The Climate Project Screening Tool for the Massachusetts Division of Fisheries and Wildlife

Report from Fall 2017 District Meetings

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Introduction

As the influence of climate change increases, it is important to consider how adaptation techniques can be integrated into current natural resource management to reduce vulnerabilities to wildlife and their habitats over time. Climate change adaptation in the near term is essential because, owing to inherent time lags in climate impacts, the effects of increased atmospheric greenhouse gases will be felt for decades even if effective mitigation begins immediately (Melillo et al. 2014). However, climate science is a particularly challenging field given the level of technical expertise required, its high degree of uncertainty, and the lack of knowledge of climate change impacts at biologically relevant scales. Thus, climate change adaptation, although understood to be important to resource management, has not been explicitly incorporated into most wildlife management plans or actions.

Some decision-support tools have been developed to aid climate change planning and preparedness in response to the needs of resource managers (Climate Change Resource Center 2017). One such decision-support tool is the Climate Project Screening Tool (CPST) (Morelli et al. 2012), developed initially to aid national forests in the early stages of incorporating climate concerns into operational work and recently modified to aid fish and wildlife management in Massachusetts.

The CPST is a platform that natural resource managers can readily use to assess the potential impacts of climate change on projects and management goals. The CPST is a review and assessment tool that allows managers to explicitly and methodically consider current and impending projects and priorities through the lens of climate change. It provides space to assess whether a specific goal or project is appropriate in light of future climate trends. Through the

CPST process, some projects might be deemed inappropriate as originally designed and be recommended for comprehensive redesign or removal from activity lists.

The CPST is a broad tool that can be modified to accommodate many different working groups and management goals. For the Massachusetts Division of Fisheries and Wildlife (MassWildlife), the tool was modified to focus on projects within the Wildlife Management Areas (WMAs) owned by the agency. Within MassWildlife, there are 5 Districts (Central, Western, Connecticut Valley, Southeast, and Northeast), all with their own - and occasionally overlapping - WMAs for which they are responsible. Information about many of the WMAs, including key target species, can be found on the MassWildlife Lands Viewer, although this information was not available at the time of these discussions. This report summarizes results common to all five Districts based on meetings where the facilitator team (Rebekah Zimmerer, Toni Lyn Morelli, and Melissa Ocana) used the CPST to discuss climate change adaptation in WMA management.

This report provides specific responses to the discussion and process questions as well as general findings and useful resources. Not all WMAs were discussed during the 3-hour meetings. Those not discussed can be analyzed by District staff using this Climate Project Screening Tool at a future date.

Methods

Overview of the CPST

The CPST is a table where the first column lists specific project or management activities of interest. Next, the tool provides a summary of climate change impacts relevant to the specific management activity, poses useful discussion and process questions, and provides space for response and record-keeping. Each management activity section concludes with a question of

whether to continue with the specific activity or not, and if so, if any portion of the activity should be modified.

CPST Column Descriptions
(See Table 1 for the CPST layout and specific responses by managers at the meeting)

Project activities of focus for the discussion

- An important first step is to identify the appropriate scale at which relevant activities will be evaluated. To this end, all project activity categories were identified from the Federal Aid report produced by MassWildlife. District managers were asked to fill out a spreadsheet identifying which activities were being considered or actively done on each WMA. This process allowed the CPST to be tailored to each District and provided a coherent and efficient structure for the meeting.

General climate change trends and local impacts

- Information about projected climate and ecosystem responses can be gathered from many sources and summarized for key indicators of relevance to the local environment. The scientific literature (including a report done specifically for the northeastern states, see Useful Resources) and experts at the Department of Interior Northeast Climate Science Center were the primary sources for local climate data for this report. The purpose of this summary is to give managers a broad sense of anticipated and ongoing changes in climate and related ecological responses throughout their District. The local impacts focus on effects at a scale that is relevant to project design and highlight appropriate changes to the project.

Key questions for managers

- The purpose of this column is to facilitate thinking about the potential impacts of climate change on a specific project type. The questions used to guide the discussion were originally developed through meetings with US Forest Service resource specialists and then modified with MassWildlife staff. Additionally, information on some project activities was gathered from the MassWildlife website. After the questions were used in the first meeting (with the Central District), modifications were made to enhance relevance in future meetings.

Response narrative

- The response narrative in the fourth column is the centerpiece of the CPST, where managers or facilitators record their answers to the questions and thus their thinking about the interaction between climate change and the project. Users are encouraged to identify and document sources for their answers.

Continue with project?

- The last column is where the user concludes whether to proceed with, modify, or cancel the project given the response narrative. It is intended as a recommendation regarding whether or not climate change impacts are likely to be: 1) insignificant enough to proceed as originally designed, 2) substantial enough to require modification to the proposed activities, or 3) whether the project cannot be adequately modified given relevant climate change effects and thus should be withdrawn. Selection and documentation of one of the three recommendations can then become part of a public report on how resource managers considered climate change prior to project implementation.

Table 1. Climate Project Screening Tool with all Activity Types

Project or Management Activity	**Climate Change Trends and Local Impacts (for more information: climateactiontool.org)**	**Key Questions for Managers**	**Response Narrative (please complete)**	**Continue with Project?**
Stream Restoration & Culvert Removal	**Trends –** Reduced snowpack, thus earlier winter-spring peak flows; wetter springs with more flooding; longer, drier summers, though with heavier rainfall events and thus increased risk of flooding, exacerbated by decreased imperviousness from drier soils **Local Impacts –** Vegetation and wildlife species movement; reduced water storage in soils; changed hydrologic regimes	• Will the hydrologic system change from perennial to intermittent over time: e.g., what is the future range of flow?		□ Yes □ No □ Yes, with modification:
		• Can this area (or project) withstand extreme weather events? Events more extreme than those currently experienced?		
		• Are current plant/wildlife species viable in the future given changes in water temperatures?		
		• Is the restoration area vulnerable to increased fire events and/or erosion?		
		• Is this culvert a barrier to species tracking climate change?		
Vegetation Control – mowing, hand cutting, herbicide	**Trends** – Increased fuel buildup and risk of wildfire; increased interannual variability in precipitation, leading to fuels build up and causing additional forest stress; increased stress to forests during periodic multi-year droughts;	• Will the activity be sufficient to control invasives that grow larger and more abundantly?		□ Yes □ No □ Yes, with modification:
		• Does the project area include anticipated future vulnerable areas (i.e. higher elevation sites, riparian areas, soil types or		

	Local Impacts – Densification of vegetation; increased invasive aquatic, plant, and forest pests; earlier and longer growing season	ecosystems not previously recorded as invaded)?		
		• Will the treatment season need to be adjusted for the earlier growing season?		
		• Will additional invasives require more work hours to control?		
Prescribed Burning	**Trends** – Increased fuel buildup and risk of wildfire; increased interannual variability in precipitation, leading to fuels build up and causing additional forest stress; increased stress to forests during periodic multi-year droughts; **Local Impacts –** Increased risk for erratic fire behavior; decreased window of opportunity for prescribed fire conditions; flashier, drier fuels; decreased water storage in soils	• Are there techniques that can be used to effectively manage a burn considering increased fuel loads and droughty conditions?		□ Yes □ No □ Yes, with modification:
		• In what ways do the increased drought conditions factor into a prescribed burn (or lack of one)?		
		• Will the timing of prescribed burns need to be adjusted given climate trends (arrival of migratory species, bud break, etc.)?		

Reforestation/ Restoration	**Trends –** Increased stress to trees during periodic summer droughts; reduced snowpack; increased invasive insects and disease **Local Impacts –** Increased risk of tree mortality; changes in local species composition; species range shifts	• Will local conditions change enough to alter the desired species composition?		□ Yes □ No □ Yes, with modification:
		• Does tree planting density and spacing address anticipated water availability and mortality rates?		
		• Are there certain species or genetic pools of native species that are well suited for anticipated vulnerabilities?		
Forest Thinning	**Trends** – Increased fuel buildup and potential risk of wildfire; increased interannual variability in precipitation, leading to fuels build up and causing additional forest stress; increased stress to forests during periodic multi-year droughts; increased water temperatures in rivers and streams and lower water levels in late summer; decrease in water quality from increased sedimentation and warmer waters **Local Impacts –** Increased risk for erratic fire behavior; decreased window of opportunity for prescribed fire conditions; flashier, drier fuels; decreased water storage in soils	• Will the projected density of the stand after it has been thinned be able to withstand stressors? Does the spacing between trees need to increase?		□ Yes □ No □ Yes, with modification:
		• Should stands be thinned at a more frequent interval to reduce forest stress or for changed growth patterns?		
		• Does the project area include anticipated future vulnerable areas (i.e. higher elevation sites, or riparian areas, refugia)?		
		• Will the season of harvesting need to change given the reduced snow pack and extreme flood events to reduce ground disturbance? Will it need to change given shortening and less reliable winters?		

Aquatic and Wildlife Species Restoration	**Trends –** Loss of seed and other germplasm sources as a result of population extirpation events; increased water temperatures in rivers and streams and lower water levels in late summer; reduced snowpack; longer, drier summers, decreased water quality as a result of increased watershed erosion; general shifts in temperature ranges; chance of fire; increased insect and disease **Local Impacts –** Historical availability of food and water sources may be altered geographically and temporally; suitable range of habitat may alter with changing forest stand structure (wildfire, species extirpation)	**Aquatic** • Are the plant/wildlife species currently present viable in the future given changes in temperatures and precipitation?		□ Yes □ No □ Yes, with modification:
		• What is the future range of flow? Will the hydrologic system change from a perennial to an intermittent system?		
		• Given increase in extreme weather events, how will the hydrologic regime change? Will it go from a snowmelt system to a rain on snow regime?		
		• Is the restoration area vulnerable to increased extreme events and erosion?		
		Terrestrial • Are the plant/wildlife species viable in the future given changes in food and water availability, as well as the range of future habitat?		
		• What is the future range of habitat for the target species?		
		• How will breeding, young, and forage seasons be altered with the changing habitat and climate? Will hunting seasons need to be altered?		

Nesting Structures – Development and Maintenance	**Trends –** Reduced snowpack; earlier green-up; longer, drier summers, general shifts in temperature ranges; increased insect and disease **Local Impacts –** Historical availability of food and water sources may be altered geographically and temporally; suitable range of habitat may alter with changing forest stand structure and temperature and precipitation regimes	• Are the plant/wildlife species viable in the future given changes in food and water availability, as well as the range of future habitat?		□ Yes □ No □ Yes, with modification:
		• Are target species arriving earlier?		
		• Are target species using different habitats?		
		• Will the future habitat of the focus species still consist of the current location?		
Maintenance and Construction: Roads and Trails, Dams, Bridges, Parking Lots, Blinds, Signs, Boundary Markers, Gates/Access Management	**Trends –** Increased interannual variability in precipitation; more extreme flood and other weather events; decreased water quality as result of increased watershed erosion and sediment flow; increased likelihood of severe flood; increased risk of fire **Local Impacts** – Changed hydrologic regimes; soil disturbance due to increased runoff and movement of waterways; likelihood of road washouts and closures increase; storm events exacerbate sedimentation and erosion from burned areas	• Given that hydrologic regimes are changing, are your crossings designed and engineered to withstand the predicted changes?		□ Yes □ No □ Yes, with modification:
		• Is the project located at the right location to reduce watershed erosion and sediment flow or other impacts?		
		• Will current road structures/surface treatments be able to withstand the more severe flood events (and possible erosion) predicted in the future?		
		• How is the surrounding topography and vegetation being considered regarding future climate trends?		

Recreation Planning – Sign and Boundary Marker Development	**Trends –** Lower water levels in late summer; reduced snowpack; decreased water quality as a result of increased watershed erosion and sediment flow and enhanced algae growth from warmer waters; increased likelihood of severe floods; increased forest stress and fire potential **Local Impacts –** Lower waterbody levels; decreased water table for campground and developed site water systems; snow range shifts; developed sites adjacent to waterways may be impacted by flood events; wildfires could damage structures	• Is the project site located adjacent to a water feature? If so, will lower water levels or frequent floods affect the proposed developed site?		□ Yes □ No □ Yes, with modification:
		• How will a reduced snowpack impact developed winter recreation such as snowmobiling and skiing? Does a potentially reduced season of use impact the contractual language in special use permits or on signs?		
		• How might the transportation and access to the project site be affected by more severe flood events and increased fire risk?		
Public Access Management	**Trends –** Increased interannual variability in precipitation; more extreme flood and other weather events; decreased water quality as result of increased watershed erosion and sediment flow and warmer waters; increased likelihood of severe flood; increased risk of fire **Local Impacts** – Changed hydrologic regimes; soil disturbance due to increased runoff and movement of waterways; likelihood of road washouts and	• Is current infrastructure resilient given increased extreme events (floods and potentially hurricanes)?		□ Yes □ No □ Yes, with modification:
		• Will flooding, drought, and other extreme weather events make it more difficult to manage public access?		
		• Will more personnel hours be needed to manage public access given future climate trends?		

	closures increase; storm events exacerbate sedimentation and erosion from burned areas; suitable range of habitat may alter with changing temperatures, precipitation, and forest stand structure (wildfire, species extirpation)			
		• For hunting, have shifts in target species distribution, vulnerability, and phenology (timing of reproduction, migration) been considered?		
Fruit Trees – Prune and Release	**Trends –** Increased stress to trees during periodic summer droughts; reduced snowpack; increased invasive insects and disease **Local Impacts –** Increased risk of tree mortality; changes in local species composition; geographic movement of species	• Will local conditions change enough to alter the desired species composition?		□ Yes □ No □ Yes, with modification:
		• Will new trees be planted if old ones die or preform goals poorly given future climate trends?		
		• Will present uses of the fruit trees persist under new climate models?		
		• Are there certain species or genetic pools of native species that are well suited for anticipated vulnerabilities?		
Agricultural License Agreements	**Trends –** Increased interannual variability in precipitation; more extreme flood and other weather events; decreased water	• In what ways do current policies regarding agricultural license agreements consider future climate trends?		□ Yes □ No □ Yes, with modification:

	quality as result of increased watershed erosion and sediment flow; increased likelihood of severe flood; increased risk of fire **Local Impacts** – Changed hydrologic regimes; soil disturbance due to increased runoff and movement of waterways; likelihood of road washouts and closures increase; storm events exacerbate sedimentation and erosion from burned areas; suitable range of habitat may alter with changing temperatures, precipitation, and forest stand structure (wildfire, species extirpation)			
		• Will climate change trends influence the level of involvement DFW has with lease holders and the properties?		
		• Should climate create a more favorable environment for agricultural land, will more properties be converted to agricultural land?		

Results

Overview

During the fall of 2017, the facilitator team met with all 5 district managers and select staff at their offices throughout the Commonwealth. Meetings centered around project activities that were identified for a given WMA. The purpose of this design was to encourage the discussion of multiple WMAs when thinking about a specific management activity as well as to ensure that each type of project activity occurring within the District was discussed at least once.

Conversation flowed from specific questions in the CPST to a broader discussion of issues related to climate change to other issues faced by the District, and then back to the tool questions in a cyclical pattern until all questions in the management activity section were asked. An interesting secondary result of this meeting was that other management issues were identified, such as big picture questions about the continued utility of wood duck boxes. This secondary result was an unintended but beneficial outcome of considering climate change impacts on Agency lands. Many of the comments, activities, and concerns faced by one District were echoed by other Districts as well. These similarities and overlaps are included in this report (see Table 2).

The CPST allows Districts to document that they are thinking about climate change when making management decisions, whether they then choose to modify current activities or not. Deciding that continuing with the current activities, or lack of activities, for now is sometimes the appropriate choice at the end of the process. The critical step is to take time to consider climate change - within daily activities and larger-scale plans.

District Staff Responses to the Climate Project Screening Tool by Management Activity

Stream Restoration & Culvert Removal

- Districts are concerned about drought conditions affecting their wetland and stream areas. Likewise, stream temperatures are rising and/or staying warmer for longer into the fall, affecting cold water-dependent species such as trout. Beavers were cited as an asset by some District staff where their damming activities contribute to water retention and the creation of habitat for many species including wood duck. However, dams may also exacerbate warming temperatures in streams. In most cases, culverts are not considered a major focus, but a few are being removed or renovated through the assistance of grant awards.

Vegetation Control – mowing, hand cutting, herbicide

- Overall, mowing takes a large amount of time to complete and Districts have taken advantage of snow-free winter months in recent years to finish annual mowing duties. Functions of mowing include maintaining meadows and other open habitat as well as for invasive species control. Districts report that mowing for invasives is working for now but that in the future it is less likely to be a complete solution. The most commonly mentioned invasive was the common reed (*Phragmites australis)*. In general, invasive work, whether it is mowing, hand cutting, or herbicide application, is very time-consuming and all the work that is needed currently is not completed. It is likely that this trend of "more work than there is time for" will only increase in the future, as invasives' impacts are expected to increase.

Prescribed Burning

- Although a useful tool for ecological restoration and fuel-reduction, controlled burns are becoming increasingly rare. Districts have fewer and fewer people authorized to conduct the burns and those that can be contracted to do the work are often unavailable. MassWildlife completed a highly detailed Prescribed Fire Handbook in 2017, and this may help reverse this trend over the next few years by highlighting the need for more fire training for District staff, and by expanding contract capacity to hire private sector contractors to assist with prescribed burns. Even so, a changing climate results in more red flag days, when prescribed burns are prohibited. Regulations identifying days when burns are possible have not kept pace with the changing climate. Attempts are being made to mimic burning with mowing; however, mowing is more labor intensive and is proving not as effective in restoring fire-dependent ecosystems.

Reforestation/Restoration

- Forest restoration is a less common management activity. It takes the form of timber harvests and mowing in order to encourage the continuance of desired species. In one case, blueberry bushes were planted in the understory and served as food for key wildlife species. Reforestation was not reported to be taking place in any District.

Forest Thinning

- The largest concern with thinning is the eventual presence of invasive species - though staff considered current treatments for invasives adequate in the areas discussed. Forest thinning is somewhat time-limited and no exact thinning schedules have been written up. One concern regarding climate change effects is that warming winter temperatures may make harvests harder to complete. The sentiment by Districts (and evidence in the literature) indicates that forest management, especially forest thinning, leads to healthier forests.

Aquatic and Wildlife Species Restoration

- Similar to discussions of stream restoration, Districts are concerned about increasingly droughty conditions affecting their wetland and stream areas. Likewise, stream temperatures are rising and/or staying warmer for longer into the fall, affecting coldwater-dependent species such as trout. Beavers were cited as an asset by some staff, where their damming activities contribute to quality water retention and the creation of habitat for many species including the wood duck. Many management areas are surrounded by development and human communities, so some species will find it difficult to disperse if conditions in their current habitat become less favorable. Lastly, timing of some management activities, such as mowing, has already been adjusted to accommodate phenology/timing changes for arrival and departure of breeding grassland birds, though further improvements could still potentially be made.

Nesting Structures – Development and Maintenance

- Districts create nesting structures almost exclusively for wood ducks though staff have observed that wood ducks are increasingly using the surrounding habitats rather than the nest boxes. This is attributed to an increase in natural suitable wood duck habitat through forest growth and maturity. In some cases, mergansers have taken over use of the nest boxes. Maintenance of the nest boxes is usually done in the winter when ponds freeze over, but due to warmer winters, the ice is either thin or nonexistent and thus unsafe to walk on. Likewise, rapidly rising water tables decrease the functionality of the boxes. Recognizing this, some districts are wondering about moving away from wood duck boxes and focusing on other species that could benefit from artificial nesting structures, such as bluebirds and kestrels.

Maintenance and Construction: Roads and Trails, Dams, Bridges, Parking Lots, Blinds, Signs, Boundary Markers, Gates/Access Management

- While districts consider most of their infrastructure to be functioning properly, they did mention that this is under current weather conditions. In the future, events such as flash flooding and more intense storms could alter that reality. In a few locations, bridges were not functioning properly and grants have been used to repair or replace them with future climate trends in mind. In other cases, dams are acting as a barrier to species movement, but some Districts reported an understanding that was not Mass Wildlife's role to consider modifying or removing them. Headquarters staff reported that regulations allow

for dam removal if proper permitting and laws are followed in partnership with other agencies, such as DER. Additional communication about this topic could be warranted to clarify the role of Districts. Erosion affects some secondary roads and parking lots and re-grading is a recurring event. Rapid flooding events have created additional needs for maintaining gates and other infrastructure.

Public Access Management

- Erosion is a concern and changes in the topography from rapid flooding and recession have created additional areas where ATVs can gain access to management areas. Illegal activities on the properties are ongoing in some districts and monitoring through cameras and working with local law enforcement is necessary. Such issues are predicted to get worse by the districts and are thought to require the allocation of additional work hours. Given that timing of species' activities is changing, there have been discussions about whether hunting dates should also change, but districts acknowledged that such decisions are not within their purview.

Fruit Trees – Prune and Release

- Fruit trees act as a source of mast for many wildlife species. Districts prune and release fruit trees as time allows. For many, they may visit the trees only once every 7 years or so. There is no current effort to plant strains that are adapted to future climate trends or plant trees in general. This is strictly a management activity that utilizes a resource that is already in place. However, there is some interest in actively planting new strains of chestnut that are resistant to chestnut blight.

Agricultural License Agreements

- Each district that has license agreements consider them a burden, primarily because they require dealing with lease holders (farmers) whose objectives are not always in line with those of the Districts. However, Districts acknowledge that many farmers contribute positively to the management area in that they take care of some of the mowing that the district may not have time to get to. Districts do not plan to create additional areas with license agreements should climate change make that a more favorable land use. License agreements can sometimes cause conflict when hunters want to utilize fields held by farmers. Lastly, the profitability of license agreement lands is negligible and not a consideration in the creation or removal of additional license agreements.

<u>Overlapping Comments from Districts</u>

- There seems to be more work than there is time to complete it.
- For example:
    - It is difficult to evaluate all of the WMAs for invasives, much less work on plans to manage and/or remove them (Northeast District).

- Mowing takes up a large percentage of work hours and still is often not completed. This leads to the possibility of invasive species getting a foot-hold (Western and CT Valley Districts).
- State Biologist H. Heusmann was mentioned frequently as being a source of knowledge as well as a decision-maker of many timing-dependent activities.
- Districts are reacting to climate change, but don't necessarily identify their activities in this way.
- There are no formal plans to deal with climate change on WMAs or within management activities currently.

Table 2. Overlapping Climate Change Findings from all District Meetings for the CPST

Project or Management Activity	Overlapping Responses	Climate Change Consideration
Agricultural License Agreements	• Agricultural License Agreements create many challenges • In some cases farmers helped reduce work-load by mowing fields that District staff then didn't have to mow • Farmers don't always recognize the requirement to provide public access (esp. to hunters) • Considered more of a burden than benefit	• As climate change continues to place increasing demands on District's time, an analysis could determine whether the lease program costs more in time than it gains for the District.
Prescribed Burns	• Increasingly difficult to burn given strict guidelines and unfavorable weather	• Could consider modification of the burn prescription regulations to allow more flexibility in timing • Additional mowing and brushing is done in place of burn practices
Nesting Structures – Development and Maintenance	• Wood duck boxes are the most common (if not only) nest box activity mentioned • Wood ducks are increasingly using surrounding habitat rather than boxes • Other species, such as mergansers, are using nest boxes • Beavers are beneficial in creating and maintaining bodies of water to act as wood duck habitat • Warmer winter temperatures making it difficult to monitor and maintain boxes because ponds don't freeze over or ice thickness is deemed	• Since wood ducks are doing well and utilizing natural habitat, could consider other species that could benefit from nest boxes • Possible new species to focus on could be bluebirds and kestrels

	unsafe	
Trout stocking	• Brook trout are stocked for recreation • Because trout do best under specific thermal conditions, timing is important • Climate change impacts the ideal release date • Timing is also important as personnel time allocation could conflict with other duties	• Have been modifying timing based on air and water temperature as opposed to a specific calendar date to ensure proper release times • Continue to monitor temperature changes and adjust

Using the Climate Action Tool

When faced with challenges to effective management as a result of climate change, the Massachusetts Wildlife Climate Action Tool (CAT, https://climateactiontool.org) can be particularly useful to District Managers. The CAT was developed in partnership by MassWildlife, the University of Massachusetts-Amherst, the Department of Interior's Northeast Climate Science Center, and the U.S. Geological Survey's Massachusetts Cooperative Fish and Wildlife Research Unit, so the information within is specifically geared towards the Commonwealth. The CAT includes information on climate impacts, vulnerability of species and habitats, and adaptation actions that can be taken. It was developed using a literature review of the most recent scientific findings as well as new expert input.

District staff can use the CAT to find species-specific information that can be relevant to management goals. For example, for one focal species, black bear, the CAT indicates that they are not identified as vulnerable to climate change, but their hibernation timing may change given milder winters. The CAT also includes habitat-specific information. For example, the spruce-fir forest at Eugene D. Moran WMA is a habitat type very affected by climate change because of its cold adaptation, presence at higher elevations, vulnerability to fire, and vulnerability to pest outbreaks.

A number of potential adaptation strategies and actions are included in the CAT that managers could refer to when considering forest management, coastal habitat restoration, or how to promote connectivity among WMAs. Please see Appendix 2: Additional Resources for examples. Since the CAT is a place to showcase existing expertise and practices, it could be modified to include some of the actions being undertaken by District staff as examples.

Next Steps

For the WMAs that were not discussed, the CPST can be used by District staff without facilitation for future projects and plans. A manager can complete it by him- or herself or with others on a team; we found great value in having multiple members of the staff present to share their input and often to spark and deepen the dialogue. This also creates buy-in for the implementation of actions. The versatility and simplicity of the CPST allows it to be useful in more than just a few select scenarios and times. A complete copy of the CPST developed for MassWildlife is available with this report.

Lastly, as its name indicates, the purpose of the CPST as a screening tool became apparent when the need for additional time to develop coherent climate change adaptation for some management activities and WMAs was identified. For projects such as these, the Climate Adaptation Workbook (see Appendix 2) was mentioned, and the Workbook passed around. The in-depth nature of the Workbook appealed to attendees and there is interest in planning a training day at the Headquarters office, to learn how to use and implement it. The CPST could be considered a first step and its completion can facilitate and enhance the use of the Adaptation Workbook for projects that would benefit from more in-depth discussion and detailed planning.

Conclusions

Using the CPST to facilitate a discussion of climate change impacts on current and planned management activities highlighted multiple results. In many cases, management professionals did not initially identify any ways in which they were modifying their work because of climate change and, in some cases, they did not readily identify ways climate change was affecting their work. However, upon further discussion, it became clear that observations of

climate change and modification of activities were occurring, just not explicitly labeled as such. Through the course of the discussion, it also became clear that agency-wide policies on climate change would be helpful or, if already in existence, these could be communicated to Districts in a more comprehensive way. As such, it would be particularly important to have both District and Division Headquarters staff present at the meeting.

Overall, the CPST meetings provided a block of time for on-the-ground managers to pause in an otherwise busy schedule and directly consider climate change as it relates to their daily projects. The goal of these meetings was to facilitate this examination and encourage thoughtful planning for current and future management activities. In this way, work hours and physical resources can be used most effectively to protect and manage Massachusetts' lands and wildlife resources in a changing climate.

Works Cited

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Morelli, T.L., S. Yeh, N.M. Smith, M.B. Hennessy, & C.I. Millar. 2012. *Climate Project Screening Tool: An Aid for Climate Change Adaptation*. United States Department of Agriculture, Forest Service. Research Paper PSW-RP-263. 40p.

Appendices

Additional Resources

- Massachusetts Wildlife Climate Action Tool http://climateactiontool.org - For specific information on species and habitat vulnerability, climate trends in Massachusetts, and adaptation strategies and actions. Example pages below.
  - Species
    - Brook trout - https://climateactiontool.org/species/brook-trout
    - Moose - https://climateactiontool.org/species/moose
    - American Black duck - https://climateactiontool.org/species/american-black-duck
  - Habitats
    - Vernal pools - https://climateactiontool.org/ecogroup/freshwater-wetlands-vernal-pools
    - Spruce Fir forest - https://climateactiontool.org/ecogroup/forest-spruce-fir
    - Coldwater fisheries streams - https://climateactiontool.org/ecogroup/rivers-and-streams-coldwater-fisheries-resources-streams
  - Adaptation Actions
    - Culvert upgrades https://climateactiontool.org/content/maintain-habitat-connectivity-retrofit-or-replace-culverts
    - Riparian restoration for coldwater streams https://climateactiontool.org/content/ensure-cool-water-temperatures-protect-and-restore-riparian-areas
    - Promote species in the northern and middle edge of their range https://climateactiontool.org/content/promote-drought-and-heat-tolerant-species-encourage-species-northern-and-middle-edge-range
    - Living shorelines https://climateactiontool.org/content/restore-and-protect-natural-shorelines-use-living-shoreline-techniques
- Adaptation Workbook https://adaptationworkbook.org - A process to consider climate change impacts and design adaptation actions. Similar to this CPST, but for a deeper dive into climate change planning for a WMA.
- Vulnerability Assessment of MA Species of Greatest Conservation Need (2017) https://necsc.umass.edu/projects/vulnerability-northeastern-wildlife-climate-change-using-decision-science-inform-manageme-0
- North Atlantic Aquatic Connectivity Collaborative (NAACC) streamcontinuity.org – Database and background information on culvert assessment and prioritization.
- The Deerfield Stream Crossings Explorer SCE.ecosheds.org – Tool to locate and prioritize road-stream crossings. Include ecological data (aquatic connectivity from the NAACC, coldwater streams) and transportation vulnerability data (risk of failure and EMS delays) for

Deerfield Watershed. Some of the data will be expanded to the entire state in the next few months.

- Climate Change Resource Center – Website run by the United States Forest Service containing general information about climate change. The website also has a section with specific tools that can be utilized when trying to make decisions in response to or monitor impacts of climate change. There is even a section which allows users to search for specific tools based on needs and geographic location.
- Northeast Regional Invasive Species and Climate Change (RISCC) Management network http://people.umass.edu/riscc - Northeast Climate Science Center initiative to address the question "How can we manage for upcoming biological invasions in the light of climate change?"
- Integrating Climate Change into Northeast and Midwest State Wildlife Action Plans https://necsc.umass.edu/projects/integrating-climate-change-state-wildlife-action-plans
- Climate Change Tree Atlas and Bird Atlas http://www.fs.fed.us/nrs/atlas/ - Includes current and possible future distributions for over 100 tree and bird species in the Eastern US