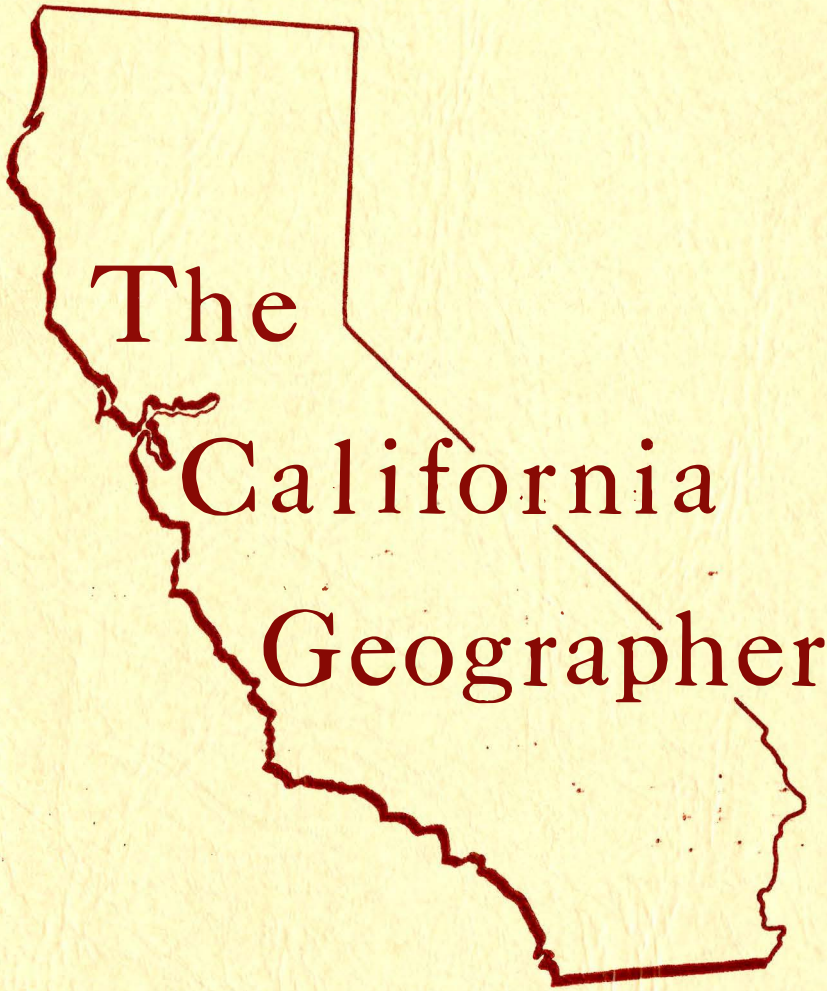

The California Geographer

Annual Publication of the

CALIFORNIA COUNCIL OF GEOGRAPHY TEACHERS

ROBERT A. KENNELLY, *Editor*

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REMNANTS OF THE RANCHOS IN THE URBAN PATTERN OF THE LOS ANGELES AREA

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California, save for the Colonies and Texas, is unique in America in that much of its best land was in private hands before it became part of the United States. Most of the present-day Los Angeles area, for example, was either owned by the Pueblo or held as ranchos at the time of the American annexation in 1848. The most extensive holdings, by far, were those of the owners of some 55 ranchos. Ranchos ranged from less than one to about 180 square miles in size, and contained one or more ranch headquarters centers. Thus when the Americans spread their traditional divisions over the land there was a significant distinction between occupied private holdings, irregularly bounded by metes and bounds, and empty public lands, surveyed by the regular Public Land Survey system.

The bulk of the traditional literature on Los Angeles includes copious material on the Pueblo and the ranchos, implying their importance to the modern urban dweller. Exactly how, and to what extent, these old land holdings are reflected in today's city patterns, however, is never explicitly stated. It is our purpose to examine these pre-American land divisions, particularly the ranchos, and assess their significance to the present-day urban features of the Los Angeles area. In addition it is hoped that findings concerning the persistence of pre-American property lines in this area may have application in other parts of California and elsewhere.

SPANISH AND MEXICAN LAND GRANTS

Spanish sovereignty, dating from the eighteenth century, produced four types of land holdings, which were modified somewhat under the twenty-six years of Mexican rule (1822-1848). The Spaniards founded missions of which two, San Gabriel Arcangel (1771) and San Fernando Rey (1797), were in the Los Angeles area. Pueblos were organized, including the Pueblo of Los Angeles (1781), and presidios were established, but not in our area. Some other lands were given to army veterans as ranchos. The Mexicans, when in control, secularized the missions, recovered mission land, and expanded the number of rancho holdings twentyfold. All of these activities affected land ownership patterns.

The two missions, in their operative period, occupied and used the land "for the benefit of the Indians." They did not own the land, but held it as "trustees." Nevertheless, they effectively controlled large blocks of land and discouraged, as far as possible, other types of land ownership nearby. During Mexican rule, under pressure from Californians, the missions were secularized and their holdings returned to the public domain. The missions were allowed to retain title only to land covered by buildings, cemeteries, and gardens: about 190 acres at San Gabriel and 77 acres at San Fernando.

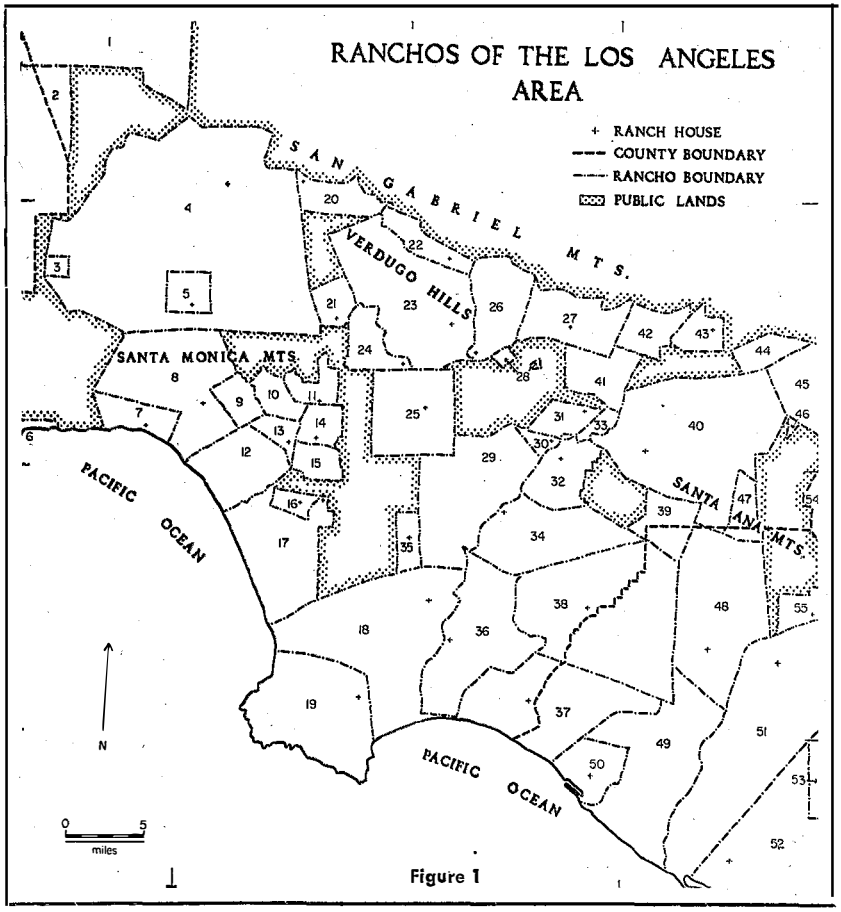

Figure 1

1. San Francisco
2. Simi
3. El Escorpion
4. Ex Mission de San Fernando
5. Encino
6. Topanga Malibu Sequit
7. Boca de Santa Monica
8. San Vicente y Santa Monica
9. San Jose de Buenos Ayeres
10. Rodeo de las Aguas
11. La Brea
12. La Ballona
13. Rincon de los Bueyes
14. Las Cienegas
15. Cienega O Pasode La Tijera
16. Aguaje de Centenela
17. Sausal Redondo
18. San Pedro
19. Los Palos Verdes
20. Tujunga
21. Providencia
22. La Canada
23. San Rafael
24. Los Felis
25. City Lands
26. San Pasqual
27. Santa Anita
28. El Molino
29. San Gabriel Mission Lands
30. Rancho La Merced
31. Portrero Grande
32. Paso de Bartolo
33. Portrero de Felipe Lugo
34. Santa Gertrudes
35. Tajauta
36. Los Cerritos
37. Los Alamitos
38. Los Coyotes
39. La Habra
40. La Puente
41. San Francisquito
42. Azuza de Duarte
43. Azuza Dalton
44. Addition to San Jose
45. San Jose
46. Los Nogales
47. Rincon La Brea
48. San Juan Cajon de Santa Ana
49. Las Bolsas
50. La Bolsa Chica
51. Santiago de Santa Ana
52. San Joaquin
53. Lomas de Santiago
54. Santa Ana de Chino
55. Canon de Santana

The Pueblo of Los Angeles, founded as an agricultural settlement, was entitled to four square leagues of land, about 28 square miles. Settlers were granted free house lots and farming land, with the requirement that the land be improved with a house and trees. In five years those that had fulfilled the conditions were granted title to their land. Unclaimed pueblo land remained as common property.

Several rancho grants were made by local Spanish authorities to retired army veterans, and some of these were in the Los Angeles area. With the advent of Mexican control, however, the rancho period began in earnest and reached a peak in the 1830's and 1840's. The Mexican government assumed control of the public domain, including vast tracts of the best land formerly held by the missions. This land was given willingly and without compensation to worthy Mexican citizens in large blocks (up to 11 square leagues, about 77 square miles). Applicants had only to petition the governor, describe the lands desired, and produce a crude map of it. The grantee had to occupy the land, stock it with cattle, build a home, plant some trees and the land was his. The bulk of the ranchos in the Los Angeles area were acquired in this way.

American Sovereignty

Under American sovereignty it was necessary to bring the vague Spanish and Mexican titles into conformity with American legal practice. To that end a Land Commission was established to confirm titles and, in practice, a review by the courts was also necessary. The small mission holdings were recognized, and the title to the four-square leagues of pueblo land was given to the corporation. But, because of poor records, validation of the rancho titles required much time. Now the ambiguous titles, inexact descriptions and vague boundaries of an earlier more relaxed period had to be precisely defined. The land owners hired trained surveyors and Yankee lawyers to clarify disputes and to present their claims. Long delays were common, —with 17 years being reported as the average time necessary to confirm a rancho title. In the interim legal fees and other costs bankrupted many rancho owners. When the titles were finally confirmed, and an official survey by the Surveyor General of California approved, a United States patent was issued. The 55 ranchos in the Los Angeles area, as confirmed, are shown in Figure 1.

American sovereignty, too, brought segregation of land not granted as well as invalidated claims into the public domain for survey and sale (Figure 1). Surveying was difficult and drawn out over several decades because of the problem of determining what was public domain and what was private land. However, both the San Bernardino Meridian and Base Line were run in the fifties. These two lines were extended over both public land and private claims, and were utilized as reference points in the patents of the private land grants. The subdivision of public land into townships and sections, though started in a small way in 1854, continued slowly through the sixties and seventies. Much of the public domain in the mountains was withdrawn from entry and remains today as the Angeles National Forest. Most of the remaining public land was settled

under the Desert Land Act—land the Surveyor General certified could be irrigated. Thus, from early American occupancy, two cadastral survey systems existed side by side in the Los Angeles area.

Persistence of Rancho Boundaries as Boundaries

It is ironic, but not surprising, that the rancho boundaries, which under Spanish-Mexican rule were not of vital importance, have persisted strongly into the present. They remain significant as boundaries of private holdings, as the boundaries of counties and cities, and in other ways.

In the vast majority of instances rancho boundaries are still boundaries between land owned by different individuals. Separate sale at different times and under varying circumstances would account for this characteristic. Carpenter, further, in surveying Rancho Encino, found that with one minor exception, subdivision tracts also stopped at the rancho boundaries.[1] Significantly, a few ranchos have remained almost intact into this century. Topanga Malibu Sequit was not subdivided until the 1920's. El Escorpion, lately known as the Platt Ranch, was held as a single parcel until 1958, and the Irvine Ranch is substantially intact today (Figure 1).

As political units developed, portions of rancho boundaries often became political boundaries. Figure 2 shows the coincidence between political boundaries and former rancho boundaries as it exists today.[2] Some 88.6 miles of boundary coincidence occurs, even at this late date.

City boundaries, being relatively temporary due to liberal annexation laws, have often coincided with rancho boundaries for periods of time, only to be changed. Rancho boundaries, on the other hand, generally remain as land ownership boundaries, and thus annexations, on occasion, have rancho boundaries. These expanding annexations may account for the fragmented city-rancho boundaries.

County boundaries, being less dynamic because of the need for state approval of change, and a generally early fixing of location, exhibit a higher degree of coincidence with rancho boundaries (Figure 2). The legal description of the boundary in the northwest portion of Los Angeles county, for example, includes the rancho boundary.[3]

Rancho Boundaries in the Street Pattern

Rancho boundaries are not only reflected in the present political pattern of the area, but they have had a significant influence on today's street pattern.

The very early roads were mere trails, casually located, generally connecting rancho headquarters with rancho headquarters, with no relationship to rancho boundaries. Even the rancho headquarters, although located with relationship to available water, were transitory and impermanent. The land was used almost solely for open range grazing, without fences, and little or no attention was given to trespass.

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[1] Bruce R. Carpenter, *Rancho Encino: Its Historical Geography,* Unpublished M. A. Thesis, University of California, Los Angeles, 1948.

[2] All of the boundaries and other data is taken from the most recent USGS topographic maps of the area, 1:24,000. The culture was revised in the early 1950's.

[3] Owen C. Coy, *California County Boundaries* (Berkeley, 1923), p. 154.

With the coming of Anglo-Saxon culture, and the spread of cultivated agriculture, the establishment of precise boundary lines was emphasized and trespass frowned upon. In some instances rights-of-way were dedicated and roads developed between property holdings. Thus trespass was minimized and the amount of land an individual owner must contribute for a dedicated road reduced.

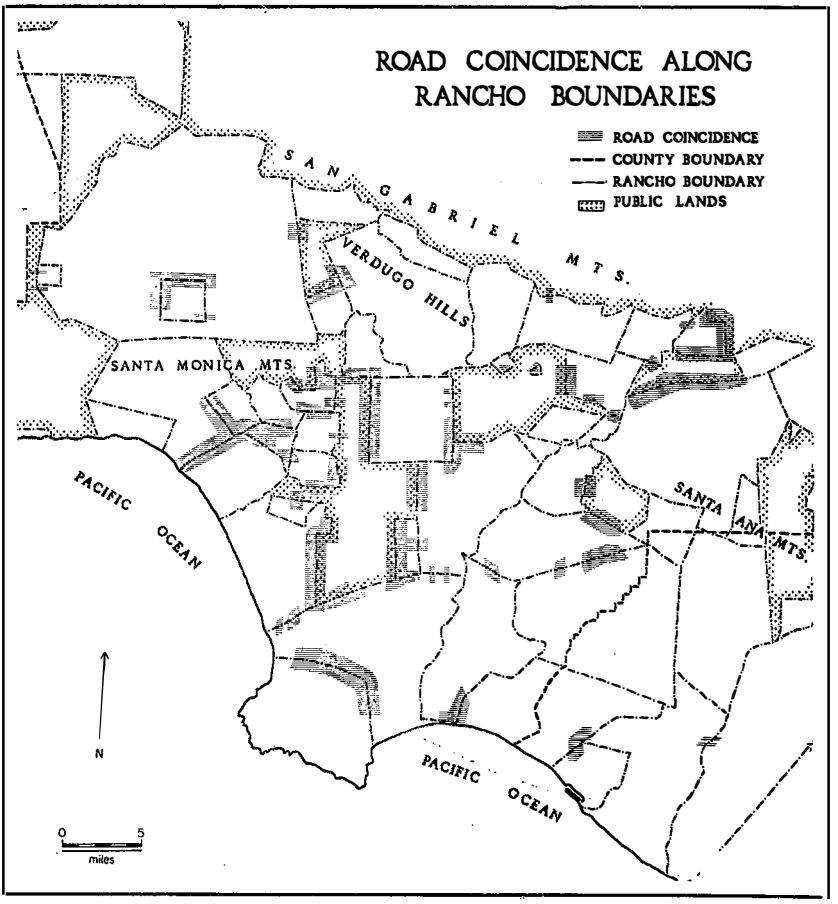

Figure 2

Today about 173 miles of roadway in the Los Angeles area coincides with former rancho boundaries (Figure 3). The total length of rancho boundaries (excluding the seashore) was about 684 miles, thus about 25 per cent of these former boundaries coincide with present roads. However, for about 132 miles the rancho boundaries are located in rugged terrain, unfavorable for road construction. Excluding these areas, roads coincide with about 31 per cent of the remaining rancho boundaries. In the few

instances where the boundaries followed the cardinal directions the degree of road coincidence is high—about 65 per cent of these boundaries are traced by a road.

Further, since the total length of streets within the Los Angeles area exceeds by many times the total length of rancho boundaries, one is

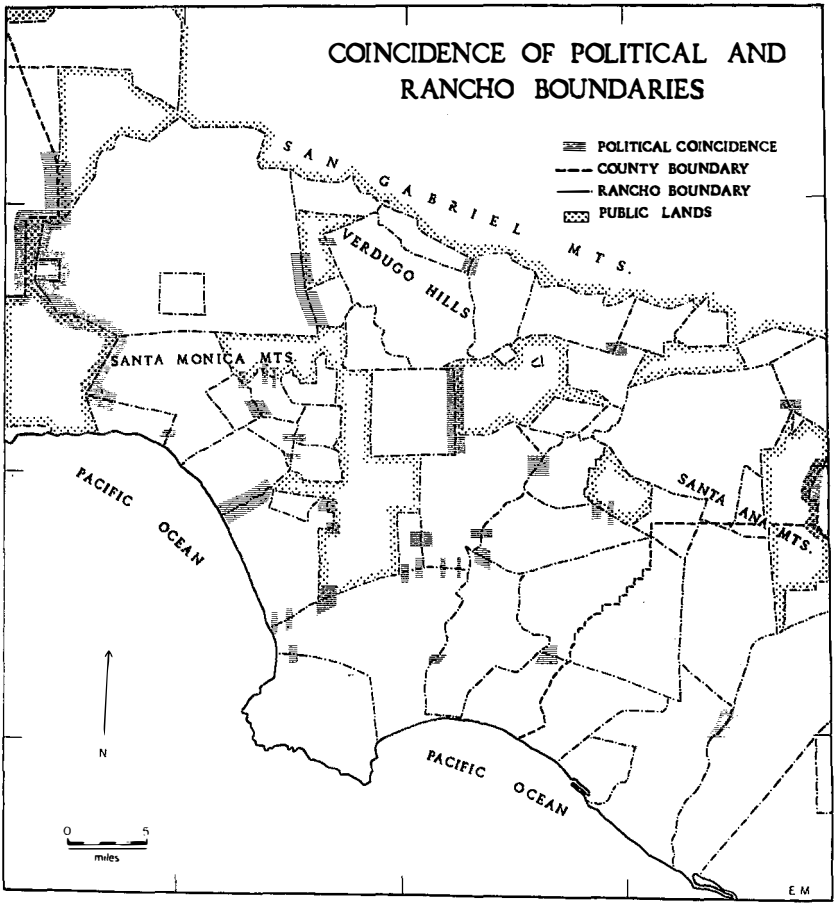

Figure 3

impressed by the fact that over half of the total length of boundary road coincidence follows major traffic arteries. Sepulveda, Ramona, Whittier, Redondo Beach, Washington, Wilshire and Pico Boulevards are examples.

Street Disruption and Distortion

Many cross streets are interrupted at old rancho boundaries, forming an additional significant boundary-street relationship. In some instances, intersecting streets do not cross the boundary-coinciding streets cleanly, but instead are offset by distances ranging from a few inches to as much as

200 feet. In other cases where no offset occurs, the cross streets bend at the rancho boundary and continue at an angle. Occasionally, streets are both offset and continue at an angle. In another type of disruption, streets dead-end at the boundary. Streets may either enter, but not cross, roads running along the boundary or, if no road is present, they may simply end at the boundary.

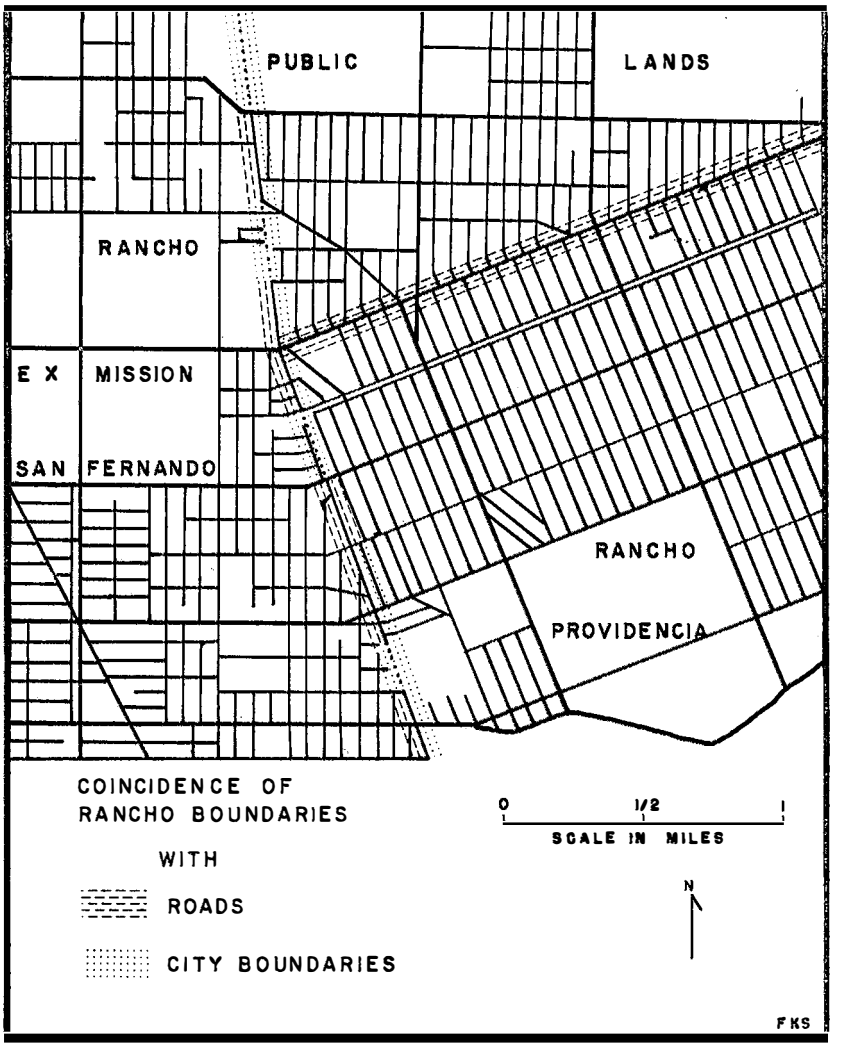

Figure 4

Within the Los Angeles area, some 66 miles of old rancho boundary, which coincide with roads, are marked by street disruption. An additional 9.5 miles of old boundary, not traced by roads, also shows clearly disrupted

streets. Street disruption is particularly noticeable along the boundaries between public lands and ranchos. Of the total disruption found, about 40 per cent (or some 31 miles) occurs along these boundaries.

The northern boundary of Rancho Providencia (Figure 4) coinciding with the present Burbank Boulevard, is an excellent example of disruption. It illustrates disruption at an angle, and also dead-ending. The western boundary of the rancho exhibits these characteristics too, as well as political coincidence. Other examples include the areas around Sepulveda Blvd., between Rancho San Pedro and Rancho Palos Verdes, Indiana Street, separating the eastern boundary of the Pueblo from public land, and Whittier Boulevard running along the boundary between Rancho Santa Gertrudes (Colina) and public lands to the north.

Finally, in numerous instances, the present street pattern within entire ranchos is oriented, in large degree, with respect to the boundaries of the ranch. In these cases street alignment often changes at or near the rancho boundary. Such streets cover large areas, but a typical example might again be Rancho Providencia (a portion of which appears on Figure 4). Other examples are in sections of Rancho Las Cienagas and Rancho Santa Gertrudis.

In an extension of this idea, there are a few examples of orientation of street pattern to a rancho line but not exactly coinciding with it. For example, street alignment on the north side of the Irvine Ranch, developed within the ranch and running parallel to the boundary, extends a mile beyond the border for a distance of 13 miles.

Other Cultural Coincidences

Several other cultural features in the Los Angeles area coincide with rancho boundaries. The most important of these are railroad right-of-ways, of which about 12 miles in the area mark former rancho boundary lines. In a few instances power line easements, for perhaps a dozen miles, follow boundaries which do not parallel a road, principally in hilly country. In a few other areas drainage ditches also follow boundary lines for limited distances.

Rancho Headquarters and Other Focal Points

Ranchos, of course, not only possessed definable boundaries, but were also the scene of houses, barns and corrals making some kind of ranch headquarters center. Not all of the ranch houses shown on Figure 1 existed at any one time, and many of them were poor, unsubstantial dwellings with a transitory life. A few were more permanent and perhaps a half dozen are still standing. It is significant, however, that in terms of today's landscape, none of the spots chosen for rancho centers has developed into an urban focal point of any sort. Generally they are in locations that today have no observable centralizing qualities. (The Pueblo, of course, is a major exception to the generalization applying to the ranchos, as the civic center of Los Angeles is anchored but a stone's throw from the original Plaza. However, the two missions, although still standing, like the rancho headquarters have not been able to maintain their focal qualities.)

Perhaps the most obvious explanation of this loss of focal qualities of the old rancho centers lies in the increasing sophistication in the control of water supplies. Generally the older ranch headquarters were located adjacent to a flowing spring, whereas such locations were less important to urban man in the era of well, irrigation ditches and water mains in the late nineteenth and early twentieth centuries. Also, it is logical that the early sale of ranch land for speculative townsites generally did not include the ranch headquarters. Often this portion would be the last area to be subdivided.

Summary

The past existence of Spanish and Mexican land ownership institutions in the Los Angeles area has repeatedly raised questions as to the present significance of these institutions. That certain tangible remnants of pre-American settlement have persisted is obvious from a casual observation of the street pattern of downtown Los Angeles or acquaintance with several locally-famous landmarks such as Olivera Street, *Casa de Adobe,* and the San Gabriel and San Fernando missions. Remnants of the more extensive ranchos, which occupied a majority of the land in the Los Angeles area, are less familiar, although the historical literature of the area is filled with references to the importance of these institutions and the livelihood of their occupants.

Most of the tangible remains of ranchos have disappeared as a result of the tremendous influx of population from other parts of the United States, combined with the extensive nature of pre-American settlement, impermanence of adobe structures, poorly-marked roads, and evolution of settlement location factors. Rancho boundaries, because of their adoption into American institutions for the purpose of legal land description and the tendency for them to remain as property lines, have, however, often become expressed in urban patterns. Unmistakable correlations exist between these boundaries and present property lines, city and county boundaries, streets, street disruptions, and other features.

The usefulness of these correlations is rather limited at the present time. It is extremely difficult to estimate the importance of quantitative statements on the present-day significance of the ranchos in urban patterns of the Los Angeles area. The correlations can be considered neither high nor low. Even though several of the major thoroughfares of the area coincide for extended distances with rancho boundaries, this coincidence and others might be considered small when it is remembered that only a little over 100 years ago the ranchos were the most important type of private land-holding of a predominantly Spanish-speaking population.

Other quantitative studies of the juxtaposition of the institutions of one culture upon another might prove rewarding. Several other areas of California were settled by Spaniards and Mexicans before the arrival of the Americans, as were portions of the American Southwest. Studies might be made of existing remnants of settlement in these areas and comparisons made between the extent of persistence and the factors influencing persistence in the Los Angeles area.

GEOMORPHOLOGY IN STRABO'S *GEOGRAPHY*

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Modern advances in geomorphology command so much attention that ancient writings on this subject are often overlooked. Excellent works in the history of science, such as the geological source book of Mather and Mason,[1] frequently include only contributions of the past three or four centuries. Although, apparently, little heed is now paid to early considerations of landforms and their development, this was not always the case. Some of the greatest contributors to earth science in the nineteenth century were well aware of the considerable understanding among the ancients regarding geomorphological processes. Thus, Sir Charles Lyell[2] commends Strabo of Amasia for anticipating some of the conclusions of modern earth science. Strabo is praised by Alexander von Humboldt[3] and Sir Archibald Geikie[4] also calls attention to the sagacious observations of Strabo upon the physical earth.

Among ancient writings on geomorphology Strabo's *Geography* is of special value because, in addition to stating his own views, the author comments upon or summarizes earlier work in earth science, much of which is lost to us in the original. An examination of Strabo's writings, therefore, provides a good basis for understanding early concepts of landform genesis, process and change.

Our knowledge of Strabo's life is based on scattered references in his *Geography*. He was born at Amasia in Pontus (northeast Turkey) about 63 B.C. Strabo was partly Greek by ancestry and received a good Greek education; at different periods of his life he was a student of Aristodemus (tutor of Pompey's sons), of Tyrannion (tutor of Cicero's sons) and of Xenarchus. Probably under these teachers Strabo developed an interest in the physical earth, but this was undoubtedly stimulated by his extensive travels. According to his own testimony, Strabo journeyed from Armenia to Tuscany and from Pontus to Ethiopia (2:5:11).[5] He was familiar with a number of the important cities of the Mediterranean and resided for considerable periods in Rome and Alexandria. While in Egypt he traveled up the Nile as far as the First Cataract.

It was probably after his return to Pontus that Strabo devoted himself to the writing of his encyclopedic *Historical Memoirs*. This great compilation, which consisted of forty-three volumes on ancient history, is lost to us except for fragments included in the work of other authors or in Strabo's

[1] Kirtley F. Mather and Shirley L. Mason, *A Source Book in Geology* (New York, McGraw-Hill, 1939), p. vii.

[2] Charles Lyell, *Principles of Geology* (London, J. Murray, 1830), Vol 1, p. 18.

[3] Alexander von Humboldt, *Kosmos* (Stuttgart and Tubingen, J G. Cotta, 1845), Vol. 1, p. 223.

[4] Archibald Geikie, *The Founders of Geology* (London, Macmillan, 1905), p. 18.

[5] Numbers in parentheses within the text refer respectively to book, chapter, and paragraph in *The Geography of Strabo* (Loeb Classical Library) with an English translation by H. L. Jones (London, William Heinemann).

own surviving writings. After finishing the history Strabo commenced his *Geography,* which may have been completed only a short time before his death in 20 A.D.

Except for minor omissions, Strabo's *Geography* has come down to us complete. The whole work consists of seventeen books in which the author attempts to bring together all geographical knowledge of his day. The first two books, which are topical and systematic in character, form a general introduction to the subject. In the remaining fifteen books Strabo is concerned mainly with regional description, treating first Europe, then Asia and finally Africa.

It is difficult to form any reliable estimate of Strabo's own contribution to earth science. Mathematical geography he neglects entirely except where he disputes the opinions of others or reports their findings, but as the result of this we are indebted to Strabo for part of our knowledge of the work of Eratosthenes, Hipparchus and Poseidonius. In addition to these authorities, Strabo cites the work of a score of other Greek natural philosophers. Strabo's *Geography* was a popular work among European scholars in the later Middle Ages. Among more recent admirers of Strabo's writings was Napoleon Bonaparte, who authorized an important French translation of the *Geography.*

Accepting cosmological ideas prevailing among Greek philosophers who preceded him, Strabo believed in the geocentric theory of the universe (2:5:2). Although according to this view the earth is regarded as a motionless planet, Strabo understood that the *surface* of the earth is constantly undergoing change. He reports the opinion of Eratosthenes that successive changes in the form of the earth have been occasioned by water, fire, earthquakes and eruptions, but criticizes the earlier author for over-emphasizing the magnitude of the resulting surface irregularities (1:3:3).

Echoing the ideas of other writers, Strabo asserts that land and water do not remain in fixed places. As evidence of that he notes the occurrence of marine fossils and salt beds at considerable distances from the sea, and quotes the opinions of several earlier authorities on the matter. In particular, Strato the Philosopher is cited by Strabo as believing that the water levels of different seas vary and that there had been changes of water level in the past (1:3:4). The Black Sea, Strabo suggested, was formerly without an outlet and had received so much water from rivers emptying into it that the surrounding land had been flooded.[6] Eventually a natural passage was forced through the Dardanelles, the water level lowered, and fossils which had been deposited along the old shore zone were revealed to view. Strato applied a similar explanation to the Mediterranean Sea which, he thought, had broken its banks at Gibraltar and left large areas, especially in the Levant, dry, fossiliferous and saline. Strabo rejects Strato's thesis, and proposes instead that it is the level of the *strata* on which the waters rest, rather than the water level itself, which changes (1:3:5). Of this idea of Strabo's, Lyell[7] writes enthusiastically.

[6] The hydrological cycle was not understood until the late seventeenth century, notably under Edmund Halley.

[7] Lyell, *loc. cit.*

Strabo had unusually good opportunities for observing the effects of vulcanism in Italy, and gives accounts of the phenomena in that country, in Sicily and in Greece. He was aware of the volcanic nature of the Naples area and in his description of Vesusvius informs us that the character of the rocks suggests that in the past it had been in an active state (5:4:8).[8] However, like his predecessors he believed that volcanoes became extinct because of lack of fuel. Strabo noted the similarity between the Naples region, the Lipari Islands and the region around Etna in Sicily. In one place he expresses the opinion that certain of the offshore islands were built up from the sea by volcanoes rather than broken off from the mainland as suggested by other authorities (1:3:10). Before the formation of Etna, Strabo reports, the Strait of Sicily suffered greatly from earthquakes, but, because the large crater and its subsidiary cones act as safety valves, shocks had become less frequent and less severe (6:1:6). Commenting upon this, Geikie[9] observes, "The doctrine that volcanoes are safety valves, which was once thought to be a modern idea, is thus at least as old as the beginning of the Christian era." Strabo relates Poseidonius' eye-witness account of the formation of a small volcano in the Lipari archipelago. In this connection Strabo comments on the relationship between winds and vulcanism, a belief widely held by the ancients. Volcanoes were thought to be caused by winds trapped below the earth which were fanned into activity by surface winds (6:2:8).

Most of the allusions to vulcanism in the *Geography* refer to the Tyrrhenian region, while his examples of seismic activity are taken largely from the eastern Mediterranean. Strabo calls attention to a number of cases of the destruction of cities by earthquakes (1:3:19,20). There are some references to the opening up of fissures, to the effects of seismic sea waves and to temporary or permanent disturbance of drainage patterns. Examples are noted of earthquakes associated with and of those independent of vulcanism. He reports that certain peaks in Laconia were said to be broken off during an earthquake shock. The same agency is reported to have been responsible for the destruction of Helice and of an extensive coastal plain seaward of the city (8:7:2).

A specific example of the alteration of drainage resulting from diastrophic activity is cited as occurring in Arcadia, where the Ladon River apparently had its sources stopped for a short period (8:8:4). More dramatic was the case of the Peneius River of Tempe in Thessaly which, after a chasm had been formed following an earthquake, changed its course to drain an area that had formerly been the bed of a lake (9:5:2). Strabo reports several cases of rivers going underground after earthquakes had taken place, but makes no clear distinction between that type of occurrence and underground drainage resulting from solution in limestone country. Hot springs are described in several localities, and examples are noted of the formation of minor features attributed to the deposition of materials carried in solution (13:4:14).

It is not surprising that there are many myths concerning the origin and development of rivers since they are so important to human life. As in

[8] Vesuvius was soon to demonstrate again its destructive powers (79 A.D.).
[9] Geikie, *op. cit.*, p. 19.

the case of other features, Strabo regales his readers with fabulous accounts of streams, but is usually careful to label them stories. Strabo discusses the character of many European and Asiatic rivers; his treatment of the Nile delta, an area he knew well, is particularly detailed. It has already been suggested that, apparently, the ancients did not understand the hydrological cycle; the significance of evaporation escaped them, but the more obvious parts of the cycle—precipitation, to stream, to sea—are well treated in the *Geography*. Strabo is aware of the causes of seasonal variation in the flow of river water, indicates the character of streams in different parts of their courses, and even hints at valley formation. There are also many references to delta construction in the *Geography*.

Since there was knowledge of the sources as well as the courses of European rivers, perhaps the most satisfactory explanation of the nature of streams is in connection with those. For example, Strabo notes that the Po River rises in the Alps, where it is a mountain torrent, becomes gentler in its middle course and is sluggish in its lower reaches where material is deposited along the banks (4:6:5). He mentions that the current of the Rhine is so swift that it is difficult to bridge the river and that its lower floodplain is as wide as Germany (7:1:3). Mediterranean streams are described as being most swollen and having greatest erosive power in winter.

The tortuous and changing course of the Maeander River is vividly described by Strabo. He attributes its serpentine nature to the fact that it traverses a level plain where it becomes choked by the materials it brings down. The plains of the Hermus, Cayster and Caicus, as well as that of the Maeander, have all been formed of soft soil deposited by the rivers which flow through them, Strabo asserts. A few instances are given of erosion in the upper parts of streams; for example, the headwaters of several rivers of Thessaly are specially mentioned as forming the ravines through which they flow (9:4:14).

In his introduction Strabo calls attention to the age-old problem of the sources of the Nile and suggests that the river rises in the Ethiopian Mountains. He quotes Herodotus' statement to the effect that Egypt is the gift of the Nile, a reference to the fact that the region of fertile soils is coincident with the margin of the alluvium deposited during annual inundations (1:2:23, 24). Strabo describes a device for measuring the rising of the Nile, a nilometer, and observes that, although there is variety from year to year, there is also a certain order and regularity in the flow of water (17:1:48). He is aware that the plain of the Nile has been built up by accumulations of silt over long periods of time.

When considering the origin of the Stony Plain in Southern France, Strabo reports Aristotle's diastrophic and Poseidonius' aqueous explanation of the development of the feature; he admits the reasonableness of both of these theories (4:1:7).

Strabo merely describes the dry-land features of Asia without attempting to explain their development, since he had not visited these desert areas. However, in an account of a sandstorm in Egypt Strabo hints at the abrasive action of particles of sand carried by the wind. Depositional work of the wind is recognized as being responsible for the formation of

sand dunes which resulted in the partial burial of the sphinxes (17:1:32).

The ephemeral nature of lakes appears to be understood by Strabo. He reports a number of cases of plains being flooded; conversely, several level areas are recognized as the beds of former lakes.

In few locations are the dynamics of geomorphology better displayed than on coasts. The margins of the almost tideless Mediterranean Sea, however, are not prime areas for observing the work of wave erosion, one of the most potent processes in coastal development. It is quite otherwise with coastal deposition, which is well exemplified in the Mediterranean region, and the causes and effects of sedimentation are treated in some detail in the *Geography*. Strabo, depending on the accounts of others, informs us of the great tidal ranges experienced along the Atlantic coasts of Spain and Mauretania (17:3:3). He describes the ria coasts of Spain and calls attention to the rapidity with which tide water fills and flushes those inlets. Like earlier writers, Strabo was aware of a relationship between the phases of the moon and the tides, but could not provide an adequate explanation for that phenomenon (3:5:8).

Within the Mediterranean itself, Strabo notes the effects of the configuration of the coasts on the course of currents. The manner in which waves break he attributes to the character of the sea floor immediately offshore (17:1:6). In discussing deltas, Strabo continually makes comparisons with the great example he knew best, the Nile delta. He mentions that Homer did not consider it worth mentioning that the Nile has many distributaries, since that is a common feature of other rivers (1:2:30). Strabo gives an excellent description of the form of the Nile delta and observes that at the time of flood it resembles a sea with the higher spots, where settlements are located, appearing as islands (17:1:4). All rivers, he assures us, show a tendency to deposit materials at their mouths, but the amount of deposition is determined by the quantity and speed of the water, and the character of the materials over which the river flows (1:3:7).

Strabo calls attention to the flatness of the country around the Rhone delta, where channels have to be artificially cleared of sediments to render the port of Marseilles navigable (4:1:8). Similar reports are made of the Po delta, and in both instances attention is paid to the salt water lagoons of these coastal areas. The formation of the numerous lagoons at the coastal margins of the Po delta Strabo atrributes to the ebb and flow of the tide at the head of the Adriatic, the only area in the Mediterranean which he believes has tidal conditions at all comparable with those in the Atlantic (5:1:5).

Constructional features described in the *Geography* include alluvial coastal plains and spits. The Tiber, Strabo suggests, brings down material deposited to form the coastal plain seaward of Ostia and Antium. These two cities were formerly ports, he notes, but by his time had lost that function due to the accumulation of sediments resulting in the formation of coastal marshes. When considering the Troad in Asia Minor, Strabo estimates the amount of growth of a coastal plain in a given time (13:1:36). It is his belief that there is a definite limit to the distance to which sediments can be carried into the sea, being prevented from further migration by the ebb and flow of tides (11:3:8, 9). There are several

references in the *Geography* to the attachment of offshore islands to the mainland by spits. A complex tombolo is reported as developing at the mouth of the Achelous river, where some of the Echinade Islands have already been captured, a fate, Strabo assures us, which awaits all of them.

Whatever opinions we may entertain with respect to Strabo's original contribution to geomorphology, we may well be impressed by the range of features he discusses and by some of the explanations offered. He deals with cataclysmic and, perhaps more important, with progressive change. Strabo recognizes a dual dichotomy in geomorphology, a science at once descriptive and nomothetic, systematic and chorographic. If, at times, Strabo was less critical than were those whose work he reports, at least we should be grateful to him for providing us with those accounts. Strabo's considerations of landforms contained in the *Geography* might have been expected to stimulate investigations from which more sophisticated conclusions might be drawn, but many centuries elapsed before great advances were made in geomorphology, even though promised so early by the efforts of the Greeks.

A SUGGESTED STUDY MODEL FOR AN INTERNAL POLITICAL GEOGRAPHY OF THE UNITED STATES

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Research development in any scientific discipline depends to a great extent on the conceptional and operational framework of the discipline. It is by this framework that the research worker may direct his study into productive channels of academic investigation, and from which generalizations may be drawn in the search for principles and laws governing the discipline. The present developmental stage of political geography in this regard is one of concern to geographers who are directly or indirectly involved with the spatial aspects of political phenomena. In political geography a satisfactory framework has not been developed.

It is the purpose of this paper to view briefly the present state of political geography as an area of scientific inquiry, and to then suggest a problem model for a systematic study of United States internal political geography. Final development of an acceptable body of theory in the field must await the tedious labor of thousands of research students; but a study model, conceived and organized in such a manner that the techniques employed, data selected, and results obtained may be readily utilized and compared by other students would decrease by years the final attainment of the goal. It is most important that the efforts of all research students should contribute toward the desired end. With this goal in mind let us proceed to a survey of the present status of political geography.

Political geography is one of the oldest branches of geography, yet it is today one of the less-developed parts of geographic study. Whatever the reason for this atrophy, it is apparent that students of the field have been unable to agree on either an approach to the subject or find a body of political phenomena suitable for geographic study. Much that has been published as political geography has not been aimed at developing a field of scholarship or presenting a body of principles. On the contrary, the intention apparently has been to serve some other purpose, such as understanding international problems.[1] As late as 1954, Richard Hartshorne noted that many political geographers had in mind "... no systematic concept of what topics should be included, or what questions should be posed for which answers are to be sought."[2] Nor has the situation changed substantially in the last eight years.

In view of this lack of conceptual development it is not surprising that most geographers desire to do their work in more organized fields of study. Especially is the beginning research student dismayed at the prospect of problem statement and research aims in a field with no consensus of opinion concerning aims, concepts, or the phenomena to be studied.

[1] Richard Hartshorne, "Political Geography" in James and Jones (eds.), *American Geography: Inventory and Prospect* (Syracuse, 1954), pp. 169-170.

[2] *Ibid.*, p. 177.

Granting that "why" is the ultimate question in a geographic study, the question of "what" is of primary concern in formulating a problem in a field where there is no agreement as to the phenomena suitable for geographic study.

If, as is assumed in Hartshorne's definition of the subject, i.e., that political geography is essentially concerned with the spatial distribution of political phenomena,[3] and if it is agreed that the voting habits of the American people constitute a political phenomenon, we may conclude that the distribution of voting habits in the United States is a valid subject of study in the field of political geography. In voting habits we have a political phenomenon which may be clearly identified and which shows variation of locational intensity from point to point over the areal surface of the earth. Thus we may not only identify our phenomenon but locate it in space and, consequently, formulate hypotheses in terms of where A, there B, or more exactly, where A, there more or less B.

It has been apparent to political geographers for some time that voting habits in the United States result in patterns of political behavior which show spatial differentiation and tend to remain stable over long periods of time. Such a pattern was first demonstrated in American geographic literature by John J. Wright in 1932,[4] essentially by two maps showing party dominance over a period of fifty-two years. This study as well as others indicate that political behavior patterns have points of high and low intensity relative to the vote in surrounding areas. Such highs and lows appear to be fixed relative to points in space, perhaps as a result of phenomena at these points which are essentially nonpolitical.

Despite the distribution of phenomena shown by Wright, only scant attention has been paid by geographers to political patterns over the last thirty years. Not more than two such studies were found by Hartshorne in his survey of the field in 1954.[5] In other areas of the social sciences, especially in political science, voting habits have been investigated with notable success. While patterns of political behaviour frequently emerge in these studies, their occurrence is usually incidental to the purpose of the study. Such studies do demonstrate that political behavior is predictable and that political patterns may be treated as stable political phenomena, thus dispelling a popular notion that caprice and accident play a major role in voting habits. While the political geographer is concerned with areal associations rather than causal relationships, there would still be no use of scientific analysis if an orderly universe were not assumed. If we accept political behavior as a suitable phenomenon for geographic study because, (1) it shows areal differentiation, (2) it may be identified, and (3) it is associated in an orderly manner with other spatially distributed phenomena, we may then proceed to the problem of describing and measuring the phenomenon to be investigated.

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[3] The definition here accepted describes political geography as " . . . the study of areal differences and similarities in political character as an interrelated part of the total complex of areal differences and similarities." *Ibid.*, 178.

[4] John J. Wright, "Voting Habits in the United States," *Geographical Review*, Vol. 22 (1932), pp. 666-672.

[5] Hartshorne, *op. cit.*, p. 178.

In American politics, citizens commonly express political attitudes by voting for one of the major political parties.[6] In a problem which requires quantification of political behavior, the vote becomes a useful measure. Votes may be used to measure the volume of political activity much as dollars are used to measure economic activities. With the vote expressed as a one-party percentage of the total, we may measure areal variations in voting attitudes and describe precisely the amount of these variations. While there are other theoretical measurements of political behavior, none appears to be more easily obtainable or more simple and precise in character. It is also a convenient measure, in that it may readily be compared with other quantified material. This last quality becomes especially significant when one begins to gather data for analysis. The vote would appear to be a suitable unit of measurement in studies of political variation ranging from the precinct to the national level.

The scale suggested in this study model is the county unit. This is the division of the state and nation for which political and other comparable data are readily available. However, other political subdivisions for which voting records and related data are available, e.g., the township or the state, are equally acceptable. Observations concerning the county scale could be readily applied to other areal scale units. While it is recognized that considerable variation exists among counties as to areas, populations and total votes, these variations are not considered germane to the problem of the political geographer here, which is concerned with explaining areal variation in party vote, not in explaining variations in the total vote. In a study of the type here considered, the political pattern can be measured and determined by the party percentage of the total vote. This percentage is not dependent in any known way on the size or population of a county, nor can it be used to estimate the size of the vote of that county.[7]

Measurement of the Degree of Association

Because of the multifarious nature of the voting attitudes the areal association of these attitudes and associated variables presents a complex problem. In dealing with such problems in the past the unknown ingredients which result in areal patterns of voting behavior have been of sufficient magnitude to sometimes lead to the conclusion that "chance" factors outweigh all other variables in attempting to explain political variation.[8] Such conclusions imply that social behavior is not causal and orderly and that scientific analysis of most social problems is impractical if not impossible. If such a conclusion were accepted, there is little left for the political geographer in his study of voting patterns except the description of political patterns. If, however, we assume that man's "free will" is limited by variables which govern his ultimate choice, it would appear that our failure has been the result of inadequate methods rather than unsolvable problems.

[6] For example see Stuart A. Rice, *Quantitative Methods in Politics* (New York, 1928), p. 93.

[7] Conceptually the county is considered a point in the state. For a discussion of the significance of county size and weighted averages see McCarty, *op. cit.*, 10 ff.

[8] See Trenton J. Kostbade, *Geography and Politics in Missouri* (University of Michigan, 1957), unpublished doctoral dissertation.

The philosophical framework suggested here for the study of political behavior patterns is that man's "free will" is limited by variables which govern his ultimate choice. It is realized that political geography is not capable of total prediction of the spatial aspects which determine voting behavior. However, it is anticipated that by the use of certain statistical techniques, hitherto not commonly employed in political geography, significant variables spatially related to the voting pattern may be measured and their effect on the voting pattern precisely stated within the limits of statistical probability theory. Incidentally, the laborious process of mathematical computations which previously placed an immense time burden on the researcher has been largely eliminated by modern computer equipment.

The main statistical methods found useful by the writer are the Pearsonian product-moment coefficient of multiple correlation, and regression analysis. Other techniques equally as valuable may be found. Any such method which adds clarity and preciseness to the statement of problems, analysis of data, and drawing of conclusions is to be desired. The above methods are suggested as a starting point and because they have been demonstrated as sound methodologically in geographic research.[9]

After the independent variables thought to determine the spatial variation of the political pattern have been tested on the dependent variable, the researcher will again evaluate his data and reform his hypotheses along the lines set down by McCarty in 1956.[10] This will entail statistical maps and regression charts in order to locate areas inadequately explained by the hypotheses. Undoubtedly the investigator will be forced to reexamine the literature in a search for new variables which account for the unexplained distribution. The new hypotheses will then be tested and this process will continue until the desired degree of explanation is obtained. In the course of this examination political areas which vary extremely from the norm may occur. In such instances the area may be investigated as part of the study or left for future case study. From such case studies new and significant insight may be gained.[11]

In conclusion, the study model suggested here will take the form of problem statement in terms of a measurable political phenomenon—the vote. The political variation so described will then be explained by associated phenomena which are found to be related to the political variation. The rationale for the association will be stated and the degree of association tested by the most precise tools available. The search for independent variables which account for the spatial variation of political phenomena will continue until a degree of explanation is reached which satisfies the investigator that further effort can not be justified in terms of personal or social benefit.

Research results should be stated in such a way that the reader can quickly find the precise relationship between the political pattern and all

[9] H. H. McCarty, et al., *The Measurement of Association in Industrial Geography* (Iowa City, 1956), p. 140.

[10] H. H. McCarty, "Use of Certain Statistical Procedures in Geographic Analysis," *Annals of the Association of American Geographers*, Vol. 46 (1956), p. 263.

[11] For discussion of deviant-case analysis see Edwin N. Thomas, *Maps of Residuals from Regressions: Their Characteristics and Uses in Geographic Research* (Iowa City, 1960), pp. 25-41.

independent variables considered. Regression equations expressing the generalized nature of the association is one convenient and simple way of recording such results. The coefficient of correlation between the political pattern and each related variable is also a useful expression of the degree of association. With such information, future investigators may improve on the results by applying new techniques to the data used in the original study or by inserting new variables into the original equation. Parallel studies may also be made of similar political areas and results compared directly. By utilizing the results from a number of these studies generalized observations may be made concerning spatial variation of political phenomena from which laws and principles governing political regions would evolve. The extreme residuals from regression isolated in the studies will offer ready subjects of study for micro-political geography of the "case study" type found so profitable in other sciences.

The pattern suggested in this study model would not impose a limitation on political geographers who wish to follow other lines of investigation but would greatly facilitate the work of developing a systematic political geography of the United States. In the pyramiding system of scientific inquiry, new political associations would be brought to light by a number of research people working along similar lines of investigation, stating problems, formulating hypotheses, and recording conclusions in a uniform manner easily utilized by fellow students.

VEGETATIVE KEY FOR THE IDENTIFICATION OF THE PRINCIPAL NON-DESERT SHRUBS OF LOS ANGELES COUNTY

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A carefully-prepared vegetative key for the identification of plant species is a useful tool for the geographic study of vegetation within a restricted area. The botanical field manual, a more desirable tool, can be used only when plants are in flower. In many types of vegetation, all of the major species are rarely in flower at one time or within a relatively short period of time. Many types of vegetation are composed of vernal. estival, and autumnal species; thus the period of time required for floristic identification may extend from early spring to late fall. A study initiated in the fall may not be completed until the following summer. In those areas in which most of the important species do produce flowers within a brief interval of time, the period for gathering species for taxonomic identification is often a brief one. Because identification of component species is normally the first step in a detailed vegetative investigation, the time for initiating a study must often be delayed unless some means other than floristic identification is available. In the absence of flowering species, rather reliable steps toward vegetative analysis of plant units can be made by the use of vegetative keys.

An investigator interested in the study of vegetation but lacking formal training in field botany can master the use of a vegetative key in less time than he would need to become adept at floristic identification. A vegetative key can be used by learning a few definitions and by comparing parts of plants with the diagrams shown in Figure 1. Usually students in physical geography have had no training in botany, but they have been able to study vegetation by means of vegetative keys.

Vegetative keys are used by a number of scientific workers. Foresters, range men, turf men and other field workers required to make appraisals of vegetation in various seasons of the year have made good use of vegetative keys during periods when many of the important range, forest, and turf species were not in flower. A number of keys have been published for range, field, and other uses. Often a species is identified in the field by the recognition of one or more distinctive vegetative characteristics.

A botanist in the preparation of a field manual often uses vegetative characteristics to separate species which are not easily distinguished by floral analysis.

In the absence of flowering species a research worker frequently collects flowerless plants and compares them with herbaria sheets. In the absence of flowers on an unidentified plant, an investigator compares growth forms and vegetative characteristics in much the same manner that one use a vegetative key in the field.

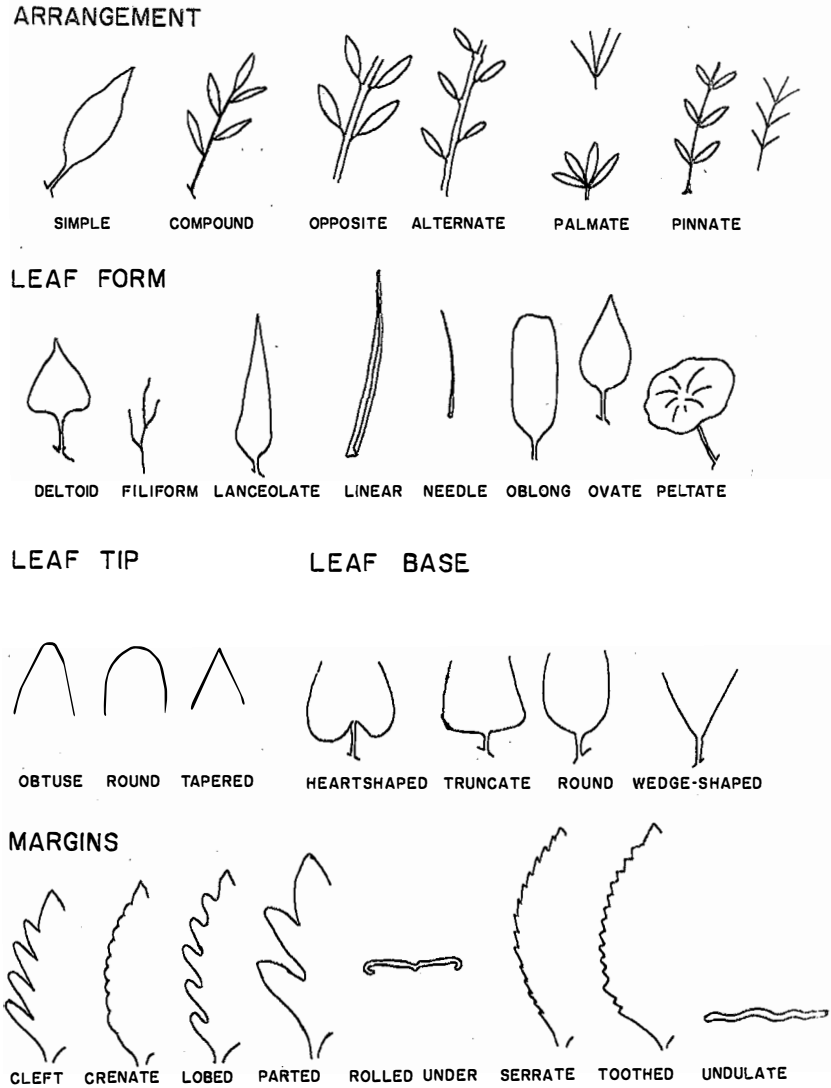

Figure 1

GLOSSARY

Bald: lacking vestiture of any kind.
Blade: the expanded portion of a leaf.
Compound leaf: leaf consisting of two or more leaf forms or leaflets.
Entire: lacking marginal indentations.
Fascicled: clustered or bundled, sometimes held in a grouping by a thin membrane.
Sessile leaf: leaf lacking a petiole.
Simple leaf: consisting of a single leaf form.
Stipule: small appendage at the base of a petiole.
Vestiture: collective term for various types of hairy and woolly growth on leaves and stems.

Limitations in the Development of a Vegetative Key

The development of a good vegetative key is complicated by a number of factors:

(1) Vegetative characteristics are variable from season to season, particularly in regions of severe edaphic stress during the frost-free period. Variations in leaves such as rolling of leaf margins or loss of vestiture may occur during a growing season. Vegetative characteristics sufficient for the identification of a species in the spring may be inadequate in the fall.

(2) Some vegetative characteristics such as lengths and widths of leaves or presence or absence of vestiture may be variable from year to year in corresponding seasons. Variations from wet years to dry years often correspond closely to variations from wet season to dry season during one growth period.

(3) Both leaf and stem characteristics may change markedly with the maturation of a plant. Leaves of seedlings often differ significantly in form and size from those of the mature plant. Leaves of young trees often differ from those of older trees of the same species.

(4) Some species are polymorphic. To prepare a vegetative key for polymorphic species requires that several combinations of key characteristics be used for the identification of a species. In the key which follows, some species have been listed under both branches of primary and secondary dichotomies or pairings.

Limitations on the Use of Vegetative Keys

One should keep in mind that a vegetative key does not insure positive identification of a species. Accepted identification rests on floral analysis. If a vegetative key is prepared accurately and carefully, it should give the same identification as a botanical field manual. Nevertheless, a species identified tentatively by means of a vegetative key should be checked by floral analysis as soon as flowering species are available.

Preparation of the Key

The species included in the key which follows are perennial shrubs and half-shrubs which grow wild, *i.e.*, apparently unaided by man, in the non-desert areas of Los Angeles County. Most horticultural and introduced shrub species except a few common *escapes* have been excluded.

No exact and wholly satisfactory criteria which distinguish all shrubs from all trees occur in the literature. Many woody forms are readily labeled *shrub* by a number of observers. However, the problem of distinguishing mature tall shrubs from mature low trees is ubiquitous, and criteria used for this purpose are often arbitrary. In the key which follows a shrub is considered to be (a) a woody plant with numerous stems arising from a common base, or (b) a woody plant with a single trunk measuring less than two inches in diameter and branching near the ground. A woody form over ten feet high with a single trunk which is two inches or more in diameter and which is unbranched below four feet is classed as a tree. Any woody plant of lesser dimensions can be classed as a shrub. On a purely physiognomic basis there is no criterion for distinguishing a young tree from a mature shrub.

Sapling forms are not always distinct. If strikingly similar tree and sapling or shrub-like forms appear in an area, one might conclude that the smaller is the sapling form of a tree species. In the absence of mature trees for comparison, there is no local clue. Therefore sampling characteristics of a number of tree species have been included in the key.

Further complications result from the fact that a species may exist in both tree form and shrub form.

The species included in the key were compiled from four botany manuals commonly used in southern California for the identification of plant species[1] and from field notes. A shrub species was included if it was not restricted to desert habitats and if Los Angeles County was named or implied in the description of the range of the species.

Vegetative characteristics used in the preparation of the key were secured from field study and from the four manuals referred to above. Manuals do not give a detailed vegetative description of a species, and occasionally notations on the less common variations of leaf form, leaf margins, and other vegetative characteristics are omitted. Thus the generalized notations given in botany manuals are inadequate for use in the preparation of a vegetative key. The botanist has no real purpose for giving exhaustive vegetative descriptions; his purpose is to provide a means of identification by floral analysis. Vegetative characteristics noted on flowering species in the field were used to correct and to supplement data given in the manuals.

Because of frequent variations in characteristics, a species often was listed under both sections of a dichotomy, and dual entries were often required in subsequent pairings. By so doing, the key was made repetitive, but this was necessary in order to encompass the variations of polymorphic species.

Utilization of the Key

The key consists of a series of numbered dichotomies. At each step the worker is confronted with a selection of one of two choices. The elected choice leads to the next pair of items and so on until a species is finally identified. For example, *leaves simple* in pair Number 1 leads to pair Number 24. A choice at 24 will lead to 25 or to 33.

Beginners should start at Number 1. After a worker becomes familiar with the key, he may recognize a species with simple, broad leaves and may turn immediately to 33, or for a plant with round stems and broad simple leaves, he may begin at 44. A user will find other short-cuts as he becomes better acquainted with the key.

In most instances the choices in each dichotomy are opposites. In a few instances, a polymorphic species may fit either of the pairs and will be identified under both sections. In such a case, the user should take what

[1] Willis Linn Jepson, *A Manual of the Flowering Plants of California* (Berkeley: University of California Press, 1923-1925) 1238 pp.

Howard E. McMinn, *An Illustrated Manual of California Shrubs* (Berkeley: University of California Press, 1951) 663 pp.

Philip A. Munz, *A Manual of Southern California Botany* (Lancaster, Pennsylvania: The Lancaster Press, 1935), 642 pp.

Philip A. Munz and David D. Keck, *A California Flora* (Berkeley: University of California Press, 1959), 1681 pp.

seems to be the most common characteristic. If unsatisfied or blocked by inadequacies in subsequent pairings, he should return to a point of uncertainty of choice and follow the other branch of the dichotomy.

As previously stated, technical terms used in this key are either illustrated in Figure 1 or are defined in a short glossary which follows Figure 1. Diagrams are used to illustrate terms descriptive of forms, margins, bases, and apices of leaves in Figure 1. Other terms are found in the glossary.

The following procedure is suggested for using the key:

(1) Be sure that there is some hard or woody tissue in the stem of the plant to be identified.

(2) Try to select plants which have not been disturbed by recent fire or recent grazing.

(3) If possible, avoid plants growing near houses or abandoned settlements.

(4) Observe several plants of the species you wish to identify.

(5) Note variations in leaf and stem characteristics.

(6) Unless otherwise specified in the key, base selections on the characteristics of older but not wilted or dead leaves of a plant.

(7) If leaf and or stem characteristics are variable, select the most common characteristics.

(8) If two or more characteristics are listed in one branch of a dichotomy, be sure that the plant in question possesses all listed characteristics before keying the plant through that branch.

(9) A hand lens, a ruler, and a knife, razor blade, or other sharp instrument will be needed at several points in the key.

Plant Names

Because widely used common names are not available for some of the species contained in the key, it was necessary for uniformity to key the species to scientific names. At the end of the key the species identified in it are listed alphabetically by scientific name followed by widely-used common names for each of the species for which an acceptable common name was available.

KEY

1. Leaves compound — 2
1. Leaves simple — 24
2. Leaves alternate — 8
2. Leaves opposite — 3
3. Leaves palmately compound — *Aesculus californica*
3. Leaves pinnately compound — 4
4. Leaflets with serrate margins; short non-twisting petioles or sessile leaves — 5
4. Leaflets toothed or lobed; plants climbing by twisting petioles — 6
5. Leaflets 5 to 9, deeply serrate, 2½ to 6 inches long — *Sambucus caerulea*
5. Leaflets 3 to 5, finely serrate, 1 to 2 inches long — *Sambucus mexicana*
6. Young branchlets nearly bald; upper leaf surface bald — *Clematis ligusticifolia*
6. Young branchlets covered with dense wool; upper leaf surfaces with some vestiture — 7
7. Leaves more or less fascicled — *Clematis pauciflora*
7. Leaves not fascicled — *Clematis lasiantha*

8. Leaves palmately compound — 9
8. Leaves pinnately compound — 11
9. Leaflets three — *Pickeringia montana*
9. Leaflets 6 or more — 10
10. Petioles less than one inch long; coastal sandhills — *Lupinus Chamissonis*
10. Petioles 1 to 3½ inches long — *Lupinus excubitus* var. *Hallii*
11. Leaflets 11 or more — 12
11. Leaflets 3 to 9 — 13
12. Leaflets entire — *Amorpha californica*
12. Leaflets coarsely serrate except at base — *Juglans californica*
13. Leaf margins spiny-tipped — 14
13. Leaf margins without spiny tips — 15
14. Leaf margins slightly undulate; 5 to 16 spinose teeth on each margin — *Berberis Nevinii*
14. Leaves strongly undulate; 3 to 8 spines nearly as long as the body of the leaf blade — *Berberis Dictyota*
15. Stipules present — 16
15. Stipules absent — 18
16. Stipules joined to the base of the petiole — *Risa californica*
16. Stipules free from the petiole — 17
17. Prickles slender and straight; margins doubly toothed — *Rubus vitifolius.*
17. Prickles stout and curved; margins doubly serrate — *Rubus leucodermis*
18. Branches prickly — *Rubus vitifolius*
18. Branches not prickly — 19
19. Leaflets crenate or even lobed — 20
19. Leaflets entire — 21
20. Terminal leaflet apparently sessile — *Rhus trilobata*
20. Terminal leaflet with distinct petiole; source of skin irritation — *Rhus diversiloba*
21. Leaflets lacking conspicuous vestiture — *Lotus scoparius*
21. Leaflets with conspicuous vestiture — 22
22. Herbage ill-scented — *Isomeris arborea*
22. Herbage not ill-scented — 23
23. Leaflets densely silky — *Lotus argophyllus*
23. Leaflets only slightly hairy — *Lotus scoparius*
24. Leaves needle-like, scale-like, filiform, filiform-lobed, or narrowly linear — 25
24. Leaves distinctly broad — 33
25. Basal cluster of long awl-shaped leaves — *Yucca Whipplei*
25. Leaves along the stems — 26
26. Leaves stiff and sharply pointed; most leaves fascicled or divided so as to appear fascicled — 27
26. Leaves not stiff and sharp pointed; leaves not fascicled — 28
27. Leaves mostly fascicled — *Adenostoma fasciculatum*
27. Leaves palmately cleft into 5 to 9 sharply pointed linear divisions — *Leptodactylon californicum*
28. Leaves divided into threadlike segments — 29
28. Leaves not divided into threadlike segments — 32
29. Leaf margins rolled under — 30
29. Leaf margins plane — 31
30. Old stems matted with wool-like hairs; broad petiole — *Eriophyllum confertiflorum*
30. Old stems smooth and lacking hairs; no distinct petiole — *Senecio Douglasii*
31. Herbage aromatic, bitter; filiform segments less than 1 millimeter wide; leaves along most of the upper part of stem — *Artemisia californica*
31. Herbage not aromatic; segments 1 to 1½ millimeters wide; leaves borne near the top of a fleshy woody trunk — *Coreopsis gigantea*
32. Old bark red and peeling; leaves 2 to 6 inches long — *Adenostoma sparsifolium*
32. Old bark rough to the touch; leaves less than 2 inches long — *Gutierrezia californica*

33. Young branches angled or ridged — 34
33. Young branches round in cross-section — 44
34. Herbaceous stems 5-angled or 5-ridged — 35
34. Herbaceous stems 4-angled — 37
35. Vestiture on young growth consisting of some branched hairs — *Solanum umbelliferum*
35. Vestiture on young growth consisting of some branched hairs — *Solanum*
36. Leaf margins wavy and toothed — *Solanum Douglasii*
36. Leaf margins not toothed, sometimes lobed — *Solanum Xantii*
37. Two opposite pairs of leaves at a node — *Galium angustifolium*
37. Leaves with opposite pairs only at a node — 38
38. Leaf margins minutely crenate — 39
38. Leaf margins entire or undulate, not minutely crenate — 41
39. Leaf bases truncate, broadly rounded, or subcordate — *Salvia leucophylla*
39. Leaf bases tapering — 40
40. Upper leaf surface green and wrinkled — *Saliva mellifera*
40. Upper leaf surface hoary white — *Salvia apiana*
41. Leaves sessile; leaf margins turned under — *Trichostema lanatum*
41. Leaves with distinct petioles; leaf margins not turned under — 42
42. Leaf margins strongly turned under — *Garrya elliptica*
42. Leaf margins plane or only slightly undulate; leaf margins not turned under — 43
43. Upper leaf surface yellow-green or grayish-green — *Garrya flavescens*
43. Upper surfaces of leaves dark green — *Garrya Veatchii*
44. Leaves fascicled or clustered — 45
44. Leaves not fascicled or clustered — 60
45. Leaves clustered on short lateral branch spurs — 46
45. Leaves not clustered on branch spurs — 49
46. Leaves pinnately veined — 47
46. Leaves palmately veined — 48
47. Leaf bases wedge-shaped and entire — *Cercocarpus betuloides*
47. Leaf bases rounded or slightly heart-shaped — *Amelanchier utahensis*
48. Leaves finely toothed, 3- to 5 lobed or cleft — *Ribes cereum*
48. Leaves entire or 3-lobed, not toothed — *Fremontia californica*
49. Leaves or leaf clusters opposite — 50
49. Leaves or leaf clusters alternate — 51
50. Leaves sessile, partly clasping the stem — *Mimulus puniceus*
50. Lower leaves sometimes petioled; sessile upper leaves not partly clasping the stem — *Mimulus longiflorus*
51. Leaves narrowly linear, threadlike or rigid, mostly less than 1/16 inch wide — 52
51. Leaves broader — 53
52. Many of the leaves with linear threadlike lobes — *Artemisia californica*
52. Leaves stiff, more or less rounded in cross-section — *Adenostoma fasciculatum*
53. Upper leaves lobed, parted, or cleft — 54
53. Upper leaves not lobed, parted, or cleft — 55
54. Many of the upper leaves with 3 long blunt lobes — *Castilleja foliolosa*
54. Leaves palmately cleft into 5 to 9 sharp-pointed divisions — *Leptodactylon californicum*
55. Leaf margins spiny toothed or serrate — 56
55. Leaf margins entire or nearly so — 57
56. Leaf margins spiny toothed — *Haplopappus venetus* var. *vernonioides*
56. Leaf margins serrate — *Haplopappus squarrosus*
57. Older leaves with margins turned under — 58
57. Leaf margins plane — 59
58. Upper leaf surfaces smooth and bald — *Eriogonum fasciculatum*
58. Upper leaf surfaces hairy — *Eriogonum fasciculatum* var. *foliolosum*

59. Leaves less than ⅛ inch wide — *Zauschneria cana*
59. Leaves ⅛ to ¼ inch wide — *Zauschneria californica*
60. Upper leaves opposite — 61
60. Upper leaves alternate — 79
61. Plants semiparasitic, mostly on oaks, sycamores, and walnuts — *Phoradendron flavescens*
61. Plants autophytic — 62
62. Upper pair of leaves connate — 63
62. Upper pair of leaves distinct — 65
63. Leaf margins serrate — *Penstemon spectabilis*
63. Leaf margins entire — 64
64. Lowest leaves with conspicuous stipular appendages — *Lonicera hispidula*
64. Leaves without stipules — *Lonicera interrupta*
65. Upper leaves sessile or nearly so — 66
65. Upper leaves with distinct petioles — 72
66. Leaves pinnately parted into 3 to 7 divisions — *Eriophyllum confertiflorum*
66. Leaves not pinnately parted — 67
67. Plant a straggly shrub; leaf margins serrate — *Penstemon cordifolius*
67. Plant an erect shrub — 68
68. Upper leaves with clasping bases — 69
68. Upper leaves free — 70
69. Margins of old leaves turned under — *Mimulus puniceus*
69. Margins of old leaves plane — *Penstemon heterophyllus*
70. Young branches without hairs — *Penstemon breviflorus*
70. Young branches with vestiture — 71
71. Leaves tapered at the base — *Mimulus longiflorus*
71. Leaves rounded at the base — *Zauschneria latifolia*
72. Leaves pinnately parted into 3 to 7 divisions — *Eriophyllum confertiflorum*
72. Leaves not pinnately parted — 73
73. Plant a straggly shrub — 74
73. Plant an erect shrub — 75
74. Leaves usually entire with long hairs on margins of leaves — *Symphoricarpus mollis*
74. Leaves mostly serrate; marginal hairs lacking — *Penstemon cordifolius*
75. Leaf margins finely crenate — *Salvia apiana*
75. Leaf margins not crenate — 76
76. Upper leaf surface bald — 77
76. Upper leaf surface covered with fine hairs — 78
77. Leaf margins toothed — *Ceanothus crassifolius*
77. Leaf margins entire or with only a few teeth — *Symphoricarpus albus*
78. Leaves borne on spur-like branches; leaves wedge-shaped — *Ceanothus cuneatus*
78. Leaves not borne on spurs; leaves ovate to orbicular — *Lonicera Johnstonii*
79. Stems armed with thorns, spines, or prickles — 80
79. Stems unarmed — 88
80. Stems with nodal spines — 81
80. Stems without distinct nodal spines but with spinose branches and twigs — 84
81. No internodal prickles on young twigs — 82
81. Young stems with internodal prickles — 83
82. Leaves clustered on ends of short lateral branches — *Ribes Roezlii*
82. Leaves not so clustered — *Ribes aureum*
83. Leaf bases tapering or rounded — *Ribes speciosum*
83. Leaf bases heart-shaped — *Ribes californicum* var. *hesperium*
84. Leaf apex obtuse and tipped with a short soft point — *Atriplex lentiformis* var. *Brewerii*
84. Leaf apex lacking a soft point — 85
85. Young branches bright yellowish green — *Ceanothus spinosus*
85. Young branches grayish or brownish — 86

86. Leaves with one main vein from the base — *Rhamnus crocea*
86. Leaves 3-veined from the base — 87
87. Young branches brownish or olive; low spreading shrub; flat-topped; montane — *Ceanothus cordulatus*
87. Young branches very gray or whitish — *Ceanothus leucodermis*
88. Leaves spinosely or bristly toothed or serrated — 89
88. Leaves not bristly or spinosely toothed or serrated — 98
89. Upper leaf surface strongly convex — *Quercus agrifolia* var. *frutescens*
89. Upper leaf surface plane or nearly so — 90
90. Lower leaf surface hairy — 91
90. Lower leaf surface bald — 93
91. Leaves sessile or with petiole-like bases — *Haplopappus venetus* var. *vernonioides*
91. Leaves distinctly petioled — 92
92. Leaves yellow-green; young twigs gray woolly — *Quercus chrysolepis* var. *nana*
92. Leaves blue-green; young twigs rusty woolly — *Quercus dumosa*
93. Leaf margins serrate — 94
93. Leaf margins toothed — 95
94. Petioles ¼ inch or less in length — *Rhamnus crocea* var. *illicifolia*
94. Petioles ½ to 1 inch long — *Heteromeles arbutifolia*
95. Leaves sessile or nearly so — *Haplopappus venetus* var. *vernonioides*
95. Leaves with distinct petioles — 96
96. Leaves holly-like — 97
96. Leaves not holly-like — *Quercus Wislizenii* var. *frutescens*
97. Lower leaf surface pale green — *Prunus ilicifolia*
97. Lower leaf surface yellowish or brownish — *Rhamnus crocea* var. *illicifolia*
98. Leaves lobed — 99
98. Leaves not lobed — 110
99. Leaves peltate — *Ricinus communis*
99. Leaves not peltate — 100
100. Young stems smooth and bald — *Ribes aureum*
100. Vestiture on young stems — 101
101. Leaves on short leaf-bearing branchlets — 102
101. Leaves not borne on short leaf-bearing branchlets — 103
102. Margins of lobes entire — *Fremontia californica*
102. Margins of lobes finely toothed — *Ribes cereum*
103. Leaf margins doubly toothed — *Ribes malvaceum*
103. Leaf margins not doubly toothed — 104
104. Upper leaf surface bald and shining — *Quercus dumosa*
104. Upper leaf surface with vestiture — 105
105. Leaf margins turned under; leaves divided once or twice into 3 to 9 divisions — *Senecio Douglasii*
105. Leaf margins not turned under — 106
106. Leaves with only 1 or 2 basal lobes — *Rhus integrifolia*
106. Leaves with 3 to 5 lobes — 107
107. Upper leaf surface finely wrinkled; vestiture unbranched — *Ribes indecorum*
107. Vestiture branched — 108
108. Young branches covered with fine hairs — *Malacothamnus fasciculatus*
108. Young branches densely woolly — 109
109. Base of leaves rounded — *Malacothamnus marrubioides*
109. Base of leaves heart-shaped — *Malacothamnus Davidsonii*
110. Leaves or leaf divisions less than 1 millimeter wide — 111
110. Leaves or leaf divisions wider — 112
111. Leaves with margins turned under — *Eriophyllum confertiflorum*
111. Leaf margins plane — *Gutierrezia californica*
112. Upper leaves sessile or tapering to a petiole-like base — 113
112. Upper leaves distinctly petioled — 121

113. Young branches round in cross-section with striations on the bark — 114
113. Bark not striated — 116

114. Leaves once or twice divided — *Senecio Douglasii*
114. Leaves not divided — 115

115. Lower leaves willow-like, entire or only slightly toothed; one-nerved or veined from the base — *Baccharis viminea*
115. Lower leaves wider in proportion with a few short teeth; 3-veined from the base — *Baccharis Emoryi*

116. Young stems bald — *Haplopappus cuneatus*
116. Young stems with vestiture — 117

117. Leaves serrate — 118
117. Leaves entire or finely toothed — 119

118. Upper and lower leaf margins serrate — *Baccharis Plummerae*
118. Only the upper leaf margins serrate; lower margins entire — *Corethrogyne filaginifolia*

119. Some leaves fascicled in axils; leaves grayish — 120
119. Leaves not fascicled — *Salix Hindsiana var. leucodendroides*

120. Leaves less than 1/8 inch wide — *Zauschneria cana*
120. Leaves 1/8 inch wide or more — *Zauschneria californica*

121. Leaf margins entire — 122
121. Leaf margins not entire — 138

122. Leaves strong-scented when crushed — 123
122. Leaves not strong-scented — 125

123. Leaves more or less trough-like; leaf margins and midrib pinkish — *Rhus laurina*
123. Leaves not trough-like — 124

124. Young branches without vestiture — *Umbellularia californica*
124. Young branches with small hairs — *Rhus trilobata*

125. Leaves with heart-shaped bases — 126
125. Leaf bases not heart-shaped — 127

126. Leaf apex rounded — *Cercis occidentalis*
126. Leaf apex tapered — *Venegasia carpesioides*

127. Leaves without vestiture on both upper and lower surfaces — 128
127. Leaves with some vestiture — 132

128. Petiole 1 to 2 inches long, greenish — *Nicotiana glauca*
128. Petiole less than 1/2 inch long or reddish in color if longer than 1/2 inch — 129

129. Petiole reddish in color — *Rhus ovata*
129. Petiole greenish in color — 130

130. Leaf margins slightly undulate — *Quercus Wislizenii* var. *frutescens*
130. Leaf margins plane — 131

131. Young twigs bald — *Arctostaphylos glauca*
131. Young twigs with vestiture — *Rhus integrifolia*

132. Stem branches forking more or less uniformly — *Eriogonum cinereum*
132. Stem branches lateral — 133

133. Young twigs without vestiture — *Ceanothus integerrimus*
133. Young branches with vestiture — 134

134. Leaves with 3 veins from the base — *Encelia californica*
134. Leaves 1-veined from the base — 135

135. Bark smooth reddish-brown — *Arctostaphylos pungens*
135. Stems or bark gray or brown — 136

136. Gray stems with brown warty stipules — *Ceanothus megacarpus*
136. Stems without warty stipules — 137

137. Lower leaf surface covered with branched hairs; low subshrub with grayish white leaves — *Croton californicum*
137. Lower leaf surface yellow or leaf colored — *Quercus chrysolepis* var. *nana*

138. Leaves only slightly toothed or serrate — 139
138. Leaves with numerous teeth or serrations — 143

139. Leaves 3-veined from the base — 140
139. Leaves 1-veined from the base — 141

140. Stems with small sinuous ridges on the bark — *Baccharis glutinosa*
140. Stems lacking pronounced marking or ridges — *Encelia californica*

141. Leaves strongly fragrant when crushed; resin dots — *Myrica californica*
141. Leaves not strongly fragrant; lacking resin dots — 142

142. Leaves thick and leathery — *Rhus ovata*
142. Leaves not leathery and thick — *Venegasia carpesioides*

143. Leaves serrate — 144
143. Leaves toothed or crenate — 149

144. Upper portions of leaf doubly serrate; lower entire — *Holodiscus discolor*
144. Lower parts of leaf serrate — 145

145. Leaves doubly serrate — *Alnus rhombifolia*
145. Leaves finely serrate — 146

146. Leaves deltoid — *Brickellia californica*
146. Leaves ovate or oblong — 147

147. Petioles with one or two glands near the base of the blade — *Prunus Virginiana* var. *demissa*
147. Glands lacking on petiole — 158

148. Leaves at least 5 times as long as wide — *Salix lasiolepis*
148. Leaves scarcely 3 times as long as wide — *Rhamnus californica*

149. Leaf margins with stiff hairs — *Dendromecon rigida*
149. Leaf margins not having stiff hairs — 150

150. Upper leaf surface bald — 151
150. Vestiture on upper leaf surface — 152

151. Leaves aromatic; 1-veined from base — *Eriodictyon trichocalyx*
151. Leaves not aromatic; 3-veined from base — *Ceanothus sorediatus*

152. Leaves covered with dense white wool above and below — *Eriodictyon tomentosum*
152. Leaves not densely woolly on both surfaces — 153

153. Upper leaf surface with short branched hairs — *Melacothamnus marrubioides*
153. Vestiture unbranched — 154

154. Leaves 1-veined from base; aromatic — *Eriodictyon crassifolium*
154. Leaves 3-veined from base; not aromatic — *Ceanothus oliganthus*

LIST OF SCIENTIFIC AND COMMON NAMES

Adenostoma fasciculatum — Chamise
Adenostoma sparsifolium — Redshanks, Ribbon Wood
Aesculus californica — California Buckeye
Alnus rhombifolia — White Alder
Amelanchier utahensis — Western Service Berry
Amorpha californica — Mock Locust
Arctostaphylos glauca — Bigberry Manzanita
Arctostaphylos pungens — Mexican Manzanita
Artemisia californica — Coastal Sagebrush
Atriplex lentiformis var. *Breweri* —

Baccharis Emoryi —
Baccharis glutinosa — Seepwillow
Baccharis Plummerae —
Baccharis viminea — Mule Fat
Berberis Dictyota —
Berberis Nevinii —
Brickellia californica — California Brickellbush

Castilleja foliolosa — Indian Paintbrush
Ceanothus cordulatus — Snow Bush, Mountain Whitethorn
Ceanothus crassifolius — Hoaryleaf Ceanothus
Ceanothus cuneatus — Buck Brush
Ceanothus integerrimus — White Lilac, Deer Brush
Ceanothus leucodermis — Chaparral Whitethorn
Ceanothus megacarpus — Bigpod Ceanothus
Ceanothus oliganthus — Hairy Ceanothus
Ceanothus sorediatus — Jim Brush
Ceanothus spinosus — Greenbark Ceanothus, Red-heart
Cercis occidentalis — Western Redbud
Cercocarpus betuloides — Mountain Mahogany
Clematis lasiantha — Pite-stem Clematis
Clematis ligusticifolia — Western Clematis
Clematis pauciflora — Southern California Clematis
Coreopsis gigantea — Giant Coreopsis
Corethrogyne filaginifolia — Cudweed-aster
Croton Californicum — Croton

Dendromecon rigida — Bush Poppy, Tree Poppy

Encelia californica — California Encelia
Eriodictyon crassifolium —
Eriodictyon tomentosum —
Eriodictyon trichocalyx — Yerba Santa
Eriogonum cinereum — Ashyleaf Buckwheat
Eriogonum fasciculatum — California Buckwheat
Eriogonum fasciculatum var. *foliolosum* —
Eriophyllum confertiflorum — Golden Yarrow

Fremontia californica — Flannel Bush, California Slippery-elm

Galium angustifolium — Chapparral Bedstraw
Garrya elliptica — Coast Silktassel
Garrya flavescens — Pale Silktassel
Garrya Veatchii —
Gutierrezia californica — Matchweed

Haplopappus cuneatus — Wedgeleaf Goldenbush
Haplopappus squarrosus — Sawtooth Goldenbush
Haplopappus venetus var. *vernonioides* — Coast Goldenbush
Heteromeles arbutifolia — California Holly, Toyon
Holodiscus discolor — Creambush

Isomeris arborea — Bladderpod

Juglans californica — Southern California Black Walnut

Leptodactylon californicum — Prickly-phlox
Lonicera hispidula — California Honeysuckle
Lonicera interrupta — Chaparral Honeysuckle
Lonicera Johnstonii —
Lotus argophyllus — Silver Lotus
Lotus scoparius — Deerweed

Lupinus Chamissonis — Dune Lupine
Lupinus excubitus var. Hallii —

Malacothamnus Davidsonii — Sand Globemallow
Malacothamnus fasciculatus — Bush Globemallow
Malacothamnus marrubioides — Hispid Globemallow
Mimulus longiflorus — Southern Monkeyflower
Mimulus puniceus — Red Monkeyflower
Myrica californica — Wax-myrtle

Nicotiana glauca — Tree Tobacco

Penstemon brevifolius — Bush Beard-tongue
Penstemon cordifolius — Straggly Penstemon
Penstemon heterophyllus — Chaparral Penstemon, Foothill Blue Penstemon
Penstemon spectabilis —
Phoradendron flavescens — Mistletoe
Pickeringia montana — Chaparral Pea
Prunus ilicifolia — Hollyleaf Cherry
Prunus virginiana var. *demissa* — Western Choke-cherry

Quercus agrifolia var. *frutescens* — Dwarf Coast Live Oak
Quercus chrysolepis var. *nana* — Dwarf Canyon Oak
Quercus dumosa — Scrub Oak
Quercus Wislizenii var. *frutescens* — Dwarf Interior Live Oak

Rhamnus californica — California Coffeeberry, Coast Coffeeberry
Rhamnus crocea — Redberry
Rhamnus crocea var. *ilicifolia* — Hollyleaf Coffeeberry
Rhus diversiloba — Poison oak
Rhus integrifolia — Lemonade Berry
Rhus laurina — Laural Sumac
Rhus ovata — Sugarbush
Rhus trilobata — Squaw Bush
Ribes aureum — Golden Currant
Ribes californicum var. *hesperium* —
Ribes cereum — Squaw Currant
Ribes indecorum — White Flowering Currant
Ribes malvaceum — Chaparral Flowering Currant
Ribes Roezlii — Sierra Gooseberry
Ribes speciosum — Fuchsia Flowering Gooseberry
Ricinus communis — Castorbean
Rosa californica — Wild Rose
Rubus leucodermis — Western Raspberry
Rubus vitifolius — Western Blackberry

Salix Hindsiana var. *leucodendroides* —
Salix lasiolepis — Arroyo Willow
Salvia apiana — White Sage
Salvia leucophylla — Purple Sage
Salvia mellifera — Black Sage
Sambucus caerulea — Blue Elderberry
Sambucus mexicana —
Senecio Douglasii — Bush Senecio

Solanum Douglasii –
Solanum umbelliferum – Blue Witch
Solanum Xantii – Purple Nightshade
Symphoricarpus mollis – Creeping Snowberry
Symphoricarpus albus – Common Snowberry

Trichostema lanatum – Woolly Bluecurls, Romero

Umbellularia californica – California Bay, Caifornia-laurel

Venegasia carpesioides – Canyon-sunflower

Yucca Whipplei – Our Lord's Candle, Spanish Bayonet

Zauschneria californica –
Zauschneria cana –
Zauschneria latifolia –

AN APPROACH TO THE STUDY OF POPULATION MIGRATION WITHIN A STABLE METROPOLITAN REGION[1]

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The migration of people between central cities and surrounding suburbs is presently an outstanding fact associated with numerous metropolitan regions in the United States. The importance of this development, and of consequent increases in social, economic, and political interdependence between cities and their suburbs, is reflected both by a proliferation of general works on the subject and by a tendency toward a regional approach in urban analysis.[2] However, available treatments of intra-regional migration fail to provide an adequate basis for the interpretation of many of its dynamic and specific characteristics.[3] For example, detailed findings concerning the distributional aspects of city-to-suburb population migration are particularly lacking. It appears that a fuller comprehension of this specific topic and of the entire process of intra-regional migration will not

[1] The following operational definitions are used in this study:

Metropolitan Region.—This term expresses the concept of metropolitan dominance. A metropolitan region usually consists of a prominent central city and the surrounding suburban areas which are economically and socially integrated with the central city.

A Stable Metropolitan Region.— A stable metropolitan region is here defined as an area of metropolitan dominance in which population growth is primarily a result of natural increase. Such regions are characterized by very little migration to or from areas beyond their boundaries.

Intra-regional Migration.—The term Intra-regional Migration is used simply as another expression of the idea of population migration within a specific metropolitan region.

[2] For general works, see, Chauncy D. Harris, "Suburbs," *American Journal of Sociology,* XLIX (July, 1943), pp. 829-40; Leo F. Schnore, "Metropolitan Growth and Decentralization," *American Journal of Sociology,* LXIII (September, 1957), pp. 171-182; Donald J. Bogue, "Urbanism and Metropolitanism," *American Journal of Sociology,* LX (March, 1955), pp. 471-486; Leo F. Schnore, "The Growth of Metropolitan Suburbs," in William Dorbriner, ed., *The Suburban Community* (New York: G. P. Putnam & Sons, 1958), pp. 26-44; William H. Whyte, Jr., "Urban Sprawl," in The Editors of Fortune, *The Exploding Metropolis* (New York: Doubleday and Co., 1957), pp. 115-139; and, Amos H. Hawley, *The Changing Shape of Metropolitan America* (Glencoe: The Free Press, 1956). For methodological works, see, Walter Isard, *Methods of Regional Analysis: An Introduction to Regional Science* (New York: John Wiley and Sons, 1960), pp. 51-79, especially see the excellent bibliography on migration estimation, pp. 70-79.

[3] Planning Advisory Service, *Population Forecasting,* Information Report No. 17 August, 1950. p. 16; Isard, *op. cit.,* p. 69; Leo F. Schnore, "Satellites and Suburbs," in William Dorbriner, ed., *The Suburban Community* (New York: G.P. Putnam and Sons, 1958), pp. 116-118; Leo F. Schnore, "The Growth of Metropolitan Suburbs," in William Dorbriner, ed., *The Suburban Community,* (New York: G.P. Putnam and Sons, 1958), pp. 40-41; F. Stuart Chapin, *Urban Land Use Planning* (New York: Harper & Brothers, 1957), pp. 155-159.

be achieved until practicable and comparable approaches are developed which will facilitate the identification and measurement of particular population shifts within individual urban regions. With this need in view an attempt is therefore made in this paper to present a comparable technique for the identification and measurement of *one type of intra-regional population migration,* namely, that which is characteristic of a stable metropolitan region, and to demonstrate this by a brief study of migration within the urban region of Worcester, Massachusetts.

Major Factors in the Study of Intra-regional Population Migration

A study of the geographic aspects of intra-regional migration must take into account at least two major factors. The first is the change in population numbers between the base and terminal years of a given study period, a change occurring both within the central city and within those suburban centers which are economically and socially integrated with it. The second is the path and volume of population migration between the central city and particular suburbs.

In most cases population change has been adequately treated by the analysis and projection of federal and local census statistics; for example, population forecasting, which is perhaps the most complex task associated with the study of population change, has been accomplished through the use of the cohort-survival method, logistic curve, arithmetic projection, and geometric projection.[4] However, the study of intra-regional migration has proven more difficult. The problem of coming to grips with this phenomenon is reflected by the fact that in the past a general idea of population shifts within urban regions was often derived from the study of such indirect indicators as school enrollment. On occasion, the cohort-survival method has been used in conjunction with school enrollment in order to obtain added accuracy—a procedure which is, however, long and complex and becomes increasingly so as the number of persons involved in migration within a metropolitan region increases.[5] A sample of the complications associated with approaches based on school enrollment data is provided by any area with a population characterized by an irregular age structure. Under those circumstances the data do not reveal the actual numerical changes and areal shifts—as for instance in Long Beach, California, where the changes in the number and distribution of the large retired population would have no relationship to school enrollment. It is necessary to emphasize, therefore, that although present techniques enable fairly reliable measurement and forecasting of changes in population numbers, they do not give adequate coverage of intra-regional migration. Consequently, much of the local migration data currently available is not reliable, and, moreover, it appears that accurate information concerning such migration can be approached only by the use of complex and laborious processes which are usually beyond the resources of most urban researchers or individual planning operations.[6]

[4] Chapin, *op. cit.,* pp. 166-183, and Isard, *op. cit.,* pp. 5-50; especially see the excellent bibliography on population projection, pp. 33-50.

[5] Chapin, *op. cit.,* pp. 172-175.

[6] Chapin *op. cit.,* pp. 151-183; Isard, *op. cit.,* pp. 51-59, and Planning Advisory Service, *op. cit.*

The Measurement of Intra-regional Population Migration

The technique here proposed for the identification, measurement, and prediction of intra-regional population migration has several distinct strengths. It is (1) reasonably objective and therefore subject to replication; (2) a simplified yet effective way to analyze such migration; (3) useful in the establishment of past, present, and future population distribution and migration patterns; and (4) it appears to be of particular value in the study of the hitherto elusive process of city-to-suburb migration. Its application to preceding time-periods has the value of not only making apparent the migration patterns for the past, but of providing insight into the development of present and future population distributions.

However, it should be clearly understood that the information and methodological findings presented below are limited in at least two ways. On the one hand, the method has been effectively applied only to a reasonably stable situation where inter-regional migration was small, and on the other hand, only one such region was studied; its degree of accuracy is unknown with respect to unstable metropolitan areas characterized by large inter-regional migration. The method, therefore, is currently recommended for use only in stable metropolitan situations. These restrictions do not, of course, nullify the value of the method; they serve rather to identify the type of situation in which it has been so far demonstrated as useful, and to enhance its value as a specific tool to help in the interpretation of a very complex process.

Implementation of this technique depends neither upon the complex mathematical formulas or indices necessary in other methods of measuring this same phenomenon nor upon the availablity of unusual information. Rather, it provides a reasonably accurate picture of population migration within an urban region on the basis of a simple bookkeeping technique, and requires no more information than that available from the *United States Census of Population* and various vital statistics reports.[7] In brief, the method here presented is a simplified one based upon the tabulation of certain readily available statistics, and the result is a statement of the balance of net in- or out-migration for any municipality within the region considered, as well as a strong indication of the previous residence of most of the migrants. In addition to the statistical information designated above it is only necessary to accept the following assumptions:

1. That the population of an area at the close of a period is equal to its population at the start of the period plus natural increase during the period, plus net migration during the period.
2. That the population of a given urban center will change at a particular rate of natural increase: $\frac{\text{Births}-\text{Deaths}}{1000}$
3. That census of population figures for urban centers may be projected with reasonable accuracy for a ten-year study period.[8]

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[7] Data for most urban centers may be procured from *Vital Statistics of the United States* published annually by the United States Department of Health, Education, and Welfare. However, when necessary data is not found at this source it may be obtained from individual state health departments or vital statistics offices or from local health agencies.

[8] Chapin, *op. cit.*, pp. 166-183, and Isard, *op. cit.*, pp. 5-50.

4. That a population figure for the base year of a ten-year study period plus natural increase for the same study period will yield a total which may be considered to be the population of an urban center not characterized by in- or out-migration.
5. That the difference between the ten-year population projection and the sum of a base population, plus natural increase for the same study period, may be considered to be *the net-migration in or out of a particular urban center.*

The following step-by-step explanation of the method will, for reasons of clarity, be largely graphic; furthermore, only three urban centers (Worcester, Holden, and Northbridge, Massachusetts) will be used, and the

Table I. Part One: Work Sheet for Measurement of Intra-Regional Population Migration

Urban Centers	Population 1950	Population (Estimate) 1960	Mean Population for Study Period	Rate of Natural Increase†	Natural Increase for Study Period	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Worcester ..... (The Central City)	203,486	193,500	198,500	.0094	18,650	
Holden	5,975	10,350	8,200	.0124	1,000	
Northbridge	10,476	10,650	10,600	.0124	1,300	Forward

†Source: Annual Report of the Vital Statistics Office of Massachusetts, 1955.

time span 1950 to 1960 will serve as a sample study period. Table 1, which is the first section of a three-section work-sheet used in this explanation, is interpreted as follows:[9]

Column I (Population 1950) is based on data taken directly from the *United States Census of Population* for the base year of the study period.

Column II (Population Estimate for 1960) is a population projection for the terminal year of the study period.[10]

Column III (Mean Population for the Study Period) is derived as follows: $\frac{\textit{Column I (Pop. 1950) Minus Column II (Pop. 1960)}}{2}$

Column IV (Rate of Natural Increase) is the mean rate of natural increase for the study period. Because of the different growth patterns

[9] Tables 1, 2, and 3 are extractions from Table 4, which is a table representing the complete numerical analysis of population migration within the metropolitan region of Worcester, Massachusetts.

[10] Geometric projection (see Chapin, *op. cit.*, pp. 181-183) was the principal technique used to derive the 1960 population estimates presented in Table 4 for each municipality within the metropolitan region. Each curve, however, was further adjusted on the basis of four factors, each of which was analyzed for the entire study period. These factors were: (1) the number of building permits granted; (2) school enrollment; (3) employment opportunities both within the central city and within each urban center; and (4) the average family size peculiar to each community in relation to each of the preceding three factors. In addition, each 1960 estimate was cross-checked against estimates for 1960 made on the basis of the cohort-survival method. In practically all cases the results of the cross-checks were favorable.

exhibited by the central city and the surrounding urban centers it proved necessary to compute two separate rates of natural increase—one for the central city and one for the surrounding centers.[11] So far as the central city was concerned, its own mean-rate of natural increase for the study period was used; however, the mean-rate of natural increase for the surrounding centers was derived from an average of the mean-rates for all such urban centers.

Column V (Natural increase for the Study Period) is derived by multiplying the mean population for the study period (Column III) by the rate of natural increase (Column IV), and these results by the number of years in the study period (in this example, ten).

The first section of the work-sheet is now complete; the next step is to apply the principal formula which was developed to identify the net in- or out-migration for particular urban centers. The formula and its factors are:

$$M = (Pb - Pa) - (N \cdot Pm)n$$

where M = Net migration for a given study period. In-migration is represented by a net gain in population by the municipality, and out-migration by a net loss in population by the community.

Pb = Population estimate for the last year of the study period (Column II)

Pa = Population for the first, or base year, of the study period (Column I)

N = Natural Increase per 1,000 population or

$$\frac{Bt - Dt}{1{,}000}$$

where Bt = Total births for a given period

Dt = Total deaths for a given period

Pm = Mean population for the study period (Column III)

n = Number of years in the study period (in this case, ten)

Implementation of this formula results in the addition of three columns to the work-sheet. These additions are shown in Table 2 and are explained as follows:

Column VI (1960 Population based on Natural Increase alone) is the sum of the 1950 population (Column I) plus natural increase for the study period (Column V).

Column VII (Net-in-migration 1950-1960) is derived by subtracting the projected 1960 population based on natural increase alone (Column VI) from the population estimate for 1960 (Column II).

Column VIII (Net-out migration 1950-1960) is derived by subtracting the population estimate for 1960 (Column II) from the projected 1960 population based on natural increase alone (Column VI).

At this point the statistical information needed to establish the spatial distribution of migrants within a stable urban region is complete. As indicated above, in-migration and out-migration for each urban center are pre-

[11] Allocated birth rates rather than registered birth rates were used in this case because most of the children were born in hospitals located within the urban centers.

sented in Columns VII and VIII, respectively. If mapped, these data would illustrate a pattern of numerical distribution which could be utilized in the development of current migration patterns, or, if similar data were developed for past periods, they could provide either a means of studying aspects of past migration or a basis for the projection of such patterns.

The next problem is to approximate as closely as possible the pattern of population movement within a specific urban region. For this purpose, a second formula was developed. This formula distinguishes the in-mi-

Table 2. Part Two: Work Sheet for Measuring of Intra-Regional Population Migration

Urban Centers	Population for 1960 based on an Estimate of Natural Increase Alone	Net In-migration 1950-1960	Net Out-migration 1950-1960	
(V)	(VI)	(VII)	(VIII)	(IX)
Worcester ..... (The Central City)	222,000	——	28,500	
Holden	7,000	3,350	———	
Northbridge ...	11,800	——	1,150	
			Total 30,150 (See Table 4)	

grants that originated in the central city from those originating elsewhere, thereby providing an indication of the specific urban centers where in-migrants were previously resident, as well as a reasonable basis for establishing flow lines between the central city and particular urban centers. The second formula and its factors are as follows:

$$\frac{Ii \cdot Oc}{Ot} = \text{the number of migrants found in a specific urban center which are assumed to have originated in the central city (Column IX)}$$

where Ii = in-migration to a specific urban center (Column VII)

Oc = out-migration from the central city (the figure for Worcester in Column VIII)

Ot = total out-migration within the study area (the total of Column VIII)

The implementation of this second formula results in two additional columns on the work sheet. These are shown in Table 3 and are explained as follows:

Column IX (The number of in-migrants found in a specific urban center assumed to have originated in the central city) is derived by multiplying the total in-migration to a specific urban center (Column VII) by the net-out-migration from the central city (Column VIII), and then dividing the answer by the total number of out-migrants within the study area (the total of Column VIII).

Column X (Number of Migrants not from the Central City) is derived by subtracting the number of migrants who moved from the central city to a specific urban center (Column IX) from its net number of in-migrants for the period 1950-1960 (Column VII).

Any surplus of in-migrants that are not assumed to be from the central city (Column X) are presumed to have originated elsewhere. This

last conclusion, although seemingly gross, does not appear to pose a serious difficulty when studying a stable region; for example, in the case of Worcester (see Table 4) there were approximately 30,000 people involved in intra-regional migration during the decade 1950-1960, but of this number, it appears that at most only about 2,000 could have originated outside the metropolitan region. Clearly, this condition provides a strong basis for

Table 3. Part Three: Work Sheet for Measurement of Intra-Regional Population Migration

Urban Centers		Number of Migrants from Central City	Number of Migrants NOT from Central City
	(VIII)	(IX)	(X)
Worcester ..... (The Central City)	———	———	——
Holden	———	3,150	200
Northbridge	———	———	——

the recommendations that this technique be used in reasonably stable situations, and not in those where the impact of inter-regional migration is unknown.

Since the preceding example demonstrates the basic workings of a method developed for the study of intra-regional population migration within a stable metropolitan region, it is fitting that there be some further mention of the situations in which this technique seems applicable. It would seem relevant:

1. For the measurement of past, present, and future migration patterns within stable metropolitan regions.
2. For the establishment of migration trends for the urban region as a whole, or for any of its component parts.
3. As an alternative or supplementary approach to the forecasting of spatial aspects of future population distribution within metropolitan regions.
4. As an alternative or supplementary method for the indentification and forecasting of present and future traffic flow between the central city and its suburbs.

Population Migration Within the Worcester Metropolitan Region[12]

The method may now be exemplified by a brief view of such migration within the metropolitan region of Worcester, Massachusetts, during the decade 1950-1960. The study area is located at the western corner of a triangle based on Boston, Worcester, and Providence, Rhode Island. The region lies within Massachusetts and includes Worcester (which is the central city) and the surrounding municipalities of Holden, West Boylston, Shrewsbury, Northboro, Westboro, Grafton, Millbury, Auburn, Leicester,

[12] The Worcester metropolitan region is used to demonstrate this technique because is was for the purpose of analyzing population migration within that region that the technique was developed. Migration was but one section of an over-all population study of the Worcester region conducted by the authors during the late 1950's while they were employed by the Worcester City Planning Department.

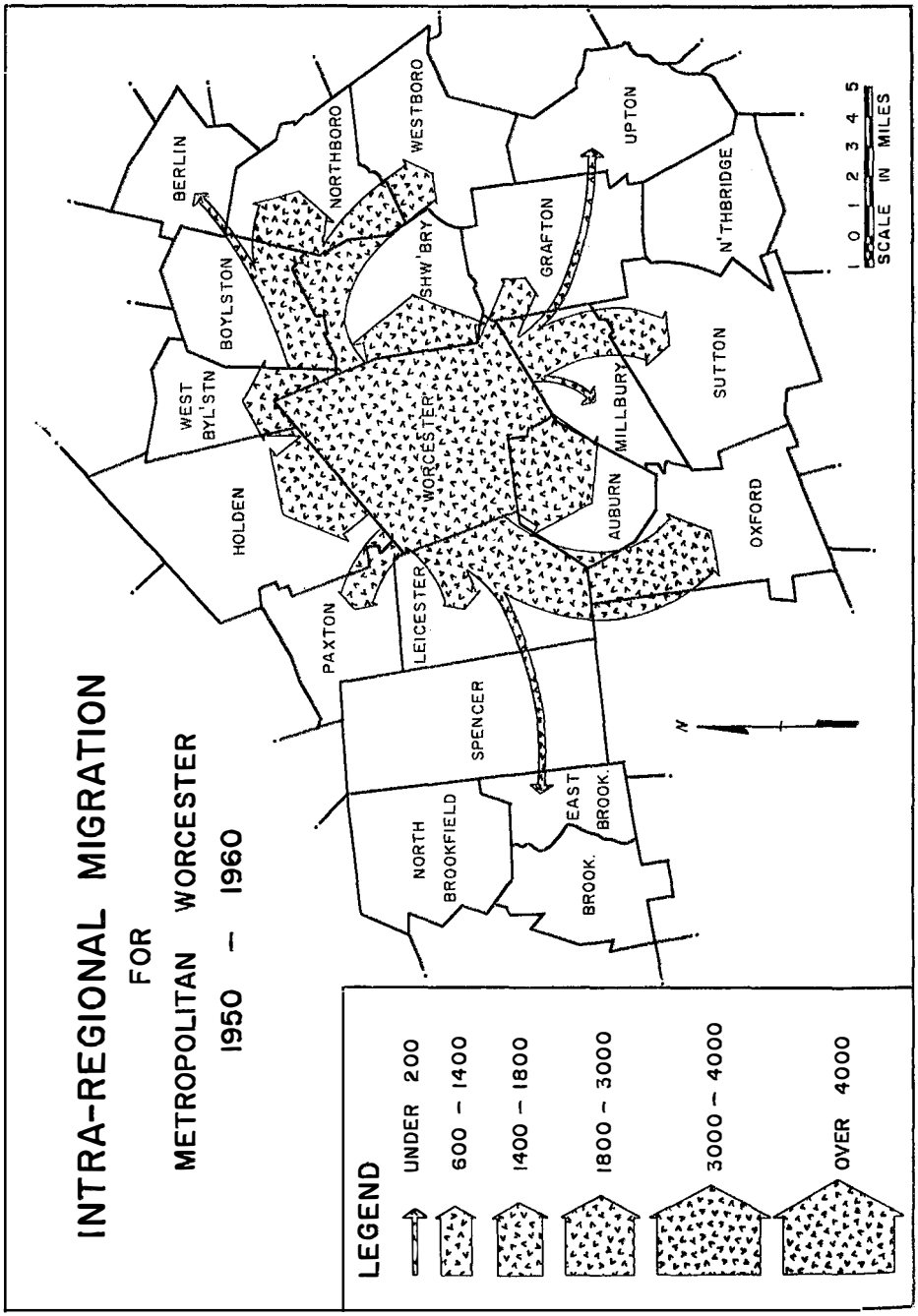
INTRA-REGIONAL MIGRATION
FOR
METROPOLITAN WORCESTER
1950 - 1960
LEGEND
UNDER 200
600 - 1400
1400 - 1800
1800 - 3000
3000 - 4000
OVER 4000
BERLIN
BOYLSTON
NORTHBORO
WESTBORO
WEST BYL'STN
HOLDEN
SHW'BRY
WORCESTER
GRAFTON
UPTON
N'THBRIDGE
SUTTON
MILLBURY
AUBURN
OXFORD
PAXTON
LEICESTER
SPENCER
NORTH BROOKFIELD
EAST BROOK.
BROOK.
N
1 0 1 2 3 4 5
SCALE IN MILES

Figure 1

Spencer, East Brookfield, North Brookfield, Paxton, Berlin, Northbridge, Upton, Sutton, Oxford, and Brookfield. Worcester is principally a manufacturing city which also serves as a retail and wholesale center for its region.[13] The surrounding centers have little industry of their own (with the exception of Millbury, which is an outstanding example of an old mill town) and are in large part the by-product of the expansion of Worcester's urban economic base. The outstanding characteristic therefore, of the suburban centers is their dormitory function.[14]

The Worcester region has a stable population in that growth is principally by natural increase; there is little in- or out-migration to or from areas beyond the metropolitan region. However, dynamic shifts of population are evident within the region, and principal among them is out-migration from the central city. As indicated above, such out-migration is by no means matched by employment opportunities in the expanding suburban areas; thus, the majority of those who migrate to the surrounding suburbs continue to work in the central city.

The conclusions concerning intra-regional migration within the Worcester Metropolitan Region produced by the application of the method described in this paper are found in Table 4 and Figure 1, respectively. Specific numerical conclusions are presented in columns VII through X in Table 4.

These figures are net-balances of people. There was, of course, some migration between all centers within the region; however, it was felt that the over-all distribution of migrants could be clearly indicated in this manner. The information presented in Table 4 may also be usefully illustrated cartographically, thus showing the approximate pattern of movement within the urban region (see Figure 1). In this case the pattern is shown for only one study period; however, it is clear that a sequence of such flow maps could be constructed for selected time intervals in the past or future, and that these maps could be used to illustrate either trends or probable migration patterns.

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[13] According to the economic classification of cities presented in the Municipal Yearbook for 1959, Worcester is a manufacturing city. This designation is based upon the following criteria: that the employment in manufacturing is 50 per cent or more of aggregate employment in manufacturing, trade, and service establishments (excluding hotels and amusements) and employment in retail trade is less than 30 per cent. Table VI, "Governmental and Economic Data for all Central Cities Over 10,000: 1959," *Municipal Yearbook,* 1959. That Worcester is the major retailing and wholesaling center for its metropolitan region is clearly demonstrated by statistics from the 1958 Census of Business. Of the 2,989 retail establishments in the Worcester SMSA 1,968 were located in Worcester; of the 16,014 employed in retail trade in the SMSA, 12,653 were employed in Worcester. U.S., Bureau of the Census, *Census of Business; 1958.* Vol. II, Retail Trade-Area Statistics (Table 103—Retail Trade: 1958, SMSAs). Of the 499 wholesale establishments in the Worcester SMSA, 436 were located in Worcester; and of the 5,132 employed in wholesale trade in the SMSA, 4,635 were employed in Worcester. U.S. Bureau of the Census, *Census of Business* 1958, Vol. IV, Wholesale Trade-Area Statistics (Table 103—Wholesale Trade: 1958, SMSAs.)

[14] Richard E. Preston and John E. Rickert, "City-Region Interdependence as Illustrated by the Worcester Metropolitan Region." (Unpublished Report for the Worcester Planning Department, 1960).

Table 4: Complete Work Sheet for the Worcester Metropolitan Region†

Column Headings: (I) Population, 1950; (II) Population, Estimate, 1960; (III) Mean Population for Study Period; (IV) Rate of Natural Increase; (V) Natural Increase for Study Period; (VI) Population for 1960 Based on an Estimate of Natural Increase Alone; (VII) Net In-migration, 1950-1960; (VIII) Net Out-migration, 1950-1960; (IX) Number of Migrants From Central City; and, (X) Number of Migrants NOT From Central City.

Urban Centers	I	II	III	IV	V	VI	VII	VIII	IX	X
Holden	5975	10350	8200	.0124	1000	7000	3350	——	3150	200
W. Boylston ..	2570	5500	4000	.0124	500	3050	2450	——	2300	150
Shrewsbury ...	10594	16550	13600	.0124	1700	12300	4350	——	4000	250
Northboro	3122	6650	4900	.0124	600	3750	2900	——	2750	150
Westboro	7378	10000	8700	.0124	1100	8500	1500	——	1400	100
Grafton	8281	10400	9400	.0124	1150	9450	950	——	900	*100
Millbury	8347	9600	9000	.0124	1100	9450	150	——	150	* 50
Auburn	8840	14050	11400	.0124	1400	10250	3800	——	3600	200
Leicester	6029	8150	7100	.0124	900	6900	1250	——	1200	*100
Spencer	7027	7750	7400	.0124	900	7950	——	200	——	——
E. Brookfield ..	1243	1500	1400	.0124	150	1400	100	——	100	* 50
N. Brookfield .	3444	3600	3500	.0124	450	3900	——	300	——	——
Paxton	1066	2400	1700	.0124	200	1250	1150	——	1100	*100
Berlin	1349	1750	1500	.0124	200	1550	200	——	200	* 50
Northbridge ..	10476	10650	10600	.0124	1300	11800	——	1150	——	——
Upton	2656	3100	2900	.0124	350	3000	100	——	100	* 50
Sutton	3102	5450	4300	.0124	550	3650	1800	——	1700	100
Oxford	5851	9250	7500	.0124	950	6800	2450	——	2300	150
Brookfield	1567	1750	1650	.0124	200	1750	——	——	——	——
Worcester	203486	193500	198500	.0093	18650	222000	——	28500	——	——
						Totals:	26400	30150	24950	1950

* Less than

†Since they are estimates, Columns II, III, V, VI, VII, VIII, XI, and X have been rounded.

Conclusion

The measurement and prediction of intra-regional population migration represents a very important area in contemporary urban research. Central city losses and increased suburban growth have put both professional and political pressure on researchers not only to interpret the process itself but to forecast its implications for metropolitan areas of the future. Thus far, however, few practicable approaches to the study of any aspect of this phenomenon have appeared. The result has been that a substantial number of the questions posed concerning the process of intra-regional population migration have been answered in only a most general and unsatisfactory manner, and the impact of increased suburbanization on the urban structure of the future remains virtually unknown. Therefore, since the approach presented in this paper proved effective in the case study of migration within the urban region of Worcester, Massachusetts, it is offered as a partial solution to the over-all question: "How does one study intra-regional population migration?" Specifically, this approach appears to provide new strength in three ways; firstly, it has comparability, and therefore provides a "model" for similar studies in other urban regions; secondly, it enables the identification and measurement of numerous spatial and temporal aspects of one type of intra-regional population migration; and thirdly, it provides a degree of accuracy unattained thus far by comparable expenditures of time and money.

THE SETTLEMENT PATTERN OF MODERN ROME

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Following the disintegration of the Roman Empire the population of the city of Rome declined steadily from over 1,000,000 to a low of 17,000 during the Middle Ages. Subsequent to this period the growing influence of the papacy provided the basis for modest population growth, but it was Rome's selection as the capital of the newly-united Italy in 1871 that made possible its re-emergence as a great city. Since that date its population has grown rapidly, increasing from 200,000 to over 2,000,000 (Table 1). However the settlement pattern coincident with this growth has been unusual.

TABLE 1: Population Growth of Rome

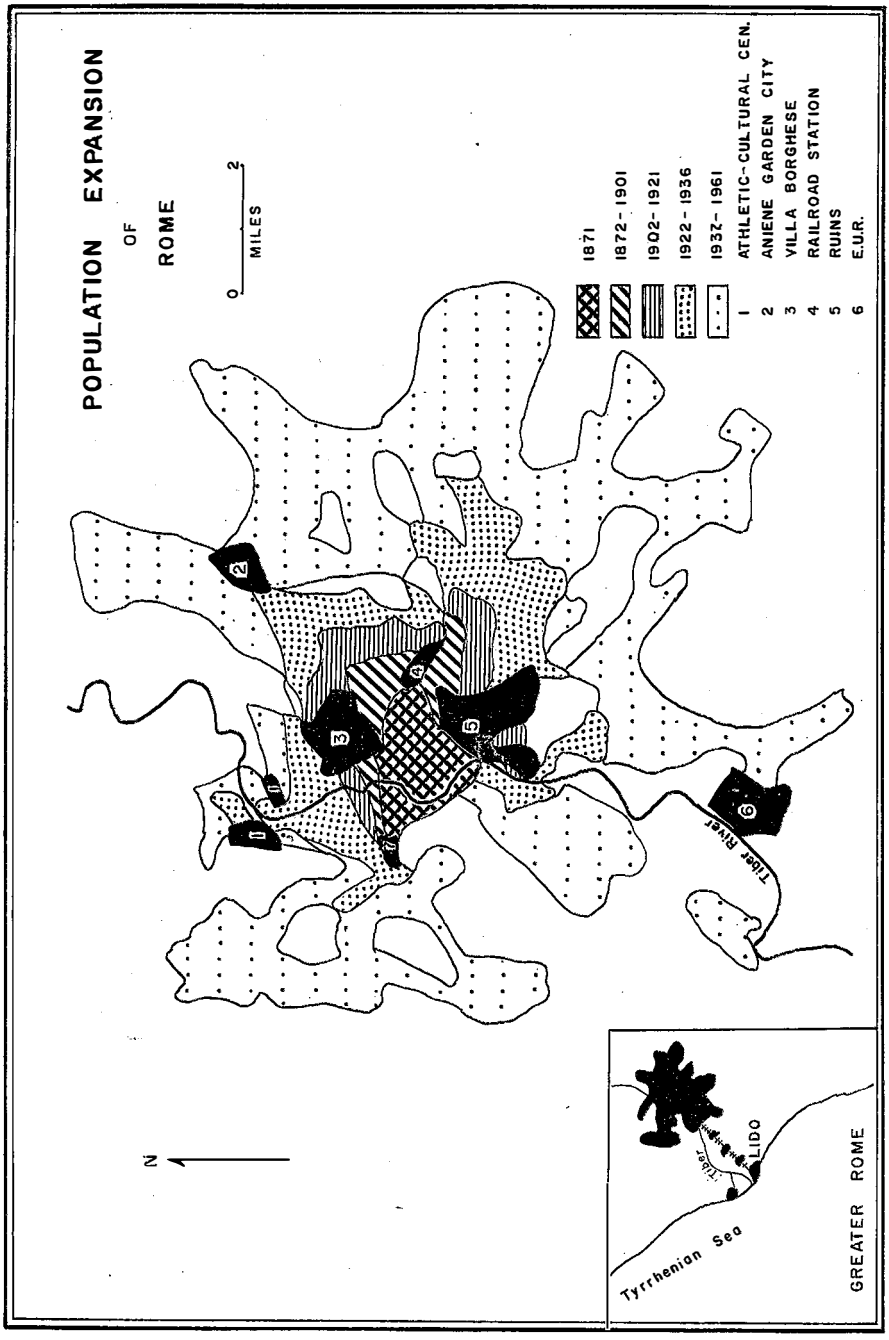
Year	*Population*
1871	213,633
1881	275,637
1891	386,626
1901	424,943
1911	546,002
1921	664,373
1931	942,206
1941	1,403,307
1951	1,653,163
1961	2,170,386

Source: Commune of Rome, *Annuario Statistico della Citta di Roma 1952-54,* and Commune of Rome, *Bolettino Statistico* 1962.

The present-day distribution of Rome's population strongly suggests that expansion from the urban core has occurred in a normal radial pattern (Figure 1). Actually, however, each of the cardinal directions of expansion was added in a separate period. In 1871 most of the population was clustererd on the left bank of the Tiber. For the next 30 years virtually all settlement occurred in a generally eastward direction. Only by the turn of the century, when Romans began to move northward, did large-scale settlement begin to unfold in other directions. It was not until the end of World War II that people began to move in large numbers to the west and south of the urban core. The explanation for this unusual growth pattern lies in a complex of physical and cultural factors.

EASTWARD SETTLEMENT

The early heavy eastward settlement can best be explained by the difficulties of growth in other directions. Since expansion was blocked by the rugged Sabatine Hills to the west, the vast Villa Borghese estate to the north, and by broad expanses of marshes and ruins to the south, the gently-rolling lands east of the urban core were especially inviting to new settlement. Still another important stimulus for an early eastward growth was the construction of Rome's major railroad station a mile east of the urban core. Completed in 1871, the station served as a principal focal point for several newly-constructed thoroughfares, the most important being the via Nazionale. As government expenditures increased with Rome's new


POPULATION EXPANSION
OF
ROME
0
2
MILES
1871
1872-1901
1902-1921
1922-1936
1937-1961
1 ATHLETIC-CULTURAL CEN.
2 ANIENE GARDEN CITY
3 VILLA BORGHESE
4 RAILROAD STATION
5 RUINS
6 E.U.R.
Tiber River
N
Tyrrhenian Sea
Tiber
LIDO
GREATER ROME

role as the national capital, the rate of in-migration to the city rapidly increased, and these new boulevards became the guidelines for the heavy eastward settlement. This dynamic early population burst established an eastward expansion momentum which has persisted to the present day, despite the fact that obstacles to expansion in other directions have been gradually overcome.

Northward Settlement

The first of these barriers to give way to the overwhelming pressures of Rome's growing population was the Villa Borghese. This large estate had effectively diverted expansion for 30 years, but by the turn of the twentieth century it began to succumb to the pressures of the city's growth. The initial stage of northern settlement had begun to take form by 1900 but it did not reach maturity for another 30 years. Not until the advent of the Mussolini era was the villa completely surrounded by residences and left behind in the wake of urban expansion.

The credit for radically altering the traditional eastward settlement pattern of Rome must be given to Mussolini. While it is often an oversimplification to associate major changes with one person, in the case of Mussolini his profound influence in Rome's settlement pattern is unmistakable.

Although a northward population drift would certainly have occurred with or without Mussolini, his development of areas north of the urban core accelerated settlement and gave it a more definite course. When Mussolini assumed control of the Italian government in 1921 population growth had advanced only slightly northward, both up the Tiber valley to the west of the Villa Borghese and along the eastern perimeter of the estate itself. The dictator's early announcement of plans for the construction of a large new athletic and cultural center two miles north of the urban center and a large garden city, Monte Sacro, three miles northeast of it provided the necessary impetus for a heavier northward expansion. The prosperity of of the Mussolini era also saw the rise of a new wealthy class, which began to move into the Parioli Hills just north of the Villa Borghese. By 1930 a full-fledged northward expansion had been established and the Rome settlement pattern had now assumed a second cardinal direction. Settlement northward, however, was never to equal the vigor and constancy of the eastward expansion. Strangely enough, it was the subsequent growth southward to the sea which was to gain a momentum equalling, and perhaps surpassing, that to the east. This greatly-retarded development most strongly reflected the will of one man. In carrying out his ambitious program in this direction Mussolini was faced with staggering emotional as well as physical barriers.

Southward Settlement

The two physical factors primarily responsible for the retarded growth were the previously-mentioned ruins districts and marshes south of the urban core. These remnants of a previous civilization provided more of a psychological than a physical impediment to Rome's growth. People had come to accept the ruins as the southern limit of settlement; to go beyond the ruins was to move beyond the pale. The tales of misery and malaria associated with the marshlands were well known to the Roman, and the

feelings of disgust and fear which he had developed were perhaps the most effective barrier of all to southward settlement. Even as late as World War I only one important residential district had arisen south of the urban core in the Tiber valley. Mussolini's great vision of Rome was one of a vast metropolis stretching all the way to the mouth of the Tiber. Fully aware of the monumental projects that lay before him, he undertook the program with pronounced vigor. The drainage of the marshlands was basic to the success of the entire program, and by 1928 this enormous project was completed, freeing the delta area and much of the Tiber valley from over a thousand years of decay. Shortly afterwards a rail line, and paralleling express highway were completed from central Rome to Lido di Ostia,[1] near the mouth of the Tiber. Having laid the groundwork, Mussolini could now look forward to his most ambitious plan: the construction of an entirely new urban core south of the existing city.

Badly disturbed by the growing difficulty of old Rome to cope with the onslaught of the automobile age, Mussolini conceived the idea of removing all central activity from the existing urban core to a new one four miles south. The new district was to serve first as an exposition area for the 1942 World's Fair, after which major governmental agencies were to occupy the monumental structures. Commerce was to follow later. Upper-income residental districts were then to surround the newly-created zones. The new area, which came to be called simply the E.U.R. (Universal Exposition of Rome), was to be more effectively connected with Rome by an additional express highway and the city's first subway.

Construction was initiated in the 1930's, but the Second World War began before the buildings and the subway were completed. The aftermath of the war brought many changes regarding the magnitude and soundness of the project. Rather than abandon its enormous investment, however, the city decided to complete the E.U.R. with certain modifications. The basic Mussolini concept, freeing central Rome of its congestion, was maintained, but the proposed size of the E.U.R. was curtailed. Several governmental agencies are already housed in the magnificent buildings, and numerous upper-income residentals units have been constructed since 1945. At present approximately 10,000[2] people live in the area. The subway, plagued with continual interruptions because of archeological discoveries, was finally completed in 1955 after almost 20 years.

The impact of the rapidly rising E.U.R. district has been strongly felt. The disdain once held for the region south of the ruins has virtually disappeared, and a nearly complete reversal of opinion has followed. Firms and individuals which would have previously shunned the area are now drifting southward towards the E.U.R., partially fulfilling Mussolini's dreams.

Closely correlated with the growth of the Universal Exposition grounds is the emergence of Lido di Roma in the Tiber delta. First connected to Rome in the 1920's bv the new railroad, the town became a popular summer resort. Extremely heavy population pressures in the post-

[1] Now called Lido di Roma.

[2] Letter from Mario Figa-Talamanca, Director, Office of Statistics of the Commune of Rome, April 1963.

World War II years changed the destiny of the Lido. As a post-war emergency measure, Lido di Roma, politically a part of Rome, was used to house some of the central city's population. The Lido's population continued to increase, and at present 25,000 people live there. Under the guidance of a master plan the eventual population will reach 135,000.[3] Several smaller settlements have also begun to appear along the Rome-Lido railroad between the E.U.R. and the Lido di Roma. Settlement in the

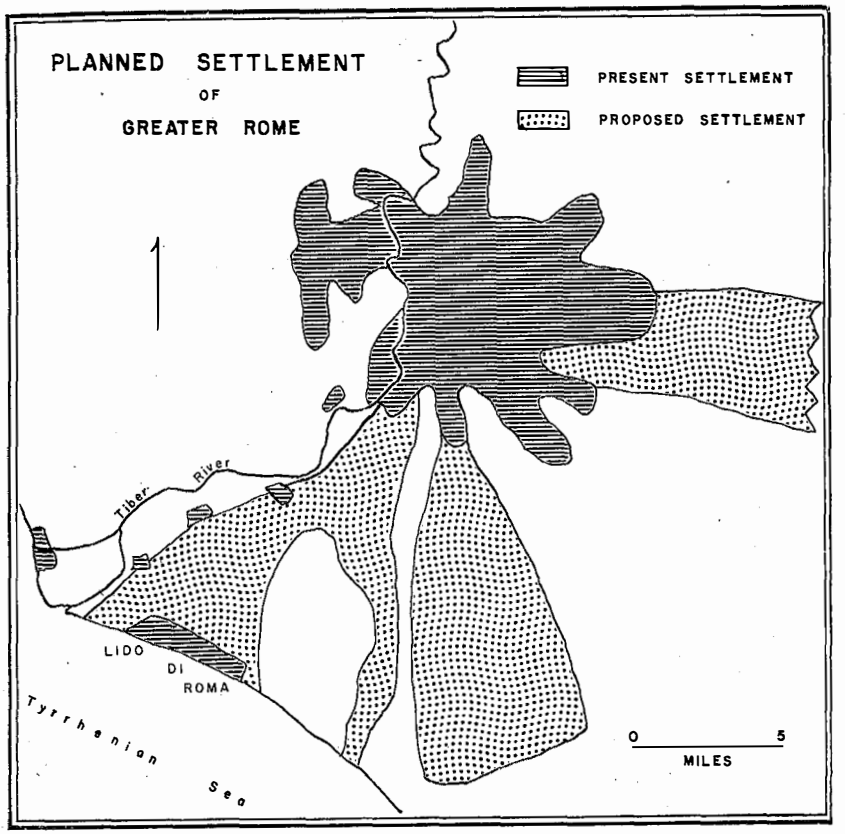


Figure 2

southern portion of metropolitan Rome has, thus, manifested itself in a series of unconnected nuclei along the railroad and highway. In time these nuclei should coalesce with the growing central city.

Westward Settlement

As with expansion southward, the westward growth of Rome has been largely a post-war phenomenon. The rugged terrain west of the Tiber provides the explanation for this retarded development. Beginning almost at the river's banks, the strongly dissected Sabatine Hills create a formi-

[3] Robson, W.A., ed., *Great Cities of the World* (London: George Allen & Unwin, 1954), p. 541.

dable barrier to urban expansion. Following World War II the previously prohibitive construction costs were largely offset by post-war conditions in Rome. The extremely critical housing shortage set into motion an almost feverish building program. With places as distant as Lido di Roma participating in the program, the proximity of the hilly western area took on new value and significance. Building contractors renewed their interest in the region as higher construction costs associated with this terrain were being offset by the rising land values resulting from the proximity to central Rome. With the weakening of the western hill barrier, Rome's settlement pattern had acquired its fourth dimension. Like expansion to the north, westward growth will probably always lag somewhat, but it will continue as long as the equilibrium can be. maintained between the proximity to the urban core and the higher construction costs on this rugged terrain.

The Master Plan Of Rome

Over the decades the role of planning has assumed continually greater proportions in Rome's settlement pattern. This role promises to increase markedly in the coming years because of the nature of the city's new master plan.[4] While previous master plans have been primarily traffic correctional schemes, the new plan encompasses many new ramifications. The major objectives of the present plan are: to broaden Rome's economic base by promoting several new industrial zones, to make central Rome largely an historical zone by diverting through traffic and removing most economic activity, and to create three vast new residential zones (Figure 2).[5]

These three zones will unfold to the east and south into terrain that offers little resistance to urban growth. Each of the zones will cover approximately 60 square miles and will house primarily low and lower middle income families. In all probability, the principal future settlement of Rome will occur in these planned districts. The northern and western flanks of the city, the traditional upper middle and upper income districts of Rome, have been left to grow "naturally" in the master plan. The relatively higher building costs in these areas, as well as the small number of people in Rome's middle and upper classes, would seem to indicate a continued slow rate of settlement in these directions.

Summary

Modern Rome's settlement pattern has been strongly influenced by both physical and cultural factors. The prejudices so long associated with certain areas of the city have been gradually subdued and are no longer a serious factor in discouraging settlement in any direction; the relief of the Roman Campagna has become the principal influence in Rome's settlement pattern. The relatively level lands east and south of the city continue to provide the least costly avenues of expansion to the growing metropolis, and primarily for this reason the new master plan has chosen these directions for future settlement. Because of these factors it would seem that the pattern of Rome's future settlement is quite clear. The city should continue to expand in all directions, with the principal growth occuring towards the east and south.

[4] The present master plan of Rome was made public in 1962.

[5] *Il Popolo* (Rome), November 18, 1962, p. 8.

THE VENTURA CHUMASH: AN EXAMPLE OF GEOGRAPHIC ADAPTATION

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Although Indian population was sparse in most of southern California at the time of Spanish settlement, a dense population did exist along the Santa Barbara Channel from Malibu to Point Conception. Kroeber[1] estimates that 8,000 to 10,000 Chumash Indians lived in villages closely spaced along the shore.

Like the other Indians of California, the Chumash depended directly on the natural environment and lived by hunting, fishing, and gathering. However, although they hunted inland to the divide between the coastal ranges and the Great Valley, their exceptional population density was supported primarily by the abundant Channel marine life. The Chumash were more nearly maritime than any other California Indians, and their distinctive attribute was a large seagoing canoe by which they could make long voyages and gather marine resources. They were predominantly a coastal people whose villages were usually established within a mile of the beach and preferably at the mouth of a stream.

Five villages are known to have been located near the mouth of the Ventura River at what is now Ventura. This site illustrates the geographic factors which were important to the Chumash economy and shows how careful adaptation to geographic conditions made it possible to support so many people by hunting, fishing, and gathering.

THE VENTURA SITE

The Ventura site on which the five villages were built is a narrow coastal plain about half a mile wide, formed of a series of uplifted marine terraces and backed by the steep, barren slopes of the Transverse Ranges. At the west end of the plain is the deltaic mouth of the Ventura River, which emerges from the mountains through a narrow valley, and has cut a shifting channel across the plain. The river itself, fed by the high and fairly well-watered Santa Ynez Mountains, is described in early accounts as carrying a large volume of water all year and supporting a dense growth of willows and other vegetation along its lower course and around an estero or lagoon on the delta.

To the Chumash the site near the mouth of the Ventura River was almost ideal for villages. It offered easy access to varied resources and had a mild climate which facilitated all-year gathering. The sea and beach furnished marine life and shellfish which were the most important food sources, and from the river fresh water and food were obtained. The river valley provided small game, construction materials, and a route to the interior grasslands and forests for larger game, timber, and trade. The marine terraces were suitable village sites.

The flat land west of the river mouth was used as a resort by the Indians from Santa Cruz Island, who regularly beached their boats in a

[1] A. L. Kroeber, *Handbook of the Indians of California,* Smithsonian Institute, Bureau of American Ethnology, Bulletin 78 (Washington: Government Printing Office, 1925) p. 550.

cove west of the mouth of the river and traded with the Ventura Chumash[2] (see Figure 1). East of the river mouth was a major cluster of villages or rancherias. Although the names of five villages in the Ventura area are known, only two specific sites have been located.

The Indian houses were hemispherical in shape, from twelve to twenty feet or more in diameter, and designed to shelter more than one

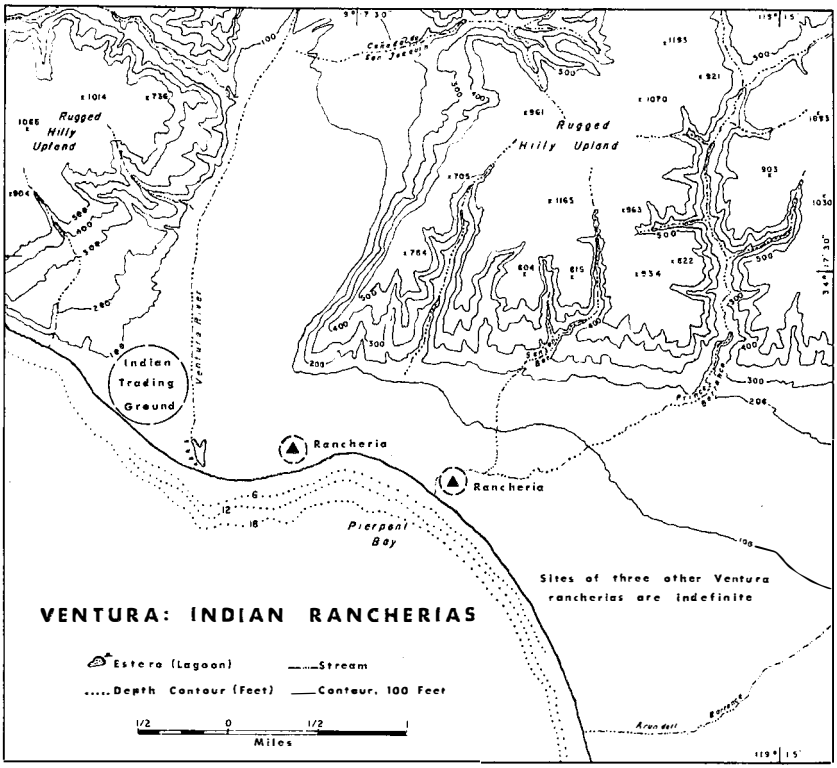

Figure 1

family. They were used only in bad weather. Father Pedro Font described them in 1775-76 as having a framework of strong willow poles bent together at the top, with a top opening to admit light and let out smoke. The walls were of dried grass or tules woven between the poles and the door a woven curtain held in place by whale bone or a stick.[3]

Within the village, debris was left where it fell and the accumulation of fish oil, camp refuse, and soot impregnated the ground as much as eighteen inches below the surface. This "greasy soil" is still one of the best indications of a former village site.[4]

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[2] Sol N. Sheridan, *History of Ventura County, California,* Vol. I (Chicago: S. J. Clarke Publishing Company, 1926) p. 119.

[3] E. K. Ritter, *History of Ventura County, State of California: Its People and Its Resources* (Santa Barbara: H. M. Meier, 1940) p. 5.

[4] Owen H. O'Neill, *History of Santa Barbara County* (Santa Barbara: H. M. Meier, 1939) p. 3.

The Indians themselves greatly impressed Father Crespi, who described them as:

> ". . .of good figure and disposition, active, industrious, and inventive. They have surprising skill and ability in the construction of their canoes which are made of good pine planks, well joined, and of graceful shape, with two prows. They handle them with equal skill; three or four men go out in the open sea in them to fish and they hold as many as ten men. . . All the things which they make are neat and well finished; and the most surprising thing is that they have no other tools for working the wood and stone than those made of flint, for they are ignorant of the use of iron and steel. . . The soldiers traded beads with them in exchange for baskets, pebbles, and wooden plates which would not be more graceful if they were turned with a wheel. They gave us a lot of fish, especially very savory bonito."[5]

Distinctive Attribute: The Canoe

The large seagoing canoe was the distinctive attribute of Chumash culture. By increasing the efficiency of food gathering it made the dense population possible, elevated the Chumash to a level above their neighbors who had none, and illustrated best their ingenious use of the materials at hand in their environment. The canoes are described as holding from two or three to as many as twenty people.[6] They were up to eight to ten varas long (25 to 30 feet) with a four-foot beam, and were built of pine planks, although it is possible that the bottoms were dugouts made from drift logs. Near Ventura, logs of sufficient size for carving dugouts were available only a long distance away in the mountains. There was no stream large enough to float them down, and carrying them down would have been laborious. However, splitting the pine logs was relatively easy and two men could carry long boards down the trail.

Without nails the boards were lashed together. Cord from bark or animal sinews was tied through holes drilled about one inch from the edge.[7] This was then sealed by the use of asphaltum from one of the numerous seeps. Although the plank boat of such construction is not strong there is no evidence that the canoes had strength-giving ribs. Perhaps they were not needed, because the Santa Barbara Channel is not an especially rough body of water.

The canoes were used extensively, for the Chumash were skillful mariners who took to the water daily if weather permitted. Fortunately the mild climate made all-year fishing possible, and the Chumash regularly made large catches of the abundant Channel marine life which provided their principal food. Every type of local fish and shellfish was gathered, hooked, speared, or netted with finely wrought implements of fiber, bone, or shell.

Nearly as important was the trade which the canoes permitted. Although Father Crespi noted the adequate supply of stone for building,

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[5] H. E. Bolton, *Fray Juan Crespi, Missionary Explorer on the Pacific Coast* 1769-1774 (Berkeley: University of California Press, 1927) p. 159.

[6] Kroeber, *op. cit.*, p. 559.

[7] B. L. Olson, *Chumash Prehistory,* University of California Publications in American Archaeology and Ethnology (Berkeley: University of California Press, 1930) Vol. XXVIII, p. 18.

the local rocks were not hard enough to act as tools nor resistant to the action of fire and sudden cooling without cracking. Steatite, which could withstand rapid heating and cooling, was apparently available only on Catalina Island. To obtain it required a two-hundred-mile round trip in the canoes.[8] Yet it was used extensively to make "ollas," which were globular thin-walled vessels with a volume up to five gallons. Flint from the San Francisco area, greenstone from the interior mountains, and obsidian from the desert were all used for making tools.[9] These indicate an extensive trade.

Without the canoe and the sea contact the dense population could not have been supported. The Chumash had no agriculture. The advantages of the site for agriculture uses which the later Spanish found so attractive had no significance to the Indians, for their culture pattern was based entirely on fishing, hunting, and gathering. They supplemented the marine resources by specialized use of the land flora and fauna. Along the river were tules and willow which were used for house construction, thatch, and mats. Willow was also used to weave baskets which were ingeniously waterproofed on the inside with asphalt.

Although the interior offered few inducements, seasonal trips to higher elevations were made at harvest time or when game was needed. Acorns and piñon nuts were the basic vegetable foods, with grass, seeds, bulbs, roots, and berries. Coastal sage and chaparral at lower elevations offered little game, but at intermediate elevations on north-facing slopes were grasslands interspersed with California live oak which offered good browse.

These forests, reached by way of the Ventura River Valley, supplied planks for the canoes and offered good hunting. Deer and antelope were sought for food and hides. A variety of other animals and birds was accessible from the Ventura River Valley: coyotes, ground squirrels and other rodents, ducks, geese, quail, and doves. Grizzly bears and mountain lions were present in quantity but were more feared than hunted by the Indians. The game provided meat, hides and skins for clothing, sinews for bow strings and fish nets, and bones for tools and whistles. Other tools, implements, and currency were made of stone, shell, or whalebone.

Conclusion

The Chumash, therefore, made the maximum possible use of the varied resources the Ventura site afforded them. The Channel, the beach, the river, and the mountainous hinterland provided the food, fibers, and materials for artifacts which the Chumash used so efficiently. Without a domesticated beast of burden, without iron or any other metal, without the wheel, and without any cultivated crop, the Chumash by careful adaptation to their environment supported the densest population of any Indian group in California. They succeeded because they developed a distinctive tool—the seagoing canoe—by which they were able to increase their efficiency in gathering the abundant Channel marine resources as a reliable food supply.

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[8] D. B. Rogers: *Prehistoric Man of the Santa Barbara Coast* (Santa Barbara: Museum of Natural History, 1929) p. 392.

[9] *Ibid.*, p. 414.

AID AND THE INDIAN: A CASE STUDY IN FAULTY COMMUNICATION[1]

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In 1868, upon release from four years of federal imprisonment, 8,000 surviving Navajos were issued 15,000 sheep which were to serve as the foundation of a native sheep industry. This was part of the government's rehabilitation program for the Navajo Tribe. The United States wanted to make the tribe self-sufficient and economically stable as soon as possible.[2] It wanted to relieve itself of the burden of administration, and, in a manner of speaking, get out of the "Indian business." The resulting phenomenal increase in both livestock and Indian populations prevented this wish from materializing. By the 1920's, the livestock load of the tribal range was far beyond its carrying capacity, and the Indian population was far beyond its capacity to take care of itself. The Government was desperately "up to its ears" in the Indian problem. A further source of confusion in Navajo-Government relations originated from the fact that the Indian Service failed to perceive adequately the nature and strength of the native cultural patterns.

Man, as a product of a multi-dimensional environment, exhibits behavior that in many ways is exceedingly complicated to predict on an intercultural basis, particularly when the patterns of response are not well known. Not only must one know something of the dimensions—the geographical, cultural, social, internal, the so-called "private worlds" of individuals, etc.—but most importantly, "the uniquely combined interplay," as Frank calls it, of living in the different environments.[3] Under these circumstances, it is not difficult to understand the lack of adequate communication that existed between the tribe and the government.

The Navajo livestock reduction program of the 1930's and 40's demonstrates the critical importance of cultural differences in the interpretation of a resource. Like the modern world, the Indian Service concept is objective and looks upon nature from a relatively superior vantage point, seeking to discover new ways to extract and use nature to serve man. Nature is viewed from without rather than from within.

Traditional Navajo, as in many tribal-oriented societies, tend to view natural resources as a mergence between man and nature; man attempts to maintain an equilibrium or harmony within the natural world.[4] The idea of extracting or using nature to serve man is contrary to their subjective view. Nature to them is viewed from within rather than from without. This paper will attempt to review and analyze the nature of the unhappy re-

[1] Field research for this study was supported by a grant from the Ford Foundation.

[2] L. Schuyler Fornaroff, "Conservation and Stock Reduction on the Navajo Tribal Range," *Geographical Review*, Vol. LIII, No. 2, April 1963, pp. 200-223.

[3] L. K. Frank, *Nature and Human Nature*, Rutgers University Press, 1951.

[4] See Robert Redfield, "Primitive World View," *Proceedings of the American Philosophical Society*, Vol. 90, 1956, pp. 30-36.

lationship betwen the Navajo people and the government from the point of view of inter-cultural communication.

The Indian Service and Its Relations to the Sheep Industry

There have been several administrative changes in the Indian Service work on the Navajo. Prior to 1934 there were six separate agencies on the reservation through which the Bureau of Indian Affairs dispensed its services. Rather than serving to unify the basically unorganized tribal structure, these administrative areas actually served to reinforce local unity, and Indians living in one agency felt no *esprit de corps* with those in any of the other five agencies. Each agency conducted its own activities in the areas of natural resources development, engineering, health, education, welfare, law and order, and administration (which in off-reservation American communities are rendered by local, county, state, federal or private agencies).

In 1934, the six agencies were united under a central office at Window Rock, Arizona. In 1937, 18 land management districts were established and a supervisor was appointed to each area. These district supervisors, working at the local level, were under the direction of the general superintendent at Window Rock. Among his other duties, the local supervisor worked on problems of range and livestock management.

Today, the central agency office for the Navajo is still located at Window Rock, and sub-agencies are scattered over the reservation. Each sub-agency has appointed range men to work at the local level, although there is no longer a separate district supervisor responsible for only one district.

Each of these administrative changes resulted in fear, misapprehension, and hostility in the Navajo. They could not understand the need to change systems, despite the relatively long periods between administrative changes. When the most recent system was organized they objected to the government's withdrawal of men working directly with the people (district supervisors), being fearful that there would be lack of contact and understanding of the local situation when a sub-agency was established. Furthermore, the shift back to a situation which the Indian Service had formerly used and then discarded as unsatisfactory caused confusion in most Navajo minds.

It was apparent that one core difficulty in the Navajo Service has always been the local worker's inability to implement in the field those plans formulated for him by administrators in their offices. The local field man has indeed been given training in "what to do" and "why to do it," but the problem of "how to do it" was somehow forgotten.

Personnel Problems

A major problem concerned the frequent turnover in range conservation personnel, which resulted in confusion and suspicion in the Navajo. Varying approaches to land management brought to the local level by personnel trained in different colleges, and the shifting techniques tried by the Indian Service to better manage the soil, caused the uneducated Navajo "to wonder whether we knew what we were doing," as one range man said. Personnel change seemed to cause more confusion for the Navajo than

program change. "They get used to a certain employee, maybe they even get to like him, then a new one comes in, and they become suspicious—especially if he brings in a new technique. . . ."

One of the subtleties involved in the antagonisms between the Navajo and the field worker of the thirties pertained to the youth of the technicians sent to work with the Indians. These young, energetic college graduates, many from the East and unfamiliar with the Western range, seemed insensitive and uninterested in the human needs of the people and more concerned with the status of the soil. The Navajo regard for age and experience made them feel that their existence was in the hands of men who had not yet lived.

Concurrently, the field men seemed thwarted bv administrative procedures and were often torn between what they felt the human needs actually were and what they were being asked to do. The "gag rule" stated in a letter by Secretary Ickes (1934)[5] illustrates the problem faced by field personnel:

> If any employee wishes to oppose the new policy (IRA)[6] he should do so honestly and openly from outside the service. This would mean his resignation. Any other course is unscrupulous and is detrimental to the Indians because it acts on the service as a canker. This condition has existed in the ranks for many years and has been partly responsible for the failures of the past. It retards and defeats the most conscientious effort toward good administration, and it will be summarily eliminated, whenever found, by dismissal.

The stumbling blocks confronting range men undoubtedly caused personal frustration and concern about the desirability of devoting a career to the reservation. The chronic lack of long-term personnel persists today.

The local range man has two phases to his on-the-job training. He must adapt his basic knowledge and training to the over-all reservation program, and he must then re-adjust this program to suit the local people and the ecological problems in the section of the reservation to which he has been assigned. Most of the administrators have come to recognize the important fact that areal, cultural and even physical differences exist among Navajo throughout the reservation. Likewise, some local range men have been able to recognize not only the extreme individualism of these Indians, but also the general distrust that persists among individual Navajo.

In the writer's impression, the local field man might be described as a sincere and hard-headed type whose first obligation is to the land. Also, he is often a person who is conscientious in trying to make change easier for the Indians if he can. The administrators themselves recognize that in reality, over the years, most men have been either over-sympathetic to the Indians or have over-emphasized the rules with little consideration of the human factors involved. Today, all agree that a balance between these extremes is the ideal combination. The Service, in trying to build toward this

[5] H. Ickes, "Letter to Indian Service Employees," Department of the Interior, April 30, 1934.

[6] Indian Reorganization Act: Legislation enacted to terminate the General Allotment Act of 1887. The IRA was formulated to help orient the Indian toward American ideas. It aimed to effect certain changes in native society while preserving native customs as much as possible.

ideal, has recently begun orientation programs to train personnel for awareness of the problems of communication, local conditions, and Navajo attitudes and behavior *before* they go into the field.

The difficulty in these indoctrinations is that while the ways of Navajo life are described, the average field man does not come away with ideas about how to use this "interesting information" to implement his range program. He comes away with valid suggestions and perspective such as Thompson provides:[7]

> The administrator must decide whether to foster and build on the Indian world-view . . . or to try to teach soil and range conservation, on one hand, and to inculcate exploitative American attitudes, on the other. But if he decides to foster Indian attitudes toward nature he should realize that a consistent program is necessary, including among other items, careful selection and re-education of Indian Service personnel and their creative application to the problem. If he does not so decide, he should realize that these basic attitudes will persist in some form regardless, and he will be ignoring a golden opportunity to relate and guide basic indigenous orientations to urgent modern problems and to bridge the gap between the traditional Indian world-view and emergent world views.

Perception of Another "World View"

One becomes aware of the differences in world view when trying to instill motivations for action. Frequent criticisms by administrators refer to the inability of invoking a "sense of responsibility" in the Indians. A typical Service complaint is that the government has "spoon-fed" the Indians, that "they've gotten too much for free." One field man complained that:

> ". . . subsidies to individual owners have been detrimental. If they'd had to make a go of it . . . with their own expenses, they might take better care of their land and not over-stock . . . They might be able to make a living then. . . "

"Making a living," of course, has totally different meanings to the Navajo and the range men. Some "progressives" seem to share goals and values of their government administrators. The average range Indian, however, is expected to take care of himself and his immediate family, "to be rich, but not too rich," or be "poor, but not too poor."[8] He has no goal to be a "success" as the white man defines this term, and he is unstimulated by the rewards of future gains which the Indian Service describes as the result of proper management techniques. To be successful in traditional Navajo terms does not always imply *material* wealth. The man who does not have much stock, land, or jewelry may still be considered successful if he possesses knowledge of the "old ways" and "owns" songs and knows ceremonies. This is "valid property" to a Navajo.

The range man who has lived and trained in a society geared to action finds progress among Indians to be painfully slow. He considers the Indian's rate of change of attitude toward livestock care to be slight and ". . . so slow that's very discouraging."

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[7] Laura Thompson, "Attitudes and Acculturation," *American Anthropologist,* Vol. 50, No. 2, 1948, p. 213.

[8] R. Hobson, *Navajo Acquisitive Values,* Peabody Museum of Havard University, Papers, Vol. XLII, No. 3, 1954.

Most of the workers among the Navajo today believe the basic attitudes about livestock are still much in evidence, especially among the older people. The generation born in the early 1930's or shortly before still maintain a feeling for the land and the flocks. The younger generation, particularly those living near non-Indian areas and exposed to off-reservation opportunities, are not as keenly interested in living off the land and flocks.

One cannot deny that the economic significance of sheep is changing over the years. But the indications are that the social value of the animal remains the same, especially among the older people.[9]

The young Navajo is in a precarious position. He has been brought up in the traditional ways of his people and has also been educated in the ways of the outside world. Especially if he has lived near or in off-reservation areas, he is often bewildered as he straddles both worlds. In actuality, he is no longer a "Navajo" in the *traditional* sense; nor is he yet psychologically integrated in the American community.

The Indian Service refers to this group as the "progressives," and attempts to work through them to effect management changes. It is essentially a small, and, to date, a relatively ineffective group. Administrators indicate that when the progressive element gains enough seats in the Tribal Council the period of effective innovation will begin. To date the "progress" itself is noticeable only in very elementary management techniques. Some Navajo have requested aid, but merely to keep livestock alive, not in learning proper herding and range management techniques.

It is still confusing to the Indians when the range man recommends a shift from an already accepted technique to a newer or better system. For example, the Navajo have been accustomed to dipping their stock as a disease control measure. A few years back, a dusting method was recommended as being better and less expensive. The reaction of most Navajo was, "You've been telling us to dip for years, and you want us to change to something else now." Only a few of the more "progressives" would dust.

Here we have another example of the kind of change which baffled the Indian. The Navajo make frequent reference to the reversals in Indian Service procedures. First, the Indian said, he is told to "increase" flocks. Then, he complained, "They're turning around and telling us to cut them down . . ." Boyle and Hadley[10] refer to this "about face policy," the "pendulum" of the Indian Service, as a source of confusion. Many Navajo believe if they wait long enough the pendulum will swing in their favor, relieving them of the necessity to act.

These people cannot easily comprehend how figures in authority can display this fluctuation in procedure. To them a law is a law and weakness is displayed in shifting emphasis.

The traditional Indian himself is slow to change (though he respects knowledge and the ability to learn). However, he is unable to grasp the white man's rationalizations and preferences for continual change. The

[9] L. Schuyler Fornaroff, *op. cit.*, p. 223.

[10] R. Boyle and J. Hadley, "Problems of Range Management on the Navajo Reservation." Recorded radio broadcast, November 23, 1938.

Navajo regard change as weakness; hence in some ways they regard the Indian Service as weak rather than strong.[11]

They also regard the Indian Service as the modern counterpart of the Holy People.[12] Like these divinities, the Indian Service is supposedly able to settle those troubles the Navajo cannot solve. The Holy People—and the Indian Service—must be treated with caution so as not to arouse antagonism. However, the Holy People—and, thus, the Indian Service—are not morally sanctified and to some extent are governed by the same laws of behavior as "Earth Surface People" (human beings). They may be either helpful or dangerous, and only in proper circumstances does the Navajo layman know about their nature and powers.

Thompson states that the Navajo attitudes toward power figures have become "coercive" and one of restraint.[13] Ladd has suggested that although avowed, under special circumstances ". . . the Holy People are not relevant to moral discourse." In other words, when dealing directly with the Holy People—and *vis a vis* with the Indian Service—the Navajo layman would do as told and look to the supernatural to help solve problems. However, once the direct dealings were discontinued, he may or may not continue to carry out the plans set by the supernatural.

For example, in an attempt to bring stock programs to the local level, the Indian Service during the reduction era established chapter meeting houses in the land management districts. The Navajo attended meetings as long as the Indian Service either required it or assisted in the conduct of the meetings. When the pressure was removed and attendance and conduct of meetings were left to the Navajo, the chapter system fell apart. There was almost total lack of interest and support. It has already been noted that in relationship with people outside the family or residence-group structures, Navajo rules are loose regarding behavior. It may be assumed then that with this lack of prescribed behavior toward outsiders, and the lack of prescribed ways of dealing with Holy People except under "proper circumstances," the Navajo have no clear set of rules for dealing with the Indian Service. What results is a *tentative* acceptance for certain plans laid by the government until pressure for participation is released, at which time the Navajo discontinue (as illustrated by the chapter system). This withdrawal is one customary way in which Navajo deal with excessive pressure over which they have no control.

The Indian Service assumes that it had adequate technological know-how to cope with the overgrazed land, and management techniques that would eventually improve the range. The problem was, and still is, how to get the Indian to accept the programs which will achieve these results.

Many Navajo obsessively reject being told how to manage or dispose of their property. This basic cultural value was, no doubt, violated by many

[11] E. Fryer, "Why the Government is Trying the Navajo Grazing Cases in the Federal Courts," Manuscript Document, U.S. National Archives, Washington, D.C., n.d.

[12] Holy People are divinities, distinguished from ordinary beings in that they possess special supernatural powers and are immortal. The Indian Service may also appear "Immortal" to the Navajo, for though individuals within the Service continually change, the Service plans go on and on. See, Laura Thompson, *op. cit.*, pp. 204-205; J. Ladd, *Structure of a Moral Code*, Harvard University Press, 1957, pp. 218-219.

[13] Laura Thompson, *op. cit.*

educational methods used in trying to make the Indian aware of the seriousness of the range problem. This "impertinence" on the part of the extension services may have been an important factor in the failure to motivate the tribe.

The Relocation and Education Dilemma

For several years, education and relocation have been considered as solutions to the overgrazing problem. Administrators have long believed that progress would be achieved through the young "progressives" who would be able to grasp the necessary concepts and, unlike their elders, are not as psychologically fated to livestock pursuits.

Off-reservation efforts through the 1950's have involved an infinitesimal portion of the population, and even this has been masked by a tremendous birth rate and reduced infant mortality. Off-reservation seasonal wage work, however, appears to be a recent trend. The families remain at home and tend the flocks and land.

In fulfillment of the treaty obligations of 1868, the Government is beginning to provide adequate school facilities. The Navajo are currently enthusiastic about education, and Government records presently show most school-age children registered in school. Attendance problems, however, are rampant. During reduction days, more than half of the school-age Navajo tended the family flocks. Today, it is still necessary to "beat the bushes" to get regular attendance, particularly in the conservative "long hair" areas. Therefore, despite the trend for education, the influence of the elders and their traditions remains greater upon the child than the influence of the teacher and his education. Even the young "progressives" reportedly still use the medicine man.

Yet there is no doubt among officials that the younger generation is becoming more interested in "making a living" and in receiving certain benefits of what we call essentials and what the Navajo would call conveniences (i.e., electricity, water, bathrooms). What worries the Indian Service is that the people do not benefit from the more educated Navajo, since many do not return to "hogan living" and a way of life which adapts Western learning to Navajo tradition. The educated Navajo may return to the reservation to work for the Indian Service or the Tribal Council, but he is now either a westernized Navajo or a man trying to straddle two cultures—a psychologically hazardous venture.

The American attitude of education as a virtue in itself that will solve all Indian problems has been a built-in characteristic of Indian Service planning. Tax[14] recently contrasted the desire for Indian education from the points of view of the Bureau of Indian Affairs and the Indians:

> . . . Indians all want the best education possible for their children. Some people think this means that Indians have finally given up and want to become like white men. My own interpretation is that just as you once learned to shoot back with the rifle, now you know that you can shoot back with education and educated leadership. You want to defend your Indianness with education. The only differences between yours and the policy of Mr. Emmons [Commissioner] is if he thinks he is giving you education in order to end your Indianness.

[14] Sol Tax, Talk before 1957 Meeting of National Congress of American Indians.

The Tribal Council

The Tribal Council, and the Navajo Police Force, are organizations that to traditional Navajo are irrationally conceived. There are no comparable authoritarian counterparts within the institutionalized framework of the native culture. Normal processes of social control were partially displaced or upset by these innovations.

By no stretch of the imagination could the Council be described as "the voice of the people."[15] At best, it serves to assure the Indian Service that issues discussed at Council meetings would also be discussed in the hogans. "The people themselves," as Kluckhohn noted, "are the real authority."[16]

It is clear the basic problem in the history of tribal government rests with the fact that the government operated on the assumption that they were dealing with "a tribe" that could be approached through a governing body that represented the people. This superimposed structure had essentially failed. It failed because the Navajo had never traditionally functioned in a unified manner with an authoritarian figure or group of figures serving as leader. Futhermore, the most ideal behavior to a Navajo is to conform thoroughly to the norm. Any deviation, such as holding office of authority, would be subject to suspicion.

Headmen and tribal elders may be loosely termed as leaders, but neither they nor rich men (who may be powerful through economic pressure) are vested with authority of formal leadership.[17]

This was evident even before the imprisonment in the 1860's. Peace treaties made with particular bands were held by the War Department as representative of the "Navajo Tribe," and the Government could not understand why other bands continued their raiding when "the Tribe" had signed a treaty. Likewise, the establishment of management districts, rather than unifying the tribe, seems to have reinforced the basic separatist tendencies. People eventually came to identify themselves with the area in which they lived. The result is something like an artificial reservation within a reservation.

The government continued attempts to work through supposed "chiefs" with little success. In an effort to have a group to speak, in any fashion, for the tribe, the Indian Service formed a body which led to the creation of the Navajo Council in 1923.

> The council as organized in 1923 was incompletely representative. Members were elected at gatherings of people at a few centers on the reservation. The people in the back areas and from the mountains could not get in, so the delegates were chosen from the agency areas.[18]

Further endeavors to procure tribal leadership led to the 1925 development of the chapter system, based on local areas and organized with a body of officers to operate in a formal parliamentary fashion. The Navajo found this meaningless, despite the fact that the government built chapter houses

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[15] See Clyde Kluckhohn, and Dorothea Leighton, *The Navaho,* Cambridge, Harvard University Press, 1946, p. 102, for summary of the establishment of powers of the new council.

[16] *Ibid,* p. 9.

[17] *Ibid.*

[18] John Collier, untitled document, Navaho File, U.S. National Archives. n.d.

and expended considerable time and money on the system. One chief error seems to have been in the government's insistence that the "headmen" adhere to government programs or lose their leadership.[19] This resulted in strong anti-government feelings to the point where the government withdrew its support, whereupon most of the chapters disintegrated. The psychological implications of "withdrawal" previously noted are relevant here.

The naiveté of the administration in believing that the organization of a council would solve the problem of tribal representation and communication between the Service and the tribe was apparent to some officials in the Service. One noted:

> It is essentially a company union, deriving its shady power not from the Navajo people but from the government. It is a House of Lords, inevitably opposing a redistribution of what are in effect the landed property rights of the class it represents. It might conceivably go so far as to sabotage the new localized method of reduction . . . the present Council could be kept alive by artificial nourishment in the form of non-controversial meetings; to be replaced at the proper time with a council based on functional representation of grouped land management districts.[20]

It is apparent that the criticism of the Council as an extension of the Indian Service existed both in the minds of the Indian Service and the Indians. An attempt to sever this association was made in the organization of the Council in 1938, which aimed to solve the problem of inadequate representation. The suggestion of "a council based on functional representation of grouped land management districts" was incorporated as the means to elect 74 delegates to compose the Tribal Council. Despite its rejection of the Indian Reorganization Act, the tribe was informed that a new council was to be established with membership elected by popular vote. Subsequent provisions under the Navajo-Hopi Rehabilitation Act provided for adoption of a suitable constitution and by-laws.

Difficulties of Adequate Representation

In order to implement government programs effectively, the Indian Service, in the absence of powerful native leadership figures, picked those whom they thought were the wealthy and most influential Indians to comprise the first Tribal Council. Later, the Navajo themselves selected the "best talkers" for office.

Adams, in his study of the Shonto village trading post, claimed that the councilman's function, as he and the community see it, is not to represent Shonto at the seat of the government, but to represent the government at Shonto.[21]

The selection of councilmen who are wealthy or who are good talkers about government programs may be somewhat objectionable to the Navajo. To be wealthy is a basic goal of every Navajo, but only to a degree. Too much wealth is looked upon unfavorably and breeds distrust and suspicion. The Navajo who would foster a government-sponsored program which was

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[19] Kluckhohn and Leighton, *op. cit.*, p. 101.

[20] Unsigned letter to Commissioner Collier, January 6, 1936, U.S. National Archives, Washington, D.C.

[21] William Y. Adams, *Shonto; A Study of the Role of the Trader in a Modern Navajo Community,* unpublished Ph. D. dissertation, University of Arizona, 1958.

unpopular among the people would fall into disfavor in the native community. During reduction days, Fryer wrote:

> Now they will follow only those leaders who tell them things they like to hear only while they are saying things they like to hear.[22]

The tribal government machinery has grown over the years, although its basic problem of adequate leadership remains. Since the war, however, according to Young, great strides have been taken toward the development of a concept of tribal unity and greater responsibilities in social and economic rehabilitation.[23]

In 1954, the responsibility for election procedures was transferred from the Bureau of Indian Affairs to the tribe. The current trend to transfer more federal responsibilities to the Indians themselves finds the interests of the Navajo Council continually expanding. In 1958, its budget exceeded $15,000,000 and covered such areas as health, education, welfare, law and order, relocation, and natural resource development.

The Grazing Regulations Problem Persists

The first set of special grazing regulations went into effect on June 2, 1937. Until the final version was adopted by the Council on April 25, 1956, a series of complicated revisions were deliberated between Washington officials, local field men and the Navajo Council. A series of supplements to the approved regulations are now periodically issued.

The regulations prescribe the establishment of grazing committees, their duties and responsibilities; functions of the land management districts; carrying capacities; methods of keeping accurate records of permits and ownerships; handling of grazing rights and permits; establishment of grazing fees; rules of trespass; movement of livestock; fencing rules; and construction near permanent livestock water developments.

Enforcement and interpretation of the grazing regulations is the charge of the Grazing Committee. The regulations, however, pose difficult enforcement problems, and the Council has been working through the "progressives" to aid in interpreting proper range management procedures. Extension workers and other Indian Service personnel also attempt to review and interpret procedures with the people by using the tribal regulations as a guide. But as one extension worker reported: "All you have to do is to show up with the Blue Book[24] in your hand and you've already lost the battle."

During 1941, there were unusually moist conditions, and the Council requested reduction through issuance of special temporary permits. These were issued with instructions that there must be reduction of stock to the total permitted numbers, as per regular and special issued permits. However, for the most part, sales in 1941 were not above par and compliance with the Council ordinance was only "probably accomplished in a few cases." The progress report emphasizes:

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[22] E. Fryer, *op. cit.*

[23] Robert Young, *Navajo Yearbook*, Window Rock, 1958, p. 195.

[24] The "Blue Book" is the official "Navajo Reservation Grazing Handbook based on the Navajo Grazing Regulations, approved by the Secretary of the Interior, April 25, 1956," published by the Navajo Tribal Council, Window Rock, Arizona, January, 1958.

> . . . that the special temporary permits were issued, on request of the Council, and with the Commissioner's approval, for a period of *one year* and were designated to *slow up* the process of bringing Navajo livestock down to the carrying capacity of the range . . . [25]

Since there was no set time-limit to the original permits, the Indians considered permit privileges to exist in perpetuity. Thus when land became over-used and it was obvious that stock should be moved or reduced on the spot, the Indian claimed *his* permit to graze *here* and felt he had nowhere else he could go because *other* permits covered *other* grazing areas. And in actuality, there was and is no unused grazing land. In order to preserve the carrying capacity, permits are negotiable only *within* the land management district and not between districts. Traveling and motion, psychological leitmotifs of Navajo life were drastically curtailed by district regulations, and according to a young Navajo, " . . . it made one feel like it's a prison."

In reality, the Grazing Committees have operated as administrative extensions of the Tribal Council and the Indian Service. They were effective in such areas as negotiating permits and settling simple land-use squabbles. They are less successful in training their constituents to improve grazing methods. In conjunction with the Extension Service, they use a variety of visual aid materials and other adult education means at their disposal. Although they avail themselves of the facilities, the Navajo do not seem to carry over the committee meeting information to action in their fields. These committees are expected to represent and deal with the local population, but one still hears the oft-repeated complaint of the local field man:

> . . . lack of real tribal leaders is at the core of the problem and . . . local conditions will be difficult to change without the influence of local leadership. . .

On various occasions the tribe has stated intentions to conduct range surveys to determine the livestock ownership patterns, but reasons had always been found not to do so.

Tribal Council Continues to Assume Greater Responsibility

In compliance with the trend of the Bureau of Indian Affairs to transfer more responsibility for tribal affairs to the tribal governing body, the Council assumed responsibility for resources care and development in 1960 when it organized a Tribal Resources Division. The Indian Service now acts in a purely advisory capacity to the Council regarding tribal stock programs; the Service cannot enforce tribal livestock programs enforcement can only be issued by the Secretary of the Interior. . . . The Tribal Council has authority to accept and enforce all types of programs; however, the passage of rules referring to livestock programs appears to be taboo. Feelings shun enforcements which in any way suggest "adjustments in numbers."

Politics play a large role in the Council. Salaries for tribal councilmen are high, and some representatives are hesitant to act in areas of sensitivity for fear of losing their tribal seat and its benefits.

Today's Council (1960) is described by Indian Service men as being predominantly composed of "long-hairs," who are fearful of a return to a reduction era—to the point where they will react in the manner described

[25] *Progress of Navajo Range Problems.* U.S. Department of Interior Report, n.d.

by some as "do nothingness." Ironically, this may involve action, but action which circumvents the core issue of livestock adjustment.

An example of such Council action, colored by fear of implications of reduction, is found in the feed-grain program of the mid-1950's. This council-sponsored program came into existence as a result of severe drought and the necessity to provide reservation stock with ample feed to prevent starvation. Federal aid was offered and the tribe purchased feed-grain (amounting to $512,000 of tribal funds) for distribution to livestock owners. Government advice on distribution techniques was sought, and the Service recommended supplying feed *only to good breeding stock* rather than providing it on a blanket reservation-wide basis. They were accused of supporting a reduction policy. The Council insisted that *all* stock be fed. What could have been an ideal means of culling old and unproductive stock, thus resulted in an eventual increase in numbers on a reservation-wide basis.

The hope for the future, according to Indian Service personnel, lies in councilmen who are able to see both sides of the picture. However, the influence of the elders on the more educated young man frequently prevents him from sponsoring those programs and activities which he might intellectually comprehend as being beneficial. Hence the grazing problem persists, and the Indian Service range ecologists are still operationally handicapped with many of the cultural problems which blocked conservation programs during reduction days.

ADAPTATION OF HOUSE TYPE TO CHANGING FUNCTION: A SEQUENCE OF CHICKEN HOUSE STYLES IN PETALUMA

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Settlement features are a distinct part of the cultural landscape. Studies have been made in recognition of these features in recent articles in agricultural geography dealing with farm structures which may act as an index to the classification of regions.[1]

This paper is a study of certain agricultural settlement features with a basis in historical geography and implications of environmental adaptability. It deals with some preliminary facts of architectural design in selected agricultural outbuildings and the role of their morphological evolution in the one-time center of commercial egg production in California. The location is Petaluma, in Sonoma County, 30 miles north of San Francisco, which has in its landscape relict poultry structures giving evidence of a sequential development and adaptation of style to climate and production.

Once known as the "Egg Basket of the world," Petaluma produced nearly 100 per cent of the commercial eggs in California and partially supplied the urban populations of the eastern United States as well. However, since the peak production era of the late 1940's, the region has been in a steady decline and now produces only seven per cent of California's eggs, the center of production having shifted to Southern California.[2]

The landscape in which the commercial egg industry of California had its origin was one of low, rolling, grass-covered hills. Colony houses were the first structures introduced on the hillsides in 1880 by dairymen who were already in the region (Figure 1A). The houses were about six feet wide and eight feet long for the smallest, others were 8 by 12 or 14 feet, with an open doorway in front, with no floors or windows and topped with a gabled roof. The smaller houses were connected six to eight in a row. The connection enhanced their portability so a team of horses could move them every month or so. The movement was away from the deposits of accumulated manure and mud to ground which made for cleaner eggs and provision for closer location to more green feed. The middle house was furnished with nesting material (litter) for laying and the others functioned as roosting houses with a capacity for 25 to 50 birds each. The larger houses usually remained where they were originally placed.

[1] Glenn T. Trewartha, "Some Regional Characteristics of American Farmsteads," *Annals,* Association of American Geographers, Vol. 38 (1948), pp. 169-225.

John Fraser Hart and Eugene Cotton Mather, "The Character of Tobacco Barns and Their Role in the Tobacco Economy of the United States," *Annals,* Association of American Geographers, Vol. 51 (1961), pp. 274-293.

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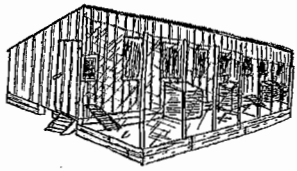
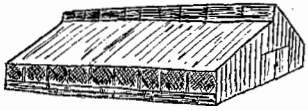
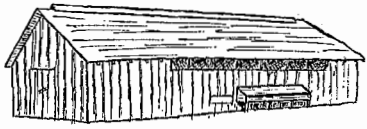
A. Colony House



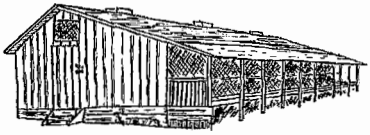
B. Lyding House



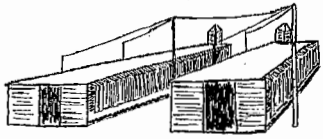
C. Semi-Monitor House



D. Closed, Gable-Roof House



E. Modified Open House



F. Open Shed Cage House

Figure I. Chicken house styles of Petaluma.

The chickens were fed outside in long narrow troughs placed in front of the houses, and they ranged for grit and grubs on the unfenced hill land. A few farmers kept this type of housing for small operations and because changing meant more capital outlay than they could afford. The majority changed because of disease problems, small roosting capacity of the houses and the muddiness of the open fields through which the farmer had to walk. Also through decrease in the size of farms and with growth of the industry a permanent type of house developed.

In Hutchison's book, *California Agriculture,* George Hart and others mention an evolutionary sequence of chicken house styles in the Petaluma region.[3] Although they seem to cover the entire sequence of house types there is no developed nomenclature for these structures. The names set forth in this article are indigenous to the Petaluma-Santa Rosa area. They serve as a style guide for the various types of houses, creating a separation between distinctive style changes and increased house size without a style change.

Walter Hogan's book, *The Call of the Hen,* has a short discussion, with photos, of the colony type of house. Structures in which the chickens are housed, however, are of minor importance since the book deals with the selection and breeding of poultry. There is some mention of the poultry factory (long building with a 500-bird capacity) but he does not mention if these are in the Petaluma or Southern California region.[4]

The permanent house type which followed the portable colony house was the Lyding house, appearing on the landscape around 1913 (Figure 1B).[5] (A rectangular, closed gable-roofed house appeared about three years before but didn't achieve prominence until 1930.) The Lyding house was 12 to 14 feet wide and 30 to 50 feet long, of shed-type construction with windows in the front for sunlight and aeration. This house had a capacity for approximately 100 birds, one for every 2 square feet, and was provided with litter on the floor for nesting material. The chickens didn't have the freedom to roam about as they did with the colony type, for there was a fenced-in yard in back of the house in which the chickens were fed a mixture of kale and horsemeat and also foraged for grit; the other half of their feed consisted of grain which was fed to them inside the house.[6] The kale was more important than it seemed, for it furnished an excellent source of vitamin A, known to be a preventative against a deficiency disease common among flocks that lacked greens in their diet.

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[3] George H. Hart and collaborators, "Wealth Pyramiding in the Production of Livestock," Claude B. Hutchison, ed., *California Agriculture,* Berkeley: University of California Press, 1946, pp. 100-101.

[4] Walter Hogan, "The Call of the Hen," Petaluma: *The Petaluma Daily Courier,* 1913, pp. 25-27, 115.

[5] An example of the Lyding house may still be found on the ranch of D.B. Walls of Petaluma, who along with Max Herrerias and Virgil Stratton, Sonoma County Poultry Farm Advisor, produced the dates and names of the house type considered in the time span between 1880 and 1950.

[6] In 1904 M.E. Jaffa, working at the University of California Agricultural Experiment Station at Petaluma, tested for a low cost feed that would increase egg production. In 1905 he published *Poultry Feeding and Proprietary Feeds* as a culmination to his research. This bulletin advised the ranchers on most of the nutritional problems they would encounter in the care and feeding of their hens.

The loss of freedom on the outside was compensated for by providing more room for roosting and laying on the inside of the house; this meant greater efficiency in handling a large flock. The added space alleviated the disease problem somewhat; however, the need for even more sunlight and aeration with expansion of the flock, provided the reasons for a change.

The introduction of the semi-monitor house in 1917 caused a definite increase in the size of the flock as well as production (Figure 1-C). It consisted essentially of two Lyding houses, one shorter than the other, placed face to face; a split level half gable roof with an opening at the top and screened half way down on one side. The method of constructive outside covering was usually board and batten occurring in all the different styles. A variation to this was the tongue and groove method.

This structure occupied approximately 720 square feet and had a capacity for 400 to 500 chickens.[7] The chickens were fed a mixture of wheat and corn. Grit had to be furnished, due to their inside environment, which they would have otherwise gotten naturally outside.

In the mid-1920's there was a migration of poultry farmers from the Midwest to the Petaluma region. These farmers brought with them their customary methods and styles of housing.[8] Their chicken house type was one of a closed, gabled-roof construction with very little opening and was designed to keep the chickens inside and protected from the "elements" (Figure 1D).

At this point the evolution of the chicken house took a backward step as far as combatting disease was concerned. Nevertheless, the new house reduced cannibalism[9] among the chickens. It seems that poor lighting proved to be an asset, providing an atmosphere where chickens weren't as apt to establish a pecking order.

These houses went through three successive stages of development. The first houses had a 16-foot width; the next model was 18 to 20 feet wide, and, finally, the third had a 30-foot width, all being about 100 feet long. Large operations, at that time, consisted of 500 to 1,000 birds in these structures. During this period the mortality rate started to climb, due primarily to lack of sunlight, crowding and to poor ventilation. In the 1930's the University of California's Agriculture Extension Service again started to make overtures to the ranchers to change their style of housing and eventually the era of the modified partially-open house was introduced.

This old house type modification appeared upon the Petaluma landscape about 1950 (Figure 1E). The change actually consisted of adding

[7] This semi-monitor structure along with the colony house may be found on the Max Herrerias chicken ranch today. The opening extending the entire length of the building between the split roof levels has been boarded up. This, Mr. Herrerias explained, was because placing burlap over the opening during foul weather and then removing it consumed too much time and effort. Instead the screening area on the side has been enlarged thus permitting more aeration.

[8] In 1921 the California shed-roof poultry house design was published by the University of California Agriculture Extension Service. This design caught on in the rest of the state but Petaluma didn't pick it up until much later.

[9] Cannibalism, often a disputed word among non-poultrymen, pertains to the dictionary definition. Chickens when pecking one another actually eat the pieces of meat they may tear off. Unless preventative measures are taken the weakest hens will eventually die. Two methods now being employed are debeaking or the inserting of contact lenses onto the chicken's eyes.

fenced-in yards to some of the smaller structures, or simply by making an opening in the side of the house and placing a screen over it. Another method suggested by the Agricultural Extension Service at Davis was the addition of a screened-in porch. The closed, gable-roofed houses were the first type destined for modification because of the high mortality rate due to disease fostered by lack of sunlight and limited circulation of air.

The ranchers, however, stood firm in their belief that their type of housing was correct and some refused to change styles, partly because of tradition and partly because of lack of available funds either from savings or through bank financing. Provincialism took hold of the area and forced a stagnant period in the evolutionary sequence. (Southern California, 10 years earlier, had been receiving large-scale bank financing and was constructing modern efficient house styles, the effects of which were soon felt by Petaluma producers.)

At the same time of the final opening up of old structures, the Agricultural Extension Service also introduced new and open structures in 1950. The first new structures were called Stratton houses (after Sonoma County's poultry farm advisor). These new types became the cage house that has persisted to the present day (Figure 1F). This house type is the most popular style in California today. It is essentially a long shed ranging from 10 to 16 feet wide and 100 to 230 feet long. The roof is often slanted (made of corrugated aluminum or some galvanized metal) and the sides are covered with removable (in some cases) slatted windbreaks. The operations studied in the Petaluma-Santa Rosa area had the south-facing side usually covered and the north-facing side left open.

There is no longer a problem of inadequate aeration and insufficient sunlight, for these open styles houses have provided an excellent solution to the problem. Inside the house the chickens are kept in stretch wire cages consisting of the individual or colony type. An individual cage is ¾ of a foot square and was introduced first. Colony cages, coming in several years later, were three feet wide by four feet long and held 16 to 20 birds.

Advantages of the chickens being kept on wire are: birds are protected from groundborne diseases, work is at a convenient height, eggs are cleaner and fewer are cracked, droppings are easily removed, and no litter has to be provided. Feed is stored in large cylindrical units at the end of every other house.[10] A gradual change in the type of feed also became evident. Up until 1947 wheat was still used; in 1950 a high percentage of the feed was barley; and from 1954 to the present, milo is the dominant grain with a small percentage of corn.

However, even in this latest style of chicken housing serious problems need to be solved. First, the housing investment is high; second, the cost of the hot-weather care that must be provided, such as fogging and sprinkling devices, is an extra expense; third, even though the productivity has

[10] From this storage tank the feed is put in a hand feeding device to distribute to the birds. This was the feeding operation used on the Crystal Poultry Farm in the Petaluma-Santa Rosa area which had a housing capacity for 300,000 chickens. It is one of the largest operations in the area at present. There are actually only three or four ranches with 50,000 birds or more; this is out of a 1962 total of 300 operators. In 1950 the total number of operators was 1084.

increased, eggs are often apt to be wire-marked; a[illegible]urth, the fly problem is aggravated by the mounds of wet manure produced. [11]

Disease is still a threat in the Petaluma area. Once infested with chicken pox and fowl cholera, whole flocks died within a short period of time. Rats were extremely prevalent in the early days and were the main carriers of cholera. There are now certain control measures for disease, such as vaccination for chicken pox and poison and traps for rats.

In conclusion, the three factors underlying the change of chicken house styles in Petaluma have been: first, the experience of economic loss due to diseases; second, a desire to reduce overhead cost through increasing the size of flocks; and third, a trend toward higher productivity and the reduction of handling costs. The causes for the industry's decline, in the last 10 to 15 years, have been provincialism, competition from Southern California, and late financing for expansion of antiquated facilities. Along with this decline has come a shift in the center of commercial egg production, leaving a landscape of relict poultry structures behind.

[11] The main problem is that the manure remains wet (70-80% moisture content) for a longer period of time than it did in the litter floor house. The best handling moisture content is 35% (the manure being dried and then spread on crops and landscaped areas, such as parks). There is specially built machinery to remove the manure but the problems of smell and flies still have to be solved. Urban encroachment in rural areas is the main reason why the problems are receiving so much attention.

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NEW BOOKS

The Sierra by W. Storrs Lee. (New York, G. P. Putnam's Sons, 1962. 350 pp.).

The Great California Deserts by W. Storrs Lee. (New York, G. P. Putnam's Sons, 1963. 306 pp.).

Exploring the Great Basin by Gloria Griffen Cline (Norman, University of Oklahoma Press, 1963, 254 pp.).

These three books are similar in the geographical areas covered, in their essentially historical approach, and in the fact that all are written by people with academic backgrounds (Lee is former dean at Middlebury and Dr. Cline teaches at Sacramento State College). But there the similarity ceases: for two of the books fade rapidly into the background, joining an array of mediocre works, while the remaining one stands out sharply as a real contribution to the general understanding of the background of our own West.

The pair by W. Storrs Lee are representative of the so-called "popular" writings of which we have a plethora today. They are written in a journalistic vein, which assumes that the intelligence of readers is of a junior high school level, and that their interest cannot be held if serious things are presented in a logical fashion. Consequently, no story can be told from the start, "human interest" must be the keynote, and everything must be spiced with dialogue. There can be no order, no discussion of inanimate things or theoretical concepts, no cause-and-effect relationships, or other elements of a scholarly approach, lest the reading become "dull." That they will sell well, however, is a foregone conclusion, for they are well promoted by an active commercial publishing house and consequently are pushed by the bookseller; they fit in with the great current surge of interest in things out-of-doors and historical here in the Southwest; and they are attractively printed, bound and illustrated. But they are not works that one will wish to read again and again, that one will cherish for years.

The two books are full of facts, relating chiefly to specific events and persons. But there is little in the way of a unifying theme or thread of continuity in each volume. Each begins abruptly (one with a modern land auction, the other with the earthquake of 1872), and ends in a similar fashion. *The Sierra* makes a pitiable attempt at presenting the geological history, with a horribly garbled result; *The Great California Deserts* makes no attempt at presenting a setting. Each could do well with an introductory chapter giving something of the physical and anthropological background. Each could well do with a proper map: the "artistic" title-page map of *The Sierra* is scaleless, has glaring inaccuracies and is generally inadequate, while the map in *The Great California Deserts* is so full of lettering as to be almost worthless.

Completely and refreshingly different is Dr. Cline's recounting of the progressive exploration of the Great Basin. It is a scholarly work, based on sound and exhaustive bibliographic research (Lee's works are based chiefly on contemporary newspaper accounts and magazine articles), and it is an orderly work, presenting the facts and the situations in a systematic, logical manner. But this does not make it dull; rather it is a fascinatingly interesting work, making its explorers exist as real people and presenting

the conflicts, fears, myths and beliefs of the times in their full forms. It contains the full meat of history, not just skimmings and broth, and as such cannot help but be interesting.

While it presents little that is absolutely new—either in fact or in interpretation—it is valuable because it brings together under one cover the entire history of the exploration of the region, including much that heretofore has been available only in scattered monographs or articles in historical periodicals.

The different historical periods are illustrated by a series of clear, well-drawn maps; in addition, there are reproductions of several significant early maps. The first chapter presents a good summary of the geography and pre-contact anthropology of the region. Thereafter, a chronological unfolding of the area is pursued, as each exploring party visits and describes a new area.

Anyone truly interested in the West—geographer, historian, traveller or weekend camper—will want to have *Exploring the Great Basin* in his library, and will find frequent occasions to refer to it.—RICHARD F. LOGAN.

California: Land of Contrast by David W. Lantis, Rodney Steiner, and Arthur E. Karinen. (Belmont: Wadsworth, 1963. 509 pp.)

The publication of *California: Land of Contrast* fills a long-standing need for a textbook on the geography of California. An examination of this volume gives one some idea of the many tedious hours of field work and library research necessary to produce such a work.

The authors have given priority to the regional approach in organizing their material. They have divided the state into ten major regions: The Northeast, The Trans-Sierra, The Mojave Desert, The Colorado Desert, The Sierra Nevada, The Southern Cascade, Southern California, The Central Coast, The Great Central Valley and the Northwest. In turn, some of these are divided into sub-regions.

Their treatment of the regions and the sub-regions is most comprehensive and includes sections on the physical geography and settlement geography of the areas as well as sections on man's use of the land. The literary style is superior to that found in most geography textbooks. This, together with the many well-chosen photographs, maps, and diagrams, helps to make the book attractive to the geographer and non-geographer alike. The book should be read by everyone seeking to understand the regional diversity of the state.—ROBERT W. DURRENBERGER

California: A History by Andrew F. Rolle. (New York, Thomas Y. Crowell Company, 1963. 649 pp.)

Dr. Rolle has rewritten *A Short History of California* by Rockwell D. Hunt and Nellie Van de Grift to give us an up-to-date history of the state to use as background material for an understanding of the present. The topical treatment of many aspects of our cultural history is particularly useful to geographers.

The relatively few maps are well done. However, one wishes that the historians would make better use of maps, charts and diagrams to illustrate their books. The book is well written and contains a comprehensive list of references at the end of each chapter.—ROBERT W. DURRENBERGER

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