COMPARISON OF AVIAN AND MICE POPULATIONS IN AN INTRODUCED EUCALYPTUS GROVE VERSUS NATIVE COASTAL COMMUNITIES

Michael T. Hanson
Department of Natural Resources Management
California Polytechnic State University
San Luis Obispo, CA 93407

Greq A. Forbes
P.O. Box 4152
Panorama City, CA 91412

Craig R. Smothers
3350 Tide Avenue
Morro Bay, CA 93442

ABSTRACT: In the past, tracts of native California vegetation have been converted to the introduced Eucalyptus, and if using this fast-growing tree as a fuel for small power plants feasible, the possibility looms that more tracts of native vegetation could be unsurped for eucalyptus. Effects on wildlife of the alteration of native vegetation to eucalyptus stands has scarcely been examined. We compared *Peromyscus* numbers in a coastal sage area and avian composition in coastal sage and coastal live oak communities with those of a eucalyptus grove, and found birds and mice to be far less abundant in the eucalpytus.

INTRODUCTION

Eucalyptus trees were introduced into California from 1850 to 1890 by various individuals and the California Board of Forestry. Although several species have been acclimatized, it was chiefly *Eucalyptus globulus*, or blue gum eucalyptus, that was afforested on a large scale. Initially heavily promoted as a potential fast-growing lumber tree, enthusiasm waned when the wood proved worthless since it shrinks, splinters, and warps during processing. An industry based on distilling oil from the leaves faltered because the low production yields and high expenses here could not compete with Australian enterprises. However, by the time entrepreneurs became aware of these shortcomings, promoters had already converted large sections of native habitat to eucalyptus plantations (Dasmann 1965). Today the tree in California is used mainly for parks, windbreaks, and landscaping.

Interest again in converting large sections of California native habitat to eucalyptus plantations may be revived if growing the tree to supply fuel for small power plants proves feasible. Experiments will soon begin at California Polytechnic State University, San Luis Obispo, to examine such a possibility. In South America several steel mills and industries are already fueled on eucalyptus wood. Characteristics possibly making blue gum eucalyptus feasible as a fuel for small power plants are their fast-growing rejuvenability from cut stumps, and adaptability to localities unsuited to other trees. Only ten to fourteen years are required for the eucalyptus to reach adequate size. Cost and labor for replanting a harvested plantation are minimal since new sprouts grow from the stumps; a eucalyptus forest could be harvested several times from one planting for as long as 60 years (Penfold and Willis 1961).

Our concern then is to assess the impact on wildlife of past and future conversions of native plant communities to eucalyptus forests, and we have initiated a program to do so. So far we have examined the effects on birds and *Peromyscus*. We compared *Peromyscus* populations on a plot in a coastal sage community with that in a nearby eucalyptus grove, but for birds we added a coastal live oak community. Differences in bird life between coastal sage and eucalyptus could likely result from structure of the vegetation, so we felt that by looking at a live oak community, any differences from forest structure would be moderated.

STUDY AREA

The eucalyptus and coastal sage study areas were located approximately eight kilometers south of the city of Morro Bay, California just within the boundaries of Montaña de Oro State Park. The coast live oak study site was located within the confines of Los Osos State Reserve which is situated 1.5 kilometers southeast of the city of Morro Bay. The three plant communities were sampled from mid-January through the last of March 1978.

The coastal sage site was basically a mature community comprised chiefly of black sage *(Salvia mellifera)*, California sage *(Artemisis californica)*, and buckbrush *(Ceanothus cuneatus)* with alternating patches of deerweed *(Lotus scoparius)*. The eucalpytus community was clearly dominated by blue gum eucalyptus *(Eucalyptus globulus)* and during mid-January through March, ripgut brome *(Bromus rigidus)* may be found on the forest floor of the eucalyptus forest. The coast live oak community was characterized by coast live oak *(Quercus agrifolia)* and scrub oak *(Quercus dumosa)* in the canopy of the forest. The understory was comprised mainly of poison oak *(Rhus diversiloba)* and where sunlight allowed, brachen ferns *(Pteridium aquilinum)* were present. The riparian portions of the oak forest displayed such species as California sycamore *(Plantanus racemosa)* and arroyo willow *(Salix lasiolepis)*.

METHODS

The *Peromyscus* study area consisted of two sample plots measuring 25 meters square. The first was located in a mature coastal sage community and the second in the introduced eucalyptus forest. The sample plots were situated approximately 30 meters apart.

We sampled the *Peromyscus spp.* populations in both communities by live-trapping from 17 February 1978 through 18 March 1978. Sherman Live Traps were placed in a random fashion throughout the two study areas and were set near vegetation and observed runways; open areas were avoided. One hundred trap nights were used to sample each plot. The traps were set at 1700 hrs. and were collected the following morning at 0630 hrs.

The captured *Peromyscus* were identified and individually marked by clipping two small notches in the ear and were then released. Recaptured *Peromyscus* were identified via previous markings, the capture noted, and they were then set free. The Schnabel method was used to estimate population numbers (Schnabel 1938).

The sampling sites for the avian portion of the study were obtained by dividing the study area into quadrants 50 meters square and then randomly selecting three quadrants per plant community for study. Once the quadrants had been determined, they were sampled using a strip-strip-transect method of observation. The transect lines proceeded along a continum for 50 meters and were 20 meters wide per side for a total sample area of 2,000 square meters.

Each transect line was walked up to three times per week in the morning hours during the period from 20 January 1978 to 20 March 1978. All avian species within the 2,000 square meters were recorded with the exception of those obviously in transit over the sampling area, i.e., gulls and brants. Due to the fact that dense vegetation frequently obstructed visual sightings, some birds were identified by their calls or songs. Frequency, relative frequency, and density values were then calculated for each species per community via the method described by Smith (1974).

RESULTS

Peromyscus population differences were quite dramatic between the two plant communities (Table 1). The population estimates of *P. maniculatus* and *P. californicus* in the coastal sage study plot was calculated at 23 and 6, respectively, but since only 2 *P. maniculatus* were captured in the eucalyptus plot, no estimates for either species were possible.

TABLE 1. Population estimates of *Peromyscus* based on results gathered via live-trapping.

Coastal Sage Study Plot	*Peromyscus maniculatus*	*Peromyscus californicus*
Number Captured	14	3
Population Estimate	23	6

Eucalyptus Study Plot	*Peromyscus maniculatus*	*Peromyscus californicus*
Number Captured	2	0
Population Estimate	--*	--*

*A population estimate could not be made because so few *Peromyscus* were captured.

Following the termination of the avian study period, a total of 198 quadrants had been sampled for an average of 66 samplings per community. The sampling within the coast live oak plant community yielded a total of 30 species and 259 individuals. The coastal sage plant community produced a comprehensive total of 29 species and 133 individuals, many of which were observed on several sampling transects. The eucalyptus plant community was found to contain only nine observable avian species and 36 individuals, the majority of which were sighted only once (Tables 2-4).

DISCUSSION

It would be erroneous for one to ascribe the differences of *Peromyscus* and birds in the eucalyptus forest to the native communities as being structural. Certain chaparral adapted birds and animals, like the California thrasher *(Toxostoma redivivum)* or the California mouse *(P. californicus)*, would not do well in any type of forest, native or otherwise. It still remains that the native communities have been altered to eucalyptus, with the apparent unsurption of native wildlife. In general, projecting our findings to similar alterations in California, it is probable that few native animals (or plants for that matter) have successfully adapted to the eucalyptus forest during the last 120 years.

TABLE 2. Total observation, relative density, frequency, and relative frequency values for avian species of the coast live oak plant community.

SPECIES NAME	TOTAL OBSERVATIONS	RELATIVE DENSITY	FREQUENCY VALUE	RELATIVE FREQUENCY
Acorn woodpecker	6	.023	.091	.043
American goldfinch	4	.015	.061	.029
American robin	5	.019	.045	.021
Anna's hummingbird	2	.008	.015	.007
Barn owl	2	.008	.030	.014
Brewer's blackbird	2	.008	.030	.014
Brown towhee	9	.035	.106	.050
California thrasher	1	.004	.015	.007
California quail	19	.073	.182	.087
Chestnut-backed chickadee	3	.012	.045	.024
Common bushtit	79	.305	.318	.151
Common crow	4	.015	.045	.021
Dark-eyed junco	11	.042	.030	.014
Great horned owl	1	.004	.015	.007
Hairy woodpecker	3	.012	.045	.021
Hermit thrush	5	.019	.076	.036
House finch	2	.008	.030	.014
House sparrow	2	.008	.015	.007
Lesser goldfinch	2	.008	.030	.014
Mockingbird	9	.035	.106	.050
Mourning dove	3	.012	.030	.014
Nuttall's woodpecker	2	.008	.015	.007
Red-shouldered hawk	2	.008	.030	.014
Red-tailed hawk	3	.012	.045	.021
Rufous-sided towhee	13	.050	.182	.087
Scrub jay	19	.073	.242	.115
Song sparrow	1	.004	.015	.007
Turkey vulture	39	.151	.136	.065
White-crowned sparrow	5	.019	.061	.029
Wrentit	1	.004	.015	.007
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Some birds in the surrounding area use the eucalyptus fairly regularly; wintering turkey vultures *(Cathartes aura)* have night roosts, herons have established a breeding rookery, and owls, according to casual reports, seclude themselves during the day. But on the whole it appears that at least during the winter few birds and mice are successful in using the eucalyptus forest, a notable exception being the hummingbirds which feast on the abundant nectar produced by the flowers. Failure of *P. californicus* to establish themselves in the eucalyptus forest is fairly understandable, since it is restricted to chaparral habitat, but *P. maniculatus* is more cosmopolitan, being found in forests as well as others (Baker 1968). Possibly the birds and mice have not fared well in the eucalyptus forest because the tree itself is difficult to use as food source, and allelopathic and litter effects produced by the eucalyptus tree inhibit the growth of native plants, which would in turn also supply food. Although several Australian birds and mammals directly eat the leaves and blossoms, so far as we know, no Californian animals do so.

TABLE 3. Total observation, relative density, frequency, and relative frequency values for avian species of the coastal sage scrub plant community.

SPECIES NAME	TOTAL OBSERVATIONS	RELATIVE DENSITY	FREQUENCY VALUE	RELATIVE FREQUENCY
Allen's hummingbird	4	.030	.061	.039
American goldfinch	2	.015	.030	.019
American kestrel	5	.037	.076	.049
Anna's hummingbird	10	.075	.167	.108
Brewer's blackbird	2	.015	.015	.010
Black phoebe	1	.007	.015	.010
Brown towhee	11	.082	.136	.088
California thrasher	4	.030	.061	.039
California quail	12	.090	.076	.049
Chestnut-backed Chickadee	2	.015	.015	.010
Common bushtit	7	.052	.061	.039
Common crow	1	.007	.015	.010
Common flicker	1	.007	.015	.010
Dark-eyed junco	2	.015	.015	.010
Hermit thrush	1	.007	.015	.010
House finch	6	.045	.054	.035
Lesser goldfinch	4	.037	.061	.039
Loggerhead shrike	2	.015	.030	.019
Mockingbird	1	.007	.015	.010
Mourning dove	4	.030	.054	.035
Red-shouldered hawk	3	.022	.054	.035
Red-tailed hawk	6	.045	.091	.059
Ruby-crowned kinglet	3	.022	.054	.035
Rufous-sided towhee	1	.007	.015	.010
Savanna sparrow	1	.007	.015	.010
Turkey vulture	27	.201	.227	.146
Western bluebird	2	.015	.030	.019
White-crowned sparrow	4	.030	.015	.010
Wrentit	4	.030	.061	.039
	133			

Most native insects apparently are unable to feed on the eucalyptus foilage, although it seems reasonable that a good number would be attracted to the nectaries. In Australia numerous insects attack the tree in a variety of ways. Indeed Penfold and Willis (1961) conjecture that eucalyptus trees in Australia grow at a slower rate compared to those introduced into California; the insects there, having evolved long ago to feed on them, retard the growth of the eucalyptus by their infestation, but since those insects are absent here, the eucalyptus grows at a fast rate. If the eucalyptus tree in California is devoid of insects, then the food base for many native birds would be lacking.

Whether any of our native birds or mice consume the seeds is uncertain, but since the small seeds are enclosed in a hard case, it seems unlikely.

The plant diversity in a eucalpytus grove is quite poor (Del Moral 1966). Some grasses do well for a short time after the winter rains, but these generally lack a good seed head. Inability of most native plants to invade the eucalyptus forest cannot necessarily be ascribed solely to its canopy cover intercepting the sunlight although this might be a contributing factor. Rather the eucalyptus itself, by shedding copious litter and by allelopaths leached from fallen leaves into the soil, inhibt the growth of an understory. Plentiful strips of bark, leaves, and nuts, dropped from the tree all year, heavily mat

TABLE 4. Total observation, relative density, frequency, and relative frequency values for avian species of the eucalyptus plant community.

SPECIES NAME	TOTAL OBSERVATION	RELATIVE DENSITY	FREQUENCY VALUE	RELATIVE FREQUENCY
Allen's hummingbird	3	.083	.061	.126
Anna's hummingbird	24	.667	.288	.595
Common flicker	3	.083	.045	.093
Lesser goldfinch	1	.028	.015	.031
Red-shouldered hawk	1	.028	.015	.031
Red-tailed hawk	1	.028	.015	.031
Scrub jay	1	.028	.015	.031
Turkey vulture	1	.028	.015	.031
Wrentit	1	.028	.015	.031
	36			

the ground interfering with the establishment of seedlings. Allelopathic terpenes leached from the leaves by rain water prevent the germination of seeds from other plants (Baker 1966). Because most native plants cannot establish themselves within the eucalyptus forest, the food and cover normally provided by them are lacking, and hence so are the birds and mice which would use them.

Although at present it might be too early to draw hard conclusions of the effects of eucalyptus forests on native wildlife, results from our preliminary studies indicate that past and future conversions of native plant communities to eucalyptus plantations are detrimental to native animals.

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