

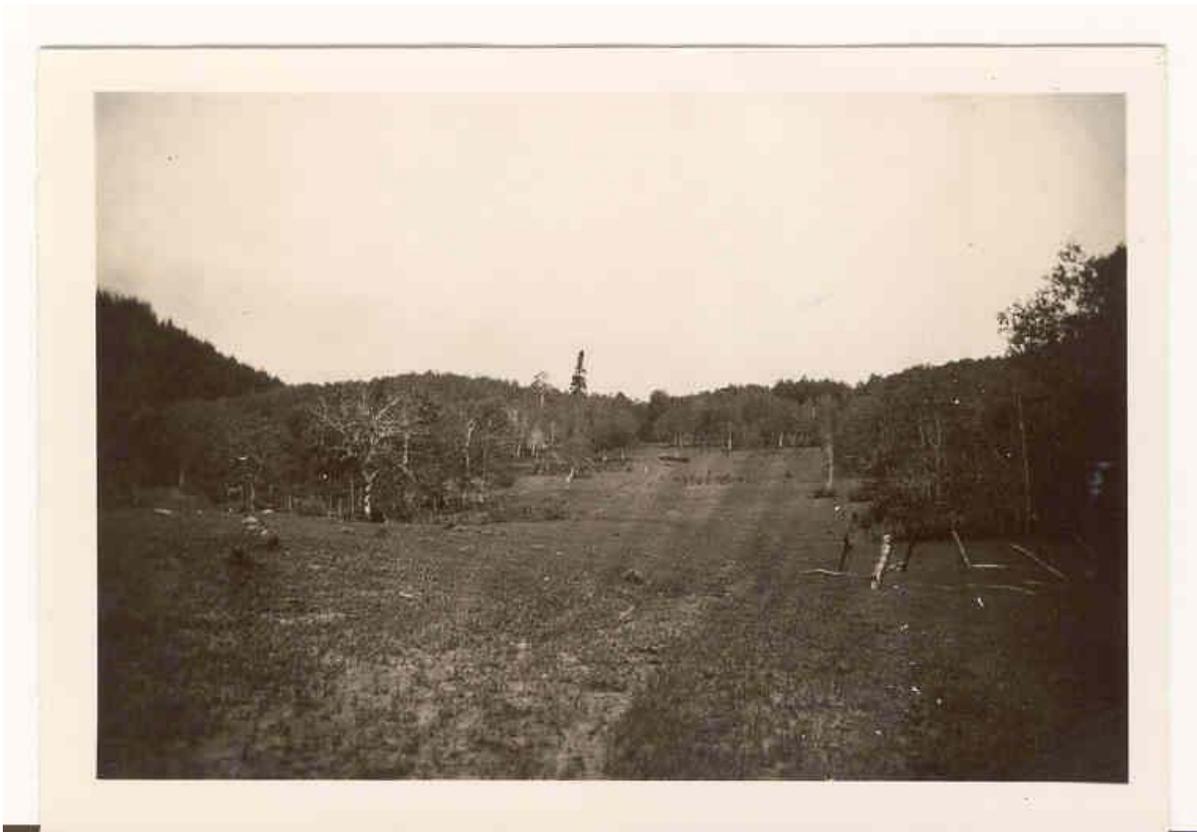
Redden Mine Lower

The Redden Mine Lower snow course is located on the west end of the Uintah Mountains several miles above the town of Marion, Utah, at an elevation of 8500 feet msl. The course has a bit of a westerly aspect and sits in a small saddle which has a little more solar exposure than many snow courses in the state. The primary vegetation type at this course is aspen cover with some conifers.

Potential weather modification:77, 89-93, 95, 01-



This 1936 photo shows the lower end of the course which is no longer measured.



Another view of the lower end of the course.



This 1936 photo shows the middle of the course looking east, up the slope. Pay particular attention to the conifer in the center of the photo. The open area at the bottom of this

photo is where several of the course sample points are located. Notice how large the open area is at this time and that some trees appear to have been recently cut down along the perimeter and up to the conifer.



This circa 2002 photo was taken looking the same direction as the previous 1936 photo. Notice the dramatic change in vegetation over the past 80 years. The truck is parked at the upper end of the previous photo opening and the conifer is just up the hill from that about 30 yards.



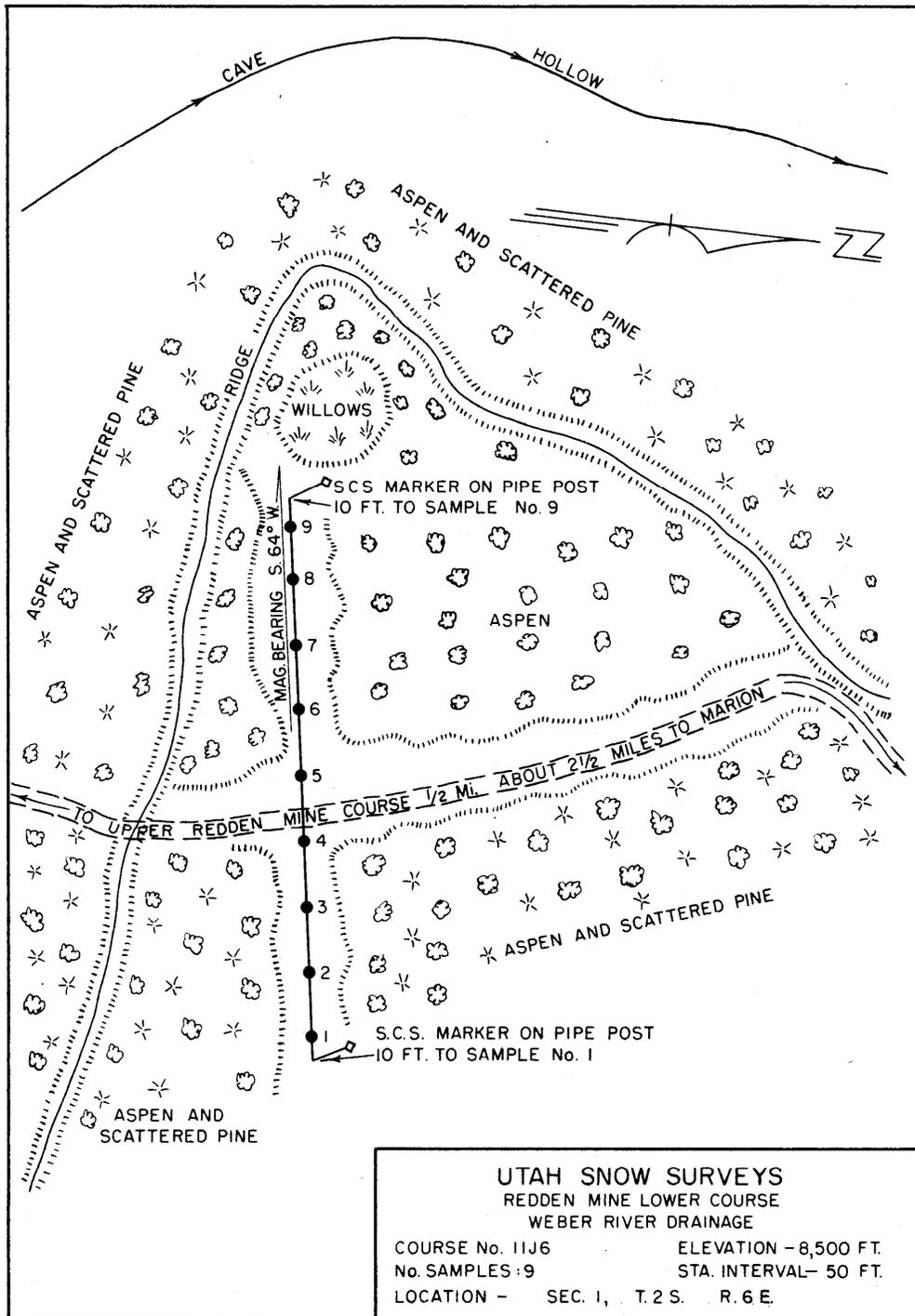
This photo of sample point number 1 is taken from the upper $\frac{1}{4}$ of the previous opening and the yellow end marker sign is just in front of the conifer.



A May 1 snow survey at Redden Mine. Note the impact that aspens can have on the course. There have also been some snowmobile and snowcat tracks down the south (left) side of the course.



Another view from the same survey in 2007, looking north perpendicular to the course. Notice the more open area in the background covered in snow (this is the helicopter landing zone) that is still snow covered despite a more direct solar angle to the south as compared to the denser aspen stand in the bottom of the photo which is nearly melted out. A reasonable question would be: is the course melting earlier and if so, is it due to increased aspen vegetation and long wave radiation or because it is getting less snow due to changes in vegetation or is it due to climate change with respect to temperature?



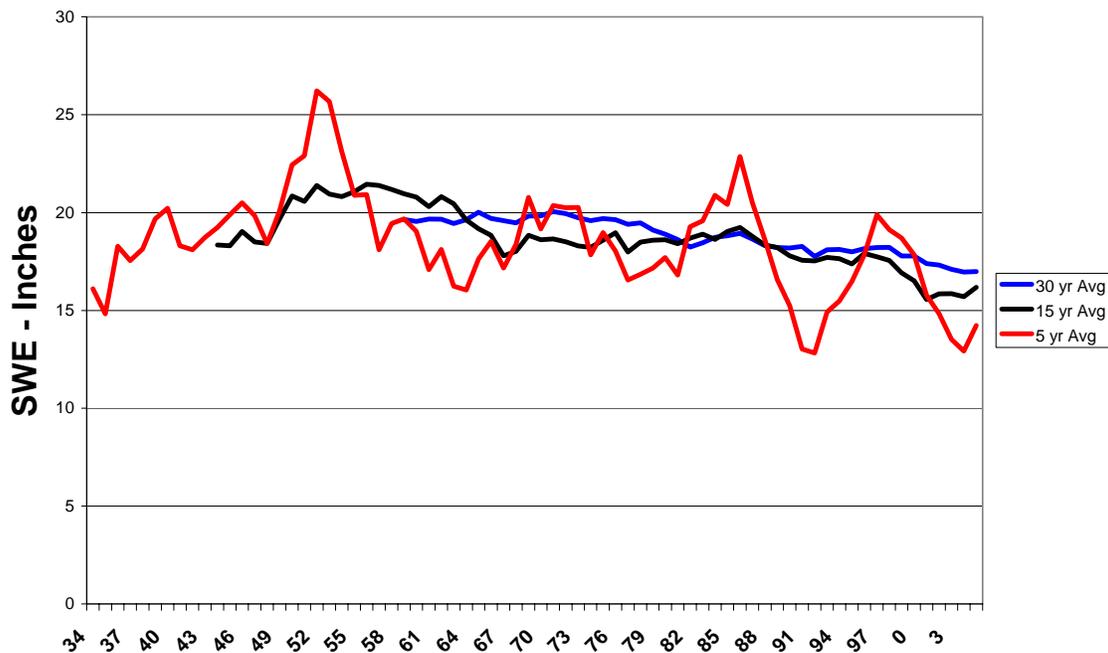
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Course shortened to 9 points.

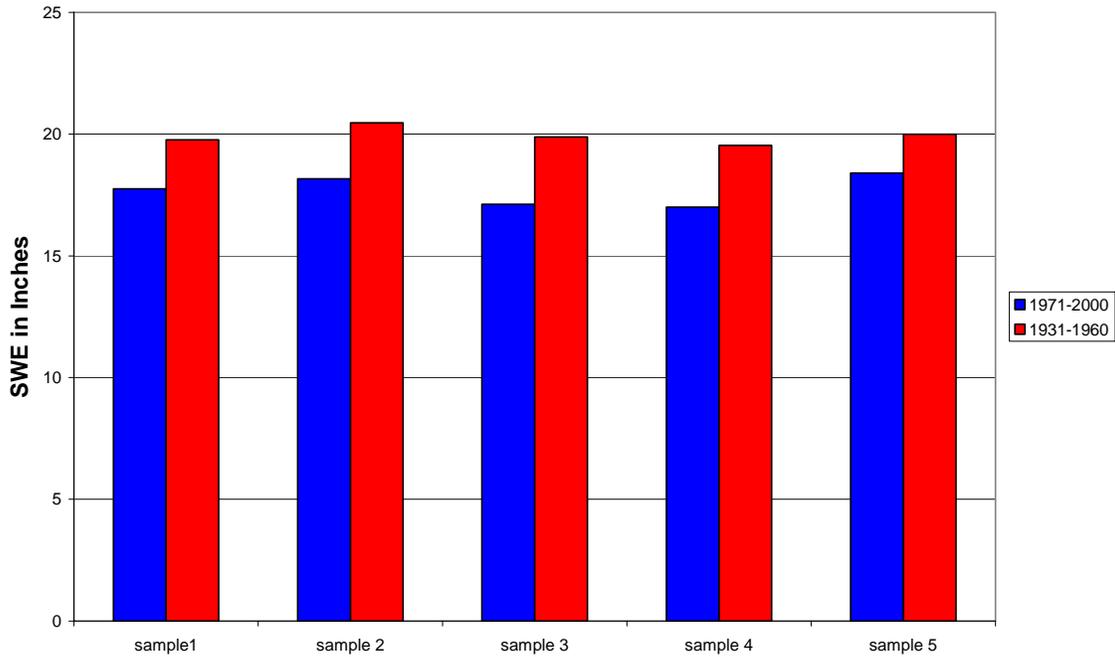
When a snow course was shortened, the original points continued to be measured although renumbered, thus points 1,2,3,4 and 5 may have originally been points 13,14,15,16 and 17. This map also shows the relative position of vegetation and other features with respect to the course. Distances are not measured and asterisks do not represent individual trees rather a general depiction of vegetation. The density of vegetation is also relative and not absolute.

Redden Mine



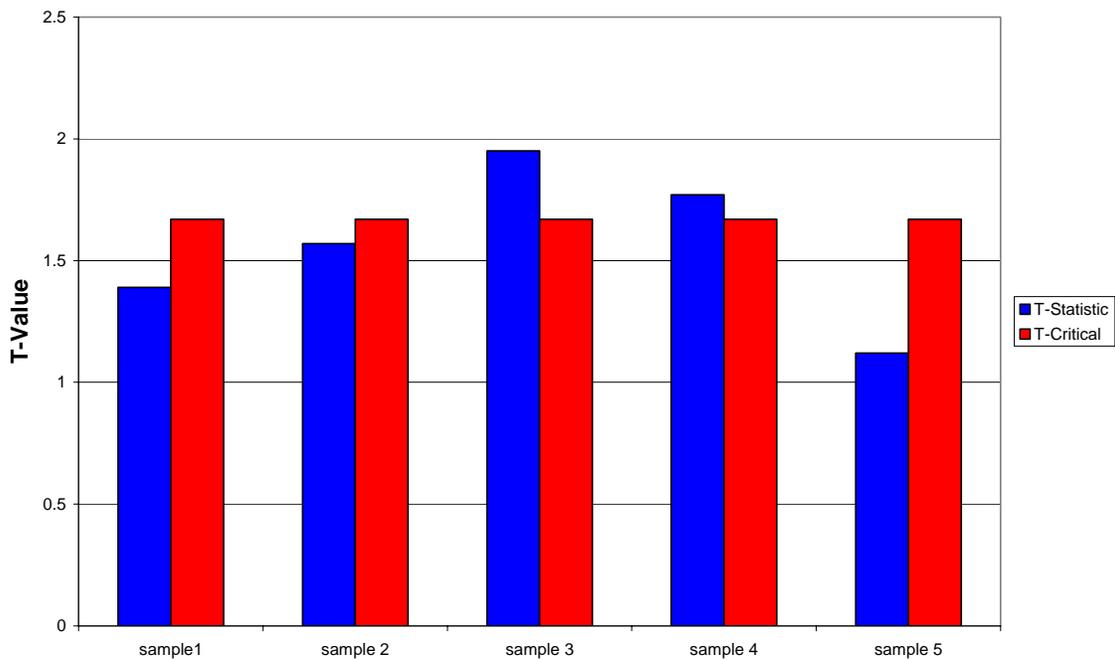
In this chart of the 5, 15 and 30 year running average April 1 SWE, notice the decline in the 30 year average starting in the early 1970's and continuing on from about 20 inches of swe to about 17 inches - about a 15% decline. This decline has been steady across the period of time. This course provided the opportunity for a more detailed look at vegetation impact on snow accumulation in the fact that each individual sample point could be tested for statistical significance and compared with its location relative to the open area in the 1936 photo.

Redden Mine Sample Point Analysis



This chart shows that each point is getting less snow comparing 1931-1960 to 1971-2000.

Redden Mine Sample Point Analysis



This chart shows whether that difference in long term accumulation is statistically significant given the variability of each point. Sample points 3 and 4 are statistically getting less snow and Sample point 3 was approximately in the center of the open area.

Sample point 4 is not seen in the photo and the overall condition of that point is not precisely known. Sample point 2 is on the upper end of the meadow and sample point 1 was in the trees. Inferentially, going from an open meadow to a more closed aspen cover seems to have had significant impact on the accumulation of snowpack at this course. The later photos, comparing the pack under the aspens to the more open area shows that earlier melt could also be the result of changes in vegetation as well.

Data from this site without adjustment for known site changes and other impacts should not be used for long term comparison.

R Julander

2007