

Volcano Ranching: Problems and Opportunities in Management of Hawaiian Range Land¹

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The Hawaiian Islands to many people mean sugar, pineapples, and scenery. To those who have never visited the Islands, it may come as a surprise to learn that ranching is one of the most important industries. From the standpoint of acreage, ranching occupies more than 80 percent of the total agricultural land in Hawaii. In 1957 there were 386 cattle ranches with 20 or more head of cattle. Cattle, numbering 160,500 head, grazed on 1,008,000 acres. (Wallrabenstein, *et al.* 1958).

History

The history and operations of Hawaiian ranches form one of the most fascinating aspects of this interesting Territory.² The first cattle were longhorns, brought to the Islands by George Vancouver in 1793. These were given to the king of Hawaii who ordered their protection. The cattle were allowed to run in the forests and within 30 years had multiplied to the point where they were destroying the forests and were even causing damage to the villages of the Hawaiians. The first commercial exploitation of the wild cattle, after the removal of the taboo, was for the hides and tallow not for the beef. The early commercial use of the beef was for the whaling ships which used to put in to the Islands for winter provisions.

English breeds of cattle such

as Shorthorns, Angus, and Herefords began to be introduced about 1850, but it was not until 1900 that the improved breeds completely replaced the longhorns. (Henke, 1929).

The size of the ranches varies from small ones on which a few cattle are kept on a part-time basis to the large Parker Ranch which consists of 285,000 acres.

The large ranches reflect the land holding system of the days of the Hawaiian monarchy. Land grants at this time were given in parcels running from the sea to the top of the mountain. These ranches thus tend to be triangular in shape with the base of the triangle toward the ocean. Since the lowlands have been taken for production of cultivated crops, many ranches do not extend to the ocean. The majority of the cattle in the Islands are therefore produced at the intermediate and higher elevations. Several of the larger ranches do have some grazing lands which go down toward the sea.

Geographical Situation

To best understand the unique conditions which make Hawaiian ranching such a challenging enterprise, it is necessary to understand the geographical setting of the Islands. The Islands lie just within the northern portion of the equatorial zone. Volcanic in origin, they rise to heights of almost 14,000 feet. They are surrounded on all sides by the warm Pacific Ocean. Prevailing winds in this area are the northeast trades which blow over the ocean, taking up moisture as they go. As the moisture-laden winds reach the mountains, they drop their moisture in highly

localized patterns, depending on exposure of the mountains to the trades, elevation, and other factors. Rainfall in these exposed areas may run higher than 200 inches a year. The lee side of the island, on the other hand, tends to be dry. The only source of rain in these dry areas comes from reversal of the trade wind condition which is brought about at irregular intervals during the winter season, and also in certain localities by land and sea breeze conditions. The lee side of the Islands may receive as little as 5 inches a year.

Considerable variation in temperature is also encountered because of differences in elevation. Although the highest peak is 13,784 feet, ranching operations are seldom carried out above 8,000 feet. The mean annual temperatures encountered over the range from sea level to 8,000 feet correspond to those from Miami Beach, Florida to Bar Harbor, Maine. While the extremes of temperatures are not as great as those encountered on the Continent, frosts and snow do occur in higher elevations.

It can be seen that almost any combination of conditions can be encountered, depending on the elevation and the exposure of the area to the trade winds.

Species

These tremendous variations in growing conditions present many problems to the rancher, but at the same time provide considerable versatility so far as his grazing program is concerned. In the lowlands, tropical grasses and legumes thrive well and in the upper elevations, temperate zone species are encountered. The lowlands provide a favorable opportunity for the growth of giant grasses such as Guinea grass (*Panicum maximum*) and Napier or elephant grass (*Pennisetum purpureum*). Para grass (*Panicum purpurascens*) provides pasturage on low

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²When this paper was written Hawaii was a Territory. It is now a State.

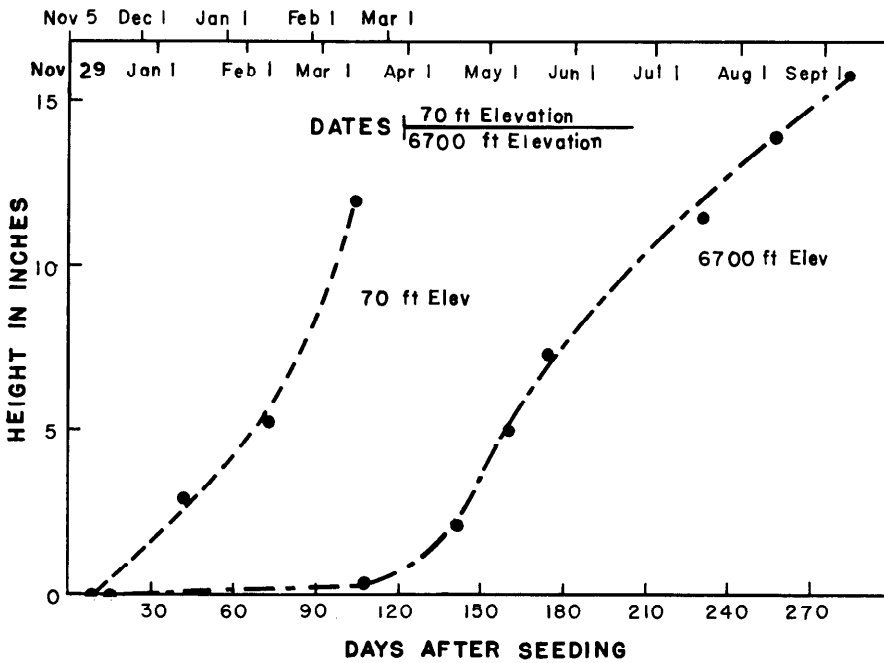


FIGURE 1. Growth in height of November sown ladino clover at two elevations. Plants near sea level began rapid growth immediately and attained maximum height at approximately 100 days. Plants at high elevation did not begin period of rapid growth until after April 1.

wet areas. Smaller grasses such as Bermuda grass (*Cynodon dactylon*) and Dallis grass (*Paspalum dilatatum*) also provide abundant growth if moisture and other conditions are favorable.

Legumes which provide feed at low elevations are Koa haole (*Leucaena glauca*), a shrub, and Kiawe (*Prosopis chilensis*), a tree related to the mesquite of the southwest. The Kiawe produces pods which are readily eaten by cattle. Three herbaceous legumes contribute to the lowland pastures. These are *Desmodium canum*, *Desmodium uncinatum*, and the recently introduced *Desmodium intortum*. Several legumes, such as bur clover (*Medicago hispida*), provide lush herbage for part of the season.

Intermediate and higher elevations support such grasses as orchardgrass (*Dactylis glomerata*), Yorkshire fog (*Holcus lanatus*), rye grasses (*Lolium* spp.) and species of blue grasses (*Poa* spp.). The most common legume

in the higher elevations is white clover (*Trifolium repens*), but other clovers (*Trifolium* spp.) may be found in certain pastures. Covering both low as well as the intermediate elevations are Kikuyu grass (*Pennisetum clandestinum*) and Pangola grass (*Digitaria decumbens*).

The only indigenous (if such it be) grass of consequence is Pili grass (*Heteropogon contortus*).

Big trefoil (*Lotus uliginosus*) may be found in certain of the wetter areas. Alfalfa can be produced in a number of localities. At sea level conditions it may be expected to produce ten or eleven cuttings a year. High relative humidity and frequency of dews and light showers even in the drier areas militate against the use of alfalfa or other crops for hay.

Comprehensive treatments of grasses and legumes in Hawaii have been published. (Hosaka and Ripperton, 1939; Ripperton and Hosaka, 1942; Hosaka and Ripperton, 1944; and Ripperton, 1948).

Because of the opportunity of pasturing 12 months of the year, and also because of the difficulty of making hay because of frequent showers and heavy dews, many ranches do not provide means of conserving excess forage during lush seasons.

Seasonal Changes

The tremendous variations in temperature and adaptation of different grasses to these conditions provide a great opportunity to the rancher. Temperatures in the lowlands in the winter season are favorable to the growth of grasses and legumes. In many areas also the winter season is the season of greatest rainfall. As the season progresses, pasture plants in the lower elevations tend to dry up. At the same time, the fields in the higher elevations begin to produce good growth because of increase in temperature. With this progression of the season and growth in plants at increasingly higher elevations, the rancher can move his animals higher and higher. Later on in the year the situation is reversed, and the cattle are moved down to the lower pastures again. The difference in growth between plants at a low elevation and those at a high elevation may be seen in Figure 1. In this particular experiment, ladino clover was sown in November at two elevations, one at 70 feet and the other at 6,700 feet. Germination in both plots occurred within two weeks, but no appreciable growth, as shown in the graph by height, occurred at the high elevation until the beginning of April, after which time the clover made rapid and abundant growth. Plants at the low elevation grew rapidly from the very beginning, reaching a maximum height at about 100 days, at which time the plants at the higher elevation were just beginning their period of rapid growth.

Those ranchers who have only pastures in limited elevation



FIGURE 2. Pasture of temperate zone grasses and legumes established on rough field formerly occupied by rain forest vegetation.

ranges can usually graze the year round, but production in the winter is much less than in summer due to colder temperature and shorter length of day.

Influence of Volcanoes

All the mountains of Hawaii are volcanic in origin; but of the seven major Islands, only the Island of Hawaii has active volcanoes. Had it not been for the volcanoes, there would be no mountains with their extensive ranges of elevations; in fact, there would be no islands.

A potent influence of the volcano is on the topography and surface of the pasture lands. The surface of the soil where there has been a recent lava flow tends to resemble more a rock pile than a pasture. In some of the areas, fortunately, the temperature and rainfall are relatively high, so that re-vegetation of the lava flow is relatively rapid. Nevertheless, on the Island of Hawaii in which volcanism still continues, pasture land tends to be rough and steep (Figure 2). This makes clearing the land from forest difficult. It also hinders the animals from moving over the surface of the ground.

The problem of water for the animals is also important because there are few natural sites for reservoirs. This usually necessitates bringing water to watering troughs by means of pipe lines.

Even in the islands in which volcanism has long ceased to be active, the steep slopes make ranching operations difficult. Plowing and other cultural op-

erations are sometimes impossible because of the precipitous terrain and the presence of rock. If the vegetative cover is removed from the pasture because of over-grazing, erosion is almost sure to occur. Figure 3 shows the deep gulches on the western portion of the Island of Maui, an area in which volcanic activity has not occurred for thousands of years. The ridge tops are relatively flat and on these, ranching may be carried on with comparative ease. Unfortunately, though, the area as a whole is broken up by excessively steep gulches in which it is impossible to practice pasture improvement.

The possibility of a volcanic eruption must also be considered in certain areas of the Island of Hawaii. There are two active volcanoes on this island, Mauna Loa and Kilauea. Manua Loa is one of the greatest mountains in the world, rising from ocean depths about 15,000 feet below sea surface to 13,680 feet above it. This volcano, although it erupts only periodically, may cause considerable damage to pastures which are within the

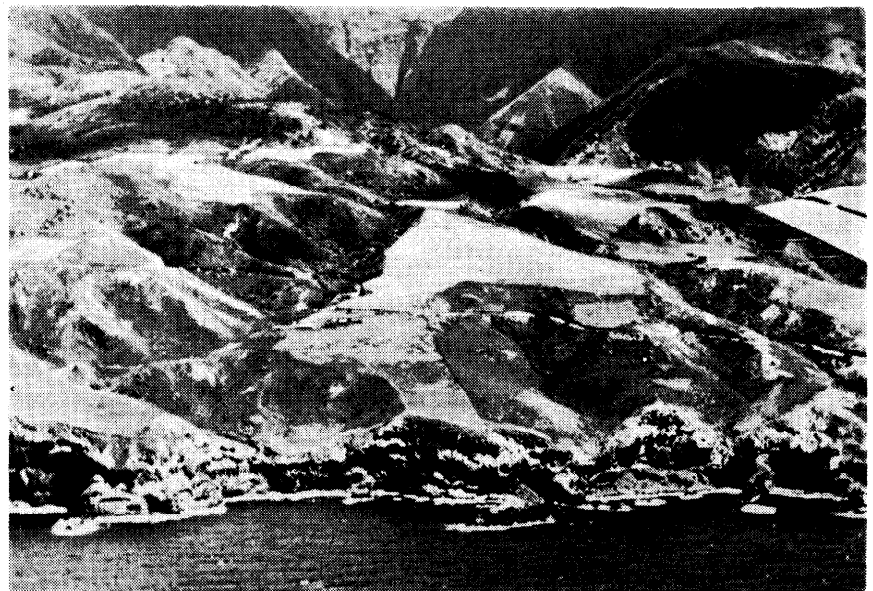


FIGURE 3. Pasture land on slopes of deeply dissected volcanic mountain. Grazing lands on flat ridge top are good for grazing but are difficult of access. Gulches are steep and liable to erosion.

paths of the lava flow. Frequently the lava flow is confined to non-agricultural areas, but a number of ranches have been devastated.

Volcano ranching, therefore, has its disadvantages and its advantages. The disadvantages caused by the presence of steep slopes, rocky terrain, and lava are offset, in part, by difference

in elevation, permitting progressive seasonal grazing.

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