

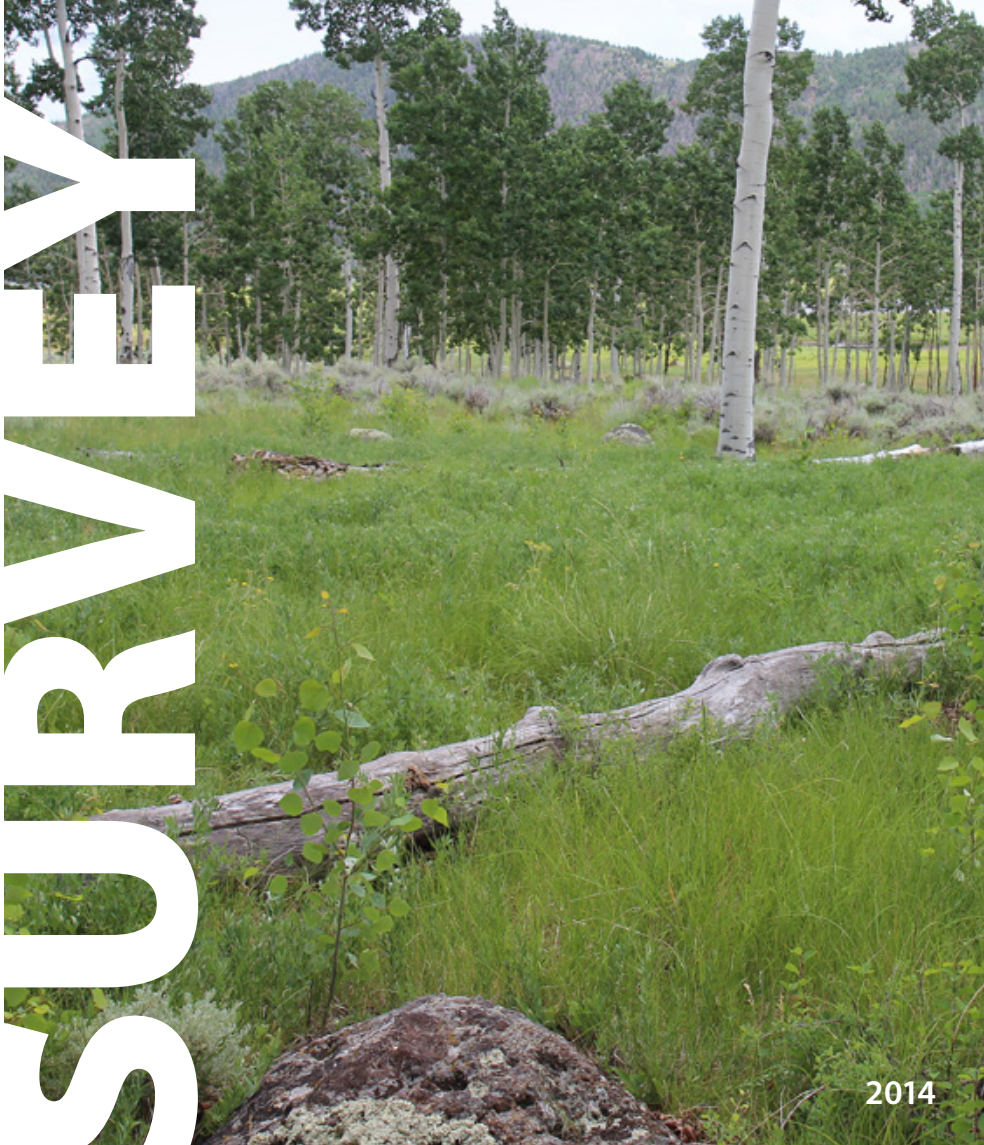
PANDO CLONE RECOVERY

REPEAT PHOTOS 2014 – 2019



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SURVEY



2014



2019



REUBEN JOLLEY

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ACKNOWLEDGMENTS

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The cover photos were taken at photopoint 4 facing East (P04 East).



2014



2019

INTRODUCTION TO PANDO CLONE RECOVERY





The world's largest known clone of aspen (*Populus tremuloides*), called the "Pando Clone" is located in the Fishlake National Forest in central Utah. For many decades, significant pressure from ungulate (deer and cattle) browsing has prevented growth of young aspen stems into trees that would replace the mature trees as they die of natural causes. There has been concern that this impressive 104-acre Pando Clone could be lost altogether due to the excessive browsing of young aspen stems. In 2013, 16 acres of this clone were fenced to exclude all ungulates (deer and cattle) so that recovery of aspen could occur in a portion of the clone.

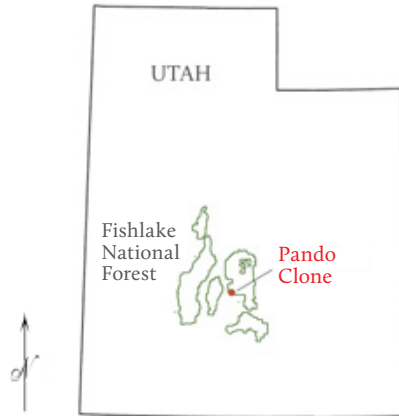
This report presents repeat photos that document the dramatic growth and recovery of aspen after the fence was built in 2013.

At left are repeat photos at photopoint 11 facing North (P11 North) that show the increase in growth of aspen in the understory from 2014 to 2019.

The photos in this report were taken by staff and volunteers of Grand Canyon Trust

PANDO ASPEN CLONE

-  Pando Clone (104 acres)
-  Exclosure (16 acres)
-  Repeat Photopoints
-  State Highway 25



To document the anticipated recovery of aspen within the fenced exclosure (see map in Fig. 1), Trust staff and volunteers established 30 randomly located photopoints where we would take photos over time, beginning in 2014. At each point, photos were taken in the north, east, south, and west directions. GPS coordinates were recorded which enabled us to return to that same point and take repeat photos every year from 2014 to 2019. We used past photos to help us capture the same area in each photo. We re-took the photos at all 30 points, in all four directions, on these dates:

- June 7, 2014
- July 8, 2015
- July 12, 2016
- July 18 – 19, 2017
- July 10 – 11, 2018
- July 12 – 13, 2019

Fig. 1. Location of photopoints within the Pando Clone exclosure. Map by David Vines, Grand Canyon Trust.

Example of Repeat Photos from 2014 to 2019

P12 SOUTH



2014



2015



2016



2017



2018



2019

The growth of young aspen is visible in these photos taken annually from 2014 to 2019 (at photopoint 12 facing south). The understory is open in the early years but becomes filled with young aspen over time. Reference points: (1) trail on the right which becomes somewhat obscured by vegetation over time; (2) dead trees on the ground, which fell between the 2014 and 2015 photos.

Repeat photos in 2014 and 2019

P10 NORTH



2014



2019

Young aspen growth is evident in 2019. The disturbance to the ground and vegetation in 2014 is probably due to fence construction in 2013. Reference points: (1) enclosure fence on the left; (2) large aspen tree at right edge of photo with cut log at base; (3) live conifer on the right in 2014, which is standing dead in the 2019; (4) crooked live aspen tree behind the conifer.

P11 EAST



2014



2019

The growth of many young aspen stems obscure the clone's mature stems in 2019. Common juniper is the abundant low-growing shrub in the foreground. Reference point: standing dead, curvy tree on the left. Few aspen have grown through the juniper.

P11 SOUTH



2014



2019

Young aspen growth is evident in 2019. Reference points: (1) boulder on the right (a fallen tree is beside the boulder in the 2019 photo, which was probably the standing dead tree in the 2014 photo); (2) logs in lower part of photo (one is obscured by aspen and sagebrush in 2019).

P14 EAST



2014



2019

Young aspen growth is evident in 2019. The meadow and wetlands around Fish Lake are visible in the background in 2014, but are mostly obscured by young aspen by 2019. Reference point: fallen log with protrusions from old branches.

P16 WEST



2014



2019

Dense young aspen growth is evident in 2019. Note the young aspen that has grown up through the fallen logs in the lower left. Reference points: (1) fallen logs that cross in the foreground; (2) large aspen in right middle, beyond common juniper, with fallen log behind it.

P17 NORTH



2014



2019

Dense aspen growth, particularly at the edges of the common juniper patch (center), fill in the 2014 view through the aspen clone. Reference points: (1) two boulders in lower part of the photos; (2) standing dead tree on the right with criss-crossing logs at the base; (3) small aspen on the left that forks, with round stump or rock at the base and larger white aspen behind it.

P19 NORTH



2014



2019

Young aspen growth obscures the clone's mature stems in 2019. Sagebrush in the foreground has also grown in the five years between photos. Reference points: (1) boulder with round depressions in the lower part of the photos; (2) logs in the lower right and center; (3) standing dead trees beyond a boulder in the center.

P22 NORTH



2014



2019

Young aspen growth obscures the clone's mature stems in 2019. Note (by zooming in) the increased abundance of wildflowers around the boulders in the lower part of photo in 2019, including penstemon (blue), lupine (blue), sticky purple geranium (white-pink), Colorado blue columbine (white) and manyflowered stoneseed (yellow). Reference points: (1) boulders in foreground with white patches of lichen; (2) pair of trees in the center; the one on the left died between 2014 and 2019; (3) hill in background.

P22 SOUTH



2014



2019

Increased abundance of young aspen obscure the clone's mature stems in 2019. Reference points: (1) boulders with consistent lichen patterns in the lower part of the photos; (2) tree on the right that has died between 2014 and 2019, with a fallen tree propped to the left. Many trees in the clone had already died before the exclosure fence was constructed in 2013.

P25 EAST



2014



2019

Dramatic growth of young aspen is evident in 2019. The aspen growth has obscured the meadow around Fish Lake in the distance. This spot was partially burned in 2013 in order to study whether juniper prevents aspen recovery. A mountain snowberry bush has grown on the left edge of the burn. Reference points: (1) burn patch and dead stems in lower right; (2) boulder above the burn patch, with log in front of it.

P25 SOUTH



2014



2019

Growth of young aspen is evident in 2019. This spot was partially burned in 2013 and most of the common juniper were killed here. Aspen have grown in the burn in the center of the 2019 photo. Reference points: (1) logs that lay oriented from lower right to upper left; (2) boulders at upper left edge of logs mentioned in the previous point; (3) sloping hill on horizon.

P27 WEST



2014



2019

Abundant aspen growth is evident in 2019. This area was burned in 2013 to reduce common juniper in a study of aspen recovery. Grasses have become abundant in 2019 and the white wildflower in the lower right is geranium. Reference points: (1) two logs in the lower part of photo, oriented towards the upper left with a log across those logs at the upper end; in subsequent years two logs from the upper right fell onto the older logs; (2) mature aspen tree in right part of photos (to the right of the boulder in 2014) with dark bark at the base; the tree to the right in 2014 has fallen onto the older logs in the 2019 photo; (3) the large boulder with whitish lichen in the center of the 2014 photo is mostly obscured by aspen in 2019.

P28 EAST



2014



2019

Increased density of young aspen is evident in 2019. The meadow and wetlands around Fish Lake are mostly obscured by young aspen in the 2019 photo. Some of the aspen on the ground were cut in 2013 as part of a study to see how tree cutting (versus burning of common juniper and burning of aspen) affected aspen recovery. Wildflowers are also more evident in the 2019 photo, including penstemon (blue), manyflowered stonecrop (yellow), groundsel, lupine and pussytoes. Reference points: (1) two boulders in lower left; (2) logs in center of photos.

P28 SOUTH



2014



2019

Abundant young aspen growth and an increase in sagebrush and wildflowers, including penstemon (blue flowers) and lupine, is evident in 2019. Reference points: (1) standing dead tree with conifer behind it (center); (2) aspen with orange paint on trunk (left), and the smaller curvy tree to the left of that one.

P29 SOUTH



2014



2019

Abundant young aspen are evident in 2019. Reference points: (1) the curved aspen tree on the left is visible in both photos; (2) the curved aspen tree on the right in the 2014 photos is mostly obscured by young aspen by 2019.

P31 WEST



2014



2019

Abundant young aspen obscure nearly all the mature trees in 2019. At this spot, common juniper was burned in 2013 to study various means of restoring aspen.



REUBEN JOLLEY



ANDREY ZHARKIKH



REUBEN JOLLEY

WILDFLOWERS

There is an impressive diversity and abundance of native grasses, shrubs, and wildflowers within the Pando Clone enclosure. Some of the wildflowers thriving with the exclusion of cattle and deer are presented on this page and native grasses and sedges are on the next page. These photos were taken in 2019.

ROW 1: lobeleaf groundsel, Fish Lake thistle, Colorado blue columbine

ROW 2: littleleaf pussytoes, Martin's ceanothus

ROW 3: Wyoming Indian paintbrush, bristly cryptantha, purple milkvetch



ANDREY ZHARKIKH



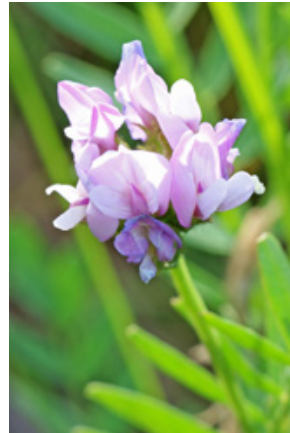
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GRASSES AND SEDGES

Inside the fenced enclosure the graminoids (grasses and sedges) are growing abundantly and tall as can be seen in the photos on this page. These photos were taken in 2019, four years after the fence was constructed. The fence has excluded cattle and deer, which commonly eat these graminoids.

ROW 1: Abundant grass (amid aspen), valley sedge

ROW 2: Nodding brome, Idaho fescue, Liddon sedge

ROW 3: Abundant grass (amid sagebrush, common juniper and aspen), tall bunchgrasses (the height of Marc's gloves)

COMMON NAME	SCIENTIFIC NAME
beardtongue	<i>Penstemon</i> sp. (likely <i>Penstemon procerus</i> and/or <i>Penstemon subglaber</i>)
bristly cryptantha	<i>Cryptantha setosissima</i>
chamisso arnica	<i>Arnica chamissonis</i>
Colorado blue columbine	<i>Aquilegia coerulea</i>
common juniper	<i>Juniperus communis</i>
conifer (fir, spruce, Douglas-fir or juniper)	<i>Abies lasiocarpa</i> , <i>Juniperus scopulorum</i> , <i>Picea pungens</i> and/or <i>Pseudotsuga menziesii</i>
Fish Lake thistle	<i>Cirsium clavatum</i>
Idaho fescue	<i>Festuca idahoensis</i>
Liddon sedge	<i>Carex petasata</i>
littleleaf pussytoes	<i>Antennaria microphylla</i>
lobeleaf groundsel	<i>Packera multilobata</i>
lupine	<i>Lupinus</i> sp. (likely <i>Lupinus argenteus</i> and/or <i>Lupinus sericeus</i>)
manyflowered stoneseed	<i>Lithospermum multiflorum</i>
Martin's ceanothus	<i>Ceanothus martinii</i>
mountain snowberry	<i>Symphoricarpos oreophilus</i>
Nodding brome	<i>Bromus anomalus</i>
purple milkvetch	<i>Astragalus agrestis</i>
quaking aspen	<i>Populus tremuloides</i>
sticky purple geranium	<i>Geranium viscosissimum</i>
Valley sedge	<i>Carex vallicola</i>
Wyoming Indian paintbrush	<i>Castilleja linariifolia</i>

PLANT SPECIES REFERRED TO IN THIS REPORT

A plant list with 110 species observed in the photo-point portion of Pando Clone is available upon request.



PHOTOS ON THIS PAGE BY REUBEN JOLLEY

OTHER RESEARCH AT PANDO

The photos in this report are consistent with research by Rogers and Gale (2017) that has documented the recovery of aspen in this enclosure at Pando Clone. That study found that three years after the fence was built there was significantly more aspen regeneration (stems less than 2m tall) in the enclosure compared to the unfenced area of the Pando Clone. Various treatments (burning, shrub removal, and aspen cutting) were done in the enclosure in 2013 to evaluate their impact on aspen regeneration but the treatments did not significantly increase regeneration compared to fencing alone. The exclusion of cattle and deer was enough to increase regeneration so that this aspen clone can recover, whereas outside the enclosure cattle and deer browsing of aspen resulted in little if any aspen regeneration. Rogers and Gale (2017) made the following somber conclusion about the Pando Clone:

“Inaction by managers is likely to lead to total collapse or, at minimum, significant reduction in extent and viability.”

More information about the Pando Clone and aspen management is available at the Western Aspen Alliance web site: <https://western-aspen-alliance.org/pando/index>

REFERENCES

Rogers, P. C., and J. A. Gale. 2017. Restoration of the iconic Pando aspen clone: emerging evidence of recovery. *Ecosphere* 8(1):e01661. 10.1002/ecs2.1661 <https://esajournals.onlinelibrary.wiley.com/doi/epdf/10.1002/ecs2.1661>