Measuring Wildlife Depredation of Native Pecans

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Abstract: Wildlife depredation of native pecans was evaluated during 1989 and 1990 using ground plots to estimate nut damage, and shuck to pecan ratios to estimate caching in peripheral areas of south-central Oklahoma native pecan groves adjacent to woodland. Total wildlife damage ranged from 28–447 kg/ha, which exceeded harvestable pecans (0–103 kg/ha) from the same areas. Caching comprised 59% (4–381 kg/ha) of the total damage attributable to wildlife. Fox squirrel (*Sciurus niger*) nut damage ranged from 17–67 kg/ha, and exceeded that of all other wildlife combined. Fox squirrel nut damage, bird nut damage, caching, total wildlife damage, and harvested pecans did not differ significantly ($P > 0.05$) between years. However, the ratio of damaged to harvested pecans was higher for all damage categories in the lower pecan production year of 1990. Significant differences were detected in fox squirrel nut damage and caching among groves within years ($P = 0.04$ and $P = 0.02$, respectively).

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Native pecan groves are created through selective clearing of bottomland forest. Where bottomland grades into upland or property boundaries or other limitations prevent clearing, groves are often left immediately adjacent to tracts of undisturbed woodland. This interspersion of an attractive food source among areas of high quality cover creates the opportunity for significant wildlife depredation, though wildlife damage is perhaps the least studied of the factors limiting native pecan production.

Wildlife damage to pecan production can be divided into 3 components: tree injury—damage to the pecan tree itself; nut damage—consumption or spoilage of pecans within the grove; and caching—removal or storage of pecans rendering them unavailable for harvest. Previous estimates of nut damage and caching of native pecans have ranged from 14 to 194 kg/ha, with fox squirrels, blue jays (*Cyanocitta cristata*), American crows (*Corvus brachyrhynchos*), red-bellied (*Melanerpes carolinus*), and red-headed woodpeckers (*M. erythrocephalus*) identified as the major depredators (Leppla 1980, Hall 1984). These studies derived caching estimates using flightline counts of birds flying out of the groves with pecans, an indirect measure which does not account for caching by other species of wildlife.

The objectives of this study were to develop an improved method of measuring

I felt that impacts of control measures were best tested in areas receiving high wildlife damage. Therefore, I established 6 4.3-ha (91- × 466-m) study areas, separated by a minimum of 368 m, adjacent to the woodland habitat in 1989. Area 1 was frequently flooded in September of 1989 and 1990 making sampling impossible; therefore, it is not included in further discussion. Fox squirrel trapping was conducted in areas 2 and 3 in 1989 and in areas 2, 3, and 5 in 1990.

Prior to 1988, damage control efforts in the RRDRF groves were limited to sport hunting of fox squirrels and American crows and shooting of blue jays under a U.S. Fish and Wildlife Service depredation permit. No wildlife damage control efforts, including hunting, were applied to any groves in 1988; to areas 4, 5, and 6 in 1989; and to areas 4 and 6 in 1990. This paper reports wildlife depredation estimated in each of the 1989 and 1990 untreated study areas.

Nut Damage Estimates

Fifteen trees were randomly selected within each study area and 2 permanent 1-m^2 circular ground plots established magnetic east and west midway between the trunk and the outer canopy of each tree. Consistent rather than random directions were used in order to facilitate locating the plots during each sampling period. Ground plots were sampled biweekly from mid-August through harvest in December 1989 and 1990. Pecan shucks and damaged pecans were removed from all plots and counted at each sampling period but undamaged pecans were left in place until the final sampling period. All trees were shaken with a Savage® model 4200 pecan shaker prior to final sampling.

Pecans were classified as either damaged by fox squirrels, birds, other wildlife, nonwildlife causes, or undamaged. Fox squirrels in caged feeding trials either left pecan shells in pieces or created a jagged, chipped shell entrance hole which could be distinguished from the damage of the other rodents present on the RRDRF (J.G. Huggins, unpubl. data). Bird damage was identified by characteristic beak indention marks and the lack of gnaw marks. Bird damage was not differentiated by species. The number of damaged pecans represented in a sample was derived by dividing the number of identified pecan end pieces by 2.

Caching Estimates

Each pecan matures inside its protective 4-valve shuck or husk (Brison 1974). Upon maturity, the shuck splits longitudinally and separates from the pecan. An unknown but probably minor amount of caching occurs prior to shuck split. After shuck split, wildlife usually remove only the pecan leaving the shuck behind. Therefore, the ratio of pecans to shucks could be used as a conservative measure of caching. Similarly, Darley-Hill and Johnson (1981) used the ratio of acorns to acorn caps remaining beneath pin oaks (*Quercus palustris*) to estimate blue jay caching of acorns.

In 1989, caching was estimated by subtracting the number of pecans from the number of shucks found in the individual ground plots. However, since the shaking procedure shook a much larger percentage of the pecans off of the tree than the

A count began at the first study area at sunrise and all counts were completed within 3 hours after sunrise. The order of each count was rotated weekly so that each area was counted first every sixth week.

Results and Discussion

Pecan production was higher in 1989 than in 1990 (Table 1), but differences between years ($P = 0.33$) and between areas within years ($P = 0.33$) were not significant. Total wildlife damage of pecans far exceeded undamaged (harvested) pecans on all areas in both years. Though total wildlife damage did not differ significantly between years ($P = 0.15$), availability of pecans probably limited wildlife damage in 1990. The ratio of total wildlife damaged to harvested pecans was much higher in 1990 than in the higher pecan production year of 1989. Total wildlife damage did not differ between areas within years ($P = 0.37$).

Caching was the most significant component of wildlife damage, accounting for 59% of the total wildlife damage estimate over the 2 years. The caching estimates should be considered conservative; a negative sampling bias likely existed because

Table 1. Estimated number of pecans/m^2, kg/ha, and $/ha of pecans by damage type in peripheral areas of south-central Oklahoma native pecan groves adjacent to woodland.

	Area 4		Area 5	Area 6	
Type of damage	1989	1990	1989	1989	1990
Undamaged					
N/m^2	8.6	0.4	6.6	1.3	0.1
kg/ha	103	5	32	3	0
$/ha[a]	72	6	22	2	0
Total wildlife damage[b]					
N/m^2	42.7	15.2	28.2	25.9	12.6
kg/ha	447	168	146	57	28
$/ha	313	193	102	40	32
Cached					
N/m^2	37.0	7.5	13.0	15.0	1.5
kg/ha	381	80	72	32	4
$/ha	267	92	50	22	5
Fox squirrel nut damage					
N/m^2	3.6	5.9	11.9	7.5	10.3
kg/ha	42	67	57	17	22
$/ha	29	77	40	12	25
Bird nut damage					
N/m^2	1.9	1.4	3.2	3.2	0.7
kg/ha	22	16	16	7	1
$/ha[a]	15	18	11	5	1

[a]Value based on price received for native pecans of $1.54/kg and $2.54/kg in 1989 and 1990, respectively.

[b]Includes caching and fox squirrel, bird, and other wildlife nut damage.

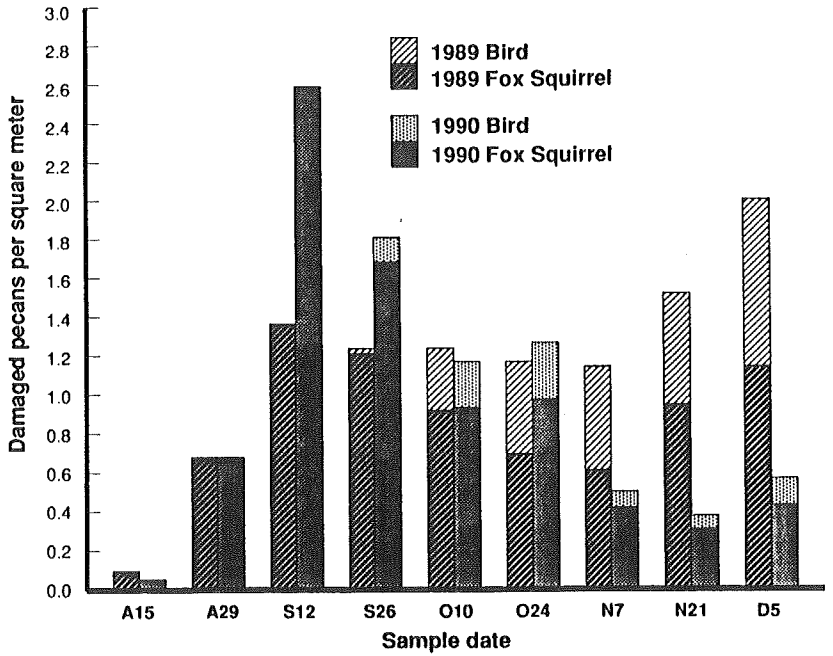

Figure 2. Chronology of pecan nut damage by fox squirrels and birds, August–December 1989 and 1990, in south-central Oklahoma. 1990 sampling dates are depicted; sampling in 1989 was conducted 1 day earlier than each 1990 date.

Bird nut damage did not differ significantly between years ($P = 0.17$) or between areas within years ($P = 0.81$). Bird nut damage did not begin until the initiation of shuck split in late September which coincided with an influx of migratory blue jays in October of each year. Bird nut damage grew steadily and peaked prior to harvest in 1989. In 1990, bird nut damage peaked in October and then declined, probably due to decreasing availability of pecans.

The estimated dollar value of native pecan damage by wildlife represents only the peripheral 91 m of the sampled groves, but such habitats make up 38% (54 ha) of the RRDRF's groves. Informed management decisions regarding the application of damage control measures are based on the perceived value of the crop (a function of production and price) and expected benefits of the control measure. Research results regarding the cost effectiveness of various control measures for pecan depredators are generally lacking. The variability of the economic losses between areas illustrates the need for pecan growers to evaluate the potential benefits of various damage control practices separately for each management unit.

The damage estimation method used in this study should be improved. The categorizing of nut damage by species requires the identification of specific nut damage characteristics for the major depredators of a region. I found it difficult to