University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Proceedings of the Fifteenth Vertebrate Pest Conference 1992

Vertebrate Pest Conference Proceedings collection

3-1-1992

URBAN CROW ROOSTS IN CALIFORNIA

W. Paul Gorenzel
Department of Wildlife and Fisheries Biology, Cooperative Extension, University of California

Terrell P. Salmon
DANR-North Region, Cooperative Extension, University of California, Davis, California

Follow this and additional works at: http://digitalcommons.unl.edu/vpc15

Part of the Environmental Health and Protection Commons

Gorenzel, W. Paul and Salmon, Terrell P., "URBAN CROW ROOSTS IN CALIFORNIA" (1992). *Proceedings of the Fifteenth Vertebrate Pest Conference 1992*. Paper 33.
http://digitalcommons.unl.edu/vpc15/33

This Article is brought to you for free and open access by the Vertebrate Pest Conference Proceedings collection at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Proceedings of the Fifteenth Vertebrate Pest Conference 1992 by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

URBAN CROW ROOSTS IN CALIFORNIA

W. PAUL GORENZEL, Department of Wildlife and Fisheries Biology, Cooperative Extension, University of California, Davis, California 95616

TERRELL P. SALMON, DANR-North Region, Cooperative Extension, University of California, Davis, California 95616

ABSTRACT: We reviewed the historical and current status of the American crow (*Corvus brachyrhynchos*), urban crow roosts and control efforts in California. Crows aggregate in traditional winter roosting areas. In the late 1930s most crows in California roosted in the Sacramento Valley in rural locations. Crow roosts were not a concern except for potential damage to adjacent farmlands. From the 1960s through 1980s crows colonized urban areas for nesting and winter roosting. A phone survey of vertebrate pest management officials indicated all known roosts were in urban areas, with most occurring in the Sacramento Valley. From 1970 to 1989 the winter crow population in the Central Valley of California doubled, with more crows found in the Sacramento Valley than the San Joaquin Valley. In the late 1980s crows in a traditional roost area in Yuba City, Sutter County, increased to 1 million birds. Political pressure prevented attempts at population reduction in 1991 and 1992 and led to examination of non-lethal techniques to disperse crows from urban roosts. Methods and materials tested included mylar tape, strobe lights, netting, monofilament lines, eyespot balloons, pyrotechnic devices, water-misters, sticky repellents, and taped crow and owl vocalizations. Qualitative evaluations by residents and local officials indicated strips of mylar tape tied on branch tips and pyrotechnic devices were relatively effective in dispersing crows.

Proc. 15th Vertebrate Pest Conf. (J. E. Borrecco & R. E. Marsh, Editors) Published at University of Calif., Davis. 1992

INTRODUCTION

The American crow (*Corvus brachyrhynchos*) in California is a common to abundant, yearlong resident of coastal regions, the Central Valley, and foothills of the Sierra Nevada. Crows are summer residents of the northeastern portion of the state and at higher elevations of the Sierra Nevada, and arc absent from desert habitats (Green 1990). Crows are communal roosters in the fall and winter.

Although crows damage a number of agricultural crops in California (e.g., Clark 1986:707-1, Salmon et al. 1986, Simpson 1972), in recent years public agencies have received an increasing number of crow roost complaints in urban locations. Most complaints concern the fouling of yards, walkways, buildings, and vehicles beneath and near roosts and the perceived health hazard from the fecal droppings. Noise from crow vocalizations in staging areas and roosts, especially in the early morning hours, contributes to the nuisance factor. Control techniques commonly used to control birds in rural or agricultural areas (e.g., shooting, trapping, poisoning, or frightening with noise-making devices) have been inappropriate for cities, unacceptable due to public opinion, or are not allowed by local ordinances. Consequently, efforts to control roosts have led to the exploration of innovative control techniques.

Our objectives were to describe the historical and current status of crow populations and urban crow roosts in California and to present as a case history the crow roost problem and control efforts in Yuba City, Sutter County.

METHODS

Historical and Current Status

We reviewed scientific and popular literature for historical and recent accounts of crow roosts. We surveyed personnel from the USDA - APHIS ADC, California Department of Food Agriculture, county departments of agriculture and health, and local agencies by telephone to identify recent urban crow roosts and control efforts. In random searches along streets of Davis and Woodland in Yolo County from September 1991 to February 1992 we identified crow roosts based on accumulations of fecal droppings and regurgitated pellets. We noted the species of trees used as roosts.

Population Changes

Christmas Bird Counts (CBC) were used to examine changes in winter crow populations in the Central Valley of California during a 20-year period (1970-1989) and to compare population levels between the northern portion (Sacramento Valley, n=7 count areas) and the southern portion (San Joaquin Valley, n=4 count areas) of the Central Valley. We followed the recommendations of Butcher and McCulloch (1990) regarding the effect of observer effort on the number of birds counted and the need to standardize observer effort. Party-miles were used as a measure of observer effort. Party-miles are heavily influenced by the amount of time spent in a car and are most useful for conspicuous species, such as crows, that can be spotted from cars (Butcher and McCulloch 1990:121). NCSS (Hintz 1990) was used for statistical analyses. We used parametric tests when assumptions of normality and equal variances were met or substituted a nonparametric analogue.

Case History-Yuba City

Information on crow roosts and past control efforts in Yuba City was obtained from written reports and by interviewing Sutter County Department of Agriculture personnel. In the winter of 1991-1992 we observed the installation and field trials of crow control devices in Yuba City by Sutter County personnel. Qualitative evaluation of field trial results on a scale of 1 to 10 (10 best) was undertaken by residents at the test sites and by Sutter County personnel.

RESULTS

Historical Status

The American crow is widely distributed throughout the United States and southern Canada. Migratory in some parts of its range, crows move southward from Canada and north-

ern portions of the United States and join resident crows on wintering areas. Crows aggregate in communal roosts in fall and winter, with most located between the 35th and 40th parallels. The most highly concentrated wintering populations occur along river valleys with open water during the winter, including the Snake, Rio Grande, Arkansas, Missouri, Mississippi, Ohio, and Cumberland rivers (Root 1989:162, Madson 1976:58). The number of crows occupying roosts may exceed 1,000,000 birds (e.g., Iams 1972). Crows use both deciduous and evergreen trees as roost sites. Kalmbach (1915:87) stated pines (*Pinus* spp.) and other evergreens are most frequently chosen, although oaks (*Quercus* spp.), maples (*Acer* spp.) are commonly used. Accounts from the 1790s and early 1800s reported crows roosting on reeds on an island in Delaware Bay (Rhoads 1886:693).

The general localities of roosts are traditional in that crows return year after year, although there may be frequent shifts among individual trees or groves. Emlen (1938) documented crows using 7 winter roosts in New York state for >25 years, 5 roosts for >40 years, and 1 roost for >125 years. Emlen (1940) identified 68 roost areas in California during the winter of 1937 - 1938 and estimated a total population of 82,000 birds. Most roosts were <1000 birds and were located along river drainages of the coastal region. The Sacramento Valley had 6 major roost areas with about 50,000 birds, well over half the state's total. Within the Sacramento Valley most crows were in or near Sutter County. In contrast, the San Joaquin Valley had only 6% of the state's crows in 8 small roosts. Emlen found a traditional use of California roosts similar to that in New York state, with some roosts occupied for at least 50 years.

Crows were the focus of studies in the 1890s and early 1900s by federal agencies (Barrows and Schwarz 1895, Kalmbach 1915, 1939). The food habits of crows in relation to agricultural damage were of particular interest. These early studies described roosts and roosting behavior, and considered roosts a potential problem only due to the proximity of surrounding farmlands and the damage that might occur in the agricultural lands. None of these studies, nor Emlen (1938, 1940), described roost damage (e.g., droppings) as a problem. This lack of concern was due to the rural rather than urban nature of the roosts. Supporting the contention that crows were not using cities as communal roosts at that time Kalmbach (1915:99) stated that crow roosts are "one of the most wonderful of bird phenomena still existing in close proximity to large cities" and that even though "the lines of flight pass daily over metropolitan districts during the winter months, only an extremely small proportion of the populace realizes their significance." Kalmbach implied that roosts are close to but not in urban areas, and considered them a most interesting wildlife phenomena rather than a potential urban problem.

In the 1970s and 1980s articles in the popular literature described increased use by crows of urban areas for feeding, nesting, and roosting. Grant (1973) described crows commonly feeding in public places, using lawn sprinklers, and flying about in large flocks and stated the crow population was increasing in urban areas in southern California. Clark (1976) reported on roost problems in a Sacramento residential neighborhood. Gilbert (1988) noted that within a 96 km radius of his home in Pennsylvania, 6 out of 7 crow roosts were in the Baltimore-Washington metropolitan area. Each of the urban roosts was close to a shopping center, which offered convenient sources of food and security from recreational gunning. In Canada, Houston (1980) noted crows first nested in 1968 in Saskatoon, Saskatchewan, and observed a shift in the fall congregations of migrating crows from just outside the city limits to residential areas within the city in 1978.

The urbanization of crows described in articles of the 1970s and 1980s was attributed to the safety from shooting at roost sites. Knight et al. (1987) found differences in the behavior of urban vs. rural crows consistent with the idea that in areas of low persecution (e.g., cities where ordinances prohibit the discharge of firearms) crows habituate to humans, and in areas of high persecution crows show avoidance behavior to humans. For example, urban crows allowed a close approach by humans to nests averaging 22 m ±17 SD before flying off. Rural (and presumably hunted) crows flew from nests at an average distance of 200 m ±110 SD, a distance out of gun range and one which would give a human few clues in finding a nest. Knight et al. (1987) suggested that the recent colonization of cities by nesting crows may in part be a response to different levels of persecution in urban and rural areas.

Population Changes

Analyses of crow numbers from CBC in the Central Valley showed no relation between the number of crows counted and observer effort ($r^2 = 0.097$, $P = 0.18$). During the 1970-1989 period observer effort measured in party-miles per count, which averaged 338.8 mi.±7.5 SE, showed a decreasing trend ($r^2 = 0.355$, $P = 0.006$, $y = 7036.069 - 3.383x$, where y=average number of party-miles per count and x=year). The lack of a relationship between observer effort and the number of crows (e.g., increased effort did not result in increased crow counts) indicated the number of crows reported from CBC could be used without any modifications for estimates of relative abundance.

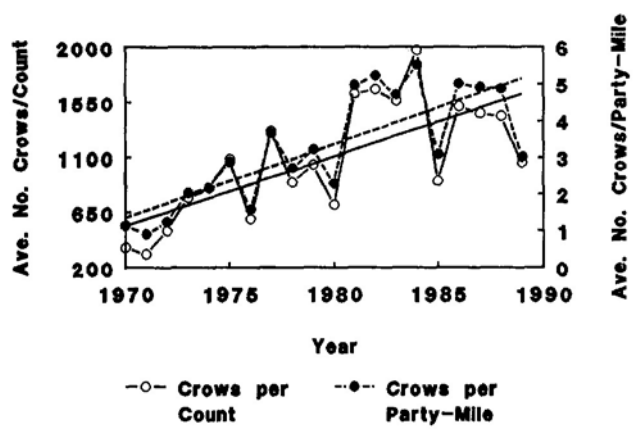

Figure 1. Average number of American crows per Christmas Bird Count (left axis) and per party-mile (right axis) for the Central Valley of California, 1970 - 1989. Solid straight line and dashed straight line represent regression lines for average number of crows per Christmas Bird Count and per party-mile, respectively.

There was an increasing trend (Fig. 1) in the number of crows counted in the Central Valley from 1970 to 1989 (r^2 = 0.508, P < 0.001, y = (-111,420) + 56.834x, where y = average number of crows per count and x = year). The average number of crows counted from 1970 to 1979 ($\bar{x}$ = 772.4, SE = 104.2) nearly doubled during the 1980-1989 period ($\bar{x}$ = 1391.8, SE = 121.6, t = -3.87, P = 0.0006). Despite decreasing observer effort, the number of crows per party-mile increased (Fig. 1, r^2 = 0.610, P < 0.001, y = (-393.975) + 0.20lx, where y = average number of crows per party-mile and x = year). The average number of crows/party-mile doubled (Mann-Whitney test, z = -3.175, P = 0.002) from an average of 2.2 ± 0.3 SE during 1970 to 1979 to 4.4 ± 0.4 SE during 1980 to 1989.

Crow numbers increased in the Sacramento and San Joaquin valleys during 1970 - 1989 (Fig. 2, r^2 = 0.344 and 0.577, P = 0.007 and <0.001, y = (-111162.9) + 56.872x and y = (-113332.4) + 57.493x, respectively, where y = average number of crows per count and x = year). The pattern of change differed between areas with a general upward trend in the Sacramento Valley from 1970 but little change in crow numbers from 1970-1980 in the San Joaquin Valley, with noticeable increases thereafter. More crows were counted (Wilcoxen test, z = 3.88, P = 0.0001) in the Sacramento Valley ($\bar{x}$ = 1414.4 ± 128.4 SE) than in the San Joaquin Valley ($\bar{x}$ = 475.6 ± 100.1 SE).

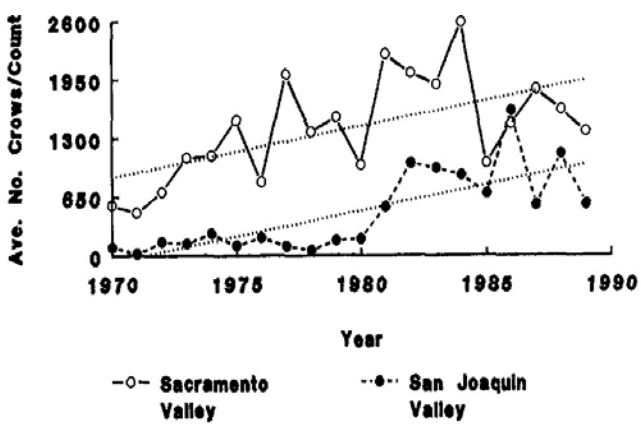

Figure 2. Average number of American crows per Christmas Bird Count for the Sacramento Valley and the San Joaquin Valley in California, 1970 - 1989. Stippled lines represent regression lines.

Current Status

Phone surveys of vertebrate pest management officials (n = 14) indicated most known roosts were in the Sacramento Valley (Table 1). Roosts generally become known to these personnel when property-owner complaints were lodged with the appropriate public agency. No rural roosts were identified by any of the survey participants.

Newspaper accounts described the annual occurrence of local crow roosts and control efforts in the city of Davis (MacDuff 1986, Yusavage 1991), Woodland (Bristow 1989), Yuba City (Anonymous 1988, Sullivan 1988, Lindelof 1989), and Hanford (Pratter 1989). Control efforts in Davis consisted of hanging ceramic owl decoys and attempting to attract barn owls to nest boxes. Residents of Woodland were advised by an animal care expert at a public meeting to scare crows with loud noises, clapping hands, screaming, cap guns, and by spraying flocks with a garden hose. Control techniques considered by the Hanford city council included scaring with bird bombs, killing with shotguns, and tree pruning.

We identified 198 individual trees used as crow roosts in Davis and Woodland. Most roosts we identified (58%) were in deciduous trees including alders (*Alnus* spp.), sycamores (*Platanus* spp.), mulberries (*Morus* spp.), oaks (*Quercus* spp.), elms (*Ulmus* spp.), or ashes (*Fraxinus* spp.). In late August and early September, when crows began roosting in Davis and Woodland (W. P. Gorenzel, pers. observ.), the deciduous trees were fully leaved. Crows continued to roost on deciduous trees after leaf-fall. Evergreen trees used as roosts included pines (*Pinus* spp.), redwoods (*Sequoia* spp.), deodar cedars (*Cedrus deodara),* cork oaks (*Quercus suber),* and olives (*Olea europa).*

Case History - Yuba City

Yuba City in Sutter County (population 27,437, 1990 census) and its twin city, Marysville in Yuba County (population 12,321), are located on opposite shores of the Feather River in the center of the Sacramento Valley. The surrounding rural lands were intensively farmed and produced toma-

Table 1. Locations in California of urban crow roosts during winter of 1991 -1992 as identified by vertebrate pest control personnel.

Region	County	City
Sacramento Valley	Yolo	Davis
Sacramento Valley	Yolo	Woodland
Sacramento Valley	Sacramento	Sacramento
Sacramento Valley	Colusa	Williams
Sacramento Valley	Yuba	Marysville
Sacramento Valley	Sutter	Yuba City
Sacramento Valley	Butte	Chico
San Joaquin Valley	Kings	Hanford

toes, rice, almonds, walnuts, peaches, plums and prunes.

Crows have roosted in the vicinity of Yuba City since at least the mid-1930s (Emlen 1940). County Department of Agriculture personnel recall crows roosting in orchards on the west side of Yuba City since the 1950s (M. Furula pers. commun.). Crow roosts were located in several orchards and the main roosting period normally ran from November to March. As Yuba City expanded in the last 20 years, roost sites were removed as agricultural lands were converted to residential and commercial uses. In the 1980s roosting crows became concentrated in an 8.1 ha block of English walnuts on the edge of Yuba City's urban development. Crows used the 1.6 ha roof of the nearby Sunsweet fruit-processing facility as a pre-roost staging area. Crows flew from the Sunsweet roof to the primary roost site in the walnuts with darkness.

In the spring and summer of 1987 local growers voiced concerns about the crow population and increasing crop damage. A questionnaire survey of growers (n = 145) about crows indicated damage to almonds, walnuts, prunes, and peaches, and poor control with conventional techniques such as shooting and propane cannons (J. Hasey and T. P. Salmon, unpub. ms.).

In response to survey results and additional concerns state and local officials suggested population reduction by baiting as one approach. The rationale for baiting included: 1) an increasing crow population; 2) damage to crops and breakage of orchard tree branches used as roosts; 3) the ineffectiveness and dissatisfaction with available control techniques; 4) an increasing number of urban complaints due to fecal droppings on machinery, buildings, vehicles, and sidewalks from residents in the immediate area of the walnut orchard roost. Health and sanitation concerns were voiced by residents and Sunsweet officials.

In March 1988 the California Fish & Game Commission authorized regulatory changes permitting the use of registered toxicants by government officials to take American crows. Baiting began in March 1988 with the objective of reducing the crow population 25 to 50% (Anonymous 1988). The crow population was estimated at 500,000 birds at the start of baiting (J. Clark and K. Harvey, CDFA, pers. observ.).

The staging area on the Sunsweet Plant roof was used for baiting because it was isolated, secure, and pre-baiting observations noted only pigeons and no other nontarget birds. After a 5-day prebaiting period Starlicide® (3-chloro-p-toluidine hydrochloride, or DRC-1339) on cracked corn was scattered on the Sunsweet roof. Crows died 24 to 32 hours after ingesting the toxic bait. Patrols picked up dead crows at the roost and at a few sites up to 16 km from the roost. The total number of crows killed is unknown. Baiting ended when crow numbers at the roost decreased, possibly in part due to seasonal dispersal to breeding areas. Operational personnel suggested control was less successful than desired due to the late start in baiting.

In fall 1988 the primary crow roost near the city was destroyed when the walnut orchard was removed for residential development. Crows established new roosts in nearby residential and commercial areas. Subsequently many crow complaints were filed with county and city agencies.

In February 1989 baiting was again undertaken with Starlicide at the Sunsweet plant. Notification was given in public meetings and the local press about the baiting and its objectives. County personnel at that time estimated the crow population at 1 million birds. The kill was estimated by a county official at 100-300 birds/day, with ≥1500 in the first 2 weeks (Associated Press 1989).

To provide relief for an affected neighborhood in another part of the city, the county and USDA-APHIS coordinated a dispersal trial using screamers, pyrotechnic devices fired from hand-held pistols. Residents were trained in the proper and safe use of the screamers, and were given pistols and screamers. The screamers were used as needed by the residents to disperse the crows in their neighborhood until 2200 hours each night. Participants recorded observations and screamer use. Local fire and police departments were notified about the program.

From the summer 1989 to spring 1990 local opposition by some residents and animal activists to the baiting program became more vocal and organized. The control program received national media attention with the entrance of an animal rights organization, People for the Ethical Treatment of Animals (PETA). PETA encouraged its members in a letter-writing campaign to local officials and Sunsweet to end the poisoning. Sunsweet was threatened with a national boycott. PETA advocated the use of owl decoys in the residential areas to deter the crows. Under pressure from PETA, Sun Diamond Growers, Sunsweet's parent company, denied the use of its property for any further baiting. With the loss of the bait site, all baiting was terminated in spring 1990. The coordinated dispersal trial using screamers, however, continued for a second year.

During the winter of 1990 - 1991 numerous complaints were again received from residents on the southwest side of Yuba City. Public meetings between residents and government representatives in January and October 1991 plotted strategies to solve the urban crow problem.

As a result of the public meetings the Sutter County Department of Agriculture evaluated a number of materials or methods in field trials during the winters of 1991 and 1992 (Table 2). Mylar tape strips and screamers were judged to be most effective in repelling crows. The mylar strips produced noise as they fluttered in the wind and a changing pattern of reflected light. Crows avoided taped trees; however, there was no area effect as crows landed in adjacent, untaped trees. Residents expressed a high degree of satisfaction with the mylar strips.

Based on the 1991 field trials, the county Department of Agriculture recommended the mylar strips. Due to breakage from wear and entanglement in branches from wind action, mylar strips installed in 1991 were replaced in 1992. Private tree service companies and the Yuba City Parks and Recreation Department installed mylar strips on scores of trees in the winter of 1992. Hourly costs for the private companies ranged from $85 to $150/hr, depending on the equipment required. In some cases a 2 hour minimum was required. Severe tree pruning was also used to make some trees unacceptable as roost sites. Additional field trials of a water-mister device, a sticky repellent, taped owl and crow vocalizations, and the USDA-APHIS electronic guard (originally intended for predator control) were under evaluation in 1992.

DISCUSSION

Emlen (1938, 1940) has shown that crow roosts are traditional. Crows return to the same wintering areas year after

Table 2. Control methods and materials tested by the Sutter County Department of Agriculture in 1991 and 1992, with comments on set-up and use, problems noted, control ratings on a subjective scale of 1 to 10 (10 best), and cost for each 6.1 m tree. Costs were calculated on the basis of materials plus $15.00/hour labor.

Control Material	Installation	Problems	Control Rating	Cost
Mylar tape strips	0.6-0.9 m strips tied on branches.	Time consuming to apply; need special equipment for tall trees.	9.7	$39.41
Mylar tape - long strands	Criss-cross pattern over tops of trees.	Crows landed at top of tree where tape was tight and didn't move.	7.5	$33.71
Airport strobe light	Battery-powered, hung in center of tree.	Not effective if tree has foliage; needs steady power source.	8.0	$315.75
Flashlight strobe light	Hung in center of tree.	Weak light; needs reliable power source.	2.0	$45.44
Monofilament lines	Criss-cross pattern over tops of trees.	Crows moved between lines.	1.5	$30.65
Plastic netting	Draped over top and sides of tree.	Cherry-picker required; crows roosted on net.	3.5	$156.58
Eyespot balloons	Tethered to over-hanging pole.	Will not hold helium; must be hung above tree; crows roosted.	1.5	$117.55
Mylar party balloons	Handpainted eyespots; tethered to over-hanging pole.	Must be hung above tree; frequent maintenance needed.	1.5	$61.25
Screamers and pistol	Fired as needed when birds approach.	Noise ordinance limits use; crows flew in after 2200 hours.	9.0	$2.75/day
USDA electronic guard	Unit hung in center of tree; siren muffled.	Cherry-picker required for tall trees.	1.0	$250/unit
Water-mist sprayer[a]	Mist nozzle at top of tree hooked to drip irrigation line & garden hose.	Cherry-picker required for tall trees.	—	—
Sticky repellent[a]	Brushed on tree limbs.	Cherry-picker required for tall trees.	—	—
Taped owl and crow calls[a]	Played on tape player as needed.	—	—	—

[a]Devices installed in 1992 and still under evaluation.

year. Emlen speculated that crows have an innate drive to adhere to a definitely prescribed winter range despite the presence of preferred foods, cover, water, and other attractive habitat features elsewhere. This suggests that removal of a grove of trees used as a "traditional" roost will not cause crows to leave the general area. Crows in Yuba City moved to the closest suitable trees when the "traditional" primary roost was removed. The definition of a traditional roost should thus encompass large geographic areas, such as a city, county, or region, rather than individual groves of trees.

We did not analyze CBCs from coastal or southern regions of California; however the present distribution of wintering crows in California is probably similar to that described by Emlen (1940). This assertion is supported by the locations of known problem roosts; almost all are in the Sacramento Valley. Also in agreement with Emlen (1940), we found more crows in the Sacramento Valley than the San Joaquin Valley during the 1970 - 1989 period.

There appears to have been an urbanization of crows, with increased nesting in cities and a shift from rural to urban roosts. We suggest this phenomenon occurred in California and other parts of North America in the 1960s. Crows should now be considered as urban wildlife, much as are raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), or even coyotes (*Canis latrans*) in some areas of California.

Cities today in the Central Valley are well forested with mature trees of many different species. Trees in these urban areas may represent the best roosting habitat in a landscape dominated by intensive agriculture. Based on our preliminary surveys of roost trees and the different species selected in

Davis and Woodland, crows are adaptable in their roost tree requirements. Suitable roost trees, such as cultivated, walnut trees, are widespread and could be used in agricultural areas. Urban areas, however, offer a safe haven for crows that is lacking in rural sites, with freedom from shooting and natural predators (e.g., great-horned owl, *Bubo virginianus*).

Interestingly, crows roosting on the edge of Yuba City were initially considered only an agricultural problem. The conversion of an orchard to a residential area resulted in the destruction of a major roost and an immediate urban problem. Efforts to reduce the crow population illustrated the political difficulties of lethal control in an urban setting. With the elimination of baiting as a viable control option, non-lethal techniques were the only options left to explore. The field trials of new materials and techniques were not designed or evaluated in a rigorous, scientific fashion, but represented instead a practical, trial-and-error approach dependent on feedback from residents. Nonetheless, the field trials identified mylar tape strips as a promising, new technique to disperse crows from roosts. The encouraging results point to the need for quantitatively evaluated research, including cost-benefit analyses. At a cost of nearly $40.00/6.1 m tree or at installation rates of $85-$ 150/hr, mylar tape may not be cost effective compared to the use of pyrotechnics or taped calls, for example.

The effective, non-lethal techniques examined in Yuba City were site-specific and resulted in crows abandoning trees only to roost in trees nearby, creating a problem for another neighborhood. In effect, site-specific techniques created a situation of pest control personnel chasing crows from one roost to another, until the crows landed in an acceptable roost. To date there has not been an organized, city-wide effort to disperse the crows from the city. The widespread application of mylar tape in Yuba City will provide experience regarding habituation and long-term effectiveness on a larger scale.

Crow populations increased in the Central Valley during the 1970s and 1980s. The impact of this increase was most noticeable at Yuba City, where 500,000 to 1,000,000 crows congregated. The cities of Woodland and Davis also experienced increasing crow problems. If the trend continues it portends increasing crow/human conflicts in urban areas, especially in traditional roost areas like the Sacramento Valley.

ACKNOWLEDGMENTS

We thank Rex Marsh and Jerry Clark for helpful discussions and manuscript review; Mike Furuta and Stacey Carlsen for historical accounts and data concerning crows in Yuba City; and USDA-APHIS ADC, state, county and local officials for reports on crow roost locations.

LITERATURE CITED

ANONYMOUS. 1988. Too many birds are nothing to "crow" about, say farmers. Appeal Democrat, 16 March:n.p.

ASSOCIATED PRESS. 1989. Yuba City poisoning crows - health threat. San Francisco Chronicle, 16 February:n.p.

BARROWS, W. B., and E. A. SCHWARZ. 1895. The common crow of the United States. U. S. Dep. Agric. Div. Ornithol. and Mammal., Gov. Printing Off., Washington, DC. 98pp.

BRISTOW, M. 1989. Something to crow about? Daily Democrat, 22 March:l,12.

BUTCHER, G. S., and C. E. McCULLOCH. 1990. Influence of observer effort on the number of individual birds recorded on Christmas Bird Counts. Pages 120-129 in J. R. Sauer and S. Droege, eds. Survey designs and statistical methods for the estimation of avian population trends. U. S. Fish Wildl. Serv., Biol. Rep. 90(1).

CLARK, C. 1976. Capital man gets no bang from Hitchcock-like crows. Sacramento Bee, 14 February:A3.

CLARK, J. P. 1986. Vertebrate pest control handbook. Div. Plant Indust., Calif. Dep. Food and Agric, Sacramento, Calif. 350pp.

EMLEN, J. T., Jr. 1938. Midwinter distribution of the American crow in New York state. Ecology 19:264-275.

———. 1940. The midwinter distribution of the crow in California. Condor 42:287-294.

GILBERT, B. 1988. Goodbye, Hello. Sports Illustrated 69:108-112,114,116,118,120-122.

GRANT, G. 1973. Crows converting to lives of city slickers. Los Angeles Times, Orange County, Part XI, 26 August: 1.

GREEN, M. 1990. American crow. Pages 462-463 in D. C. Zeiner, W. F. Laudenslayer Jr., K. E. Mayer, and M. White, eds. California's Wildlife, Vol. 2, Birds. Calif. Dep. Fish and Game, Sacramento, Calif.

HTNTZ, J. L. 1990. Number cruncher statistical system version 5.03. J. L. Hintz. Kaysville, Ut. 442pp.

HOUSTON, C. S. 1980. Fall crow roosts in residential Saskatoon. Blue Jay 38:42-43.

IAMS, G. 1972. Fort Cobb crow study. Okla. Dep. Wildl. Conserv., Oklahoma City, Okla. State Project #W-82-R-10, Job No. 10.

KLAMBACH, E. R. 1915. Winter crow roosts. Pages 83-99 in Yearbook of the United States Department of Agriculture. U. S. Dep. Agric, Washington DC,

———. 1939. The crow in its relation to agriculture. U. S. Dep. Agric. Farmer's Bull. No. 1102. 22pp.

KNIGHT, R. L., D. J. GROUT, and S. A. TEMPLE. 1987. Nest-defense behavior of the American crow in urban and rural areas. Condor 89:175-177.

LINDELOF, B. 1989. Yuba City ducks, rails at crow invasion. Sacramento Bee, 15 February:B1-B2.

MacDUFF, C. 1986. "Dodge city" in Davis. Davis Enterprise, 17 January: 1-2.

MADSON, J. 1976. The dance on Monkey Mountain and other crow doings. Audubon 78(1):52-61.

PRATTER, M. 1989. Crow wars seen. Hanford Sentinel, 6 Septembers, p.

RHOADS, S. W. 1886. Crow roosts and roosting crows. Am. Nat. 20:691-701,777-787.

ROOT, T. 1989. Atlas of wintering North American birds. Univ. Chicago Press, Chicago, 111. 312pp.

SALMON, T. P., A. C. CRABB, and R. E. MARSH. 1986. Bird damage to pistachios. Calif. Agric. 40(5-6):5-8.

SIMPSON, G. 1972. Some approaches to controlling depredations by crows and jays in Tulare County. Verte. Pest Conf. 5:112-117.

SULLIVAN, G. 1988. Thousands of pesty crows have YC man crying foul. Appeal Democrat, 13 December: 1.

YUSAVAGE, M. 1991. Birds find there's a lot to crow about in Davis. Davis Enterprise, 16 December:1.