INTRODUCTION

A growing beaver (Castor canadensis) population and subsequent resource damage have become a problem in much of the southeastern United States, including Texas (Woodward 1983; Ramsey and Wade 1986). Beaver numbers are high, especially in the eastern third of Texas, and their range is expanding (Ramsey and Wade 1986). According to Ramsey and Wade (1986), damage is severe in eastern parts of Texas, and beaver control is legal year round.

Damage values associated with beaver activities have been estimated for parts of the U.S. and Texas. Woodward (1983) reported that the estimated value of damage (including value of finished wood products) on 400,000 hectares in the southeastern U.S. exceeded four billion dollars during the last 40 years. The Texas Agricultural Extension Service estimated that beavers caused $34 million in damage during 1994 in a 42-county area in the eastern third of the state (Douglas 1995; Upshaw 1995). The U.S. Department of Agriculture - Wildlife Services Program in Texas reported $2.4 million in beaver damage in its State Damage Summary for beavers for the period October 1996 through September 1997 (Anonymous 1996).

When Texas Wildlife Services Program personnel remove beavers from damage sites, landowners are urged to monitor their property to minimize additional damage by reinvading beavers. Many times landowners do not monitor their property after beavers are removed. Population dynamics help explain why monitoring is important. As numbers of beavers within colonies increase, there is more pressure on younger beavers to disperse. They may travel only 2 to 3 km but usually travel up to 8 to 16 km and have been known to travel as much as 161 km in search of new homes (Jackson 1996). Also, their dispersal rate has been reported to be about 0.7 to 1 km per night (Weaver 1986). Beavers can travel great distances in a short period of time. Due to this fact and the fact that beaver numbers are large and continue to increase in Texas, property can be reinvaded quickly. Beavers have been known to quickly reinvade previously controlled sites.

This project attempted to answer the following questions: Can landowners minimize additional damage from reinvading beavers by periodically monitoring sites after initial removal of beavers? Conversely, is the damage going to be the same whether resources are monitored or not? If damage can be minimized by continued monitoring, then how great is the difference in the amount of additional damage between monitored and "neglected" (unmonitored) sites? In addition, what factors made some sites more susceptible to reinvasion than others?

STUDY AREA

The sites were located in nine southeast Texas counties. Total area for the nine counties is 2,003,573 ha. The Brazos and Navasota Rivers are the major drainage systems for the eight contiguous counties in this study area and are probably the primary sources of beavers.

METHODS

Beaver damage surveys and initial removal of beavers from damage sites (primary removal) began in August 1996. Removal of reinvading beavers (secondary removal) continued until March 1997. Removal methods included: body grip traps, leghold traps, neck snares and shooting. Thirty-four sites were included in this study. Each site contained only one family group of beavers and all sites were within the parameters identified by Buech (1985) for one beaver colony.
The 34 sites were divided into two categories, monitored and unmonitored. The sites were alternately designated monitored or unmonitored as requests for assistance were received. Sixteen sites were selected for monthly monitoring, and the remaining 18 sites were not monitored (unmonitored). After primary removal, monitored sites were evaluated monthly until March 1997. If beavers had returned to a site, they were removed. Additional damage since the time of primary removal was recorded for each site. For unmonitored sites, a final survey was completed some time between January 12, 1997 and March 15, 1997; no beavers were removed from these sites after primary removal. In the final survey of unmonitored sites, if reinvasion had occurred, additional damage was assessed. A checklist was used to assess resource damage and to record numbers and ages of beavers taken. Beaver age was estimated based on body weight.

Differences in damage estimates between monitored and unmonitored groups were evaluated using a standard t-test (significance was determined in all t-tests using $P \leq 0.05$). The non-reinvaded sites in both groups were given $S_0$ values. The original hypothesis was that additional damage for unmonitored sites would be larger.

Delorme Map Expert® software was used to determine distance to a permanent water source (river, major tributary, etc.) for each site (Table 1). These distances represent waterway distances, when waterways could easily be followed on the maps. The difference in distances to a permanent water source between all reinvaded and all non-reinvaded sites was tested for significance with a standard t-test. The original hypothesis for the test was that the distance was smaller for reinvaded sites. Exposure days were also calculated for each site (Tables 2 and 3). These were the number of days a site was susceptible to reinventing beavers. The total exposure days for sites were from the last day of primary removal to the last visit. A standard t-test was used to determine if there was a significant difference in exposure days between monitored and unmonitored groups. Also, the difference between exposure days for reinvaded unmonitored sites and non-reinvaded unmonitored sites was tested for significance with the standard t-test. The original hypothesis was that the number of exposure days would be greater for reinvaded unmonitored sites. Correlation between exposure days and amount of additional damage for reinvaded, unmonitored sites was evaluated with a linear regression analysis.

Difference in numbers of beavers taken in primary removal between reinvaded sites and non-reinvaded sites was tested for significance with the standard t-test. The original hypothesis was that reinvaded sites had more beavers taken in primary removal.

**RESULTS**

The total number of beavers taken in primary removal was 121; 52% were adults, 16% were juveniles, and 32% were of unknown age (Table 2). The average number of beavers taken per site was 4 ± 2. Numbers of beavers taken at sites ranged from 1 to 12. The total initial damage estimate before primary removal began was $52,865$. The average for each site was $1,555 ± 1,523$.

Seven of 16 monitored sites (44%) were reinvaded by beavers (Table 3). Two of the seven sites were reinvaded within two months and the other five were reinvaded within one month. The total number of reinventing beavers taken in secondary removal was 22; 68% were adults, 14% were juveniles, and 18% were of unknown age. The average number of beavers taken in reinvaded sites was 3 ± 1. Six of seven reinvaded sites were reinvaded only once; one site was reinvaded three times. The total additional damage estimate for monitored sites was $250$ (Table 4). The average damage estimate for these sites was $36 ± 55$. Seven of 18 unmonitored sites (39%) were reinvaded (Table 5). The total additional damage estimate was $4,700$. The average damage estimate for these sites was $671 ± 947$.

Seven monitored and seven unmonitored sites were reinvaded by beavers (14 of 34 sites). Damage following reinvasion occurred more often when sites were not monitored (5 of 7 sites compared to only 2 of 7 reinvaded monitored sites). When damage occurred at reinvaded sites, monetary value appeared to be greater without monitoring (average $940$, $n=5$) than with monitoring (average $125$, $n=2$). However, a t-test using $P \leq 0.05$ to determine significance indicated that there was no significant difference in damage values between monitored and unmonitored sites ($P=0.08$).

The average distance to a permanent water source for all sites was 2.4 ± 2.4 km (Table 1). The average distance for all reinvaded sites was 1.9 ± 2.7 km. The average distance for all non-reinvaded sites was 2.6 ± 2.2 km. No significant differences were found in distances to permanent water sources between reinvaded sites and non-reinvaded sites ($P=0.24$).

Linear regression analysis showed little correlation between number of exposure days and amount of additional damage for reinvaded unmonitored sites. The correlation coefficient ($r=-0.3$) was not significant.

Average number of exposure days for monitored sites was 104 ± 42. The average number of exposure days for unmonitored sites was 95 ± 40. There was no significant difference in exposure days between the two groups ($P=0.53$). The average number of exposure days for reinvaded unmonitored sites was 73 ± 26 days. The average number of exposure days for non-reinvaded unmonitored sites was 109 ± 44 days. The original hypothesis was rejected, as non-reinvaded rather than reinvaded unmonitored sites were found to have a significantly larger number of exposure days ($P=0.02$).

A significant difference was seen in the number of beavers taken in primary removal between reinvaded sites and non-reinvaded sites ($P=0.003$). Seventy beavers were initially taken in the 14 reinvaded sites (Avg. = 5 ± 3 beavers/site). Fifty-one were taken from the other 20 sites (Avg. = 3 ± 1 beavers/site).
Table 1. Beaver damage site information.

| Site Name              | County         | Area (ha) | Monitored monthly (yes/no) | Distance from major stream/river (km) | Name                  |
|------------------------|----------------|-----------|----------------------------|--------------------------------------|-----------------------|
| Bower’s Lake           | Burleson       | 12        | yes                        | 0.2                                  | Davidson Cr.          |
| Camp Creek Lk.         | Robertson      | 304       | yes                        | 4.8                                  | Camp Cr.              |
| CCWD #19               | Fayette        | 13        | yes                        | 0.3                                  | Spencer Pool Cr.      |
| CCWD #22               | Fayette        | 11        | yes                        | 1.3                                  | Spencer Pool Cr.      |
| CCWD #26               | Fayette        | 6         | yes                        | 0.5                                  | Cummins Cr.           |
| Chick Ln. Stables      | Brazos         | 1         | yes                        | 0.6                                  | Turkey Cr.            |
| CIC Agency, Inc.       | Brazos         | 1         | yes                        | 5.6                                  | Peach Cr.             |
| Clay Place             | Washington     | 2         | yes                        | 0.8                                  | Yegua Cr.             |
| TMPA DP-1              | Grimes         | 18        | yes                        | 2.7                                  | Gibbons Cr.           |
| Fletcher/Koening       | Washington     | 2         | yes                        | 3.2                                  | Independence Cr.      |
| McCully                | Brazos         | 1         | yes                        | 0.0                                  | Bee Cr.               |
| McDaniell Farm         | Floyd          | 1         | yes                        | 2.7                                  | Clear Cr.             |
| Moore Ranch            | Brazos         | 18        | yes                        | 2.9                                  | Brazos River          |
| Nicholson Club         | Polk           | 1         | yes                        | 0.2                                  | Piney Cr.             |
| Schumacher             | Washington     | 1         | yes                        | 5.1                                  | Yegua River           |
| TAMU Annex             | Brazos         | 1         | yes                        | 1.8                                  | Thompson's Cr.        |
| TMPA 6A                | Grimes         | 15        | no                         | 1.6                                  | Gibbons Cr.           |
| TMPA 7A                | Grimes         | 9         | no                         | 1.3                                  | Gibbons Cr.           |
| Bourn/Goodwin          | Brazos         | 1         | no                         | 1.0                                  | Little Cedar Cr.      |
| Breaux                 | Milam          | 1         | no                         | 1.1                                  | Sixmile Cr.           |
| Ferguson               | Burleson       | 1         | no                         | 4.5                                  | Cedar Cr.             |
| Hill Creek Ranch       | Burleson       | 5         | no                         | 4.5                                  | E. Yegua Cr.          |
| Howard Smith           | Leon           | 2         | no                         | 0.0                                  | E. Caney Cr.          |
| Kilias                 | Leon           | 1         | no                         | 4.2                                  | Lwr. Keechi Cr.       |
| Knight Ranch Rd.       | Leon           | 1         | no                         | 1.4                                  | Malachomy Cr.         |
| Kristoff               | Burleson       | 2         | no                         | 1.9                                  | Davidson Cr.          |
| Marge Nelson           | Leon           | 6         | no                         | 10.1                                 | Navasota River        |
| Oakwood Sewer          | Leon           | 1         | no                         | 0.0                                  | E. Caney Cr.          |
| TMPA P12               | Grimes         | 1         | no                         | 0.3                                  | Panther Cr.           |
| Prince                 | Grimes         | 2         | no                         | 4.0                                  | Gibbons Cr. Res.      |
| TMPA SP-10             | Grimes         | 15        | no                         | 0.5                                  | Gibbons Cr.           |
| Tract 1080 (VLB)       | Burleson       | 4         | no                         | 1.6                                  | E. Yegua Cr.          |
| Pike Tree Farm         | Leon           | 2         | no                         | 1.0                                  | Mustang Cr.           |
| Truelock               | Leon           | 1         | no                         | 8.7                                  | Brushy Cr.            |

Total 463

Average 14 2.4

Standard deviation 51 2.4
Table 2. Primary removal results and exposure days.

| Site Name               | Adult | Juvenile | Unknown | Total | Initial damage estimate ($) | Exposure Days |
|-------------------------|-------|----------|---------|-------|----------------------------|--------------|
| Bower's Lake            | 3     | 0        | 0       | 3     | 1,000                       | 47           |
| Camp Creek Lake         | 2     | 1        | 0       | 3     | 3,000                       | 114          |
| CCWD #19                | 0     | 0        | 5       | 5     | 1,500                       | 116          |
| CCWD #22                | 2     | 2        | 0       | 4     | 2,000                       | 132          |
| CCWD #26                | 2     | 0        | 0       | 2     | 1,000                       | 107          |
| Chick Ln. Stables       | 1     | 0        | 0       | 1     | 300                         | 173          |
| CIC Agency, Inc.        | 1     | 0        | 0       | 1     | 0                           | 116          |
| Clay Place              | 1     | 0        | 3       | 4     | 1,154                       | 87           |
| TMPA DP-1               | 1     | 0        | 3       | 4     | 2,925                       | 57           |
| Fletcher/Koening        | 2     | 4        | 0       | 6     | 2,925                       | 57           |
| McCully                 | 3     | 0        | 0       | 3     | 500                         | 186          |
| McDaniel Farm           | 0     | 0        | 2       | 2     | 500                         | 111          |
| Moore Ranch             | 0     | 0        | 12      | 12    | 4,000                       | 37           |
| Nicholson Club          | 2     | 1        | 0       | 3     | 300                         | 52           |
| Schumacher              | 1     | 0        | 0       | 1     | 150                         | 154          |
| TAMU Annex              | 2     | 0        | 0       | 2     | 150                         | 103          |
| TMPA 6A                 | 4     | 1        | 0       | 5     | 2,308                       | 39           |
| TMPA 7A                 | 3     | 0        | 0       | 3     | 1,154                       | 93           |
| Wayne Bourn/Goodwin     | 2     | 0        | 0       | 2     | 55                          | 56           |
| Breaux                  | 3     | 1        | 0       | 4     | 650                         | 86           |
| Ferguson                | 0     | 0        | 1       | 1     | 500                         | 183          |
| Hill Creek Ranch        | 2     | 2        | 0       | 4     | 1,000                       | 93           |
| Howard Smith            | 0     | 0        | 4       | 4     | 300                         | 99           |
| Kellas                  | 2     | 0        | 0       | 2     | 1,000                       | 40           |
| Knight Ranch Road       | 2     | 2        | 0       | 4     | 550                         | 46           |
| Kristoff                | 4     | 2        | 0       | 6     | 450                         | 93           |
| Marge Nelson            | 0     | 0        | 7       | 7     | 3,000                       | 63           |
| Oakwood Sewer           | 2     | 0        | 0       | 2     | 1,400                       | 114          |
| TMPA P12                | 2     | 1        | 0       | 3     | 3,462                       | 113          |
| Prince                  | 1     | 0        | 0       | 1     | 500                         | 184          |
| TMPA SP-10              | 0     | 1        | 5       | 6     | 3,462                       | 93           |
| Tract 1080 (VLB)        | 8     | 0        | 0       | 8     | 6,600                       | 85           |
| Pike Tree Farm          | 4     | 0        | 0       | 4     | 5,000                       | 135          |
| Truelock                | 2     | 0        | 0       | 2     | 1,000                       | 99           |

| Total                   | 63    | 19       | 39      | 121   | 52,865                      |              |
| Average                 | 2     | 1        | 1       | 4     | 1,555                       |              |
| Standard deviation      | 2     | 1        | 3       | 2     | 1,523                       |              |

*Note: The data represents the number of adults, juveniles, and unknowns, along with the initial damage estimate and exposure days for each site.*
Table 3. Secondary removal results for monitored sites.

| Site Name          | Reinvaded (yes/no) | Adults | Juvenile | Unknown | Total removed | No. of times reinvasion | Time to reinvasion (months) |
|--------------------|---------------------|--------|----------|---------|---------------|------------------------|----------------------------|
| Bower's Lake       | yes                 | 1      | 2        | 0       | 3             | 1                      | 1                          |
| Camp Creek Lake    | no                  |        |          |         |               |                        |                            |
| CCWD #19           | yes                 | 0      | 0        | 4       | 4             | 1                      | 2                          |
| CCWD #22           | no                  |        |          |         |               |                        |                            |
| Chick Ln. Stables  | no                  |        |          |         |               |                        |                            |
| CIC Agency, Inc.   | no                  |        |          |         |               |                        |                            |
| Clay Place         | no                  |        |          |         |               |                        |                            |
| TMPA DP-1          | yes                 | 4      | 0        | 0       | 4             | 1                      | 2                          |
| Fletcher/Koening   | no                  |        |          |         |               |                        |                            |
| McCully            | yes                 | 3      | 1        | 0       | 4             | 3                      | 1                          |
| McDaniel Farm      | no                  | 0      | 0        | 0       | 0             |                        | 1                          |
| Moore Ranch        | yes                 | 0      | 0        | 0       | 0             |                        | 1                          |
| Nicholson Club     | yes                 | 3      | 0        | 0       | 3             | 1                      | 1                          |
| Schumacher         | no                  |        |          |         |               |                        |                            |
| TAMU Annex         | yes                 | 4      | 0        | 0       | 4             | 1                      | 1                          |
| **Total**          |                     | 15     | 3        | 4       | 22            |                        |                            |
| **Average**        |                     | 2      | 0        | 1       | 3             |                        | 1                          |
| **Standard deviation** |                   | 2      | 1        | 1       | 1             |                        | 0.5                        |

Table 4. Amount of additional damage after primary removal on monitored sites.

| Site Name          | Reinvaded (yes/no) | Additional damage ($) | Type of Damage                  |
|--------------------|---------------------|------------------------|---------------------------------|
| Bower's Lake       | yes                 | 0                      | Damage threat, digging in dam   |
| Camp Cr. Lake      | no                  |                        |                                 |
| CCWD #19           | yes                 | 0                      | Damage threat, digging in dam   |
| CCWD #22           | no                  |                        |                                 |
| Chick Ln. Stables  | no                  |                        |                                 |
| CIC Agency, Inc.   | no                  |                        |                                 |
| Clay Place         | no                  |                        |                                 |
| TMPA DP-1          | yes                 | 0                      | Damage threat, draw down pipe   |
| Fletcher/Koening   | no                  |                        |                                 |
| McCully            | no                  | 0                      | Damage threat, draw down pipe   |
| McDaniel Farm      | no                  | 0                      | Damage threat, dammed drainage  |
| Moore Ranch        | yes                 | 150                    | Plugged culvert, damaged road   |
| Nicholson Club     | yes                 | 100                    | Dammed drainage                 |
| Schumacher         | no                  |                        |                                 |
| TAMU Annex         | yes                 | 100                    | Damaged drainage                |
| **Total no. reinvaded** |                   | 7                      |                                 |
| **Total damage**   |                     | 250                    |                                 |
| **Avg. dmg. reinvaded** |                 | 36                     |                                 |
| **STD for damage** |                     | 58                     |                                 |
Table 5. Amount of additional damage after primary removal on unmonitored sites.

| Site Name            | Reinvaded (yes/no) | Additional damage($) | Type of Damage        |
|----------------------|---------------------|----------------------|-----------------------|
| TMPA 6A              | yes                 | 200                  | Dammed drainage       |
| TMPA 7A              | no                  | 0                    | Dammed drainage       |
| Bourn/Goodwin        | no                  | 0                    | Dammed drainage       |
| Breaux               | no                  | 0                    | Dammed drainage       |
| Hill Creek Ranch     | no                  | 0                    | Dammed drainage       |
| Kristoff             | yes                 | 0                    | Dammed drainage       |
| TMPA P12             | no                  | 0                    | Dammed drainage       |
| Prince               | no                  | 0                    | Dammed drainage       |
| TMPA SP-10           | yes                 | 300                  | Plugged drain         |
| Tract 1080 (VLB)     | yes                 | 0                    | Flooded timber        |
| Ferguson             | no                  | 0                    | Flooded timber        |
| Marge Nelson         | yes                 | 2,900                | Timber and roads      |
| Knight Ranch Road    | no                  | 0                    | Flooded timber        |
| Truelock             | no                  | 0                    | Flooded timber        |
| Howard Smith         | yes                 | 500                  | Timber                |
| Kellas              | yes                 | 800                  | Timber and roads      |
| Oakwood Sewer        | no                  | 0                    | Timber and roads      |
| Pike Tree Farm       | no                  | 0                    | Timber and roads      |
| Total no. reinvaded  | 7                   | 4,700                |                       |
| Total damage         |                     | 4,700                |                       |
| Avg. damage for reinvaded |         | 671                  |                       |
| STD for damage       | 947                 | 947                  |                       |

**DISCUSSION**

Lack of significant difference in additional damage between monitored and unmonitored sites was most likely due to the high variance in damage values for the unmonitored sites. Less variance in damage values might be achieved in the future by obtaining a larger sample size. Although there was not a significant difference between the two groups, \( P = .08 \) suggests that monitoring may have been important. The difference in damage values between the two groups (average damage for reinvaded unmonitored sites was $671, average damage for reinvaded monitored sites was $36) would be important to landowners. Also, five of seven reinvaded sites in the monitored group had $0 damage compared to only two of seven with $0 damage for the reinvaded sites in the unmonitored group. Monitored sites were left unchecked for only a month at a time, and reinvaded sites in this group with $0 damage were controlled again before beavers had time to cause additional damage. Unmonitored sites, on the other hand, were all left unchecked longer than a month. Beavers had a longer time to cause damage, and they did.

Among unmonitored sites that were reinvaded, there was no significant correlation between number of exposure days and amount of additional damage (\( r = -0.3 \)). Some sites had relatively few exposure days, but, at the same time, had relatively large additional damage values.

This was related to variability among sites because properties and resources were different, and resources differed in value.

The evaluation of differences in exposure days between monitored and unmonitored sites was used to determine if biases existed that resulted in the unmonitored group having more exposure days, increasing the likelihood of reinvasion. However, no significant difference was found between the two groups.

The authors' data suggests that additional damage was minimized and sometimes totally prevented by evaluating sites for the presence of beavers and promptly removing new beavers. Further study is needed to determine if damage is significantly different between monitored and unmonitored sites. The results of this project support the concept that landowners will be able to minimize additional damage by regularly monitoring their property and removing reinvading beavers quickly.

The second question addressed in this study was, "What factors made some sites more susceptible to reinvasion than others?" One possible factor could have been shorter distance to permanent water sources for some sites. Assuming beavers were in a permanent water source, dispersers could return to the site more quickly. However, distance to a permanent water source for reinvaded sites was not significantly less than the distance for all the other sites.
A second factor related to reinvasion susceptibility might have been the number of days between surveys for unmonitored sites. Reinvaded, unmonitored sites could have had more exposure days, compared to non-reinvaded unmonitored sites, which would allow more time for reinvasion. However, a t-test showed that in this case, the opposite was true. For the unmonitored group, non-reinvaded sites had significantly more exposure days compared to reinvaded.

A third factor in susceptibility to reinvasion could have been alteration of the site which made it unsuitable for beavers. One site was altered after primary removal, which could have prevented reinvasion. A larger culvert was installed, and the area was drained. Alteration to prevent beaver reinvasion at other sites was either not desired by the landowners, or was too costly.

A final factor could have been differences in quality of habitat for certain areas. Better habitat should support more beavers and possibly hasten reinvasion into a previously controlled site. The importance of this factor was tested, indirectly, by comparing the number of beavers taken in primary removal between reinvaded sites and all other sites, with the assumption that better habitat would support more beavers for a given site or colony. Buech (1985) stated that habitat quality is an important factor in determining family (colony) size. The authors' data support this by showing significantly more beavers taken in primary removal, per site, in the reinvaded sites compared to other sites.

Every site in this study, except Camp Creek Lake, was less than 20 ha, which fit into the home range for one beaver family (Buech 1985). Camp Creek Lake measured 304 ha, but had only one family group of beavers. Some of the sites had more than one beaver lodge, but within each site all lodges were used by the same family of beavers.

If a reinvaded site had relatively better habitat quality, then surrounding habitat may have also been of better quality. Therefore, beaver density in the whole area may have been relatively high. It appears likely that quality beaver habitat recently opened up by removal would be reinvaded sooner in a high beaver density area. Aleksiuik (1968) found a Canadian population of transient two-year old beavers ready to permanently settle in suitable sites when they became available. A high beaver density area would have a higher population of transients, and reinvasion would occur sooner.

Weaver (1986) also discussed the importance of subadult (two-year old) beaver dispersal in the overall expansion of beaver populations. He suggested that the reason this particular age class is so important is because of possible delayed dispersal due to unsuitable colonization sites. Delayed dispersal is due to the fact that as beaver densities in an area increase, less sites are available for new colonization, and dispersal by young beavers decreases. Resident beavers may instinctively build more scent mounds as the relative number of dispersers passing through their territories increases. Dispersers may react to the prevalence of scent mounds encountered as they pass through territories. Young beavers may explore surrounding territories but withdraw when they encounter large numbers of fresh scent mounds. Young beavers who delay dispersal and grow larger have a better chance of being successful once they do disperse. They may not disperse until they are two years old or older. Therefore, in high beaver density areas, most beavers that reinvade newly opened territories should be two-year old sub-adults (Weaver 1986).

Adults comprised 68% of the reinvading beavers taken in this project. Non-breeding adults (sub-adults) were not differentiated from breeding adults as long as they were close to the same size. The percentage of adults probably would have been larger if the age of all beavers had been known. Because most reinvading beavers were adults or sub-adults, it could be hypothesized that the sites from which they were taken were high beaver density areas. Delayed dispersal along with better habitat quality can also help explain higher numbers of beavers initially taken per site for reinvaded sites. Additionally, another indication of relatively high beaver densities in the areas of reinvaded sites is that monitored sites were reinvaded so quickly, five sites within one month and the other two sites within two months.

It appears from this study that varying habitat quality and subsequent beaver density are the most important factors in determining a site's susceptibility to reinvasion. However, all damage sites are at risk of reinvasion and monitoring is appropriate at all sites where damage has occurred. Threshold density per unit area, which would cause a site to be reinvaded in a given time period, is unknown and warrants further investigation.

CONCLUSIONS

Reported beaver damage has increased in Texas in recent years. However, many resource managers do not realize how quickly beavers can reinvade sites, and some have experienced extensive beaver damage because of this lack of knowledge. Resource managers have often believed that once beavers were removed from a site, they would be gone forever, or it would take years for other beavers to return. They tend not to sufficiently evaluate their property because they lack knowledge of beaver densities in the area and are not aware of beaver population structure and dynamics.

Beavers will travel great distances in search of a suitable colony site, and resource managers should be informed that when beavers are removed from a site, a favorable site for reinvasion is created. Using continued monitoring of beaver damaged resources as a beaver damage management tool can minimize additional beaver damage.

ACKNOWLEDGMENTS

The authors would like to thank J. Falke and S. Dezell for their assistance. G. Connolly and D. Slack provided technical assistance and helpful suggestions on the manuscript.

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