Technical Report No. 3

THE INFLUENCE OF FERAL GOATS ON KOA (*Acacia koa* GRAY) REPRODUCTION IN HAWAII VOLCANOES NATIONAL PARK

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ABSTRACT

Goats were introduced to the Hawaiian Islands nearly 200 years ago. They have become wild and today roam in many Hawaiian ecosystems with dry-season climates from the lowlands to the mountains. A quantitative analysis was made to evaluate the influence of feral goats on tree reproduction of *Acacia koa* in the mountain parkland ecosystem on the east flank of Mauna Loa. In this ecosystem, the endemic koa is the only important tree species. Here it reproduces vegetatively from root suckers. Suckering has resulted in the formation of small, dense tree colonies. Ten transects were established through a goat exclosure that was constructed three years earlier (in 1968). In addition, six transects were run across several typical nonfenced koa colonies. All suckers were counted, measured for height and mapped. It was shown that koa reproduction below 10 cm height is abundant outside the exclosure and at the unfenced colonies. Almost totally missing are suckers between 0.5 m and 2 m height. However, hundreds of this height grow inside the goat exclosure. Most of the few trees of this height found outside the fenced area were dying or dead showing that the current goat pressure is so high that the reproduction cycle of koa is nearly disrupted. The dense and vigorous sucker growth inside the exclosure, which is the result of current release from goat browsing pressure, was found to be an artifact. The artifact has resulted from increased suckering density caused by goat feeding and probably trampling on shallow roots. Thus, the entire forest stand structure in the mountain parkland is directly related to herbivore feeding and departs definitely in spacing and probably in height growth from the original forest structure as evolved during island ecosystem evolution.

INTRODUCTION

Goats (Capra hircus L.) are a relatively recent addition to the biota on the Hawaiian Islands. They were brought to Hawaii with the first explorations of the white man, about 200 years ago (in 1778 by Captain Cook; Tomich 1969). Since then, they have multiplied and spread into all natural vegetations in climates with dry seasons. Here they found no natural predators, except man. Their population numbers are therefore controlled only by availability of food, by their own capacity to reproduce and by interference from man.

Their food supply consists of nearly all plants available in the dry-zone habitats, but as is well known, their preference is for woody species. Foremost among them is one of the two most important native tree species, Acacia koa (koa). The tree is a non-thorny legume that can grow to a height of 30 m in favorable habitats. It has the typical leguminous compound leaves in the early juvenile stage. The compound leaves are later dropped, when the leaf-stalks broaden into sword-shaped phyllodes reminiscent of eucalyptus leaves. The ancestral form undoubtedly is of Australian origin.

Acacia koa occurs on all high Hawaiian Islands, usually in locally restricted areas bordering the Metrosideros (ohia) rain forests. Acacia koa can be found forming closed forests, but often occurs more or less scattered in grass-covered areas. Where open-grown, its distribution may have been influenced by fire and grazing (Mueller-Dombois and Lamoureux 1967). The upper altitudinal vegetation on Mauna Loa ~~has been described by Fosberg (1959), Krajina (1963) and Mueller-Dombois (1967).~~

On the east-flank of Mauna Loa, Acacia koa is prevalent between 1,200 m (4,000 ft) and 2,000 m (6,600 ft) elevation. From about 1,500 m (5,000 ft) upwards the tree forms small forest stands that are haphazardly distributed within a matrix of grass and scrub vegetation. This type of vegetation is locally referred to as mountain parkland, and a sizable portion of it occurs within the boundaries of

Hawaii Volcanoes National Park (Fig. 1).

The climate of the mountain parkland is summer-dry showing a peak of rainfall during the winter months. The annual rainfall decreases upslope from about 1,250 mm (at 1,500 m) to 1,100 mm (at 2,000 m) altitude. The annual mean temperature decreases over the same altitudinal ranges from about 14°C to 12°C. The annual range of these mean temperatures is only about 5°C, while the daily range is about 10°C. Thus, a nocturnal ground frost can be expected any time during the winter months (December through February).

The whole area of the mountain parkland, except for a few recent lava flows, is covered by a thin sheet of soil from ash, 10-50 cm deep. The rocky substrate is mostly aa lava, but also pahoehoe lava occurs.

In this ecosystem, _Acacia koa_ reproduces almost entirely from root suckers (Baldwin and Fagerlund 1943, Lanner 1965, Mueller-Dombois 1967), while in wet forests, koa reproduction is primarily from seed. The sucker reproduction of koa in the mountain parkland ecosystem is responsible for the occurrence of koa in circular colonies in this habitat. One or two old trees are often found in the center of these colonies and the outward growth is characterized by concentric rings or belts of successively smaller koa suckers.

This structural distribution pattern of koa is primarily the result of recent historical events. The area was cattle ranch land until it became part of the National Park in 1916. Yet, cattle was allowed to graze again during the Second World War until 1948. With removal of cattle from the area, _Acacia koa_ showed a dramatic come-back. Comparing air photos taken in 1954 and in 1965, Mueller-Dombois (1967) found that koa colonies were radially expanding into the grassland at the rapid rate of 0.5-2.5 m per year. Nevertheless, several kinds of goat damage on koa were recorded at that time (Mueller-Dombois 1967), and establishment of several exclosures to study the goat impact was recommended to

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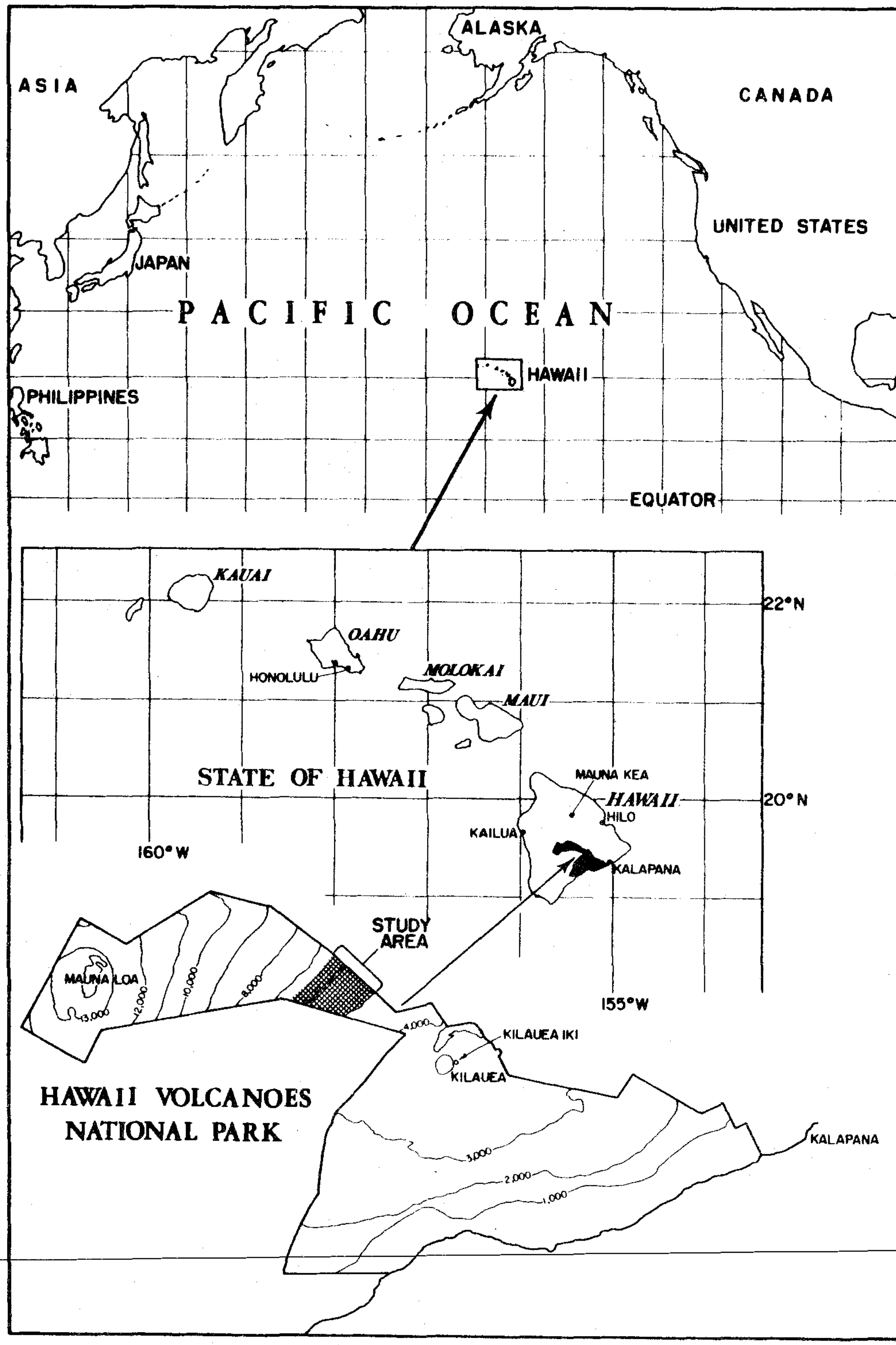

Fig. 1. Map of Hawaiian Islands with Hawaii Volcanoes National Park and study area.

the Park Service. Earlier, Baldwin and Fagerlund (1943) had observed that the effect of herbivores other than cattle was negligible. In subsequent years goat damage became evident, and the Park Service stepped up its goat control program. This is reflected in the history of the goat control program of Hawaii Volcanoes National Park as recorded by Geerdes (1964). The first goats were destroyed in the Park in 1927. Between 1960 and 1967, 24,666 goats were eliminated throughout the Park, from 1964 to 1967 alone 17,839. From 1968 to 1970 only 5,310 goats were removed.

In recent years an increase in the goat population has become obvious. Current Park Service estimates rate the number of goats as between 15,000 to 20,000. Of these, not more than 500 are believed to browse in the mountain parkland ecosystem. Probably there are many more. In any case, the goat population is much too high in this relatively small area.

So far, no quantitative information on the impact of goats in Hawaii has ever been published.

METHODS

The methods used in the present study include firstly, the quantitative analysis of koa reproduction in a 100 m by 10 m goat exclosure and in its surrounding area, and secondly, the structural analysis of six unfenced koa tree colonies in the mountain parkland ecosystem.

Exclosure analysis

The goat exclosure was built in July 1968 by the Park Service near the Mauna Loa Strip Road at 1,880 m (6,200 ft) elevation.

Ten transects were established and analyzed in June 1971 across the exclosure (Fig. 2). Along the 10 transects all koa suckers were counted in 2 m wide belts.

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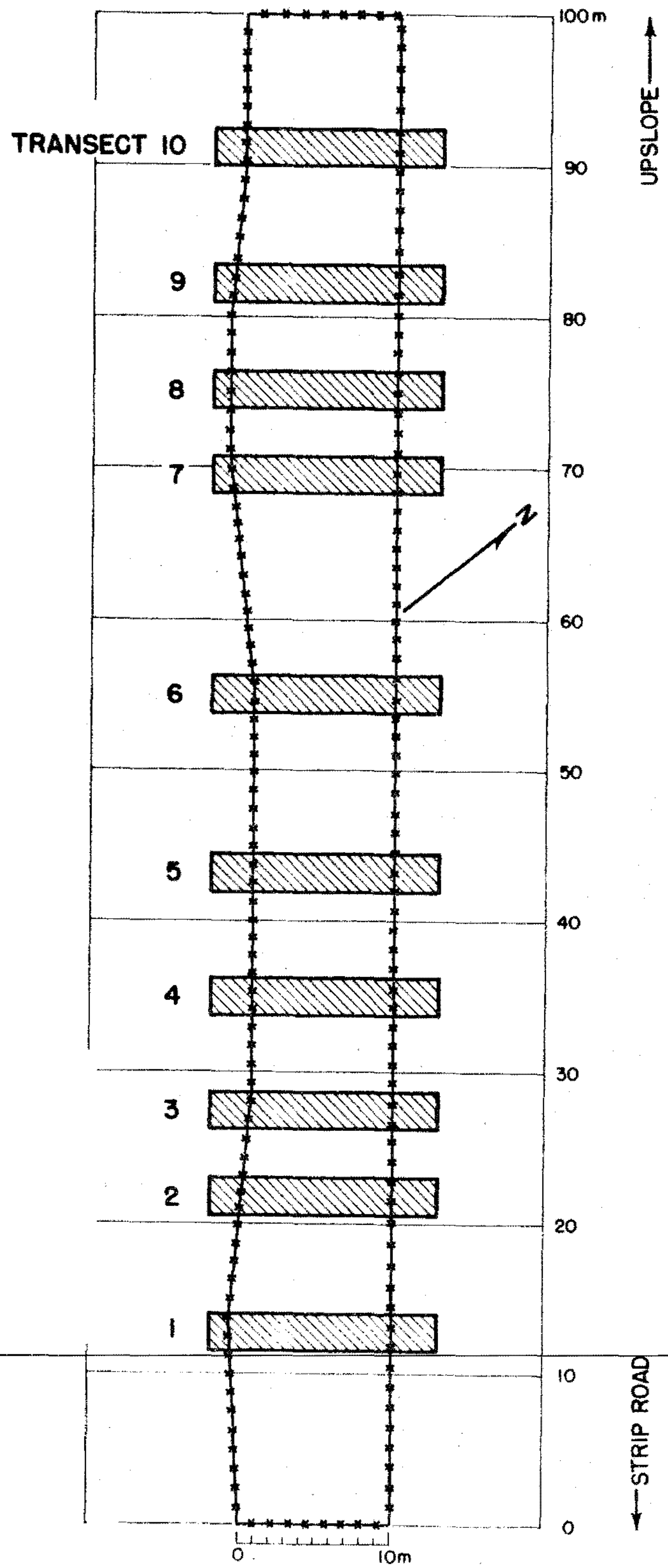

Fig. 2. Outline of goat exclosure and sample transects in mountain parkland at 1880 m (6200 ft.) elevation.

The height of each individual was also measured. Additionally their positions were mapped. The total sample includes 1058 enumerations inside the exclosure on 200 m^2 and 564 enumerations outside on 100 m^2.

Subsequently, the sucker heights were grouped into nine height classes as shown in Table 1 under RESULTS AND DISCUSSION.

Transects through unfenced koa colonies

In addition to the exclosure analysis, six other transects between 30 to 50 m long were established through unfenced typical koa colonies between 1,600 m (5,300 ft) and 2,000 m (6,600 ft) elevation. These were selected to represent all conceivable variations of goat damage now found in the tree stands in the mountain parkland. The transects were run in each case through the center of a koa colony outward through the fringing sucker belts into the surrounding grassland. Along these transects again all koa trees in a 2 m broad strip were counted, measured, and mapped. Each tree recorded was classified as either unbrowsed, browsed, broken or girdled by goats. Browsing was recognized by clearly visible goat-chewing marks on the sucker stems, by remnants of bitten-off foliage, and by freshly chewed branches. Broken-off woody stems apparently result in death of an individual and not in replacement with a new leader. Similarly, total girdling results in death. Such damages were classified as "dead" as were dead, still standing suckers. The measured koa individuals were subsequently grouped for the structural analyses into the same height classes as used for the exclosure.

RESULTS AND DISCUSSION

Exclosure transects: the contrasting koa reproduction trends

The mapped enumeration result of exclosure transect 7 is shown as an example

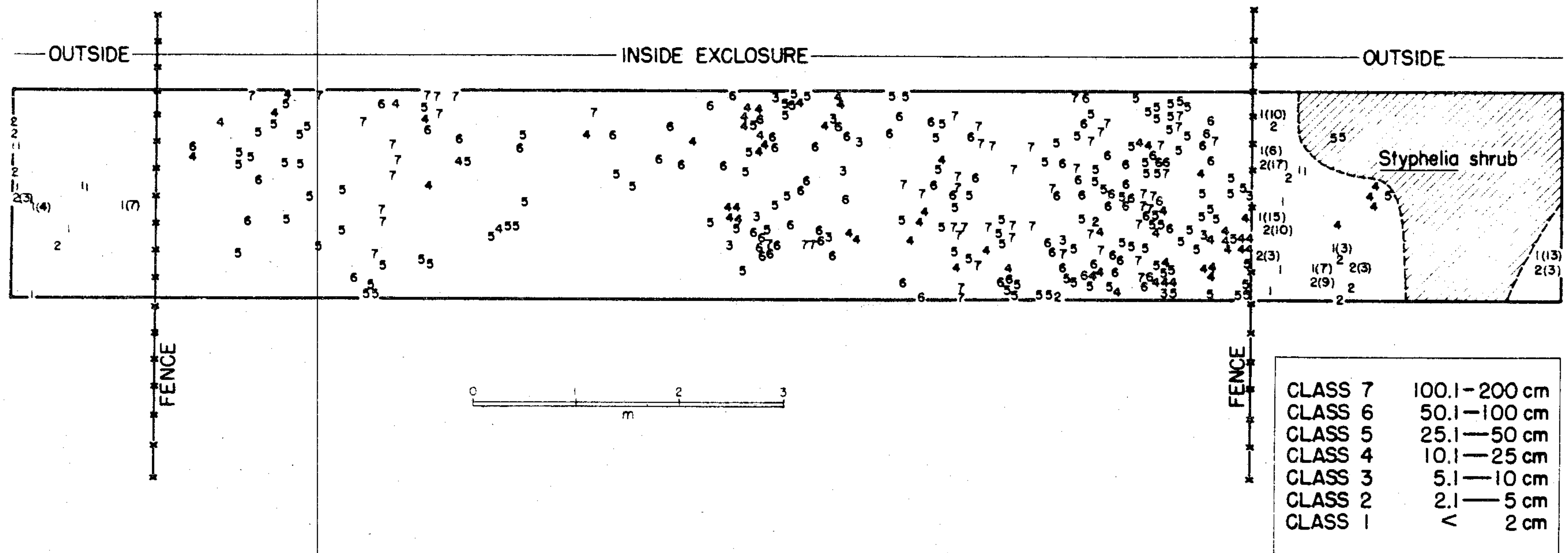

Fig. 3. Map of koa sucker distribution across the goat exclosure (transect 7 on Fig. 2). Size class numbers refer to sucker heights in cm. A figure in parentheses refers to number of suckers. For example, 2(17) means 17 koa suckers of size class 2 (i.e. between 2.1 - 5 cm tall).

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on Fig. 3.

A tremendous response to the three-year exclusion of goats (1968-71) is evident inside the fenced area. As seen on Fig. 3, the recovery inside the exclosure with koa suckers is primarily in terms of their size (height growth). Outside the fence, suckers are similarly abundant, but they are all very small. Most of them are under 2 cm tall. A few reach up to 10 cm height. Only within the protection of a Styphelia tameiameia (Cham) F. Muell. (Epacridaceae) bush a few seedlings were taller, up to 50 cm.

In contrast, all sizes between 10 cm to 2 m height are represented in the exclosure transect. The majority of koa suckers are between 25 cm to 1 m tall. Release from goat pressure by fencing in 1968 apparently resulted in an immediate height growth of the koa suckers that were present at that time.

The example of exclosure transect 7 is backed up by the other 9 transects. The total enumeration result is shown in Appendix 1. All 10 transects display the same general trend so that the average of these 10 can be used to clarify the contrasting reproduction pattern of koa in the presence and absence of goat pressure.

Table 1 shows the mean number of koa suckers for each size class. The number of koa suckers up to 5 cm height (size class 1 and 2) is very much greater outside than inside the exclosure. This trend converges in size class 3 (5.1-10 cm height) in which the number of koa suckers is almost the same outside and inside. The small size class trend is reversed in the larger size classes, from class 4 through 7 (10 cm - 2 m height), in which the number of suckers is very much greater inside the exclosure. In fact, no suckers between .5-5 m height were found outside the exclosure. The few suckers in size class 5 (25.1-50 cm) were badly browsed without exception. The number-trend converges again in size class 9 (5-10 m height) in which there are about as many suckers outside as inside the exclosure.

Table 1. Mean number of koa suckers per m^2 recorded in ten exclosure transects inside and outside the fenced area.*

Size class	Height limits	Number of koa suckers inside	outside
1	<2 cm	.07	2.83
2	2.1 - 5 cm	.25	1.96
3	5.1 - 10 cm	.50	.61
4	10.1 - 25 cm	1.03	.41
5	25.1 - 50 cm	1.67	.06
6	50.1 - 100 cm	1.29	0
7	100.1 - 200 cm	.40	0
8	200.1 - 500 cm	.02	0
9	500.1 - 1000 cm	.06	.04

* The data of all ten transects are shown in Appendix 1.

These large-sized suckers obviously were there before the exclosure was constructed. They show by their presence that goat-browsing pressure must have been less at this location several years ago. Even the few individuals in size class 8 (2-5 m tall) inside the exclosure may belong to this older, less-damaged sucker generation. However, the relatively great number of individuals in size class 7 inside and the absence of the same sized individuals outside, leaves little doubt that these 1-2 m tall suckers grew up immediately after the fence was built in 1968. Since their mean height is 1.5 m, the annual rate of height-growth of koa suckers is probably about 50 cm in this habitat when not browsed.

Thus, the structural pattern of vegetative koa reproduction with and without goat pressure seems clear from this study.

When severely browsed, suckers never reach a height of 50 cm. As shown by the very large number of small suckers (below 5 cm height), they remain cropped close to the ground. This situation may allow grasses to overgrow such places, and goats, if maintained constantly in high numbers, can thus totally eliminate koa trees from the mountain parkland by interfering with their reproduction cycle.

Undoubtedly, the koa trees reproduce outside the fence very vigorously. When a shoot growing upwards from a root is browsed by goats, the koa roots sprout more new shoots like a "hydra." But under high browsing pressure, few shoots have a chance to grow above 25 cm. Goats do not stay in the same place for very long. However, a number of goat herds roam throughout the mountain parkland. Thus, a koa sucker colony may remain unbrowsed for weeks or even months. But, thereafter the goats return, and they usually do not spare a single sucker among those that grew up in the meantime.

Transects through unfenced koa colonies: structural patterns reveal different goat pressures

Transect-profile through a typical koa colony

Fig. 4 shows a transect-profile through a typical koa colony in the mountain parkland. The transect-profile is drawn to meter-scale in length (30 m), width (2 m) and height (16 m). The senile tree in the center is surrounded by suckers that decrease in size outward. On the left side, 15 m from the center, sucker heights decrease abruptly from above 5 m to less than 2 m. This shows a disruption in colony development, which is not duplicated on the right side of the center. Here, at 15 m, sucker heights decrease more gradually. On both sides, most of the suckers under 2 m height are badly browsed, which is indicated by lack of foliage. The very small suckers under 10 cm are still herbaceous, but they are abundant on both sides. Thus, the profile diagram indicates goat browsing pressure across the entire koa colony. But the most intensive browsing occurs at the fringes, and here the left-side fringe obviously was more strongly affected in the recent past (about 2-5 years ago) than the right-side fringe.

The structural diagrams for six such koa colonies are shown on Fig. 5. Suckers were recorded in three categories, unbrowsed, browsed and dead. The three classes of suckers are shown separately by differently marked population curves. A fourth curve shows the total number (unbrowsed + browsed + dead) on each graph (Fig. 5). Koa suckers were grouped into the same height classes as used for the preceding exclosure transects and as shown in Table 1. Except a tenth size class was added which includes all trees larger than 10 m. The complete data for all six transects are given in Appendix 2.

The six graphs on Fig. 5 are arranged in order of increasing goat-browsing pressure. This is seen from the combination of curve-patterns on each graph.

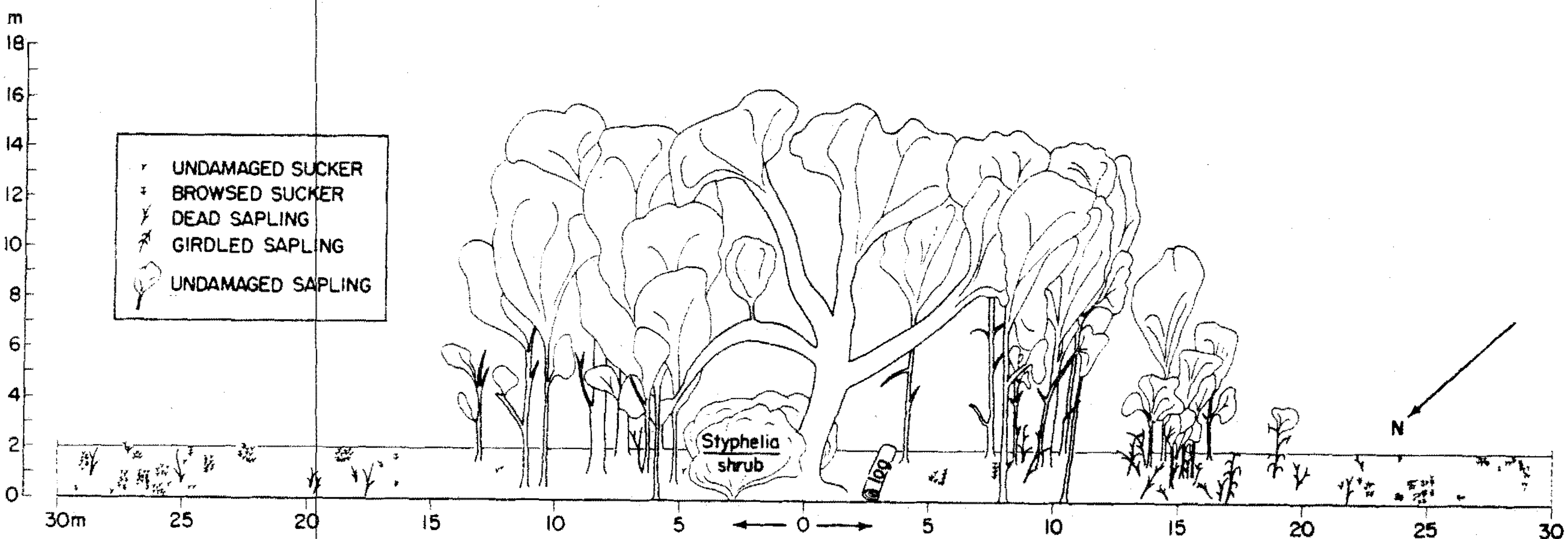

Fig. 4. Transect-profile through a typical koa colony at 1640 m (5400 ft) elevation in the mountain parkland ecosystem on the east-flank of Mauna Loa.

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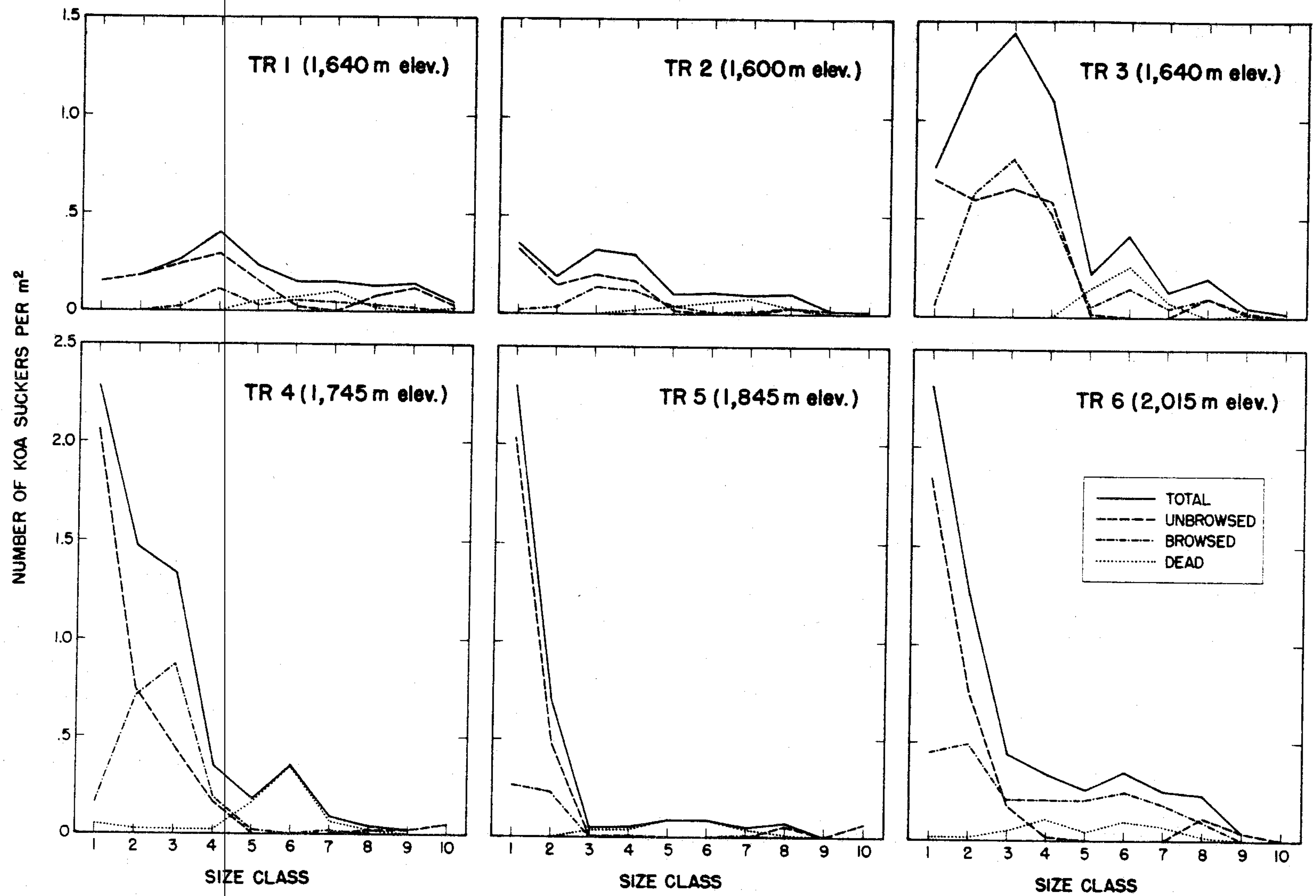

Fig. 5. Number of koa suckers per square meter in ten size classes along six transects (TR) through unfenced koa colonies.

to follow Fig. 4

Transect 1 with low goat pressure. Koa colony at 1,640 m (5,400 ft) next to Mauna Loa Strip Road.

The total curve, which includes all categories of suckers, shows an increasing trend up to size class 4. From then on, it decreases to size class 6. Thereafter, it remains relatively horizontal through the upper size classes. This means that the greatest number of suckers was between 10.1-25 cm tall (size class 4). Most of the smaller individuals below 10 cm (size class 1-3) grew freely without browsing damage. Therefore, there was no significant "hydra"-effect, which would otherwise increase the number of suckers in the small size classes. Only a few browsed individuals occurred below 10 cm. This indicates a near-absence of recent browsing pressure. However, while a good number of suckers were present in all size classes, the curve pattern shows that most of the individuals from .5-5 m height (size class 6-8) were either dead or browsed. Thus, goats did interfere with the reproduction cycle of koa temporarily. Live reproduction is entirely absent between 1-2 m (size class 7). Browsed suckers were found all through from 5 cm height on (size class 2) to 10 m (size class 9). Transect 1 is an example of low goat pressure in the mountain parkland. This koa colony is next to the IBP climatic station at the Mauna Loa Strip Road. The transect extends from the center of the colony outward to within 30 m of the road. The area is often frequented by people and goats visit the place less often. Goats did not feed here for the last 5 months prior to the analysis. Nevertheless, their activity prior to that time is manifested through nearly all sizes of koa reproduction.

Transect 2 with moderate goat pressure. Koa colony at 1,600 m (5,300 ft)

The trend for transect 2 is generally similar to transect 1. But, the higher number of browsed suckers below 5 cm height (size class 1 and 2) and the disappearance of unbrowsed reproduction between .5 m and 2 m height (size class 6 and 7) is indicative of a somewhat higher goat pressure.

Transect 3 with intermediate goat pressure. Koa colony at 1,640 m (5,400 ft) away from road

Still greater is the present goat pressure for transect 3. Already between 5-10 cm (size class 3) occur more browsed than unbrowsed suckers. But, the goat pressure can still be called intermediate because live suckers are present in all size classes even though they are all browsed from 25 cm to 2 m tall (size class 5-7).

Transect 4 with high goat pressure. Koa colony at 1,745 m (5,700 ft)

This transect is typical for a situation where the goat pressure has become really high. The very high number of koa suckers below 2 cm (size class 1) indicates what has been defined as "hydra" effect in this paper. Under high goat pressure, vegetative koa reproduction is higher than under low pressure, but only because more sprouts come up directly from the adult koa roots where one sprout is clipped off. Trampling and direct injury of surface roots may also be responsible for the same symptom.

Between 5 and 10 cm (size class 3) the number of browsed suckers is already much greater than the number of unbrowsed ones. There is no unbrowsed reproduction between 25 cm to 2 m height (size class 5-7) and most individuals are dead in this size range. Indeed, many dead trees in this size range are a sad reminder of a reduced goat population several years earlier.

Transect 5 with extremely high goat pressure. Koa colony at 1,345 m (6,100 ft)

This transect shows extremely high goat pressure. In all previous transects, the number of browsed suckers increased from <2cm to 10 cm (size class 1 to 3). In transect 5, even the number of browsed suckers decreases with increasing height. Reproduction is totally absent between 25 cm and 1 m height (size class 5 and 6), and only a few browsed individuals occur between 10 cm and 2 m height (size class 4-7). Most of what was still present in koa reproduction from 10 cm to 2 m height, was dead.

Transect 6 with past low and recently very high goat pressure. Koa colony at 2,015 m (6,650 ft)

A special case is presented with transect 6. The area through which this transect was run, was protected for many years by a fence. Recently, the goats broke in, because the fence was out of repair. Their influence is strongly reflected in the curve pattern. The clearest manifestation of severe goat browsing and trampling is shown by the very high number of small suckers (<5 cm, size class 1 and 2) and by the relatively high number of browsed suckers in all size classes up to 5 m (size class 1 through 8). There are currently still many more living than dead trees. The goats have not been feeding long enough to destroy all reproduction that was established during the years of protection. However, there are already no more unbrowsed trees between 25 cm to 2 m height (size class 5-7). After one or two years, almost no tree will survive if the present goat pressure continues.

General goat pressure in mountain parkland

Fig. 6 shows the average trend of the six koa colony transects. This is here contrasted to the koa reproduction pattern recorded next outside the 1968 goat exclosure and the pattern found inside. It is seen that the goat pressure outside the exclosure is slightly more severe than found generally in the mountain parkland ecosystem. It is possible that the vigorous koa reproduction inside the exclosure forms an attraction to goat herds and thus results in a concentration effect next outside the exclosure.

However, the average curve for unfenced koa colonies shows a remarkable

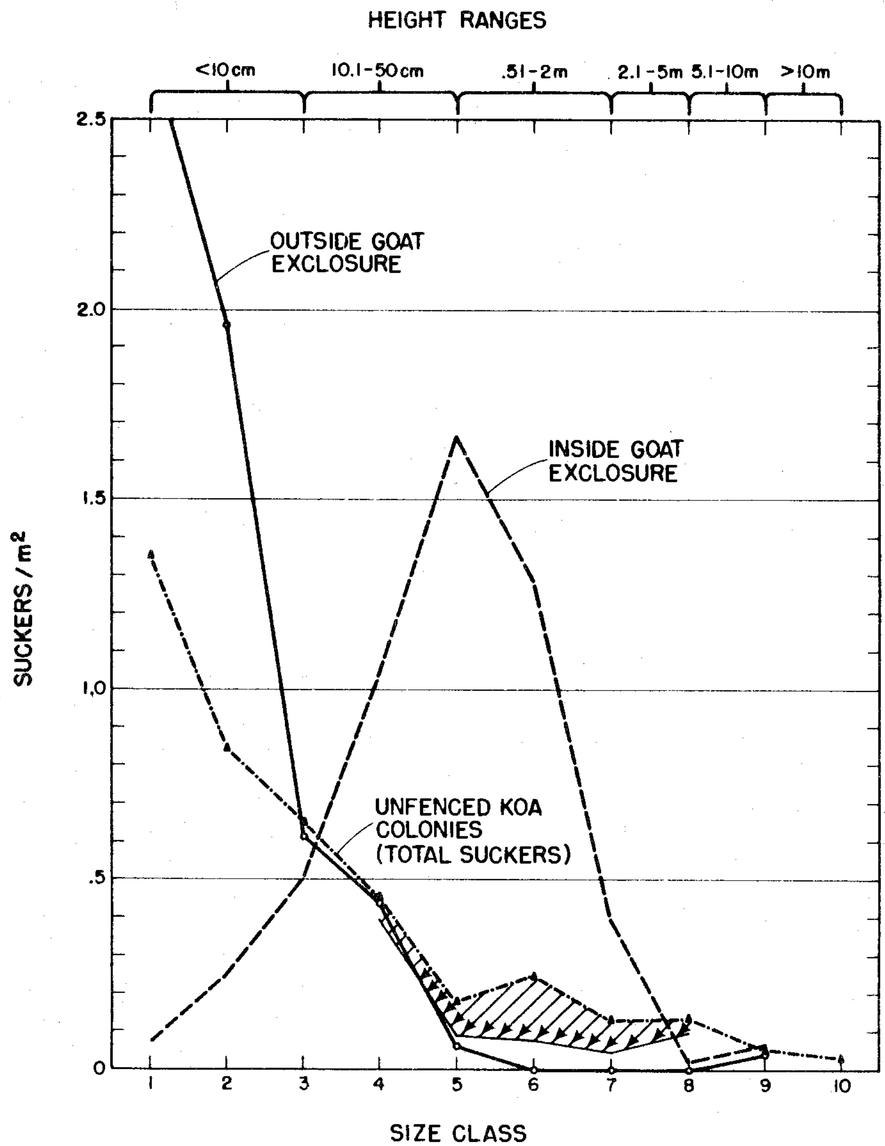

Fig. 6. General population structure-trend of unfenced koa colonies as compared to koa development inside and outside the goat exclosure. The arrows indicate recent die-back among the 25 cm to 2m tall koa reproduction by pointing to the amount of survivors left in this size group.

resemblance to the outside-exclosure curve, and both contrast markedly to the inside-exclosure curve.

Since each koa colony was selected for studying the range of variation from low to high goat pressure now existing in the mountain parkland, one may question the validity of the average curve. However, from the widespread goat damage now apparent wherever one walks through the mountain parkland, the average curve may be regarded as giving a conservative estimate. The average curve contains live and dead suckers. Between 25 cm and 2 m height (size class 4-8) , many suckers were dead at the time of the survey (September 1971), but still standing. This recent die-back is indicated on Fig. 6 by arrows pointing to the presently surviving suckers. This die-back trend is fast approaching a total disruption of koa reproduction under the present goat pressure in the mountain parkland.

CONCLUSIONS

Reduction of goats will allow maintenance of koa in the mountain parkland ecosystem. But the entire structure of the mountain parkland vegetation is affected even by a low level of goat population, because clipping of herbaceous root suckers and trampling produce too dense a koa stand which likely will become stunted. In times of high goat pressure, the entire reproduction cycle of koa is interrupted. If such high levels of goat presence are allowed to perpetuate, the koa stands will become senile and the remnant trees will eventually die a normal physiological death as is presently demonstrated in the parallel ecosystem on Mauna Kea (Mueller-Dombois and Krajina 1968), where cattle interferes with the reproduction cycle of koa.

As known from Rudge and Smit (1970), goat populations that are periodically cropped or controlled, can more than double every two years. Therefore, an occasional reduction of goat populations will result merely in an increased reproduction rate of the goats. This management practice will perpetuate this ecosystem in an unstable condition.

If recovery of this earlier cattle-grazed area by native plants is to be continued to achieve a stable natural balance soon, the goats will have to be exterminated and the whole area must be fenced.

Koa can find right reproductive circumstances only when the goats are removed totally. Then, koa can reproduce without artificially imposed fluctuations. Stand density will be less, leaving space for other native species. Natural koa stands will redevelop in a pattern that was shaped through island ecosystem evolution.

Appendix 1. Number of koa suckers per square meter, inside and outside the goat exclosure

	Height class																	
	1		2		3		4		5		6		7		8		9	
Transect	in	out	in	out	in	out	in	out	in	out	in	out	in	out	in	out	in	out
1	0	1.32	0	0.09	0.11	0	0.27	0	0.05	0	0	0	0	0	0	0	0	0
2	0.26	3.27	0.74	1.27	1.21	0.91	0.95	0	1.11	0	0.42	0	0.21	0	0	0	0	0
3	0	0.83	1.17	0.08	0.78	0.08	1.11	0	1.55	0	1.11	0	0.11	0	0	0	0	0.17
4	0	1.50	0	0.25	0	0.25	0.11	0.08	0.17	0	0	0	0	0	0	0	0.33	0
5	0	2.67	0.05	2.15	0	0.34	0.22	0	0.49	0	0.43	0	0.05	0	0	0	0.11	0
6	0.22	2.42	0.11	0.75	0.72	0.08	2.00	0.08	2.00	0	0.83	0	0.05	0	0	0	0	0.08
7	0	6.02	0	6.70	0.33	2.27	1.98	0.68	5.42	0.57	4.71	0	2.69	0	0	0	0	0
8	0	2.63	0.09	2.00	0.55	0.63	1.14	0.50	2.45	0	2.23	0	0.23	0	0	0	0	0.13
9	0.05	5.54	0.28	4.52	0.61	0.68	1.14	0	1.84	0	1.51	0	0.38	0	0.19	0	0	0
10	0.20	2.10	0.05	1.80	0.65	0.80	1.15	0	1.60	0	1.60	0	0.15	0	0.05	0	0.15	0

Appendix 2. Number of koa suckers per square meter along six transects through unfenced koa colonies

Height class	Height limit (cm)	Transects 1 u*	1 b	1 d	1 t	2 u	2 b	2 d	2 t	3 u	3 b	3 d	3 t
1	< 2	0.15	0	0	0.15	0.33	0.02	0	0.35	0.70	0.06	0	0.76
2	2.1 - 5	0.18	0	0	0.18	0.15	0.04	0	0.19	0.60	0.63	0	1.23
3	5.1 - 10	0.24	0.02	0	0.26	0.20	0.14	0	0.34	0.66	0.81	0	1.47
4	10.1 - 25	0.29	0.11	0	0.40	0.17	0.11	0.02	0.30	0.59	0.52	0	1.11
5	25.1 - 50	0.15	0.03	0.05	0.23	0.02	0.04	0.04	0.10	0.02	0.05	0.15	0.22
6	50.1 - 100	0.02	0.06	0.07	0.15	0	0.01	0.10	0.11	0	0.15	0.26	0.41
7	100.1 - 200	0	0.05	0.10	0.15	0	0.01	0.08	0.09	0	0.05	0.08	0.13
8	200.1 - 500	0.08	0.03	0.02	0.13	0.03	0.03	0.03	0.09	0.10	0.10	0	0.20
9	500.1 - 1,000	0.12	0.02	0	0.14	0.01	0	0	0.01	0.02	0.03	0.02	0.07
10	> 1,000	0.03	0	0.02	0.05	0.01	0	0	0.01	0.02	0	0	0.02

* u = unbrowsed d = dead
b = browsed t = total

Appendix 2. Continued

Height class	Height limit (cm)	Transects 4				5				6			
		u*	b	d	t	u	b	d	t	u	b	d	t
1	< 2	2.08	0.16	0.05	2.29	2.03	0.27	0	2.30	1.85	0.45	0.02	2.32
2	2.1 - 5	0.74	0.71	0.02	1.47	0.49	0.23	0	0.72	0.76	0.49	0.02	1.27
3	5.1 - 10	0.44	0.87	0.02	1.33	0.01	0	0.04	0.05	0.18	0.21	0.05	0.44
4	10.1 - 25	0.16	0.19	0.02	0.37	0	0.01	0.04	0.05	0.02	0.21	0.11	0.34
5	25.1 - 50	0	0.02	0.16	0.18	0	0	0.09	0.09	0	0.21	0.05	0.26
6	50.1 - 100	0	0	0.35	0.35	0	0	0.09	0.09	0	0.25	0.10	0.35
7	100.1 - 200	0	0.02	0.07	0.09	0	0.01	0.04	0.05	0	0.18	0.07	0.25
8	200.1 - 500	0.02	0	0.02	0.04	0.06	0	0.01	0.07	0.11	0.10	0.02	0.23
9	500.1 - 1,000	0.02	0	0	0.02	0	0	0	0	0.04	0	0	0.04
10	> 1,000	0.05	0	0	0.05	0.07	0	0	0.07	0	0	0	0

* u = unbrowsed d = dead
b = browsed t = total

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