the California Geographer

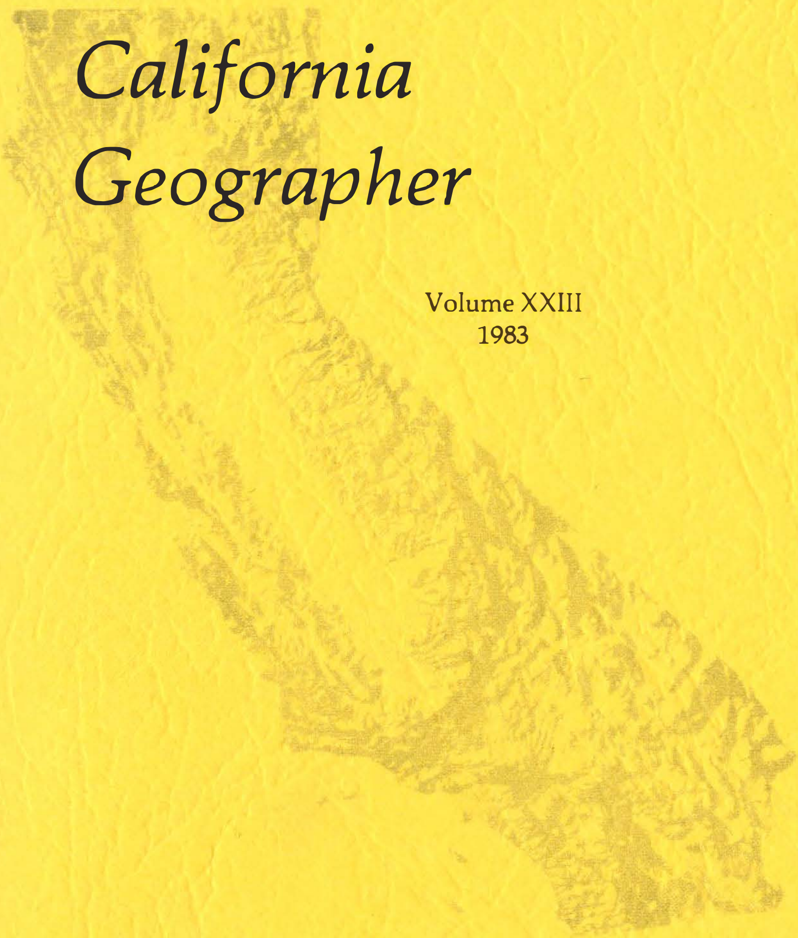

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TABLE OF CONTENTS

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THE RETICENT GEOGRAPHER, THE POPULAR IMAGE, AND PRE-UNIVERSITY EDUCATION: PERCEPTIONS FROM RECENT INTERDISCIPLINARY EXPERIENCE

*John Lier**

Prompted by a growing frustration during a recent six-year experience, this is a plea to reassess our professional behavior. Energies must be channelled in directions that not only promise to strengthen the academic position of our discipline in the United States, but also will lead to greater exposure of geographic research as well as promote much wider recognition of geography as basic to a well-informed society and to the primary and secondary levels of American education.

The Experience

Since 1977 I have been the organizer of the section on Atmospheric and Hydrospheric Sciences (Section W) for the annual meetings of the Pacific Division of the American Associa-

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The article is based on a paper given at the Association of American Geographers, Annual Meeting, Denver, Colorado, April 26, 1983. In addition to those whose correspondence is cited under "Notes," the author wishes to thank Carl L. Johannessen, David Lantis, Linda Lizarraga, James J. Parsons, Peter Rodda, Joseph E. Spencer, and Donald Tattersall for their valuable assistance.

tion for the Advancement of Science (AAAS), a valuable yet discouraging experience. Few geographers participated, a condition which I have come to regard as a symptom of an affliction from which many of us suffer and which demands immediate attention, for it is endangering American professional geographers as a species.

The Pacific Division covers a territory similar to that of the Association of Pacific Coast Geographers (APCG) (Fig. 1). Not surprisingly, this territory contains more than forty times as many AAAS members (some 25,000) than the total membership of the APCG (some 600); for, after all, geography is essentially an integrative discipline. There are always fewer integrators than the more separation-oriented scholars who comprise the bulk of the AAAS membership. For the same reason, one should not be surprised that the Association of American Geographers (AAG), even though it is numerically the major national professional organization of geographers in this country, is the smallest of a selection of such groups (Fig. 2).

The annual meetings of the Pacific Division, like those of the national AAAS, offer a variety of sections, symposia, and other scholarly gatherings, including many to which geographers of almost every kind could make important contributions in an open-forum atmosphere. Unfortunately, during the period of my involvement, very few geographers seized the numerous opportunities thus offered to display their research and have face-to-face discussions with colleagues in allied fields. A ray of light in this gloomy situation was provided by thirty-one of the papers being given in Section W, partly as a result of direct contacts and announcements in the *AAG Newsletter*, the *Bulletin of the American Meteorological Society*, and elsewhere. The remaining ten papers were read in sessions on ecology; energy; horticulture; the social, economic, and political sciences; and in Section E (Geology and Geography) (Table 1). Outside Section W, no geographer participated in symposia which included such naturals as one on biogeography and one entitled "San Francisco Bay System: Use

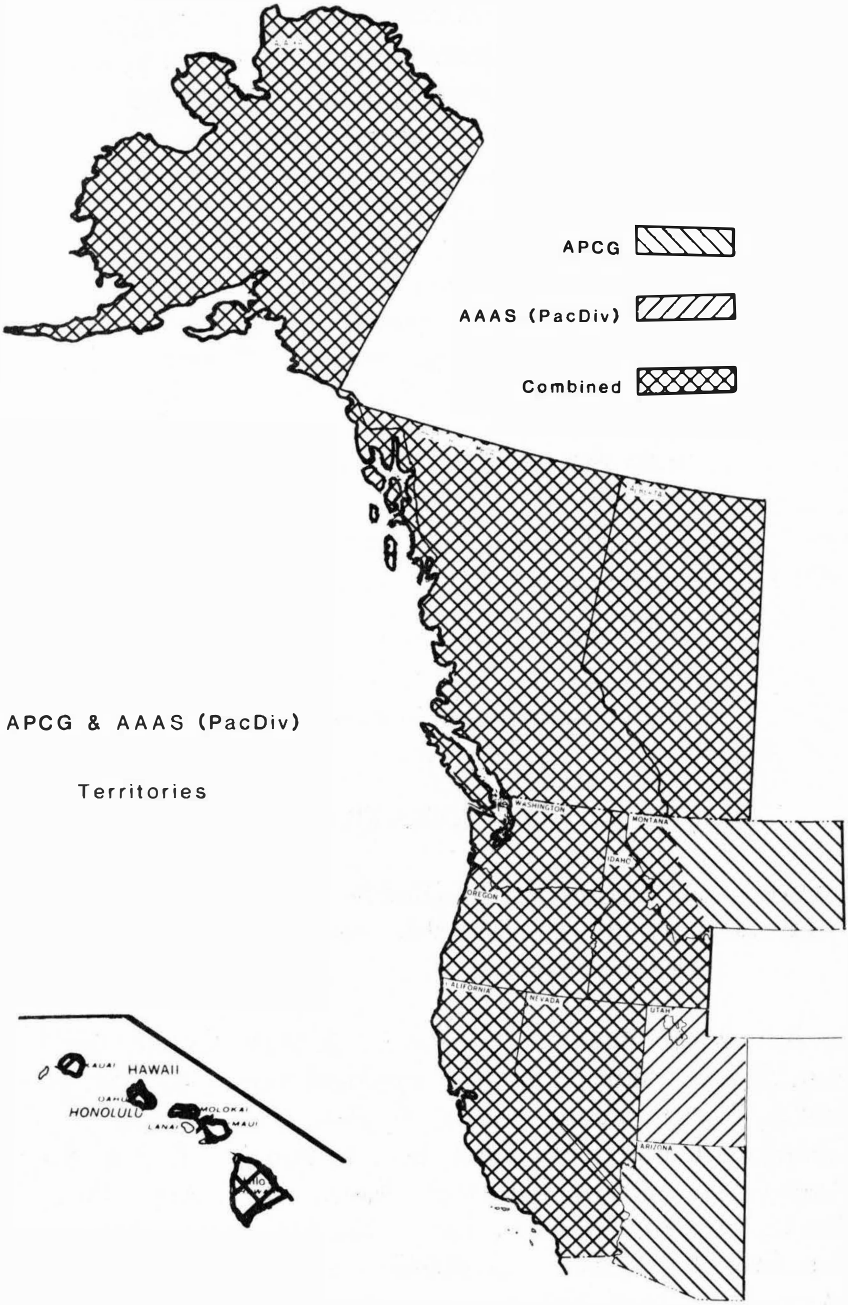
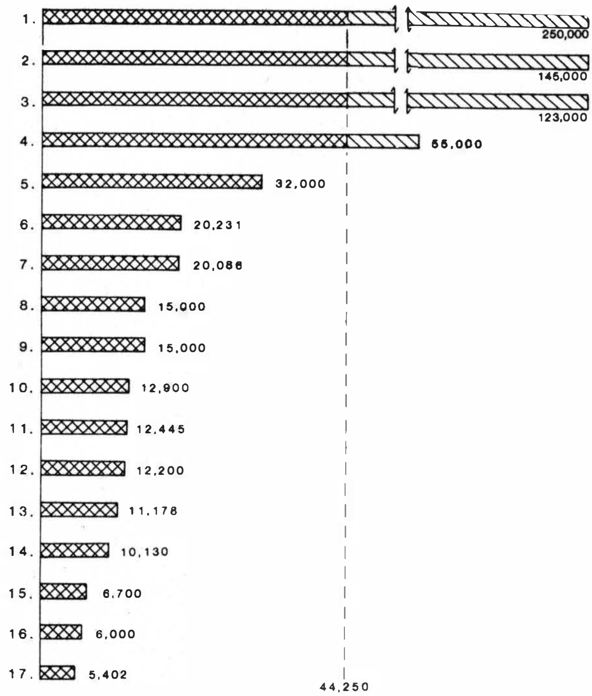

APCG
AAAS (PacDiv)
Combined
APCG & AAAS (PacDiv)
Territories
WASHINGTON
MONTANA
IDAHO
OREGON
NEVADA
UTAH
ARIZONA
HAWAII
HONOLULU
MOLOKAI
MAUI

Figure 1



Current Membership of Selected Professional Organizations

Figure 2

ILLUSTRATIONS

Figure 1. APCG and AAAS (Pacific Division) Territories.
Figure 2. Current Membership of Selected Professional Organizations.

1. Am. Med. Assn.; 2. AAAS; 3. Am. Chem. Soc.; 4. Am. Psych. Assn.; 5. Am. Physical Soc.; 6. Am. Math. Soc.; 7. Am. Econ. Assn.; 8. Am. Stat. Assn.; 9. Am. Geophys. Union; 10. Geol. Soc. of Am.; 11. Am. Sociol. Assn.; 12. Am. Historical Assn.; 13. Am. Pol. Sc. Assn.; 14. Am. Meteor. Soc.; 15. Am. Philos. Assn.; 16. Am. Inst. of Biol. Sc.; 17. AAG.

Dashed line indicates mean.

and Protection." Section E was held only from 1980 to 1982, during which time three geographers participated.

It seems that, at least in recent years, our record at the annual meetings of the national AAAS has been just as bad. Apparently, even geographers from the host city have tended to stay away, a situation that has been particularly disturbing to our colleagues with British backgrounds who are well aware of the strong participation by geographers in the famous British Association for the Advancement of Science.[1] Although there are no hard data on the participation by geographers in the meetings of the national AAAS, recent experience with "symposia that have a principal geographic motif" tells us that it has been minimal. Besides, "few if any geographers attend the planning session of Section E (of the national AAAS), and it is there that most of the ideas for symposia originate. Since geologists and paleontologists do show up... they naturally suggest programs of interest to them."[2]

Table 1
Annual Meetings, AAAS (Pacific Division), 1978-1983
Papers Presented or Co-Authored by Geographers

	Number	Percent
Seattle	7	2.2
Moscow	3	1.3
Davis	9	2.1*)
Eugene	4	1.2
Santa Barbara	9	3.0
Logan	9	3.2*)**)
	41	2.2

*) includes Section W symposium.
**) joint meeting with Southwestern and Rocky Mountain Division, both divisions included in count.

Benefits of Interdisciplinary Meetings

Appearances to the contrary, the purpose of this essay is neither to wave the flag for the AAAS *per se*, nor for any of its divisions; but where outside the AAAS can one find as wide a range of scholars converging regionally and nationally? Interdisciplinary contact is essential to academic well-being, not only by means of publications, but also, and *especially*, face-to-face. No single group is more in need of participation in meetings of other disciplines than geographers. Not only does our bent for synthesis demand participation, as distinct from mere attendance, but we also need each other's perspectives and expertise to combat parochialism and inbreeding as well as for evaluation, in short, for the general promotion of the scholarly quality of our work. That we recognize periodic face-to-face contact as important to professional progress is evidenced by our own meetings. Yet why do so many geographers seem to feel that as long as we talk to each other, all is well?

On a personal note, my involvement with Section W has amounted to nothing short of professional enrichment. With one foot on the human side of geography, my interests lie largely in climatology; and, despite a background in meteorology, the exposure of my recent research to an audience of mostly atmospheric scientists has, in the meeting room and outside, tended to reassure me, show me new directions, and make me aware of concepts that otherwise might have escaped my attention. There have been signs that the presentations by the few contributing geographers also benefitted the audiences. Our approach tends to be more holistic and to produce more spatial comparisons for we have a tendency to offer a spatial perspective; rather than to imply spatial uniqueness. Particularly important during presentations is our greater inclination to use maps. When recently I used two borrowed wall maps, the appreciation by the audience of what seems to us such a customary device, was surprising.

Apart from scholarly benefits, there is a second, no-less-important reason for our participation in the meetings of other disciplines. Among the world's developed, industrialized nations, the United States may well be unique in its neglect of geographic instruction at the pre-college/university level. Introducing and developing our discipline in institutions of higher education has exposed us for years to charges by individuals whose ignorance of geography, stemming from their American primary and secondary schooling, breeds suspicion of its worth. Among other things, we have been accused of eclecticism and parasitism.[3] The former charge, if it means that we use ideas and findings originating outside geography, is absurd; and long may the practice continue. The latter is groundless: the benefits of research are reciprocal, although the reciprocity is not in perfect balance and can never be. The same ignorance-rooted position is now putting us on the defensive more than ever, when certain politicians, lost for argument in our favor and hard-pressed to reduce spending by similarly unknowing constituencies, require university administrators, many of whom have little notion of geography either, to direct their budget slashing at us and a few other fields which are considered dispensable. Of course, we are all aware of this—such dreary events as at the University of Michigan still prey on our minds—and so is the AAG; but we must do much more than depend on AAG committees, projects, and pamphlets. We, *individually,* must carry the torch. It is imperative that we show who we are and what we can do, ultimately to turn such ignorance into conviction that society is far better off with us than without us. Not only must we advertise geography in the wide, wide United States, but also, vigorously, among our colleagues in other disciplines. For, as Richard Morrill has pointed out, "the image or understanding of modern geography is clouded, even among academics in closely-related fields," and we have done little to dispel it.[4] Some of us, by implication and attitude, have even fostered it. Moreover, the subject of our focus which we shall now consider, suffers from a widely-held perception of unimportance. Only a concerted effort on our part will lift the haze and correct the perception.

Geography's Unmysterious Core and Its Popular Perception

Trimmed to its essence, the core of geography is the study of earth space. Among the components of that space are location and place. This is no new revelation; yet one often hears the assertion that geography lacks a focus; and some have suggested, or implied, that the heterogeneity of papers at our annual meetings or the wide variety of course offerings at some institutions is evidence of that deficiency.[5] Emphatically, the assertion is false. For comparison, one should consider the meetings and curricula of some other disciplines, such as history and biology, which are about as diverse and apparently not subject to the same criticism.[6] Our focus holds no mystery. Even if only in their minds, serious geographers have their own more elaborate, everyday working definitions, all derived from that focus, as any examination of our multifarious professional literature will show. Of course, there are disagreements among us; and may they ever be debated; but they concern elaborations, such as research approaches and methods, research priorities, interpretations of data, emphases to be placed on classes of phenomena and processes, not the focus itself. No professional geographer will assert that our *prime* concern is time, or the nature of matter, or mathematical procedure, or any of numerous foci that clearly belong to other fields. Having the study of space as our centerpiece, however, does pose a problem of popular perception.

Our kind of space is rarely perceived by non-geographers as worthy of much attention, much less of scholarly concentration. Few question space as a basic element of existence; it is hardly noticed. Everyone questions time, most value it. Times past tend to arouse nostalgia. Except in a few instances, such as the voyages of discovery, we read history to gain a perspective of time much more than of space.

Most people know the names of two or three historians. Who, in the general public, can cite the name of a single geographer? If space is to be dealt with, it is a matter for the engineer, the airline pilot, the surveyor, or the planner; but planners are few; and who takes planning very seriously in our *laissez-faire* society?

In our daily commute, we are far more concerned with time spent than distance covered. The international businessman wonders whether he can squeeze in that flight to Tokyo before he sets off on his earlier, planned tour of his representatives in Europe. Although his travels are eminently spatial, it is time that is uppermost in his mind. The general perception is that modern living is controlled by the clock far more than by space. We measure time constantly, space rarely. Everyone is aware of time marching on relentlessly, irretrievably. Space is taken for granted; besides, it shrinks—also a function of time—so why bother with it? Such, more or less, is the popular perception of the core of our field. To counter it is one of our basic challenges.

Spreading the Message

Unfortunately, our modest numbers and our daily professional obligations are major obstacles to any effective proselytizing among the general population, at least initially, in order to achieve a greater appreciation of the significance of the study of earth space and a clearer understanding of our aims. We must start with our colleagues in other disciplines by facing them in person. They are a more manageable group, ready to give us their scholarly attention and should, in the normal course of our annual work cycle, be part of our professional interaction. By thus showing them our wares, abilities, points of view, and intentions, we stand to stimulate their curiosity more effectively than before, make them see more clearly that they need our approach and knowledge, and gradually convince them of our basic value to both the scholarly community and society at large.

Once our colleagues are won over, our message will diffuse through ever-wider circles, acquiring the real prospect that with sustained impetus, geography will become established as a fundamental and full-fledged subject in the curricula of primary and secondary schools in the United States, as it has been traditionally in so many other countries. In short, it is face-to-face contact at interdisciplinary meetings that offers the most promising beginning to bring geography into the spotlight.

The advocated interaction should serve us very effectively, unless some of us continue to leave the impression that the basic subject matter of geography is ill-defined or elusive and allow this to be echoed in all quarters. If confronted by an outsider who demands a definition of geography, the worst possible reaction is to be wavering and apologetic. As a subject, geography is no less clear than history, the main difference being one of orientation and emphasis. Geography is the study of earth space; and having thus begun our answer, let us continue without jargon along the lines of our individual working definition.

Are We Isolationist?

Why do we avoid meetings that are not mainly for geographers? Perhaps the problem concerns publicity, although, due to the sheer weight of its membership (Fig. 2) and the press coverage of its meetings, that may not apply to the AAAS. *Science* the Association's weekly which regularly carries announcements, is sent to all members, of whom by latest count (1981) 356 belonged to the AAG, a number believed to be growing.[7] The Divisions make their own announcements—the Pacific Division by direct mail to the members in its territory and to other individuals—and so, in various ways, do the participating groups.

Years ago, general curiosity caused me to wander into a local Pacific Division meeting, where a chance encounter resulted in my subsequent involvement. Before then I had paid little notice to the AAAS, having regarded it as an organization for health scientists, biologists, physicists, geologists, and some others, but certainly not for geographers. I know now that the organization is not for these disciplines exclusively, but it is run by them. Although there are sections for social scientists, they are much less apparent, either at meetings or in terms of their publications in *Science*. As to geography, our virtual non-participation may be related to a misconception about the meaning of the term science, as used by the AAAS. Many of us believe it to exclude the social sciences. *De facto* this is so, but mainly by default. We and others have stayed away. There is neither a legitimate reason why *Science* should be commandeered by the few groups mentioned, nor why our use of it as a voice should be restricted to one or two heroes like Nigel Smith who once even provided the cover photo.[8] As any democratic organization, the AAAS is subject to elective change. Let us do our part to change it; and to begin, we should do something about Section E which, by its very title, glaringly displays our lack of interest by maintaining the outdated image of William Morris Davis as the fountainhead of geographic inquiry. A change to "Geology and Geomorphology" or "Earth Sciences," with a separate section entitled "Geography" which would concentrate on its human aspects, is one possibility.

There may be other reasons for our being distant. Could it be a prevailing inferiority complex about the quality of our work? Are we afraid that its luster will fade in the broad daylight of outsiders' scrutiny? Perhaps some geographers should keep their work under wraps until their presentations improve, but my recent experience, not only in Section W, has led to the conviction that poor papers are not unique to geographers, and that on the whole we need not be ashamed.

Could it be self-consciousness about the small size of our group? It would seem that our size is all the more reason to be more vocal and visible. Life presents many examples of small groups that are far from the verge of oblivion. Think of the Swedes!

Perhaps we fear the prevalence of strangers at meetings outside geography. Such feelings are, of course, highly personal and depend on whether socializing is one's prime motive for going to meetings. But, remember, we were strangers once!

Finally, in the West, has the APCG detracted from geographers' participation in Pacific Division meetings? Undoubtedly, although the modest membership of 611 (substantially less than the number of professional geographers in APCG territory—the AAG alone has 889 members there) does not suggest significant competition.[9]

The APCG offers an interesting instance of what could be interpreted as an example of, irony of ironies, geographers' isolationism. Until about 1960, the organization had met for years within the Pacific Division's framework. Then, by a narrow vote, it decided to separate. It seems that the decision had to do with several complaints: perceived lack of attention by the Pacific Division to the quality and location of meeting places, a clashing of meeting and teaching schedules, and too many concurrent sessions. Strangely, in my experience, the APCG has continued to meet at about the same time as the Pacific Division, and not until 1983 has it switched to a Fall schedule. As to sessions being concurrent, that, of course, is an aspect of numerous professional gatherings, *including those of the APCG.* In fairness, the latter are smaller than most and concurrent sessions fewer. Therefore, to some they may be preferable, but whether the per capita yield of professional satisfaction increases in inverse ratio to size of meeting is doubtful. It is difficult, indeed, to escape the conclusion that the APCG's decision of some twenty years ago was ill-considered and that it was motivated by a proud but unprofitable isolationist attitude which could become fatal if persisted in at present. Meanwhile, the Association has lost much help with meeting arrangements and the crucial benefits of face-to-face interdisciplinary exposure and interaction. To be small is one thing; to seem meek and to retreat when things are not exactly right can be perilous. The problems that were perceived then were not and are not unique to the APCG and can be discussed. American geographers in general need to be more aggressive, if we are not to become isolated, ignored, or even trampled underfoot.

"American geography has a story to tell and *is* a story to tell. . ."[10] Let us tell it and make our demands known and fight for them, but let us not hide our treasures and spirit. We cannot afford it.

NOTES

1. Wilbanks, Thomas J., Oak Ridge National Laboratory, Oak Ridge, Tennessee, personal correspondence, January 10, 1983; Hart, John Fraser, University of Minnesota, Minneapolis, personal correspondence, November 22, 1982.
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3. Morrill, Richard, "The Nature, Unity and Value of Geography," *Professional Geographer,* Vol. 35, No. 1 (February 1983), pp. 1-9.
4. Morrill, op. cit.
5. Morrill, op. cit.; O'Driscoll, Patrick, "Mapping out the way we live now," *USA Today,* April 28, 1983 (cover story of the AAG meetings, Denver, April 1983).
6. Consider also the "extraordinary diversity" of economics, praised recently by the 1983 Nobel laureate in that field, Gerard Debreu, in William Rodarmor, "Cheering up the dismal science," *California Monthly,* Vol. 94, No. 2 (December 1983), p. 13.
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8. Smith, Nigel J.H., "Colonization Lessons from a Tropical Forest," *Science,* Vol. 214, No. 4522 (November 13, 1981), pp. 775-761 and front cover photo.
9. *Newsletter, Association of Pacific Coast Geographers,* Fall 1982.
10. Adams, John S., "Presidential Remarks," *AAG Newsletter,* Vol. 18, No. 3 (March 1, 1983), pp. 1-2.

SINCLAIR'S "VON THUNEN AND URBAN SPRAWL": THE CONVERSION OF AGRICULTURAL LAND TO SUBURBAN USES IN SONOMA COUNTY, CALIFORNIA, 1950-1970

*Christopher H. Exline**

Introduction

The outer edge of the metropolitan region is often one of the most dynamic areas of the urban realm with respect to the changing use of land. Pressure for the conversion of agricultural land to urban and suburban uses in the rural-urban fringe has been particularly great in California. Sonoma County, California, offers an excellent example of the processes and problems associated with such transitions in land use. This paper will focus on the evolution of the suburban landscape of Sonoma County through consideration of a model of land-use change proposed by Professor Robert Sinclair.

Sonoma County Within the Context of the San Francisco Metropolitan Region

An understanding of the change in the use of land in a given area comes from two principal considerations: the internal organization of the study area and the influences which come from beyond that region. The fact that agricultural lands are

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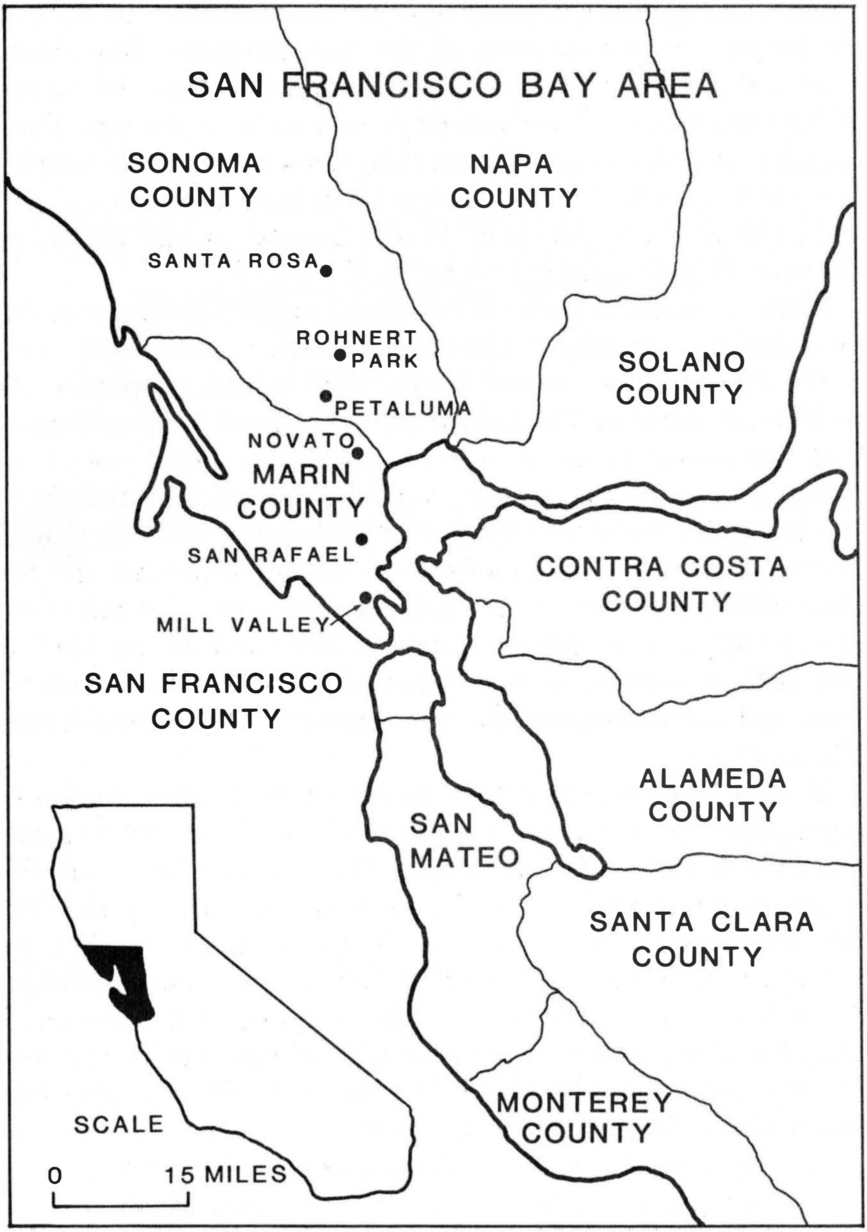
succumbing to urban uses and that cities within Sonoma County are growing rapidly may be considered to be part of the larger urban evolution of the San Francisco Bay Area. Within the context of this regional morphogenesis, the nature of Sonoma County has changed dramatically in the past three decades. In order to understand this phenomenon more clearly, one must consider the characteristics of both Sonoma County and its neighbor to the south, Marin County, as they existed in the years immediately following World War II.

Marin County, in terms of per capita income, long one of the most affluent counties in the United States, is considered to be in the San Francisco urban fringe, with a high proportion of residential, commercial, industrial, and vacant land as distinct from farmland. These factors coupled with a rapid rate of increase in population density, land-use conversion, and commuting typify the urban fringe.[1] Traditionally, Sonoma County exemplified that component of the metropolitan mosaic most distant from the urban core, the rural fringe.[2] A high proportion of farm as distinct from non-farm and vacant land, a low rate of increase in population density, land-use conversion, and commuting are all characteristics of the rural fringe (Figure 1).

The San Francisco Bay Area, as did much of urban America, experienced tremendous growth in population and a rapid spatial expansion of both small urban centers and suburbs following the Second World War. It was during this period that the landscape of Sonoma County began to show the signs of transition from the rural fringe to the home of rapidly growing urban areas and suburbs. In order to grasp fully the rapid nature of this transition, the evolution of land use in Sonoma County may be placed in the most basic of historical perspectives. This overview includes:

1. A pre-agricultural era which lasted until the early 1800's and the beginnings of significant Spanish and Mexican influence.
2. An era of agricultural development during which

Figure 1


SAN FRANCISCO BAY AREA
SONOMA COUNTY
NAPA COUNTY
SANTA ROSA
ROHNERT PARK
PETALUMA
SOLANO COUNTY
NOVATO
MARIN COUNTY
SAN RAFAEL
MILL VALLEY
CONTRA COSTA COUNTY
SAN FRANCISCO COUNTY
ALAMEDA COUNTY
SAN MATEO
SANTA CLARA COUNTY
MONTEREY COUNTY
SCALE
0
15 MILES

time the flavor of Sonoma County was distinctly rural agricultural: a period lasting approximately from 1820's to the 1930's.

3. The formative years of a typical rural landscape as measured by the definition of the rural-urban fringe beginning in the 1930's. This stage may be viewed in light of Howard Gregor's observation on the development of the transportation system of the Bay Area:

   "...not until 1927 were any of the several intersecting bays connected by bridges. Then, within ten years five crossings were constructed, enabling the increasingly cramped populations of the Bay Area to spill out into most distant reaches several of which had been comparatively sparsely populated."[3]
4. The years following the Second World War during which pressure on agricultural land was exerted only randomly and marginally at first but with incentives for land-use conversion becoming systematic and powerful by the 1960's.
5. Although beyond the scope of the paper, the current stage in the drama of land-use decision making and landscape evolution: the era of growth restriction beginning in 1972 with the inception of the much discussed "Petaluma Plan."

It is apparent from this simple outline that the fundamental nature of land use has changed in Sonoma County,as indeed it has in much of California, at an accelerating rate. In light of this assumption the question then becomes how does one begin to assess and analyze the processes involved in the complex and often chaotic web of processes that have led to such a profound turn from the traditional use of the land.

Perspectives on the Study of the Conversion of Land at the Edge of the City

Efforts to bring order to the dynamics of land-use change at the periphery of the metropolitan region involve techniques covering the range of methods employed in academic investigation. Early studies were generally empirical, and many were directed toward regions of California. In one of the early looks at the suburbanizing landscape, Jan O. M. Broek examined the sequence of occupance of the Santa Clara Valley, especially as it was manifested in patterns of land use. Broek's work, published in 1932, dealt with the region in the early stages of the major change from agricultural to urban land use.[4] In a further study of this same area, Howard Gregor found that by 1957 approximately 70 percent of the prime agricultural land of the Santa Clara Valley had been converted to urban uses.[5] Gregor highlighted one of the leading causes of the rapid suburbanization of California lands when he noted that of the 222 annexations made prior to 1957 by the city of San Jose, 207 were accomplished after World War II.[6]

In another consideration of the Santa Clara Valley, Griffin and Chatham considered empirical evidence and determined that population pressure, transportation inputs, and poor planning were the major causes of the decline in agricultural acreage.[7] They described how such urban related factors as pilferage of crops, a sinking water table, and the fact that farmers could not spray near subdivisions caused agricultural land use to diminish.

Studies of land-use change at the edge of the urban region were not confined, quite obviously, to California. Major investigations of this phenomenon took place in the Eugene-Springfield, Oregon, area in the early 1940's, southern Wisconsin in the mid and late 1940's, and the southeastern United States in the 1950's and 1960's, to cite but a few examples.[8]

By the 1960's American geographers, sociologists, and planners had written to some extent on the rural-urban fringe of most major American cities. Additionally, examination of foreign, English-language publications reveals research pertaining to the fringe areas of cities such as Sydney, Adelaide, Melbourne, London, and Johannesburg during the same period.[9] Studies undertaken beyond the United States tended to treat the rural-urban fringe in terms of an area of spill-over of urban populations which were removed from the central city spatially, but with nearly all activity still focused on the city. This would imply that the fringe was directly connected, through a complex of linkages, to the urban center socially, politically, and economically. Foreign scholars describe rural-political maturity and adequate planning as factors controlling land utilization and land use-change at the urban perifery.

Historically, American academic study has considered the rural-urban fringe in terms of uncontrolled, sprawling, residential areas representing a vast, spatial expansion of the urban realm. In contrast with foreign scholars, especially the British, American researchers seldom saw meaningful, functional control over land use patterns in the rural-urban fringe. The epitome of this concern for uncontrolled sprawling growth patterns is reflected in the terms Megalopolis and conurbation, both suggesting vast networks or urban places linked in part by their respective, urbanized fringes. Generally, American scholars have concluded that, for the most part, the rural-fringe of U.S. cities had far less political and social dependence on the urban center than their foreign counterparts. In the realm of economic dependence, however, there was a commonality between the situation in the United States and non-U.S. cities.

Contrasts worthy of further elaboration exist between the American urban condition and other areas of the world, especially when considering suburbs and the rural-urban fringe. There are, however, a number of similarities which also rate additional investigation. Basically, these commonalities exist in the topics considered and method of study employed. The common themes of research on land-use change on the rural-urban fringe include the topics of: transition and adjustment in the rural community; transition and adjustment in the urban community; transportation and economic problems associated with dispersed settlement; demographic factors; and, land use and environmental considerations. The most commonly used research methodologies produce descriptive results, often with little in the way of development of underlying theory. A significant and logical reason for this latter point in the case of United States cities is the fact that although on the macro-scale (the general elements of the dynamics of land use) most fringe areas are basically the same, on the micro-scale (the particular components of each study area) there are vast differences between regions. This results in researchers using relatively broad generalizations, rather than developing complex principles to explain land-use change in the rural-urban fringe. It is troublesome that the theoretical foundation which does exist has been infrequently tested for validity. The remainder of this paper, therefore, will focus on (a) discussion of a model of land use designed, in part, to explain land-use change at the edge of the city and (b) a test of that method of analysis by using as a time frame the 1950-1970 period of transition from rural fringe to suburban landscape in portions of Sonoma County, California.

Von Thunen and Urban Sprawl

The methodology that is of primary importance in this study was developed by Robert Sinclair. Sinclair employed concepts first developed in 1826 by J. Henirich von Thunen[10] as a basis for his model of the impacts of urban sprawl on rural land use.

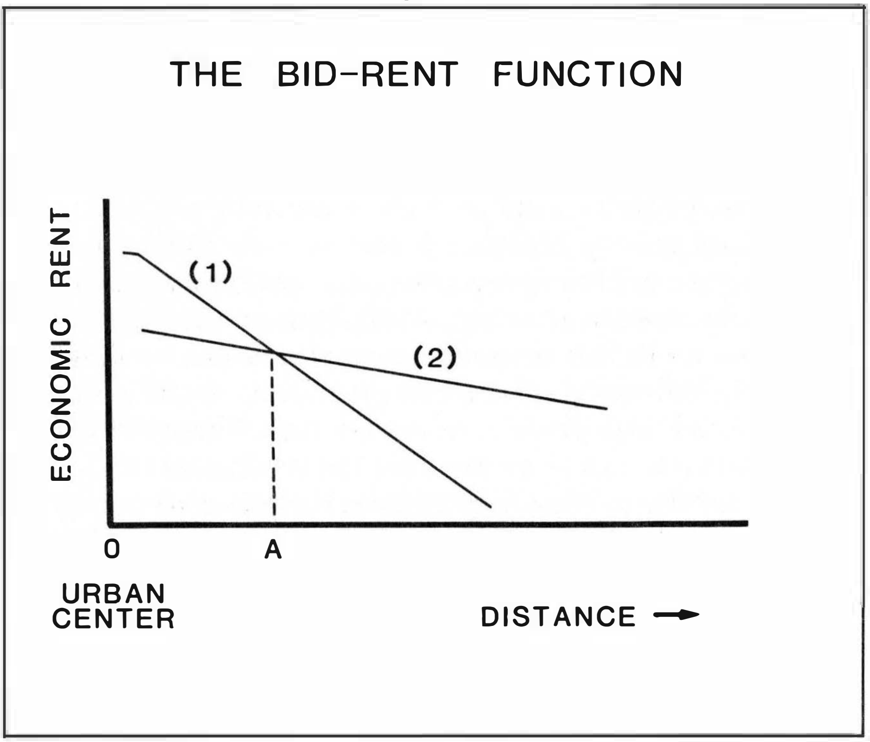
Empirical observations in the Hamburg region of Northern Germany led Von Thunen to develop a method of assessment of patterns of agricultural land use. Von Thunen's ideas did not necessarily constitute a pure theory of location, but rather a method of analysis which could be generally applied to a number of situations. Von Thunen's observation was that on any particular segment of land the activity which yielded the greatest net return would prevail. It is important to note that this net return was measured in profit per unit of land, not in profit per production unit. For example, in considering competition between wine grapes and apples, the significant element would be financial return per acre of land for either crop, rather than financial return per ton of product.

In order to explain this competition, Von Thunen used the term economic rent. As Chisholm notes, economic rent is not the same concept as the term rent in ordinary usage. Economic rent denotes the payment which a tenant makes for the right to occupy a farm or dwelling or other property.[11] Economic rent in the case of agricultural land use is a combination of factors such as soil quality and transportation costs as they relate to the net return of profit per acre of land. Economic rent is, then, all costs involved in growing and marketing a product.

The nature of this economic competition can be illustrated by a basic, bid-rent diagram (Figure 2). Land use (1) is an enterprise in which high profit is generated; thus, this activity is able to locate in the high cost zone near the urban area (0). In competition for the particular space near the urban center, practitioners of land use (1) are able to out-bid those involved in land use (2). As distance from the urban center increases, practitioners of land use (1) are unwilling to continue to pay high rent; thus, land use (2), which may bid more to be at that particular distance from the city, becomes the dominant use of that space. In this case, such a transition would occur at point (A). The land from the urban area outward to distance 0-A features land use (1); and from point A outward, land use (2) prevails as a function of economic competition.

Von Thunen put forth this theory using as an example the *"Isolierte Staat,"* that is, the ideal or isolated state. Given an area of flat, tillable land of uniform physical characteristics, a single transportation system, agriculturalists flexible as to their use of the land, and a centrally-located and uniformly-accessible central market, Von Thunen postulated six concentric zones of agricultural activity around the city. Given the technology and needs of the day, zone one consisted of dairy and perishable vegetable production and zone two forest land, since the need for wood as both fuel and building material was great. The remaining four zones, in order as they would be found with increasing distance from the city, were: intensive

Figure 2



crop farming; crop farming with pasture; three-field rotation; and, livestock grazing.

Von Thunen considered the boundaries of the urban area to be static and not dynamic as in the case of modern, metropolitan regions. The dynamic nature of the urban boundary is one factor that has produced contemporary agricultrual land-use patterns quite different from those suggested by Von Thunen. The utility of the concept proposed by Von Thunen in the assessment of modern urban expansion and suburbanization, however, is found in the notion of economic competition for land as related to zones of agricultural production. Robert Sinclair, for instance, postulated that the fundamental principle proposed by Von Thunen could be applied to the explanation of land-use change at the rural-urban fringe.[12]

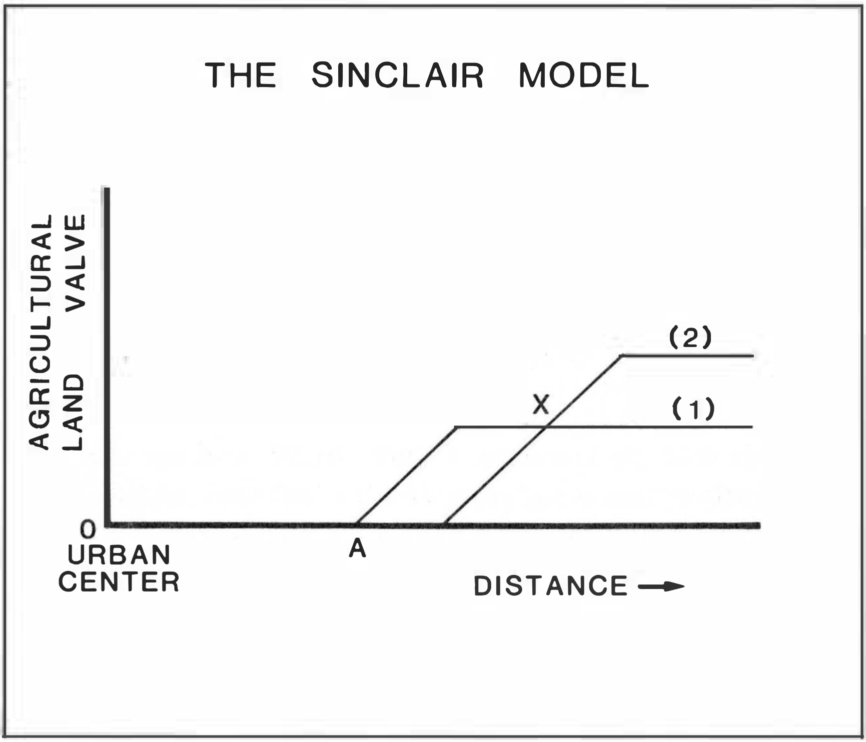
Sinclair suggested that agricultural land use would become more intense with increasing distance from the city, owing largely to the cost of land and the role of speculations on the rural-urban fringe. In essence,

> Urban land today is much more valuable than rural land, so that where there is direct competition between urban and rural land use, urban uses generally take over. Further, land where urbanization is expected also is more valuable than rural land. Such land rises in value, and either is purchased from the original owner by developers and speculators or held by the original owner as speculation.[13]

The thesis that the intensity of agricultural land use decreases near the urban area is supported by the fact that "as the urbanized area is approached from a distance, the degree of anticipation of urbanization increases."[14] This produces an ever-increasing ratio of urban to rural land and thus "...although the absolute value of the land increases, the relative value for agricultural utilization decreases."[15] Sinclair tied the decreasing intensity of agricultural land use found near the urban center to land speculation when he observed: "Obviously the greater the chances of urban land uses taking over, the less practical it becomes for the owners to invest highly in capital and labor for agricultural purposes."[16] This meant that near the urbanizing zone of the rural-urban fringe agricultural pursuits such as irrigated pasture or low-input grain crops would be found, while high-input activities such as orchards or vineyards would be found at a greater distance from the urban area. Sinclair's hypothesis was that the activity requiring the least economic input would be near the urban edge and that this zone would be the least valuable for agriculture.

A simple bid-rent diagram of economic competition between two crops illustrates the nature of this reverse of the Von Thunen pattern (Figure 3). Extending from the urban area (0) there is a zone (0-A) in which speculation is so great that there is, in a relative sense, no value for agriculture because of

Figure 3



the impending land-use change. At point (A) there is some value for agriculture; and a very low-intensity, low-input agricultural land use (1) is found in this region, for example, grain crops or pasture. Intense speculation in land decreases with distance from the city; therefore, greater capital and labor inputs become more practical with distance since there is an increasing stability to the agricultural future. In this case, at point (X) low input crops may be replaced by orchard or vineyard crops which are typical of land use (2). Like Von Thunen, Sinclair postulated a series of expanding, concentric rings surrounding the city; and in these zones the following agricultural activities would be found: urban farming, vacant and temporary grazing land, field crops, dairying and field crops, specialized crops.[17]

Sinclair's intial hypothesis, the effect of speculation on land-use change, was a meaningful contribution to land-use theory. However, the concentric zone aspect of his proposal, when applied to the North American city, may not have direct, universal applicability. It may be noted, for instance, that the rural fringe or rural hinterland of many North American urban regions is characterized by dynamic, multicenter urban growth much like the pattern of urban-suburban land-use conversion suggested by Gottmann in *Megalopolis*.[18] Sinclair's model does provide, in any case, a most useful way to consider land-use change.

Land-Use Change in Sonoma County, California

In order to apply the Sinclair model to land-use change in Sonoma County, several basic types of data were employed. First, statistical information relating to population growth, regional demographics, housing starts, and agricultural land-use practices were examined. The second phase of the study involved coupling the statistical information with the interpretation of aerial photographs taken between the years 1950 and 1970. Finally, the wedding of statistical data to spatial patterns as seen from the air formed the basis from which further examination of planning documents, land-use maps, and other records was undertaken.

The dynamics of population growth and the expansion of nearly all forms of economic activity into the suburbs following World War II has been well documented.[19] One expression of this growth is found in a comparison of the share of the total population increase of the Standard Metropolitan Statistical Areas (SMSA's) of the United States that went to the cities, as compared to the percentage of growth found in the suburban element of SMSA's. Between the years 1950 and 1960, 23.8 percent of the growth of SMSA's was in cities, while 76.2 percent of all SMSA growth took place in suburbia. The cities' share of SMSA growth between 1960 and 1970 was 4.4 percent, thus an astounding 95.6 percent of the population increase of SMSA's occurred in the suburbs.[20] The cities of Sonoma County were not immune to this rapid growth (Figure 4) (Table 1).

Figure 4

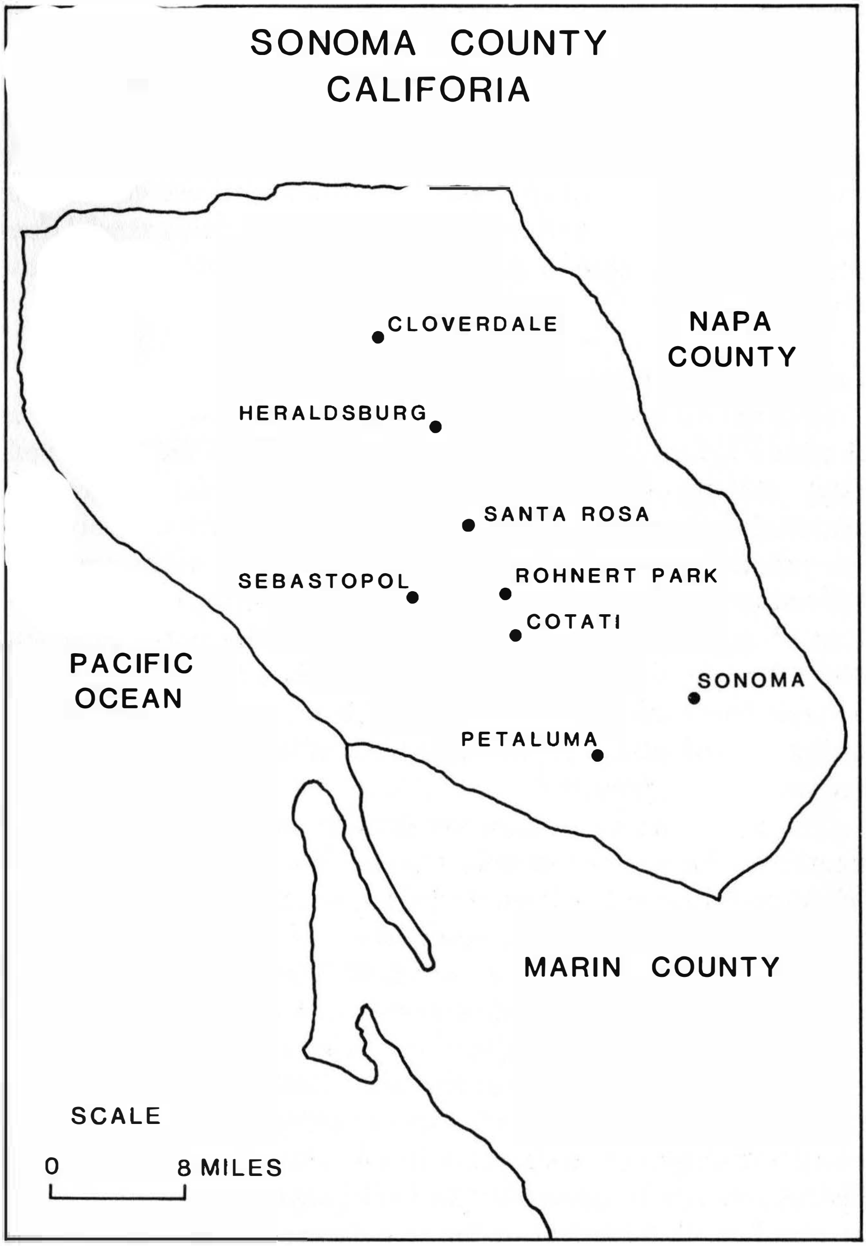


Table 1
POPULATION TRENDS BY CITY, SONOMA COUNTY
1920-1970

City	1920	1930	1940	1950	1960	1970
Cloverdale	718	759	809	1,292	2,848	3,251
Cotati						1,368
Healdsburg	2,412	2,296	2,507	3,258	4,816	5,438
Petaluma	6,226	8,245	8,034	10,315	14,035	24,870
Rohnert Park						6,133
Santa Rosa	8,758	10,636	12,605	17,902	31,027	50,006
Sebastopol	1,493	1,762	1,856	2,601	2,694	3,993
Sonoma	801	980	1,158	2,015	3,023	4,112

Source: 1920-1970 figures from the United States Census of the years 1920-1970.

It is not surprising that cities located on the main, north-south arterial from San Francisco (Petaluma, Cotati, Rohnert Park, and Santa Rosa) experienced the most dramatic growth. That much of their development was related to the establishment of relatively low-cost, tract-housing subdivisions is reflected in their median-age statistic (Table 2).

Table 2
MEDIAN-AGE STRUCTURE FOR CITIES IN SONOMA COUNTY, 1970

Sonoma County	
Cotati	24.6
Petaluma	26.4
Rohnert Park	20.4
Santa Rosa	29.1
Sebastopol	40.5
Sonoma	45.3

Source: *The San Francisco Bay Area 1970 United States Census* (San Francisco: San Francisco Bay Area Council of Governments, 1973) Vol. 1, Table 4.

The "freeway cities" fall in the relatively low median-age category. Rohnert Park with a median age of 20.4 has an exceptionally low median-age value. The cities not impacted by commute flows and new subdivisions showed evidence of some of the highest median-age structures of any California cities: note Sonoma and Sebastopol with median-age statistics of 40 plus years.

In short, such indicators of rapid growth translate into pressure on agricultural lands. As was the case in the Santa Clara Valley, the most suitable sites for subdivision in southern Sonoma County were also the location of orchards, vineyards,

Table 3
PASTURE AND GRAIN ACREAGE, SONOMA COUNTY 1950-1969 (Acres)

Year	Pasture-Permanent Irrigated	Grain
1950	5,500	13,000
1951	7,000	18,059
1952	10,000	22,469
1953	11,000	21,465
1954	11,500	12,800
1955	12,000	22,400
1956	12,500	25,500
1957	14,614	26,000
1958	15,000	25,500
1959	15,000	30,000
1960	15,000	31,000
1961	15,000	31,000
1962	15,500	30,600
1963	17,000	26,000
1964	19,000	25,000
1965	19,000	24,000
1966	15,000	26,000
1967	15,000	26,000
1968	15,000	21,600
1969	15,000	22,700

Source: Percy F. Wright, *Agricultural Crop Reports 1950-1969,* (Santa Rosa: County of Sonoma), pp. 1-5.

seed farms, and prime pasture lands. The Sinclair model suggested that demands for suburban development and the attendant land speculation would likely result in the transition from high-capital and labor-intensive crops to low-intensity agriculture. Comparision of Tables 3 and 4 illustrates the change in the intensity of agricultural land usage in Sonoma County during the study period.

Table 4
ORCHARD CROPS, SONOMA COUNTY 1950-1969 (Acres)

Year	Pear	Plum	Prune	Total
1950	2072	174	18,338	20,584
1951	2076	174	18,071	20,321
1952	1975	169	16,914	19,058
1953	1802	132	16,140	18,074
1954	1778	119	16,141	18,038
1955	1783	120	16,127	18,030
1956	1783	115	16,032	17,930
1957	1728	0	14,795	16,523
1958	1735	0	14,893	16,628
1959	1765	0	15,090	16,855
1960	1621	0	13,918	15,539
1961	1629	0	14,197	15,826
1962	1633	0	14,711	16,344
1963	1631	0	15,156	16,787
1964	1754	0	15,743	17,497
1965	1848	0	16,243	18,091
1966	2044	0	15,807	17,851
1967	2056	0	15,821	17,877
1968	1992	0	16,146	18,138
1969	2001	0	15,997	17,998

Source: Percy F. Wright, *Agricultural Crop Reports 1950-1969,* (Santa Rosa: County of Sonoma), pp. 1-5.

Table 3 provides clear evidence that between 1950 and 1969 a substantial increase occurred in the land area devoted to grain crops and pasture. The peak and valley pattern of increase followed by decrease in acreage found in the years 1962-1965 was the result of a period of rather widespread planting, followed by years in which several very large housing tracts were developed. The urban growth of the Rohnert Park-Cotati region provided a dramatic example of Sinclair's contention that land could lose all value for agriculture. The *Sonoma County Agricultural Crop Report* for 1962 stated that:

> Seed crops for a number of years were produced in large quantities on the Rohnert Seed Farms and were an important segment of the agricultural economy of the County. Many kinds of vegetable, flower, and grass seeds were produced. This farming operation has been discontinued as it lies in the path of urban expansion.[21]

The demise of this segment of the agricultural industry was a significant economic loss (Table 5).

Seed farms appear to have disappeared completely from the Rohnert Park area by 1970 and were directly replaced by the city of Rohnert Park, one of the most rapidly growing cities in California.

Table 5

SEED FARM ACREAGE AND COMMERCIAL VALUE

Year	Agreage	Commercial Value in Dollars
1950	1,800	630,000
1955	1,700	311,000
1960	1,600	157,000
1962	372	16,000

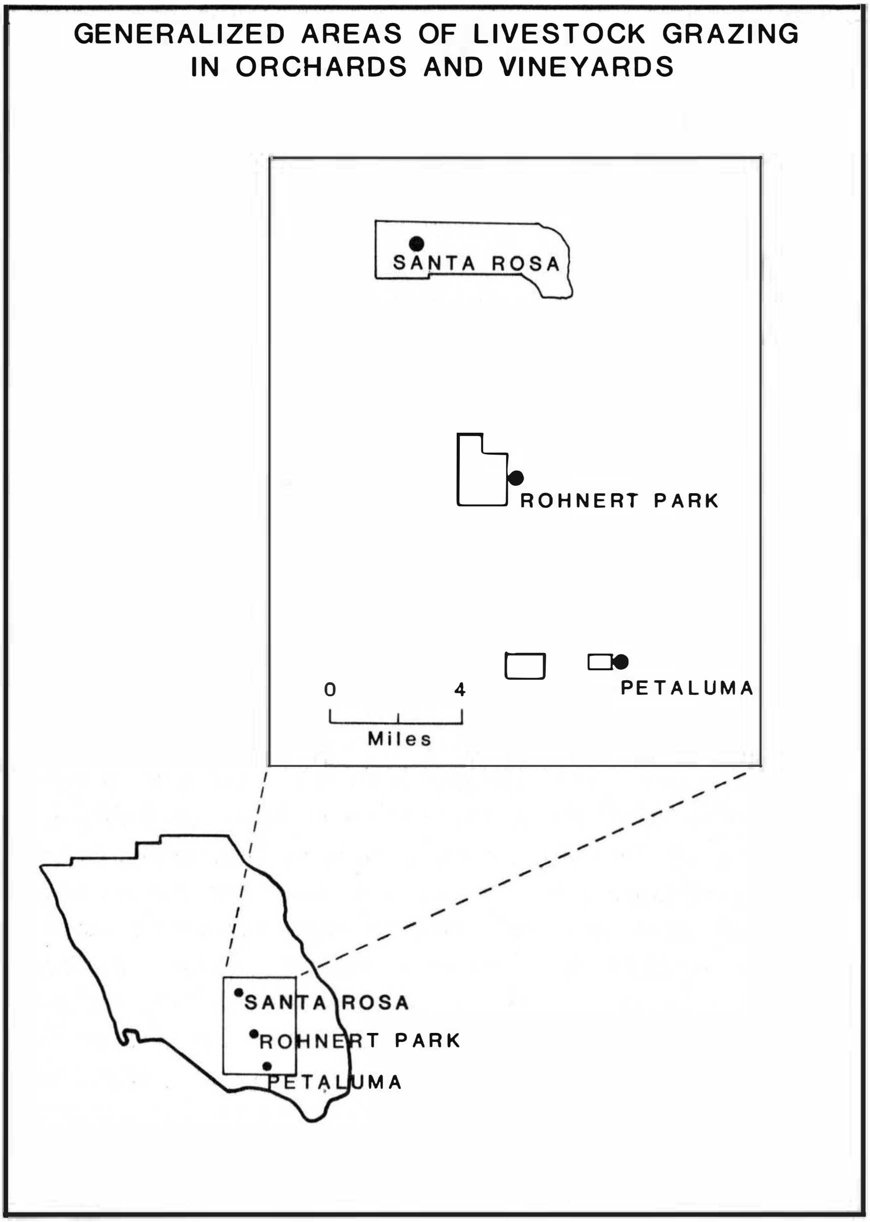
Source: County of Sonoma, *Agricultural Crop Reports,* 1950, 1955, 1960, 1962, (Santa Rosa: County of Sonoma).

Examination of Table 4 indicates a general, downward trend in one of the higher intensity agricultural land uses. At least one caviet with respect to these data is necessary. Market conditions and local weather anamolies play a role in the production of these orchard crops. Based on county agricultural records, however, it can be generally inferred that the economy and micro-climatological patterns were not responsible for broad changes in the occurrence of the crops listed in Table 4. The establishment of new orchards in the valleys far removed from the zone of competition between agricultural and urban uses was responsible for preventing a far more drastic drop in acreage used for orchard crops.

Agricultural statistics and census data alone do not provide sufficient data upon which to gauge the applicability of Sinclair's theory to this region. In order to achieve a fuller measure of the spatial dimension of this statistical information, interpretation was made of aerial photographs taken in 1951, 1962, and approximately 1970.

Through examination of aerial photographs it became evident that much of what Sinclair postulated about the patterns of agricultural land use did occur in the southern part of Sonoma County. Aerial photographs provided clear evidence of orchards going into disuse, with the total area involved largely reflected in the acreage changes listed in Table 4. In some cases, on the immediate edge of the urban fringe, orchard and vineyard lands were converted to grazing uses while potentially productive trees and vines still remained on the land. In the areas surrounding Petaluma, Rohnert Park, and Santa Rosa, evidence was found of approximately 200 acres being involved in this most direct transition in land use (Figure 5). It should be recognized that this 200-acre figure undoubtedly understates the amount of land included in this particular aspect of conversion, as it is an approximation arrived at through personal photo-reconnaisance flights, sampling, and use of archival photographs and records. The southeastern Sonoma County valley in which the town of Sonoma is located

Figure 5


GENERALIZED AREAS OF LIVESTOCK GRAZING
IN ORCHARDS AND VINEYARDS
SANTA ROSA
ROHNERT PARK
PETALUMA
0
4
Miles
SANTA ROSA
ROHNERT PARK
PETALUMA

as well as the county's extreme northern valleys, all far removed from the most active competition for land during the study period, were the sites selected for new, high-capital and labor-intensive agricultural pursuits.

Conclusion

Much of what Sinclair expected from his model of land-use change occurred in Sonoma County between 1950 and 1970. High-cost agricultural practices did give way to lower-input uses or no agricultural use of the land at all. Zones of land without value for agriculture developed. The highest capital- and labor-intensive agricultural uses were found at greater distances from the expanding urban fringe. A substantial portion of this movement took place long before actual suburban encroachment forced agriculturalists to relocate. Sinclair's observation that mere perception of potential speculation was an important factor in the location of agricultural activities was seemingly borne out as some agricultural practices were reduced from high- to low-intensity fully a decade before suburbs began to bound fields, orchards, or vineyards.

Attempts to model land use, especially land-use change, are always fraught with dangers of over-generalization, restatement of the obvious, and failure to account for spurious influences. Sinclair's model generally avoided these pitfalls and provided an interesting and useful way in which to view the upheaval in the use of land near rapidly-growing cities. In any event, the Sinclair model of land-use change worked well in the particular case of Sonoma County, California, and was of great assistance in helping to provide an observation point from which to view this most dynamic period in the evolution of the Sonoma County landscape.

NOTES

1. Robin J. Pryor, "Defining the Rural-Urban Fringe," in Larry S. Bourne, ed., *Internal Structure of the City:*

Readings on Space and Environment (New York: Oxford University Press, 1971), p. 62. Continuing a long-standing trend of being among the leaders, Marin County, with an average of $17,428 per inhabitant, led California in per capita income in 1981. According to data provided by the Bureau of Economic Analysis, United States Department of Commerce, for that same year per capita income for California was $11,968 with the national per capita income standing at $10,495.

2. Ibid., p. 62.
3. Howard Gregor, "Urban Pressures on California Land," *Land Economics*, 33 (1957), p. 315.
4. Jan O.M. Broek, *The Santa Clara Valley, California: A Case Study in Landscape Changes* (Ph.D. dissertation, University of Utrecht, 1932).
5. Gregor, op. cit., pp. 311-325.
6. Gregor, op. cit., p. 322.
7. Paul F. Griffin and Ronald L. Chatham, "Urban Impact on Agriculture in the Santa Clara Valley, California," *Annals*, The Association of American Geographers, 48 (1958), pp. 195-208.
8. For example see: L.M. Faust, "The Eugene, Oregon, Rural-Urban Fringe," *The Rural-Urban Fringe, Proceedings of the Commonwealth Conference* (Eugene: University of Oregon, 1942), pp. 5-12; Richard B. Andrew, "Urban Fringe Studies of Two Wisconsin Cities, A Summary," *Journal of Land and Public Utility Economics*, 21 (1945), pp. 375-382; Malone Young, "Some Geographic Features of the Urban Fringe," *The Southeastern Geographer*, 2 (1962), pp. 1-6.
9. For example see: N.R. Wills, "The Rural-Urban Fringe: Some Agricultural Characteristics with Specific Reference to Sydney," *Australian Geographer*, 5 (1945), pp. 29-45; R.J. Johnston, "The Population Characteristics of the Urban Fringe: A Review and Example," *Australian and New Zealand Journal of Sociology*, 2 (1966), pp. 71-82; R.E.

Pahl, "Urbs in the Rure: The Metropolitan Fringe in Hartfordshire," *London School of Economics and Political Science, Geographical Papers*, 2 (1962), pp. 52-63.

10. J. Heinrich von Thunen, *Der Isolierte Staat in Beziehung auf Landwirtschaft und National Okonomie* (Rostock, 1826). The translation used in the study is from Peter Hall, ed., *Von Thunen's Isolated State* (New York: Pergamon Press, 1966).
11. Michael Chisholm, *Rural Settlement and Land Use* (Chicago: Aldine Publishing Company, 1972), pp. 21-32.
12. Robert Sinclair, "Von Thunen and Urban Sprawl," *Annals*, The Association of American Geographers, 57 (1967), pp. 72-87.
13. Ibid., p. 80.
14. Ibid., p. 78.
15. Ibid.
16. Ibid.
17. Ibid., p. 80.
18. Jean Gottman, *Megalopolis: The Urbanization of the Northeastern Seaboard of the United States* (Cambridge, Mass.: The M.I.T. Press, 1964 ed.).
19. For an excellent treatment of this subject see: Peter Muller, *Contemporary Suburban America* (Englewood Cliffs: Prentice-Hall, 1981).
20. U.S. Census of Population: 1960. *Selected Area Reports: SMSA, Social and Economic Data for Persons in SMSA's by Residence Inside or Outside Central City*, Final Report PC(3)-LD. 1960-1970; data from Peter O. Muller, *The Outer City: Geographical Consequences of the Urbanization of the Suburbs* (Washington, D.C.: Association of American Geographers, 1976), Resources Paper No. 75-2, p. 4.
21. Percy F. Wright, *Sonoma County Annual Crop Report* (Santa Rosa: County of Sonoma, 1962), p. 5.

FOOD SUPPLY REGIONS FOR THE CALIFORNIA GOLD RUSH

*Lary M. Dilsaver**

Prior to January 24, 1848, California was a distant, pastoral territory of the United States. On that date, the foreman of a sawmill construction crew discovered gold on the banks of the American River, and the non-Indian population of approximately 10,000 exploded to more than 200,000 by the end of 1850. At least 100,000 more were added by 1855. The new immigrants came by land over the California and Santa Fe Trails, across Mexico, and from Canada. They came by sea around the horn and by way of Panama and Nicaragua. Virtually all came for the single purpose of mining gold. From Europe, Asia, North America, and South America they poured into the sleepy territory, bringing enough supplies for only a few weeks or a few months worth of mining. Almost all planned to return home in a short time with enough gold to ease the labors of their remaining lives.

Settling throughout the foothills of the Sierra Nevada and other California mountain ranges, this vast army of miners created a huge demand for food supplies which immediately outstripped California's small agricultural output. Contemporary observers deplored the paucity and monotony of available foods. Frenzied scenes greeted each arriving pack train or cattle drive as hungry miners competed for meager

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supplies. Prices for all products soared to previously unimagined heights, such as one dollar for a single egg.[1]

These grossly inflated prices, along with perception of the California market as a long-term one and prompt payment in gold, created a commercial atmosphere that electrified the countries and territories of the Pacific Basin and western North America. The Royal Hawaiian Agricultural Society reported happily in 1850:

> The extension of the territory and government of the United States to the borders of the Pacific, the wonderful discoveries in California, and the consequent almost instantaneous creation of a mighty state on 'the western front of the American Union, has, as it were, with the wand of a magician, drawn this little group (Hawaii) into the very focus of civilization and prosperity.[2]

Virtually overnight, areas only recently settled by advancing European and American frontiers were drawn into an international, commercial network of remarkable growth and proportions.

From the beginning, this difficult but potentially lucrative trade in foodstuffs magnified geographical relationships which, in turn, fostered spatially unequal economic development over the Euro-American frontier of the Pacific Basin and adjacent coastal Americas. The intent of this paper is to define the major regional patterns of this food system and also to identify the logistical factors behind geographic inequality of trade participation and economic development that occurred as a byproduct of that trade.

Spatial Patterns in the Supply Trade

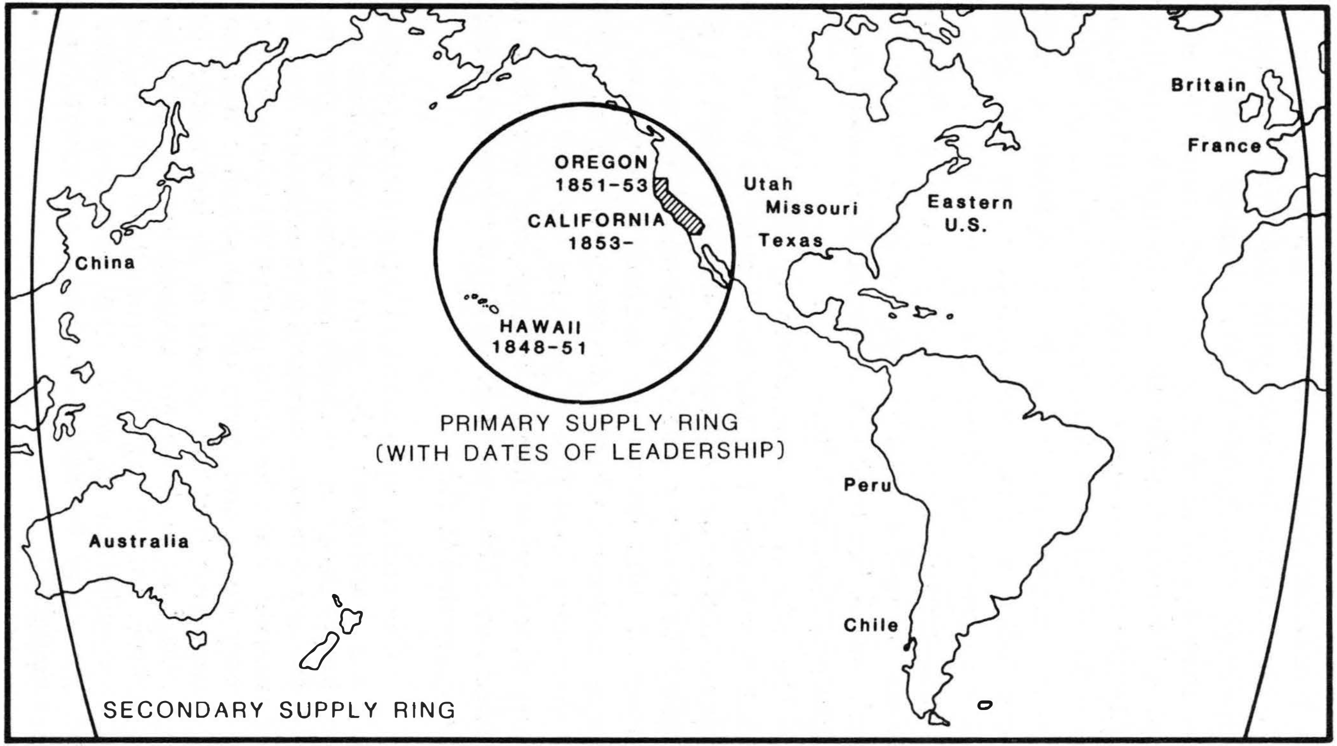
In the five years between the discovery of gold in 1848 and the establishment in 1853 of sufficient California agriculture to feed the state's population, two principal spatial patterns developed in the supply system. First, there was a segregation of supply regions into a pair of rings around the market, determined by distance (see Map 1). The outer ring included a group of secondary supply regions which faced transport journeys of more than two months each way. Typical one-way journeys for this geographical group required 64 to 79 days from Chile, 66 to 80 from China, 84 to 93 from Australia, and 165 to 200 from either New York or Britain[3]. Because of great distance and high transport costs, these suppliers each provided a relatively small variety of products which could withstand the long trip and for which there was a particulary high demand. Thus, Australia sent wheat and flour.[4] Chile and Peru sent wheat, flour, and potatoes.[5] Texans, Mormons from Utah, and even enterprising traders from Missouri and Arkansas drove cattle and hogs to the mines.[6] The eastern United States sent dried fish, liquor, and other processed products.[7] Distant China supplied rice, fish, and tea, as well as particular dietary products demanded by the growing population of Chinese miners in California.[8]

Inside this group was a closer ring of primary supply regions. The principal components of this ring were the kingdom of Hawaii, the territory of Oregon, and California itself. Due to their relative proximity, these regions supplied both a greater proportion and a greater diversity of the foodstuffs.[9] A second geographical pattern emerged within this group as each of these three regions successively held the role of principal supplier to the gold fields. Immediately after the discovery in 1848, Hawaii dominated the trade, only to be replaced by Oregon around 1851, and California in 1853. With each shift, the former supply leader faced a trade loss of potentially serious economic consequence.

Hawaii as Principal Supplier

Hawaii in 1848 was an outpost of New England. The arrival of Boston merchants and missionaries nearly three decades earlier had erased the fledgling British presence and supplanted it with Yankee influence. The New Englanders had quickly seized the ample, economic opportunities presented by the

PRIMARY AND SECONDARY SUPPLIERS TO GOLD RUSH CALIFORNIA



rich, plantation resources of land, labor, appropriate crops, and a lucrative market based principally on New England and European whalers. As late as 1851, although decline had set in, more than 400 whaling ships per year visited the islands for supplies.[10] Hawaii had become an important way station and distribution center for products moving to and throughout the Pacific Basin. Subsistence agriculture continued to feed most of the native population, but a base of commercial agriculture, concentrating on sugar, fruit, and potatoes, with appropriate marketing and transport systems, had evolved. Food produced for trade moved through the major ports of Honolulu and Lahaina, as well as smaller regional ports such as Waimea, Hanalei and Koloa on Kauai, Hilo and Kealakekua on Hawaii, and the tiny island of Niihau.[11]

At the time of the gold discovery, both whaling and the market it provided had peaked. Depletion of much of the whale population and widespread use of competitive products curtailed the need for whaling ships and threatened Hawaiian commercial agriculture with economic depression. Hence, when news of the California discovery arrived, agriculturalists and merchants were free to embrace the new market. Local traders shook off economic lethargy and scrambled to meet new demands. The newly-formed Royal Hawaiian Agricultural Society reported in 1850:

> Our coffee and sugar no longer remain piled in our warehouses. Our fruits and vegetables no longer decay in the spot where they were grown. We are not even compelled to seek for them a market, but clamorous purchasers come to our very doors and carry off our supplies with an eagerness that has caused us to feel a scarcity ourselves, and we are assured for not only all these, but for any other products of the soil that we will raise, a steady and increasing demand that may be relied on from our enterprising neighbors.[12]

With journeys to California taking only 21 to 36 days, visits by merchant ships rose from 90 in 1848 to 180 in 1849, 469 in 1850 and 446 in 1851.[13] Production was diversified and rapidly increased, while a brisk trade in Irish potatoes, sweet potatoes, and other vegetables, plus coffee, sugar, wheat, poultry, and fruit developed.[14] Despite emigration to California, by foreign and Hawaiian labor, the number of farms and farm acreage in Hawaii quickly expanded, as oldtimers and newcomers rushed to cash in on the bonanza. Former whalers, seamen, missionaries, and miners became farmers overnight, some in the infant sugar trade, despite a complete absence of any experience with the crop.[15] Serious repercussions resulted, including skyrocketing land values. By 1850 land formerly worth one dollar an acre was selling for five, and vigorous political pressure resulted in the repeal of laws prohibiting land ownership by non-naturalized foreign born. Particularly favored in this expansion was Maui, where the cool slopes of Haleakala produced hundreds of tons of potatoes for export. Between July 1850 and June 1851, at the height of supply by the Hawaiian Islands, the port of Lahaina accounted for 20 percent of the sugar, 80 percent of the syrup, 47 percent of the sweet potatoes, 68 percent of the onions, 96 percent of the Irish potatoes, more that two-thirds of the tropical and citrus fruits, and all of the butter exported by the kingdom.[16] Hawaii forged toward a goal of production sufficient to supply itself and the mainland mines (Table 1.).

Table 1[17]

Agricultural exports from the Hawaiian Islands

	1848	1849	1850	1851
Sugar, lbs.	449,533	653,820	750,238	21,030
Coffee, lbs.	58,065	28,231	208,428	27,190
Irish Potatoes, bbles.	147	858	51,957	43,923
Molasses, gals.	28,978	41,235	53,855	13,631
Salt, bbls.	4,570	2,866	6,000	3,719
Value of Exports	$66,819	$89,744	$380,323	$197,889

Even as Hawaii recorded its highest annual shipping totals for the nineteenth century in 1850 and 1851, the promising, mainland trade collapsed, almost as quickly as it began. Labor costs continued their burdensome increase as remaining workers used the threat of emigration to inflate wages. Far more serious, however, was the rise of competition from Oregon. Wheat and potatoes from California's closer neighbor flooded the San Francisco market, depressing prices and underselling Hawaiian products. Island grown potatoes, the mainstay of the trade for several years, were especially hard hit. During the 1849 and 1850 seasons, eager merchants and planters had shipped substandard potatoes and even seeding stock in their frenzy to make a financial killing. This episode fostered a bad reputation for Hawaiian potatoes. For a while merchants overcame the problem by fraud. The Agricultural Society reported unabashedly, "many an island red Irish potato has graced the tables of California as 'fresh from Oregon...' " Hence, when Oregon did begin to provide its own potatoes in sufficient numbers and quality, no hope remained for Hawaii's growers.[18]

For the Islands, the effect of a basic shift in food-supply zones was catastrophic. Unrealistic land speculation and immense over production, coupled with inflated wages ruined many entrepreneurs. The same men who, in early 1850, had boasted of a "steady and increasing demand," now lamented:

> California, the great market of the Island, is now paralyzed; and the immense importation of sugar and other products...has reduced the prices of most articles of our produce below their prime cost.[19]

Scores of planters and merchants went bankrupt, and much of the newly planted land reverted either to native agriculture or to forest. From the century's high of 469 in 1850, the number of merchant ships visiting Hawaii plummetted to only 125 three years later.[20] Ultimately, Hawaiian agriculture stabilized around production and trade of tropical products, especially sugar. In the process, however, many learned a hard lesson relating to the inconsistancy of supply and demand in a gold rush economy (see Table 1).

Oregon as Principal Supplier

Oregon's permanent Euro-American settlement began with the arrival of Yankee pioneers in the 1830's, although a fur-trading post had been established two decades earlier. The early settlers consisted primarily of missionaries and farmers. With the tacit support of Dr. McLoughlin of the Hudson's Bay Company, the Americans built a network of tiny settlements along the Willamette, Umpqua, Rogue, and Cowlitz rivers. Each area contained a scattering of people with "simple wants, few goods, arduous toil, and the realization that they dwelt on the edge of the world."[21]

The Oregon settlements learned of the California gold discovery from the captain of a visiting ship in the summer of 1848, and they immediately fell prey to emigration. The first wagon train, carrying 150 prospective miners, departed overland for California only a few weeks later. Ultimately, at least two-thirds of Oregon's able-bodied men deserted their farms and families to join the mining rush.[22] Even before this emigration, Oregon's agricultural system was poorly suited to the new economic situation. The British fur trade had declined, and Oregon settlers operated a frontier agricultural economy based on local subsistence farming. Thus, initially, Oregon was able to supply only a small portion of the demand for food. Although traders delivered a few staples like wheat and potatoes by ship and drove cattle to the northern California mines during the period 1848 to 1850, Oregon posed little threat to Hawaiian trade dominance.

By summer of 1851 the situation had changed. Indeed, change was foreshadowed as early as spring of 1849 when, only months after their departure, an estimated 1500 Oregonians had returned from California mining districts, bringing with them more than $2,250,000, or some $1,500 apiece, in gold. Drawn home by families and temporarily abandoned farms, they returned not only with adequate funds for farm-improvements, but also with a keen, first-hand appreciation for the potential money to be made in food supply. The remainder of 1849 and much of 1850 were spent using their hard-won money and knowledge to extend improved farmland, plant more crops, and increase participation in the California food trade. In Oregon prices were high—ten dollars for a bushel of apples—but in California apple prices in 1849 occasionally reached $125 per bushel and remained inflated for several more years.[23]

Returning miners were supplemented by new settlers. Some had come from California or the eastern United States to search for gold in Oregon's newly discovered Rouge River fields, and turned to farming thereafter. Others had come deliberately to pursue agriculture. During the first two years of the gold rush, Oregon continued to attract a trickle of settlers who preferred its farmlands to California's alluring but unstable mining economy. The passage of the Land Donation Act of September, 1850, increased this trickle to a steady flow. This liberal act granted 320 acres to all male settlers above the age of eighteen who were citizens, or who declared their intention of becoming such by December 1, 1850. In addition, if a settler was married or chose to marry before December 1, 1851, his wife also received 320 acres. New settlers arriving between December, 1850, and December, 1853, received 160 acres if single or 320 acres if married.[24] Most farmers—new, returning, or stay-behinds—quickly adapted to the new supply trade.

Apples, vegetables, beef, and especially potatoes and flour, all staples of Oregon's subsistence agricultural economy, were also items much sought after by a California mining population dominated by Americans and western Europeans. Hence, production of these already familiar commodities allowed a relatively easy transition to an expanded, commercial production system and the establishment of a marketing network which saw Oregon products move to California along three routes. Ships carried foodstuffs from the Willamette and Columbia Rivers to San Francisco, taking less than half the time a voyage from Hawaii did. During the period 1846 to 1850, the number of annual visits by trading ships rose from eight to fifty. In the process, the focus of settlement shifted from inland Oregon City to Portland.[25] A second route, also by sea, took ships to Humboldt Bay, from whence mule trains carried food, lumber, and tools to the northern mines.[26] The third route was a laboriously carved wagon trail, completed by the spring of 1849, which followed the Rouge River to Klamath Lake and then turned south into California. Despite periodic attacks by local Indians, scores of wagon and pack trains plied this route every month, bringing products from Oregon's revitalized agricultural communities to California markets.

As in the case of Hawaii, Oregon's role as the dominant supplier to California exercised their logistical advantage to the detriment of Oregon trade. However, Oregon did not suffer the same fate as Hawaii for two reasons. First, mining had expanded into the Pacific Norhtwest reaching southern Oregon by 1851. Later in the decade, miners penetrated British Columbia, Idaho, and Montana. Oregon farmers and the city of Portland served those regions as well as the teamsters and sailors bringing California materials to the north. Second, the population of Oregon and adjacent territories continued to grow rapidly, jumping from 13,087 to more than 63,000 during the 1850's. This rapid expansion into the Northwest, for both mining and agricultural purposes, prevented the catastrophic depression that plagued Hawaii. Although Oregon certainly missed the California trade, the Northwest became an important settlement region itself and the Willamette and adjacent valleys its major suppliers.

The Rise of California Agriculture

Of course, the effect of the gold rush was nowhere greater than in California, where a simple agricultural economy with a variety of crops for local consumption, but only hides and tallow from cattle as a significant export, all but disappeared under the onslaught of tens of thousands of eager miners. Logically, the creation of such a huge demand would suggest that rapid growth and tremendous financial returns should occur in cattle raising and agriculture. For several reasons, however, the livestock industry proved wholly inadequate to the demand. First, according to Thomas Larkin and other gold rush observers, Californians hastily abandoned not only cities and farms, but also military installations, coastal shipping, and the old ranchos throughout much of the future state.[27] Additionally, the largest cattle herds were located in southern California, a full month's trail drive from Sierra mining districts. This meant that, in terms of transport time, the main cattle rearing areas of California were more distant than either Hawaii or Oregon. Finally, the California cattle trade was hurt by the practice of selling off breeding stock, in an effort to maximize profits while prices were inflated during the first eighteen months of the rush. The net result of this practice was a decline in the cattle population averaging more than 15,000 head per year for several years thereafter.[28]

As the boom years wore on, many miners tired of the deprivation and disappointments of mining and sought alternate economic pursuits. By 1850, agriculture had reappeared in many of the coastal valleys and in the delta region of the Sacramento and San Joaquin rivers. Areal expansion into the Central Valley and substantial production increases followed.[29] By 1853, California clearly dominated the supply trade to its own mining regions. A year later, the new state's governor could report to the legislature that "the products of the year 1854 are generally believed to be amply sufficient for the supply of the home market."[30] From that time onward, California has not only supplied itself, but also become the nation's largest agricultural exporter.

Conclusion

These two geographical patterns—the division of suppliers into primary and secondary rings, and the succession of principal suppliers—illustrate the uneven impact that the California gold rush exerted on the rest of the Euro-American frontier. Factors responsible for these patterns can be divided into two sets: (1) The relative proximity of each supply region to the California market, influenced by distance, mode of transport, and barriers, such as adverse ocean currents, mountains, deserts, or hostile Indians; and (2) the agricultural production and marketing ability of each region, influenced by type and amount of foods produced, amount of local demand for food products, and the scale of commercial marketing facilities available.

Distance, conceived as time necessary for a supply excursion, quickly reduced many areas to secondary roles in the supply trade. Trips from distant supply regions took twice as long or more, requiring these merchants to hire more cattle drovers or send more ships to compete with closer suppliers. This proved impossible as desertion from incoming ships and pack trains decimated the labor ranks.

Among the primary suppliers, initial lack of capacity to produce and transport foodstuff negated the proximity factor. With a firmly established commercial economy, relatively distant Hawaii assumed an early lead. However, once production and marketing recovered and expanded in Oregon and later in California, proximity led to the shift of trade primacy and the eventual ascendancy of California agriculture.

The gap between demand and supply was so vast in the early years of the rush that it encouraged hasty, speculative development wherever possible. Thus, Hawaii paid for its early lead with nearly a decade of economic depression. The slower development of Oregon and a more dispersed network of markets resulted in preservation of the territory's agricultural economy after the supply trade deserted to California.

Food supply is a fascinating subject, and never more so than when it results from a demand as enormous and sudden as that of gold-rush California. Production ability and distance were the major factors in generating the spatial patterns of this trade. But many questions remain unanswered. What effect did various political powers have on the trade response from their colonies? What role did the ethnicity of the California mining population have in determining the products demanded?

And, ultimately, what role did the rush for California gold—the geographical event and its subsidiary influences—have in the long-term settlement and economic development of the Pacific Basin and western North America?

NOTES

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2. *Transactions of the Royal Hawaiian Agricultural Society,* 1 (1851), p. 6.
3. "Boats Arriving in San Francisco Bay from March 26, 1849, to December 30, 1849," *Quarterly of the Society of California Pioneers,* 1 (1928), pp. 36-45.
4. Joan Margo, "The Food Supply of the California Gold Mines, 1848-1855" (unpublished Master's thesis, University of California, Berkeley, 1947), pp. 88-101.
5. Jay Monaghan, *Chile, Peru, and the California Gold Rush of 1849* (Berkeley: University of California Press, 1973), pp. 168-174.
6 J. H. Atkinson, "Cattle Drives from Arkansas to California Prior to the Civil War," *Arkansas Historical Quarterly,* 28 (1969), pp. 275-281; James G. Bell, "A Log of the Texas-California Cattle Trail, 1854," *Southwestern Historical Quarterly,* 36 (1932), pp. 47-66; Robert Cleland, *The Cattle on a Thousand Hills* (San Marino: The Huntington Library, 1941), p. 144.
7 Margo, op. cit., pp. 88-101.

8. Robert F. G. Spier, "Food Habits of Nineteenth-Century California Chinese," *California Historical Society Quarterly*, 37 (1958), No. 1, pp. 79-84; No. 2, pp. 129-136.
9. It appears that Mexico and Central America were never major suppliers, despite their relative proximity. There were several reasons for this. First, the areas of Mexico nearest to California were agriculturally unproductive. Tropical areas further south faced the adverse California current, and journeys to San Francisco from Mazatlan took four to six weeks ("Boats Arriving in San Francisco Bay," op. cit., pp. 36-45). Second, agricultural surpluses in Mexico and Central America were quite small, and much was consumed by the Argonauts crossing at Tehauntepec or stopping along the coast on their way from Panama to California.
10. *Transactions of the Royal Hawaiian Agricultural Society*, 1 (1851), pp. 86-87; 2 (1852), p. 140.
11. Ibid.
12. Ibid., 1 (1851), p. 77.
13. Joseph T. Morgan, *Hawaii, A Century of Economic Change, 1778-1876* (Cambridge, Mass.: Harvard University Press, 1948), pp. 154-155.
14. *Transactions of the Royal Hawaiian Agricultural Society*, 1 (1851), p. 77.
15. Sylvester K. Stevens, *American Expansion in Hawaii, 1842-1898* (New York: Russell and Russell, 1945), pp. 31-35.
16. *Transactions of the Royal Hawaiian Agricultural Society*, 1 (1851), pp. 86-87.
17. Ibid., p. 90. Although total exports are listed in this table, the variance was provided by the California demand.
18. Ibid., 2 (1852), p. 140.
19. Ibid., 1 (1851), p. 9.
20. Morgan, op. cit., p. 154-155.
21. Leslie M. Scott, "The Pioneer Stimulus of Gold," *The*

Quarterly of the Oregon Historical Society, 18 (1917), p. 149.

22. Anna L. Guest, "The Historical Development of Southern Oregon, 1825-1852" (unpublished Master's thesis, University of California, Berkeley, 1929), pp. 61-68; Charles H. Carey, *A General History of Oregon Prior to 1861* (Portland, Oregon: Metropolitan Press, 1935), p. 479.
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24. Carey, op. cit., pp. 481-482.
25. Guest, op. cit., pp. 61-71.
26. Oscar O. Winther, "Pack Animals for Transportation in the Pacific Northwest," *The Pacific Northwest Quarterly*, 34 (1943), p. 131.
27. Thomas O. Larkin, "Letter to James Buchanan, July 28, 1848," printed in *House Executive Document 1*, 30th Congress, Second Session, 1848-1849, pp. 53-56.
28. Cleland, op. cit., pp. 144-146.
29. For background on early California agriculture see: Jan O. M. Broek, *The Santa Clara Valley, California: A Study in Landscape Changes* (Ph.D. dissertation, University of Utrecht, 1932); Cleland, op. cit.; Margo, op. cit.; Effie Martin, "The Development of Wheat Culture in the San Joaquin, 1846-1900" (unpublished Master's thesis, University of California, Berkeley, 1924); Agnes O'Connell, "The Historical Development of the Sacramento Valley before 1848" (unpublished Master's thesis, University of California, Berkeley, 1930); Wallace Smith, "The Development of the San Joaquin Valley, 1772-1882" (unpublished Ph.D. dissertation, University of California, Berkeley, 1932).
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PROPOSED HYDROELECTRIC POWER PLANT LOCATIONS: INYO AND MONO COUNTIES

*Larry Simon**

Introduction

The number of permit applications for small hydroelectric power plant development (less than 25 Mw) in Inyo and Mono counties has increased dramatically since 1980. The availability of undiverted streams with suitable gradients and flow rates, Federal land ownership, and regulatory and economic incentives have resulted in increased numbers of applications to the Federal Energy Regulatory Commission (FERC).

The development of California water resources has consistently been an important field for geographic research and application. The *Central Valley Project Studies*, development of statewide water plans, and publication of the landmark *California Water Atlas* all used geographers.[1] The future of the State Water Project and the management of Owens Valley water resources are two of the more controversial issues recently examined from a geographic perspective.[2]

The State Water Resources Control Board (SWRCB) recently ordered that a "cumulative impact" study of potential regional economic and environmental impacts associated with small-hydro development in Inyo and Mono counties must be completed prior to approval of pending applications.[3] The unique perspective and skills that geographers possess are well suited

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to this type of regional resource analysis.

A significant problem for government agencies charged with evaluating potential impacts is a lack of aggregate locational information on all proposed projects. The precise locations of all proposed small-hydro facilities in Inyo and Mono counties are unavailable in a unified tabular or cartographic form.[4] The design of a map illustrating the location of all proposed projects is essential to the aforementioned regional analysis and is the primary objective of this report.

The main body of the paper includes a discussion of the importance of the research problem in a regional context, an analysis of incentives for small-hydro development in Inyo and Mono counties, an outline of research objectives, a review of the methodology, and a presentation of the project results.

Regional Analysis

Project locations currently can be determined only by reviewing individual FERC application notices, a time-consuming and inefficient process which greatly hinders any effort to visualize the potential impacts of proposed small-hydro development on a regional basis. A regional, dual-county evaluation is necessary to determine the cumulative nature of any environmental, economic, or cultural impacts which may result if aggressive development of the small-hydro resource is pursued.

Theoretically, while individual project impacts might be localized and manageable, the impact of up to several dozen such projects could be detrimental to the region's biological and economic environment. Confirmation of such a hypothesis would be difficult, if not impossible, were a regional approach not used. Rhoads Murphey wrote that, "The regional whole must be understood as the context in which any of its parts are to be examined since all of its parts are interrelated."[5] Numerous inquiries into water and energy issues have successfully employed a regional concept and the December, 1982, SWRCB ruling mandated a regional approach in the small-hydro study of Mono Basin and the Owens Valley.

Regulatory and Economic Incentives

Proposed hydroelectric projects in the Inyo-Mono region are targeted for relatively small streams, most with an average annual stream flow of less than 35 cubic feet per second.[6] Flow rates for six Inyo-Mono streams and three larger rivers in California are listed in Table 1.

Steep stream gradients compensate for low flow rates to provide potential generating capacity. Previously, these conditions would not have justified development of the resource. However, recent changes in energy regulatory and tax credit policies at both the Federal and State level have provided more than adequate incentive to a host of public- and private-sector project sponsors to pursue small-hydro development.

Table 1
Stream Flow Rates

Stream	Mean Annual Flow (cubic feet per second)
Tinemaha	7
Independence	12
Cottonwood	22
Rock	26
Lee Vining	68
West Walker	205
Kern	598
Tuolumne	1162
Feather	7040

Sources: Michael Donley, Stuart Allan, Patricia Caro, and Clyde Patton, *Atlas of California* (Culver City: Pacific Book Center, 1979), p. 143; California Department of Fish and Game, Bishop Office, small-hydroelectric power project files.

The Federal Public Utility Regulatory and Policy Act of 1978 (PURPA) requires FERC to establish rules encouraging small power production, requires investor-owned utilities to purchase such power, and authorizes certain exemptions from Federal and State permit processes. New Federal and State tax laws also provide numerous energy tax credits, loan guarantees, and bond programs for small power producers. Pending in the California legislature are bills requiring investor-owned utilities to pay small power producers avoided-cost rates for energy and to provide those producers interconnection with existing utility distribution grids.[7]

The result has been a flood of applications to FERC for permits to develop small-hydro projects in California. The California Department of Water Resources (DWR) reports more than forty projects in the Inyo-Mono region alone.[8]

Objectives

Development of the small-hydro resource is partly contingent upon satisfactory sponsor compliance with Federal and State statutes designed to protect physical, biological, and cultural resources from any adverse environmental impact. Inyo National Forest and California Department of Fish and Game (DFG) are the lead agencies in assessing potential environmental impacts of each project. The potential for individual and cumulative adverse impacts is well documented.[9] Inyo National Forest and DFG are simultaneously evaluating proposals on a site-by-site basis and attempting to assess the cumulative impact that widespread small-hydro development would have on the Inyo-Mono region.

In an effort to alleviate a critical deficiency in project location data essential to a cumulative regional hydropower analysis, three primary research objectives were designed: development of a master list of small-hydro projects proposed for Inyo and Mono counties, to include FERC number, stream, and installed capacity; location of each proposal on U.S. Geological Survey (USGS) fifteen-minute topographical quadrangles; and drafting a map of project locations at a scale of 1:250,000.

Methodology

Information necessary to compile a project list and draft a project map was located through a lengthy and detailed document search and review. California DWR publications on existing and proposed small-hydro resources provided the initial data on a majority of Inyo-Mono projects, including targeted streams, FERC numbers, installed capacity, and project sponsor. Subsequent examination of FERC application notice summaries in the *Federal Register* gave further project specifications but no accurate locational data.[10] The *Inyo County Small Hydroelectric Workbook* also was lacking in this respect, although additional projects were identified from both the *Workbook* and *Federal Register.*

Copies of FERC application notices for each proposal in the Inyo-Mono region, located at the DFG office in Bishop, proved to be the only useful source of accurate project locations. The FERC notices and accompanying documents (environmental studies, government reports) provided a wide range of both type and quality of locational data. Several notices included detailed topographical maps or township and range location while others provided only small-scale regional maps, stream names only, or verbal descriptions. Additional projects were discovered in the DFG files and added to the list. This data accumulation process emphasized both the difficulty in attempting a regional analysis of cumulative project impacts without necessary data and the immediate need for such summaries of locational information by DFG and Inyo National Forest.

Project specifics pertinent to the research objectives were then tabulated by both FERC number and stream location to permit cross referencing. Projects were located on USGS fifteen-minute topographic maps as accurately as on-file data would allow. A base map (1:250,000) of the Inyo-Mono region with overlays depicting current hydroelectric development and proposed small-hydro project locations was then drafted.

Results

Research findings are presented in both tabular and cartographic form. Complete listings of proposed small-hydro projects are arranged by FERC number and stream location (Table 2 and Table 3, respectively). Existing hydro-electric development within the region and proposed small-hydro projects are illustrated on separate maps (Figure 1 and Figure 2, respectively). Sixty-two small-hydro projects are listed and of those, forty-eight are accurately located on topographic quadrangles and the regional map produced here (Figure 2). Several of the listed projects consist of more than one powerhouse; this accounts for the more than forty-eight powerhouse symbols in Figure 2. In addition, there are competing FERC applications for development at several sites and these also are noted in Figure 2. Only a general site for each of the remaining fourteen proposals is known because of a lack of precise locational data on individual FERC application notices or accompanying documents.

Table 2
Proposed Hydroelectric Development
Arranged by FERC Number

FERC No.	Stream	Installed Capacity (kW)
3189	Lee Vining (now 3272)	—
3242	Rock	2500
3252	Green	*
3258	Pine	2000
3259	Wilson	1027
3272	Lee Vining	428
3413	Millner	700
3497	Millner	658
3525	Cottonwood, Lone Tree	417
3580	Piute	400

3582	Convict	300
3583	Horton	1400
3695	Pine	4680
3741	McGee	433
3835	Coldwater	350
3884	Morgan	950
4009	Millner	400
4051	Mill	*
4267	Piute	400
4314	Green	700
4669	Bishop	600
4854	Coldwater	100
5004	Bridgeport Dam	*
5115	Morgan	1450
5263	Independence	17,200
5277	Big Pine	8200
5280	Birch, Tinemaha, Goodale	10,050
5310	Cottonwood	4050
5329	Lone Pine	2700
5380	Goodale	2970
5381	Birch, Tinemaha	7180
5382	Little Pine	1700
5383	Lone Pine	1370
5384	Baker	600
5385	Big Pine	1370
5386	Independen	4950
5387	Cottonwood	4050
5425	West Walker	6200
5493	West Walker	22,720
5527	Little Walker	1300
5528	Silver	1700
5529	West Walker	6200
5599	Rock, Falls	30
5621	Rock	4000
5622	Virginia (now 6549)	—
5623	Robinson	*

5632	Marble	250
5852	Oak	100
5910	Baker, Big Pine	1720
5914	Big Pine	500
5933	Wolf	450
5934	Leavitt	450
5943	Cottonwood	8700
6114	Big Pine	5000
6134	West Walker	300
6135	Lost Cannon	*
6148	Tinemaha, Independence, Cottonwood	1500
6156	Pellisier, Middle Canyon, Birch	420
6158	Independence	*
6186	Birch, Tinemaha, Red Mountain	*
6187	Spring Canyon	*
6188	Tinemaha, Red Mountain	*
6549	Virginia	675
(CA.26570)	Warren Fork[a]	*

Note: *data not available.
[a]FERC number not available; SWRCB Water Right Application Number given.

Table 3
Proposed Hydroelectric Development
Arranged by Stream, North to South

Stream	FERC Number
Spring Canyon	6187
Lost Cannon	6135
Mill	4051
Silver	5528
Wolf	5933
Leavitt	5934
West Walker	5425, 5493, 5529, 6134
Little Walker	5527
Bridgeport Dam	5004
Robinson	5623
Green	3252, 4314
Virginia	6549
Wilson	3259
Warren Fork	(CA.26570)
Lee Vining	3272
Convict	3582
McGee	3741
Rock	3242, 5621
Morgan	3884, 5115
Pine	3258, 3695, 3884, 5115
Horton	3583
Bishop	4669
Marble	5632
Rock	5599
Falls	5599
Pellisier	6156
Middle Canyon	6156
Birch	6156
Cottonwood	3525
Lone Tree	3525

Millner	3413, 3497, 4009
Piute	3580, 4267
Coldwater	3835, 4854
Baker	5277, 5384, 5910, 5914, 6114
Big Pine	5277, 5385, 5910, 5914, 6114
Little Pine	5277, 5382, 5914, 6114
Birch	5280, 5381, 6186
Tinemaha	5280, 5381, 6148, 6186, 6188
Red Mountain	6186, 6188
Goodale	5280, 5380
Oak	5852
Independence	5263, 5386, 6148, 6158
Lone Pine	5329, 5383
Cottonwood	5310, 5387, 5943, 6148

The project listings and maps provide conclusive evidence of the intense degree of proposed development of the small-hydro resource in Inyo and Mono counties. Complete development would tap nearly every remaining perennial stream flowing down the east slope of the Sierra Nevada south of Sonora Pass. Together with planned development in the White Mountains northeast of Bishop and existing hydro-electric projects, hydropower generation could become a significant land use throughout the region (Figure 2).

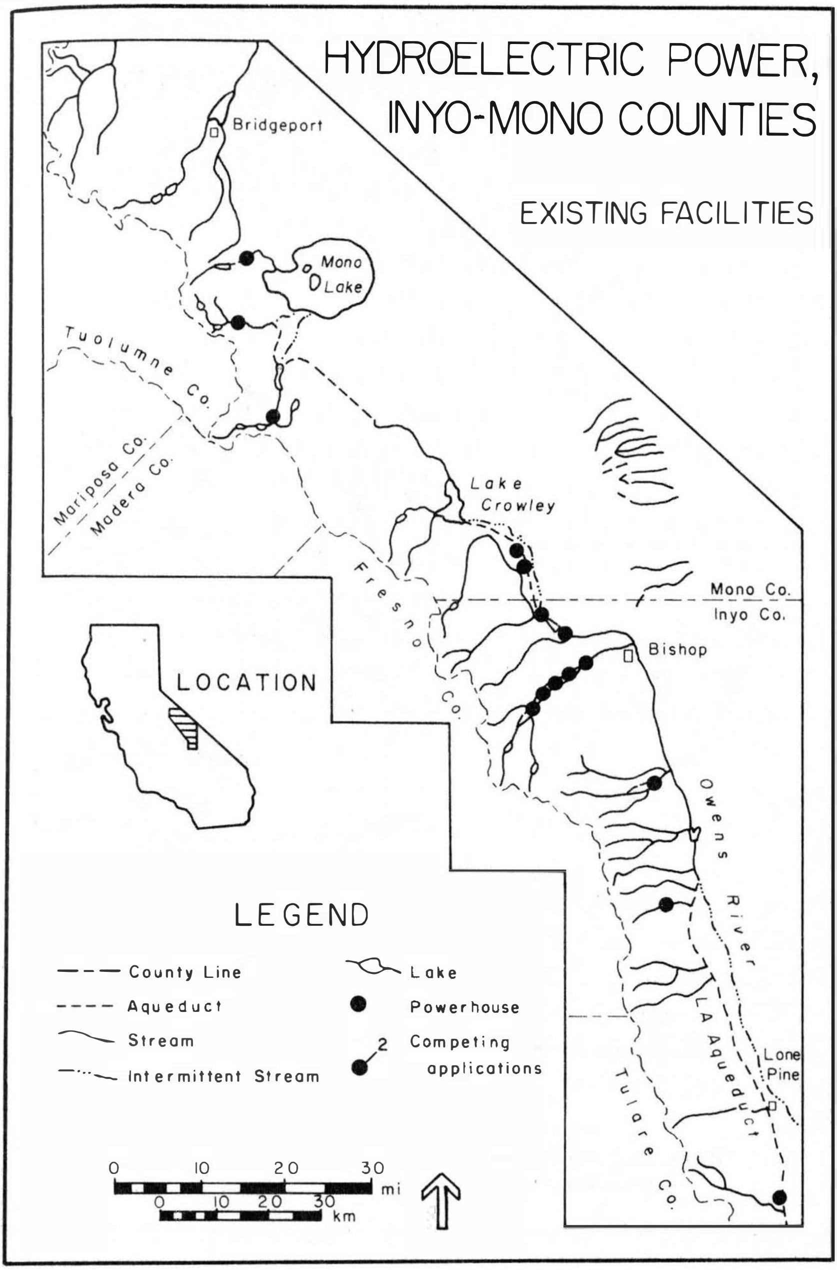
HYDROELECTRIC POWER, INYO-MONO COUNTIES
EXISTING FACILITIES
Bridgeport
Mono Lake
Tuolumne Co.
Mariposa Co.
Madera Co.
Lake Crowley
Fresno Co.
Mono Co.
Inyo Co.
Bishop
LOCATION
Owens River
LA Aqueduct
Lone Pine
Tulare Co.
LEGEND
County Line
Aqueduct
Stream
Intermittent Stream
Lake
Powerhouse
2
Competing applications
0
10
20
30
mi
0
10
20
30
km

Figure 1

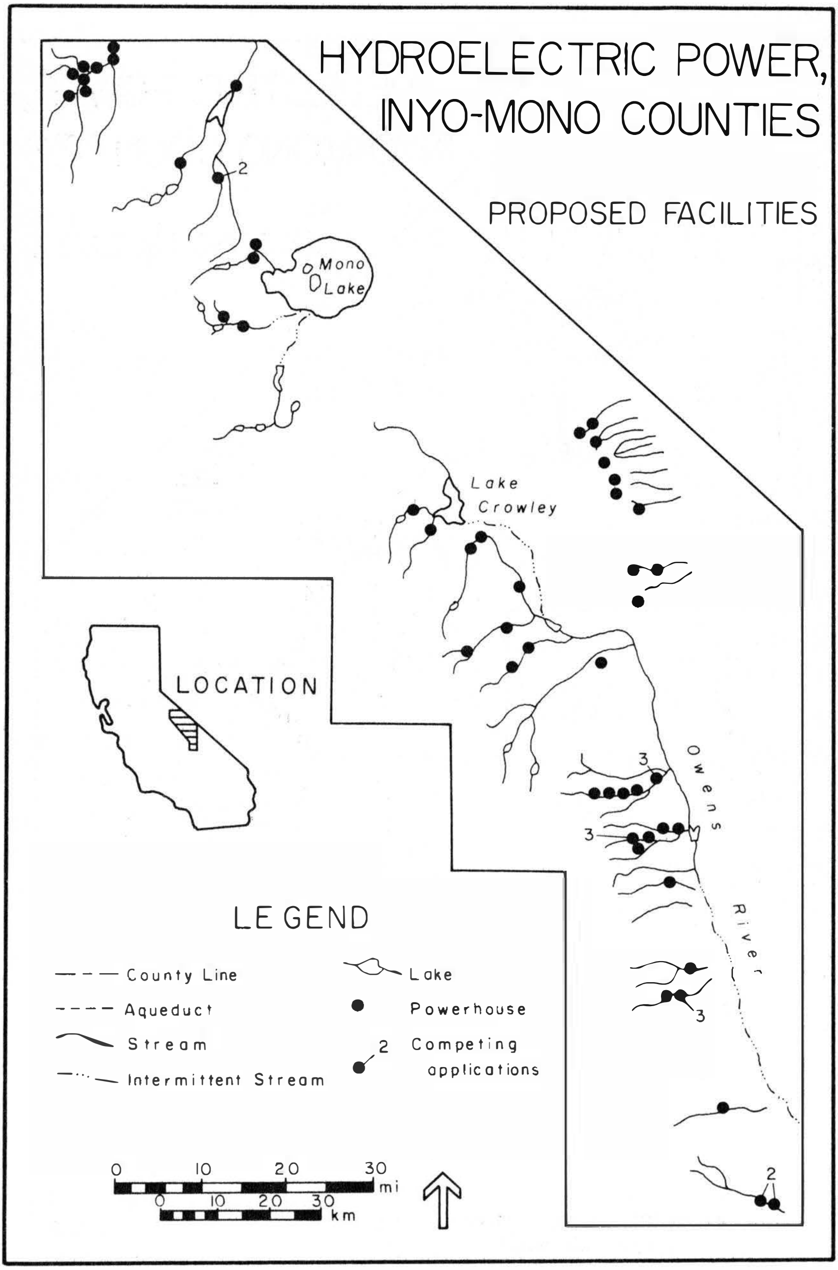
HYDROELECTRIC POWER, INYO-MONO COUNTIES
PROPOSED FACILITIES
Mono Lake
Lake Crowley
Owens River
LOCATION
LEGEND
County Line
Aqueduct
Stream
Intermittent Stream
Lake
Powerhouse
Competing applications
0 10 20 30 mi
0 10 20 30 km

Figure 2

Summary

Suitable hydrologic conditions in the eastern Sierra Nevada coupled with a favorable regulatory and economic climate toward small power production have resulted in a large number of applications for small-hydro development in Inyo and Mono counties. A regional understanding of the potential cumulative impact on the environment from wide-spread small-hydro development has been hampered by the absence of a complete listing and a regional map of proposals for both counties. A detailed review of all available government documents and project summaries has provided a tabulation of proposed projects and a map accurately locating these projects.

The results of this study indicate the potential areal extent of total development of the small-hydro resource and will assist in efforts to identify potential cumulative impacts on scenic, recreational, and fishery resources. Evaluating small-hydro development decisions in a regional context rather than on an individual site basis appears logical based on the large number of proposals and the potential for near-complete use of all perennial stream flows in both counties for hydroelectric power generation.

NOTES

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THE SOCIAL AND POLITICAL IMPACT OF APPLIED TECHNOLOGY: THE CASE OF REMOTE SENSING

*William R. Daniel and Joseph S. Leeper**

Virtually every policy analysis textbook contains statements regarding the vast amount of information needed in order to make effective decisions in our modern, complex society. This "need for data" has generated major technological advances in the fields of information gathering, storage, and retrieval systems. One such advance has involved the development and refinement of a sophisticated "remote sensing" technology.

Remote sensing is a new and rapidly growing technology which, in the not too distant future, may have a profound impact on society as we know it. While the actual use of remote sensing instruments is nothing new, accelerated development and expansion of the capabilities and uses of remote sensing technology are a by-product of the United States' space program of the 1960's. Since that time, a number of satellites with sophisticated "sensing" instruments on board have been launched for the express purpose of providing scientists, educators, political decision makers, private industry, and others with a vast array of new knowledge about the earth's surface. New developments in terms of instruments, data processing, and dissemination of information are occurring on an almost daily

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basis, to the extent perhaps that "pure" technology is outstripping our ability to use it. That some experts consider remote sensing to be a powerful data gathering tool with broad applicability is best exemplified by remarks of Dr. Robert Colwell at the first annual Conference of Remote Sensing Education: "Within a few years there will be very substantial progress toward a globally uniform information system, based primarily on remote sensing data."[1]

"Pushers" of remote sensing argue that the technology offers tremendous benefits for mankind. Remote sensing, it is argued, will be invaluable to public agencies (local, state, national, and international) and private industry as well, in areas ranging from the discovery of new sources of oil to urban land use planning. While remote sensing technology may well offer potential benefits, one must ask (as one must with any technological advance) are there potential harmful consequences connected with the use of remote sensing? If so, are these consequences controllable? If uncontrollable, does potential harm outweigh potential benefits? What is the potential impact of remote sensing technology on political and social organizations, or on individuals? Given the high degree of probability of extensive use of remote sensing technology, the answers to these questions become exceedingly crucial; for we are reminded that "The development and application of a new technology without a careful assessment of its impact poses a grave threat to the quality of life as we know it."[2] Unfortunately, these and similar questions are not being asked. The major orientation of those knowledgeable in the area focus almost exclusively on the technical aspects of gathering of quality data for use in rational decision making.

Thus the emphasis is placed on information gathering and analysis, and possible latent functions of extensive use of remote sensing tend to be ignored. There is a substantial volume of literature dealing with the "scientific aspects" of remote sensing as well as a body of material, proclaiming the virtues of the technology, which borders on propaganda. Also, there exist a number of applications of cost benefit analysis regarding the use of satellite remote sensing compared to other methods of data collection.[3] These applications tend to exhibit a problem common to many cost/benefit analyses in that they largely ignore potential "social" costs. In short, little attention is given to the potential impact of the introduction of a powerful new technology on society. Among the first to recognize possible dangers to individual rights of privacy posed by remote sensing, as well as to make tentative suggestions regarding use of remotely sensed data, was Samuel D. Estep. Additionaly, Estep realized that collection and distribution of data obtained from foreign nations via satellite might have international ramifications,[4] but his article, prepared in 1969, has not stimulated further analysis. Before irrevocable actions are taken, such considerations should be addressed.

Use by State and Local Government

The directors of the National Aeronautics and Space Administration (NASA) Remote Sensing Program are convinced that state and local governments provide a fertile field for expanded use of remote sensing technology, especially Landsat technology. However, at this point in time NASA officials have been somewhat disappointed in the limited acceptance and use of remote sensing by state and local governments. As of 1978, states and localities accounted for only 2% of the total usage of Landsat data; comparatively, the federal government accounted for 23%, colleges and universities 10%, foreign governments 23%, and private entities 42%.[5] Several factors may account for this relatively low usage by state and local governments. Respondents to a 1978 Governmental Sciences Engineering and Technology Advisory Panel (ISETAP) survey listed the following factors as contraints on the use of Landsat remote sensing technology: lack of a federal commitment to data continuity and compatibility, data timeliness, inadequate federal technology transfer, ill-defined federal agency responsibilities, failure of federal agencies to use and encourage the use of Landsat data, and state constraints including political fragmentation, lack of trained personnel, bureaucratic inertia, and lack of funding.[6] Yet another perspective is provided by Ida Hoos, who asserts that:

> Of the more commonly encountered perspectives which delineate our spatial relations with remote sensing is the *get a horse* syndrome; this maintains a pessimistic posture on any new technological advance. It is derived from the choice given Henry Ford by the skeptics. Sometimes impediments are more subtle, as when current practice is valued because "it is the way we always have done things," or because new methods upset the comfortable though archaic horse-and-buggy ways.[7]

Since gathering, dissemination, and analysis of remote sensing data is primarily a bureaucratic function; and since, as will be argued below, the introduction of a new and powerful technology may necessitate organizational changes in bureaucratic structures, bureaucratic inertia may be a major factor in the rather slow acceptance of remote sensing technology by state and local governments.

Despite impediments, a number of state and local agencies are now using "remotely sensed" data in a number of policy areas. Landsat data has been used for one purpose or another in forty-eight of the fifty states. Furthermore, seventy-six local governments and regional agencies have used Landsat data. According to the ISETAP report:

> Thirty-three states have institutional mechanisms which could facilitate Landsat use. Ten states have purchased, budgeted, or ordered analysis equipment. Twelve states have Landsat programs which are legislatively recognized...Nearly eighteen million dollars have been invested in Landsat Technology...Nearly fifteen hundred personnel have at least some training in the use of Landsat data...From a capability standpoint, even states are said to have independent ongoing operational Landsat analysis and

> application abilities; twelve states have completed, or nearly completed demonstration projects, and are close to deciding the applicability of Landsat to their ongoing data needs; and sixteen states are in the early phases of demonstration programs to assess the applicability of Landsat to their needs.[8]

Currently the major uses of Landsat in the states are: land cover inventory for resource management (18 states), water quality assessment and planning (18 states), wildlife habitat inventory (9 states), lineament mapping (9 states), surface water inventory (7 states), crop inventory (7 states), geologic mapping (6 states), and forest inventory (6 states).[9]

Although it appears that current utilization is low, the groundwork for much more extensive future usage is being laid. Indeed, a substantial case can be made for the assertion that remote sensing data gleaned from satellites will be widely utilized by state and local governments before the year 2000. For the first time in U.S. history, the public "world view" must recognize that we are entering an age of scarce and limited resources. We are told that in order to survive on this planet, man must be extremely wise regarding the management and utilization of the earth's resources. Though this reality may be a bitter pill to swallow, our political system is moving in the direction of planned management. Because wise planning and careful implementation require very complex and difficult decisions at all levels of government, the collection, dissemination, and analysis of huge volumes of data has become crucial. Clearly, abundant information is now of paramount importance in our society; unfortunately, necessary information also seems ever more costly to obtain. Yet, in light of the much discussed taxpayers revolt, politicians have found that economic resources are not unlimited either. The perceived "fiscal crisis" has initiated a new wave of cost consciousness among policy makers, thus enhancing the status of cost/benefit analysis as a tool for judging and ultimately selecting alternative courses of action.

In light of the above, planners, managers, and legislators need a tremendous amount of information obtained by cost/beneficial methods. Compelling evidence suggests that in many policy areas remote sensing data from satellites meets the need for cost/beneficial information. As Figures 1 and 2 indicate, state and local "users" surveyed by a National Conference of State Leislatures (NCSL) argue that Landsat data is cheaper to obtain than other types of data[10] Furthermore, these users indicate that in certain areas, Landsat data is of a higher quality than other data.[11] The ISETAP task force concludes not only that Landsat is now cost effective for a number of applications, but also that it will become more cost effective for an increasing number of applications. Twenty-three states responding to the ISETAP survey indicated that they were utilizing Landsat because it is more cost effective than other techniques.[12]

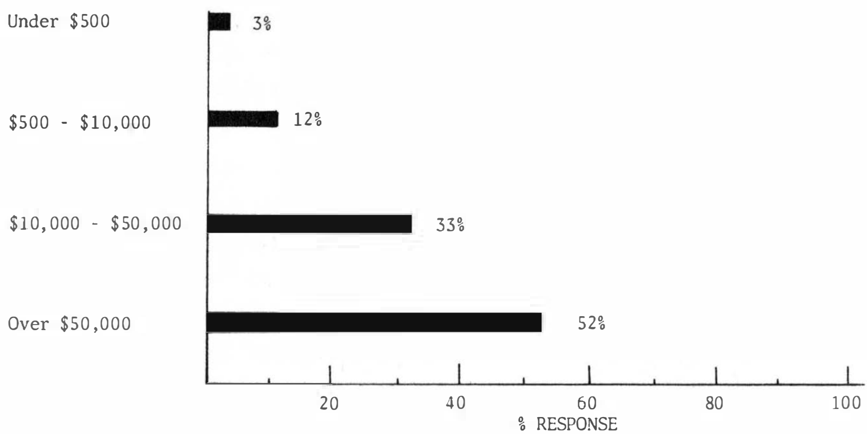

Figure 1 Approximate Cost of Data Collection Effort Without the Use of Satellite Remote Sensing

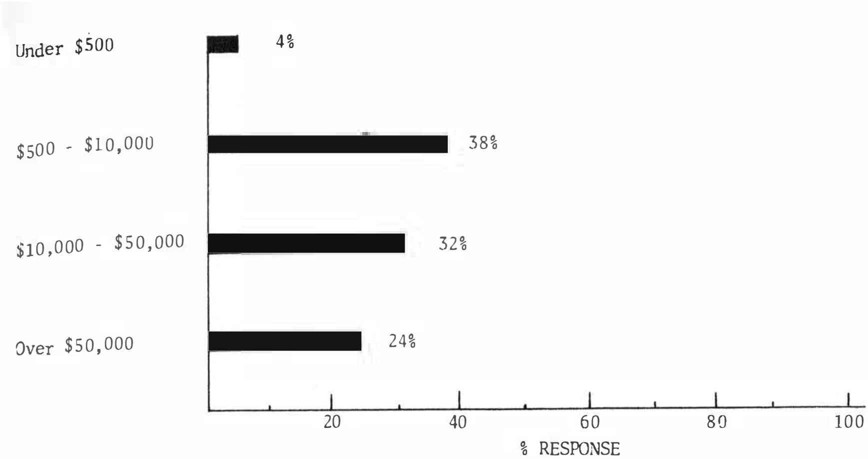

Figure 2 Approximate Cost With Satellite Remote Sensing

In addition to cost effectiveness, Landsat may be regarded as valuable because its repetitive coverage permits frequent monitoring of change occuring over large areas. Landsat's multispectral and synoptic characteristics provide a totally new means of viewing the environment and obtain information virtually impossible to acquire with conventional techniques. Also, Landsat provides uniform, standardized data in all-digital format which is easily incorporated into computerized information systems. Furthermore, recent innovations show promise of reducing turnaround time, one of the impediments concerning Landsat usage. Since April, 1979, users have been able to obtain Landsat imagery less than five days old, as compared to a previous average turnaround time of five weeks. Enhanced accessibility has been gained by a new NASA system which links RCA's Domestic Communications satellite (Domsat) with receiving stations at the Goddard Space Flight Center as well as with the Department of Interior's EROS Data Center. In addition, NASA spokesmen claim that new instrumentation aboard Landsat-D, launched in 1981, now provides information 2½ times more accurate and precise than earlier Landsat information.[13]

TABLE 1: SATELLITE DATA APPLICABILITY TO TYPICAL STATE AGENCY TASKS

	Perceived Satellite Data Applicability*				Perceived Landsat Follow-Up Applicability*			
	H	M	L		H	M	L	
a. Urban Growth Monitoring	32%	32%	10%	High/Mod	71%	23%	3%	High
b. Urban Flight Detection	1%	15%	51%	Low	3%	23%	58%	Low
c. Wetlands Mapping	42%	24%	8%	High	45%	45%	3%	High/Mod
d. Inner Urban Land Use Analysis	5%	8%	53%	Low	3%	41%	41%	Mod/Low
e. Drainage Basin Studies	31%	34%	3%	High/Mod	58%	29%	3%	High
f. Population Density Mapping	7%	22%	42%	Low	13%	45%	29%	Mod
g. Statewide Land Use/ Land Cover Mapping	51%	20%	3%	High	81%	13%	10%	High
h. Crop Monitoring	36%	29%	14%	High/Mod	45%	29%	10%	High
i. Critical Environmental Areas Mapping	22%	42%	7%	Moderate	29%	48%	16%	Moderate
j. Utilities Site Selection	3%	27%	41%	Low	6%	35%	45%	Low
k. Recreation Planning	5%	32%	37%	Low/Mod	3%	41%	39%	Mod/Low
l. Transportation Planning	8%	29%	34%	Mod/Low	13%	58%	19%	Mod
m. Water Resources Development	5%	42%	20%	Moderate	35%	41%	10%	Moderate
n. Coastal Zone Planning	15%	32%	14%	Moderate	29%	41%	13%	Moderate
o. Mineral Resources Development	8%	39%	22%	Moderate	13%	51%	23%	Moderate
p. Open Space Planning	10%	36%	27%	Moderate	23%	45%	23%	Moderate
q. Surface Mined Areas Mapping	31%	29%	14%	High/Mod	48%	32%	16%	High
r. Decisions Regarding Construction Materials Availability	0	20%	49%	Low	6%	19%	58%	Low
s. Floodprone Areas Mapping	24%	32%	15%	Moderate	39%	35%	19%	High/Mod
t. Snow Cover Monitoring	25%	17%	24%	—————	45%	26%	13%	High
u. Lake Trophic Levels Monitoring	12%	31%	24%	Moderate	23%	39%	19%	Moderate
v. Earthen Dam Condition Survey	5%	12%	58%	Low	3%	13%	65%	Low

OTHERS SUGGESTED BY RESPONDENTS:

Forest Inventory
Range Inventory
Noxious Weed Inventory
Geologic Hazards Inventory and Assessment
Game Management
Vegetative (Wildland) Health Trends
Abandoned Surface Mined Land - Unreclaimed
Timber Harvest
Rural Residential Development
Wildlife Habitat Mapping

* Response of participants in rounded percentages of total survey responses

In sum, the need for cost/beneficial data which can be provided by Landsat remote sensing technology, when coupled with current and planned improvements in the Landsat information system, provides compelling evidence that obstacles concerning the use of the technology will be overcome and that extensive use by state and local governments is, indeed, likely. If expanded usage is likely, in what areas will it occur? Table 1, provided by the NCSL task force survey, provides a possible answer.[14] Thus it would appear that the most likely areas of expanded use are urban growth monitoring, surface mined areas mapping, and snow cover monitoring. As higher resolution sensors are employed on satellites, more discriminating large-scale projects will likely appear, including wetlands mapping and drainage basin studies as shown on Table 1.

Impact of Use

If remote sensing technology does become a major tool used by state and local decision makers, what are the most likely consequences for society? This is a difficult, though important, question. As previously noted, lack of systematic research regarding the potential impact of Landsat technology makes the analysis presented here incomplete, speculative, and tentative in nature.

That applied technology has a profound effect on the way we live is a truism not likely to stimulate a great deal of debate. For present purposes, it can be argued that the application of a new technology will have both manifest and latent consequences for society. In the case at hand, providing scientists, private corporations, and public decision-makers with a wealth of cost/beneficial data would constitute a manifest consequence of the application of Landsat technology. Unplanned or unforeseen latent consequences of Landsat technology might involve either the development of new bureaucratic organiztions or upsetting the distribution of power in old ones. A technology may also have "spin off" effects, as products developed for a particular use are applied in other areas. One of the by-products of the space program, for example, has been mass production for private consumption of inexpensive pocket calculators. That spin offs, too, may carry latent consequences is exemplified by the many educators who speculate on the effect which use of pocket calculators may have on children's ability to learn basic mathematical concepts. NASA, in "selling" its programs, has produced abundant material proclaiming the "spin off" benefits that have accrued to mankind. In so doing, NASA has, even as with remote sensing itself, concentrated on manifest consequences and largely ignored possible latent consequences. Though it is not difficult to conceive of many possible "spin offs" from satellite remote sensing technology, discussion here will be limited to analysis of two potential latent consequences, specifically, possible effects on political organization and structures, and possible effects on individuals' right to privacy.

Political Organization and Structures

That technology has had an enormous effect on political systems has been recognized for centuries and is a particularly prominent theme in the writings of Karl Marx. Yet one need not be a Marxist to recognize the inter-relatedness of technology and politics. In an excellent analysis of CIA failures and successes, for example, Patrick McGarvey provides an informative account of how institutional functions as well as the balance of power within the organization shifted as a result of development and use of sophisticated surveillance devices.[15] In the same vein, Ida Hoos notes that the needs of institutions are often dictated by the capabilities of the technology used to fulfill the purposes of the institution, and thus there is a tendency for an organization to adapt to the needs of a particular technology, rather than adapting technology to meet the needs of an organization.[16] These are but two of many accounts relating the effects of technology on organizations.

Advocates of Landsat technology already indicate that some reorganization of our political system is necessary if we are to take full advantage of the benefits of remote sensing. Hence, we are told that "For state and local governments to realize the full social and economic value of Landsat, an operational Landsat information system must be developed."[17] The nature of the information system is explained thusly. "A Landsat information system would involve international as well as national issues and requires a private and public sector team effort that is multidisciplinary, inter-governmental, and multi-institutional."[18] Finally, we are warned that "Whether the benefits from practical uses of Landsat will ever approach full realization depends on an ability as a nation to organize ourselves to capitalize on these new capabilities."[19]

What impact, then, would one expect remote sensing technology to have on state and local government in the United States? While the eventual outcome is far from certain, at least two consequences may be the creation of new and powerful bureaucratic agencies and the centralization of political power.

Presently, many NASA officials are concerned about the overall success of their technology transfer program. They cannot understand why state and local governments haven't jumped at the chance to take advantage of a beautiful new technology which could solve many data acquisition problems. Apart from the problem of convincing elected officials of Landsat's necessity, a student of public administration might suspect that bureaucratic inertia is a major factor impeding the progress of the technology transfer program. In its attempt to build a clientele, NASA seems intent on working within existing bureaucratic structures. Yet scholars now recognize the role which needs of individuals within an organization may play in determining the behavior of that organization. Eugene Lewis argues rather effectively, for example, that individuals who develop a new expertise within an organization often find their status aspirations frustrated because their expertise tends to be viewed as a threat to the status of superordinates;[20] and Simon, et al., have recognized the incongruity of status, hierarchy, and specialization, long considered as perennial features of bureaucratic organizations.[21] What happens when individuals' needs cannot be satisfied within a given organization? If a need for their expertise can be demonstrated, new agencies may be formed. Thus if NASA is successful in training personnel who rise to middle management levels, it would not be unreasonable to assume that these technologists will eventually serve as a catalyst for creation of new agencies which will fit the mold of the multidisciplinary, inter-governmental, multi-institutional Landsat information system described above.

In addition to the creation of new Bureaucratic agencies, the widespread use of Landsat technology will, along with numerous other factors, probably contribute to centralization of political decision-making in the United States. These assertions are based on analysis of Landsat capabilities, costs of the system, and the assumed subtle impact of data on perceptions of those who view it.

Regarding current and pending capabilities, Landsat is geared toward larger geographical areas than those covered by many of our fragmented local governments. Furthermore, current and planned resolution (the size of the smallest area that instruments can "see") is not entirely suitable for functions normally performed by the smaller local governments. The data produced may be invaluable to such functions as metropolitan land-use planning, however. Secondly, to make use of data, an entity must have both trained personnel and adequate computer facilities, conditions which portend prohibitive costs for many smaller units of government. Finally, mosaics produced by Landsat are powerful, indeed. They provide viewers a much better sense of the integrated nature of covered areas than does conventional data. Though there is no basis for suggesting that people who view the data will suddenly adopt holistic orientations, it is not unreasonable to expect that over time, as data becomes more widely used, the holistic view it presents will have an impact on the way decision makers view the world in which we live.

Given these conditions, enhanced use of Landsat technology will most likely be accomplished through regional agencies, such as the numerous Councils of Governments (COGs) which have been created in the past decade. At first, such agencies would probably assist constituent governments in data acquisition and analysis. In time as they develop an expansion-minded bureaucracy, COGs could play a more active role in the development of regional, land-use plans, and might eventually assume jurisdiction over a number of implementation programs. At the same time, it seems likely that the technology could serve as a catalyst for development of statewide land-use plans. The development of satellite remote sensing technology has made production of large-scale, land cover maps feasible in the sense that such maps can now be produced more quickly and cheaply than through use of conventional methods. Beyond production of land-cover maps and development of statewide plans, Landsat technology could aid in the implementation phase and enhance state control as it provides an effective means for state agencies to monitor the actions of local governments on a repetitive basis. Furthermore, given the intergovernmental nature of an integrated Landsat information system, extensive federal involvement seems inevitable. In fact, the ISETAP report strongly urges the designation of a federal lead agency which would have overall fiscal and policy responsibilities for the space system, data processing and distribution, training, technology transfer, planning and management, and which would be budgeted directly for these functions. Whether the creation of such a superagency is possible in our political system is subject to some doubt, but close federal supervision, whether by one or several agencies, seems a likely development. In a nutshell, what is envisioned here is the development of an intergovernmental remote sensing bureaucracy which will have a profound influence on decision makers in a broad number of areas.

Individuals' Right to Privacy

> The intensity and complexity of life, attendant upon advancing civilization, have rendered necessary some retreat from the world, and man, under the refining influence of culture, has become more sensitive to publicity so that solitude and privacy have become more essential to the community; but modern enterprise and invention, through invasion of his privacy, have subjected him to mental pain and distress far greater than could be inflicted by mere bodily injury.[22]

This statement, made nearly ninety years ago by Warren A. Brandeis (before he became a justice on the U.S. Supreme Court), exemplifies a problem inherent in any new information gathering and dissemination technology: how does one weigh the need for information against one of the more universal needs of mankind, the need to be let alone? This dilemma is addressed by a more recent statement directed specifically at remote sensing:

> There is nothing inherently immoral in gathering remote sensing information, but the potential exists for abuse of this information. The problem is one of controlling information generation and dissemination without restricting its significant use and application. One thing is clear from modern technology. *There is no privacy* from a well financed, technically adept person or agency determined to gain personal information about an individual, group or country.[23]

Given the presence of a technology which can detect a farmer's overplanting a cotton crop, which can determine if a building is properly insulated, or which can detect industrial pollution of waterways, serious questions are raised about the proper use of that technology. Thus we must ask, what are the current standards regarding the right to privacy? Will remote sensing technology cause these standards to be changed? Exactly what is the nature of the danger posed by Landsat to rights of privacy? Do there currently exist sufficient legislative and judicial protections against invasion of privacy by satellite remote sensing devices? These are important as well as difficult questions; and up to this point, little attention has been paid to them. Although this is not the place for extended treatment of the right to privacy, a brief analysis of the problem is in order.

The United States Supreme Court recognizes that a right to privacy does exist,[24] and the bill of rights in several states includes a "right to privacy" clause. Unforturnately, there exists no extensive listing of actions which might be labeled as acts beyond the touch of government or private individuals. Alan Westin suggests that there is a felt need for at least some privacy in almost every modern society and lists two universals which fit under the rubric of privacy—performing the sexual act, and the need for personal space. Beyond these needs what is "private" and what is "public" is a product of societal norms which differ from society to society.[25] Common "wisdom" regarding privacy in the United States holds that the right to privacy exists in those areas where the actions of individuals do not affect significant "other parties." One might argue, therefore, that acts which do not affect other parties, or even acts involving two consenting adults, where others are not affected, might be regarded as "private" acts subject to protection. On the other hand, there should be little argument against the conclusion that dumping of toxic substances into waterways near populated areas directly affects significant "other parties." There exists, however, a huge grey area between these extremes. For example, does an individual's refusal to insulate his home constitute an act which affects other parties? Rather than listing specific private acts, judicial determinations regarding privacy tend to hinge on the question of whether an individual in performing a given act, has a reasonable expectation of privacy, and whether an individual actually intended his act to be private.[26] These guidelines tend to be rather unique and are subject to change as social mores and technological skills change.

What dangers are posed by Landsat? We may tentatively answer this question only if we assume that privacy is a multidimensional concept. Two possible dimensions of privacy involve the gathering and use of information and a psychological dimension including the perception that one, indeed, has privacy at certain points in time.

An analysis of Landsat capabilities allows us to address the question with respect to the first dimension of privacy. At present an individual need not fear Landsat "detection" of activities which are not continuous in nature and which occur within a small area. The earlier Landsat can "see" an area approximately 80 by 80 meters, while Landsat-D has a resolution of approximately 30 meters by 30 meters; Landsat cannot, of course, see through buildings. Thus, the sexual act is safe for the moment. Currently, only those activities which occur out of doors, which are continuous in nature, and which require a large land area are subject to detection. Capabilities are, however, subject to change; and one must assume that as technological advances are made with respect to resolution, frequency of observation, and turnaround time for data analysis, the list of activities subject to detection will expand dramatically.

Even so, gathering information and being able to use it are two different things. There is such a thing as gathering too much data. McGarvey's account of CIA difficulties is appropriate, for he argues that the CIA has become so proficient at collecting information that the agency cannot possibly evaluate its usefulness and make intelligent decisions thereupon.[27] Engineers refer to such a problem as "systems overload." In recognition of this problem, NASA officials cancelled plans to use certain instruments because they would provide more data than existing hardware could process. Given this constraint on data processing, it is unlikely that law enforcement officials, for example, would use Landsat data for "fishing expeditions." In order to make use of Landsat data for law enforcement, officials would have to be reasonably sure when and where an activity was taking place; and even then they would probably find other methods of detection more suitable. It should be stressed again, though, that this assertion is based on assessment of present capabilities. Advances in computer technology are occurring so rapidly that the "protection" afforded by ability to deal with only limited amounts of data may soon be dramatically eroded.

Thus the problem of whether sufficient judicial and legislative protections exist is of paramount importance, and according to some observers they do not. Estep, for example, argued in 1969 that existing state and federal legislation did not cover the types of activities connected with remote sensing.[28] No evidence suggests the situation has changed since then. Every state has laws against trespass, but trespass involves, by and large, a physical intrusion. It hardly seems conceivable that a court would regard a "passive" system more than five hundred miles from the scene of an activity as "physical intrusion." The same may not be true for "active" systems which might "shoot" beams, radar, for example, into a given area and acquire information from the reflected beams. Yet Westin effectively argues that the danger posed by machines may be greater than the danger posed by persons, for individuals may take steps to avoid persons. There is no way to avoid a machine, however, and often an individual may be unaware that he is being monitored.[29]

Furthermore, protections offered by the U.S. Supreme Court as well as by state courts may be inadequate. In dealing with the right to privacy, the U.S. Supreme Court relies on interpretation of the First, Fourth, Fifth, and/or Fourteenth Amendments to the U.S. Constitution. State courts rely on similar provisions in state constitutions. These interpretations are procedural in nature and deal with the use of information; they do not protect the right of privacy per se. The procedural orientation of judicial decisions and the heavy reliance on analysis of these decisions by "privacy" scholars almost totally neglects the psychological dimension of privacy. The lack of research in the area precludes a detailed analysis of either the spectrum of dangers or what constitutes adequate protection from the dangers to individual rights of privacy posed by increased use of "the eye in the sky." Here we begin to touch on the psychological dimension of privacy, and neither the spectrum of dangers nor what constitutes adequate protection can be clearly summarized in the absence of research dealing with the psychological effects imposed on individuals by the "eye in the sky."

Presently, all that can be said is that if a semblance of protection is to be afforded, Congress and state legislatures must propose a list of remote sensing uses that are expressly prohibited; and steps must be taken to make citizens secure in the knowledge that satellite information will be used only for certain specific purposes. Here it should be stressed that the Federal Freedom of Information Act does not prevent gathering of information; rather, it places limits on what can be done with such information and provides an individual the opportunity (not unlimited) to inspect his or her government file. The Federal Privacy Act of 1974 provides some protection to individuals, but this protection is procedural, not preventive, in nature. Furthermore, the act applies to the federal government only, not to intended major users of remote sensing technology, namely state and local governments. Certainly, if sufficient protections are to be provided, not only a more inclusive "Freedom of Information" act must be devised, but also "privacy advocacy" agencies, with full power to investigate activities of governmental and private users of remote sensing data, must be created.

Conclusions

We have attempted to show that in the not-too-distant future it is highly probable that satellite remote sensing technology will be used extensively by state and local governments. Additionally, we have described the current technology transfer program implemented by NASA, and have argued that there exist political, social, and legal ramifications with respect to the application of the technology. Clearly, enormous potential benefit to mankind may accrue from application of remote sensing technology; but if these benefits are to be fully realized, steps must be taken to assess and remedy potential negative consequences. At a minimum, a thorough analysis of societal impacts should be conducted before making decisions which foreclose policy options. Perhaps the best way to conclude this essay is to relate part of a statement of philosophy developed at a 1977 Conference in Remote Sensing held at Humboldt State University:

> (W)e should appreciate the uses and potential of new technology for dealing with environment of earth and our evolving way of life upon the earth. At the same time, we must not allow technology to limit our vision of what values and purposes our earthly environment and way of life should serve.[30]

NOTES

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25. Alan Westin, "Surveillance and the Future of Privacy,"

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SWIDDEN CULTIVATION IN THE SHADOW OF THE ARCTIC CIRCLE

*Donald R. Floyd**

Currently the practice of slash and burn or swidden cultivation is confined almost exclusively to the Tropics. Such a relatively limited geographic spread has, however, by no means always been characteristic of this style of agriculture. At various times and places it has been utilized in countless instances outside the Tropics. Up until the early decades of the present century, a variety of swidden farming could still be encountered in parts of northern Sweden, while in northern Finland an occasional swidden plot was being planted as late as the mid 1950's.

Just how far back in time swidden techniques were first employed in Scandinavia is open to some question. It has been suggested that swidden practices were brought to Scandinavia by its earliest inhabitants.[1] While that is surely an overstatement, it does seem fairly clear that by 1900 swidden agriculture had been present in the North for at least four millenia. Pollen analysis of peat bogs, for example, indicates that swidden farming techniques were probably being utilized in parts of what is now Denmark as well as in the southern reaches of contemporary Norway and Sweden at least as early as 2500 B.C.[2]

Linguistic evidence, too, supports the notion of a lengthy, northland history for swidden farming. In Sweden alone scores

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of present-day place names reflect a former link to swidden farming. Much more significant, though, is the face that all of the modern Scandinavian languages contain a variety of native words and terms to denote swidden agriculture. Apart from *svedjebrug*, *sve* or *svia*, and *svedjebruk* which are the usual Danish, Norwegian, and Swedish designation for swidden farming, it is not unusual to encounter an array of more specialized terms which denote various stages of the swidden cycle. In Varend during the 1850's, for example, a stand of forest slated for cutting and burning was termed a *dunge* or *falle-dunge*. Once trees had been felled, the resulting clearing was designated a *falla*, *rodja*, or *falle-rodja*. After a clearing had been burned the terms *brane*, *brana*, *svedja*, *svedje-falla*, *smet*, *smet-falla*, or *smet-svedja* were applicable. When planted and fenced a plot was referred to as a *lycka*, *smet-lycka*, or *svedje-lycka*. To rekindle a plot which had already produced a crop was to *bara bal*, *branna bal*, or *bal-branna*. An open field which resulted from repetitive burnings was known as a *ryd*; and when the soil in such a field became so impoverished that it bore only heather and moss, it was known as a *ljung-ryd*.[3] At least one additional possibility is suggested by linguistic material. Specifically, one cannot but wonder whether swidden farming may have been introduced or, more likely, reintroduced in northern England by Scandinavians; for the term "swidden" itself apparently entered the English language as an anglicized version of *svithinn*, the past participle of the Old Norse verb *svitha*, which means to clear by burning.

Whether or not swidden farming techniques were at any time exported from Scandinavia, for several hundred years they did constitute an important component of farm technology, especially in Sweden's relatively sparsely populated northern reaches. During the first half of the eighteenth century it was recorded, for example, that around Asen in Dalarna swidden lay beside swidden in the forests nearest the village on both the east and west side of the Dal River, while from Lima and Sollero in the same province came the observation that whole mountainsides by the villages and the summer dairies had been systematically burned off for swiddens.[4] It might here be emphasized that, for at least the last four hundred years of its lifespan, swidden cultivation in Sweden was almost invariably practiced not by people who shifted their abodes through the forest along with their fields, but rather by permanently-settled villagers who utilized this technique to expand their very limited economic horizons.

The meager economic prospects of pre-twentieth century Swedish farmers had direct environmental links. In most parts of Sweden, but especially in the north, a principal after effect of Pleistocene glaciation was a marked shortage of sedimentary soil suitable for agriculture. Actually, arable land was in such short supply that in order to survive farmers were forced to rely heavily upon a combination of crops and animal products. During summer months natural browse in forests, around marshes, and on bogs made animal maintenance relatively easy. Winter maintenance, on the other hand, was a constant and considerable problem; for the inadequate soil base made it extremely difficult, indeed, in the majority of instances all but impossible, to grow enough food *and* fodder to support the existing population of humans and animals through the long, northern winter.

The constancy as well as the severity of the food/fodder problem faced by farmers can hardly be overstressed. The rural people of Varmland, by no means the most hard pressed in Sweden, were so often faced with some degree of grain shortfall that they devised at least a dozen varieties of so-called famine bread *(nodbrod)*. To stretch a typically inadequate flour supply through the winter, straw, chaff, moss, sallow leaves, linseed hulls, tree bark, bone, unthreshed grain spikes, or any of several grass varieties could be ground and blended with flour to make bread. Commonly, as much as 50 percent, or even more, of the total content of a loaf might consist of some type of filler material.[5] That winter food for farm animals was normally as scarce as that for humans can be partially demonstrated by pointing out that forest-region farmers, in the mere hope of acquiring sufficient winter fodder, regularly stripped the leaves from deciduous trees and cropped vegetation from every bog and marsh fringe within reasonable distance of farm or village. "Reasonable distance," by the way, could sometimes involve a stretch of fifty to sixty miles.

In this economy of semi-perpetual need, swidden plots played a useful even if somewhat controversial role. There is scant indication that government took any kind of stand on swidden cultivation until post-Viking times. From the eleventh or twelfth century until the present, though, virtually every government assumed a stance on swidden farming. Occasionally this stance was supportive. More often it involved mild, modest, or even severe restrictions, including heavy fines for violators of official policy. By the end of the second decade of the present century, government's full recognition that timber constituted an increasingly valuable and far from inexhaustible national resource, had led to an outright ban on all swidden farming techniques.[6] Whatever the official government stance, however, right up to the early years of this century most forest-region farmers continued to view swidden plots as an absolutely essential element in their economy. Plots were deemed valuable because they could be utilized to ease the all too frequent grain short-falls, to expand fodder production and increase the extent of pasturage, and, in some instances, to increase the extent of arable land. In actual farm practice swidden plots normally occupied a niche between permanently tilled fields and permanent summer dairies *(fabodar)*; and the manner in which they filled this niche, as well their relation to the overall economic system, at this point might well be enhanced by an overview of a typical swidden cycle. The cycle described will be based primarily upon the form of swidden farming practiced in Dalarna during the early nineteenth century. Techniques employed there are thought to be markedly similar to those of earlier times, but some variation of technique did occur in different parts of the country.

The northern swidden cycle involved essentially the same steps encountered in present-day tropical cycles. Accordingly, site selection, clearing, burning, planting, and harvesting were as significant in the North as they still are in the Tropics. In Dalarna, as throughout Sweden, swidden cultivation was largely confined to shallow, rocky, moranic soils that were covered by predominantly coniferous vegetation. Within this particular milieu, the location of swidden plots was linked to considerations of both site and situation. Ideally, a potential site should be covered with a dense, brushy, moderate-sized stand of mixed forest. The presence of some deciduous trees on a site was considered a sign of suitable soil. Further, a good site would be relatively stone free and would lie on a south-facing slope where snow melted early and there was adequate drainage. Marshy or low-lying sites, which were difficult to dry and burn, seldom were selected; for a poor burn meant a poor yield. Too, frost risk was somewhat less on high or sloping ground.[7] Normally, only when a potentially suitable site was situated in reasonable proximity to water as well as an individual farm, a village, or a summer dairy, would a swidden plot be cleared and planted. Preferably, plots would be cleared within a few miles of a given farmstead, village, or dairy, though in some instances farmers did clear plots at distances as great as sixty miles.

Sites selected for swidden plots were sometimes cleared as early as April or May. In most instances, though, clearing occurred in June, during the two or three weeks prior to midsummer. Depending upon plot size anywhere from one to a dozen or more workers might take part in the actual process of clearing a swidden. Working in a line from one side of the plot, woodcutters felled trees one over another in the same direction so that the whole area would be covered with a fairly even layer of vegetation. Around a plot rim trees were felled inwards to make a fire break. Frequently, trees were left just as they fell; occasionally, branches, especially from larger trees, might be removed and spread about to make a more even layer of vegetation. Regardless of plot size, axes and, in some cases, the *kassara*, a special knife for branch removal, were the only tools used. Upon completion of clearing, vegetation on the plot normally was allowed to dry for at least a full year and not uncommonly for two years; for it was widely held that results would be better if vegetation had actually begun to decay a bit before burning.[8]

Most swiddens were burned in the two or three weeks following midsummer. This relatively narrow time span resulted primarily from the circumstance that throughout Sweden this tends to be the driest period of summer, but it had the additional advantage of allowing labor on swidden plots to be expended at a time of otherwise light work loads prior to the onset of harvest from permanent fields. According to Bannbers the firing of a swidden plot could be a most noteworthy spectacle.[9] In virtually all instances, however, such firings were very carefully planned and executed events. Preferably, burns were conducted on windless, sunny days. Alternatively, a plot might be lit late in the evening or even after sundown, for generally there was less wind at those times than during daylight hours. Before any fire was lit several safety precautions were observed. The fire break around the plot was cleared of debris; in some instances it might even be widened on the side toward which the wind blew; the fire break itself was thoroughly wetted down; and extra buckets of water were placed at various points around the plot.[10]

In addition to these logical precautions, folk literature indicates that considerable reliance might be accorded to custom or procedure that would supposedly hinder the spread of fire. The following examples, from the provinces of Ostergotland and Smaland, serve not only to illustrate the point, but also to confirm the use of swidden techniques in Sweden's southern forest regions:

> (1) In Godegard *askvigg* or *govigg* was the usual name for stone axes.* I believe they were called *goviggs* most of the time. They were hurled to

earth by Goen (Thor), according to the oldsters. From what I heard the oldsters had—perhaps not the most elderly of my time, but in any case their parents—worshipped *goviggs* as some sort of divinity, and I heard that Thor was named in connection with the *viggs*...everyone who had *goviggs* was so careful with them that they kept them locked up in cupboards. When a forest clearing was to be burned, someone first walked around the clearing with a *vigge* for safety's sake. At least that is the way it was done in Godegard and in neighboring parishes of both Narke and Ostergotland. I myself participated only once in the burning of a forest clearing. I was only a boy then, and my job was to watch the fire. I had no *govigge* for assistance; instead we had to rely on ourselves. They probably had to do that anyway, even on those occasions when they walked around clearings with their *goviggs.* I believe that in my grandparents time hardly anyone around dared to light a clearing without taking Goen (a lightning wedge) along to help guard the fire (that is, keep it from spreading). But then who knows how it was on the occasion that I participated. There were many [there] who believed in superstition, but they would only practice it on the sly.[11]

**Torsvigg, govigg,* and *askvigg* are all terms used by the folk to refer to old stone weapons, that is, to stone axe heads, flint axe heads, flint chisels, and the like. According to folk belief every time lightning struck it hurled such an axe head down to earth, where it penetrated to a depth of seven arm spans (approximately forty-two feet). Thereafter the *vigg* was assumed to slowly work its way back to the surface. The rate of resurfacing for *viggs* ranged from one arm span per year to one arm span per decade. Anyone who managed to locate a *vigg* when it surfaced was thought to possess an object of great magical power. *Viggs* could only be acquired after they had surfaced. Those who sought to dig up a *vigg* at the point of a lightning strike never succeeded, for the *vigg* would sink into the earth to a depth equal to each spade of earth removed.

(2) In Godegard it looks different than it did in my childhood during the late 1850's and early 1860's. It was common practice then for people to burn the forest and sow rye in the ashes, [or] sometimes grass seed if it was better suited. The rye which grew on the burnt lands, the clearing rye, was really first rate, with big kernels in large spikes. It sometimes happened that the fire could spread beyond the clearing and go into the forest. But most people were in the habit of walking around a clearing with a lightning wedge before lighting a fire. Further than [where] the lightning wedge [had been] the heat would not go. If there was someone who had been born with a caul, people used to lead him or her around the clearing, and a better way to arrest the heat did not exist. I never participated in burning a clearing, but I heard how it was done many times. On several occasions I did see how people walked around [a clearing] with a lightning wedge, and one time I witnessed the very best medium for preventing forest fire. There was no adult in the district who'd been born with a caul. But a woman had recently given birth to a child with a caul. It wasn't feasible to take the child to the clearing; so instead they forced the caul over the mother's head and led her around the clearing; and it didn't prove a failure, for where she walked, the heat stopped. It was exactly like clipping off a thread.[12]

Accounts such as these which tell of the efficacy of *askviggs* and cauls in limiting the spread of fires are not at all uncommon in the folk literature of Sweden; and while there is no particular reason to doubt that many informants did indeed see fires stop along the margins or routes traversed by persons who carried a *vigg*, a caul, a horseshoe, or some other object,[13] large numbers of informants failed to mention a rather significant aspect of preparing a forest field for burning:

(3) In order to avoid forest fires when swidden land is burned, the circumference of [the swidden] should first be cleared and cleaned, after which one should drag a Thor wedge on the ground around the margin of the clearing and every twentieth step strew a little crushed charcoal from a lightning fire, over which no forest fire can make its way.[14]

This brief notation to the effect that the margin of a swidden should be "cleared and cleaned" dates from the early 1800's, and without doubt it was the general observance of this advice which lent credence to folk belief in the power of lightning wedges, cauls, and their ilk to limit the spread of swidden fires.

Once precaution and custom had been given their due, workers stationed themselves at strategic points around the plot; and fire was set at the point where risk of spread beyond the clearing seemed greatest. Then, workers all around the plot extended the fire so that it burned inward from plot margins turning most vegetation into ash. When the fire burned down, so-called *smetved*, i.e., any material which had not burned completely, was sometimes gathered and rendered to ash at a second burning. Alternatively, charred trunks and branches might be used either to fence a plot or to build a rack upon which to dry plot crops. When not utilized for one of these purposes, such wood might be taken home and used for firewood. On occasion, especially in the mining districts, it would be made into charcoal which, until replaced by coal in the early 1800's, served as the principal energy source for iron-making and smelting.[16]

Planting of swiddens often took place within less than twenty-four hours following a burn. It was, in fact, not uncommon for a field to be seeded even before its ash layer had fully cooled. Here and there the surface of a newly burned plot might be partially worked with a snaggle-ended stick called a *kratta*. Rarely, it might even be lightly plowed with a forked stick or primitive wooden plow. Much more frequently, though, the moranic soil of swidden plots was too shallow and too stony to work or plow, and planting proceeded with no soil preparation whatsoever. It was in the unworked fields that farmers felt compelled to plant as quickly as possible; for if rain fell before seeding, a crust formed on the ash. When this happened it meant extra work, as the crust then had to be pulverized before seeding.[17]

In marked contrast to tropical swiddens, which often contain a dozen or more different crops all growing at the same time, northland swiddens were often seeded with but a single crop. During the eighteenth and nineteenth centuries, rye was by far the most common swidden product. Hay and turnips, too. were frequently planted, while barley, oats, flax, and potatoes occurred more sporadically. The rye produced in swiddens was not ordinary field rye, but rather a special variety known variously as Finn, winter, or swidden rye. It grew in tufts, was especially well-suited to rooting in unworked soil, and generally produced an abundant yield of high-quality grain.[18] In the fall it was not uncommon for farmers to allow some of their animals to graze briefly on the by then well-established green rye. This not only provided an extra bit of forage for livestock, but also served to thin out the rye and thereby minimize the possibility that snow mold might cause it to rot in the following spring.[19] Swidden turnips, which were grown mainly for human consumption, are sometimes described as being uncommonly large and sweet,[20] elsewhere as small, round, bluish, hard-skinned, and sweet-tasting.[21] Though an entire field might be set in turnips, more often they occupied only a small portion of a field sown with rye or hay.[22] Especially on those swiddens situated near summer dairies, hay might be the only crop sown.[23] More commonly, hay or grass was sown on swiddens only after an initial harvest of rye and/or turnips.

Again, in marked contrast to tropical swiddens, where harvest activity may occur over a period of months, the actual harvest of northland swiddens was usually completed within a few days. Typically, late in the summer of the year after planting, rye would be cut before it had become too ripe; and it was then either hung on racks or laid in shocks for a period of three to four weeks to ripen thoroughly. To protect fully ripened grain from being damaged by weather and forest animals, a temporary structure, called a *lotak,* might be erected to house shocks until winter, when they would be loaded on sleds and driven home for threshing.[24] Alternatively, only a wooden floor might be laid, upon which grain shocks could be stacked and then covered with straw or some other material until winter snows made it possible to sledge the harvest home.[25] Similar procedures were followed in reaping hay, oats, and barley. However, because the rough and stony surface of swidden plots made the use of scythes impractical, the only tool used in harvesting grain or hay was a hand-held sickle.

Once a swidden had produced its initial crop, usually grain, it might continue to be utilized in some fashion over a ten- to twenty-year period. Seldom was a plot simply abandoned after only one, two, or three years. In rare instances an especially well-situated swidden on better than average soil might gradually be cleared of stones and stumps and turned into a permanent field. Normally, a different course was followed, and a second or even a third grain crop might be sown. Where this was not done, a first harvest of grain might be followed by seeding with grass or hay.Often no seeding at all occurred.[26] Yet seeded or unseeded, a plot usually remained fenced for an additional two or three years, during which time any forage it produced was harvested for winter fodder. Custom decreed that after three years, swidden fences should be removed in order that livestock might graze on the grass and other herbaceous vegetation growing on the cleared land. Through the years, of course, both grass and herbaceous vegetation would gradually give way to forest, first deciduous birch and alder, and eventually a blend of deciduous and coniferous. While deciduous trees were dominant, the former plot still yielded winter fodder in the form of an annual "leaf harvest"; and once the pines and spruce had again become fully established, the swidden cycle could be commenced anew.

Conclusions

In retrospect it does seem that swidden plots partially fulfilled the principal functions which prompted forest-region farmers to clear and plant them. Sown with rye or barley they helped to ease, though not eliminate, persistent grain shortfalls; and whether cropped for hay or utilized for grazing, they eased, but did not eliminate, the problem of winter fodder shortage. Though in recent centuries swidden farming led to only a miniscule increment in permanently tilled fields, prior to 1600 it played a somewhat larger role in this respect, most notably in conjunction with the advance of settlement into frontier areas.

Swidden agriculture died out in Sweden not because the government finally outlawed it shortly after World War I, but rather because the social and economic environments that had once made it a virtual necessity had been dramatically transformed. During the first two decades of the present century the introduction of new forage crops, the widespread expansion of cooperative creameries, and an improved system of transportation combined to render obsolete the age-old summer dairy and subsistence agricultural system. This, in combination with a series of industrial sector changes which commenced in the 1850's when the steam saw was introduced into Scandinavia, helped to usher in an era in which Sweden's forest resources have been utilized primarily for timber and pulp, rather than as fertilizer for catch crops of rye and hay.

NOTES

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THIRTY-SEVENTH ANNUAL MEETING, C.C.G.E.
San Luis Obispo, May 6-7, 1983

The final, annual meeting of the California Council for Geographic Education (the organization will convene as the California Geographical Society in 1984) was sponsored by the geographers of California Polytechnic State University, San Luis Obispo. The opening session featured Daniel Krieger (historian), who delivered the opening address/presentation entitled: "San Luis Obispo 100 Years Ago." Awards presentations were handled by Donald Holtgrieve (CSU, Hayward), and the luncheon-banquet debate featured John Sumner (engineer, Pacific Gas & Electric Company) and Valerie Endres (spokesperson for Mothers for Peace), who presented contrasting views on the topic: "Nuclear Power: The Case For and Against Diablo Canyon."

PRESENTATIONS

Thomas D. Best, Covina Travel Center, **Nostalgeography: An Example.**

Don P. Chavatal, Professional Book Center, Inc., **Compilation and Uses of the** *Atlas of California.*

Lois J. Gershenson, San Francisco State University, **From Artichokes to Zinneas: An Historical Geography of the Agriculture of San Mateo County.**

Myron B. Gershenson, San Mateo High School, **A Fair Fight: The Dispute Over the 1915 Panama-Pacific Exposition Site.**

Harold F. Gilman, University of South Florida, **Baseball and the Art of Geography.**

Donald Holtgrieve, California State University, Hayward, **Land Management and Conservation Practices of an Unusual Public Agency.**

Robert Hoover, California Polytechnic State University, San Luis Obispo, **Culture Change at Mission San Antonio, 1771-1834.**

Carol L. Kurtz, California State University, Hayward, Landscape Evidence for Eastern Religions in California: Buddhism, Hinduism, Sikhism.

Jorge G. Lizzarraga, California State University, Hayward, **Early Agribusiness: The California Bonanza Wheat Farm Era, 1865-1895.**

Peggy Mandel, Resource Specialist, **The Ghosts of Cerro Gordo.**

George N. Nasse, Fresno State University, **Preservation of National Monuments in Albania.**

Linda C. Newton, California State University, Hayward, **The Message From the Garden: Community Gardening in the San Francisco Bay Region.**

Don Oliver, *California Weekly Explorer*, **Methods For Presenting the Geography of California to High School and Elementary Students.**

Clement Padick, California State University, Los Angeles, **Preservation of the Rundling in West Germany.**

Larry Simon, San Diego State University, **Proposed Hydroelectric Power Plant Locations: Inyo and Mono Counties.**

Stephen Slakey, La Puente High School, **High School Urban Studies: An Historical Building Survey.**

Merrill M. Stuart, Fresno State University, **The Development of a Self-Guided Field Course To the Southern Mother Lode Historic Gold Mining Region.**

Jim Switzer, Southwestern College, **Primary Steelmaking: A Geographic Focus On the Western United States.**

Robert Wallen, Mendocino College, **A Geographer Mixes Media To Blend Learning Styles.**