ALFALFA AS WILDLIFE HABITAT

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The development of modern, intensive agriculture has replaced most wildlife habitat with agricultural crops in the Sacramento Valley. This transition of land-use has occurred so rapidly that most growers in the Valley have witnessed dramatic decreases in the abundances of many wildlife species. Due to the rapidity of this land-use transition, and due to the natural productivity of agricultural lands, most native wildlife species still exist in the Valley, albeit as remnant populations that mostly inhabit nature reserves and the margins between crops. However, most of these species do use agricultural crops as food, cover and nesting resources. Some of these species damage particular commodities, but most are either beneficial or neutral to agricultural production. Together, native wildlife species improve the aesthetic value of the farming landscape; they provide another reason for people to appreciate farmland.

More important than the aesthetic value of farmland is the integrity of its life-support system -- the greater ecosystem. Critical to the stability of this system are functional populations of vertebrate predators, such as carnivores, snakes, insectivorous birds, hawks, owls and other birds that prey upon small mammals. These predatory animals prevent pest outbreaks in agriculture and in natural environments by consuming individuals and by regulating the behavior of prey animals with their mere presence. Prey forage and reproduce less when they must be more vigilant for predators. Perhaps the most effective predators of small mammals are hawks and owls.

Most hawk species migrate to the Great Central Valley, annually. Red-tailed Hawks (*Buteo jamaicensis*) winter in the Valley and then disperse to all the Western States and Mexico. Swainson's Hawks (*Buteo swainsoni*) winter in Argentina and migrate to the Valley for their springs and summers. The regional status of these species depend on their most limiting resources, and those are found in the remnant habitat of the Great Central Valley, where they must obtain sufficient food to live through their seasonal visits. If all small mammals were removed from the Valley, these two important hawk species would be nearly decimated throughout western North America. Farming in the Valley not only has a stake in maintaining this component of its life-support system, it has the means to do so.

METHODS

Since January 1990, we have conducted frequent wildlife surveys along a 128 mile road transect through Sacramento Valley farmland. We mapped our observations of bird and mammal locations, numbers, activities and associations with crops and natural areas, while also mapping crop type, cultural practices and other qualities of the farming landscape. We identified *selection* for crop types by wildlife species after relating the percentage of a species in a certain crop type to the percentage of that crop type in the sampled landscape. The resulting ratio is interpreted as the occurrence of species A in

crop *i* as the multiple of that to be expected by chance. Because our selection values were estimated from the total observations on all transects during the sampling program, we regard our results as preliminary. We did not characterize the strong seasonal and location differences in wildlife species' selection for alfalfa.

RESULTS

Wildlife did not use the farming landscape in a random way. Wildlife species avoided most annual crops, and many selected irrigated, perennial crops. Out of 79 wild vertebrate species observed during the survey, we saw at least 29 of them (up to 36) on or above alfalfa, even though alfalfa was only 1.8-2.3% of the cumulative transect length. Alfalfa was visited by 18 times the number of species that would be expected if species partitioned themselves among land-uses in a mutually exclusive manner based on competition. In other words, wildlife aggregated in alfalfa. Predators of small mammals and of ground-dwelling invertebrates were most selective of alfalfa, including large hawks, Great Blue Heron, Dunlin, White-faced Ibis, Brewer's Blackbirds, American Crows, Yellow-billed Magpies, and European Starlings (Table 1). The larger prey of hawks, Black-tailed Jackrabbits and Desert Cottontail, were also observed as road-kills more often at alfalfa fields. Although probably domestic, dogs and cats also selected alfalfa for hunting voles and pocket gophers.

During the last four years, alfalfa was visited by Swainson's Hawk 10 times the number expected by chance (Table 1). The Swainson's Hawk is a state-listed threatened species and a candidate for the Federal Threatened Species list. Alfalfa was also strongly selected by the Northern Harrier and White-faced Ibis, which are state-listed species of special concern. Other state-listed species of special concern also occurred in alfalfa, including the California Gull, Golden Eagle, Merlin and Prairie Falcon. Also, most of the species that were observed in alfalfa are migratory. For example, vultures migrate into the Valley from the north during summer, Cliff Swallows breed in the Valley during spring/summer, and falcons, gulls and most shorebirds winter in the Valley. Even Starlings, Crows and Mourning Doves move around in the Valley, seasonally.

Some wildlife species in alfalfa eluded observation during our surveys, due partly to small size and to the small amount of alfalfa along the transect. Our survey did not include counts of voles or pocket gophers, even though alfalfa fields usually have more of these two species than any other land-use in the Valley. Many of the species missed during our wildlife surveys were observed during our landscape study of pocket gophers in alfalfa (Table 1). Counting these species, alfalfa was visited by at least 51 vertebrate species during our studies.

DISCUSSION

Our crude association analysis revealed a strong selection by wildlife for alfalfa. We would find stronger selection for alfalfa by more species (of the 29 observed in alfalfa during the transect surveys) if we divided the analysis by season, age of stand, and location with respect to natural areas. For example, 20-30 times more large hawks selected alfalfa during summer than would be expected by chance. Territoriality and the

greater numbers of hawks in the Valley during winter saturated the perches around alfalfa fields. Hence, many hawks were forced into fields of other crop types during winter. Alfalfa fields near natural areas had up to four times the number of hawks as other alfalfa fields. Also, older alfalfa stands were visited by a greater variety and abundance of wildlife species. Older fields offer wildlife a greater variety and abundance of invertebrate and vertebrate prey species.

Wildlife visitation into alfalfa fields can be improved with several strategies. First, wildlife movement corridors can be engineered in the landscape to facilitate wildlife infiltration into Sacramento Valley farmland from the surrounding foothills and mountains. Such corridors are best developed by restoring native vegetation along streams and other water channels. Natural vegetation along the margins of agricultural fields can be established and connected to these stream corridors so that a corridor "network" is established. Theoretically, a corridor network would dramatically increase wildlife visitation to agricultural fields, and it would provide farmers with a definable structure that they can manage for beneficials, recreation and ecosystem services such as erosion control and regulation of pest population dynamics.

More hawks could visit alfalfa by providing more perching. Because large hawks prefer to perch on telephone poles with multiple crossbeams, among which they prefer the lower beam, telephone poles along roads can have a crossbeam added under existing beams that support wires and equipment. Oaks, Cottonwood, willows, and American Elm make the best perches for hawks, and they provide nesting sites for owls and a variety of other beneficial birds. Owl nest boxes can also be added to solid, vertical structures around alfalfa stands (C. Ingles 1992, Birds of prey assist farmers. Sustainable Agriculture 5:5-8).

Finally, some management practices in alfalfa could be modified to improve wildlife visitation and abundance. For example, the first harvest in early spring could be made with a higher cut. During gopher survey work in March 1993, we noticed many nest attempts by Mallard Ducks, Ring-necked Pheasants and Red-winged Blackbirds. Many of these birds perceive alfalfa as an attractive habitat for nest establishment, but their nest season overlaps with the first cutting of alfalfa. Empty nests and crushed or unguarded eggs were left after the first spring swathing. Nest destruction is inevitable during the first spring swathing because these nests are hidden in the alfalfa. But even if they were visible, alfalfa growers can't move the nests nor could they go around them (there are too many) or stop production. What can be avoided during this first swathing is the destruction of the mother birds, many of which refuse to leave the nest as the swather approaches. These mother ducks and pheasants crouch into the nest and try to avoid the swather's blades. This strategy worked in fields where uneven ground or some other factor caused the cut to be made higher than the crouched birds. But in some fields, the alfalfa was cut so low to the ground (3-4"), these animals could not crouch low enough. Their deaths prevent establishment of a second nest, which is typical of birds after their first nests are destroyed (surviving birds do not attempt nest replacement in alfalfa). In these low-cut fields, we also noticed gopher snakes that had been killed by the blades of the swather. Most of these wildlife mortalities can be avoided by not swathing for maximum yield during the first cut.

Most farmland present animals too many stresses, such as annual till and pesticide applications. With natural areas, pasture and a few other land-uses, alfalfa provides important refugia and resource patches to many remnant populations of vertebrate species. This means that the animal component of our life-support system in the Sacramento Valley and surrounding areas depend on the acreage and management of alfalfa. Vertebrate pest control must be expected to have a negative effect on the predators of these pests, not just in a field, but regionally. A shorter rotation of alfalfa must also be expected to affect wildlife negatively. Of course, market conditions and profit margins have decided alfalfa acreage and management, but now public perception and ecosystem function are becoming major factors in the move toward sustainable agriculture, and in water- and land-use planning. The benefits of alfalfa production on wildlife populations need to be recognized so that this commodity group can be better supported with water allocation, land protection and research.

Table 1. Selection of alfalfa by wildlife species during the Sacramento Valley farmland survey from January 1990 until September 1993. Principal food resources for each species are denoted: V = vertebrate animals; I = invertebrate animals; S = scavengers of dead animals; P = plant matter (leaves, stems, roots, seeds); G = general. The symbol D identifies species as having caused damage to alfalfa.

SPECIES	COMMON NAMES	SELECTION VALUE	FOOD
Accipitridae	All large hawks	**2.4**	
Buteo spp.	Hawks, unnamed	2.7	
Buteo jamaicensis	Red-tailed Hawk	1.1	V
Buteo swainsoni	Swainson's Hawk	10.0	V,I
Buteo regalis	Ferruginous Hawk	7.7	V
Kite spp.	All Kites	1.9	
Circus cyaneus	Northern Harrier	2.1	V,I
Elanus caeruleus	Black-shouldered Kite	1.3	V,I
Falconidae	All Falcons	**1.1**	
Falco sparverious	American Kestrel	1.4	I,V
Cathartes aura	Turkey Vulture	0.5	S
Pica nuttalli	Yellow-billed Magpie	1.7	G
Corvus brachyrhynchos	American Crow	2.4	G
Lanius ludoviscianus	Loggerhead Shrike	0.6	I
Tyrannus verticalis	Western Kingbird	1.9	
Sturnus vulgaris	European Starling	2.9	I
Zenaida macroura	Mourning Dove	0.3	P
Columba livia	Rock Dove	0.2	P
Larus californicus	California Gull	0.01	G
Calidris alpina	Dunlin	49.3	I
Charadrius vociferus	Killdeer	50.8	I
Phasianus colchicus	Ring-necked Pheasant	0.3	G

Ardea herodias	Great Blue Heron	3.8	V
Casmerodius albus	Great Egret	1.2	V,I
Egretta thula	Snowy Egret	0.4	I,V
Nycticorax violacea	Black-crowned Night-heron	0.3	I,V
Plegadis chihi	White-faced Ibis	50.8	I,V
Sturnella neglecta	Western Meadowlark	0.9	I
Agelaius phoeniceus	Red-winged Blackbird	0.2	G
Euphagus cyanocephalus	Brewer's Blackbird	6.7	I
Lepus californicus	Black-tailed Jackrabbit	1.7	P,D
Sylvilagus bachmani	Desert Cottontail	3.9	P,D?
Canis familiaris	Domestic Dog	13.5	V
Felis catus	House Cat	2.8	V

Other species seen in alfalfa during the pocket gopher study:

Aquila chrysaetos	Golden Eagle	V
Buteo lagopus	Rough-legged Hawk	V
Falco columbarius	Merlin	I,V
Falco mexicanus	Prairie Falcon	I,V
Anas platyrhynchos	Mallard Duck	G
Numenius americanus	Long-billed Curlew	I
Myiarchus cinerascens	Ash-throated Flycatcher	I
Aphelocoma coerulescens	Scrub Jay	I,P
Corvus corax	Common Raven	G
Turdus migratorius	American Robin	I
Hirundo pyrrhonota	Cliff Swallow	I
Lophortyx californicus	Valley Quail	I,P
Recurvirostra americana	American Avocet	I
Bubulcus ibis	Cattle Egret	I,V
Canis latrans	Coyote	V
Urocyon cinereogensis	Gray Fox (sign)	V,I
Mephitis mephitis	Striped Skunk (Dead)	I,V
Procyon lotor	Raccoon (sign)	I,V
Spermophilus beecheyi	California Ground Squirrel	P,D
Thomomys bottae	Pocket Gopher	P,D
Microtus californicus	California Vole	P,D
Sceloporus occidentalis	Western Fence Lizard	I
Pituophus melanoleucopus	Gopher Snake	V
Coluber constrictor	Racer	V,I