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NOISE-POLLUTION PERCEPTION
IN A CALIFORNIA UNIVERSITY TOWN

Stephen C. Jett*

Noise—or unwanted sound—has, of course, long been recognized as a negative environmental factor. Only fairly recently, however, has it received much scientific study and political attention. In the Report of the Environmental Pollution Panel, President's Science Advisory Committee of 1965, noise was recognized as an "environmental pollutant that affects people psychologically and perhaps physiologically" but whose "clinical significance is unknown." The Panel merely recommended that local sound-insulation codes be adopted for apartment buildings. However, the negative physiological, psychological, and social effects of occupational and environmental noise—such as hearing damage, sleep disturbance, contribution to anxiety and to stress-related diseases, communication disruption, and the like—came to be increasingly documented, and during the late 1960s several federal agencies mounted an effort to increase the country's involvement in noise control. In 1972, Congress passed H. R. 11021, The Noise

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Control Act, which directed the Environmental Protection Agency (EPA) to set national noise-source standards, especially for motor vehicles and construction equipment, and otherwise to promote "an environment for all Americans, free from noise that jeopardizes their health or welfare," by coordinating federal programs, by giving state and local technical assistance, and by other means. In the period between 1973 and 1976, state and local noise-control programs—including the State of California's Office of Noise Control—increased from 288 to 665. In the meantime, the U.S. Department of Labor's Occupational Health and Safety Administration (OSHA) has become increasingly involved in setting and enforcing occupational noise standards. ³

Perception of Noise

Although there is now a considerable literature on the health and safety aspects of noise, on its general environmental impacts, on legal implications, and on technical aspects of sound measurement, acoustical design, and the like, ⁴ very little of this literature has been generated by, or is familiar to, geographers, and even less has dealt with the specifically geographical approach of environmental perception. ⁵ Yet, a major part of noise's impact falls into the "nuisance" category—that is, annoyance rather than immediate and obvious health or safety effects.

Some 49 percent of Americans in 1974 considered their neighborhoods too noisy, and Americans queried in the same survey ranked noise first of all undesirable conditions listed. ⁶
The question of what sounds under what conditions constitute nuisances is a subjective matter, but some measure of noise perception is essential for the establishment of community standards and regulations to control this form of pollution. It is with these considerations in mind that the present effort is made to present the results of two recent studies of noise perception in Davis, California.

Davis, California

Davis, California, is located some 14 miles southwest of Sacramento. It is noted as being a pioneering city in the development of bicycle pathways, energy-conservation building requirements, solar energy use in homes, and population growth control. In 1976 Davis had a population (including the University of California, Davis, dormitories, outside of the city limits) of approximately 38,800. Apart from a university-student population of over 17,000, the socioeconomic make-up of the city is relatively homogeneous, with few poverty-level or lower-class residents and few wealthy or upper-class citizens. Average educational levels are high, and much of the work force, (about 10,500 in 1975) is employed in academic and nonacademic capacities at the University. Other citizens are proprietors and employees of small commercial retail, service, and construction enterprises or are public employees and professional and business people who commute to Sacramento and elsewhere. Too, there are municipal and public school employees; employees of a utility company, a food-processing plant,
and a small metal-products factory; personnel of an insurance company and a small hospital; children; and retirees.

Unquestionably, the University is the dominant influence in the community, and the principle sociological dichotomy is between the "permanent," middle-class residents of the city, who live primarily in family organizations, and the individually temporary but collectively permanent student population, whose average age is about 20 years and who are largely unmarried but normally share living quarters with one or more students. For convenience, these two populations will be referred to as "family" and "student", respectively. Off-campus students (numbering about 11,000) live largely in apartment houses, with a minority in rented duplexes and single-family houses, whereas the bulk of families live in single-family houses.

The Noise-Perception Survey Questionnaires

Under state law, each California city, including Davis, is required to develop a Noise Element for its General Plan. In December, 1974, the Davis City Council appointed a 9-member Ad Hoc Noise Element Study Committee, including both professionals in the noise field and lay persons, and including professors, students, and nonuniversity members.

Two surveys were conducted. The first was to measure perceptions of the nature, bothersomeness, and locations of annoying noise. The second was to determine attitudes regarding appropriate noise-control levels and means.

A different random sample was taken for each survey by
choosing for sampling every 41st and 49th address, respectively, from the customer list of Pacific Gas and Electric Company, the local utility (thus, dormitories--outside of city limits--were excluded). Households containing both male and female adults were asked to have a male respond if the street number was odd, and a female if it was even. Residence patterns of the two principal populations allowed a reasonably good division of the data into family versus student responses. For the first survey, returned questionnaires were sorted as to dwelling type to differentiate responses of these two populations. This was not done with the second survey since only overall popular opinion with respect to proposed regulations was being measured.

The Noise-Problem Survey

A two-page questionnaire was mailed to 334 residential addresses in May, 1975. Eighty-five (25.5 percent) at least partially completed questionnaires were returned. The questionnaire's purposes were to find out: 1) what noises Davisites consider problem noises, and which of these they consider the most bothersome; 2) when and how often these noises are annoying; 3) in what ways the most annoying noises bother people; and 4) the geographic distributions of worst-noise problems in Davis.

Instead of relying on respondents' spontaneous suggestions of bothersome noises, a list of likely noise sources was provided (in no particular order), so that no important source
would be overlooked by respondents. Respondents were also invited to add "other noises." A list of potential effects of noises was supplied, and comments were also solicited. Respondents, though anonymous, were asked to name the street intersection nearest their dwelling to permit geographical analysis.

Because of differing residential densities as well as to differentiate the two major populations in Davis, analysis of the questionnaires was divided into "apartments and duplexes" and "single-family houses"; data received from 10 duplexes were lumped with those of apartments because duplexes are two-unit apartments and because duplex responses appeared to be statistically similar to those of apartment dwellers.

Each respondent was asked to identify the externally generated noise sources which were "most bothersome," "second-most bothersome," and "third-most bothersome," at his or her residence. To weight noises statistically, a "most bothersome" noise was valued as 3, a "second-most bothersome" noise at 2, and a "third-most bothersome" noise as 1. Each of the 18 noise sources in the questionnaire's list was considered to be a currently bothersome source by at least three respondents in each of the two residence categories. Most, but not all, of the sources listed were also chosen by one or more respondent as among the three noises most bothersome at his or her residence. These are discussed below, in order of importance. Data are fully summarised in Tables 1
Automotive Noises. Automotive noises--motorcycles, cars, trucks, and busses--comprised by far the most frequently mentioned gross category of bothersome noises, accounting for 39 percent (with the weighting) of single-family-house residents' three most bothersome noise sources, and 35 percent of apartment dwellers'. Motorcycles showed up distinctly not only as the most annoying automotive noise source, but also as the overall most bothersome noise source, among both single-family-house residents (24 percent) and apartment-dwellers (18 percent). Automobiles took second place among all sources for apartment residents (14 percent), and third among single-family-house inhabitants (11 percent). Trucks were in 13th and 10th place, respectively, in single-family-house and apartment neighborhoods. Busses, though not on the questionnaire list, were mentioned by a few respondents.

Motorcycle noise appeared to cause particular problems in three separate areas. One was where "dirt-biking" was popular adjacent to the Southern Pacific Railroad tracks; a second was in a neighborhood near the cannery, where motorcycle-owning house-renting students and cannery workers are probably concentrated; and a third was in an area heavily populated by University faculty and other professional people (studies show a positive correlation between noise-consciousness and educational level). Car-noise annoyance is rather evenly spread throughout
town, indicating that street rather than highway car noise is more significant (two freeways and a county road pass through Davis). Somewhat higher-than-average annoyance appears among residents of the northern and western core area, where traffic is heavy. Several respondents mentioned "hot-rod" as a particular problem. Because of traffic restrictions, truck noise is primarily a phenomenon associated with the three major thoroughfares. Truck traffic—much of which goes to and from the cannery—is especially heavy during the late summer-early fall harvest season. Since this survey was taken in May, response to truck-noise annoyance was probably not as great as would have been the case at harvest time.

Automotive noise tends to occur every day. Its largest single negative effect is sleep interference, although it also bothers people in a wide range of other ways, such as causing tenseness and interfering with study, etc. Overall, problems are more a daytime phenomenon in single-family-house neighborhoods and more an evening one in apartment areas, but substantial annoyance occurs in daytime, evening, and nighttime.

Pets. Pets, apparently mainly barking dogs, but to some extent cats, are Davis' number-two noise problem in single-family-house neighborhoods (19 percent of the three most annoying noises), and number-three in apartment areas (12 percent). Annoyance is very frequent, almost daily, among respondents, although not as frequent as with automotive noise. Annoyance levels are highest at night, and sleep interference is the
greatest single problem caused, but significant annoyance is recorded at all times of day, and the whole range of annoyance effects, particularly tenseness, are given significant mention.

Pet-noise problems are fairly evenly distributed over the city, although one or two areas seemed to experience higher levels of annoyance, for reasons that are unclear.

**Amplified Sound.** After automotive noises and pets, the various forms of amplified sound—"radios, TV's, hi-fi's live bands, and parties" (exclusive of "live human voices")—are the most frequently mentioned bothersome noise sources among respondents, even though they occur only occasionally. This gross category ranks third among single-family-house residents (8 percent of the three most annoying kinds of noises), and second among apartment dwellers (16 percent). Among the former, such sound of outdoor origin ranks fifth in the list, whereas such sound of indoor origin ranks tenth. For apartment-dweller respondents, indoor amplified sound is more important (third place), whereas, outdoor amplified sound ranks lower (seventh). The importance of indoor sound in apartment complexes reflects multi-unit living, high-volume sound, and poor sound insulation between units. In the student Housing Viewpoint survey, many apartment-dwellers mentioned this kind of noisiness as a problem.13

Frequency of amplified music, etc., is less than that of the noises discussed above. Such sounds are annoying particularly during the evening and at night, and cause nearly the whole range of annoyance effects, particularly sleep and study
interference and tenseness. Outdoor music significantly discourages yard use and interferes with conversation in single-family-house neighborhoods. The data do not show any clear geographic concentration of outdoor amplified-sound problems. This may reflect wide distribution of loud private parties as well as the fact that amplified music from campus, apartment-house, and fraternity-sorority outdoor social events can transmit sound a mile and a quarter or more.

Live Human Voices. Vocal noise, though not very annoying to homeowners (thirteenth in rank), was quite important (fifth place, 11 percent) to apartment inhabitants. The reason for this, and the effects, are similar to those relating to indoor radios, hi-fi's, etc.

Railroad. A major junction on the Southern Pacific's main east-west line exists in downtown Davis. The railroad ranks fifth (8 percent) among the noises listed as among the three most annoying to apartment dwellers; sleep-interference is the primary negative result, and most of the other negative effects are also felt by some for whom railroad noise is a fairly frequent annoyance. Nighttime switching, as well as through trains, create annoyance.

The problem areas are localized according to the location of the railroad tracks and the density of nearby population; relatively distant areas record little or no railroad-noise annoyance. Very clearly, the main complaint area is that occupied by apartment houses along the two streets adja-
cent to the north-south tracks.

Because of the fixed locality of the railroad and its well recognized noise-causing qualities, it is probable that most people sensitive to this form of noise try to avoid neighborhoods near the tracks, thus partially accounting for the fact that train-noise annoyance, though important, is not listed more frequently than it is.

**Aircraft.** Although aircraft noise ranked only twelfth of those sources listed by apartment residents as among the three most annoying, it was number four (8 percent) in single-family-house areas, and such listings were virtually absent in the northeastern part of the city. Annoyance generally increased westward to a peak at the westernmost neighborhood, and occurred a few times per week. It is therefore certain that the University airport located near the above-mentioned neighborhood is the principal source of aircraft noise pollution in Davis, although crop-dusters were also mentioned. The City has also received complaints about low-flying military, police, and flying-club helicopters. Principal effects of aircraft noise are awakening from sleep, and conversation and study interference.

**Power Tools.** Power lawnmowers, chain saws, edgers, and the like were house-dwellers' sixth-most annoying noise category, and apartment denizens' tenth. The effects on people more or less run the gamut, but early-morning awakening and interference with study seem to be the main ones.
Air Conditioners. These stationary machines, often placed in narrow side yards or beside apartment buildings, caused bothersome noise number seven for homeowners, and number eight for apartment people. They are, of course, seasonal in operation, but their noise is frequent at those times of year. Negative effects on sleep and other activities sometimes occur, especially if the machines are poorly maintained. Sound from well-maintained air-conditioners is continuous and broadband, and far less annoying than the rattles and pulsing hums of poorly mounted or maintained units.

Trash and Garbage Collection. City trash and garbage collection, including street-tree and utility-company trimmings collections, were eighth and ninth, respectively, for apartment and single-family-house dwellers. Early morning awakening a few times a week or month is the main complaint. It has also been noted that trash collection sets dogs to barking.

Minibikes, Go-Carts, and Model Planes. These recreational machines were eleventh for householders and twelfth for apartment respondents among the three most annoying sounds, although some respondents probably classed minibikes with motorcycles. People annoyed were bothered a few times a week, and in several ways. This is essentially a daytime problem where it exists at all (around parks, playgrounds, parking lots, and the like).

 Sporting Events. Because of their relative infrequency and limited locations, sporting-event noise ranked only eleventh
and fourteenth for house and apartment occupants, respectively. The significant sources of noise seem to be the University football field--especially the announcing during games--and, less importantly, the High School football field. The actual amplified words of the University football announcer can sometimes be heard inside closed houses over two-thirds of a mile from the field.

**Commercial Noise.** Commercial noise, such as deliveries, are fourteenth and fifteenth in rank for householders and apartment people. The main problem appears to be early-morning deliveries awakening residents; effects are no doubt localized.

**Other Noise Sources.** Swimming-pool splashing, filter pumps, etc., annoy some apartment dwellers, and probably a few homeowners. Factory and construction noises seem not presently to cause serious annoyance, although early-morning starts on the latter may occasionally awaken people. The City has received complaints regarding pneumatic drills. Volunteered annoying sounds included car horns, tire-squealing, sirens, (which have increased since this survey), a city water pump, typewriters, farm machinery, pounding by a child, and crows.

**The Noise-Control Attitude Survey**

Having gathered data concerning those noise sources which were most bothersome to the public, the Committee endeavored, by a second questionnaire, to ascertain people's
thoughts on appropriate legal controls of the most important noise sources. Since regulation of automotive noise is pre-empted by state and federal standards, our relevant questions involved only attitudes toward enforcement and sound-barrier construction. However, to obtain an information base for a proposed municipal noise ordinance, questions on possible regulation were asked with respect to pet noise, amplified sound, power tools, and trash and garbage collection. A sample of 250 addresses was selected and surveyed in January, 1976; stamped return envelopes were included, and 150 (62.5 percent) at least partially completed questionnaires were returned, plus 10 (2.5 percent) returned as undeliverable. The 22 questions were not arranged in any special order; their analysis below follows the order of importance of the noise sources as determined by the earlier questionnaire.  

Automotive Noise. Nearly 82 percent of those responding felt that the police should be instructed to place a higher priority on enforcement of state and federal laws related to the loudness of motorcycles and other vehicles. Many respondents underlined "motorcycles" in the question.  

On the issue of allocating funds to erect barriers against vehicular noise in impacted areas, 54.5 percent replied negatively while 45.5 percent were in favor.  

Pets. When presented with various duration options, more than 15 percent of the respondents to questions on pet noise felt that dog barking should not be allowed at all,
and an additional 38.3 percent felt that 5 minutes should be the maximum legal limit. A fifteen-minute maximum was chosen by another 33.6 percent; thus, 87 percent favored a limit of 15 minutes or less ("one hour" accounted for 8.2 percent, "more than one hour" for 4.8 percent). Almost 75 percent felt that if an owner cannot or will not prevent his dog from barking longer than the time limits they favored, the animal should be removed and delivered to the animal shelter. This is particularly striking in a relatively animal-loving community.

Amplified Sound. Outdoor amplified-music parties and concerts sponsored by apartment complexes, fraternities, and the like have generated considerable public complaint in Davis. Though these events have a good deal of student support, many residents of single-family neighborhoods have expressed their belief that the sound-level, duration, time of night, and frequency of such occurrences are excessive. Since this particular issue, unlike other noise issues, has received so much public attention, questionnaire responses should be viewed with this in mind.

Over 83 percent of those responding felt that amplified music at public dances and concerts should not be allowed to exceed levels that may cause permanent hearing damage. An overwhelming 96.6 percent agreed that amplified sound must never exceed levels detrimental to the health of those not attending the performance.
In response to the question "How often should people's amplified sound be allowed to disturb others?," 36.5 percent of those responding (8.7 percent did not respond) answered "never". An additional 19 percent wished to allow such disturbances only on a limited number of holidays. With another 10.2 percent favoring a frequency of no more than once a month, a total of nearly 66 percent felt that such amplified sound should be permitted once a month or less. Fewer than 14 percent of total respondents felt that such disturbance should be permitted daily, with an additional 20.4 percent expressing approval for restriction to Fridays and Saturdays only.

Those individuals favoring allowing at least some occasions upon which disturbance of people in their homes would occur were asked to choose at what point the disturbers should be required to desist. Of those answering, the largest number, over 35 percent, believed the disturbance should cease upon receipt of the first complaint. Another 22.7 percent thought that several complaints should first be received. Thus, 58 percent believed citizen complaint should terminate disturbance even on special days on which amplified music is allowed. For virtually all of the remaining 42 percent, such events should be allowed to continue, even if disturbing, no later than 8:00 P.M. (3.1 percent), 10:00 P.M. (15.6 percent), 12:00 A.M. (17.2 percent), or 1:00 A.M. (5.5 percent).

The idea of a limited number of more permissive "noise days" to which large outdoor events featuring amplified music
would be confined originated in a series of meetings of irate citizens, apartment-house and fraternity representatives, the Police Department, and the District Attorney's Office, and voluntary guidelines were applied in 1973 to one part of town. Knowledge of this probably conditioned questionnaire responses. Those respondents favoring designation of such "public-party days" could indicate the maximum duration which those events' disturbingly loud music should be allowed to last. Nearly 23 percent said 5 minutes; other choices were: half an hour (15.9 percent), 1 hour (14.1 percent), 2 hours (11.5 percent), 3 hours (16.8 percent), four hours (11.5 percent), and five hours (4.4 percent). There was clearly some ambiguity in the question, with some respondents interpreting it to mean allowed time to comply with an order to desist, others viewing it as meaning maximum duration assuming that complaints would not be cause to terminate parties or concerts. One may hypothesize that the bimodality of the responses reflect a division of opinion between the city's two principal populations.

Power Tools. When asked whether there should be restrictions on the loudness of power tools even if that meant certain types would be prohibited, 43.5 percent said yes, 56.5 percent said no. Power-tool noise in residential areas should be prohibited before 9:00 A.M. according to 43.6 percent of the sample, before 8:00 A.M. according to an additional 29.5 percent, before 7:00 according to another 16.1 percent, before 6:00 for 4 percent more. Some 6.7 percent felt there should
be no temporal restrictions.

**Trash and Garbage Collection.** Over 71 percent of respondents did not care to restrict sound-levels of trash compressors, tree-trimmings shredders, etc., if this would require use of less efficient equipment. However, most felt such machinery should not be used near residences before: 9:00 A.M. (14.9 percent), 8:00 A.M. (an additional 21.6 percent), 7:00 A.M. (an additional 13.1 percent), or 6:00 A.M. (another 14.7 percent). Thus, although 11.5 percent favored no time restrictions, nearly 70 percent preferred that trash collection occur only after 7:00 in the morning.

**Discussion and Conclusions**

Since Davis is usually thought of as an at least moderately permissive, "do-your-own-thing" town, the rather stringent restrictions on noise favored by residents is perhaps somewhat surprising. For example, three-quarters of the residents as reflected in the sample favored sending dogs that barked for more than 10 or 15 minutes to the pound, two-thirds believed that disturbingly loud musical events should not occur more than once a month, and 58 percent felt that even on these occasions, one or several citizen complaints should result in abatement. Perhaps the explanation lies in the facts underlined in the first survey, that noise is significantly bothersome to large numbers of people. For motorcycles, pet barking, amplified music, and cars seem to be serious sources of annoyance, with other sounds contributing
to the problem in lesser degree. Furthermore, Davisites are unusually well educated and environmentally and politically aware and many engage in activities requiring mental concentration. Davis' high level of concern about noise is also consistent with the Bureau of the Census' 1974 survey, in which noise was the most frequently indicated undesirable condition, and with L. R. Jacoby's 1969 findings for Detroit, where respondents expressed a higher level of concern about noise pollution than about air or water pollution. Too, in Sacramento, in 1974, "Pollution, such as too much noise, litter, smog, and water pollution," was viewed by residents as the most serious problem (of a list of 29) in their lives. 15

Results of the few noise-attitude surveys from other American cities are not fully comparable, due to differences in sampling, questions, noise categories, and analysis. Nevertheless, it is of some interest to compare the results of Davis' first survey with similar surveys from other locales (I know of no survey similar to Davis' second). In 1966, 259 households in Los Angeles, Boston and New York were surveyed. It was found that traffic was the most universally bothersome general noise source, closely followed by "children and neighbors"; planes, animals, industry, and trains, were lesser sources. Since large, diverse urban areas are involved here, and the survey was a decade earlier than Davis', it is not surprising that the results—to the extent they can be compared—are somewhat different. A 1976 survey of urban and rural
Washington state revealed the following order of annoyance: traffic, aircraft, radio/television, industry, don't know/other, and office.¹⁶

More similar to Davis' perceptions were those of residents of Tulare County, California (principal city: Stockton), in 1973 reported the following order: motorcycles, other vehicular traffic, barking dogs, trains, miscellaneous, neighbors, industry, planes, and practicing bands.¹⁷ Notable is the lack of "amplified sound" and the presence of "industry" in these lists. The former is no doubt partly subsumed under "neighbors"; in Davis, its particular importance presumably reflects the sizable student population. The lack of heavy industry accounts for little concern about industrial noise.

There are several approaches to control of environmental noise in a community. The EPA has established noise-emission standards for various categories of motor vehicles and machines. The State of California has also established stricter motor-vehicle sound-level maxima. Enforcement of these would go far towards alleviating traffic-noise problems, but practical considerations inhibit this; a particularly common problem is illegal modification of mufflers by motorcycle owners. The State and City have adopted sound-insulation standards for various types of buildings, including multiple-unit dwellings, as specified in the 1973 Uniform Building Code.¹⁸ This law--if enforced--should significantly improve the noise situation in new apartment buildings. As for Davis,
the City Council adopted a Noise Element in 1976, which included in its action programs: incorporation of noise assessments in environmental-impact reports and in planning, zoning, and design decisions; enforcement of state and federal building-code and vehicle-emissions standards; establishment of priorities for sound-barrier erection; passage of a comprehensive municipal noise ordinance; and specifying of "a certain number of quiet and noise days." It is too early to assess the degree to which these action programs of the General Plan will mitigate noise problems, but a few steps have been taken. Among these are the joint acquisition with the County of a few sound-measurement devices, and the requesting or requiring that developers erect noise barriers along highways. At this writing, the City Council is considering three possible noise ordinances for adoption: the League of California Cities Model Noise Ordinance, the State Office of Noise Control Model Noise Ordinance, and an amplified and modified version of the latter drafted by Davis' noise-study committee to meet the special character and needs of the city, as determined by our surveys. As always, the ultimate success of any such ordinance will depend more on its enforcement by the City and on the understanding and good will of the public than upon the specific provisions of the law.
<table>
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<th>Importance</th>
<th>Frequency</th>
<th>Effects</th>
<th>Interference with:</th>
<th>Annoyance times</th>
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<td>Radios, TV's, hi-fi's, live bands, &amp; parties (indoors)</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
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</tr>
<tr>
<td>6</td>
<td>Power tools (mowers, edgers, chain saws, etc.)</td>
<td>13</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>4</td>
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<td>12</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
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<tr>
<td>8</td>
<td>Railroad trains</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Trash &amp; garbage collection</td>
<td>10</td>
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<td>1</td>
<td>1</td>
<td>21</td>
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<td>7</td>
<td>2</td>
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<td>4</td>
<td>1</td>
<td>4</td>
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<tr>
<td>11</td>
<td>Minibikes, go-karts, model planes</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>Sporting events</td>
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<td>2</td>
<td>1</td>
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<td>13</td>
<td>Trucks</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Live human voices</td>
<td>5</td>
<td>1</td>
<td>2</td>
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<td>1</td>
</tr>
<tr>
<td>15</td>
<td>(Buses)</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>16</td>
<td>Commercial noises</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Construction noise</td>
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<td></td>
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</tr>
<tr>
<td>18</td>
<td>Factory noise</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>19</td>
<td>Swimming pool noise</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>20</td>
<td>Other noises</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.
RESULTS OF CITY OF DAVIS NOISE SURVEY, 1975: SINGLE-FAMILY-HOUSE RESIDENCES
(Sample size = 44)
### Table 2:
#### 1975 City of Davis Noise Survey

<table>
<thead>
<tr>
<th>Rank</th>
<th>Noise Source</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
</table>

#### Apartment & Duplex Residents

<table>
<thead>
<tr>
<th>Rank</th>
<th>Noise Source</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
</table>

#### Construction

<table>
<thead>
<tr>
<th>Rank</th>
<th>Noise Source</th>
<th>Importance</th>
<th>Frequency</th>
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</table>

#### Commercial

<table>
<thead>
<tr>
<th>Rank</th>
<th>Noise Source</th>
<th>Importance</th>
<th>Frequency</th>
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</thead>
</table>

#### Industrial

<table>
<thead>
<tr>
<th>Rank</th>
<th>Noise Source</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
</table>

#### Transportation

<table>
<thead>
<tr>
<th>Rank</th>
<th>Noise Source</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
</table>

#### Supplemental Comments

- Lot noise.
- Radio, TV, stereo.
- Radio, TV, stereo (outside).
- Live band and partee (indoors).
- Live human voices.

#### Interference with:

- Any free sleeping
- Any free eating
- Any free talking
- Any free reading
- Any free recreation

#### Frequency of Noise:

- Daily
- Few times a week
- A few times a month
- Occasionally
- Rarely

#### All Noises

<table>
<thead>
<tr>
<th>Rank</th>
<th>Noise Source</th>
<th>Importance</th>
<th>Frequency</th>
</tr>
</thead>
</table>
NOTES

1 A preliminary version of this paper was presented as: Stephen C. Jett, "Noise-Pollution Perception in a California University Town." Abstract in: Yearbook, Association of Pacific Coast Geographers, Vol. 40 (1978), 161.


6 Environmental Protection Agency, op. cit., p. 6. citing the Bureau of the Census' 1974 Annual Housing Survey.

7 This law, passed in 1971, is now Section 65302g, California Government Code. Division 28 of the California Health and Safety Code established the Office of Noise Control, State Department of Health, which aided in the collecting of technical data for Davis' Noise Element.

8 City Council Resolution 1586. Individuals serving on the committee during some or all of its life included Charles W. Beadle, Ph.D.; Edward Bloomberg, Ph.D.; Marlene Bloomberg; Kenneth W. Collier; Stephen Henry; Stephen C. Jett, Ph.D. (Vice Chairman); Keith Kramer; Lynn Marchand; Dougall MacClise; Russ Suey; and Paul Taloff, M.A. (Chairman). Among
those consulted on, but not responsible for, the format of the survey were Prof. Robert Sommer (Psychology) and Prof. John Moore (Mathematics).

Ad Hoc Noise Element Study Committee. Report of the City of Davis Ad Hoc Noise Element Study Committee. Davis: Planning Division, Department of Community Development, 1976, 124-43. Although tabulation and analysis of the first questionnaire were accomplished by the present author, tabulation of the second questionnaire was done by Planning Division employee Helen Dinsdale, and preliminary analysis was undertaken by Edward Bloomberg. Errors of calculation in the original have been corrected. I wish to thank Dennis J. Dingemans for editorial suggestions respecting this article.

This relatively low return was primarily due to the City's failure to enclose return envelopes with the questionnaires. Other probable reasons include: 1) some people's feeling no noise was sufficiently bothersome to motivate return of the questionnaire (only one respondent indicated that no noises bothered him); 2) procrastination; 3) questionnaire length; 4) vacant addresses; 5) some people's lack of willingness to cooperate with "officialdom".

Thus, if 12 respondents chose noise A as "most bothersome", 7 as "second-most bothersome," and 4 as "third-most bothersome", the weighted total would be $12 \times 3 + 7 \times 2 + 4 \times 1 = 54$. The sum of the totals for each of the sources provided a grand total which, divided into the individual source totals yielded a percentage score for each source.
This weighting is somewhat arbitrary, and the reader should be aware of
the impossibility of precisely quantifying subjective reactions, such as
those to noise.

12 U.S. Department of Housing and Urban Development, *Noise in
Urban and Suburban Areas: Results of Field Studies*. Washington: U.S.

13 Fair Housing Committee. *Housing Viewpoint*. Davis: Associated
Students, University of California, Davis. Published periodically.

14 Although tabulation and analysis of the first questionnaire
was accomplished by the present author, tabulation of the second question-
naire was done by Planning Division employee Helen Dinsdale, and prelimi-
nary analysis was undertaken by Edwin Bloomberg. Errors in calculation
in the original have been corrected.

15 Environmental Protection Agency, op. cit., 6; Jacoby, op. cit.,
170, 173; John Chung Hwang and Kenneth William Hirsch. *Community Problems
in the Lives of Sacramento Area Adults*. Project Report 1, Department of
Communication Studies, California State University, Sacramento, (1975),
8-10. It is possible that Davis' survey sample had proportionately fewer
student than family responses due to: 1) the high proportion of loud-
music-induced hearing impairment among people 12 to 25 years of age;
2) students' lower propensity to return questionnaires due to other demands
on their time and to lack of a long-term stake in the community.


19 *City of Davis General Plan* (revised). Davis: (Department of Community Development), 1977, 77.
SAVANNAS ON THE ISLAND OF HAWAII

Marvin D. Frost*

The purpose of this study was to investigate and attempt to characterize the vegetation of certain savannas on the Island of Hawaii with respect to similarity or uniqueness, and possible relationships to other tropical areas or mid-latitude continental regions. Since the area is an island, one might expect low species diversity, as well as considerable floristic similarity between sites. Sites were selected for physiognomic similarity of the vegetation and differences in the physical environment in order to meet the goals noted.

Hawaii (Figure 1) is the largest, and geologically the youngest island in the archipelago, with half its area being relatively barren volcanic material. Elevations vary from sea level to Mauna Kea's altitude of 13,796 feet (4205 m). The northeast trade winds predominate, producing considerable variation in rainfall, ranging from over 200 inches (508 cm) on the windward side to less than 10 inches (25 cm) on the leeward. When traversing the island, one is struck by the variety of

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Dr. Frost is Assistant Professor of Geography, and Coordinator of Environmental Studies at California State College, San Bernardino.
environmental zones, including rainforest, arid, alpine, and savanna. Savanna-like areas occur in most of the island's environmental zones, but especially in the drier leeward areas.

Methods

For this reconnaissance study, sites were selected in two altitudinal zones (Figures 1, 2 and 3). Care was taken to avoid ruderal areas by choosing sites at least 10 meters from roads. Research methods included using a meter-square sampling quadrat placed along various transects (Figure 4). Samples were taken at either 5- or 10 meter intervals, with internal spacing being consistent for individual transects. Presence of plant species was recorded in order to determine frequency along the transects within each site. Cover class and sociability were also recorded using class values similar to the Braun-Blanquet method. Each species was initially assigned a number and a sample was collected for identification (see Table 1 for species list). The field work was conducted during the years 1975 and 1976.

The Sites

Site one (Figures 1 and 2) was 1.5 miles (2.4 km) from the junction of the Saddle Road and the road to Mauna Kea. Physiognomically it appeared similar to many other savanna areas, being grassland with scattered trees. The site was located at an elevation of 7120 feet (2170 m), in the transition between Zone E low phase and Zone E high phase of the "Vegetation Zones
Figure 1
of Hawaii" noted in the system by Ripperton and Hosaka. This zone has frequent fog in addition to rainfall ranging from 20-40 inches (51-102 cm). The soils were Inceptisols, in the "medial, isometric" family (annual average temperature from 47 to 59°F, 8-15°C), of the Kilohana series. Kilohana loamy fine sand was predominant on 12 to 20 percent slopes, grading into a type referred to as "reconnaissance cinder land" in surrounding areas. The soil was dark brown to very dark brown (10YR2/2 - 10YR4/3, using the Munsell Color system), mildly alkaline, with high permeability, slow runoff, and slight erosion. The area is now used predominantly as rangeland for cattle, but the presence of the inoperative Humuula Sheep Station (about 1 mile, 1.6 km, from the site) indicates that in the past sheep were grazed there.

With respect to vegetation (Table 1) the dominant tree, mamane (Sophor chrysophylla), was observed in varying conditions, from dead and nearly so to quite healthy. Hairy cats-ear (Hypochoeris radicata), a herbaceous weed, was present in 93 percent of the samples, covering 5-10 percent of the quadrat area considered. Grasses of Agrostis sp. were present in 98 percent of the samples, with an average coverage of 35 percent of the quadrat area. Poa annua (annual bluegrass) was present in 100 percent of the samples on the east side of the road (covering 30 percent of the quadrat area), and in 19 percent of the samples on the west side (but with negligible coverage) where the soil was more sandy and rocky. The overall value was 46 percent of the samples. Other species of lesser importance were Taraxacum...
Figure 2

Figure 3
Photograph of Site 2. Facing southward, February 1976.
officinale (49 percent frequency with negligible coverage), and various species of moss and lichens. Patches of bare earth were present throughout the area. Of the species noted, at least 2/3 were introduced within the past 200 years.

Site two (Figures 1 and 3) was on the lower slopes north of the Hualalai mountain area, 3.2 miles (5.2 km) up the slope from Waikoloa. Physiognomically it also appeared similar to other savanna areas. It was at an elevation of 1520 feet (463 m), in the upper portions of Zone A and in Zone B of Riperton and Hosaka. The average annual rainfall is approximately 20 inches (51 cm). The soils included both Aridisols and Inceptisols, with the former order being dominant in the sample area. The Aridisols were in the "medial isohyperthermic" family (average temperatures of more than 72°F, 22°C), of the Waikaloa series. (Essentially the Kawaihae series soil was on the lower warmer portions while the Waikaloa series was at a cooler higher elevation). The Kawaihae series soil was dark reddish brown (2.5YR2/4) and the Waikaloa series soil was essentially the same color but with a color code of 5YR2/2. Both soils ranged from neutral to mildly alkaline and had moderate permeability and medium runoff with moderate erosion hazard. The Kawaihae soils were stony with a thin, very fine sandy loam to a depth of about 2 inches (5 cm).

The predominant tree in site two was kiawe (mesquite, algaroba, Prosopis pallida). Fountain fingergrass (Pennisetum setaceum) was present in 100 percent of the samples, covering
an average of 35 percent of the quadrat area. *Sida* sp. (*Lei-ilima*) was present in 73 percent of the samples covering 5 percent of the quadrat area, and *Emilia sonchifolia* (floras point-brush, red pualele) was present in 93 percent of the samples, also covering 5 percent of the quadrat area. Other species included *Rhynchelytrum repens* (Natal redtop; 53 percent presence frequency), *Plantago lanceolata* (narrow-leaved plantain; 73 percent presence frequency), *Sonchus oleraceus* (sow thistle, pualele; 13 percent presence frequency), *Opuntia megacantha* (prickly pear cactus; 7 percent presence frequency). Small patches of bare earth were present throughout the area. *Coprosoma* sp. (pilo) and *Indigofera suffruticosa* (Indigo) were not present within the site, but were found nearby. Again, at least 2/3 of the species noted were introduced during the past 200 years.

**Discussion**

The low number of endemics and the high incidence of introduced species, especially with a notable presence of forage species, indicate that both areas have probably been broadcast seeded for pasture and perhaps partially cleared of brush. Authors such as Ripperton and Hosaka refer to these sites as "woodland" ("dry woodland" in Carlquist) in general discussions, but at present, they are grasslands with scattered trees, or what is generally known as savannas. Savannas have been of considerable interest to many researchers, and discussions have been made for various areas.  

It would appear that since the areas studied are on
an island, (an isolated area that is usually low in native species diversity) there should be considerable floristic resemblance from one savanna-type area to another (if they are natural). However, reconnaissance studies show considerable variation, with the majority of species (2/3 or more) being introduced within the past 200 years. It has been noted that "An island vegetation is delicately balanced, a slight disturbance of equilibrium often leads to its partial or complete destruction... Many of the introduced trees, grasses, and herbs found their new habitat so ideal that they became dominant in many locations and almost completely forced out the native species." It is reasonable to state that there has been considerable disturbance of the vegetation in the areas that presently fit into the savanna category. Furthermore, one can suggest that most of the savanna-like areas of Hawaii are really pastures with scattered trees. In fact, many areas on the Island of Hawaii are pastures and rangelands with varying degrees of improvement, and several have been studied in detail by the University of Hawaii Agricultural Experiment Station, especially permanent pasture zones. Sites included in this study have not been extensively researched because they are drier, have less productive potential, and fit into the realm of rangeland. Nevertheless there is some speculation that even these sites had more trees in former times. T.S. Newman suggests that the destruction of natural vegetation was begun by the native Hawaiians, and was continued by agriculture and introduced animals.
Soil Survey of the Territory of Hawaii\textsuperscript{13} indicates that very little land was cleared by natives and that most of the vegetation destruction has occurred since the arrival of Americans and Europeans in the late 1700's, with their subsequent introduction of animals, especially cattle, sheep, and goats "...and the sharp hooved animals feeding on the leaves and injuring the root systems soon destroyed the native forest in large areas."

Carlquist also notes that "The destruction of Hawaiian flora and fauna has been indirect, as well as direct. Animals and plants introduced by man have gone wild. Pigs, goats, sheep, and other herbivores have been unleashed on a flora which has evolved under herbivore-free conditions...the disturbance the herbivores create paves the way for weeds that might not otherwise enter."\textsuperscript{14}

Kay states that by 1885 the forests of the plateau of Waimea, Hawaii were entirely depleted by the damage caused by the bulk force and foraging of cattle.\textsuperscript{15} Marie C. Neal notes that native mamane is found between 1,000-9,000 feet (305-2895 m) (to the tree line on Mauna Kea and Mauna Loa) and states "Herds grazing among mamane trees eat the leaves and young growth and threaten the existence of the tree."\textsuperscript{16}

Feral animals have had considerable impact upon the Hawaiian landscape. Being an island ecosystem, the introduction of cattle (\textit{Bos taurus}), sheep (\textit{Ovis aries}), and goats (\textit{Capra hircus}) in the late eighteenth century presented a problem for plant species not adapted to extensive trampling, grazing, and browsing. Pigs (\textit{Sus scrofa}) were originally brought by the
Polynesians, with subsequent introductions in the early nineteenth century following European contact. Rooting and browsing by pigs has caused damage to the watersheds including forest floor, forests, and grasslands in many areas. Their affect on ferns, pukiawe, and seedling mamane has contributed to reducing the forest areas to savannas, but considerably more damage has been caused by cattle, goats, and sheep. 17

Kramer indicates that the Hawaiian forests are susceptible to injury by cattle and notes that "trampling of the undergrowth causes the soil to dry out and the shallow-rooted trees cannot obtain the necessary moisture for survival." It was estimated that there were 10,000 wild cattle on Mauna Kea alone in 1904. 18 Destruction is intensified by eating and trampling young trees so there is no replacement for the older dying ones. In 1907 steps were taken toward protection of mamane forests by fencing. 19 This kept the livestock from going to the higher elevations of the Mauna Kea reserve, and hence, one can observe forest patches upslope, whereas downslope it is, at best, savanna. At present feral cattle are not as numerous as before. Goats and sheep also have done widespread damage to native plant species. It was noted that there were 75,000 goats on Hawaii in 1931. 20 Their habit of eating on slopes has resulted in considerable erosion. Special elimination programs have reduced their numbers; goats nevertheless are currently quite destructive. 21 In 1937 it was estimated that there were 40,000 feral sheep in Mauna Kea Forest Reserve (80,000 acres, 32,375 ha.,
which extends down to the 7,000 foot level, 2134 m), and Kramer indicates that sheep have caused damage to mamane trees and other vegetation and that exclosures show grass, herbs, and sprouting of mamane. The present sheep population is still presumed to be beyond the estimated carrying capacity of 1,300-1,500 head, and efforts to control them have been instituted. A side effect is that by eating the seeds they destroy a food source of the palila (Psittirostra bailleui) which is an endangered bird. In addition, this degrades the bird's habitat, by not allowing the mamane to regenerate. Other feral animals such as the horse (Equus caballus) and the donkey (Equus asinus) have not been present in such large numbers and have not been as damaging. However, the large numbers of feral cattle, sheep, and goats during the early part of the twentieth century certainly had extensive impact. Kramer notes that certain zones from sea level to 10,000 feet (3048 m) (C1, C2, D3, E1, and E2 of Ripperton and Hosaka) were formerly forested by now are largely open grassland with a few trees and that this is due to overgrazing.

Conclusions

The results of this study indicate that certain savannas on the Island of Hawaii have a low percentage of native plant species and a high frequency of introduced ones. The higher elevation site (#1) had basically a temperate zone floristic composition while the lower one (#2) contained more subtropical or tropical species. The research did not support the contention that since the area is an island, one might expect
low species diversity. The sites studied were found to support many types of plant species. The diversification may be accounted for by environmental differences and human influences, including introductions which resulted in most species being native to other areas, both temperate and tropical. Human impact through direct effect upon the landscape by clearing and planting, as well as the introduction of animals has been the major factor in the development of savannas in various areas of the Island of Hawaii.

NOTES

1Paper presented at the Association of Pacific Coast Geographers annual meeting, Portland, Oregon, June 13-16, 1978. Data were collected while the author was a Visiting Assistant Professor at the University of Hawaii, Hilo College (1975-1976). Current position is Assistant Professor of Geography and Coordinator of Environmental Studies at California State College, San Bernardino 92407.

2This of course varies with factors such as the type of island (e.g. high volcanic landform, coral atoll, etc.), its geologic age, size, and distance from other land areas. Also, this depends upon whether one is considering only naturally dispersed species or also including very recent introductions. Lowland Hawaii tends to have low diversity or richness of "native" biota (especially fauna) when compared to similar altitudinal zones in areas such as Central and South America. The idea of relative species diversity on islands such as Hawaii is to some individuals a matter of debate, especially when ecological opportunity and adaptive radiation are considered for selected taxa. Refer to: S. Carlquist, Island Biology, (New York: Columbia University Press, 1974), 660 pp.; and R. H. MacArthur and E. O. Wilson, The Theory of Island Biogeography, (Princeton, N.J.: Monographs

³K. A. Kershaw, *Quantitative and Dynamic Ecology* (New York: American Elsevier Publishing Company, Inc., 1964), 178pp.; D. Mueller-Dombois and H. Ellenberg, *Aims and Methods of Vegetation Ecology*, (New York: John Wiley and Sons, 1974), 547 pp.; and D. W. Shimwell, *The Description and Classification of Vegetation*, (Seattle: University of Washington Press, 1971), 322 pp. Frequencies are noted at appropriate points, and in the species list. Significant cover class values are also noted at appropriate points in this paper. None of the species were highly sociable except in isolated cases, several were moderately so, but not enough for significant analysis purposes. Frequencies and cover class values proved to be more useful and this is in agreement with Mueller-Dombois and Ellenberg, 1974.

⁴Reconnaissance field work was conducted during October and November 1975, vegetation sampling in February 1976, and revisited as late as June 1976. Identifications and interpretations were primarily made by the author in consultation with various individuals (including R. Baldwin) at Hilo College. Numerous sites were observed throughout the island. Two sites were selected and were initially covered in general with overall sampling and notes taken. This was followed by a total of 61 quadrats being sampled for this reconnaissance study from the two sites; four transects with a total of 46 quadrats in site #1 (25 at 5 m apart and 21 at 10 m apart); one transect of 15 quadrats (5 m apart) in site #2 with extensive reconnais-
sance sampling of the surrounding area to supplement the lower number of quadrats. Botanical references included: E. Haselwood and G. Motter (Eds.), *Handbook of Hawaiian Weeds*, (Honolulu: Experiment Station Hawaiian Sugar Planter's Association, 1966), 479 pp.; M. C. Neal, *In Gardens of Hawaii*, (Honolulu: University of Hawaii Press, 1968), 355 pp. A number of the Latin binomials are also known by synonyms. The names given in this paper are based upon the reference sources noted.


7 See footnote 5.


9 See footnote 2.

10 Cline, op. cit., footnote 6, p. 29.


21. Many people in Hawaii hunt pigs, sheep, and goats for food and recreation. As a result, there is strong opposition to efforts aimed at significantly reducing the populations of these feral animals. As previously noted, exclusion of grazing animals can result in a recovery of native plants.


24 Kramer, op. cit., footnote 17, pp. 184-185/Table 4.

Figure 4
Meter-Square Sampling Quadrat
Table 1  
FLOWERING PLANTS FROM SITES ONE AND TWO  
Origin and Date First Recorded in Hawaii

<table>
<thead>
<tr>
<th>INTRODUCED</th>
<th>Origin</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Achillea millefolium</em> L. (Common Yarrow)</td>
<td>Native of Eurasia and North America;</td>
<td></td>
<td>(N);</td>
</tr>
<tr>
<td></td>
<td>#1 (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Conyza canadensis</em> (L.) Cronq. (Small-leaf Horse Weed; Canada Fleabane)</td>
<td>Native to Temperate North America; (H &amp; M);</td>
<td>#2 (7)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Emilia sonchifolia</em> (L.) DC. (Floras Paintbrush; Red Pualele)</td>
<td>Native to Old World Tropics; (H &amp; M);</td>
<td>#1 (7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Erodium cicutarium</em> (L.) L'Her. (Redstem Filaree; Herons Bill)</td>
<td>Native to Mediterranean Region; (H &amp; M);</td>
<td>#1 (7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>Geranium carolinianum</em> var. australis (Benth.) Fosb. (Wild Geranium; Cranesbill)</td>
<td>Australia (probably); early introduction; (N);</td>
<td>#1 (4)</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td><em>Hypochoeris radicata</em> L. (Hairy Cats-ear)</td>
<td>Native to Mediterranean Area; (H &amp; M);</td>
<td>#1 (93)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Indigofera suffruticosa</em> Mill. (Indigo)</td>
<td>Native to West Indies; about 1850; (H &amp; M);</td>
<td>#2 (*)</td>
<td></td>
</tr>
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<tr>
<td><em>Opuntia megacantha</em> Salm-Dyck (Prickly Pear; Panini)</td>
<td>Native to Mexico; about 1809; (H &amp; M);</td>
<td>#2 (7)</td>
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<tr>
<td><em>Pennisetum setaceum</em> (Forsk.) Chiov. (Fountaingrass; Feather Fingergrass)</td>
<td>North Africa; 1926; (R); #2 (100)</td>
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<tr>
<td><em>Pennisetum setosum</em> (Swartz) L. C. Rich. (Feathery Pennisetum)</td>
<td>Tropical America; 1921; (R); #2 (40)</td>
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<tr>
<td><em>Plantago lanceolata</em> L. (Narrow-leaved Plantain)</td>
<td>Native to Eurasia; (H &amp; M); #2 (73)</td>
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<tr>
<td><em>Poa annua</em> (Annual Bluegrass)</td>
<td>Europe; 1864; (R); #1 (46)</td>
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<tr>
<td><em>Prosopis pallida</em> (Humb. and Bonpl. ex. Willd.) HBK. misdetermined in Hawaii as <em>P. chilensis</em>, <em>P. juliflora</em> (Mesquite, Algaroba, Kiawe); <em>P. pallida</em> from South America; after 1828; (N); #2 (*)</td>
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<tr>
<td><em>Rhynchelytrum repens</em> (Wld.) C. E. Hubb. (Natal Redtop)</td>
<td>Africa; 1895; (R); #2 (53)</td>
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<tr>
<td><em>Solanum nodiflorum</em> Jacq. (?) (Black Nightshade; Popolo)</td>
<td>Throughout Temperate and Tropical Regions; (Probably of Accidental Introduction to Hawaii); (H &amp; M); #2 (27)</td>
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<tr>
<td><em>Sochus oleraceus</em> L. (Sow Thistle; Pualele)</td>
<td>Native to Europe; Early Introduction; (H &amp; M); #2 (13)</td>
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<tr>
<td><em>Taraxacum officinale</em> (L.) Weber in Wiggens (Dandelion; Lau-Lele)</td>
<td>Native to Europe; (H &amp; M); #1 (49)</td>
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</table>
Waltheria americana L. (Hialoa) -- Native to Tropical America; Very Early Introduction; (H & M); #2 (60)

NATIVE TO HAWAII

Sophora chryophylla (Salisb.) Seem. (mamane) -- (N); #1 (*)
Styphelia tameiameiae (Cham.) F. Muell. (pukiawe) -- (N); #1 (2)

UNDETERMINED SPECIES OR ORIGINS

Agrostis sp.--(R); #1 (Of 12 species listed by Rotar, only 2 are native to Hawaii (98)
Compositae--(?); #1 (2)
Euphorbia--Introduced Weed (?); #1 (22)
Medicago--Introduced from Europe (?); #1 (9)
Rumex acetosella L. (Sheep Sorrel; Sour Dock)--Introduced Weed (?); #1 (26)
Sida sp. (S. falix Walp.?, S. cordifolia L.?)(Sida; Lei ilima; 'Ilima)
--Pantropical Weed; (H & M); #2 (73)
Trifolium sp. (Clover)--Introduced from Europe (?); #1 (2), #2 (7)
Verbesina sp. (?)--#2 (20)

EXPLANATION OF SYMBOLS

Source for origin (see footnote 4):

H & M : Haselwood and Motter
N : Neal
R : Rotar

Site number and percent frequency (percent of sample quadrats in which species is present):

Example: #1 (93): Site number one and present in 93 percent of the sample quadrats
#2 (*) : In site area number two but not in sample plots

(Site one: 46 quadrats; Site two: 15 quadrats; Total quadrats: 61)

Table 1 (Continued)
Oxnard, California
Zone Changes 1960-1965

Map 1
THE ZONE CHANGE AS AN INDICATOR
OF CHANGING URBAN STRUCTURE AND
COMPREHENSIVE PLAN EFFICIENCY

W. Tim Dagodag *

For most urban geographers zoning, in either its conceptual context or daily application, remains somewhat foreign. While geographers have paid considerable attention to urban land use theory and data gathering activities, surprisingly little work has been done in the area of urban policy implementation such as zoning. This condition is even more startling when one acknowledges the fact that all urban land use activities must conform to regulations prescribed by comprehensive zoning and embodied in the text of the zoning ordinance. Zoning would appear to be the ultimate extension of those urban policies which have been devised to guide the general growth and development of the city - it is, in the urban planner's jargon, a tool for the implementation of the master or comprehensive plan.

Zoning has, however, escaped the eye of most urban

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geographers because of its mundane nature and an expectation that land use activities occur in a manner consistent with normalizing or rational locational behavior. Then too, the piecemeal or incremental changes in the city-scape may appear insignificant when, in the aggregate, such changes actually denote a subtle yet highly dynamic condition. It is precisely on this dynamic aspect of zoning which this paper focuses in an effort to deduce something about the nature of rethinking the assignment of land uses. In this paper attention is devoted to a single aspect of the zoning process, rezoning or the zone change, which as a public policy action and as that mechanism allowing for the land use to take place, reveals information about changes in the internal structure of the city, the attitude underlying these changes, and the efficacy of local plans in creating a more rational allocation of land use. Necessarily, the discussion here deals with the general nature of zoning, the zone change process, and an analysis of data yielded by a case study of Oxnard, California. In a more formal sense, it is maintained that the zone change process accounts for effective changes in the internal arrangement of land uses within a city and simultaneously serves as a measure of comprehensive plan efficiency.

The Purpose and Nature of Zoning

Zoning, in its simplest expression, provides a means for the protection of property values, allows for implementation of land use policies, and serves to protect the general welfare
of citizens. These explicit functions of zoning are well-recognized, unequivocally accepted, legally sanctioned through enabling legislation, and supported by local governmental ordinances. Virtually all local units of government subscribe to some form of zoning, either as a result of the early assumption of police powers made available through enabling legislation or in response to mandates from the Federal government to produce zoning plans as a condition for receiving funding of planning activities. There is also, implicit in the concept of zoning, a commitment to the idea of collective well-being and confidence in its utility as a regulatory land use device. Both of these attributes are boldly displayed in the homogeneous classifications of land use activities which, in their real and spatial expression, have persisted for decades, and in the plethora of official zoning maps which have achieved near doctrinal standing.

In recent years, however, zoning has been severely criticized for failing to achieve its stated objectives and most importantly for the dysfunctions created. In this regard Siegan has appeared to be the most noteworthy of zoning's detractors commenting that:

It is not necessary; it is not desirable; it is detrimental. It has no relationship to public health, safety, and welfare except on the whole, an adverse one. It is regulation almost solely for the sake of regulation.

Weaknesses reflected in the zoning process which have contributed to this generally negative image include: the failure to
deal satisfactorily with problems imposed by jurisdictional limits; the matter of sequential timing of development; fiscal or exclusionary land use abuses; a failure to adjust to conditions imposed by urban growth; and, piecemeal application.

Notwithstanding these deficiencies and well-warranted criticisms, it is safe to assume that zoning will continue to be the primary means of allocating land use in American cities. And, for purposes of this paper, it should be noted that the zone change mechanism is, itself, a method of dealing with that characteristic inflexibility stemming from the prior assignment of land uses.

The Zone Change

Zone changes have been traditionally examined from the standpoint of planning law rather than from any concern for their impact on urban structure. Nonetheless, an examination of the legal constraints or justifications for undertaking a change in zoning is required.

Arnebergh, Mandelker, Tσagris and Davis, among others, observe that zone changes are justified when there are substantial changes in the urban environment, when additional rights to the property have been acquired after initial zoning, or when current use of the land is no longer appropriate from a community standpoint. It can be maintained that zone changes are a method of handling unanticipated social, political and economic variations in city growth. Zone changes should not, then, be unexpected.
In spite of the sound legal-theoretical premises upon which rezoning rests, the process has been open to abuse as Mandelker and others have noted:  

Zoning amendments have often been employed to take care of limited changes in use, usually confined to one lot, a technique that has disapprovingly been called "spot zoning". Spot zoning for one parcel, vigorously opposed by adjacent neighbors takes on adversary characteristics that give it a distinctly adjudicative cast.  

In those instances where a fragmented pattern of land uses has occurred through "spot zoning" interest generally focuses on legal issues involving a change in conditions surrounding the use of the property  and the impact on the immediate area. Whether or not the proposal to rezone property is sustained depends largely on proving that a change in conditions has occurred and there would be conformity with the general or comprehensive plan.  

The extent to which invalid or unjustified rezoning has taken place is reflected in the lack of conformance between zoning and the comprehensive plan. In California, for example, abuses have been so widespread that the State mandated such conformity by 1974, an action which caused considerable alarm and the initiation of hasty land use studies on which to base a "rollback" of extant zoning. In a related vein, two problems emerge here concerning the perpetuation of current land uses which are inconsistent with zoning and inferences to be
drawn about changing urban structure.

Firstly, any rezoning which resulted from the zoning rollback mandate created additional "non-conforming uses" within each affected zone. Such uses are viewed as being anachronistic and if at all possible to be phased out over time regardless of their viability. In short, some very real hardships are imposed on property owners and on communities where established livelihood patterns may be interrupted. Secondly, the absence of conforming zoning and the need to formally declare "rollbacks" denotes something about decision-making attitudes and urban public policy in general. It can be assumed that past decisions to zone or rezone land in a manner which was inconsistent with planning law and adopted plans is a consequence of a desire to promote urban growth and development rather than a by-product of poor legal advice - awarding of higher density uses is generally regarded as proof of this development orientation.

In summation, the zone change is a multi-faceted land use control device. Its influence on land use may be beneficial or adverse depending on the legal-theoretical framework maintained by the unit of local government.

Oxnard, California: Case Study of Zone Changes, 1960-1965

Background to the Study

Oxnard, California was chosen as a case study site for several reasons including: 1) the City's commitment to
basic tenets of planning and zoning law; 2) the City's experiencing of rapid growth and a recognition, through zoning, of a need to regulate growth; and, 3) the writer's familiarity with the City's zoning process as a result of tenure as a City Planning Staff member and private consultant.

Bordering on the Pacific Ocean (inset map No. 1), Oxnard is located approximately 60 miles north of Los Angeles. Although incorporated in 1904, the greatest urban expansion occurred in the decade 1960-1970 - the city experienced a 43.5% growth rate (from 40,265 to 71,225 population), while the SMSA (designated in 1964) was identified as one of the fastest growing in the nation. 8

In an attempt to cope with urbanization pressures, the City constantly changed its zoning maps, modified its initial Master Plan (1949), and adopted a new plan in 1962 which was subsequently updated in 1969. 9 In the aggregate these regulatory land use devices provide the background for analysis.

Note on Methodology

For the purposes of this study a zone change is defined as a proposal to alter the use of land through a formal application to the City, the approval of this request, and the ultimate alteration of land use. 10 In the case study approach used here, all (N=121) successful and implemented zone changes occurring between 1960 and 1965 were examined. Some twenty-eight separate zoning classification and six combinations of these classifications were identified, along with the characteristics
of location, size, associated land use, and initiator of the action.

The Zone Change Process in Oxnard

While the zone change itself may be initiated in either the public or private sector, and involve the Planning Commission, City Council, individual, group, institution, or corporate interest, the process is three-step (Fig. 1) which requires a planning staff analysis of the proposal, Planning Commission and City Council approval.\(^\text{11}\) Anyone knowledgeable of the process described here must at once recognize that the City Council has the ultimate authority to accept or reject the findings of the planning staff and commission.\(^\text{12}\) In addition, appeal of a council decision is guaranteed if time restrictions are observed by the applicant. Moreover, an applicant may continue to re-file an application for a change of zone after an unfavorable decision has been rendered.

Although the rezoning process, as outlined, suggests stringency and rationality, decision-making may often be a subjective matter. Willhelm points out, that indeed zoning decisions are highly subjective in nature and are divorced from technically-based findings.\(^\text{13}\) While this intuitively based aspect of rezoning is beyond the scope of the present study, it should nevertheless be kept in mind.

Types, Distribution and Size of Zone Changes

Table 1 reveals that the prevailing type of zone change during the five year period was residential. In all years
ZONE CHANGE PROCESS

INITIATION OF ZONE CHANGE

Public Sector

Private Sector

PLANNING DEPARTMENT

Analysis and Recommendation

PLANNING COMMISSION

Recommendation

Deny

Approve

Refer Back For Further Study

CITY COUNCIL

Recommendation

Deny

Approve

Refer Back For Further Study

APPEAL

Figure 1
except one, residential rezoning accounted for over 50 percent of the proposals. Commercial, mixed, manufacturing, and agricultural-open space-community reserve rezoning followed, in this sequence, although at much lower frequencies. All but eight of the zone changes involved an increase in land use density, that is, an increase in the level of urban activity. This fact suggests that the comprehensive plan frequently underestimated the need for multi-family housing and commercial or industrial space.

Of the total number of residential zone changes (64), 88.9 percent related to increases in the density of development, especially where apartment complexes or planned unit developments were introduced. The ascendancy of multi-family dwelling unit construction in the southern California region during this period certainly supports this observation (see figure 2).

In the area of commercial rezoning the associated land use requested was either retail or office space. Individual office buildings, district and neighborhood shopping buildings, gas stations, medical centers, and general retail outlets encompassed the variety of activities dependent on the change of zoning. Offices (39.1 percent) were the most frequently cited of these commercially classified land uses.

Mixed land uses were proposed in 9.9 percent of the cases. Examples of the types of activities include: combinations of single-family and multi-family housing, offices and retail, multi-family residences and shopping centers, and retail
Table 1
Zone Changes, 1960-1965 (N=121)

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<tr>
<td><strong>Residential</strong></td>
<td>9(69.2)</td>
<td>13(59.1)</td>
<td>17(94.4)</td>
<td>13(65.0)</td>
<td>11(32.3)</td>
<td>9(64.3)</td>
<td>72</td>
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<td><strong>Commercial</strong></td>
<td>2(15.4)</td>
<td>7(31.8)</td>
<td>3(15.0)</td>
<td>10(29.4)</td>
<td>1(7.1)</td>
<td>23</td>
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<td><strong>Manufacturing</strong></td>
<td>1(7.7)</td>
<td>1(5.0)</td>
<td>5(14.7)</td>
<td>2(14.3)</td>
<td></td>
<td>9</td>
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<tr>
<td><strong>Agriculture - Open space - Community reserve</strong></td>
<td>1(5.0)</td>
<td>4(11.8)</td>
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<td>5</td>
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<tr>
<td><strong>Mixed (residential, commercial, manufacturing)</strong></td>
<td>1(7.7)</td>
<td>2(9.1)</td>
<td>1(5.5)</td>
<td>2(10.0)</td>
<td>4(11.8)</td>
<td>2(14.3)</td>
<td>12</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>13</td>
<td>22</td>
<td>18</td>
<td>20</td>
<td>34</td>
<td>14</td>
<td>121</td>
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and manufacturing. Here rezoning was closely related to subdivisions or industrial parks which provided for a diversity of uses as part of recent innovations in zoning.

The remaining two categories, manufacturing and agriculture-open space-community reserve, represent a highly diverse grouping of land use activities. Not only are customary heavy and light manufacturing uses noted, but also more exotic ones such as farm labor camps, rights-of-way for industrial drainage facilities, an airport, mobile home facilities, neighborhood and district parks, and churches.

The distribution of all zone changes in the study period are shown on Map 1. Indicated here are the various types of zone changes, a series of concentric line intervals which allow measuring distance from the Central Business District (CBD), and an outline of the current municipal limits. Virtually all, 97.5 percent, of the rezoning occurred within a four mile radius of the city core, a fact which is not surprising since zone changes are premised on a reconsideration of use due to changes in the circumstances of the site in question or in its vicinity.

The emerging distribution pattern corresponds with the cruciform shape of the city, and the north-south, east-west alignment of highways and streets. The concentration of zone changes along both major and minor thoroughfares further suggests that accessibility must be considered as a physical factor influencing rezoning, especially in the case of commercial activities.
PERCENTAGE MULTIPLE-FAMILY UNITS
OF TOTAL DWELLING UNITS AUTHORIZED
1960-1965*

LOS ANGELES COUNTY

ORANGE COUNTY

VENTURA COUNTY

*SOURCE: VICTOR GRIEN ASSOCIATES AND SECURITY FIRST NATIONAL BANK.

Figure 2
As for more precise characteristics of the rezoning pattern, these can be seen in Map 2, which encompasses an area of 1.2 square miles and is situated within a two mile radius of the CBD. This site contains 10.7 percent of the rezoning cases examined. The pattern displayed here as well as dispersal in the time of rezoning do not represent a cohesive or well-planned effort to reassign land uses. To the contrary, spot and strip-zoning are clearly evident and indicate that the process of change was rather incremental in nature. Moreover, the size of the recorded parcels lends credence to this suggestion.

The impact of rezoning upon the structure of Oxnard can be, perhaps, best measured by reference to the size of the rezoned area and parcels. Approximately 12 percent of the incorporated area was rezoned during the five year period. This figure is somewhat unexpected since relatively small parcels (the mean size of the 121 zoning actions was 11.8 acres) were used to transform urban land uses in an incremental fashion. When even smaller parcels are considered, those under five acres, 71.1 percent of the zone changes are accounted for. As a general comment regarding size, it can be said that rezoning in Oxnard was accomplished by submitting proposals involving small discrete parcels. Nor is this approach without liabilities as Rody and Smith have noted in their enumeration of mistakes most frequently encountered in zoning ordinances:15
Zoning extremely small areas, one or two lots, for a use instead of providing a district of sufficient size to make the zoning ordinance truly comprehensive in scope [is incorrect].

Eventually, the issue must be raised concerning the initiation of the zone changes - were they public or private in origin? In recording data on each zone change only two classes of initiators were distinguished; the city officials and those represented by a composite group of private individuals, builders, developers, and corporate entities such as businesses and partnerships. According to these distinctions, the zone change process can be attributed to the private sector which initiated 82.7 percent of all actions. In short, the zone change process would appear to be a private rather than a public response to urban growth and the ensuing need to adjust comprehensive plan allocations of land use. The presence of so many individual interests and agents helps to explain the fragmented nature of rezoning characterized by a spatial and temporal scattering of small parcels or lots.

Conclusions

In utilizing a case study of Oxnard, California during a period of rapid growth in the early and mid-1960's, several conclusions emerge which support the initial contention that zone changes are an effective influence on the internal arrangement of urban land uses.

Firstly, residential land uses were seen to be the most strongly influenced category of land uses. The majority of
rezoning cases dealt with increases in dwelling unit density, an expected occurrence since any increases in the ratio of multi-family units to the total number of residential units is normally associated with increases in population density. During the study period, Oxnard was apparently undergoing the same growth patterns and pressure witnessed elsewhere in the Southern California region. Consequently, any pressures to rezone property would have been an expression of general market conditions recognized by the private but not the public sector. Since the impetus for rezoning originated in the private sector, little if any of a creative role can be attributed to zoning officials. In this instance, the planning commission and city council must be viewed as reactive agents rather than as vigorous contributors to change.

Secondly, while the resulting land use pattern may be considered as fragmented, and indeed indicative of spot or strip zoning abuses, a more important conclusion concerns the official "rethinking" of land uses. To this end, city officials initiated some zone changes, and in the majority of cases approved privately sponsored rezoning. On the whole, however, the distribution, types and sizes of rezoned parcels invoke some doubt as to the legality or reasonableness of the process and ultimately raise questions concerning the competency of estimates in the original comprehensive plans. Certainly some zone changes were necessary since they serve the public interest, and yet the numerous zoning amendments may be taken clearly as
an accurate measure of inefficiency.¹⁸

Lastly, the effect of rezoning on urban structure must not be underestimated. Although the zone changes individually comprised rather small parcels or lots, a cumulative impact was rendered. Residential rezoning, in particular, affected the distribution of population and influenced the location of supportive services. On the other hand, each zone change which increased the level of land use activity must be viewed as a catalyst for other changes in the vicinity.

NOTES


⁴Roger Arnebergh, "Zoning: When Should It-And When May It Be

Mandelker, op. cit., p. 761.


7 State of California, Government Code, Section 65862.


10 Zone Change files made available to the author by the Oxnard City Planning Department.

11 Oxnard is a general law city and is empowered to adopt and enforce zoning regulations. See: State of California Government Code Sec. 65800, et. seq.


Four zone changes involving combinations of single and multi-family construction were classified along with other mixed zoning actions.


An opposing view has been witnessed in the States of Washington and Oregon where the supreme courts are maintaining that rezoning should be considered an administrative or quasi-judicial act. See: Roger A. Cunningham, "Rezoning by Amendment as an Administrative or Quasi-Judicial Act: The 'New Look' in Michigan Zoning", *Michigan Law Review* 73 (August, 1975), 1341-1360.

Clark Wiseman notes that: "In many real cases, probably the vast majority, actual zoning changes are partially anticipated in the sense that buyers and sellers of land attach some subjective probabilities to both the nature and timing of various possible future zoning changes"; See: "Land Zoning and Zoning Changes; and Economic Perspective", *The Rocky Mountain Social Science Journal* 12 (April, 1975), pp. 62-63.

Urban sprawl in the United States has given rise to the coining of several place names for developing conurbations, including Bos-Wash, Chi-Pitts, and San-San. While there are still numerous open spaces within each of these areas, by far the largest gap is in the projected California megalopolis, San-San, between San Francisco and San Diego (Fig. 1). Indeed, between Monterey and Santa Barbara, a highway distance of 229 miles, there is no city along or near the coast with as many as 40,000 residents.

At the heart of the "San-San Gap" is San Luis Obispo County, three times the size of Rhode Island. In 1950, the county was the home of a mere 52,000. By 1979, however, the population had reached 140,000; the annual rate of increase during the 1970's averaging more than four percent, triple the state rate.

National and State Population Trends

This population surge is in part a reflection of two

*Dr. Wilvert is Associate Professor of Geography, California Polytechnic State University, San Luis Obispo.
national trends. The first, described as the "sunning of America," involves the migration of northerners to fifteen southern states stretching from the Atlantic to the Pacific. This phenomenon, long evident (though of fluctuating intensity) in California, has only recently become apparent in some other parts of the "sunbelt," especially the south central states. 4

Figure 1

The second trend—and the one probably more relevant to the San-San Gap—is the recent national migration to rural areas. Between 1970 and 1977, nonmetropolitan areas grew by 10.7 percent, as opposed to a total United States population increase of 6.4 percent.\(^5\) Calling this reversal of the historic rural to urban migration a "rural renaissance," the Population Reference Bureau notes the "Even remote nonmetropolitan areas...far distant from urban...influences...have been registering net migration gains instead of their once perennial losses...Population growth in distinctly remote rural areas...cannot be explained away semantically as simply urban sprawl sprawling further."\(^6\)

Decentralization of manufacturing was a major factor in nonmetropolitan population growth during the 1960's. Since then, tertiary employment has surpassed manufacturing as a source of nonmetropolitan growth. There are three basic causes of this nonmanufacturing employment expansion today in rural areas. First are the services required by retirees, who have lately been moving into nonmetropolitan areas in unprecedented numbers. The trends toward earlier retirement and larger retirement benefits make this group a "floating population of consumers whose presence in an increasingly service-oriented society creates jobs wherever they go." Second is the rising economic importance of recreation, a growth industry especially common in "amenity-rich" areas. Third, is the accelerated exploitation of coal and petroleum, revitalizing many old coal-
mining districts in the East and creating new communities, primarily in the western states.\textsuperscript{7}

While rural areas in general are experiencing immigration, the trend has been longer and more fully developed in places perceived as rating high in "amenities." The concept of amenities, as used currently, seems to apply to rural areas having a low population and a physical environment widely regarded as attractive.\textsuperscript{8}

In California, with rural areas often possessing such amenities, this trend toward nonmetropolitan growth has been especially pronounced. Explaining the unprecedented and accelerating movement to remote coastal and Sierran foothill areas—the "cow counties"—of the state Sokolow\textsuperscript{9} has noted:

> The answer involved some affluence, some poverty, some inflation and considerable lifestyle change—a combination that has developed only since the late '60s. Actually there are at least three kinds of people joining in the urban-to-rural exodus. Some are newly retired couples and singles, some are younger urban dropouts, and others are conventional middle-class families with school-age children.

Amenity areas, then, entice not only retirees and visitors but many others, especially younger people who provide the services for these groups and who are themselves seeking the "good life."

\textit{County Characteristics and Trends}

Western San Luis Obispo County (Figs. 2 and 3), with
Figure 2

Figure 3
its hills and valleys, predominantly rural land uses, scenic coast, and sunny, ocean-moderated climate, would surely be considered an amenity area by any definition. In addition to these appeals are the county's low crime rate and absence of visible pollution. The largest city, San Luis Obispo (population 36,000 in 1979), conveys a rare blend of old-fashioned charm, sophistication, and economic vitality. Sometimes likened, especially during the green winter months, to a Swiss or Austrian community because of the surrounding peaks, the picturesque city has a thriving tree-lined central business district, a two-century-old mission, and active fine arts associations.

The county's age distribution, compared with that for the state, clearly shows a prominence of younger and of older adults. Adding to the young adult population are California Polytechnic State University students. Many former university students also remain in the county after finishing school.

There is little industrial employment in San Luis Obispo County, the tertiary sector dominating the job market. The especially large employment boost during the last decade in trade, services, and construction suggest the expanding role of the county as a destination of retirees, tourists, and students. Employment, then, seems to have been stimulated by population growth, rather than growth being stimulated by employment opportunities. (Table 1).

The explosive population growth rate of recent years
is assaulting traditional land uses, both in once sleepy communities and in the agricultural hinterlands. Wherever one looks, there are signs of change. New construction is ubiquitous; vacant lots within communities and nearby pastures and croplands are giving way to the relentless demand for housing. A proliferation of realty offices reflects this demand.

A far more aggressive force than urban sprawl in causing the conversion of rural lands from traditional agricultural uses in San Luis Obispo County has been the rapid rise in hobby ranches, or "ranchettes," typically 10 or 20 acres but ranging between two and one-half up to about 40 acres. These small farms are highly conspicuous in the valleys of the western part of the county. Thus it is the land close to urban areas--largely uncovered by agricultural preserve zoning--where this trend is most fully developed. In many of these areas the annual population growth rate in recent years has exceeded ten percent, more than twice the county rate. Indeed the availability of these rural parcels has been an important factor behind the county's overall growth rate. It is believed that a significant number of the properties are owned by retirees who have migrated to the county.

One index to the extent of the rural construction boom is the number of single family housing permits issued for the unincorporated areas. Between 1970 and 1977, there was a six-fold increase, some being for hobby ranches and others for dwellings on city-sized lots in unincorporated communities.
Another index of the growing demand for hobby ranches is the rise in applications for subdivisions of land in unincorporated parts of the county. Between 1971 and 1977, such applications more than doubled. Approximately two-thirds of the applications for the rural parcel splits are generally approved.\footnote{13}

With the increasing demand for land, especially in valleys of the western county, farm values have risen steeply. Even on some of the agricultural preserve land, traditional usages--pastures or unirrigated crops--are proving uneconomic. There is, therefore, in certain environmentally favored areas having water for irrigation, a trend toward higher value agricultural land uses. These more intensive patterns consist primarily of crops limited to frost-free areas (largely along the southern coast), such as avocados, lemons, and increasing acreages of vegetables. Plantings of wine grapes, in both inland and coastal locations, have also increased dramatically. To the environmentalist, long-term plantings, such as orchards and vineyards are a welcome check on urban sprawl, at least for the time being. Yet, given the rapid population growth San Luis Obispo County, will the San-San mid-section someday be as solidly urbanized as the burgeoning conurbations at its northern and southern ends?

Constraints on Growth

Some of the factors associated with the long-standing growth of the San Francisco Bay area and greater Los Angeles-San Diego include: locations at the ends of transcontinental
routes; excellent harbors, whether natural or man-made; large areas of level or gently rolling terrain; abundant water (at least in the past) imported from other parts of the state; and a historic philosophy that "bigger is better" thus encouraging industrial growth and land development schemes.

San Luis Obispo County does not share these traits. No transcontinental highway or rail line terminates in the San-San Gap. Nor does the county, with its shallow-water recreation and commercial fishing ports have, or have the ready capability of having, a large-scale multipurpose commercial port.

Topographically, the county, except along the South Coast, lacks large level or near-level expanses in the climatically desired western portion. Indeed, rugged terrain characterizes an estimated 60 percent of the county (Fig. 2). Still another factor mitigating against solid urbanization is the large amount of government land, or, to use Steiner's term, "reserved land," primarily the Los Padres National Forest.

Unlike megalopolitan California, sparsely and variably watered San Luis Obispo County is not the recipient of imported water. Of physical factors, water scarcity is surely to become fairly soon a major constraint on growth. Current water sources are wells and several reservoirs.

If high growth rates persist, and, barring the decision to embark on further water projects, severe water problems are anticipated in several parts of the county not later than the mid-1980's. The problems are especially acute in some of the
coastal communities dependent upon wells. The fear that continued pumping of ground water in these areas could result in further encroachment of salt water into the aquifers caused Morro Bay to impose a building moratorium in 1977. The city of San Luis Obispo is dependent upon two reservoirs, Salinas and Whale Rock (Fig. 3). These sources supply a safe annual yield sufficient to support a population of 43,000 (about 7,000 higher than the 1979 population), a number anticipated by the early 1980's.

North County communities of Atascadero, Templeton, and Paso Robles, plus the agriculture of that area, obtain water from wells in the 630-square-mile Paso Robles Ground Water Basin. Usage by the late 1970's was approximately the same as the safe annual yield of 47,000 acre feet. By "mining" the basin, estimated to contain 26 million acre feet, the population could grow for years, but without alternate water sources these areas would, of course, face inevitable shortages. 18

San Luis Obispo County could augment its water supply by two developments: the State Water Project and the Nacimiento Project. In 1960, the county contracted with the state for eventual rights to 25,000 acre feet of water per year from the California Aqueduct. The plan specified construction of an 84-mile pipeline, running from the aqueduct through San Luis Obispo County and terminating in Santa Barbara County. In March 1979, Santa Barbara County residents voted almost three to four against the project. That county's withdrawal would
raise the costs of construction of the pipeline for San Luis Obispo County by an estimated 22 to 76 percent. It thus seemed improbable that the county would acquire state water in the foreseeable future.

With the Nacimiento Project, the county has rights to 15,000 acre feet annually from Lake Nacimiento, a reservoir owned by Monterey County (but located in San Luis Obispo County). If the project is built, some of the water would be pumped into the Paso Robles Basin to prevent over-drafting there. The remainder would be sent to Whale Rock Reservoir and then to nearby coastal communities, including Morro Bay and Los Osos. The city of San Luis Obispo would also receive increased water via Whale Rock. A bond to finance the project was narrowly defeated by the voters in 1974, the main reason being fear that additional water would simply stimulate growth. Should the voters eventually approve a bond, project construction would require about six years.

Factors other than lack of water which could cause additional communities to limit growth include the desire of many residents to retain community character and not to follow the Southern California example of urban sprawl. Also, suspicion of growth is often linked to the pocketbook, i.e., unwillingness of communities to expand schools or to invest in sewers.

The obvious changes wrought by rapid growth, and the expectation for continued growth, have stimulated vigorous debates between no-growth and pro-growth advocates throughout
the county. Organizations representing these opposing positions are often strident in their demands. Most governing bodies, including the County Board of Supervisors, are split philosophically on the growth issue.

One planning vehicle by which coastal growth is being regulated is the Coastal Commission, mandated by the California State Legislature and in effect as of 1977. This legislation empowers the Commission with sweeping authority over all development between the coast and a zone ranging from 1,000 feet to five miles inland. Throughout much of San Luis Obispo County, the zone extends to the legal limit of five miles in order to protect the watershed areas. Empowered to protect wetlands and estuaries, to preserve coastal agriculture, and to cluster new construction in urbanized areas, the Coastal Commission could continue to be a significant constraint on growth (if the Commission's many opponents are unable to reduce its statewide authority).

There are, then, in San Luis Obispo County present and potential constraints on growth not experienced during the earlier expansion at either end of San-San.

Prognosis

It seems likely that the population pressure experienced in many nonmetropolitan areas will continue to be abundantly manifested in San Luis Obispo County. Yet continued growth will surely diminish the rural charms attracting so many of the new residents. Without an industrial base to draw people, one
can only wonder when, due to an increasingly urban character, "success may spoil" the county, so that potential immigrants may be attracted instead to more remote areas.

Making predictions is fraught with hazards because of the many variables. One of these is political. Should elections shift governing bodies within the county from their current split on the growth issue to decidedly no-growth, and should the voters continue to reject bonds to finance water projects, the growth rate would inevitably fall.

Even without such political developments, water is likely to become a constraint on growth in several parts of the county in less than a decade. Assuming the unlikely possibility that both the Nacimiento and State Water Projects should be approved and that all of the additional water is made available for urbanization and none for agriculture, the additional water would support about 200,000 more people. Beyond these sources of water, several small reservoirs, mainly along the North Coast, might eventually be built. However, the number of additional residents these could support would apparently be only a few tens of thousands.

A far larger potential source of water would result from the gradual conversion of irrigated farmland to urban use. Irrigated agriculture in California actually consumes roughly twice as much water as urban uses, acre-per-acre. More significantly, irrigation consumes about 86 percent of the water in San Luis Obispo County, as opposed to only 14 percent for urban
usage. Yet the urbanizing of irrigated areas, so widespread historically in California, will surely be impeded in the county by agricultural preserves, the Coastal Commission, and the political "clout" of agriculturalists.

While it seems inevitable that rapid growth will continue in the short run, constraints, both physical and cultural, will almost certainly eventually slow, or perhaps even halt, growth. It seems unlikely, then, that the San-San Gap will in the foreseeable future become solidly urbanized. Although there is controversy as to the rate at which the county might grow, and much more controversy as to the merits of growth, one fact is inescapable: San Luis Obispo County has been "discovered", and the bucolic landscape is changing in ways alien to many of the residents, themselves often recent emigrés from big cities.

NOTES

1While "San-San" is most commonly defined as the area between San Francisco and San Diego, it has been described by Haggett as the far shorter zone between Santa Barbara and San Diego. The latter delimitation would, of course, exclude the entire central coast area, of which San Luis Obispo County is a part. Refer to Peter Haggett, Geography: A Modern Synthesis, 3rd ed. (San Francisco: Harper and Row, 1979). p. 340.

2The five largest San-San Gap cities in 1978 were Santa Maria, 35,550; San Luis Obispo, 34,100; Lompoc, 25,350; Arroyo Grande, 10,200; and Morro Bay, 8,625. Source: California Department of Finance, Population Estimates for California Cities and Counties, 1970 through 1978, Report 78 E-4, pp. 44 and 46.
3Ibid, p. 63.


7Ibid., pp. 21-22.


10Mountain barriers impose significant controls on the winter-rainfall Mediterranean climate. To the west of the Santa Lucia Range, an area bathed by ocean breezes and often blanketed at the coast by fogs, temperatures are moderate, the range between summer and winter means being only 12 to 14 degrees. The average annual precipitation at the coast, roughly 20 inches (51 cm), increases dramatically along the windward flanks of the Santa Lucias. In their rainshadow, precipitation decreases, reaching a low of six inches (15 cm) at the southeastern edge of the county.

11In 1975, 14 percent of county residents were between ages 20 and 24; 10 percent were between 60 and 69. The figures for the state were nine percent and seven percent, respectively. The county has lower percentages of children and middle-aged persons than the state. See California Department of Finance, *Population Projections for Calif. Counties, 1975-2020, with Age/Sex*
Detail to 2000, Report 77 P-3.

12The California Land Conservation Act of 1965, commonly known as the Williamson Act, was designed to give tax reductions to landowners contracting with county governments to keep their land in agriculture—thus the term "agricultural preserves." By 1979, well over half of the farm land in the county was in preserves. Acceptance of the program, however, has generally been poorest near cities (both in the county and statewide), as most landowners are reluctant to foreclose the option of selling their properties for development. See John B. Dean, "A Panacea That Wasn't" The Williamson Conservation Act Needs Repair," Cry California, Vol. 10 (1975), 11.

13Unpublished Records, San Luis Obispo County Planning Department.

14The absence of traditional industrial location factors, however, would not necessarily be a major disadvantage to labor-intensive industries which produce high-value commodities using few raw materials. I.B.M., for instance, has long had a policy of locating plants in small, sometimes remote cities such as Burlington, Vermont; Boulder, Colorado; and Chapel Hill, North Carolina. The company was prompted to select each of these locations because they were considered desirable places to live and because each was also the home of a university. San Luis Obispo shares these traits.

15Plans tentatively call for the expansion of Port San Luis (about five miles northwest of Pismo Beach); by the early 1980's it would have a 900-boat capacity, by far the largest in the county. Most of these would be pleasure vessels, and the remainder, fishing craft. The longest boats which could be accommodated would be only about 60 feet in a slip and 100 feet at moor.


17Kenneth Schwartz, Mayor of San Luis Obispo, in a speech delivered to Obispo Beautiful meeting, Dec. 9, 1976.

18Clinton Milne, Deputy County Engineer, San Luis Obispo County, interviews, January, 1977, and April, 1979.


21. The two projects would total 40,000 acre feet per year. Since the annual water consumption of an urban Southern California family of five is about one acre foot, the 200,000 figure is reached by multiplying five times 40,000.

22.Milne, interviews.
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Agricultural Employment                  | 2,550        | 1,900        | - 25              |

A GEOGRAPHICAL INTERPRETATION OF ETHNIC SETTLEMENT IN AN URBAN LANDSCAPE: RUSSIANS IN SACRAMENTO

Susan W. Hardwick

Adaptation of immigrant groups to their new environment, with resulting settlement patterns and culture change, has been a theme of study in both urban and cultural geography. A number of contemporary geographers have dealt with this topic, including Jakle and Wheeler in their study of the Dutch in Kalamazoo, Doeppers with his analysis of ethnic neighborhoods near Denver, and Novak's study of Puerto Ricans in Manhattan. Geographic processes and culture change are also themes in Gordon's book *Assimilation in American Life*.

This research project focuses on ethnic settlement and the cultural landscape of Russian immigrants in Sacramento, California, and will deal with the following questions:

1) What are the forces operating in an American city to create and change ethnic neighborhood patterns of settlement?
2) When and why did Russians settle in Sacramento?
3) Why is a tightly clustered pattern of settlement in a...
suburb of Western Sacramento (Bryte), and a more dispersed pattern in other parts of the city? Is dispersal more common in 1970 than in 1950 or 1960?

4) Finally, how is the pattern and distribution of this ethnic group related to the processes of assimilation and acculturation in American cities?

Russian Settlement in the United States

Old World conditions forced most of the early Russian people to emigrate from their homeland, so the majority of the immigrants arriving in the United States were of peasant origin. Many came to escape the poverty and problems of czar dominated Russia. The major index of peasant status is land, difficult to achieve in an American city, so Russian neighborhoods leaned heavily on their customs and kinship patterns in order to maintain some sense of stability in a new environment. When Russian immigrants first arrived in this country, they were motivated to settle in a particular location because of job opportunities there, but, more importantly, because Russian neighborhoods already existed there. This latter pull on the new immigrants resulted in homogeneous Russian neighborhoods in many large American cities. By 1910, thousands of Russians had already settled in this country, with the majority concentrated in urban or quasi-urban settings.

Throughout the twentieth century, Russians continued to migrate into the United States, sometimes in large groups, sometimes individually. Large urban centers like New York,
RUSSIAN POPULATION DISTRIBUTION - 1950
SACRAMENTO URBAN AREA

Figure 1
Boston, Minneapolis, Chicago, San Francisco, and Los Angeles still have substantial numbers of Russian immigrants today.\textsuperscript{3}

Russians settling specifically in California have followed this same general trend and today live mainly in Los Angeles and San Francisco. Los Angeles, for example, has a great number of Russians belonging to the Molokan sect; Pauline Young's study of this religious group has added to our understanding of Russians in California.\textsuperscript{4} San Francisco, too, has a large population of Russians today, and Tripp's thesis on their geographical location patterns as well as Dunn's work with Potrero Hill Russians has added to our knowledge of Russians in California urban areas.\textsuperscript{5}

\textbf{Russians in Sacramento}

As a case study in immigration and settlement, residential patterns, and assimilation of Russians in the United States, Sacramento offers an excellent example. About four thousand persons of Russian descent currently live in this moderately sized city, their distribution and residential patterns typify Russian settlement in American cities and exemplify an ethnic culture landscape and assimilation in urban areas. The residential distribution of this group has shown several major trends, including clustering in a western Sacramento suburb, minor clustering in two other neighborhoods of Sacramento, and dispersed settlement throughout many of the remaining census tracts of this urban region (See Figures 1, 2, and 3). Most Russians in Sacramento are clustered west of the Sacramento River in the small suburb of Bryte.
Western Sacramento

Sacramento's western suburbs are part of the East Yolo County region and include the three areas of West Sacramento, Broderick, and Bryte. This area was first developed after a large reclamation project filled in the land after 1911, thus protecting residents from flood danger. The area's western-most community, Bryte, is located on this reclaimed river land, bounded on the south by the Southern Pacific railroad tracks, on the north by the Sacramento River, on the west by Yolo County agricultural land, and on the east by the suburb of Broderick. The D.W. Hobson Company was the original developer of the area. Riverbend, as Bryte was originally named, was bought up by the West Sacramento Land Development Company, and consequently changed rapidly from an agricultural area to a developing residential region.

Sacramento Boulevard is Bryte's main access road; neighborhoods extend off this arterial highway to the north, eventually reaching as far as the river. Small, frame houses are the norm here with large backyard gardens and small, neatly trimmed or hedged or fenced front yards. Very few sidewalks have been paved here and the street pattern is only occasionally a grid.

Despite this lack of a grid system, Bryte does not appear disorderly. Cars are at a minimum on the streets and many pedestrians are usually visible. Mostly one notices the elderly Russian people working in their gardens or yards or
walking along the edge of the street carrying their packages. Houses with families of Russian surnames are distinguishable by their neat, well trimmed appearance, and especially, by their front yard fence or hedge. The fences result from a homeland tradition of maintaining and protecting one's own property; most front fences have a gate and lock for additional protection. In comparison, the homes and lawns of other ethnic groups in the neighborhood are less well maintained. This may partially be explained by a difference in social status between the mainly middle class Russian homes and the predominantly lower middle class properties of other groups. Cultural values may also play a part in the differences observed.

"Once subdivided, Bryte developed a distinctive social characteristic sheltering what may be the largest Russian settlement north of San Francisco." Five Russian families who came to Bryte in 1911 were among the first pioneer families settling there. Others of Russian origin trickled in from San Francisco throughout the 1920's and 1930's, most from Vladivostok, Siberia, or Harbin, Manchuria. According to Michael Lokteff, who arrived in Bryte with his parents in 1950, the area reminded these early immigrants of home with its fishing and hunting amenities and its rural atmosphere. "Many of these original settlers had contact with other relatives in San Francisco, and spread the word that the natural characteristics resembled those with which they had become familiar in Russia." Although Russian immigrants continued to settle in the
Sacramento urban area through the 1970's, the group who arrived in 1950 were the last large number to settle in the region. The tendency to cluster in western Sacramento fits Jakle and Wheeler's suggestion that "large influxes of ethnic immigrants intensify the degree of ethnocentricity and reduce social interaction." Due to the effects of chain migration, these 1950 arrivals found Bryte already containing familiar institutions and a culture area much like their Russian homeland. Two Russian churches, a Russian food store, neighborhoods with familiar names, and shared cultural experiences all contributed to this perception. Bryte's clustered residential pattern is an expected reaction to ethnic settlement in an unfamiliar environment.

These 1950 immigrants had lived most of their lives in T'ungchan, China, in the region of Manchuria near the border of the Soviet Union. Escaping from Communist rule, a group of over five thousand Russians had relocated in Manchuria prior to and during the Russian Revolution of 1917. In 1948, following the Communist takeover in China, the government ordered the Russians to return to the Soviet Union or leave for some other country. Choosing the United States, specifically California, the Russians travelled by wagon train for over a year in 1948-49, finally reaching the port of Shanghai for departure to the United States.

Upon their arrival in this coastal city, the group was informed by the International Refugee Association that they were
no longer permitted to enter the United States because of the newly developing "Red Scare" there. Arrangements were then made for the group to resettle temporarily on an island in the Philippines until permanent arrangements could be made. A government was organized, Russian schools were opened, United States army tents and World War II rations procured, and the settlement of Orthodox Russians, Baptists, Pentecostals, and other groups was organized.

This temporary settlement was only a stopover for the group on their way to America. It was a heterogeneous mix, not only in terms of religion, but also in social status. The residents ranged from peasant farmers to wealthy upper class merchants and professionals. Eventually the waiting proved too much for many, and several thousand left for South America and Australia. Near the end of 1950, the remaining Russians finally departed for California, settling mainly in San Francisco and Sacramento.

This large group of Russian immigrants was attracted to Bryte by the nucleus of Russians already there. Also, the Fruitridge Baptist Church in Sacramento sponsored many families and so settlement in this area was encouraged. Life in a new land was eased by the presence of other Russians and familiar customs and institutions.

One of the strongest and most stabilizing institutions in Bryte was the church even though the Russian immigrants were divided into several major faiths, primarily Orthodox and Baptist.
These institutional ties with Russia encouraged the retention of the original language and culture in the clustered settlement of Bryte. The intensive clustering of Russian households in this western Sacramento suburb after 1950 is the culmination of the ethnic neighborhood first established during the Russian Revolution. Newly arriving immigrants held on to these familiar customs thus adding cohesion and homogeneity to the neighborhood.

Clustered settlement in Bryte has resulted in a distinct ethnic suburb in western Sacramento. The quiet, neat appearance of this area is largely a result of this ethnic settlement; Bryte certainly differs from Sacramento's other sprawling, rapidly developing suburbs. Even adjacent Broderick, which separated Bryte from downtown Sacramento, seems modern and bustling in comparison. The ethnic mix of this region lends a Russian flavor to its visual appearance as well as to its census figures. In 1979, almost half of Bryte's population is Russian.¹⁵

Secondary Clustering in the Sacramento Urban Area

Religious factors help account for the two minor areas of Russian clustering in the Sacramento area. The first is a newly developing grouping near the new Russian Evangelical Mission on Franklin Boulevard. Established only eight years ago after a disagreement with the Bryte church, the church has encouraged the settlement of primarily the children of original Russian immigrants from the 1950 group. The census for 1980 should reflect this new cluster along Franklin Boulevard although the data shown in Figure 3 does not, because of its very recent
Another secondary cluster of Russians in Sacramento is located in the Arden-Arcade area. Neighborhoods in these census tracts are largely upper middle class in social status; therefore, many of Sacramento's Jews live in this area. Since many immigrants of the Jewish faith were Russian, this region shows a minor clustering pattern.

**Dispersed Russian Settlement in the Sacramento Area**

As a comparison in settlement processes, Russians are also dispersed throughout the Sacramento urban area. In 1970, Russians were spread over a large area showing very little clustering, except in the three areas discussed previously in this paper. The distribution of 1970 reflects more dispersal as the Russians become more and more assimilated into the mainstream culture through time. This partially agrees with Johnston's observation: 16

As minority groups become assimilated, their residential distribution becomes dispersed and shows few differences from that of the total population. At early stages, they will be concentrated in communities in the city's inner zones, but these will disappear through time and the group will spread through the whole city.

Dispersed Russians in the Sacramento area also fit the evidence gathered by Cressey, Ford, and Kiang on ethnic dispersal in Chicago. 17 Their studies on residential distribution patterns showed a similar clustering in the early years and a later dis-
persal to outer zones as assimilation occurred. Bryte's clustered settlement, although not strictly central city in location, does partially support the theories of these early studies. One locational deviation from other residential patterns is Bryte's site in the urban fringe area instead of the central city, although this is consistent with Jakle and Wheeler's study of the quasi-urban Dutch settlement in Kalamazoo.

Further analysis of Figures 1, 2, and 3 shows this early clustering of Russians with a later dispersal to outlying areas of the city. The pattern for 1970 continues to show this out migration trend as the second and third generation move out of the study area. Also in support of this, the population totals for each of the years show less Russians in Sacramento in 1970 than in 1960.

**Summary and Conclusions**

This research project on Russian residential patterns and culture area in an urban setting has helped clarify the methodology involved in any study of ethnic settlement. Additionally, location models and settlement patterns of ethnic groups are partially supported by this population in the Sacramento area, showing an early clustering and a later dispersal through time.

Residential patterns of Russian settlement in the study area are similar to Russian neighborhood locations in other American cities. Simirendo's research on the Russians in Minneapolis shows a strict adherence to the Ghetto hypothesis. The original
Russian neighborhoods in northeast Minneapolis were located near the central city and grew outward until the immigrants were gradually dispersed to other parts of the city. Most moved to the suburbs, and those remaining in the ethnic core area were most strongly involved with the concept of the Russian community. Studies of other Russian settlements in American cities frequently support the early clustering pattern with increased dispersal through time as assimilation occurs.

Theories of Ethnic Assimilation and Residential Location

According to currently accepted social science theories on assimilation, Russians in Sacramento should fit one of the following models in their adjustments to American culture: 19

1) Anglo Conformity: Complete adoption of Anglo-Saxon values and behavior and renunciation of Russian culture.

2) Melting Pot: Biological merger of Russian immigrants with all others and a subsequent blending of cultures into a new American type.

3) Cultural Pluralism: Preservation of Russian culture and values within the context of American society.

Observing residential distribution of Russians in the Sacramento area shows a continued and expanding clustering in Bryte. This suggests that the model of cultural pluralism may be dominant in this region. Certainly this must be the case among the Russians in Bryte, although other factors such as social status and educational limitations, as well as age, also work effectively to intensify clustering in this neighborhood.
Dispersed Russians have largely adopted a philosophy of Anglo conformity.20 Many Russian families speak only English in their homes, encourage their children to "fit in" and seem uncomfortable discussing their Russian heritage. They tend to live in mixed neighborhoods and so dispersal results.

Attitudes toward the majority culture, then, tend to determine the dominant assimilation process and consequently clustering in Bryte is a result, at least partially, of cultural pluralism values. Dispersed patterns of Russian settlement in other parts of the Sacramento area favor Anglo conformity. Both ends of the assimilation continuum are thus represented in the study area.

Future Trends

This study of Russians in Sacramento suggests a partial acceptance of the theories of ethnic settlement and resulting assimilation patterns in American cities. These theories need updating, however, to include a stronger emphasis on suburban clustering and cultural pluralism. In support of the dispersal through time hypothesis, most of the second and third generation Russians have moved to other parts of Sacramento or out of the study area altogether. Practically all of the first generation Russian immigrants still live in Bryte however.21

A trend in the late 1970's is toward increased clustering in Bryte, not decreased, as in previous models of location. Retired Russians from San Francisco are buying property and moving to this neighborhood in a steady stream because of the
rural atmosphere amenities offered by the semi-urban environment. Perception of land and land ownership has consistently been a positive value in Russian culture; home ownership is affordable in Bryte as compared to other Sacramento suburbs and even the inner city. Russians continue to perceive Bryte as a desirable and affordable place to live and stay. Therefore, the previously supported concept of immigrants settling originally in a clustered, ghetto neighborhood, then gradually disappearing to the higher status suburbs, is not entirely supported in this study of Russians in Sacramento.

NOTES


6 East Yolo County General Plan, Woodland, California, (May, 1976), p. 5


9 An interview with Michael Lokteff of Bryte confirmed this. When Mr. Lokteff built a new house in Bryte he did not initially plan to put in a front yard fence but, "My mother-in-law made me." (Interview, Dec., 1978).


11 Information summarized by the author from the Naturalization Records for Yolo County (1900 through 1930).


14 See Gordon and Doeppers (footnotes 1 and 2) for more on this clustering pattern and model.


19 Gordon, op. cit., footnote 2, p. 84-159.


21 I compared the addresses of 140 Russian people in the Sacramento City Directory for 1960 and 1975 to determine migration patterns within the study area. A 100% sample continued to live in Bryte in 1975.

22 A conversation with Ms. D. Poole confirmed this fact. She recently sold two lots in Bryte to Russian families from Davis and San Francisco. (Local real estate offices also confirmed this information).
CLASSROOM CONSTRUCTION OF RELIEF MODELS

Donald Holtgrieve and Frank A. Piazza*

The construction of relief models as a classroom activity is probably as old as the study of geography itself. Who can not remember dubbing in paper mache, modeling clay, plaster-of-paris or some other goop (and loving every minute of it) in their school classroom?

While the motivation for model making remains unchanged the materials and techniques for doing so have improved considerably. A professional technique for making terrain models in City Planning department is offered here. The advantage of the method is its accuracy and low cost. Youngsters with model airplane making skills (Junior High School or above) should be able to do the work with little difficulty.

The materials needed are:

1) Contour or topography map at a large scale (1" = 500' or 1" = 300').
2) Balsa wood strips (1" sq.)
3) Fiberglass screening.
4) Instant papier-maché.
5) White glue.
6) Pastel for shading hill slopes.
7) Spray can of green paint.
8) A firm board (\(\frac{1}{4}\)" or \(\frac{1}{2}\)" plywood) for mounting entire project.

*Dr. Holtgrieve is Associate Professor, Geography Dept., California State University, Hayward, and Mr. Piazza is a Cartographer for the City of Hayward Planning Department.
All materials are readily available at most hobby stores.

Procedures for Construction of the Model

First glue the contour map firmly onto the mounting board. After it has thoroughly dried, begin cutting balsa strips to pre-determined lengths. The length of the balsa strip depends on the scale of the contour map. By following the direction of the contour line and gluing the balsa strips in a vertical position periodically along the same contour, you will establish a constant height or elevation. As you repeat this with each 50' contour, the physical appearance of the peaks and valleys will begin to form. A vertical exaggeration of two to one proportion (plan scale of map to remain while the vertical distances are two times the plan scale) will give an optically, more true-to-life, appearance of the slopes.

After completing this step, the fiberglass screen is pushed down into the valleys and glued. It may be necessary to fold or cut the screen in "orange peel" fashion to fit into deep valleys. Work your way from valleys to peaks gluing at the ends of balsa strips. Staple the screen to ends of strips as well.

The next step is to cover the entire screen with papier maché. The maché is to be pushed into the openings of the screen. The application should be put on as smoothly as possible. Neverthe less, the mache can be sanded for an even finish. The mache must dry thoroughly before it is to be painted. The drying process may take a week. When completely dry, the surface can be
painted as time permits.

The finishing touch of shading slopes, or indicating streets with graphic tapes and perhaps titling, can add the final ingredient of a professional looking presentation model.

Fig. 1--Back side of completed hill area terrain model. Cardboard can be used to cover back and sides if desired.

Fig. 2--Side view of hill area terrain model. Lowest point on model (to front) is the base board.
1979 will be remembered, among other things, as the year of the atlas in California. Two epochal books of maps of that vintage have finally provided the state with basic cartographic references appropriate to its magnitude and importance. First is the California Water Atlas (Los Altos: Wm. Kaufmann, 1979, $37.50). Its seven pound weight and 16"x18" format are entirely fitting for such an ambitious work. Conceived by Berkeley geographer Ted Oberlander, funded by the Governor's Office of Planning and Research, along with the Water Resources department the atlas is truly the product of, and tribute to, the cartographic design team guided by William Bowen, David Fuller and Marlyn Shelton. The CSU Northridge Cartography Laboratory was the workshop for this illustrious publication. The California Water Atlas contains eleven chapters of text, each by an authority, on a gamut of topics including: climate; ground water; economics; and water quality. The narrative is unified with an array of nothing less than stunning maps, graphs and high altitude photographic imagery which combine to form a volume of rare impact and appeal—an American atlas without peer in this century. From the very first plate, "Hydrologic Balance for California," to the color view of the San Francisco Region on p. 111, there is simply no interruption of visual excitement throughout this extraordinary atlas. The maps and graphics dominate the senses, yet one is hard pressed to choose a single "best" map. Plate after outstanding plate captivate the eye. "Mean Annual Precipitation", "Virgin Waterscape", "Historic Water Development" are just a few ideally suited for framing as wall hangings. The largest map, "California Waterscape", should be available as a poster for installation in every school room, library and public building in the state. The California Water Atlas is an unmitigated delight and, at $37.50, an excellent buy.
The second major gift of 1979, the *Atlas of California* (Culver City: Pacific Book Center, 1979, $47.50), takes its place as the most important general atlas of the state to date. Somewhat smaller than the *California Water Atlas*, with its 12"x15" format, but thicker with 175 color maps and gazetteer in its 200 page span. This new atlas is the product of the Oregon cartographic team which recently produced the *Atlas of Oregon* which met with popular and critical acclaim. Each of the team members has taught, studied or had a major research interest in California. Divided into four major segments, the *Atlas of California* opens with a segment on "The Human Imprint" followed by the "Economic Patterns" section. "Physical Environment" is third in order, quite appropriately in a state in which human modifications of the natural order have been so monumental. The last part, "Reference", includes a 3,000 place name gazetteer and, one of its most useful features, a ten map reference set at the scale, 1:1,000,000. The photographic divider pages are among the most attractive features of the atlas. Special maps and distributions abound, including: natural hazards and catastrophe distribution, the evolution of central business districts in Los Angeles and San Francisco; varietal grape geography; collegiate and professional sports maps and many detailed vegetation profiles, to name a few. Both atlases will interest the public at large as much as the teachers and researchers who now have no excuse for being without the two new superlative reference works. They show the world just how necessary and worthwhile geographer's products are, and they give us constant reminder that not the least of geography's benefits is to entertain and enthral as well as to enlighten.

Editor
THIRTY-THIRD ANNUAL MEETING, CCGE

California State University, Fresno, May 4 and 5, 1979

The Fresno "where California takes you to its heart" meeting was hosted by the Geography Department at California State University. The sessions held on that campus included such diverse topics as: Non-Academic Job Opportunities in Geography; Geography and the Travel Industry; California Ethnic Groups; Archaeology and Geography--the North Coast of Peru; and Strategies for Strengthening Geography in the Colleges and Universities. Local arrangements were capably handled by Roger E. Ervin, Jerry C. Towle, James S. Kus, Robert E. Lee, George N. Nasse and Stanley F. Norsworthy. The opening address was by Chester F. Cole and the Banquet speaker was Peter F. Mason. CCGE warmly thanks all who made the meetings successful despite sporadic service station closures which hampered attendance from some parts of the state.

PAPERS AND PRESENTATIONS

Colleen Beck, University of California, Berkeley, "Ancient Roads: Landscape Modification by the Early Peoples of Peru."

Pamela Beck, California State University, Fresno, "Land Use and the Basque Population of Fresno County".

Joseph B. Beaton, University of California, Los Angeles, "If Hollywood is being Revitalized, It must have Deteriorated."

Chester F. Cole, California State University, Fresno, "Apartheid as It Works in the Capetown Area." Opening Session Address.

Eugene F. Coleman, Southwestern College, "Our National Parks and Physical Geography".

A. J. Conovalaff, California State University, Fresno, "Molokans and Doukhobors: The Comparative Effect of Social Organization on Migration Behavior in Two Ethnically Related Groups."
Tim Dagodag, California State University, Northridge, "Illegal Mexican Alien Settlements in Los Angeles."

Judy Davidson, California State University, Northridge, "Prehistoric Exchange of Elite Commodities Between Ecuador and Peru."

Christopher Exline, University of Colorado, Colorado Springs, "Issues in Urban Growth Management: The Marin and Sonoma Counties, CA."

Myron Gershenson, Adult Education Division, Jefferson High School District, Daly City, "Reintroducing the Landscape."


Jeffrey H. Gross, California State University, Chico, "Vacaville: A Major Link in the San-Sac Corridor."


John L. Harper and Scott Kruse, Humboldt State University, Arcata, "The End of an Enclave: Mineral King in Sequoia National Park."

John James, Mountain West Weather Service, "Tahoe Revisited: Has the Recent Building Voom and Tourist Onslaught Finally Doomed this Beautiful Alpine Basin?"

Ladd Johnson, California State University, Chico, "The Orland Project: 75 Years of Water Resource Development."

Gary Klee, California State University, San Jose, An Advisor's Guide to Environmental Courses and Programs in U.S. Colleges and Universities."

James S. Kus, California State University, Fresno, "Ancient Irrigated Fields in the Moche Valley, Peru."

Mary Ludwig, California State University, Fresno, "The Multi-Cultural Institute: Studying Cultural Diversity in the San Joaquin Valley."


Ellen Murphy Oicles, Piedmont Hills High School, "India, Land of Contrasts."

Clement Padick, California State University, Los Angeles, "Wenland Hege: Man, Land and Game Relationships in Northern Germany."
John Passerrello, Project Director, California Conservation Corps, "Reforestation Efforts in California."

Nick Polizzi and Russ Flynn, Cypress College, "Southern California: Visual Images and Impressions."

Gary Smith, University of California, Davis, "The Assyrian Community of Stanislaus County, California: A Social Geography."


William L. Thomas, California State University, Hayward, "The Geographer's Role in Teaching about International Tourism."

Jerry C. Towle, California State University, Fresno, "Salomid Enhancement in British Columbia."

Jean C. Wheeler, Paul de Long, Pamela De Palma, Bernice Kinsman and Harold Simkins, California State University, Long Beach, "A Vegetation Analysis of Eight Slope Aspects in the San Gabriel Mountains."

Jerry R. Williams, California State University, Chico, "Azorean Immigration to the United States, 1820-1978: A Response to Adversity and Opportunity."

Drawings: Suzanne Shimek

Layout: James W. Yerdon

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