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Year-end Report on RAC project entitled "Propagating Aspen Clones: Survival in the 21st Century"

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Year-end Report on RAC project entitled “Propagating Aspen Clones: Survival in the 21st Century”

This year’s report has several segments:

- Report on the planting done in July 2013
- Report on the planting done in July 2014
- Progress with Stacked Propagation
- Plans for 2015 and 2016

Report on the planting done in July 2013

Initial damage caused by wild ungulates was minimal. In August 2013, a large elk pulled off five cones and destroyed three saplings on the exposed, eastern side of the enclosure. Although deer tracks were plentiful in the bare earth of the fire line, there was no evidence that deer had harmed the saplings. The combination of a cone and a mesh sleeve on the exposed saplings sufficed.

The story with rodents is entirely different. Already in August 2013, I noticed the strange disappearance of some saplings. The cone was present and upright, but no plant remained inside. The culprits were probably pocket gophers (*Thomomys* spp.), but mottled ground squirrels (*Spermophilus variegatus*, aka rock squirrel) cannot be ruled out. I have never seen a rodent above ground at the planting site, where I could identify it conclusively (as I can in my own backyard, where mottled ground squirrels prey on my tomatoes).

By early June 2014, the mortality rate for the entire site had become approximately 20%. I looked into methods to eliminate (or greatly reduce) the number of gophers. Correspondence with colleagues at Utah State University and in the Forest Service, a conversation with Phil Patterson at the NAU greenhouse, and a search on the Internet suggested only two effective routes: trap or poison. In the lumpy meadow of bunch grasses, it was not feasible to find the main tunnels and set traps in them. The Forest Service ruled out poison.

So I resigned myself to accepting losses at the 2013 site, but I decided to plant with wire-mesh protection against gophers at the 2014 site. I’ll describe the latter in the next segment of text.

Given our dry winter and spring, the ground at the site had dried out by the end of May. FoNAF’s Aspen Team distributed 450 gallons of water twice: on June 5th and 27th. Monsoon rains arrived in mid-July.

On July 19th, I removed all the cones and took an inventory. Here's a tabulation of the results.

	Inside enclosure	West side of enclosure	East side of enclosure
Saplings planted	129	118	132
Dead or absent	27	39	54
Sick or dead whip	7	4	11
Healthy	95	75	67
Percent healthy	74%	64%	51%

These figures were disappointing.

Visit on August 22.

Recall that I removed all cones (and, outside, all mesh sleeves) on July 19th.

East side. Basically nothing left. Elk and/or deer have browsed most plants to sticks.

West side. Very little left.

The planting site lies in the Geyler Pasture of the Peaks Grazing Allotment, which has been closed to cattle for at least 20 years. So cattle are not the culprits.

Inside. Some “new” mortality—though it may have been of plants that I listed as “sick” in July. Some leaves have been eaten by insects: smooth arcs have been cut out. Perhaps 12-15 *tall* plants exist. One is shown in the photo; it has put out branches. Many small plants are scattered throughout the tall grass. Leaves are small everywhere—smaller, in my opinion, than the leaves of suckers at similar height. Probably that reflects the different root systems and hence the different sources of nutrients.



Quite discouraging.

Visit on September 22. Still the same, for all practical purposes.

East. I saw at least six saplings still alive and with some green leaves. Gopher mounds proliferate within 12' of the fence and also at SW end of the east side.

West. Little sign of gopher mounds except at NW end of west side. Photo here shows a sapling on the west side with leaves remaining at both top and bottom. Perhaps the best of all saplings on the west side.

Need to look again after the winter's snow has knocked down the tall grasses.

Inside. View from the outside: still some tall saplings with green or yellow leaves, especially at the N end.



Although I visited the two sites at various times later in the fall and early winter, there's nothing new to report.

Overall assessment

In 2012, FoNAF collected roots from aspen stands whose growth in the forest—in particular, the presence of healthy young growth—suggested that the aspen were resistant to browsing. The saplings planted in 2013 (which came from those roots) have failed to exhibit the hoped-for resistance.

Report on the planting done in July 2014

After rejecting a site southwest of the 2013 site (because the ground was too stony), I settled on an attractive site southeast of our first planting site. The soil is deep and free of stones. Most of the site is grassy and is largely free of the fallen trees that remind us all of the Hochderffer fire of 1996.



In April, a group from FoNAF's Aspen Team bucked up five massive downed trees and carried the pieces to the perimeter of the site. In May, the Aspen Team constructed the enclosure.

In mid-July, the Aspen Team constructed our defense against gophers. We bought five rolls of poultry netting: 1" hexagonal mesh with a height of 24" and a length of 150'. We cut the netting into segments 24" long (or a tad more) and then folded the square piece once—so that 9" of netting partially overlapped 15" of netting. The idea was to roll the ensuing piece into a cylinder (15" tall) that would fit into a hole 6" in diameter. [See adjacent photo.] The region of overlap gave us a region where the mesh size was as small as 0.5" and would stop even infant gophers.



The photo shows a container 14" high inside the mesh cylinder. The aspen saplings come in such containers but with only 12" of potting soil. Thus the mesh should rise approximately 3" above the adjacent ground and provide an above-ground barrier as well.

The unit cost of material for a cylinder is insignificant: about 50 cents. You can imagine, however, the many hours of cutting and folding that were required for cutting up 750' of chicken wire, needed for planting some 330 saplings (with a modest excess to cover contingencies). (The actual figure was 19 person-hours, which works out to 3 minutes per cylinder.)

FoNAF contracted with American Conservation Experience (ACE) for help in planting the saplings. A crew of six worked on our project. ACE had experience with using a two-person auger, and so FoNAF paid for rental of a power-driven auger. Here you see Matt Schultz and Kyle Heron at work:



The auger drills a hole of nominal diameter 6". That would be perfect for the mesh cylinder—because the cone that we place over the sapling (for its first year) has a diameter of 6.5". An easy and snug fit would ensue.

Alas, in the dry soil of this year's feeble monsoon season, the auger wobbles around and hollows out a hole of substantially larger diameter; the wire mesh expands to fill the available space; and the cone fails to sit neatly on the mesh cylinder.

The burrito method

Wells Vaiana, second in command of the ACE crew, invented a solution. Here's a sequence of four photos that shows Wells working his magic. He starts with the sapling and its root system (in potting soil) after they have been removed from the container. Deftly, he rolls up the burrito:



The fourth photo shows a perfect cylinder in place.

FoNAF will use the burrito method again in 2015, but we will use only 3" or so of overlapped chicken wire. Put differently, we will cut the chicken wire into rectangles 18" by 24" and then fold over 3" of the 18" part. The only significant reason for folding over is to provide a smooth edge so that hands or gloves are not torn while the sapling is being planted.

Given the dry soil, we watered on both the second and third planting day. Tom Mackin and Bob Dyer delivered 500 gallons of water on each of those days. At the NAU greenhouse, Phil Patterson had given the saplings a thorough watering early on the first day, when all saplings made the trip to the site. The saplings showed no harm from having been watered only on the day following planting.

Here's a photo of the site, taken from the west, while the ACE crew is watering the east-side saplings for a second time. Bob and Tom stand beside the water buffalo, ready to refill buckets.



Every sapling got at least two gallons of water, and most were fortunate enough to get an additional gallon.

Tally of saplings planted:

Inside the enclosure	88	
East side	84	
West side	158	Total: 330

During the period August 2nd through December 12th, I made six visits to the planting site. Only once did I find any damage by elk or deer. On August 22nd, I found that 11 cones had been knocked over or were missing the mesh sleeve. Three saplings had been pulled from the ground and were dead. Of the other eight saplings, the leaves had been browsed off and/or the top nipped off on seven of them. There was no obvious evidence of damage from burrowing rodents.

So, as of December, the planting made in July 2014 is ready for the winter.

Progress with Stacked Propagation

In last year's report, I described and illustrated Stacked Propagation: a method to clone aspen plants by letting the roots of a mother plant grow into an array of cylinders filled with potting soil. After the roots have grown to a threshold diameter (roughly 1/8 of an inch), the roots are severed from the mother plant and are encouraged to send out leaves.

At the NAU greenhouse, Phil Patterson and I made the first such cutting of roots in September. Here's a photo of the array, taken on December 23rd.



To me, the number of plants is astonishing. Phil had spread out the roots of the mother plant, and that step was highly effective.

Altogether, the greenhouse has 24 mothers, which came from the following sources:

- Priest Draw (3 mothers),
- Priest Draw West (3),
- Weatherford Plateau: three areas (6, 3, 2),
- Brollier Park (2), and

Alto Spring: two areas (2, 3).

By December, the roots had been severed from all of the mothers, and the cylinders are getting warmth and fertilizer to encourage the roots to send up leaves.

The young plants will have grown into substantial saplings by July 2016 and will be ready for planting at that time.

Phil and I initiated the Stacked Propagation project in anticipation (1) that the saplings would show substantial browse resistance and (2) that the Forest Service would want to begin planting in the Hart Prairie aspen restoration area in a wide-spread fashion right away. If the experience this year with the 2013 planting persists through other controlled plantings, then the progeny from Stacked Propagation may find another use, to be described in the next section.

Plans for 2015 and 2016

Our experience with the planting done in 2013 required a re-evaluation of next steps. What follows here is the big picture.

Big Picture

1. Keep testing for browse resistance. Nothing is definitive or comprehensive yet.
2. In the past year, no promising new sites for root collection have appeared (despite some looking). Unless some compelling stand of aspen is found, cease collecting roots.
3. Instead, plant stock that is in the normal pipeline, that has been held back for any of various reasons, or that will emerge from Stacked Propagation.
4. Plan to plant in both 2015 and 2016. FoNAF's RAC grant goes through 1 August 2016.
5. Continue to plant on terrain that is free of cattle.
6. Remember the "worst case:" the saplings in FoNAF's control plots will grow and provide a gene bank for a future time when browsing pressure is less and is more like the situation 150 years ago.
7. With that point in mind, consider shifting the proportion of saplings planted inside the enclosure back to 1 in 3 (rather than the 1 in 4 that I used in 2014, when I focused on exposing saplings to browsers).
8. If need be, plant all saplings in 2016 inside enclosures and with the goal of re-introducing aspen where they once flourished along Highway 180 and where the saplings would soon restore attractive fall foliage.

Planting sites

The planting in July 2015 will be in FoNAF's standard style: an exclosure for the control saplings and then other saplings planted outside, adjacent to two sides of the exclosure. Shawn Martin, while still a silviculturalist on the Flagstaff Ranger District, suggested a site on FR9002T. The site lies just north of Fern Mountain in an aspen restoration area of the Hart Prairie project. Here's a photo of the site.

If, by spring 2016, the plantings done in 2013 and 2014 have both failed to exhibit browse resistance, then the plan may change to planting the remaining saplings (1) inside new exclosures where aspen once flourished and (2) where the saplings will enhance the public's view of the forest. Those goals lead to planting in two arcs along Highway 180 in the Hart Prairie project. Maps (provided by Shawn Martin) that depict those two arcs appear as attachments to this report (because I have only pdf files of the maps).

One arc lies along the once-beautiful "Aspen Curve." The other arc lies opposite Crowley Cinder Pit. The maps carry a notation about "FY15," but that's an error induced by miscommunication. Shawn thought that FoNAF intended to plant out there already in July 2015. Archaeologist Jeremy Haines has been asked to check the two areas for archaeological clearance.

If FoNAF planted saplings in an irregular spatial distribution but with an average separation of 10', then 700 saplings would cover 1.6 acres. Two or three exclosures running parallel to the ADOT ROW fence would generate attractive fall foliage already in 10-20 years.

An exclosure 100' by 300' would accommodate 300 saplings. So one could lay out two or three "long but narrow" exclosures where most--if not all--of the overstory aspen have died. The areas on the two maps merely indicate where such exclosures might go. The boundaries on the maps would NOT become enormous exclosures!



Categories of saplings

The table below lists all current categories of saplings and their tentative allocation to plantings in 2015 and 2016. The table serves also as a summary of tentative plans for 2015 and 2016. (The letters RSN stand for Root Serial Number.)

Source of saplings	Action in 2015
In the pipeline from roots collected in 2014. Current estimate: 437 plants in July 2015.	Plant only 300 or so because saplings from some RSNs are highly redundant (as test saplings). Save some of the latter for 2016.
Held back from planting in 2013 and now in large containers. (35 saplings)	Plant all 35, some inside and others outside the enclosure.
Held back from planting in 2014 for either of two reasons. (a) Highly redundant RSNs (8 saplings) (b) Nipped off by rodent (15)	Plant if sufficiently tall. Expect that all (23) will be ready to plant. The sum of the items here and above provides 360 or more saplings for 2015.
Converted to “mothers” for Stacked Propagation from roots collected as follows. (a) In 2012 (16 saplings) (b) In 2013 (8)	Retain as potential mothers for a potential second round of producing progeny.
Emerge from Stacked Propagation in fall and early winter of 2014. The number <i>could</i> be large: 24 mothers times 40 or more children each (on average).	Wait for 2016. Expect to have 700-1000 saplings available for planting in enclosures to regenerate aspen along Highway 180. Funding for planting so many saplings may need a creative solution.

About finances

Payments to the NAU Greenhouse through the end of July 2016 and payments to hire an ACE crew to help with the planting in July 2015 will leave *approximately* \$3,000 in the RAC grant for planting in 2016. If FoNAF were to continue with its typical planting mode—a small enclosure plus an ACE crew to plant 350 or so saplings—the \$3,000 would pretty much cover costs in 2016.

If, however, the plan shifts to constructing two or three large enclosures along Highway 180 and hiring an ACE crew to plant 700-1000 saplings, then an infusion of funds will be required. If the Forest Service provides the building material from the supply in the boneyard, then only extra funds for hiring the ACE crew for an extended period of time would be needed. That extra money would be *approximately* \$3,000 to \$6,000. Until we know how many progeny will emerge from Stacked Propagation, I cannot provide a better estimate.

The Treasured Landscapes collaboration with the National Forest Foundation may be a source of extra funds.

Volunteer hours

For the calendar year, FoNAF’s volunteers contributed 349 hours.

Submitted by

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