

COMMUNICATION

**Postfire Regrowth of *Vaccinium consanguineum*
(Ericaceae) in the Costa Rican Páramos**

Sally P. Horn

Department of Geography, University of Tennessee, Knoxville, Tennessee 37996, USA. Fax (423)9746025, shorn@utk.edu

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Resumen: Se estudió el crecimiento de *Vaccinium consanguineum* Klotzsch en el páramo de Buenavista, Costa Rica, cinco años después del incendio de 1992, usando 50 plantas en cada uno de dos lugares. Las alturas medias fueron 72.6 ± 24.6 cm en Asunción y 75.2 ± 17.6 cm en Zacatales, mientras que las medias antes del incendio diferían en 30 cm. Esta diferencia puede explicarse por diferencias en la cronología de incendios recientes u otras condiciones ambientales locales.

Key words: Costa Rica, fire, páramo, regeneration, regrowth, *Vaccinium consanguineum*

Vaccinium consanguineum Klotzsch is a common shrub in high elevation páramo vegetation (3200-3800 m a.s.l.) in the Cordillera de Talamanca, Costa Rica (Weber 1959, Horn 1989, Schneidt and Weberling 1992). Most of the Costa Rican páramos have burned during this century due to accidental or intentional ignition by humans; charcoal fragments in lake sediment cores from the Chirripó highlands document earlier páramo fires, ignited by people or lightning at intervals over the past 10,000 years (Horn 1993). The above ground portions of shrubs of *V. consanguineum* are usually killed by fire, but the plants resprout vigorously from basal buds (Janzen 1973). Typically nearly all shrubs within a burn site will resprout following crown loss, but individuals are slow to regain their prefire stature (Horn 1989).

Janzen (1973) presented data on height recovery three years after a fire on Cerro

Asunción in the Buenavista páramo (Cerro de la Muerte) along the Inter-American highway (study site near 3340 m elevation). Horn (1989) provided similar data for nearby sites that had burned one year (Tower 65; 3310 m), 12 years (Cerro Zacatales; 3340-3370 m), and 12 or more years before sampling (Cerro Sábila; 3370-3410 m), and for the more remote Conejos site (3480-3500 m) within the Chirripó páramo, which had burned nine years before sampling. Williamson *et al.* (1986) also reported on regeneration of *V. consanguineum* on Cerro Zacatales, but may have confused this shrub with the smaller ericad *Pernetia coriacea*.

In March 1992 a fire burned some 100 ha on the upper slopes (>3300 m) of Cerro Asunción and parts of the south slopes of Cerros Zacatales and Sábila (Moya 1992, and pers. obs.). This fire, likely human-set, provided opportunities to investigate shrub regeneration

following the reburning of previously studied burn sites. Sampling in February 1994 revealed that 88% of burned shrubs of *V. consanguineum* on the upper south slope of Cerro Asunción (3340-3370 m), and 96% of burned shrubs on the upper south slope of Cerro Zacatales (3340-3370 m), had resprouted within two years of the fire (Horn 1997).

In March 1997 I examined the same populations of *V. consanguineum* to assess height recovery in the five years since the fire. I randomly selected 50 resprouting shrubs from each population, and measured the heights of their tallest living and fire-killed stems to the nearest cm using a rigid metal tape measure. As in previous work by Janzen (1973), Williamson *et al.* (1986), and Horn (1989), the heights of fire-killed stems were used as estimates of the prefire stature of the shrubs. The actual heights of the plants prior to burning may have averaged somewhat higher owing to the loss of the smallest twigs in the last fire. The estimated prefire heights reflect regrowth following the penultimate fire at each site. A voucher specimen collected on Cerro Asunción prior to the 1992 fire was deposited at CR (S.P. Horn 114; CR #109167), with duplicates sent to the UC and WIS herbaria.

I selected the plants to measure using Ward's 1974 "ignorant man" technique, which I suggest be renamed the "ignorant researcher" technique. This technique requires a field assistant, who has in hand a list of ordered random numbers, drawn from within a range judged to approximate the number of individuals in the population to be sampled. For this study, I wanted to collect height recovery data on 50 burned shrubs from within areas that I estimated to each include about 200 shrubs, so I used a list of 50 random numbers drawn from within 200 numbers. Some such lists are included in Ward (1974) and others can be generated from random number tables, programmed calculators, or even creative use of playing cards or dice. My role as the "ignorant researcher" was to walk through the study sites, counting aloud shrubs that fit my criteria (in this case, shrubs burned in the last fire that

had subsequently resprouted). I was "ignorant" while counting shrubs of the ones that would be selected to measure; my assistant held the list of random numbers, and advised me when I reached a number that called for a plant to be sampled. This "ignorant researcher" method produced an unbiased and rapid randomization of plants, that allowed us to quickly collect field data without the need to number all individuals or establish plots or transects.

Average postfire heights for *Vaccinium consanguineum* at the two sites were within 3 cm of each other (72.6 ± 24.6 cm at Asunción and 75.2 ± 17.6 cm at Zacatales), whereas the average prefire heights differed by more than 30 cm (129.6 ± 58.6 cm at Asunción and 98.4 ± 30.4 cm at Zacatales). The latter difference is statistically significant (Mann-Whitney, $p < 0.05$), and may in part reflect the differing fire histories of the sites. The penultimate fire at the Asunción site was in 1969; prior to that the site may have been fire free for some 30 years (Williamson *et al.* 1986). The Zacatales site had previously burned in 1973, after an earlier fire perhaps only 10-12 years beforehand, and another fire some 10 years before that (Williamson *et al.* 1986, Horn 1989). The lower prefire statures at the Zacatales site may reflect both the later occurrence of the penultimate fire, and the fact that the site had had a shorter fire-free interval during which to recover root reserves (Williamson *et al.* 1986). Other environmental factors not measured in this study may also have influenced growth rates following the penultimate fires.

The nearly identical rates of regrowth at the two sites suggests that by the time of the 1992 fire, root reserves may have recovered to more even levels. However, future monitoring may reveal differences not apparent over the five year time span investigated here. The similarity in postfire growth rates for *V. consanguineum* and in postfire resprout rates for this shrub and *Hypericum irazuense* (Horn 1997) also suggest approximately similar burning conditions, but no data exist on fire temperatures or other burning parameters. Postfire climatic conditions are assumed to be nearly

identical, owing to the proximity and corresponding exposure and elevation of the two sites.

Fig. 1 compares the prefire and postfire height data from this study with earlier results from Janzen (1973) and Horn (1989). Within five years, regenerating shrubs of *V. consanguineum* on Cerros Asunción and Zacatales were as tall as nine-year old shrubs in the Conejos study site within the Chirripó páramo. This difference may be explained by possibly harsher climatic conditions at the Conejos site, which is some 140 m higher in elevation than the Asunción and Zacatales sites. The five-year old stems measured in this study were

also taller than 12-year old stems on shrubs that regenerated following the penultimate fire on Cerro Zacatales. As suggested above, the comparatively slower growth following the 1973 Zacatales fire may reflect the fact that root reserves at the time of this fire had been depleted by successive fires at close intervals. Varying climatic conditions could also have affected the regrowth rates; the five years following the 1992 fire may have been more favorable to plant growth than the 12 years following the 1973 Zacatales fire.

Information on postfire shrub regeneration is important for assessing not only the ecological impacts of páramo fires, but also their *visual* impacts. I have suggested elsewhere (Horn 1998) that resource managers might want to consider using some prescribed burning within the páramo of Chirripó National Park. Prescribed burning of small areas could be useful in limiting the occurrence of large fires, and in enhancing overall habitat and species diversity. But prescribed fires, and the firebreaks that would contain them, could affect visitor perceptions and perhaps enjoyment of the páramo environment, by detracting from the "wilderness" experience that many visitors seek (Horn 1998). Thus careful thought needs to be given to the rate at which burned vegetation will recover its prefire appearance. Height recovery is an important part of this. The recent burning of easily accessible sites within the Buenavista páramo provides good opportunities to collect data needed to assess visual impacts of possible future prescribed fires in the Costa Rican páramos.

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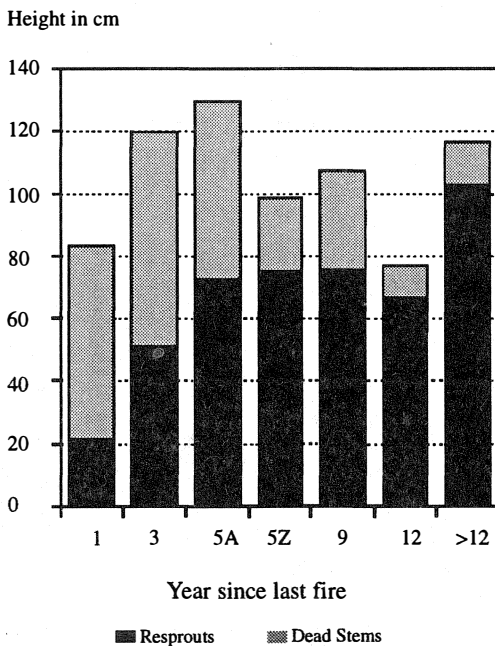


Fig. 1. Heights of fire-killed and regenerating stems of *Vaccinium consanguineum* after seven recent fires in the Costa Rican páramos. Numbers on x axis indicate time since last fire. Study sites are as follows: 1 — Tower 65 Site, 1984 fire, Horn 1989; 3 — Asunción site, 1969 fire, Janzen 1973; 5A — Asunción site, 1992 fire, this study; 5Z — Zacatales, 1992 fire, this study; 9 — Conejos site, 1976 fire, Horn 1989; 12 — Zacatales site, 1973 fire, Horn 1989; > 12 — Sábila site, ≤ 1973 fire, Horn 1989. Date of last Sábila fire was estimated based on ring counts in regenerating shrub stems.

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