University of Wisconsin-Stevens Point

Students: Naomi Albert, Casey Olson, and Michael Mills  Faculty Advisor: Anna Haines

Center for Land Use Education
College of Natural Resources
University of Wisconsin-Stevens Point

# Climate Change Impacts on County Forest Planning in Wisconsin

## Abstract

Climate change is projected to shift ecosystems in northern Wisconsin, bringing profound change to forests including altered forest structure and habitat loss for vulnerable species. These changes will pose management challenges which should be addressed in forest planning. Counties manage the greatest acreage of public forest in Wisconsin. Since the number of privately-owned forests is high and it is difficult to access landowner management plans, county forest plans are our best tool to gage climate change preparedness in Wisconsin forests. We examined current county forest plans for inclusion of climate change issues and topics, but most plans were created in 2005-6 and do not address climate change. Thus, in order to understand county forests' preparedness for climate change, we surveyed county forest managers to investigate whether climate change adaptation is being incorporated into planning and if so, to what extent. Our objective is to understand how climate change is influencing forest planning.

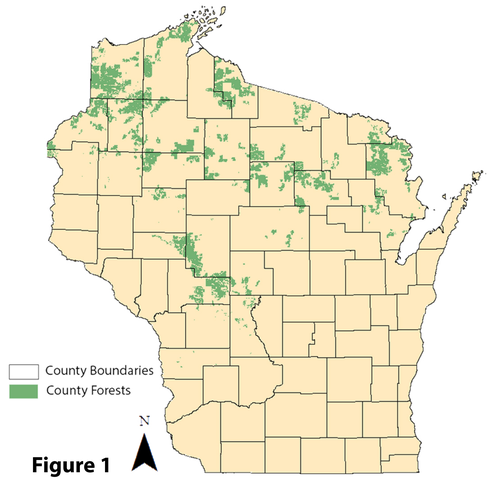


Figure 1

## Literature Review

The advent of climate change is projected to influence forested ecosystems in Northern Wisconsin as species composition is affected by higher temperatures, increasingly severe and frequent storms and longer growing seasons (Janowiak et al., 2014). While some trees, especially boreal species, are especially vulnerable to projected changes, other more adaptable species may be favored (Janowiak et al., 2014). As the climate changes, old management practices may no longer yield the same results due to new conditions.

Climate change information could be considered to help forest management practices adapt to future conditions (Janowiak et al., 2014; Millar et al, 2007; Joyce, et al., 2009). The literature suggests that adaptive, flexible management informed through frequent monitoring will become increasingly important due to climatic uncertainties (Janowiak et al., 2014; Millar et al., 2007). Planning for and protecting against increased disturbances, such as wind, fire and invasive species, was another recommended management practice (Janowiak et al., 2014; Joyce). Shifting forest management goals from preserving current conditions to preserving ecological processes may be necessary (Joyce et al., 2009). Many of the forest adaptation strategies identified by the literature could be incorporated into forest plans which ultimately guide management practices. While these strategies provide a framework for ideal forest management, whether they are currently being implemented in forests is another question. Literature regarding how climate change information is being incorporated into forest management practices is largely focused on public land in general or National Forests (Petersen et al., 2013; Anhalt-Depies et al., 2016; Laatsch and Ma 2015). There is a lack of research specifically on county forest adaptation.

Understanding how county forests are preparing for climate change is particularly important in Wisconsin, as county forests are the largest owner of public land (Haines et al., 2005). In fact, county governments hold 15% of forested land in Wisconsin, amounting to about 2.4 million acres (Haines et al., 2005). Therefore, county forest management plays a critical role in the health of Wisconsin forests and the state at large. Indeed, county forests bolster the economy through recreation, tourism and forest products. County timber sales alone, amount to as much $30 million each year (WI DNR). Wisconsin is home to 29 county forests, most of which are concentrated in the North (WI DNR). These county forests are required by state statute to complete 15-year land use plans to guide operations (WI State Statute 28.11). Since these plans are intended to guide management, they could incorporate climate change information to facilitate adaptation to future conditions. Our research investigates whether and to what extent County Forest plans are addressing climate change.

## Methods

Current county forest plans were analyzed for reference to climate change. This analysis was done by searching the documents for key phrases associated with climate change. Search terms included: climate change, adaptation, resilience, carbon, etc.

The literature was used to create an exhaustive list of possible strategies which forest plans could include to adapt management to climate change. These possible strategies were used to design a survey. Survey questions were designed to evaluate which strategies were being implemented by managers. The survey was administered through Qualtrics.

The survey consisted of 72 questions. Most questions were multiple choice, using a 5-point Likert scale, but some questions were close-ended multiple choice. Several free-response questions were also included to allow greater flexibility.

The survey was sent by email to county forest staff, representing all 29 county forests in Wisconsin. 74 emails were sent directly to employees along with 4 website-based mails, three emails were undeliverable resulting in a total sample size of 75 participants.

After Qualtrics survey results were collected, we used IBM SPSS Statistics software to analyze the data. We found are showing frequency distributions from selected questions that are central to answering our research questions.

## Results

**Preliminary Assessment of Current Plans:**
- o Our analysis did not find any reference to climate change in any of the current plans evaluated.

**Survey Responses:**
- o Responses to our survey were received between March 27, 2019 and April 1, 2019.
- o 15 responses in total.
- o 20% response rate.

**Perceived utility and influence of the plan:**
- o 87% found the plan moderately to very useful.
- o 87% agreed that they would consult the plan when faced with new challenges.
- o 100% said the plan is referenced when creating new policies.
- o 87% agreed that the plan influences management practices in the field.
- o 87% referenced the plan monthly or more frequently.

**Plan Updates:**
- o All respondents intend to complete a new plan by 2021.
- o 67% intend to significantly revise and update their forest plan.
- o Stakeholders which provide input on plan revisions included: forest staff, hunters, snowmobilers, Town Board members, silent sport participants, campers, neighbors, tribal entities, WI DNR, friends groups and loggers.

**Climate Change in Future Plans:**

o 47% said that it was unlikely that next plan would include more comprehensive disturbance planning because of climate change, 33% were unsure and 13% said it probably would.

o 80% said climate change is unlikely to change county land acquisition priorities.

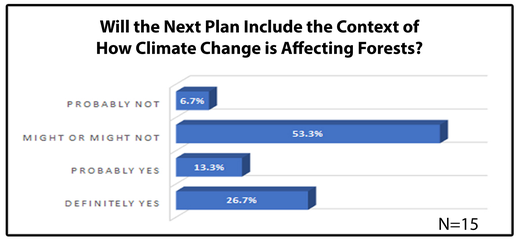


Figure 2

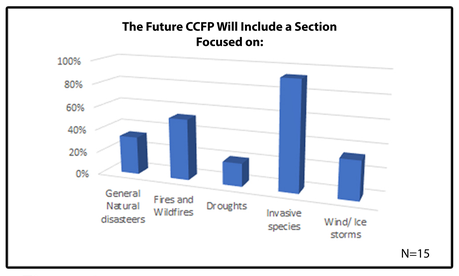


Figure 3

o 33% of foresters said that the new plan will identify climate vulnerable ecosystems or species.

o When asked which climate change mitigation activities the next plan would include, 60% said it would avoid deforestation, 67% said it would encourage planting trees and 7% said it would reduce emissions from operation.

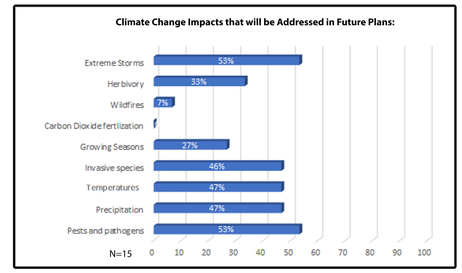


Figure 4

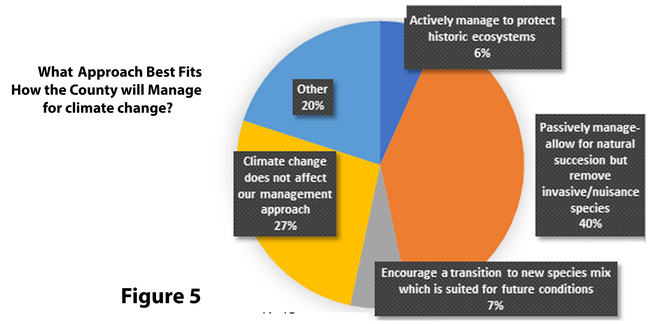


Figure 5

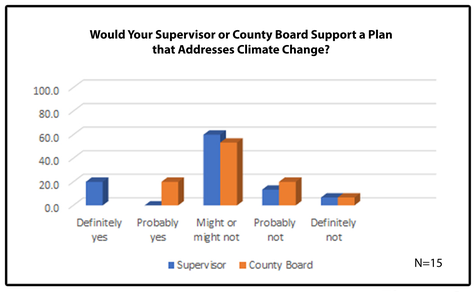


Figure 6

## Discussion and Conclusions

When looking at the collected data, we sought to answer our initial question: do county forest managers use their Comprehensive County Forest Plan and are they planning to incorporate climate change adaptation in future comprehensive plans? Our data shows that most respondents find their comprehensive county forest plan useful and reference it often, especially when creating new policies. This suggests that county forest plans impact forest management, increasing the relevance of our data.

Intentions to include climate change in future planning varied widely. Most county foresters (Figure 2) were unsure whether they would include the context of climate change's impact on forests in their future plan. This uncertainty may reflect unsupportive attitudes from stakeholders. Most felt uncertain about whether a plan to address climate change would be supported by their supervisor and county board. Further, 40% felt that including the phrase climate change in their plan could cause conflict.

We found that foresters were most likely to manage for climate change in a way which is consistent with current best management practices rather than through more novel approaches. Generally, they chose to take a more passive approach (Figure 5) and favored traditional strategies such as planting trees and avoiding deforestation over reducing operation emissions.

Our study provides insight into the future of Wisconsin county forest management. Our preliminary results suggest that climate change is not greatly impacting current thought in forest planning. However, these results are not conclusive. With a 20% response rate, we are unable to draw conclusive findings. We will continue to receive surveys in the coming weeks to increase our pool of data and thus the robustness of our findings.

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