
DEPARTMENT OF NATURAL RESOURCES
DNR
MICHIGAN
Red Pine Regeneration Challenges
Michigan SAF Fall Conference
October 16 & 17, 2014
Bay Harbor Village Hotel

Overview:

- The State Forest red pine resource
- DNR management regime
- Criteria for evaluating regeneration
- Issues on State Forest lands

State Forest Red Pine

Currently:

250,000 acres

- ~85% planted
- ~15% natural

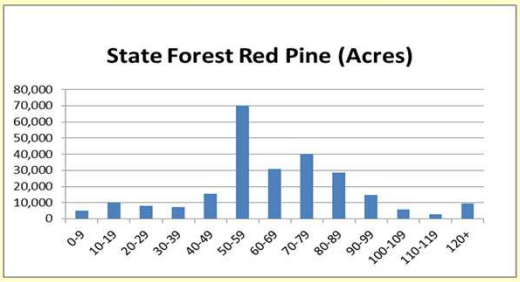
Planned:

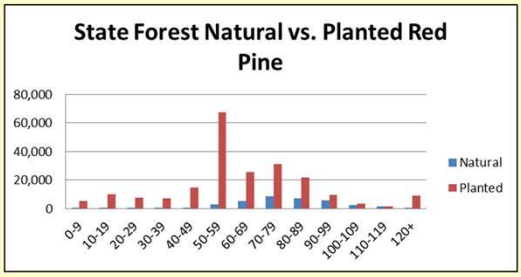
264,636 acres

- 60% in the NLP
- 25% in the EUP

Average site is in the 50-60 site index range

(PArVHa, PArVVb, PArVAa)





In 2008, at the start of the 'Red Pine Project'– a three year operational initiative to catch up on red pine regeneration to help balance age classes on State Forest land, the goal had been to maintain a population of ~270,000 acres of red pine.

Currently our inventory shows a total of 249,121 acres of "R" type. The Regional State Forest Management Plans completed in 2013 using 2012 inventory data called for maintenance of 264,636 acres. The difference is likely the continued conversion of old Operations Inventory system cover type data to IFMAP inventory cover type classifications… In other words, acres that had been called 'R' are getting reclassified as other cover types when re-examined under today's inventory rules.

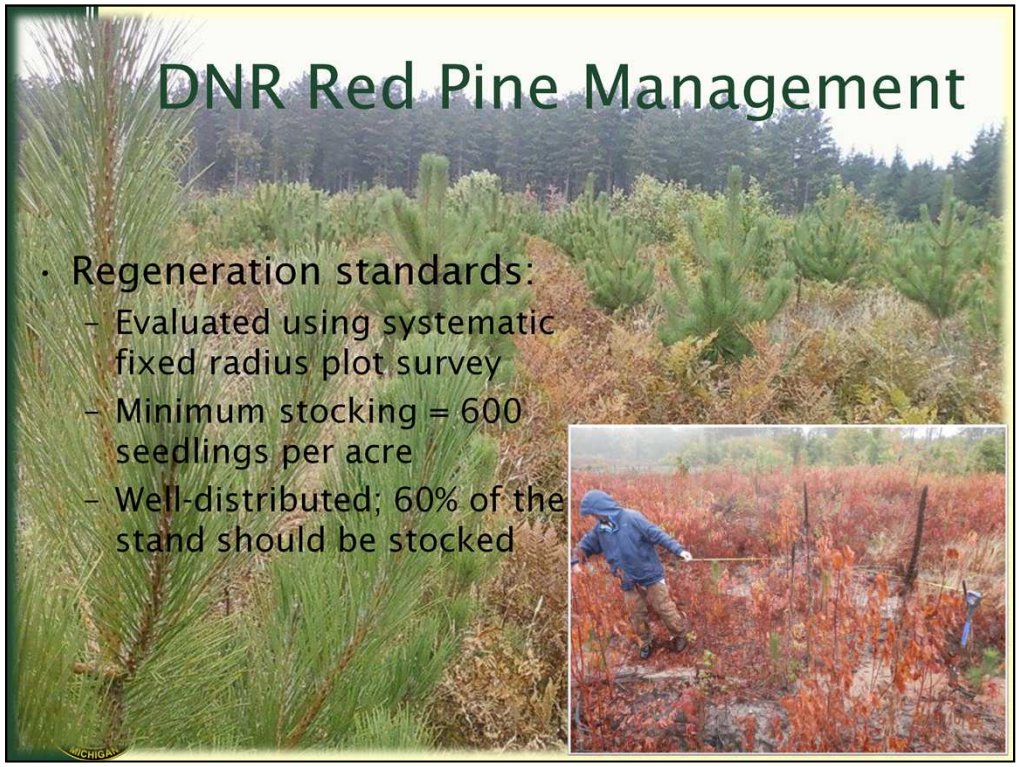
Some of these acres are likely getting classified as mixed conifer cover types.

Site productivity– most DNR sites fall in the 50 to 60 site index range; we have some sites on very low productivity (PVE and PVCd habitat types) and high site productivity habitat types (AFO, AFOCa) (Burger & Kotar, 2003). Some of this is a legacy of the CCC planting days. MDNR's policy is to match site suitability as much as possible when replanting red pine…. Very low productivity sites like PVCd and some PVE sites are regarded as poorly suited for red pine, as are some very high productivity hardwood sites like AFOCa.

Yet a case can be made for planting red pine off-site under certain circumstances– for example, in stands degraded by past management or by by BBD and EAB, on sites where a longer lived pine component is desired, or for visual/aesthetic concerns.

Generally aim for a rotation of 80 years, meaning harvest at ages 80 to 90, generally when the stand average DBH reaches 14 inches. Thinnings typically are:

- 1st thinning at 40 to 50 years, when BA reaches 170+ ft^2/acre. Generally every third row removal, trying not to go below 120 ft2/acre.
- 2nd thinning is generally from below, residual again about 120 ft^2/acre.
- 3rd thinning if done is usually a crown thinning, residual of 90 ft^2/acre or more.
- Final harvest at rotation age, generally with retention of some trees for biodiversity.
- Site preparation is generally via trenching using a two-row disc trencher (TTS Delta powered disc trencher or TTS-35 passive trencher) aiming for evenly spaced trenches, 8 feet between rows.
- Hand planting by migrant worker contract crews, 6 to 8 foot spacing in the trenches. About 900 seedlings per acre result.
- Some sites require roller chopping to mechanically reduce competing vegetation before they can be trenched. Generally to knock down sapling sized hardwood trees and shrubs, aspen whips.
- Some sites need herbicide site prep spray applications generally with glyphosate.
- Release spray applications may also be necessary, again with glyphosate.



MDNR's minimum acceptable regeneration criteria for red pine are 600+ seedlings per acre that are at least 6 inches tall or taller within 3 to 5 years post-planting, or post harvest for natural regen stands.

Regeneration should be well distributed, and 60% of the stand should be well stocked.

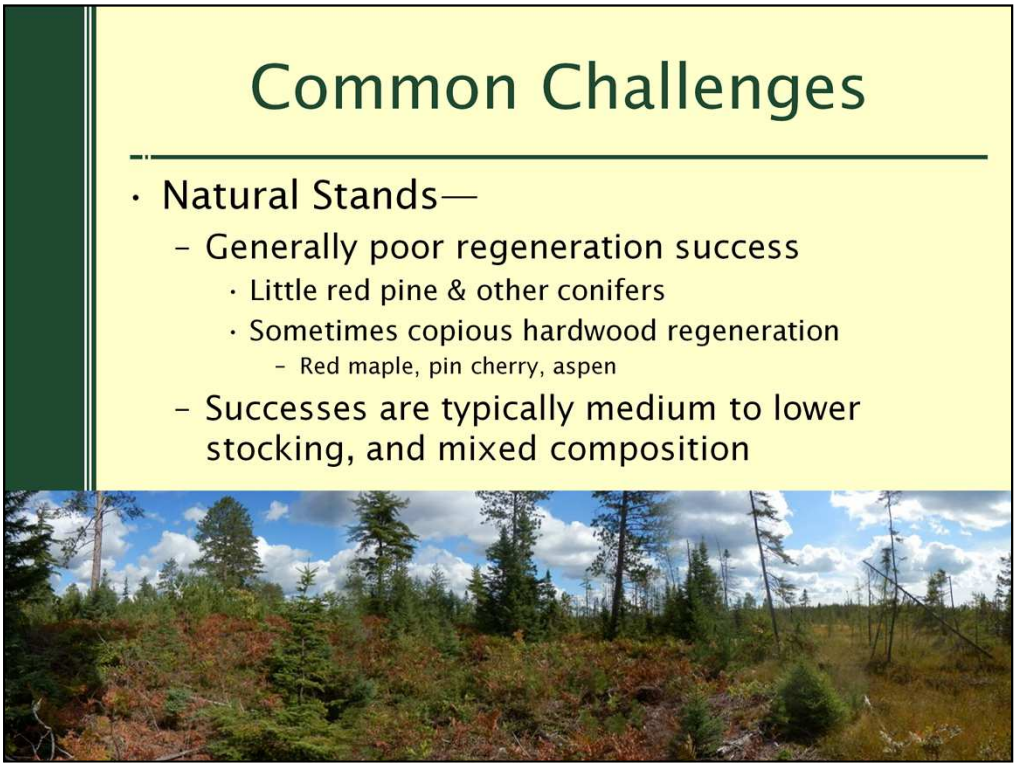
We typically use systematic fixed radius plot surveys to assess average density and percent stocking. The protocol also includes qualitative description of free to grow status, and other competing species. In some districts, quantitative data may be collected on density & height of competing species, and height of the planted species.

Typically managed on longer rotations– 90 to 100+ years

- Seed tree or shelterwood harvests
    - Seed tree 10 to 30 ft^2/acre
    - Shelterwood 30 to 50 ft^2/acre
    - Overstory removal should occur once the regeneration is established (1+ ft., 600+ seedlings/acre) but doesn't generally occur on DNR lands
- Often with scarification– either accomplished as part of the harvest (e.g., whole tree skidding, harvesting restricted to snow free conditions) or via anchor chain scarification.
- The top picture on this slide shows a red pine shelterwood harvest that was just anchor chained on a medium to lower productivity site (habitat type). The goal is to expose bare mineral soil on as much of the site as possible, to create ideal conditions for red pine seed germination, should any fall that year. Success depends on whether that fall has a good cone crop, weather, and how well the site was scarified.
- Occasionally prescribed fire (underburn) will be attempted.
- Usually poor regeneration results from natural regeneration attempts. Most sites end up with little red pine or any other conifer regeneration (low density, low percent stocking), like the site shown in the lower photo.
- A lot of times will see heavy red maple, pin cherry, and aspen understory on the

higher productivity sites, with little red pine regeneration.

Seed tree harvest near Grayling, hardly any red pine, but a medium stocking of jack pine. Outcome: Management objective will probably be changed to accept conversion to jack pine.

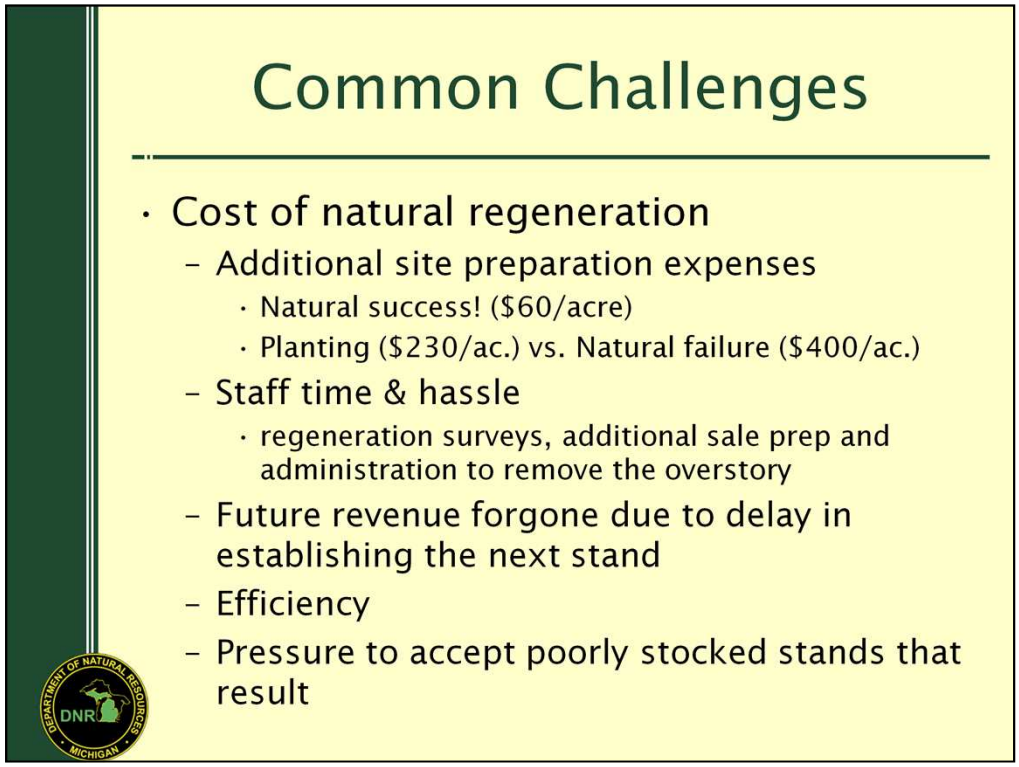


Successful natural regeneration can range from medium to fully stocked, but we rarely see fully stocked predominately red pine natural regen stands. Instead, they tend to be medium to poorly stocked mixed stands, with a red pine component, but not predominately red pine. Regeneration tends to be patchy– areas of well to overstocked condition, and areas with little regeneration.

The photo shown here is a natural regen stand in the EUP that has a young RP component, with advanced regen of spruce and white pine. Was the intent to produce a mixed conifer stand or a red pine dominated natural stand? If the former, this is a success.

We have examples of medium to well stocked mature natural stands, some of which we are attempting to regenerate, but little success in reproducing them.

Overall, natural stands are not shaping up to be utility pole-producing economic engines.



If it works, if it produces a medium to fully stocked red pine dominated stand the first time attempted, natural regeneration could be cheaper than the standard artificial regeneration regime.

Since it usually doesn't work, additional costs for repeated natural regen attempt or the cost of going to artificial regeneration can make natural regeneration an expensive proposition:

- Costs of regeneration surveys, since we'll have to look at it more than once
- Additional timber sale prep and administration expenses to remove the residual overstory if switching to artificial regeneration
- Additional roller chopping, and/or herbicide site prep applications to reduce competing vegetation that may be worse than if we had gone right to artificial regeneration immediately after the harvest.
- Revenue forgone due to the delay in establishing a new stand– this process can effectively lengthen the period between final harvests by 15 to 20 years. Will also delay the time between previous stand final harvest and the first thinning in the new stand. Understocked stands will also have to be carried longer until stocking reaches a level appropriate for a first thinning.
- Inefficiency– to achieve a fully stocked stand, it could take:
    - Artificial regeneration– 4-6 years post-harvest to be considered

established

    - Natural failures– 12 to 20 years
- Pressure to accept poorly stocked stands that result from natural regeneration, when a fully stocked stand was desired.

We have plenty of challenges with artificial regeneration of red pine as well– many of which could be mitigated or avoided with extra attention to timber sale preparation and administration, and the ability of loggers to meet our post harvest site requirements….

- High stumps– make it very hard on equipment and operators to trench and roller chop.
    - Stick to sale specs for keeping stumps 12 inches or less for sawlog sized trees and 4 inches for pulp and smaller sized trees
    - Enforce the specs! Pay extra attention during winter sale administration. A lot of times in the winter loggers are reluctant to put the saw head into the snow…
- Too much slash– slash piles, windrows, piled tops are hard to trench through. This can result in poor seedling survival.
    - Encourage operators to disperse tops
    - Enforce utilization specs– encourage operators to utilize and remove as much as possible
    - Where markets exist, require tops to be chipped.
    - Prescribed burning should be a last resort– it's expensive, can cause delay, and a single burn generally does not control woody competition and exacerbate woody competition (pin cherry in the seed bank). Several

burns may be required for woody competition control with several years between burns to allow enough fuel to accumulate to meet the burn's objective.

- Too much standing and down unmerchantable hardwood residual– too many hardwood saplings left after the harvest will be a problem when trenching. The trencher just rides up over the hardwood saplings. Poor trench quality and subsequently poor seedling survival result. Too much standing residual will also be severe competition with any planted seedlings unless controlled prior to planting.
    - Require loggers to cut all stems >2 inches
    - If markets exist, require loggers to chip all stems > 2 inches.
    - If we have too much unmerchantable hardwood residual (standing or down), we have to roller chop the site, then spray after the stems re-sprout usually the following growing season. Then trench the year after. It delays planting by at least two years.

This photo shows a red pine stand planted in 2013 on a high productivity site. The 1-year post planting regeneration survey conducted in Spring 2014 indicated the potential for pin cherry to take over the site, so the site was scheduled for aerial herbicide release. Glyphosate was used, and this photo shows early subsequent leaf color change on the pin cherry (success we hope!), and no effect on the red pine.

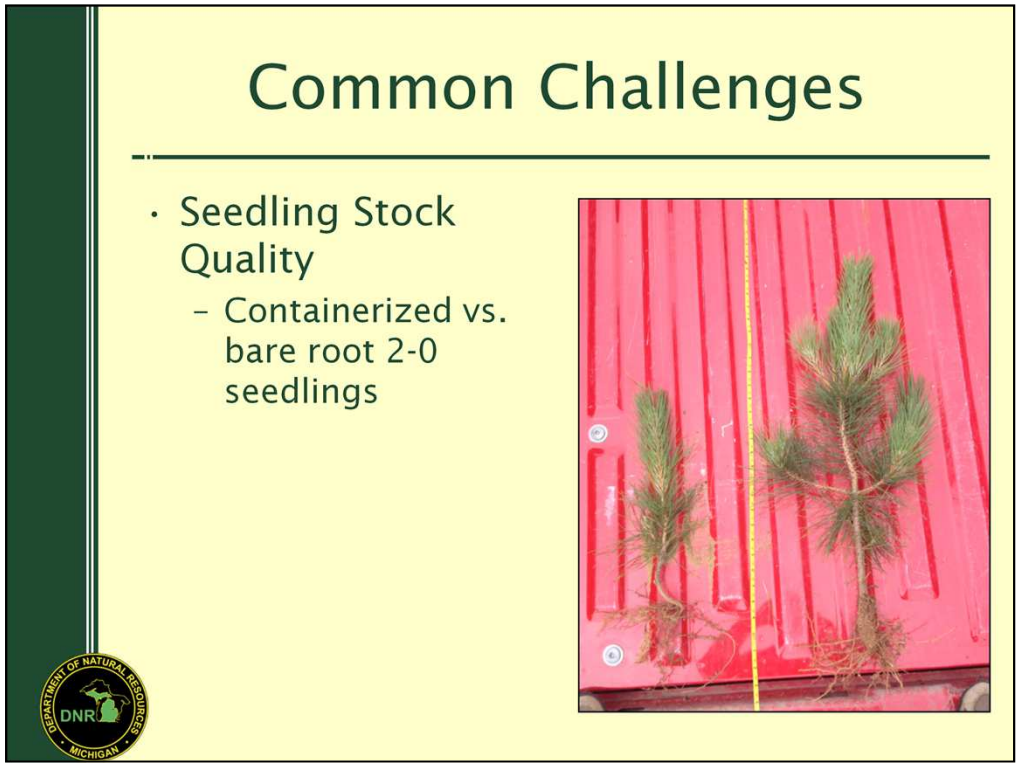
Post planting we do year 1 and year 3 surveys to assess average survival, percent of the site that is stocked, and competing vegetation. These surveys help us to keep on top of the need for release treatments or re-planting.

Post planting monitoring is important– once we've invested $300+ per acre to establish red pine, it's important to monitor seedling growth until they reach 'free-to-grow' status. Seedlings aren't considered free-to-grow until they reach 6 feet or taller with most of the stand NOT over-topped by competing vegetation.

This photo shows a site planted with red pine that clearly has significant hardwood competition. Pin cherry, red maple, oak and aspen. One year post planting, there appear to be about 300 seedlings per acre of red pine, and a lot of pin cherry, red maple and oak. If a red pine dominated stand had been desired, this is clearly not a success. Hardwoods range from 3 feet to 10 feet tall on the site, and from the road it looks like a hardwood clearcut. This site is a typical PArVHa site, well suited to red pine, but also well suited to aspen, red maple, and oak. The pre-harvest site was a jack pine stand mixed with aspen, that was clearcut about 5 to 6 years ago, but not planted until last year (2013). Competing vegetation was not eliminated prior to planting.

Choices at this stage include roller chopping, spraying, trenching and planting, or abandoning the original prescription and accepting the conversion to mixed hardwood/conifer. So an expensive solution either way. Spend more to fix it, or a loss of $300/acre to achieve a low quality hardwood stand. If nothing else, sustainable forest management would suggest that we learn from our mistakes, and

try not to repeat them.



Finally, seedling stock quality plays a role in regeneration success. MDNR produces most of it's red pine seedlings in-house at Wyman State Forest Nursery. However we've been short on red pine for the last several years, at a time when red pine planting need has been elevated due to increased focus on balancing age classes.

We've had an opportunity to buy containerized seedlings, plug 1+0 from US and Canadian nurseries, and staff have been very impressed with the quality and perceived higher growth rate post planting.

From initial regeneration surveys, it appears that we're getting about 90% first year survival with containerized stock, and about 75 to 80% with our 2-0 seedling stock.

The containerized seedlings typically are 4-8 inch tops, with 4 to 6 inch root plugs, and very uniform. The seedling on the right is a containerized seedling dug up one year post planting. The seedling on the left is a Wyman produced 2-0 seedling 1 year post planting. Obviously the containerized seedling looks better.

2-0 stock from Wyman are a bit smaller than we would like to plant– about 3-4 inch tops and 4-6 inch roots. We prefer to plant 3-0 bare root seedlings, but haven't had

enough recently due to the nursery shortfall.

Which is better? It depends on survival and cost, and how that cost is paid. The bare root seedlings cost about $90/1000 seedlings to produce; the containerized cost about $167 to $220/1000 seedlings to purchase. MDNR's bare root stock are produced in-house, and the cost is 99% payroll. Staff at the nursery also do timber inventory and sale work in the winter, and payroll spent on the nursery could be considered 'sunk.' On the other hand, containerized seedlings must be purchased using discretionary funds that could also be used for other expeditures…

Contributors to this presentation include Tim Greco, Don Kuhr, Tom Seablom and Scott Throop. Tim Greco and Don Kuhr provided several of the photos used.