Summary

Die in tieferen Lagen (bis ca. 1500 m) auf Skipisten oft zurückgedrängten "empfindlichen" Futterpflanzen z.B. Festuca pratensis und Dactylis glomerata kommen in höheren Lagen gar nicht mehr vor.
Der Rückstand in der Vegetationsentwicklung wirkte sich in einem geringeren Ertrag aus. Der durchschnittliche Ertragsausfall auf den drei Transekten im Pistenbereich betrug im Jahr 1982 17.2%, im Jahr 1983 19.0% und im Mittel 17.8%. Diese Ertragseinbussen fielen weniger hoch aus als diejenigen in tieferen Lagen (bis ca. 1500 m). Dies ist die Folge der in der subalpinen Zone höheren und länger liegenbleibenden Schneedecke, die einen besseren Schutz gewährleistet und der Tatsache, dass in dieser Zone nur "robustere", an extremere Klimaverhältnisse angepasste Arten verbreitet sind.
Bei der Bestimmung des Futterwertes wurden zwischen der "älteren" Vegetation neben der Piste und der "jüngeren" auf der Piste wider Erwarten keine Unterschiede festgestellt.
Da die Erhebung der Schäden auf jeder einzelnen Landparzelle sehr arbeitsintensiv und kostspielig wäre, wird die Ausrichtung gebietsweise anzusetzender grosszügiger Pauschalentschädigungen empfohlen.

SUMMARY

On the Clavadeler Alp near Davos (GR) the effects of downhill skiing were investigated on a subalpine fertilized meadow (Trisetion) situated about 2040 m a.s.l. (see Table 16).
Three transects of 100-140 m length and 10, 11, and 25 1 m^2 plots were established. The influences of the compressed snow cover, of the ice formation, and the delayed thaw on the phenological development and the yield of the subalpine fertilized meadow were investigated.
Two segments of the investigated parts of the ski runs were unexpectedly sooner free of snow than the rest of the meadow. This is presumably the result of a thinner snow cover due to a slightly humped site and intensive skiing around a marking of the ski run.
In spring an ice layer of 1-6 cm thickness was always (n=26) measured on the ski runs, partly still under a snow cover. Only a third of the measurements outside the ski runs (n=31) showed layers of ice only 1-3 cm thick.
Underneath the layer of ice on the ski run the soil was frozen everywhere to at least 5 cm depth. Outside the ski run the soil was mostly not frozen or only to a depth of 2 cm at the most.
After the melting of the layer of ice it took about two weeks for the soil to thaw completely. The living organisms in the frozen soil are little or not at all active. Therefore the ski run areas are still brown without evident growth two weeks after the melting of the snow. The areas that were free of snow earlier showed the same state.
One week after the thawing of the soil, that is three weeks after the melting of snow and ice, the plants on the ski run area had grown about as far as the ones that broke straight through the last snow on areas outside the ski run. The phenological development of the four species Crocus albiflorus, Taraxacum officinale s.l., Ligusticum mutellina and Silene dioeca is described. The development was delayed from ten days to two weeks. In the early flowering species Crocus albiflorus and Taraxacum officinale this delay was far more noticeable, probably due to the greater difference in the temperature of the soil within and outside the

Table 16. Effects of downhill skiing on a subalpine fertilized meadow at c. 2040 m near Davos from summer 1982 until spring 1984.

Time	subalpine meadow	
	Ski run	undisturbed meadow
Winter - Spring	The snow cover is compressed by levelling machines and skiers.	The snow cover is more or less loose.
Beginning of June	The soil is frozen, in some places to a depth of 20 cm, and mainly covered with ice and snow. No plant growth.	The unfrozen soil is covered with snow, or Crocus emerges through remnants of snow and blooms.
Middle of June	Crocus blooms. The average height of the herb layer is 3.2 cm.	Crocus faded. The average height of the herb layer is 5.7 cm.
End of June	The average length of the stem with bud of Taraxacum individuals is 4.2 cm. The average height of the herb layer is 10.6 cm.	Most of the Taraxacum plants are in bloom. The average length of the stem with bud is 29.9 cm. The average height of the herb layer is 17.2 cm.
Middle of July	The Taraxacum plants are in bloom. The average height of the herb layer is 20.3 cm	The Taraxacum plants are faded. The average height of the herb layer is 27.9 cm
Shortly before the hay harvest	The plant cover of Alchemilla sp. and Trifolium repens on the ski run in all three transects is at least 10% greater than beside the ski run. The average height of the herb layer is 26.4 cm.	The plant cover of Ligusticum mutellina, Trifolium badium, and Ranunculus montanus beside the ski run in all three transects is at least 10% greater than on the ski run. The average height of the herb layer is 32 cm.
Hay harvest middle - end of July	The average yield of dry substance is 31 dt/ha.	The average yield of dry substance is 38 dt/ha.

ski run at this particular time. The delay was somewhat less in the later flowering species Ligusticum mutellina and Silene dioeca.
Apart from the development of the flowers the average height of the plant cover was also used as a measure for the delay. Shortly before the hay harvest the average height within the ski run came to only 70% of that outside the ski run at two transects out of the three. A slower growth on the ski run areas during the first 30 days increased the delay caused by the late beginning of growth.
Slightly more than half the species occurred more frequently outside the ski run than on the ski run, and only 20% more frequently on the ski run than outside the ski run. In all three transects the species Ligusticum mutellina, Trifolium badium, and Ranunculus montanus were found more frequently, with at least ten percent of cover difference, on the areas outside the ski run than on those within the ski run. Within the ski run areas Alchemilla sp. and Trifolium repens appeared more frequently, also with a difference of at least ten percent of cover.
Small differences in the topography of the site influenced the combination of species therefore each transect was partly characterized by an individual combination of species.
"Sensitive" forage plants such as Festuca pratensis and Dactylis glomerata repressed on lower altitude ski runs (up to about 1500 m) cannot be found at all at higher altitudes.
The consequence of the delay in the development of the vegetation was a smaller yield. The average loss of yield on the three transects in the ski run area came to 16.2% in the year 1982, to 18.8% in the year 1983, and to 17.2% average . These losses of yield were smaller than those at lower altitudes (up to about 1500 m). This is the result of a deeper snow cover that remains longer in the subalpine zone and guarantees better protection, as well as of the fact that only more robust species, adapted to extreme climatic conditions, are distributed.
Unexpectedly there were no differences in the nutritive value of the older vegetation outside the ski run and the younger one within the ski run.
As it would cause very much work and expense to establish the damage to each plot of land, the payment of generous, regional, lump-sum compensations is recommended.