

Supporting Research for Desired Future Condition Draft for BRCA Vegetation Management Plan, by Juli Ames-Curtis

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Historically, the vegetation within what is now Bryce Canyon National Park was open forest, with scattered trees and grassy meadows (Roberts, 1993 and Buchanan, 1982). It is now known that frequent fires (every 4-7 years) helped sustain this type of landscape (Buchanan and Tolman, 1983). Since 1900, the mean fire return interval for mixed conifer lengthened from 7.5 to 45 years (Jenkins, Dicus, and Godfrey)

Many visitors to the area in the 1800's spoke of a different landscape than we have today. Extensive exploitation of the resources occurred with the arrival of the first white settlers. Many factors such as fires suppression, overgrazing, and logging changed the landscape dramatically. Prior to this time it is quoted that "the entire forest was once much more open and park-like" (Cooper, 1960). In the 1870's: scientists of the Wheeler, Thompson, Bailey parties, and the Powell Expedition, intensively studied the "luxuriant vegetation" and Wasatch Formation at Table Cliffs.

In 1957, Hayle Buchanan initiated an inventory of the forest cover and re-inventoried in 1978-80 (Buchanan and Tolman, 1983). Sample plots were established to provide a qualitative and quantitative study of the plant communities (Buchanan and Tolman, 1983). During the 21-year period between surveys, striking changes occurred that were assumed to have followed trends that began when the first white settlers arrived. During the interval from 1957-1980, all forest types extended their boundaries into adjacent un-forested areas. Most impressive was the increase in density and volume of tree growth. Over-all density of trees increased by 84%, saplings increased by 322% and seedlings decreased by 79% (Buchanan and Harper, 1981). Tree volume also increased by 84% in the 21 year span. At the same time, shrub cover declined 38%, grasses and grass-like herbs declined 25% and forbs declined by 14%.

PONDEROSA PINE (PIPO)

The Ponderosa pine forests of the southwest evolved under the influence of natural fires (Cooper 1960). Historically, low intensity fires must have been common and severe fires rare, because of the low fuel accumulations. Fires thinned stands and helped maintain an open park-like forest, with an understory of grasses, forbs, and shrubs (Kulesza et.al. 2000, Cooper 1960). Periodic fires created uneven-aged stands comprised of various even-aged groups (Kulesza et.al. 2000). Stands of old, large trees had low numbers of trees per acre.

Ponderosa pine requires bare mineral soil for seed germination. Fire exposes mineral soil and reduces competing vegetation (Kulesza et.al. 2000). PIPO saplings in the past were kept in check by natural low intensity fires spreading randomly through the litter on the forest floor (Kulesza et.al. 2000, Cooper 1961, Covington et al. 1985). The trees remaining after fire and other causes of mortality have taken effect maintained an essentially random spacing pattern (Kulesza et.al. 2000, Cooper 1961).

Man's attempted exclusion of fire and the introduction of livestock had induced marked changes in the vegetation of the southwest (Cooper 1960). Roberts, et. al. (1993), using historic photographs taken by Dr. Hayle Buchanan in 1959 and W.B. Alcorn in 1958 and photos taken at the relocated sites in 1989 was able to study any changes in the forest. In the report, plates 6-9 show an increase in PIPO forest density (some very dramatic in their differences) from the historic photos and the ones taken in 1989. Data from fire history studies by Buchanan and Tolman (1983) shows 93 fires from 1565 to 1900 (average intervals of 3.60 years or 27.78 per

100years) in the ponderosa pine type forest and only 5 since 1900. Without fire to randomly kill the too many ponderosa pine seedlings, the forests at Bryce Canyon NP have become dense.

Based on sawtimber estimates DIF, Cedar City District (Butler, 1909) the average mean taken from 8 units of varying acreage shows 10.75 trees per acres for PIPO forest. Contrasting that with data gathered by Henry Bastian from 1995-2000 for live overstory (15cm DBH or >) in fire monitoring plots (50m X 100m) trees per acre almost doubled during the century. The average trees per acre in the control plots were _____.

Cooper (1960) found in his analysis of early growth of (PIPO) trees comprising the present mature stand in one study site that their growth in the sapling stage was greater than that of most trees of comparable age in present young stands. The implication is that the older trees began their life in relatively open sapling stands.

MIXED CONIFER (ABCO/PSME)

The mixed conifer forests at higher elevations have probably been modified even more than the ponderosa pine forests (Buchanan and Tolman, 1983). In pre-grazing times frequent fire prevented the dense stands we see today (Buchanan and Tolman, 1983). Ponderosa pine was probably the dominant species, occurring in groves with grass-covered openings. The frequent fires not only prevented regeneration of ponderosa pin, white fir and Douglas fir, but also killed saplings. Aspen groves were islands of low flammability in the highly flammable open forests. At times entire aspen groves may have burned on the surface, yet could have easily regenerated from buried root systems that were not damaged by the fire (Buchanan and Tolman, 1983).

The mixed-conifer forests were typified by openness and great diversity (Buchanan and Tolman 1983, Cooper 1960). Now more than a century later, there is a proliferation of white fir seedlings, saplings and trees, covering what were once grassy openings in the forest. This is also true in the understory in groves of old pine and other tree species (Buchanan and Tolman, 1983). The great numbers of white fir trees throughout these forests form a fuel ladder that will easily carry fires into the forest canopy to become crown fires. The aspen groves are decreasing in size, number and vigor as the fire-controlled succession had favored white fir and other conifers. The aspen trees are so far depleted that their root systems may not provide for clonal regeneration.

Data from fire history studies by Buchanan and Tolman (1983) shows 87 fires from 1616 to 1900 (average interval of 3.26 years or 30.67 per 100years) in the mixed conifer type forest and only 6 since 1900. The decrease in fire frequency since 1900 reported by Buchanan and Tolman (1983) and further documented in Jenkins et. al. (1995) study support the notion of an altered stand composition in favor of white fir and Douglas fir. This data supports the conclusions of Roberts et.al. (1992) that reduction in surface fires has altered community type structure reducing the area occupied by quaking aspen and ponderosa pine (Jenkins et.al. 1995). Roberts study documented an increase in trees/ha and density and an overall change in ecosystem diversity.

Based on sawtimber estimates DIF, Cedar City District (Butler 1909, found in Ogle 1997) the average mean taken from 17 units of varying acreage shows 23.126 trees per acres for mixed conifer forest. Contrasting that with data gathered by Henry Bastian from 1995-2000 for live overstory (15cm DBH or >) in fire monitoring plots (50m X 100m) trees per acre increased dramitically during the century. The average trees per acre in the control plots were 124.56.

Roberts, et. al. (1993), using historic photographs taken by Dr. Hayle Buchanan in 1959 and W.B. Alcorn in 1958 and photos taken at the relocated sites in 1989 and using current field notes were able to study any changes in the mixed conifer forest. In the report, plates 10-17 show an increase in mixed conifer forest density from the historic photos and the ones taken in 1989. Of significance were the notations of the absence of apsen (*populus tremuloides*) in 1989 and also the evidence of the loss of meadows.

Table 1. (Extrapolated from Jenkins, et.al. 1995)

Area in BRCA	PIPO trees/acre (est.)	ABCO trees/acre (est.)	PSME trees/acre (est.)	Mixed conifer Average trees/acre
Yovimpa Pass	120	473	157	750
Bridge Hollow	138	445	132	315
Whiteman Bench	128	146	140	684
Total	386/3=129	1065/3=355	429/3=143	1749/3=583

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