Silviculture Handbook: Chapter 33 - Jack Pine Cover Type Revision Comments and Ad Hoc Team Responses

December 9, 2015

<u>Note from the Jack Pine Ad Hoc Team</u> – We would like to sincerely thank all those who took time from their busy schedules to review and provided comments on the revised chapter. Each comment, even if it did not result in a significant revision, was carefully discussed and ultimately helped improve the thoroughness of the final product. Thank you!

1. Page 33-5: 1st paragraph states "However with the advent of modern fire suppression practices, conditions for successful jack pine regeneration have been greatly diminished…" This statement continues the assumption that jack pine needs fire to regenerate. But hidden in this belief is the fact that heat, not the flames of fire, is what is needed to open the jack pine cones to drop seed. The conditions for jack pine regeneration can and still do occur today without fire as long as heat is available to open serotinous cones and a prepared seedbed is available. Significant acreage of jack pine regeneration occurs annually relying solely on summer sun and seedbed preparation. Also many mature jack pine stands that exist today originated after harvests, not fire. Is there any data to support that most of the current jack pine type originated form fire versus non-fire harvest practices? I expect most current stands are not fire origin. Continuing to promote or link fire to jack pine regeneration is futile since large scale fire for deliberate jack pine regeneration efforts is unlikely and not operationally practical in Wisconsin. Continuing to mention and promote fire as the route to regeneration will discourage some from trying to regenerate jack pine with other methods. Some jack pine stands will be burned due to unplanned fire and successfully regenerate but the focus on fire as a preferred method to regenerate jack pine should be dropped.

   <u>Response</u>: We agree that fire will likely play a lesser role in current and future jack pine regeneration due to the additional resources required and operational difficulties. The chapter therefore covers a variety of recommended regeneration methods for jack pine; including extensive discussions on non-fire methods such as mechanical scarification and clearcutting (refer to Regeneration Systems section). This is an introductory paragraph highlighting the historical importance of fire disturbance in shaping Wisconsin's jack pine forests and the subsequent decline in jack pine acreage since fire suppression. Language was added to emphasize the general statement that current jack pine stands resulted from both fire and scarification/logging.

   <u>Revision</u>:
   "Still today over three-quarters of all jack pine in Wisconsin is naturally occurring (i.e., not planted), a result of fire or <u>scarification treatments</u> and logging disturbance." (p. 33-5, 1st paragraph)

2. Page 33-7: Two references on this page describe the statewide percentage of jack pine volume within two Habitat Groups. In one reference, 48% of the statewide jack pine volume occurs in the Northern Habitat types and 39% occurs in the Southern Habitat types, totaling 87%. Where does the other 13% occur in Wisconsin?

   Response: The 13% is within "undefined" groups where no habitat type could be determined on the FIA plots (see Figure 33.5 for explanation and percentage breakdown).

3. Page 33-8: Last paragraph - Trees can contain all serotinous cones, no serotinous cones, or a combination within a tree. I would add: "While this plasticity of serotinous and non-serotinous cones is not fully understood, such factors as wildfire intensity, frequency, size, and distribution, as well as seed predation may be determinants of the types of cones present (Gauthier et al. 1996). This may also be an adaptation to allow jack pine to occupy a wider range of sites over its large range."

   Response: Thank you for the additional reference on this subject. Team felt that the level of discussion on cone serotiny and the associated natural selection drivers was adequate for this section. It is also identified in the Regeneration Systems section that trees can contain a range of serotinous to non-serotinous to partially serotinous cones. Language was added to clarify the effects of fire regime on serotiny in the Radeloff et al. study, which had similar conclusions to the Gauthier et al. study.

   Revision:
   "The savanna-type landscape of the southwest Pine Barrens experienced frequent, non-lethal surface fires that may have favored trees with non-serotinous cones. High density tree cover in the northeast portion of the Pine Barrens would have allowed for stand replacing crown fires that may have favored trees with serotinous cones (86)."

4. Page 33-10: 2nd paragraph - In addition to slash, Ahlgren (1974) noted that shade cast by the new flush of green vegetation after a fire also contributed to and facilitated successful regeneration. While not crucial to add, some might interpret conducting an Rx burn as bad as it would consume slash needed for shading.

   Response: While new vegetation after of fire is a component of this shade, the paragraph indicates slash and snags can be a benefit on both "burned-over or cut-over areas" and the team felt additional detail was not critical here.

5. Page 33-10: 3rd paragraph - Competition from other herbaceous, woody, and shrubby vegetation is also a significant factor that can reduce jack pine seedling survival and should be highlighted in this paragraph.

   Response: Agree, revision added.

Revision:
"Numerous factors hinder seedling survival: drought, high soil surface temperatures, vegetative competition, prolonged flooding, insects, diseases, deer browse, ice damage, and nipping and girdling by snowshoe hares."

6. Page 33-10: 5th paragraph - The distinction should be made between conditions created after Rx burning and wildfires. All of the studies that talk about the lack of organic matter inhibiting seedling establishment are from studies that look at wildfires. Eluding that seedlings might die after fire might deter some managers from implementing Rx burning that typically leaves far more organic matter intact.

   Response: This paragraph refers to seedling failure due to too much organic matter. Refer to Prescribed Fire section for more detailed information on Rx regimes and seedbed requirements. Here is just a broad introduction to the topic of fire and seedbed condition.

7. Page 33-11: 1st paragraph - It says that poor sites break down at about 60 yrs. Rudolph (1983) and Rudolph and Laidly (2004) suggest that it should be 40 years. Later in the manual, it eludes to a minimum rotation of 40yrs. For continuity purposes and adhere to other studies, that 60 should be 40 or perhaps add a range 40-60yrs. If that is the case, the table on pg. 33-12 will have to be adjusted as well.

   Response: These ages refer to stand-level biological health (i.e., pathological rotation) and not the minimum timber rotation (40 years) which is based is on peak MAI and economic considerations. Added clarification to sentence.

   Revision:
   "On the best sites stands begin to decline in growth and vigor after 80 to 100 years; on poor sites after 60 years."

8. Page 33-13: Table 33.2 - The category labeled Damaging Agents in this chart should also include Annossum Root Rot as well as a review of recent stand history of jack pine budworm damage which would reduce the supply of stored seed in cones.

   Response: Annosum is not a major issue in jack pine stands, likely because these stands are not typically thinned, which would result in annosum introductions and spread. Jack pine budworm is listed in this table and language will be added to the Forest Health Guidelines to expand on potential impacts to seed production. Also added category to Special Considerations section of table on importance of stand history assessment.

   Revisions:
   Table 33.2 – "Special Considerations – Stand history"

   Forest Health Guidelines (Table 33.7) – "Stand history of defoliation events may also impact seed production and the supply of stored seed in serotinous cones."

9. Page 33-14: 2nd paragraph - Here's a suggestion to aid in assessing seedling stocking and growth surveys. I suggest that such surveys be delayed until after

October 1 to allow leaf drop which will help surveyors detect 1-2 year old seedlings. Even more useful is the change in needle coloration that jack pine takes on in this time period, turning a shade of purple which visually helps locate younger seedlings.

Response: Thank you for the great suggestions. Monitoring protocols are not discussed in this section however. The reference to “early monitoring” here only refers to the long regeneration period of jack pine and the need to consider this when assessing follow-up management needs.

10. Page 33-17: 3rd paragraph - A good addition would be: "Prescribed burning could provide additional ecological benefits that may be desired."

    Response: This section is more of a how to guide on seed tree and not designed as a discussion on ecological benefits of prescribed burning. The benefits of prescribed fire are discussed more in Wildlife and Landscape management sections.

11. Page 33-17: Seed Tree - Use of a prescribed burn soon after a seed tree harvest in a serotinous jack pine stand may successfully regenerate jack pine if the surface fire provides sufficient heat to open serotinous cones remaining in the seed trees. Seasonal weather may or may not provide the prescribed conditions for the burn and aging of the jack pine logging debris after 2 years may allow enough deterioration of the logging debris to not provide sufficient fuel to carry the burn or provide the heat to open cones. The window of opportunity for prescribed burning is much narrower than the period of time available to use soil scarification techniques combined with a harvest to provide conditions to regenerate jack pine from seed. The logistics and costs of regeneration with scarification are more predictable and less than assembling the resources to safely conduct a prescribed burn in a recently harvested stand.

    Using prescribed burning after a harvest without leaving seed trees is not recommended since surfaces fires burn hot enough to consume branches and cones, especially in a backing fires. The high heat and destruction of cones destroys the viable seed present in the logging debris on the surface. So please clarify that use of prescribed fire in a clearcut harvest without seed trees has frequently not been successful and is not a recommended practice if relying on direct seeding from the cones in the harvested jack pine branches/tops. There is no issue with using prescribed burning as part of the site preparation process for direct seeding or artificial regeneration.

    The risks of leaving jack pine seed trees that survive the prescribed fire should also be highlighted. Jack pine seed trees that survive will be attractive targets for jack pine budworm populations since they will offer abundant male flowers that these insect initially rely on as young larvae. Subsequent jack pine budworm build up on these seed trees will greatly raise the risk of significant damage to the younger jack pine understory, acting as a magnet to pull budworm to younger stands that usually are less attractive to budworm. In addition, overstory jack pine can also contribute to Sirococcus shoot blight in the understory. Attempts to harvest the seed trees should be made if markets for scorched wood are available.

Response: Thank you for the great discussion on this topic. Many of these points are addressed in both the Seed Tree and Prescribed Fire sections. Details on the fire intensity and timing necessary to open cones in seed trees are covered in both sections. The logistic and cost benefits associated with mechanical scarification are addressed in the Scarification section. Clarification was added to the Prescribed Fire section on the impacts of prescribed fire to cones in clearcut slash (see below). Based on the seed tree trials observed by the team and documented in the literature, jack pine seed trees generally do not live very long after the harvest and prescribed fire, but a cautionary statement was added to the section on the potential forest health risks if seed trees survive beyond the regeneration period (see below).

Revisions:
Page 33-21, 4th paragraph –
"Most research indicates the best use of prescribed fire for jack pine is in site preparation for regeneration (93). Regeneration methods commonly used in conjunction with fire include tree planting, direct seeding, and seed tree. Note that prescribed fire in clearcut slash (i.e., without seed trees) does not usually result in adequate natural seeding, because most of the cones within the slash ignite, destroying this source of seed."

Page 33-17, 3rd paragraph -
"If seed trees survive beyond the regeneration period they can increase the risk of insect and disease problems."

12. Page 33-18: 2nd paragraph - Scarification methods. In my experience, many of the scarification methods offered here have routinely been successful with the exception of disking, especially deep disking. The use of a disk appears to incorporate organic matter into the soil and create air cavities or loose soils when the disk turns the soil surface over. This "fluffed up" soil seems to contribute to early seedling mortality in mid to late summer even though mineral soil is present. My conclusion is that after germination, young jack pine seedling root growth is not fast enough to keep up with the falling soil moisture that dries faster due to the many air cavities in the disked soil. As a result, the young seedling becomes stranded and loses contact with soil moisture, eventually dying. In contrast, packed sandy mineral soils have good results since the seedling does not loose contact with soil moisture. This success on packed sands can be observed especially along skid trails or haul roads in previous jack pine harvests. Packed soils/sands can hold soil moisture longer than disked soils.

    Response: Disking is mentioned as a potential mechanical scarification method, but based on the team's experience this method is no longer common in Wisconsin. They agreed on potential problems of loose soils after scarification and depending on the scarification method used and the soil type it could be more or less of a problem. Wording was added to identify this issue and recommend allowing time for the soils to stabilize.

    Revision:
    "Soil sloughing can be minimized by allowing the scarification to settle prior to harvesting or seeding. Depending on the scarification method and soil type,

allowing loose soils to stabilize may also help reduce air pockets and improve early seedling survival."

13. Figure 33.8: Proper credit for the photo in figure 33.8 should – Vilas County Forestry Department.

    Revision: Photo credit corrected.

14. Page 33-24: 2nd paragraph - The last bullet point before Direct Seeding: I agree with the statement in this bullet point, however, I would add that successful supplemental planting can still be conducted by the third growing season, particularly if 2-0 planting stock is used and your initial site preparation was aggressive (still holding value by the third season). I have used this technique on the NHAL State Forest for 20 years with great success. There are minimal to no discernable differences between these trees by the time their canopies significantly close (usually around 10 to 15 years). I would not recommend trying it beyond the third year though, as long-term, the inter-planted trees can have difficulties with lagging height growth when compared with the earlier-planted trees.

    Response: Agree, revision added.

    Revision:
    "First year regeneration monitoring is important to determine if supplemental planting is needed to improve stocking levels. Supplemental planting should be conducted by the second or third growing season while site preparation is still adequate."

15. Page 33-28: Last bullet - On page 28 conversion of jack pine to red pine or white pine with 50 sq.ft./acre is not adequate stocking to fully capture the site, unless you are planning a shelterwood to regenerate PW or PR and crown closure at that level is too high to successfully regenerate any shade intolerant species. Otherwise, if you were to convert jack pine to one of these cover types I think the stocking for PR or PW should be at or above the 'B' line on the stocking chart for pole or sawtimber stands.

    Response: The team has had considerable discussion over this recommendation. The recommendation originates from the former jack pine chapter guidelines and was not found in any other reference sources. It basically illustrates a situation where the jack pine are harvested or die, leaving an understocked stand of white or red pine. These overstory pines are then retained and presumably the gaps within the stand would need to regenerate, similar to a shelterwood. If the stand was already at the B-line with red or white pine, it likely would not have typed out as a jack pine stand originally. After more discussion, the team decided to strike this recommendation in favor of emphasizing the options of overstory removal (i.e., if sufficient advance regeneration) or shelterwood (i.e., if sufficient red or white pine to create the appropriate crown cover).

Revision:
"Red and White Pine – Stocking of at least 400 seedlings/saplings per acre or sufficient overstory of red or white pine to facilitate shelterwood regeneration methods."

16. Figure 33.12: There is a typo in the captioning for Figure 33.12 "Planting pattern in in a Kirtland's Warbler management area".

    Revision:
    "Planting pattern in a Kirtland's Warbler management area…"

17. Page 33-47: 2nd paragraph - I don't support the use of Relative Importance Value (RIV) here since the data bases for the calculations are not equal. The use of RIV here attempts to provide evidence of jack pine presence in Wisconsin based solely on witness trees used during the initial survey work. The methods to select and inventory witness trees by early surveyors are completely different than FIA survey protocols. This is equivalent to comparing apples to oranges. Selection of witness trees by surveyors involved many biases by many different surveyors.

    Why compare the jack pine importance in the mid-1850s when the surveys were made against present day importance? Some historians speculate that native peoples influenced fire occurrence above that which would have occurred naturally, so jack pine presence may have been artificially high or low when the surveyors selected witness trees. What about jack pine presence 1000 to 5000 years ago? Calculating RIV consistently using FIA data would be much more valid. Either revise using a consistent data source or drop this section on RIV.

    Response: This section is providing only a historical backdrop or context of where jack pine forests (and the species associated with these forests) would have been important based on past disturbance regimes. This is only a snapshot in time and does not represent the entire historic range of variation that may have occurred on these landscapes. The team also agreed with the stated limitations of using land survey records, however due to the general lack of historical data on forest composition felt this information still provides insight to better understand these landscapes. The available timeframe for FIA data is limited, but the overall trend of declining jack pine presence is similar whether comparing modern FIA data (e.g., Figure 33.3) or relative changes from GLO survey data. The team felt showing these multiple lines of evidence helps foresters understand this bigger context and the possible management options within these landscapes. Clarification was added to further explain how RIV is used here and its limitations.

    Revision:
    "Relative Importance Value (RIV) is a metric that combines relative basal area and relative density (He et al. 2000) to determine the "importance" of a particular species relative to other species in a given area. The RIV of jack pine in the Northwest Sands was over 30% at the time of General Land Office surveys in the mid-1880s[1]. Its RIV in the Northwest Sands now, based on 2013 FIA data, is less than half of that amount (Fig 33.16). The RIV decrease is less pronounced

in the Central Sand Plains, but many areas there have also been converted to other forest types and land uses."

"In more recent decades, jack pine acreage has been consistently declining in Wisconsin since 1983 based on FIA data (see Figure 33.3), and this change has been concurrent with an increase in red pine (120). Between 2004 and 2014 it is estimated that roughly 40,000 acres of jack pine were converted to red pine in Wisconsin (63)."

"[1]Tree data from the General Land Office surveys are from a particular point in time and can be biased for a number of reasons, including due to limitations in the data collection methods. However, as the only statewide source for pre-Euro American settlement vegetation data, they can be useful for exploring vegetation patterns at large scales, such as ecological landscapes. These data are used here to better understand the ecological capabilities of these areas and not to imply that conditions should be returned to any particular point in Wisconsin's history."

18. Page 33-49: 1st paragraph - Research conducted by Guyette (2011) and Steigerwaldt et al. (2015) in the Northwest Sands, Northeast Sands, and the Northern Highlands suggests that some pine stands had recurrent fire as often as 5-12 years before European Settlement. I would add: "Some pine (red, white, jack, and mixed pine) stands had pre-European settlement fire return intervals that maintained stand dynamics and promoted ecological health and diversity. These low intensity surface fires occurred as often as 5-12 yrs. within the Northwest Sands, Northeast Sands, and the Northern Highlands Ecological units (Guyette 2011, Steigerwaldt et al. 2015). Stand replacing crown fires historically frequented jack pine stands of the Lake States every 50-70 yrs. (36)."

    Response: Thank you for the additional references. The occurrence of low intensity surface fires was briefly covered in the Silvical Characteristics section discussion on the development of non-serotinous cones. The current paragraph broadly covers the concept that fire return intervals and intensities varied across jack pine sites.

19. Page 33-52: 1st paragraph - Climate change Adaptations - "Jack pine was ranked as moderately vulnerable to climate change…….However, this species is at the southern extent of its range in Wisconsin and may be less able to persist and regenerate." If climate change is occurring and I believe it is, then why attempt to maintain a species in a location/habitat that will offer a declining and unsuitable climate for this species? Why would a landowner attempt to manage a species through a rotation period knowing these stands will struggle due to climate induced stresses?

    Anticipating impacts of climate change on jack pine stands would lead me to attempt to provide other better adapted tree species in addition to regenerating jack pine or at minimum, give preference to jack pine from more southern sources. Are younger stands expected to be more resilient? If so, does this suggest younger rotations? More insect and disease issues?

This section seems incomplete. Convince me and other readers why it is important to maintain jack pine and how to manage healthy stands?

Response: The purpose of the jack pine chapter is to describe the most effective silvicultural methods for managing jack pine that are supported in the literature and consistent with field experience. Hopefully managers will find the information presented here useful for effectively managing healthy and vigorous jack pine stands. Discussion on this section was deliberately kept short due to limited available information and the fact that climate adaptation strategies are just now being researched. The goal of this section was to make the reader aware of the issue relative to jack pine and to provide additional reference material (i.e., The Northwoods Climate Change Response Framework). As the chapter states, jack pine is a species that is moderately vulnerable and it may have some advantages in a warming climate (i.e., adapted to droughty soils and disturbance), but may also be impacted negatively depending on the degree of warming. As more information becomes available on these impacts relative to jack pine, this section can be expanded.

20. Page 33-52: 1st paragraph - under "climate change adaptations" remove the use of "that" from the last sentence. The sentence should look like: "USFS (44) hypothesizes regeneration failure could occur more frequently in drought conditions and pests and diseases could become more damaging."

    Revision:
    "USFS (44) hypothesizes that regeneration failure could occur more frequently in drought conditions, and pests and diseases could become more damaging."

21. Prescribed Fire Section - The big thing that I saw is an addition that needs to be made to the prescribed burning section. I am glad that this section got included. However, it is too short. There is so much information that could be added, but this may not be the place for it. Perhaps sometime down the road, we'll have to get together and write a whole manual on Rx Burning similar to the BMP manual. However there are two things vitally important to consider for conducting an Rx burn in PJ.

    The first is the Hudson Bay High. This is a high pressure system that forms over the Hudson Bay in the spring. It has the tendency to sit over Canada idle and build until it rapidly progresses south without warning. Weather predictions for the day can show perfect burn conditions; however, this system can move into the great lakes within 12 hours without warning. This was actually cited as a contributor to the blowup of the Mack Lake Fire and possibly the Peshtigo Fire. What happened during the Mack Lake Fire is that the system moved in quickly and without warning, RH dropped, winds picked up, and winds shifted unpredictably. Careful consideration is needed to monitor on site weather conditions until this risk diminishes as the year progresses.

    The second and larger consideration for conducting Rx burning in jack pine is timing burn operations so they take place prior to or after the spring dip phenomenon that takes place in conifer species. Prior to the flush of new growth in the spring, conifers store carbohydrates, sugars, and fats in the old needles that in terns decreases relative live fuel moisture content. Jack pine live fuel

moisture has a more pronounced dip than any other conifer in our region. This was cited as the second contributing factor to the Mack Lake Fire as the drop in Live Fuel Moisture is a contributing factor to crowning potential. John Hintz (WDNR), Matt Jolly (Missoula Fire Lab) have done a lot on the topic. I suggest watching the following webinars to get more information about timing Rx burn operations in jack pine and maybe include some elements.

Response: Thank you for the great comments. The Prescribed Fire section was purposely kept limited in scope. However, we agree these fire operational considerations are critical and your comments have been forwarded to the Prescribed Fire Handbook team.

22. General Comment - I read the entire chapter and talked to several wildlife biologists and jack pine ad hoc team members. The silviculture in the chapter is sound. The sections of wildlife habitat and landscape ecology are sound. The rotation ages are appropriate and will benefit wildlife habitat including habitat for threatened and endangered species. I recommend approval of the jack pine chapter for inclusion in the Silviculture Handbook. My compliments to Greg Edge and the ad hoc team for developing this chapter.

    Response: Thank you!