Minutes
Region II-III Reforestation Science & Technical Committee (S&TC)
Meeting #5 – February 4, 2015

Bridgit/Teleconference sites: Fairbanks, Anchorage, Soldotna

S&TC Attendance

Roger Burnside,	Nick Lisuzzo	John Winters
Jim Durst, co-chair	Mitch Michaud	Trish Wurtz
Marty Freeman, co-chair	Tom Paragi	John Yarie
Doug Hanson	Will Putman	
Glenn Juday	Amanda Robertson	

Unable to attend: Nancy Fresco, Teresa Hollingsworth, Brian Young

Note: Handouts referenced in the minutes are available from either co-chair.
To-do items are marked with ►
Items for research needs list are marked with *

Agenda and minutes. The Committee approved the agenda without change, and approved the draft minutes from the November 25, 2014 meeting with minor changes.

Public comments.

- Freeman reported a question on traditional knowledge and uses from a December workshop on the Forest Resources and Practices Act (FRPA; *see handout*). The question followed a discussion of FRPA inspections and a description of the S&TC process. Freeman noted that on public land, traditional and other land uses are addressed during the land use planning processes; on private land, the landowners have authority over uses. Putman noted that there is not much information on Native use of fire for landscape management in Alaska. Paragi will forward some publications for the bibliography.
- Freeman briefed the Board of Forestry on the S&TC process at their December 9 meeting and responded to questions *(see handout).* The S&TC noted the ongoing discussion about reliance on natural regeneration, appropriate time frames for natural regeneration, and the importance of clear goals in determining appropriate reforestation standards. The Board also asked about including Kodiak in the current S&TC process because of reforestation difficulties. Freeman responded that the committee will look at the relevance of Region II & III information to the Kodiak situation once the process is further along.

BIBLIOGRAPHY UPDATE. Freeman is incorporating additional citations identified by the authors of the section summaries. When the summaries are complete, she will post the updated bibliography and index to the Division of Forestry (DOF) website. Committee members asked about breadth of citations to include; when in doubt, error on the side of inclusion.

PRESENTATION

The S&TC heard the final presentation addressing identified issues. A summary of key points, and a link to a PDF of the presentation slides, follows.

- **Amanda Robertson, Northwest Boreal Landscape Conservation Cooperative**
  Population-level differences in adaptive capacity to climate change in a boreal forest tree, *Populus balsamifera* L.
  A PDF of the PowerPoint for this presentation is available at:
  http://forestry.alaska.gov/forestpractices.htm#reforestation

Assisted migration: Can refer to either transferring populations beyond the species' current range or to transferring individuals among populations within the species' current range. The former is often used for threatened species while the latter can be used to increase the adaptive capacity of a species and tends to be less controversial. Within a single species, adaptive capacity can vary due to evolutionary history and different selection pressures in different part of a species' range. Populations are locally adapted when they have the highest relative fitness at their home sites and lower fitness in other parts of their range. Local adaptation can result from gradients in environment and selection or from limited gene flow.

Local adaptation in boreal forest trees: There is a well-known adaptive cline with latitude in boreal forest trees, the result of local adaptation to climate and photoperiod gradients. Photoperiod cues inform the trees when to start growing, when to flower, when to cease growth, and when to set bud. There is a trade-off with intense selective pressure between maximizing growth during the summer and minimizing risk of cold injury. Genetically controlled responses to photoperiod cues have resulted in a cline of decreasing growing season with increasing latitude.

Local adaptation in a changing climate: In a relatively stable environment, local adaptation is beneficial. In a changing environment, some populations of a locally-adapted species may react differently than others due to differences in genetic diversity, phenotypic plasticity, or physiological tolerances. For example, northern populations of balsam poplar are adapted to a short growing season and a relatively high investment in cold tolerance mechanisms. Conversely, populations from the southern portion of the species' range are adapted to a long growing season and a relatively low investment in cold tolerance. Reciprocal transplant experiments have shown that these different growth strategies are genetically determined. In a warming climate, northern populations may not be able to take advantage of longer growing seasons, while southern populations may migrate northward with growing season changes but may be limited by genetically determined cues for cold tolerance leading to winter damage or kill.

Research using balsam poplar: Robertson undertook research to determine whether adaptation to local environments affects balsam poplar's intrinsic adaptive capacity to respond

to climate change (increases in temperature and growing season length). Three questions were posed:

- Do populations from the north and south differ in their potential growth in a northern environment? (genetic differences)
- Is there a phenotypic response to warming (acclimation)? (plastic responses)
- Do genotypes from then north and south of the species' range respond differently to increased temperatures? (genotype x plasticity)

To test these questions, she compared growth and plasticity of different genotypes growing in the same environment, growth of same genotypes in two environments (Fairbanks ambient and warmed), and compared genetic diversity across latitude. Samples were used from a wide range of latitudes (50-70°N) within balsam poplar's range to capture the majority of genetic and plastic variation.

Results and implications for adaptive migration:

- Northern populations had higher than predicted plasticity despite lower genetic diversity.
- Phenological traits (e.g., bud set) were influenced by temperature (warmer temperature delayed bud set), in contrast with widely-held view that poplar bud set is determined by genetics only.
- Southern populations had the highest growth rates in the northern environment (ambient or warmed), consistently growing larger than northern genotypes, but had the highest incidence of cold injury.
- Local genotypes of balsam poplar (Fairbanks sources) were not the best performers at either Fairbanks ambient or Fairbanks warmed conditions. This may be evidence of an adaptational lag resulting from recent 1.4°C warming and nearly 50% increase in growing season length documented for the region.
- The apparent adaptational lag was increased when cuttings were experimentally warmed, suggesting that local tree fitness may continue to decline with future warming.
- Overall, the best-performing genotypes were those collected from 5-10° south of Fairbanks latitude (approximately 350-700 miles).
- When choosing best genotypes for Region III, plot genetic clines (e.g., bud set and height growth) against mean annual temperature of source environments, then model the severity of the expected adaptation lag given a particular amount of warming.
- When considering reforestation, limiting seedlings to all current or all southern stocks may be too limiting. It is probably better to plant a diverse mix.

Discussion items:

- Tom Paragi noted that when new species have been brought in for some provenance trials, herbivores seemed to key into the new species and cause heavy mortality in the seedlings.
- Glenn Juday said that in common garden/reciprocal trials in Ontario and Central Canada, stock from 2½° south of the planting site gave the best growth results for multiple boreal tree species. In white spruce, there is a history of western marginal populations increasing growth with an increase in temperature while central populations decrease growth under warmer temperatures due to near-lethal temperatures being reached.

- Robertson found that southern populations of balsam poplar were capable of hedging their bets with multiple bud sets, essentially restarting a growth then bud set cycle on each warm day in the fall.

REVIEW OF DRAFT SECTION SUMMARIES

Section 1 - General Background - Freeman

- Short section; no changes

Section 2 – Silvics – Yarie and Juday

- Citations will be added, e.g., where text says, "It has been suggested…"
- Yarie: Seed crop variability between and within species can affect not only regeneration and species mix, but also clumping and other distribution patterns.
- Discussion clarified that the audience for the summaries includes the Board of Forestry and Implementation Group.

▶ Juday will review and supplement the draft summary

Section 3 - Reforestation methods and stocking standards- Putman and Hanson

- There is a lot of overlap between this section, Silvics, and Site Preparation; the intro to this summary refers the readers to those sections as well. Hagelin suggested emphasizing key points that both sections found as important or relevant.
- Information in the Silvics section on reseeding characteristics of tree species is an important factor for the Reforestation Methods section.
- There is little published information on stocking standards other than Packee's Levels of Growing Stock studies. Those stocking numbers are targeted at maximum fiber production.
- More research has been done on white spruce than birch. Recent experience shows that birch regeneration is not automatic. In some cases, hardwood regeneration can be adequate to meet FRPA standards, but may not provide sufficient sawtimber.
- Paragi: It's important to remember that areas of birch regeneration can maintain strategic fuel breaks to reduce risk of fires spreading into white spruce stands near communities (may also provide moose attraction for hunters).
- Summarize what has been harvested and replanted, and how much has regenerated. How "well" is the system working. Freeman said some information data is available from forest practices data, regeneration reports and surveys, and reforestation exemptions. Juday noted that Miho Morimoto is doing an assessment for Interior region. Glen Holt may have information on birch regeneration.

✳ Additional research is needed on hardwood regeneration, especially given the importance of hardwoods for biomass for fuel, fuel breaks for wildfires, and wildlife habitat.

✳ Improve data collection on reforestation results.

Section 4 - Site preparation, competition control, and soils – Michaud and Winters

- Michaud: Whether site prep is mandatory or not, will be an important consideration to implementation team. It is very site dependent, operation dependent, and region dependent. It is one of the most varied issues relative to regeneration.
- Winters: Site prep has focused on scarification. Broadcast burning can be effective but would require many more resources (staff, funds, and social license) that currently have available. Herbicides can also be effective and are available, but are rarely used.
- Allaby: His research showed no big increase in white spruce recruitment with site preparation following white spruce harvest and burning in the Fairbanks area. Rupp's thesis (1998) suggests that site preparation may be needed for white spruce regeneration, especially when seed rain is low.
- Juday: Does mechanical site preparation achieve all effects that fire achieves? -- there are several reports in the literature that it cannot.
- Michaud: Chemical site preparation might be an option for private land, rather than public land. Juday indicated that the literature suggests chemical prep works well.
- Winters: Prescribed fire may not be an option, especially on public land, due to the difficulty controlling it. Does it offer enough benefit to look further into it?

✳ Scientists need to identify the key issues regarding the comparative effects of mechanical site preparation, fire, and chemical prep.

Section 5 - Fire and regeneration – Hollingsworth (Freeman presented overview)

- Fire incidence and severity is changing with climate change. Severity determines what comes back post-fire.
- Hagelin: It would be useful to include a paragraph on how fire impacts specific timber species. Right now the summary is excellent at talking about broad patterns, but could it also highlight information on fire and white spruce, for example? Jandt concurred. This information could be useful to private landowners.
- There was a discussion of the role of management goals and desired forest outputs, and how that interacts with public acceptance of fire.
- Juday: Exclusion of fire is problematic, and mechanical prep is not an adequate substitute. There is a British Columbia (BC) study indicating that there was a measurable reduction in growth. In Sweden, there's a problem with allelopathic effects and reduced tree recruitment where fire is excluded. The concerns were significant enough that BC changed their silvicultural systems in the northeast part of the province. He also referenced a study with Dan Rees *(see bibliography)* on fire-dependent species that don't appear in the absence of fire. This isn't a landscape-scale issue at this time, because there's a lot of fire occurring.
- Paragi: There is a lot of literature on aspen fire ecology to consider including.

▶ Provide any additional citations that members may have regarding effects on specific tree species.

Section 6 – Wildlife – Paragi and Hagelin

- Paragi: Interactions between wildlife and reforestation can be positive or negative, depending on silvicultural objectives and design. There are three major interactions:

herbivory, predation on insect and mammalian herbivores, and dispersal of mycorrhizal fungi. Maintaining predators on the landscape can increase forest resilience (e.g., mitigate irruptions of insects, increase biomass, etc.).

- The Yukon-Tanana uplands have high small mammal diversity. Hagelin: Red-backed voles play a key role in dispersal of fungi. Juday: Fungal inoculation has a dramatic effect on tree growth. Robertson: Becky Hewitt's PhD thesis looked at the availability of mycorrhizal fungi following burns of varying severity. If nurse shrubs and trees survive there's enough inoculum available; if not, there's no dispersal.
- Paragi: Harvest configuration is important to managing herbivory. Leaving uncut forest islands within harvest areas increases small mammals and predators. Decreasing grass cover will decrease *Microtus* and hare populations. Alden asked about the size of uncut islands needed. Paragi said that research in the Pacific Northwest showed a tipping point when about 40% of the area was retained.
- Juday: Woodpeckers are keystone species for other insectivores. Mixed habitat across the landscape is valuable. Wurtz: Studies show that promoting woodpeckers increases tree health.

▶ Paragi and Hagelin will add citations to the bibliography on the obligate role of small mammals in fungal dispersal and the connections of fungi to tree growth.

✳ Research is needed on retention area design in relation to herbivory in Regions II and III. Paragi reported that ADF&G is working on a broad review to help identify edge vs. interior habitat.

Section 7 - Insects and disease – Burnside and Lisuzzo

- Burnside intro: Insect species are numerous and diverse, and respond quickly to changes in hosts and the environment, including climate change. In Alaska, fewer tree species in boreal Alaska means there are fewer problem species of insects. Much of the research has been in Region II. The agencies have risk-rated areas for susceptibility to spruce bark beetles.
- Burnside: In the future, exotic or invasive insect species that may become established could pose a greater risk to boreal forests than exotic or invasive plant species. Firewood presents a significant problem for transport of invasive pests.
- Wurtz: Include citations documenting import of exotic species, especially local studies, regardless of whether they have been published.
- Juday: Asked about insect risks for newly planted trees and whether the risk is increasing. Temperature and stress are triggers for insect outbreaks. Wurtz said that is happening here now.
- Juday and Wurtz: Old growth features provide greater stability with regard to arthropod populations.

▶ Include citations by T.D. Showalter on stability of old growth canopy arthropod species.

▶ Add citations on wildlife mitigating irruptions of insects.

▶ Add citations on pathology (coordinate with Lori Winton).

▶ Add citation for study on spruce budworm and seedlings (Burnside and Mahal)

✳ Is there a research need regarding tree pathogens in Regions II and III?

Section 8 - Non-native and invasive species – Wurtz and Lisuzzo

- Wurtz: Few invasive animals other than insects have established in Alaska's forests. Of those, the ones that seem most likely to affect reforestation at some point in the future would be slugs and earthworms. They can change forest floor conditions from mor to mull.
- Juday: Some of the lodgepole pine planting in Sweden was intended to establish commercial tree species on wetland sites. Subsequent problems with pine growth were in part a result of planting on poor sites. The pines became root-bound and susceptible to disease. Results were better in Iceland.
- Alden: Lodgepole pine has already naturalized in Alaska, which is the first step toward invasiveness. It is the most widely planted introduced conifer in Regions II-III. Lodgepole is a shade-intolerant species. If there is a white spruce seed source nearby, it will invade the lodgepole in 40-60 years. Lodgepole could provide early growth and then white spruce could grow.
- Alden: Siberian larch is also shade-intolerant.
- Wurtz: Lodgepole is native to Whitehorse, YT.

▶ Add sentence regarding invasive earthworms and effects on forests. Add Bowser reference for earthworms.

▶ Add references from John Alden on Siberian larch in Alaska

Section 9 - Climate change and assisted migration – Robertson and Fresco

- Robertson: Boreal forests are dynamic systems that have seen large changes over time. More than 6,000-8,000 years before the present, the interior Alaska climate was hotter and drier, and the dominant species was balsam poplar. Post-glacial warming was rapid in this region.
- Robertson: Future changes will be influenced by a complex interaction of phenotypic plasticity and ecological thresholds. Reforestation with mixed stocks are important to maintain plasticity of population assemblages.
- Alden: Balsam poplar tolerates a wide range of temperatures.
- Yarie: There are many dimensions to climate change, not just temperature. The amount and timing of precipitation is important. For example, snow melt is important as a supply of early season moisture as trees start to grow. Changes in snow pack and snow melt could become an issue. If snowfall is sufficient, ecosystems will probably be able to retain the species assemblages, but growth could decrease. Juday: There is a strong connection of cold climate conifers to moisture from snow melt.
- Juday: Preceding year precipitation is a good predictor of deviation from temperature-predicted growth.
- Robertson: SNAP climate change models show more precipitation in much of Alaska, but greater increase in evapotranspiration, so that the net effect is likely drought.
- Climate in Region II and III
    - Juday: The Alaska Range is a barrier that influences climate differences between Regions II and III: extremes of warmth and annual precipitation, and wildfire are less prevalent south of the Alaska Range.

- Robertson: Region III expected to become more like Region II in future but with more moisture stress.
- Robertson: Scott Rupp's work shows an increase in fire in Region III followed by a decrease in the fire return interval due to changes in species cover.
- Paragi: Jandt noted that warmer shoulder seasons are predicted and modeling shows some areas with predicted mean annual temperatures above freezing.
- Robertson: Modeling predicts a shift toward a savannah cover type on the western Kenai.
- Alden: John Morton has a 100-year prediction for more mountain hemlock on the Kenai. The Chugach National Forest is also updating its management plan, including a risk analysis.

- As we proceed, it is important to clarify whether the goal is to preserve **the** existing forest, or a forest.
- ▶ Write paragraph on the climate projections for each region.
- ▶ Juday: Add citations on links between cold climate conifers and snow melt.
- ▶ Reorganize bullets to emphasize assisted migration and other points that are most easily implemented.
- ▶ Review climate change scenarios and identify the major pros and cons for the scenarios of concern. Is Region III likely to become more like current Region II?
- ✳ Research is needed on thresholds for species change in response to climate change.

Section 10 - Reforestation modeling -- Young (Freeman presented overview)

- Freeman: Most work done is focused on undisturbed sites. Can we use inventory work done to date, along with newer work such as Miho's, to begin development of model for disturbed/logged sites?
- ▶ Add additional citations if others know of them.

Section 11 - Regeneration assessment and technology - Freeman

- ▶ Summarize what has been harvested and replanted, and how much has regenerated. How "well" is the system working. Freeman said some information is available from forest practices data, regeneration reports and surveys, and reforestation exemptions. Juday noted that Miho Morimoto is doing an assessment for Interior region. (see also Methods and Modeling sections)
- ✳ Improve data collection on reforestation results.

PROCESS OVERVIEW

Freeman summarized the overall process for reviewing the FRPA reforestation standards, including the roles of the Board of Forestry, this Science & Technical Committee, and a future Implementation Group *(see PowerPoint on process, issues, and standards at: http://forestry.alaska.gov/pdfs/Process_Standards_History_2015_02_04.pdf).* Results from the S&TC will include consensus points on findings, recommendations for changes to FRPA standards or implementation, and research needs.

The Board is interested in advice on whether the recommendations of the S&TC would also be applicable to the Kodiak-Afognak area. That area has vegetation similar to other parts of Region I, but its reforestation challenges are similar to other areas of Region II. Challenges include competition from *Calamagrostis* and salmonberry, and herbivory of tree seedlings by hares.

REVIEW OF ISSUES AND EXISTING STANDARDS

Freeman reviewed the existing FRPA reforestation standards. *(see PowerPoint link above)*

Discussion points/questions:

- How is the 7-year timeframe for reforestation managed? DOF keeps a list of operations and owners.
- Is reforestation realistic given climate change?
- Are reforestation targets for biomass and sawlogs fundamentally different? *(added to issues list)*
- The definition of "commercial species" is flexible and depends on what species are marketable. Putman: How does this interact with potential rural biomass harvests?
- Paragi: Are retention areas within harvest areas included in regeneration surveys? Putman: Islands would be excluded. Rinke: Unharvested acreage is not counted in regen surveys. Winters: Where there are partial cuts residuals come into play in regen assessments. We should clarify what's included and excluded. *(added to issues list)*
- Juday: There's often a difference between the area included in a harvest plan and the area actually harvested – harvesting is often less than the initial proposal. Often only black spruce is left after harvest – do they count?
- Are material sites closed after use? Freeman: It depends on the long-term road use plans.
- There are separate regulations for slash management.
- Paragi: The standards in AS 41.17.060 include reforestation "to result in a sustained yield of merchantable timber." FRPA is designed to avoid degradation of the forest and protect public interests. The sustained yield may decline with climate change. We may need to define a "fully-stocked stand."
- There is opportunity to apply variations to reforestation standards where they don't fit the site conditions.
- Even distribution of trees may not always be desirable. Natural forests have clumpiness and relatively open areas which may have benefits for wildlife. Winters: We need professional discretion to address the distribution of regeneration in light of the stockability of subsites. *(add distribution of regen to the issues list)*
- Does there need to be an interaction of short- and long-term management goals by landowner when considering regeneration standards? Yarie: Since the shortest rotation lengths in R3 are about 75 years, it's hard to predict what will actually be on the ground in 7, 50, or 75 years after harvest. Does this affect how we approach regeneration standards?

NEXT MEETING DATES AND AGENDA. Freeman will send out a Doodle poll to select the dates for two spring meetings – the meetings will focus on development of recommendations.

TO DO LIST

- **Freeman and Durst:**
  - Minutes
  - letter to mail list
  - date and agenda for next meeting
  - Post PowerPoint on process and standards to the website (done)
  - Freeman: Summarize reforestation statistics from FRPA data and annual reports

- **All:**
  - Section summaries and additional citations due by **February 25**, including specific references on the tree species-fire section.

Other attendees

John Alden, USFS retired
Andrew Allaby, UAF
Julie Hagelin, ADF&G
Rick Jandreau, DOF
Randi Jandt, UAF-Alaska Fire Science
John Morton, USFWS-KNWR
Hans Rinke, DOF