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Pando's Lessons: Restoration of a Giant Aspen Clone

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PANDO'S LESSONS: RESTORATION OF A GIANT ASPEN CLONE

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Overview

A 106 acre (43 ha) aspen clone lives in the Fishlake National Forest in south-central Utah. Clones are comprised of multiple aspen stems, called ramets, which are genetically identical. This particular colony of ramets was named "Pando" (Latin for "I spread") by researchers believing it to be the largest living organism by mass on earth. Recently, forest managers have noted a rapid dying of mature stems without recruitment of younger trees. This unsustainable situation has galvanized restoration efforts at Pando. Human interventions caused this imbalance; restoration will rely on protection, monitoring, and innovation. As a laboratory, this forest icon may provide insights for much broader human-nature interactions.

Background

In the 1970s, researchers Kemperman and Barnes (1976) examined relationships between leaf physiology, clone size, and regional biogeography of quaking aspen. These scientists discovered a very large aspen clone near Fish Lake in south-central Utah. Based on leaf shape, color, and timing of senescence he described a genetically identical stand of aspen 106 acres (43 ha) in size. Later, biologist Michael Grant (1993) estimated the weight of this giant clone, including above and below ground mass, to be 13 million pounds (5.8 million kg) and gave it the name Pando. DeWoody et al. (2008) conducted systematic genetic work using modern microsatellite techniques and confirmed the area covered by Pando almost exactly as earlier researchers had mapped it. Unlike precise measures of size, there is not an accurate method for aging the entire Pando clone; it is certainly hundreds, possibly thousands, of years old. Tree coring places mature individual stems at 110-130 years.

Fig. 1 *Mule deer outside fence at Pando*

Concurrent with scientific measures of Pando's size, managers noted dying canopy trees and an absence of new recruits. While mature aspen commonly die-off, the cause of missing recruitment was crystalized when small clear-fell coppice harvests in the late 1980s resulted in complete loss of forest cover. All regeneration, which was initially abundant, was consumed by herbivores; most likely mule deer or cattle based on current scat counts. After a 1992 harvest operation eight foot (2.4 m) fencing was erected and the flush of regrowth survived. Unfortunately, the area fenced after disturbance was only a small portion of the total Pando clone. In the early 2000s, forest scientists continued to find very few surviving young aspen. This type of "stable" aspen is unlikely to experience catastrophic disturbance (see Rogers et al. 2014), which makes Pando more dependent on continuous recruitment, underscoring the urgency in this dearth of young trees. Meanwhile, during the 25 years since the clearfell-fence operation, a dense stand of 20-30 foot (6-9 m) tall saplings remain, whereas the bulk of Pando has experienced accelerating mortality of large trees. Since 2014, two additional fenced exclosures have been erected.

Experimental Restoration at Pando

In 2017, researchers undertook a total assessment of Pando, now effectively divided into three levels of browse protection: a 2013 fence (17 ac/7 ha) with experimental burning, shrub removal, and tree cutting (Rogers & Gale 2017); a 2014 fence (37 ac/15 ha) encompassing the old 1992 fence, plus additional area; and the remaining unfenced portion of Pando (52 ac/21 ha; Rogers & McAvoy 2018).

The main result was that the 2013 fence was showing sustainable levels of aspen recruitment, while other zones were not (Fig. 2). The

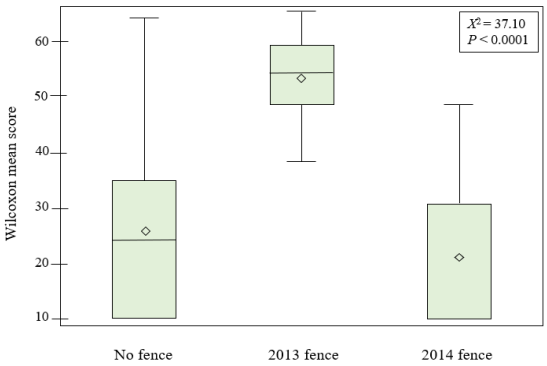

Fig. 2 *Aspen regeneration, three levels of protection.*

much larger 2014 fenced area was being breached by mule deer, as browsing signs were evident, visitors reported deer inside the fence, and new growth was minimal. Since that time, additional restoration of this fence has taken place and efforts to reduce cattle use in the unfenced portions of Pando are beginning.

To supplement ground measures, researchers also compiled a 72-yr. record of aerial photos at Pando (Fig. 3). Close examination of this chronology shows bare spots and thinning in Pando's once continuous cover.

Restoration activities to date show promising signs, however there is considerable work ahead. Less than half of Pando is unprotected from chronic browsers. Further, it is not clear that fencing is the ultimate answer to the difficulties of both domestic and wild ungulate herbivory. A solution that addresses the base causes of browser numbers and movement patterns, perhaps in combination with fencing, is expected to yield the most lasting positive results.

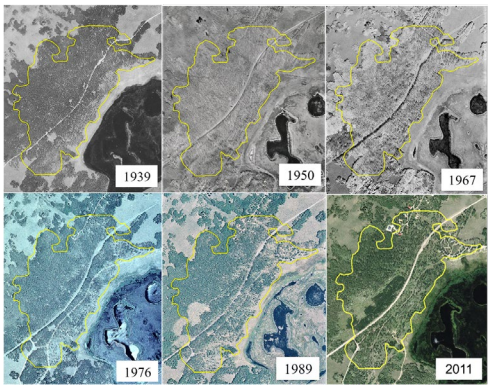

Fig. 3 *72-years of change at Pando.*

Management Recommendations

The lessons learned at Pando are instructive at larger scales, though there are obvious limitations to consider. Obstructing browsers from eating young aspen suckers using fencing is not economically feasible, even if it were desirable, at larger scales. Even where fencing is affordable, regular checking for breaches and making repairs is essential, though costly as well. Another consideration: interventions used here do not necessarily have natural analogs, however, the dire situation at Pando required immediate action in tandem with clear documentation of outcomes. A valuable lesson is, that where treatments are used to rejuvenate aspen subject to excess herbivory, it is essential have a protection and monitoring plan ready. At Pando, initial success was achieved with both active (treatment) and passive (fencing only) approaches. Before specific actions are taken a keen understanding of functional differences in aspen communities (Rogers et al. 2014) will provide a clear basis for management actions grounded in established science.

Solutions aimed at causal agents of aspen failure at Pando and elsewhere will involve state and federal cooperation in wildlife, forest, and range management, but likely a better understanding of social science and natural resource economics, as well. A clear research need is to more fully understand sustainable levels of herbivory for domestic and wild ungulates. An adaptive strategy—action, monitoring (Fig. 4), adjustment—is likely to yield desirable and demonstrable endpoints for restoration at Pando and aspen at-large.


Fig. 4 *Students monitoring at Pando.*

Key Findings:

1. At the Pando clone, we found that chronic herbivory was the overarching causal factor threating this iconic aspen community.
2. Experimental disturbance stimulated regeneration, but fencing without disturbance provided sustainable suckering.
3. Protection from browsing ungulates is critical, but follow-up monitoring was needed to demonstrate 2014 fence failure.
4. While fencing to keep herbivores out provided a short-term recruitment window at Pando, similar situations at broader scales will require interdisciplinary solutions besides fencing to combat causes of non-sustainable browse levels.

Sources

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