thinned from below, removing the midstory of shade-tolerant tree species without facilitating regeneration in the understory. Often, the understory will be dominated by regeneration-inhibiting plants like hay-scented fern. Thinning from below in stratified mixed-species forests removes shade tolerant species, reducing species diversity and resilience of the stand to disturbances.

Treatment 2.1:
If there is advance regeneration present, create or expand existing gaps to create a shelterwood canopy tree distribution (aiming for 8-9 TPA on more mesic sites, and 21 TPA on drier sites). If no advance regeneration is present, wait for an oak mast year then remove more canopy to encourage regeneration. If hay-scented fern is abundant, do not implement treatment as this will exacerbate the dominance of hay scented fern and regeneration will be stunted. In this case, hold off treatment until canopy closure.

Purpose of Treatment 2.1 and intended outcome:
Treating the forest to encourage regeneration helps to encourage structural and species diversity. This should make the stand more resilient in the face of future disturbances.

Example 2.2:
Stands in the pole timber class dominated by black birch (*Betula lenta*). On mesic (moist and productive) sites, black birch outcompetes oak and other desirable species in medium and sometimes high light conditions. While black birch is not undesirable, it can create monodominant regenerating stands by shading out most other species.

Treatment 2.2:
Clean around any desirable species that is not birch with an 8’ cleaning radius, maintaining 10-15’ spacing between crop trees. In portions of the stand without other species, the most rigorous black birch above 4” DBH without *Neonectria* canker should be released. Eligible stands should be <20 years old, but already with canopy closure.

Purpose of Treatment 2.2 and intended outcome:
Release of non-birch species will help ensure their recruitment to the canopy and promote multi-species stands, which improves stand resilience to disturbances and increases the volume of long-lived wood products. Thinning will also increase the growth rate of residual trees.

Example 2.3:
Old field white pine stands in stem exclusion.

Treatment 2.3:
Release hardwoods and well-formed pines on 3-4 sides with crown thinning, removing or girdling UGS. Post-treatment should target B-line density. If no hardwoods or well-formed pines are present, treat as a shelterwood.

Purpose of Treatment 2.3 and intended outcome:
Encouraging the growth of hardwoods within old-field-pine stands increases the diversity and therefore resilience of the stand. Releasing well-formed pine trees increases the potential for these trees to be utilized in long-lasting carbon products in the future by giving them more growing space and ensuring their quickened growth. Thinning of these stands increases stand health and increases its ability to withstand future disturbances.

Example 2.4:
Low beech removal during harvest.

Treatment 2.4:
Stand to be regenerated has a dense understory of “beech brush,” or beech sprouts from diseased beech trees.

Purpose of Treatment 2.4 and intended outcome:
Beech sprouts are removed, leaving space for non-diseased beech trees and other AGS to grow. Beech sprouts have the same genetics as trees that have been susceptible to Beech Leaf Disease and Beech Bark Disease, so will likely not grow to become harvestable trees. Their removal allows other trees better suited to disease and climate change-imposed challenges to grow in their place.

Condition 3:
Leave retention trees in the stand

Example 3.1:
Retention of legacy trees in regeneration treatments or thinning treatments of maple stands.

Treatment 3.1:
Reimbursement to leave exceptionally large trees, including those that are emergent above the overstory layer (i.e. white pines), wolf trees that would otherwise be removed, and white oaks

and tulip trees that would otherwise be removed. These will be permanent legacy trees. This practice must be affiliated with regeneration harvests. NEFF will show preference to compensating landowners for retention of healthy, well-formed trees that have merchantable value rather than large, rough trees with limited merchantable value to ensure additionality. Preference will be shown for long-lived species. Species cannot be paper birch, Populus spp., Prunus spp., or other short-lived species.

For sugar stand thinning, non-maple trees composing up to 25% of the stand can be paid for as legacy trees.

Purpose of Treatment 3.1 and intended outcome:

Leaving legacy trees keeps high carbon storing and high carbon sequestering trees on the ground and growing into the future. These trees are already sequestering lots of carbon, and this allows them to continue to do so. They also provide wildlife value as a structure and seed source. This practice can be implemented on stands set to be cut for shelterwood or gaps. Diverse trees in sugar stands increases the resilience of the stand by increasing the types of disturbances the stand as a whole can withstand.

Condition 4:
Even-aged stands with excessively high density

Example 4.1:

Stands with a mixture of species in dominant and co-dominant canopy positions, in pole timber or small sawtimber size classes, with very high competition between individual trees. Growth has slowed and individual trees are not developing large, healthy crowns needed for stability and sustained growth.

Treatment 4.1:

Crown thinning – remove primarily UGS to give more growing space to AGS. Removals should target release of AGS trees with larger crowns, while maintaining species diversity. Preference should be given to trees well adapted to projected climate change[2].

Purpose of Treatment 4.1 and intended outcome:

Crown thinning increases health and growth rate of trees remaining in the stand, and ideally increases resilience of stand to stochastic disturbances due to healthier individual trees, and

[2] Refer to climate projections for individual tree species here: https://forestadaptation.org/sites/default/files/NE_SouthernCoastal_1x1_01212021.pdf

shifts more carbon into larger, higher quality trees, leading to more carbon stored in long-lived wood products.

Condition 5:
Unique condition proposed by landowner or forester

Example 5.1:
Tell us about the stand and what about its present condition reduces adaptability to disturbances and other climate-induced stress. Tell us about the site quality, aspect, species composition, age class(es), and forest health issues.

Treatment 5.1:
Tell us your proposed treatment and associated costs.

Purpose of Treatment 5.1 and intended outcome:
Tell us the purpose of this treatment and what the goal stand condition will be and how that will improve the stand's ability to be more resilient or resistant, or to transition in the face of climate change.

Definitions
o AGS: A healthy tree that can produce a log now or in the future.
o UGS: A tree that does not meet the definition of AGS due to defect, deformity, curvature of the trunk, disease, or canopy condition.