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A Study of the Beaver (Castor canadensis mexicanus)
in Big Bend National Park, Texas

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Abstract- The beaver of the Rio Grande River, Castor Canadensis mexicanus, in Big Bend National Park show ^{limited} sign of competition with the introduced halophytic species, Tamarix pentandra, salt cedar, or tamarisk. This species did compete with riparian vegetation, Salix sp., Baccharis sp., Phragmites communis, but in limited context where fire or flood left open areas where this hardy species could take seed. It was found that in some areas the beaver were using the seedlings as a food source, but not enough to affect tamarisk population. The parks population of Cottonwood Populus fremonti(?) is limited. The genus populus is a preferred food species of the beaver, in general, and there was only one area where the beaver did recent damage. Two other cottonwood stands were noted, one with seedlings. Population of the beaver seemed to be small for that large of an area, ca. ninety-four ^{individuals} in a 172 km area of the river. Activity was limited, yet steady in that no one area was obviously inhabited by a ^{large} colony of beaver. Activity consisted of digging, tracks, and cuttings. It is not yet known whether trapping is a variable in Big Bend beaver populations.

Key words: Tamarisk, Populus fremonti, colony, activity areas, burrows, willow.

Introduction

The Southwestern subspecies of beaver, Castor canadensis mexicanus has made several previously unnoted adaptations to the Chihuahuan desert habitat along the Rio Grande River. These beaver dig burrows rather than build lodges, in response to the size and unpredictability of periodic flooding of the river.

Tamarisk, Tamarisk pentandra, an introduced tree common along the Rio Grande, was brought to the Southwest from Europe. (ca. 1913, a letter from Geo. Kinne dated May 28, 1943, on file at the New York Botanical Gardens suggested that Tamarix sp. was introduced to the Southwest from Africa.) Tamarisk concentrates salts, having a high water requirement (Berry, 1971), and tends to replace the native plants in the riparian vegetation. It was feared the beaver would be forced out if the tamarisk became too abundant. The beaver, we found will inhabit these tamarisk-dominated areas and even feed on the young tamarisk.

Populus fremonti, and other cottonwoods exist in small numbers in the park. Bailey (1927), found cottonwood a preferred beaver food.

Study Area

The Rio Grande River flows along the southern border of Big Bend National Park, bordering Mexico and the United States (Fig.1). The U.S. side was used for livestock grazing and farming prior to the opening of the park in 1944 (Waver,1973). At present the park is experiencing problems with trespass livestock from Mexico. The river flows through 172 km of the park. A raft trip from Cottonwood Campground to Rio Grande Village constituted 90-100 km. Thirteen km of the river from Hot Springs to the beginning of Boquillas Canyon was studied intensely before the raft trip to understand population and food habits more thoroughly (Fig.2). The average width of the river in the park is thirty meters, with a water depth of less than one meter during the month of January. The wettest months are May through October with September recording the highest average precipitation (Wauer,1973). During heavy rains the river has been known to rise six meters in less than twenty-four hours. The river is always muddy with very little visibility beneath the surface of the water. Areas with cottonwood trees were looked at more closely, specifically at Santa Elena crossing, 0.2 km past Black Dike, and near Johnson's Ranch on the Mexican side(Fig.1).

Methods

The three week study was done during the month of January. It consisted of a raft-trip eighty km long, and a more intense study on two beaver colonies in the Rio Grande Village and Daniel's ranch areas (Fig.1,2).

The raft-trip was to study activity areas and to estimate the total population of beaver in the area. Territories were considered, ca. 0.8 km in length, (Aleksink, 1968), with the center 0.4 km, being the main activity area. When an activity site was encountered, we considered that as the nucleus of the entire territory. . . . 0.2 km before and after that site of 0.4 km would also be considered territory even if no activity or tracks were seen. In this way, different territories have less chance of overlap when activity seemed steady ~~or~~ with areas of non-activity inbetween, ^{that continued} for several kilometers. Activity, we define as areas with felled trees, digging, tracks, a scent mound, or a burrow. Tracks without any other "activities" nearby were not considered activity areas.

Colony size was estimated from the amount of activity seen plus a error percentage for the activity not seen. For example, the stand of willows cut down between Daniel's ranch and Rio Grande Village was counted as ninety-seven, twenty year old willows. We estimated that colony to be four (plus or minus two) individuals. In Northern Michigan, stumps were counted for a family of six to be 100 trees, six and a half cm in diameter for a winter supply (Bailey, 1927). The Rio Grande beaver colonies appear to be smaller because the Michingan beaver cut trees and store them

for winter with probably much more waste. The beaver in Big Bend since they have no food caches, due to the warmer climate, cut what they want for one night only. One small aspen (2.5 cm in diameter), was found sufficient for one night for a captive beaver. In the wild, much less bark is required because of other food sources available (Bailey, 1927).

The more intense study of a beaver colony was conducted from Hot Springs to Boquillas Canyon, ca thirteen km. This area was rafted and travelled by foot to get maximum activity data. Burrows, scent mounds, tracks, and cuttings were noted to lay out precise boundaries and colony sizes (Fig. 2).

Cottonwood stands were studied for seedlings and cuttings along with tamarisk. Each vegetation type was recorded in response to activity sites and burrows. Measurements between burrows were estimated by eye on the raft trip, and measured accurately between the two colonies between Daniel's Ranch and Rio Grande Village.

Activity

Beaver sign is evenly distributed throughout our study area. There is only two areas of concentrated feeding activity; an area before Daniels Ranch and an area past Johnsons Ranch.(Fig.1). All other activity areas show no concentrated feeding besides scattered diggings, tracks, scent mound, or occasional cut or girdled willows.

We estimate a total of forty-one activity areas in a 113 km. stretch of the river. Activity is most concentrated in the Johnson Ranch area.(Fig. 1; 13). The least active area is from Petits to Mariscal Canyon, where the vegetation seemed no different than areas of medium activity; reed, willow, and tamarisk, in order of dominance.(Fig. 1; 25,26).

A trend in activity sites is the ^{general} lack of beaver in Tamarisk dominated areas. In the area before Talley, when the vegetation becomes mostly tamarisk on the Mexican side and a fire has left Nicotina glauca, and some reeds on the American side, there was no activity. Of forty-one activity sites twenty-three were located in willow dominated areas. This follows since the staple tree used as food was the willow. Eight sites were located in reed dominated areas which ^{seemed to be} the preferred burrow habitat of the beaver in the park. Eight sites were also noted in tamarisk dominated areas. No activity was found in a complete tamarisk community, although it was found in almost complete tamarisk areas.

Burrows

Many burrows were located along the river in our study area (Table 1). The preferred area for beaver to locate their burrows was in deep fast water, often located in a slight bend in the river where the current had made water depth *greater* than the immediate area. The Johnson Ranch area, (#13), for the entire length was slow moving and an average of one meter deep. In this area were six burrows. We were unable to identify the active from the inactive burrows, ^{since they were all in usable condition.} Johnsons Ranch and three other activity areas were the only areas where we found burrows located in slow moving water. Most of the burrows were observed from a moving raft and it was not possible to determine the active from the inactive burrows. Beaver colonies usually have more than one lodge or burrow, which are used in emergency situations or when the pregnant female chases the yearlings and male from the lodge just before giving birth in late winter or early spring. (Bailey, 1927). It was not uncommon to see more than one burrow in a beaver colony.

There is a trend in preference of burrows located in the base of common reeds. Of nineteen burrows identified as active, ten were located at the base of common reeds. This reed is abundant along the edges of the river and affords protection when the beaver pull the shoots down over the openings to help conceal the burrow entrances. Six active burrows found were not located in reeds.

Vegetation

Willow- The willows constitute the biomass of the vegetation and consequently the major source of the beavers diet. But in twenty-one recorded cases of our study, the willows were passed up for sedges and in some cases tamarisk. Two willow species were noted along the river, Seepwillow Baccharis sp., and Salix sp.. The Salix species was the only willow utilized by the beaver. Salix loses its leaves during the winter while Baccharis maintains its leaves. ^{Willow} Leaves and growing tips in the summer months is a main food source due to the high protein available to the beaver (Aleksiuk, 1970). Aleksiuk reported that in the winter months the beaver lowered its food intake and relied entirely on the stored food from the fall, which consisted of bark from branches. Due to the climate in Big Bend, the beaver do not store food. Since tree growth is slowed down and some willows lose their leaves, the beaver seem to favor the sedges along the river when available. The willows are common throughout the river's length, except in areas such as Mariscal canyon or other rocky or exceptionally sandy areas. Of forty-one activity areas, twenty-three were willow dominated, nineteen of these areas showed no other activity other than feeding on willows.

Sedges- Sedges, Cyperaceae sp. are common in areas where the reeds have receded far enough to allow sufficient light. On every occasion that this species was seen, beaver were found to be feeding on it. The beaver seemed to enjoy this non-woody plant more than the other grasses and composites. We suggest that this species be studied for overgrazing, and the extent of its use in seasons other than winter.

Cottonwood- The only cottonwoods found that the beaver were utilizing were the cottonwoods at the Santa Elena Crossing-Costolon area. These large trees have no seedlings, and over half of the stand covering approximately five square hectares, are girdled. Of nineteen cottonwoods, eleven are girdled or cut down by the beaver. The larger trees had a diameter from 1.35-2.62 meters. and the smaller, 1.0 meters in diameter. Trees this large are of little food value to the beaver for several reasons. It takes a beaver nearly a week to cut down a tree of this size, and often only a portion of the tender stems were within reach. The lower bark on trees this big are too tough for the beaver to be able to use for food. These trees in particular were of little use because only one tree was cut down and the rest were just girdled. These trees were located 50-100 meters from the water and the distance from the water made it hazardous for the beavers to use except in times of high water.

The other cottonwoods stands are untouched by the beaver. One stand is on the Mexican side near Johnsons Ranch and has no seedlings (Fig. 1). This area is used extensively by livestock. The other cottonwood stand is 0.8 km from Black Dike on the U.S. side. This area is a bit more protected from livestock (although not excluded from them), and has a substantial number of seedlings. We suggest that livestock may have more effect on lack of cottonwood seedlings than the beaver. Livestock grazing should be studied. The cottonwoods in the Costolon area should be protected either by wire around their base or use of beaver repellent (Huey, 1956).

Tamarisk- Tamarisk, or salt cedar, has the potential of becoming a serious pest in the Southwestern United States, and some states have already taken action against tamarisk (Hughes, 1966). Its common occurrence is from the environmental instability of vegetation removal, dams, irrigation and most other changes in the environment that are common in the Chihuahuan desert. The tree is salt and draught resistant which makes it a hardy competitor. Tamarisk has a greater fire danger, and can unpredictably fluctuate ground water level noticeably. Tamarix gallica, the evergreen species and other tamarisk species secrete mainly sulfates of sodium and calcium with some sodium-chloride (Denaeyer, 1947). Berry (1971) found that controlled plants can hold a fifty fold increase in salt concentration over the concentration in the nutrient solution.

Of forty-five found burrows, three are located in tamarisk dominated areas. Of fifty-one feeding areas, eight of them occurred in tamarisk dominated regions. Tamarisk is dominant in relatively few places, but is sub-dominant and common throughout the riparian vegetation. Since beaver were not found in many tamarisk dominated areas this suggests that tamarisk control the beaver territories by causing the beaver to seek better areas.

In a small amount of areas are sandy shores exposed by low water. These in most cases, contain large stands of tamarisk seedlings of 0.5 to 1.0 m tall. Several of these beaches had beaver tracks leading to the seedlings, and some of the seedlings had been snipped off near the base. These cuttings were found in the water with what appeared to be all of their leaves and

bark still intact. But when compared to standing seedlings, we noticed that the very smallest branches and leaflets ^{at the base of the plant} had been snipped off and apparently eaten.

We found that tamarisk seedlings are eaten even when other food sources are available and apparently just as "easy" to get to as the tamarisk.

One situation in which beaver shy away from tamarisk is when the tamarisk trees are large and old, and have completely overrun a sizeable stretch of land (from 5-20 hectares). Several cases of porcupine Erethizon dorsatum, were noted having eaten bark from large tamarisk. The high salt content of the tree would seem favorable to the porcupine, since they are noted for seeking out salt from other sources (Burt, 1975). Apparently

← tamarisk is a supplementary food source for the beaver

A case of beaver eating tamarisk bark, was a small branch ca. 10 cm. in diameter and 1 m. in length. This specimen is on file at the park. Three large tamarisks were cut down by the beaver in different parts of the park, but we are in doubt if the beaver ate any of the bark from these trees, even though we found several branches cut from the main trunk. The beaver near Hot Springs (38), were eating the tamarisk roots, and rhizomes.

We do not conclude that the tamarisk is a staple food source for the beaver. We believe that the beaver prefer it second to willow and sedges, and only stress factors should they use it regularly. Since its nutritive value is unknown, little more can be guessed about the actual preferences. We suggest that the young tamarisk parts as described, do not contain

concentrated salt substances that Berry (1971) found in his studies.

Beaver adapting to food scarcity was observed in Mariscal Canyon. Activity was scarce, and the estimated population in the canyon is three (Fig., 27). The dominant plants in this particular area were Nicotina glauca, Acacia constricta, and Gramineae spp. The tobacco tree plant, Nicotina glauca, and the grasses, Gramineae spp. were sporadically throughout the study area, but acacia was eaten only in the canyon. Although acacia is limited in the canyon due to poor substrate, we noticed one instance where one beaver had been feeding quite extensively on this species for a short distance of 200 meters.

Population

Most areas of beaver activity seem to be in less use than the "normal" beaver colony would show (Brenner, F.J., 1962; Morgan, 1868; Rue, L.L. 1964; Seton, E.T., 1953). The Mexican beaver territories may be slightly larger, and litter sizes smaller to accommodate the harsh conditions of the Chihuahuan desert.

The "average" beaver colony consists of two adults, two yearlings, and three to six kits (Bailey, 1927). When the female is ready to give birth to the kits, the male and yearlings are forced out of the lodge or burrow until the kits are several weeks old (Brenner, 1962; Seton, 1958). Only at Johnson's Ranch did there seem

to be this complete family unit, as other areas had scattered and brief activity in their territories. Panov (1967), found that in the U.S.S.R., beaver population growth is limited by weak forage reserve and the negative effect of cattle grazing in riparian areas. This may be one reason why there appears to be low colony sizes in the park. Due to lack of time, the effects of trapping by the Mexicans, or predation on beaver could not be determined.

Estimated population of beavers in our study area was ninety-four individuals with a maximum of 125-165 individuals. This is an average of approximately two per colony with a maximum of four per colony, with local fluctuation (See Table 2)

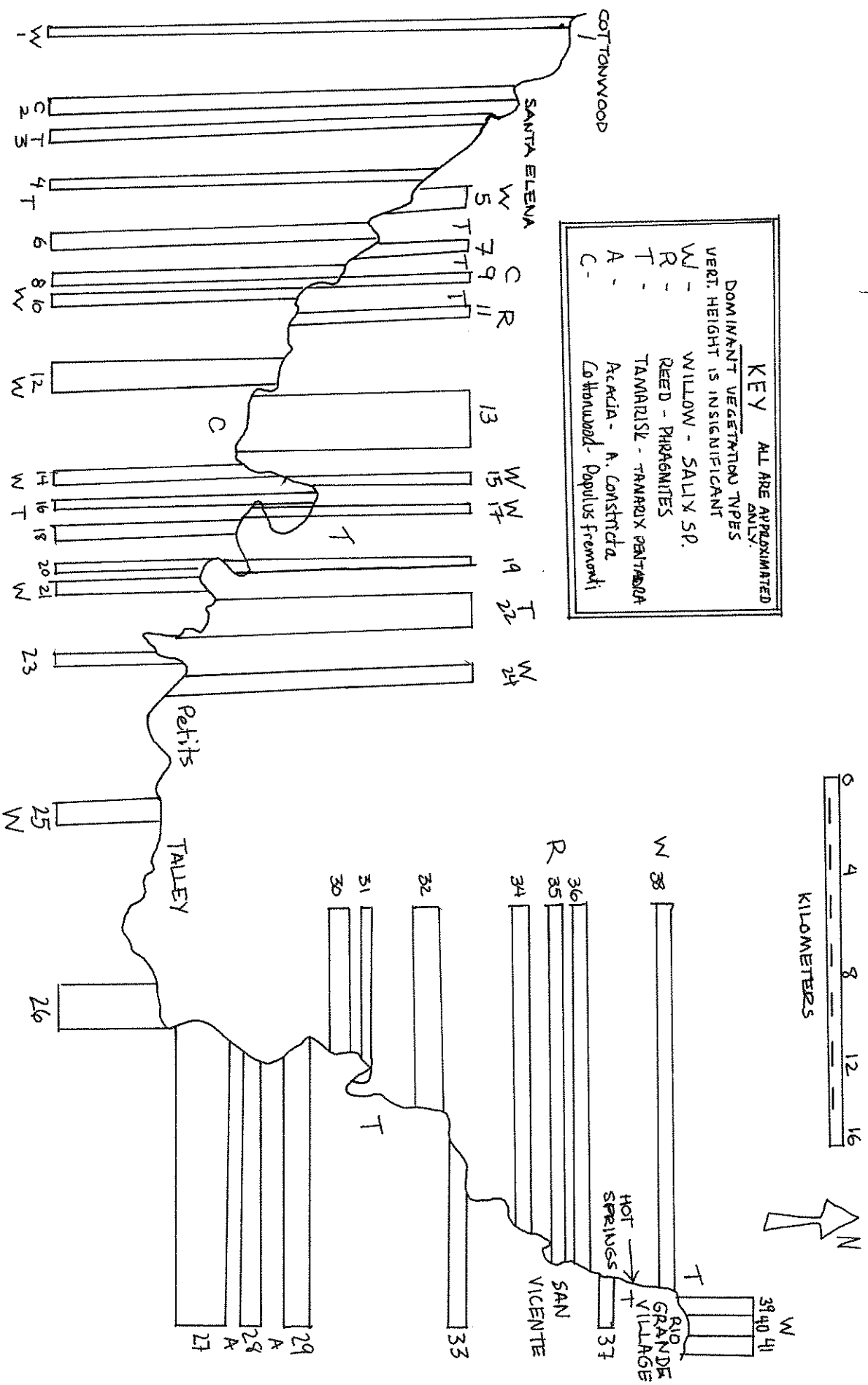
We find there is little danger in the immediate future to beaver populations from vegetation changes in Big Bend National Park. The status of trapping however was not studied and therefore little is known about it's effects on the beaver. They are able to co-exist with certain amounts of tamarisk, although more research needs to be done to find tolerance levels to this introduced halophyte.

The beaver are eating lightly and selectively, so that they are not yet leaving large areas exposed and susceptible to the hardy tamarisk seedlings. If tamarisk populations maintain the present density, we believe beaver populations will continue to be healthy as long as the present environment of the beaver is unaltered.

Affects of human interaction- Beaver were active near or within many of the river campgrounds, indicating their ability to withstand certain levels of human interaction. Since they are chiefly nocturnal, they may feed without interference from many campers. However, in the Rio Grande Village area, a beaver colony was in

competition with man in willow cutting (Fig.1,40). The human cutting was not campers cutting wood for firewood, but for other reasons, due to the large trees cut, the amount cut, and the inaccessibility to the normal camper that camps in the Rio Grande Village. It apparently was Mexicans cutting wood for building materials. If the rate of cutting that we observed continues in this area, the beaver will have to seek other food sources within the next year. From our observations man and overgrazing seem to effect the beaver more than anything else.

FIG 1, Beaver (*Castor canadensis mexicanus*) activity areas, Big Bend Nat'l Park, Texas, January 1976.



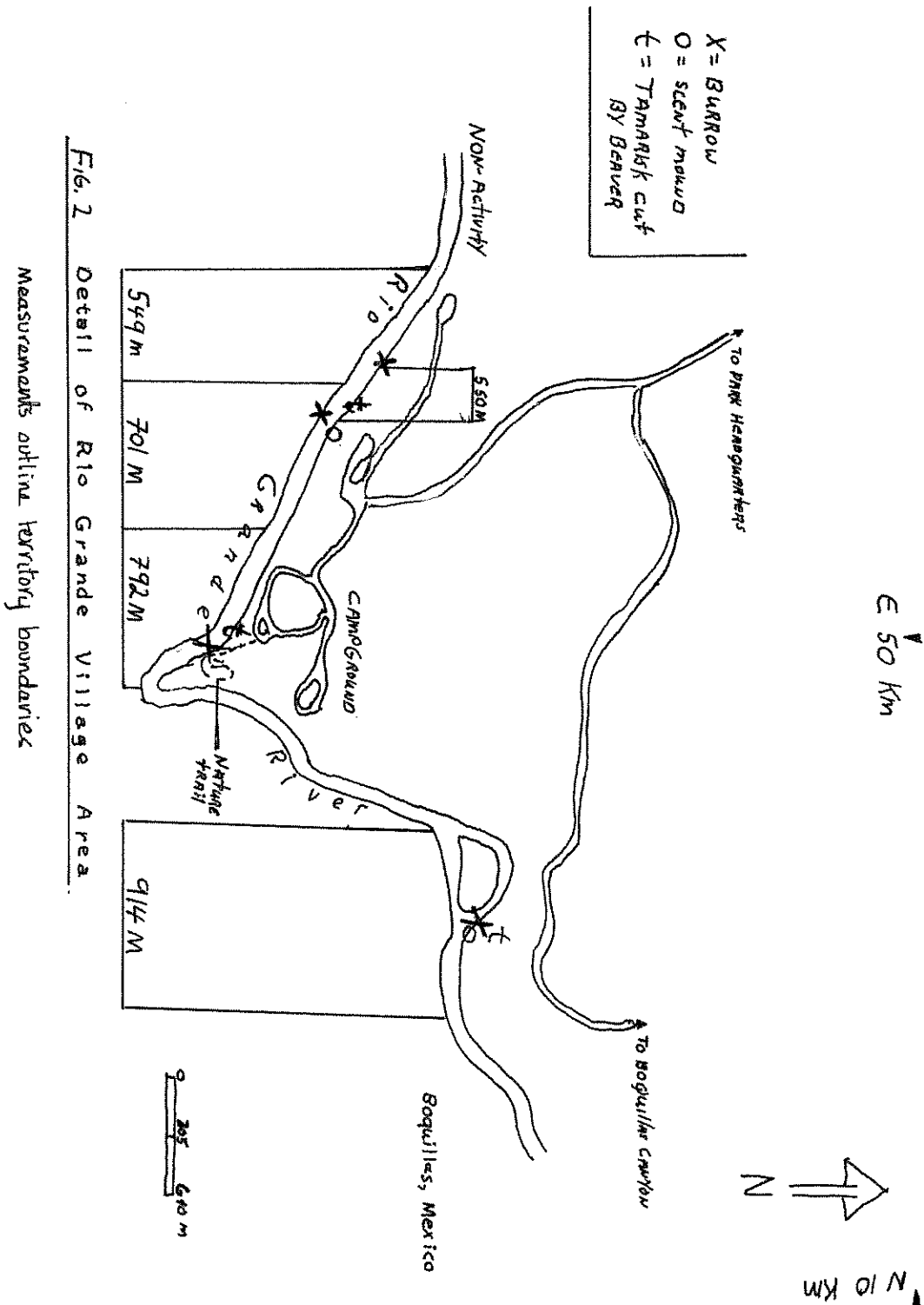


Fig. 2 Detail of Rio Grande Village Area.

Measurements outline territory boundaries

Table 1

Food Species of Castor Canadensis mexicanus
in Big Bend National Park, Texas

<u>Salix</u> sp.	<u>Nicotina glauca</u>
<u>Cyperaceae</u> sp.	<u>Populus palmeri</u>
<u>Tamarix pentandra</u>	<u>Gramineae</u> sp.
Mormon Tea	<u>Phragmites communis</u> (?)
<u>Populus fremonti</u>	<u>Compositae</u> sp.
<u>Acacia constricta</u>	

Table 2

Burrows, dominant vegetation, and estimated population
per colony, Big Bend National Park, Texas

The letters for vegetation types correspond with those on Fig.1
and 2, W=willow, T= tamarisk, C= cottonwood, A= acacia, R= reeds.

Activity site	<u>Dominant vegetation</u>				Burrow	Population/area
	W	T	R	A		
1	x				x	4
2	x				x	1
3		x			x	1
4	x					2
5	x				x	3
6		x				2
7		x				1
8		x			x	3
9	x					4
10	x				x	2
11			x			1
12		x				3
13	x					4
14	x					8
15	x				x	1
16		x			x	2
17	x					1
18		x			x	1
19	x					3
20	x				x	4
21	x				x	5
22	x					3
23	x					1

table 2 continued

Activity site	Dominant vegetation				Burrow	Population/area
	W	T	R	A		
24	x					3
25			x		x	1
26				x	x	2
27				x	x	1
28	x				x	4
29			x		x	1
30		x			x	2
31		x			x	2
32			x		x	2
33	x				x	1
34		x			x	3
35	x				x	1
36			x		x	1
37			x			2
38		x				1
39	x					3
40		x			x	2
41			x		x	2
total population						<u>94</u>

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