

Garden City Summit

The Garden City Summit snow course is located near the watershed divide of the Logan River and Bear Lake at an elevation of 7600 feet msl. The course is in a small drainage physically cut off by highway 89 about 200 yards to the north. This course has been dramatically altered by vegetation change. At one time it was along a narrow road directly in the bottom of a small drainage with primarily aspens as the dominant vegetation. It is now primarily dense conifer cover with the trees close enough that the melt rings from long wave radiation off the trees as well as the interception factor are influencing sample points.

Potential weather modification: 89-



This photo from 1936 is looking south southwest up the drainage. To the bottom right is the fill base or beginning of highway 89 from Logan to Bear Lake. The course begins about halfway from the individual in the photo to the aspens in the upper left. Notice the prevalence of aspens in the photo with some individual conifers on the upper right and one tongue of conifers in the upper left.



This photo take from the top of the course looking north northeast also shows the aspens in the bottom of the canyon on both sides and the single tongue of conifer coming from the east (right).



In this aerial photo from the March 2007 survey you can see that the once predominant aspen cover has been completely replaced by dense conifer cover. The course runs up the center of the drainage and one can see the snowshoe tracks along the bottom left of the photo. Accumulation and ablation characteristics have been altered by this change in vegetation.



Sample number 1 looking north at the beginning of the course.



Looking northwest west through the least dense part of the conifers.



Looking south southwest along the course, notice the close proximity of the conifers to the sample markers.



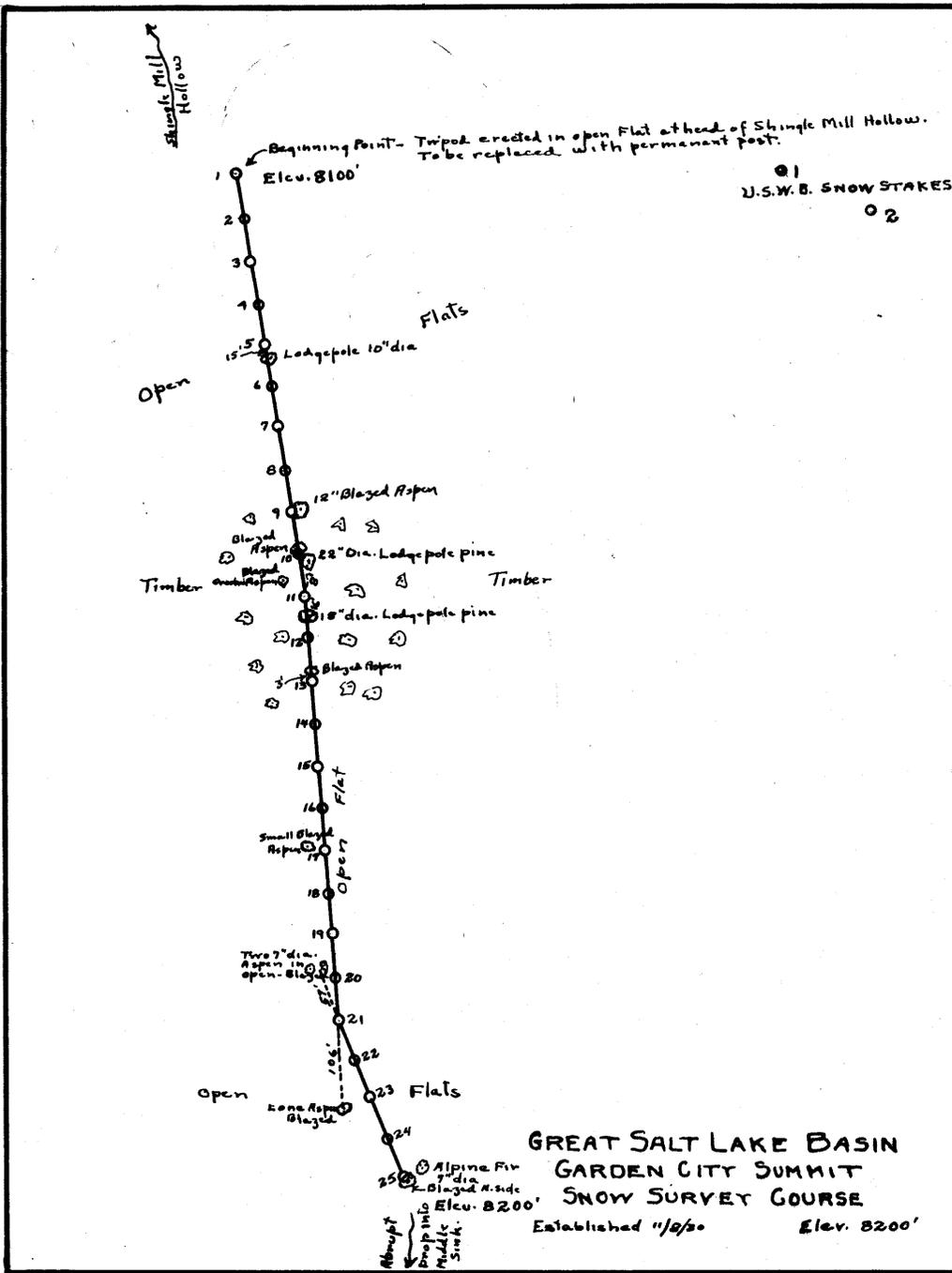
Looking up the hill to the southeast in the more dense portion of the conifers.



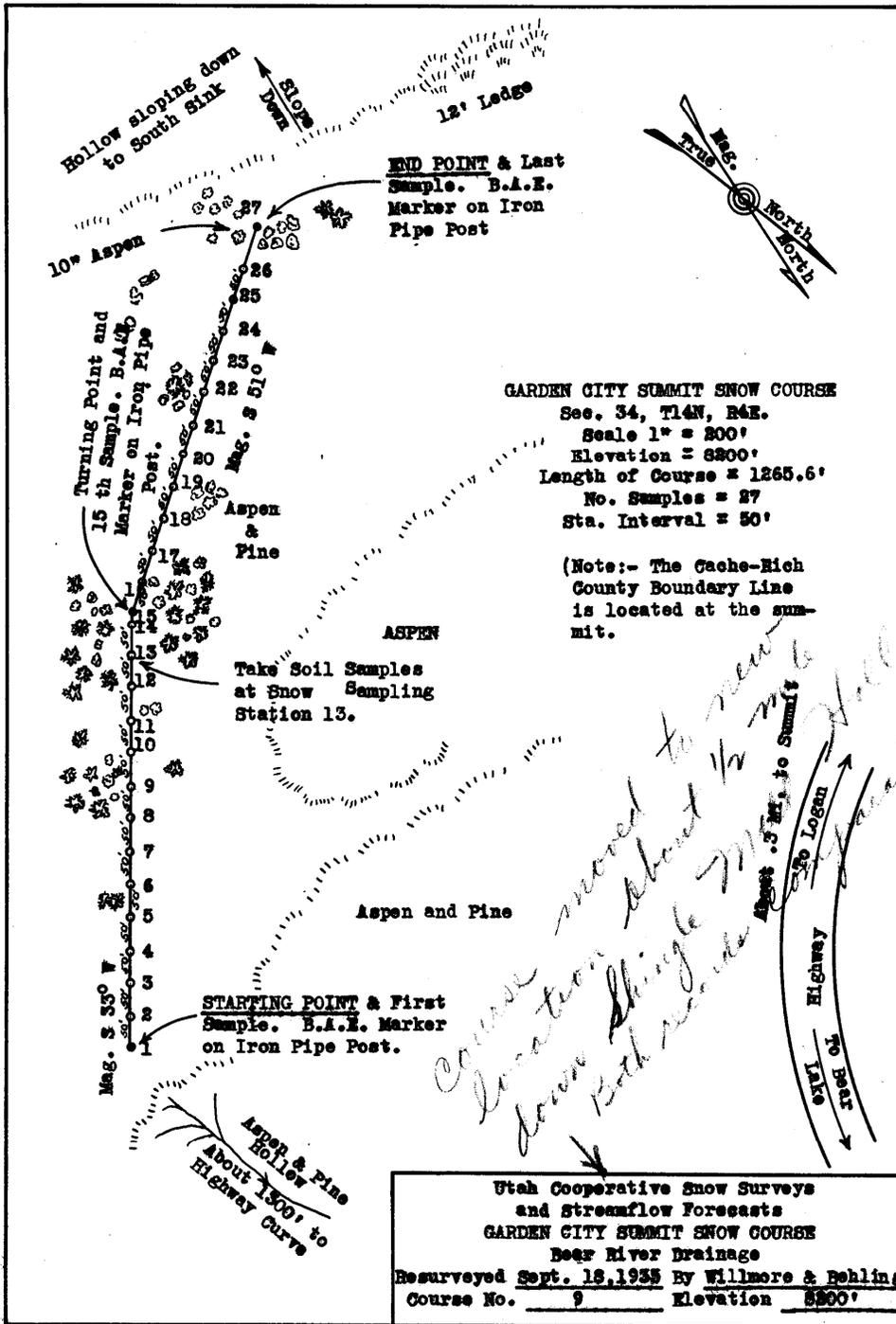
This photo shows clear impacts of the current conifer overstory impacts on the course. Note the melt rings around various trees and the undulating snow surface where deposition has been altered by conifer crowns.



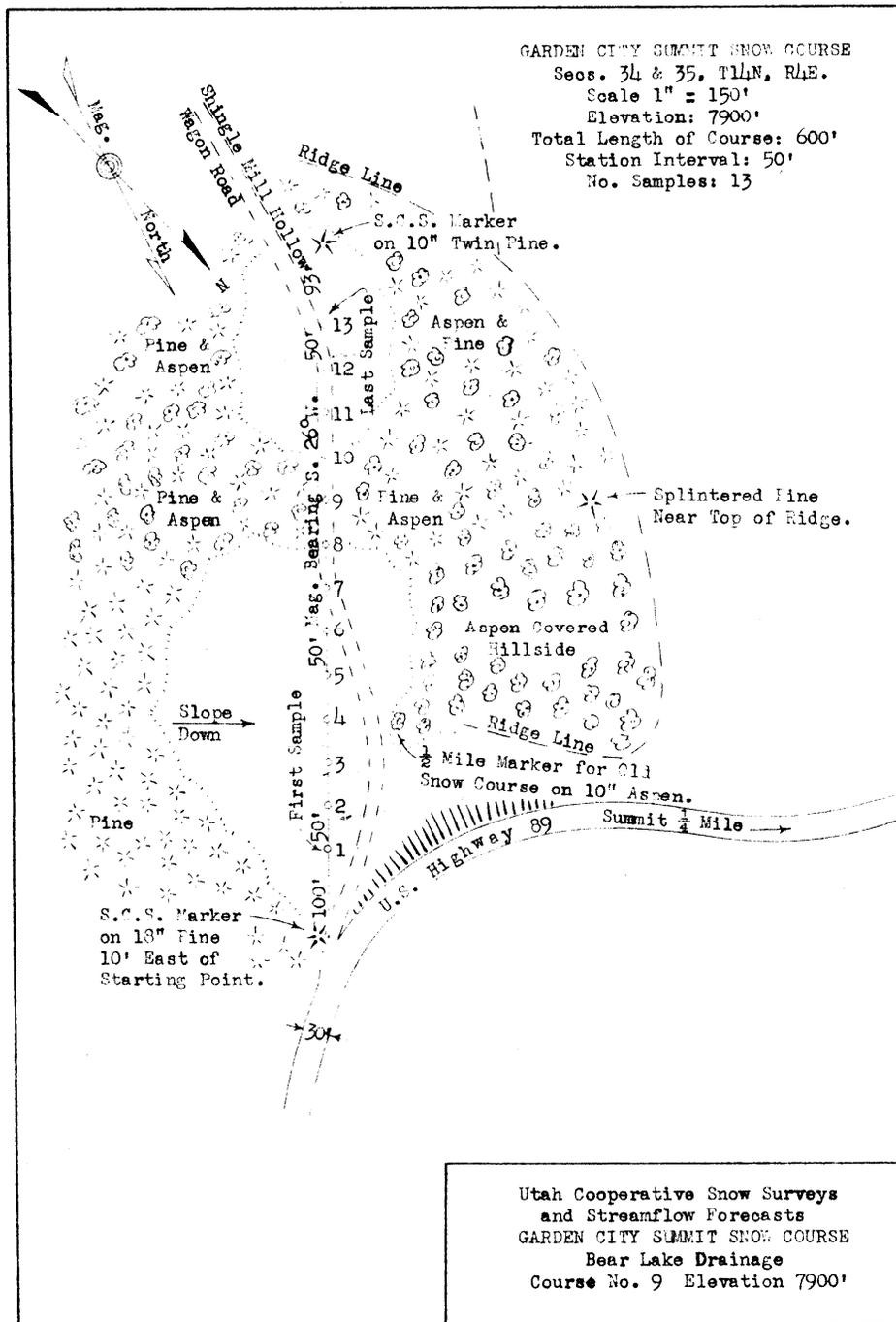
Melt rings near and at sample points. At this end of the course in the early 2000 time frame, several large conifers that were physically impacting sample sites were removed. It is likely that these sample points will be accumulating more snow currently than in previous records.



Original Garden City Summit snow course Map.



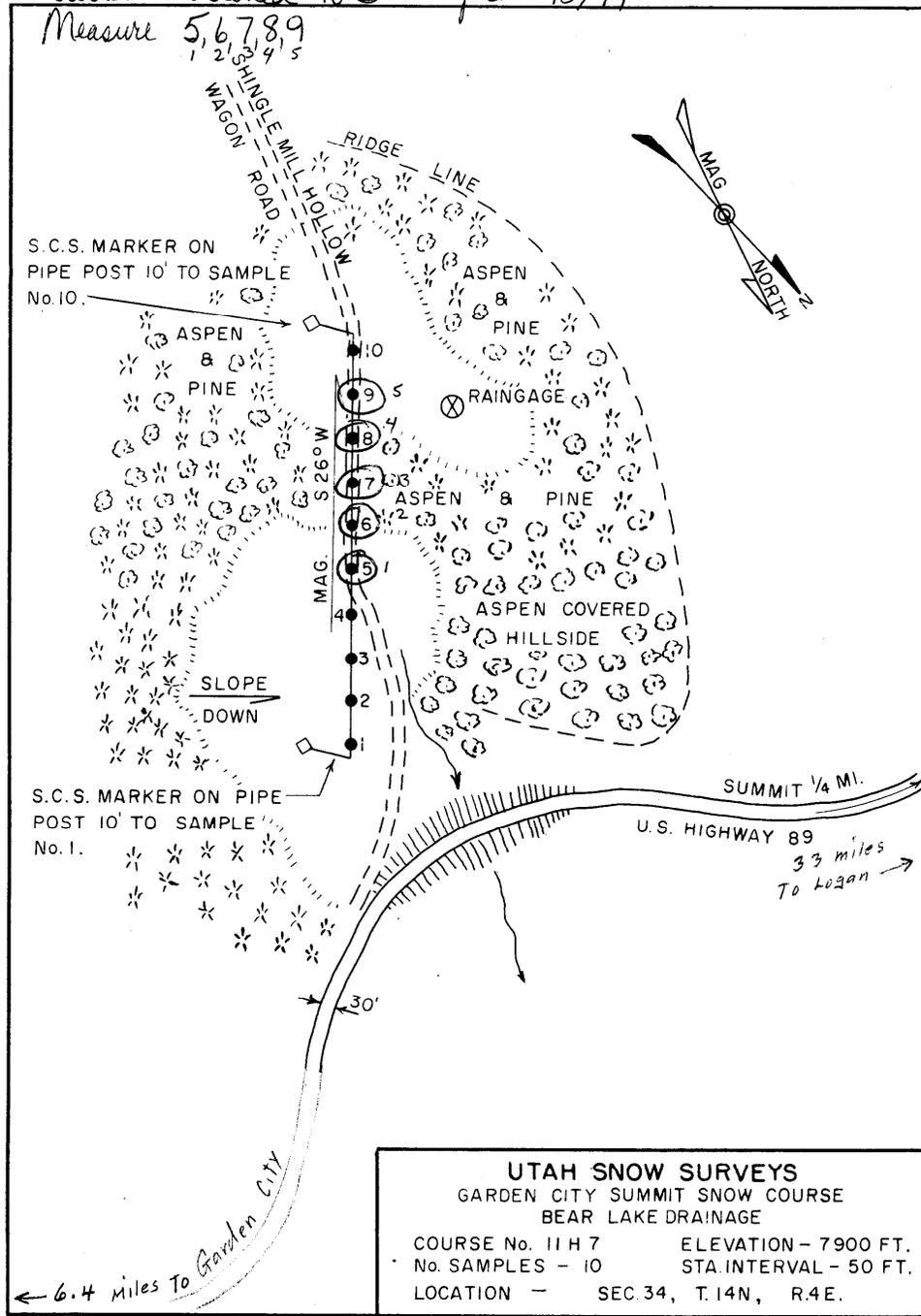
Course moved closer to highway.



New course with 13 sample points. Note the open meadow conditions from samples 1 to 8 and 11 to 13.

Course shortened to 5 samples 12/74

Measure 5, 6, 7, 8, 9
1, 2, 3, 4, 5



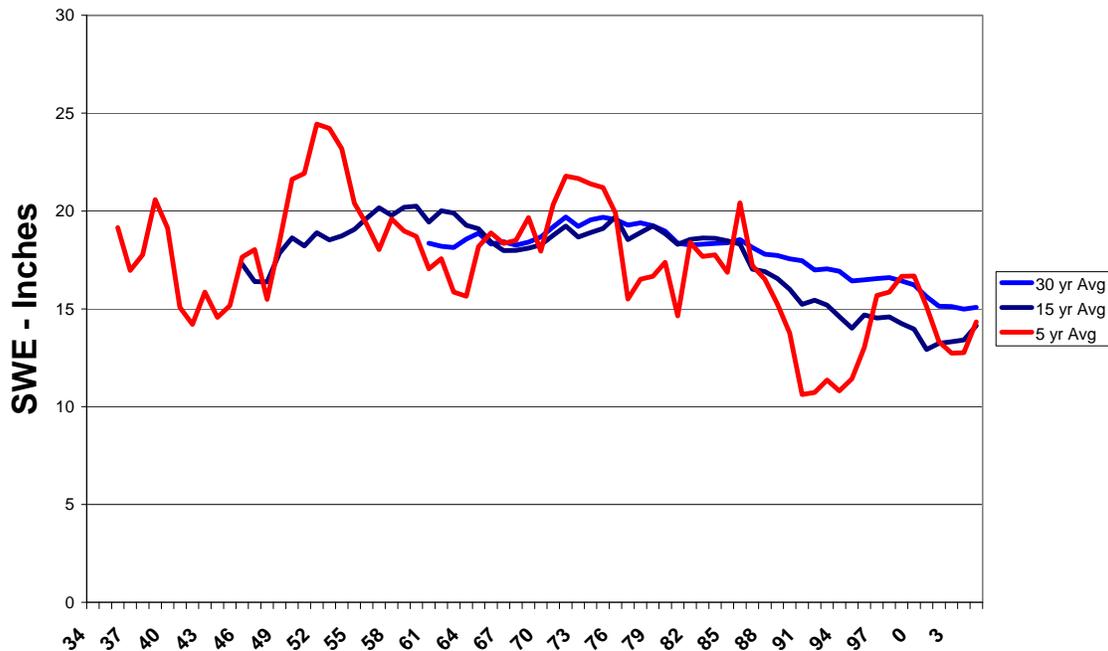
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Current course configuration with 5 sample points as of 1974. somewhere between this map and the previous map, the course was shortened from 13 points to ten.

When a snow course was shortened, the original points continue 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.

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In this chart there is clear evidence that this site has been getting less snow over time, from a 30 yr avg high of nearly 20 inches of April 1 swe in the mid 70's to nearly 15 inches in later years. The decline has been relatively steady since the early 50's on all traces: 5, 15 and 30 year running averages. Given the extent and type of vegetation change as well as the magnitude of decline (25%) - most if not all of this decline could be attributed to these site changes. There have always been some trees near this site, in the early days, primarily aspens which have subsequently been almost completely replaced by dense conifer cover. A decline of 25% is pretty much in line with other research and observations. This site should not be used in long term comparisons without data adjustment to compensate for vegetation and other potential changes. In about 2000, a few trees were removed from the west end (sample #4 and 5) of the course to limit the direct impact of interception as well as melt ring influence to the course.

R Julander
2007

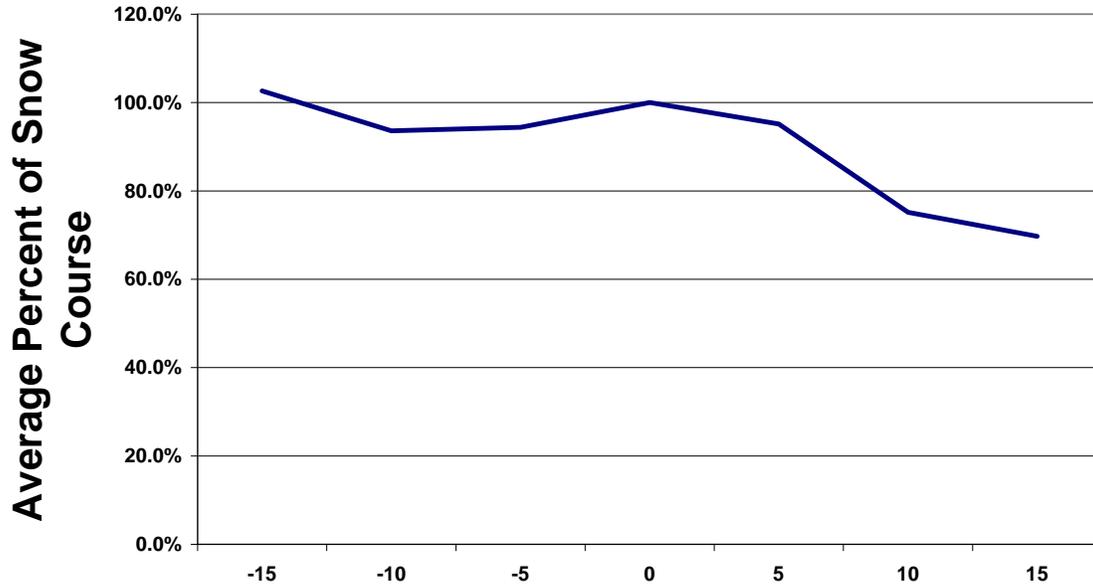
Addendum

A SNOTEL site was added in the summer of 2009 near the west and north end of the course near sample #5. The area selected is mostly open (cleared for installation) with a few aspens nearby.



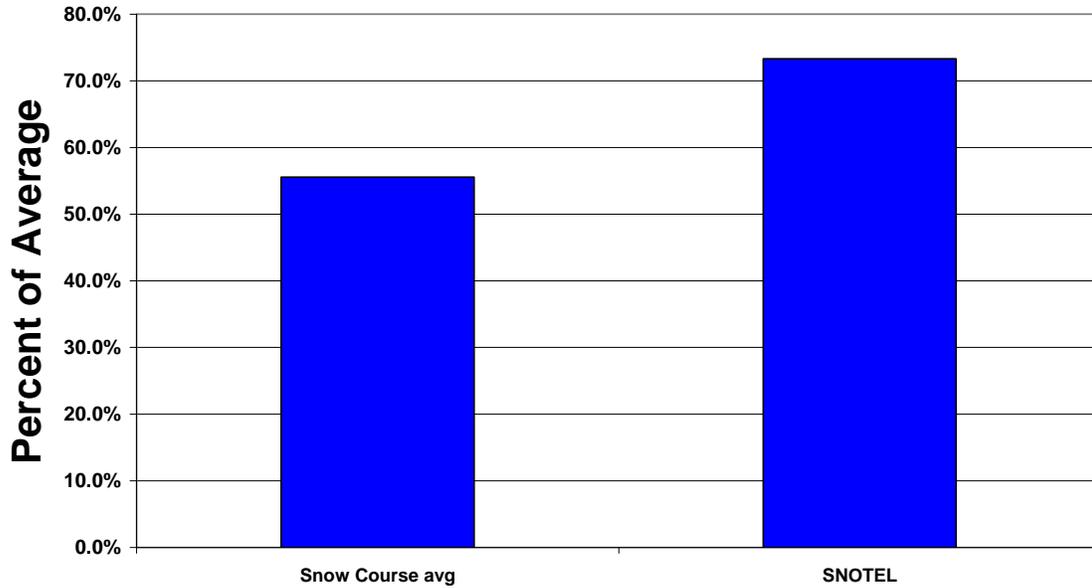
On the march 1, 2010 snow survey, transects perpendicular to the snow course were measured to determine the impact that vegetation encroachment has had on the long term average at this site.

Garden City Summit Snow Course - March 2010



The zero point is the snow course measurement. At both plus and minus 5 feet from the course, there is a decline of about 5% to 7%. The range of the plus and minus 5 foot from the snowcourse is -35% to +33% indicating some real problems at specific sample locations on this course. On the heavily timbered side of the course at plus 10 feet, the decline is about 25% and about 8% on the less vegetated side. (note, trees were removed from this side of the course in early 2000.) The difference between the new snotel site and the existing snow course is dramatic.

Garden City Summit Snow Course to SNOTEL · March 2010



There is about 20 to 25% more snow accumulating at the snotel site compared to the long term average of the snow course – directly in line with the observed loss of snow at the snow course suggesting that changes in vegetation have been mostly responsible for the observed decline in snowpack at this location.

R. Julander
March, 2010