IDENTIFYING AND ADDRESSING VULNERABILITIES OF OAK ECOSYSTEMS

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Extended abstract—The Climate Change Response Framework (CCRF 2014) was developed to provide a collaborative approach to supporting adaptation decisions in natural resource management that accommodate diverse management goals, ecosystem types, and organizational structures. An essential element of the CCRF is the Adaptation Workbook—a five-step adaptation-planning process that helps land managers consider climate change in their management and planning (Swanston and others 2016). A key resource for the Adaptation Workbook is a menu of adaptation strategies and approaches that represent a continuum of adaptation concepts ranging from resistance (preventing ecosystem change), resilience (enhancing ecosystem capacity to recover to its original state after disturbance), and transition (intentionally accommodating change to help ecosystems adapt). To date, more than 250 adaptation demonstration projects have been developed throughout the Midwestern and Northeastern United States using the Adaptation Workbook and menu of adaptation strategies. These projects serve as examples of how land managers have integrated climate considerations into planning at scales where management decisions are made and actions are implemented (CCRF 2014, Ontl and others 2018). Here, we focus on three adaptation demonstration projects in oak-dominated forests in the Central Hardwoods region.

“Collaborative Oak Management in Southeast Ohio” brought together forest managers and resource specialists from the Wayne National Forest and Ohio Division of Forestry. A team from each organization considered climate change in separate vegetation management projects using the Adaptation Workbook process; teams first completed each step for their project area before both teams then worked together to identify commonalities among the two areas. In step one, teams identified common management goals for the two areas: create early successional habitat for wildlife; improve forest health; and restore oak-hickory forest on the landscape. In step 2, teams identified common impacts and vulnerabilities among the two areas. Vulnerability to climate change under a range of future climate scenarios was previously assessed for 18 forest ecosystems in the Central Hardwoods and Central Appalachians regions (Brandt and others 2014, Butler and others 2015). A negative impact is potential increases in invasive species and disease (i.e., oak wilt), and a positive impact is potential increases in suitable habitat for native oak and pine species. In step 3, these impacts were evaluated on their ability to create challenges or opportunities to meeting management goals and objectives. An opportunity is to use shelterwood regeneration treatments in mature oak stands, followed by site preparation to promote natural regeneration of oak and hickory species as maple becomes less competitive in a warming climate. In step 4, teams used the menu of adaptation strategies to identify adaptation actions for oak-hickory management, including actions to match prescribed burn windows to environmental conditions and stages of oak development; reduce tree density in overcrowded stands; encourage future-adapted species by underplanting with shortleaf pine (or pitch pine); and managing the northward expansion of southern red oak. The exact timing and application of these broad strategies are expected to vary based on ownership and site conditions. In step 5, teams identified monitoring metrics to evaluate progress toward meeting management goals and objectives. For example, the number of acres and stocking level of oak seedlings and saplings may indicate trends in oak and associated species.

“Improving Bottomland Hardwood Forest” (Ducks Unlimited, Inc. 2017) brought together a team from Ducks Unlimited, the National Wild Turkey Federation, and State and Federal partners to complete an adaptation workbook on the Mississippi River and Cache River Bottoms of southern Illinois and Patoka River Bottoms of southwestern Indiana. Step 1 management goals were to: maintain hydrology in bottomland forests during

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severe and variable flood regimes; enhance natural regeneration of flood-tolerant oaks and hickories via thinning and prescribed burning; and restore bottomland forests at higher elevation sites previously converted to farmland. Step 2 impacts for the project area included increasing severity and number of heavy precipitation events, increases in runoff and peak streamflow during winter and spring, and increases in flood magnitude and frequency. Step 3 challenges were associated with changes in vegetative species composition (i.e., habitat for migratory waterfowl during fall migration) driven by spring flooding and subsequent soil erosion, and dry periods during the summer. Step 3 opportunities included potential for improved conditions for prescribed fire in the fall, which could help regenerate oak and control invasive species; favorable conditions for pin oak, which provides a key food source to migratory waterfowl; and potential increases in overwintering waterfowl that historically migrated further south. Step 4 adaptation actions included efforts to increase productive wintering habitat for waterfowl; diversify species composition and genetic stock of species used for reforestation; and take advantage of dry periods to conduct controlled burns. Step 5 monitoring metrics to gauge the successful advancement of bottomland oaks included oak regeneration success, effects of upgrades to water management structures, and floral diversity.

"Restoring Jerktail Mountain Woodland" (Jerktail Mountain 2018) brought together a team from L-A-D Foundation's Pioneer Forest and the National Park Service's Ozark National Scenic Riverways to enhance the adaptive capacity of woodland ecosystems in southern Missouri. Step 1 management goals are to: reduce woody species encroachment; restore and maintain the woodland ecosystem; and enhance adaptive capacity to cope with a range of future climates. Step 2 impacts include mean annual temperature increases ranging from 2 to 7 °F; increased precipitation in winter and spring and declines in summer; and increased wildfire frequency and severity. Step 3 opportunities are projected increases in suitable habitat for shortleaf pine and post oak. Step 3 challenges are projected summer stress on black oak and scarlet oak; encroachment of eastern redcedar; and potential increases in fire intensity beyond this system's tolerance. Step 4 adaptation actions included methods to restore fire to fire-dependent systems; favor native species expected to cope with a range future climates; and allow for areas of natural regeneration after disturbance. Step 5 monitoring metrics included pre- and post-burn species richness.

Although described briefly here, these examples highlight a diversity of adaptation options for managers that address anticipated climate impacts, as well as a variety of management goals and objectives for oak-hickory management and restoration in a changing climate.

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