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LAND USE IN THE NORTHERN COACHELLA VALLEY

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ABSTRACT

ERTS-1 imagery has proved to have great utility for monitoring land use change and as a data source for regional planning. In California, open space desert resources are under severe pressure to serve as a source for recreational gratification to individuals living in the heavily populated southern coastal plain. Concern for these sensitive arid environments has been expressed by both federal and state agencies. The northern half of the Coachella Valley has historically served as a focal point for weekend recreational activity and second homes. Since demand in this area has remained high, land use change from rural to urban residential has been occurring continuously since 1968. This area of rapid change is an ideal site to illustrate the utility of satellite imagery as a data source for planning information, and has served as the areal focus of this investigation.

1. INTRODUCTION

ERTS-1 imagery has been useful for monitoring land use change and has served as a potential data source for regional planning in one Southern California test site. Open space desert resources, in California, are under severe pressure to serve as a source for recreational gratification to individuals living in the heavily populated southern coastal plain. Concern for these sensitive arid environments (the Colorado and Mojave Deserts) has been expressed by both federal and state agencies. The northern half of the Coachella Valley, part of the Colorado Desert natural province, has long served as a focal point for weekend and seasonal (winter) recreational activity.

2. AREA

The Coachella Valley is the northern most extension of the Salton-Imperial Trough (Figure 1). Land use has traditionally been a contrast between agriculture and recreation. The valley is approximately 50 miles (80.5 km) long and averages less than 15 miles (24 km) in width. As a

structural trough it is bounded on both the north and southwest by the highest mountain ranges in Southern California. It terminates in the south at the Salton Sea and narrows to the north to form San Gorgonio Pass. If one wished to delimit geographic regions solely on physical characteristics, the Coachella would qualify. Dominant land use types dictate that the valley be divided into two regions (Glend nning, 1949). The northern half of the valley possesses a recreational economic base while the southern half from Indio to the Salton Sea depends primarily on an agricultural economic base. The investigation has been limited to the northern half of the valley where recent residential and recreation oriented building occurs at rates far above county averages.

3. RESEARCH DESIGN

Research objectives involve the qualitative testing of ERTS-1 imagery as a data source for land use monitoring at the urban-rural fringe in the desert environment. Base land use data was obtained in 1966 and 1969. This information was then compared with the record obtained from ERTS-1 to produce a map of change. Analysis of the change, where it is concentrated, and how quickly it is occurring will provide insight into potential regional problems.

4. DATA SOURCES

Although ERTS-1 imagery served as the primary data source both U-2 and RB-57 photography were also used. Field surveys and the aforementioned high altitude imagery allowed the information interpreted from the ERTS-1 to be verified and more precisely located.

Two formats of ERTS-1 imagery were used with an I^2S Mini-Addcol Color Viewer to produce interpretable false color representations. 70 mm positives were used in their entirety, while only a portion of reproduced 9" x 9" (22.9 cm x 22.9 cm) positives were used. The accompanying diagram illustrates the basic workings of the color viewer. Diazochrome black and white positive transparencies were prepared from 9" x 9" (22.9 cm x 22.9 cm) ERTS positives. These were then cut to fit the 2-3/4" x 2-3/4" (6 cm x 6 cm) yoke format of the color viewer. The resulting scale as visible on the ground glass view plate of the color viewer was approximately 1:150,000. This technique provided more enlargement, but less resolution than the enlarged 70 mm positive transparencies. MSS bands 4, 5, and 7 were used in three of the four channels of the color viewer. In order to reconstruct a false color infrared image band 4 was projected through a blue filter, band 5 through a green filter and band 7 through a red filter. In order to enhance the image record of commercial activities along main thoroughfares the filters used for bands 5 and 7 were switched and a false color image with green in place of red was created.

5. MAPPING PROCEDURES

The largest portion of the mapping was accomplished from enlarged positives or projected slides taken of a portion of the reconstructed 70 mm image on the color viewer view plate. Projected images were worked at scales no larger than 1:62,500. Resolution usually extended to 80 acre 1/8 sections. Better resolution occurred where intense signatures associated with specific uses can be found in isolated parts of the valley. Linear features and land use arrays appear to be more visible than other features of equal area. Such findings were expected and not in themselves surprising.

Strict procedures were established for and followed during the mapping process. One interpreter accomplished all the mapping. Factors which influence the quality and resolution of land use information gleaned during this study include the scale of the imagery, the scale of the final map product, the availability of secondary data sources, the expertise of the interpreter, and finally, how well the interpreter knows the subject area. In evaluating the usefulness of a remote sensing system, there is no justification for faulting a mapping procedure because one interpreter, through his own knowledge of an area is more proficient at correctly identifying land use than another equally skilled individual who does not know the area.

During this study more land use information could be extracted from the imagery because the interpreter "knew" the region, than would have been possible otherwise. Familiar areas where residential and commercial urban uses are fixed, because of high capital investment, served as a base for identifying uses in less well known areas and in areas where change has taken place. Members of any regional planning organization should be as knowledgeable about areas under their jurisdiction as our interpreter in the Coachella.

Previous land use mapping in 1966 by R. Van Curen served as a base for change comparison. An intermediate set of information was obtained in 1969 through the work of J. B. Bale and W. G. Brooner for Palm Springs. The land use classification used for ERTS-1 derived information, is a modification of the one used in 1966. This, of course, is necessary to maintain consistency and allow land use change identification. In most areas, the classification scheme allows more detail to be recorded than is actually visible from the imagery--the 1966 survey was based on both a low altitude large scale photographic record and detailed field work. A less detailed classification system would inhibit interpretation processes where additional information is available on the photo.

Techniques developed in previous agricultural surveys at the University of California, Riverside and elsewhere facilitate identification of agricultural uses. Crop calendars, dependence on false color

infrared film where various shades of red facilitate interpretation, and the fact that agricultural fields usually cover large areas, allow interpreters to obtain greater detail (even to identification of specific crops) in an agricultural area than in urban areas. In the Coachella Valley, however, certain urban associated recreation uses, specifically golf courses and fairway side housing, can be easily identified (Tamarisk, Bermuda Dunes, La Quinta, Canyon Country Club, Thunderbird, etc.). This combination of residential and recreational use has its own category in the land use classification scheme.

6. "GROUND TRUTH"

All areas where positive change was mapped within the city limits of Palm Springs were ground checked February 18, 1973. In every instance some form of positive change had taken place in or adjacent to the boundaries drawn on the map. In no instance were the boundaries drawn on the map exact representations of the actual area where the change occurred. Although no attempt was made to identify the new land uses as they were being mapped, it was noted in the field that all change identified consisted of residential structures or subdivisions except for one park in section 34 at the north end of town. All areas of change 1/8 section or larger were recorded. Change did occur which was not recorded, but it was from one use other than open space to another or it occurred over an area which was too small to be recorded (Figure 2).

East of Palm Springs in the unincorporated portion of the test site, land use change was monitored with similar accuracy to that which was achieved in the more densely occupied city area. Identification of land use type as well as land use change was attempted. Boundaries again could not be placed exactly, but in only two instances were land uses misinterpreted. The first case was a locational problem involving the improper positioning of a small area of abandoned vineyards in the south central part of Figure 3. Secondly, at Thousand Palms recreational residential use involving mobile homes around a golf course was not identified. Less critical problems involved the category of agricultural abandonment (C2a in figure 3). Here, no distinction could be made between actual removal of orchards or groves, and their complete removal. The difference between active agriculture, and abandonment or disinvestment was always apparent.

7. RESULTS

From both maps and the ERTS-1 imagery, it is obvious that much of the urban development has occurred on the various alluvial fan surfaces that eminate from the San Jacinto Mountains. These areas, somewhat protected by spur ridges from the winds which are strongest along the axis

of the valley, were developed first and still contain most diversified urban uses (residential, parks, commercial). More recent residential development has occurred on the upper portion of some fans (Deep Canyon Fan for example) or along the south center axis of the valley at the expense of open space or agricultural uses. All agriculture will be gone from the north half of the valley within the next few years.

Change in the Palm Springs area consists primarily of the filling in of an already urban environment. Alternate sections within the city limits belonging to the Agua Caliente Indian Reservation are now being transformed from open spaces to urban uses. Problems were encountered while working in this more complex urban environment. With the present system of combining and projecting reconstructed imagery, land use boundaries within the city could not accurately be drawn. Furthermore, except for most single family residential areas, parks, golf courses, and some, specific commercial uses, a full range of urban uses including most commercial areas, multi-family residential, governmental, and other institutional uses were not discernible. Positive change however was visible where other forms of use have replaced open space.

Farther to the southeast, in what was originally a less complicated agricultural landscape, change occurs in the center of the valley. This area, originally a "blow-sand" environment is undergoing a transformation from open space and agriculture to recreational and residential uses. What exists is perhaps the heaviest concentration of golfing facilities in any area of this size in the world. In situations where direct conversion from agriculture does not occur, fields are abandoned, left fallow or trees (either citrus or date palm) are maintained as ornamentals to residential uses. Agricultural abandonment is one form of factor disinvestment common to the rural-urban fringe in Southern California (Goehring, 1971).

8. ANALYSIS

Although no regional planning agency with responsibilities in the Coachella Valley has yet to integrate ERTS-1 imagery into their resource management procedures, various members of the planning departments of Riverside County and Palm Springs City have made casual use of reconstructed images. Individuals from both organizations have, from other sources, already been made aware of problems illustrated by ERTS-1 imagery. Alarmed by what appears to be a loss of amenities in a primarily recreational urban environment, officials in Palm Springs have called a temporary building moratorium, and proposed revolutionary measures to maintain open space within the city (personal communication, Department of Planning and Development, City of Palm Springs and Proposed Open Space and Conservation Element, Palm Springs General Plan). County officials have expressed little concern over loss of open space but have been confronted by numerous local conservation

organizations that have expressed concern over a number of related topics ranging from loss of wildlife habitat to deteriorating ground water quality.

Perspectives available from ERTS-1 imagery allow regionwide views containing information in quantities not available from compoiste sources (maps or photo mosaics). The sequential nature of the imagery adds to potential utility although biannual collection instead of every 18 days would suffice to monitor urban land use change in the northern Coachella Valley.

Additional building and subsequent increases of human activity will jeopardize numerous specialized natural habitats in surrounding areas. Most recent land use change suggests a loss of unique natural habitats, including fan surfaces emanating from the San Jacinto Mountains, the sand dune habitat that extends along the axis of the valley, and the Bighorn sheep habitats in the mountain slopes surrounding the valley bottom. Continued residential construction has also reduced the habitat value of the valley to man. Increased environmental pollution (air pollution, noise and visual pollution) threaten the area's economic base. Amenity loss stemming from the lack of attention to concepts of environmental design and consequent impacts of continuing development can be inferred. Sequential ERTS-1 imagery has recorded the most recent chapter of the Coachella Valley's continuing environmental alteration.

9. REFERENCES

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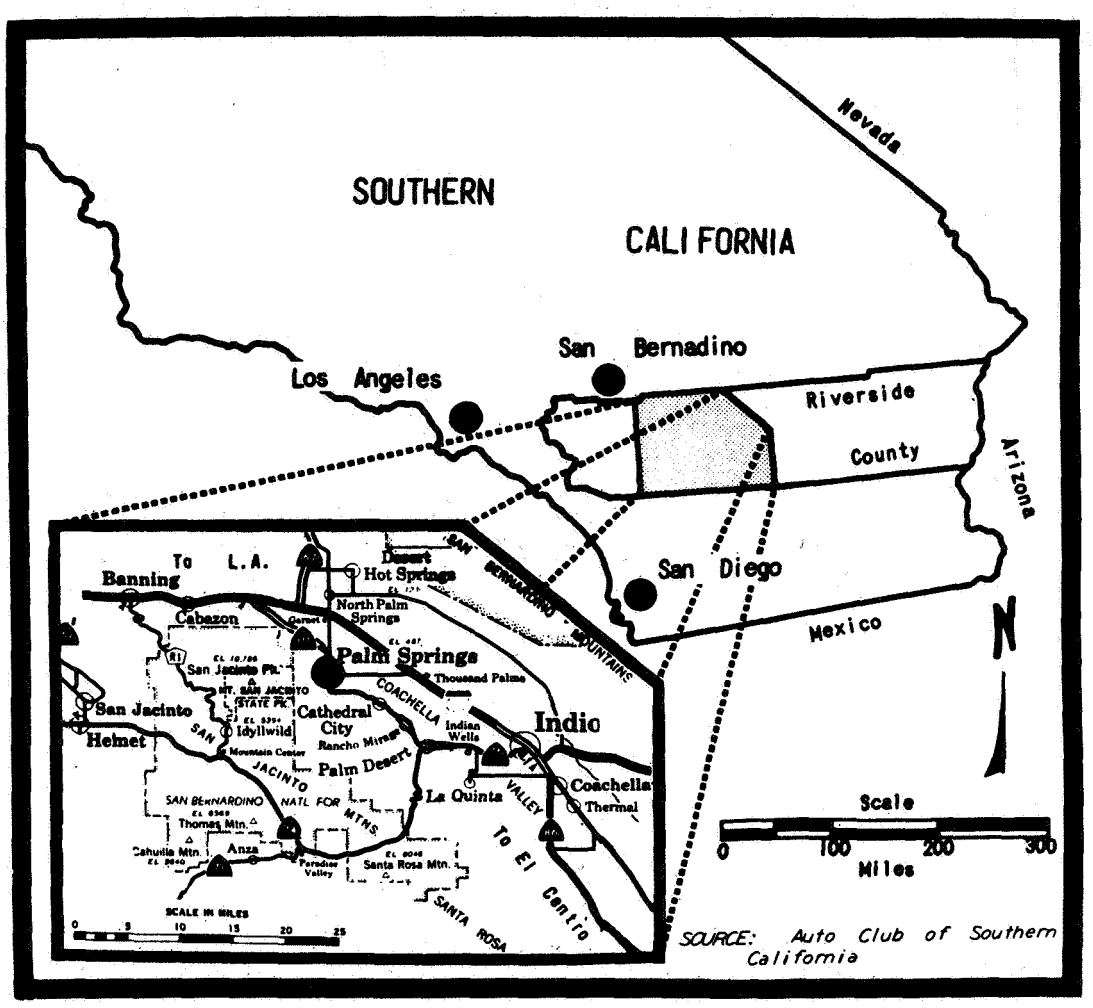

Figure 1. Location of Study Area

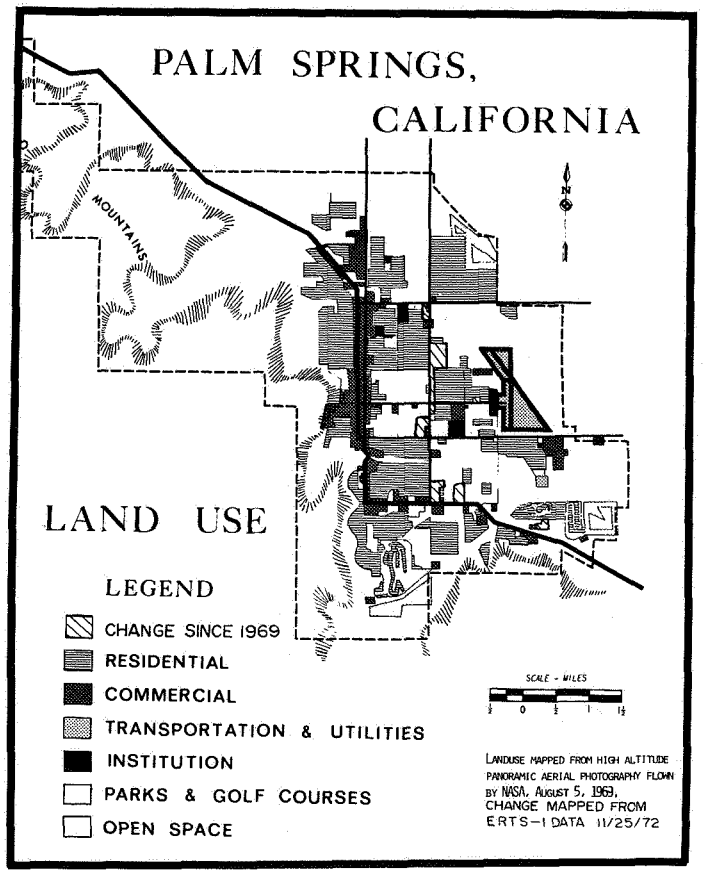

Figure 2. Change in Palm Springs

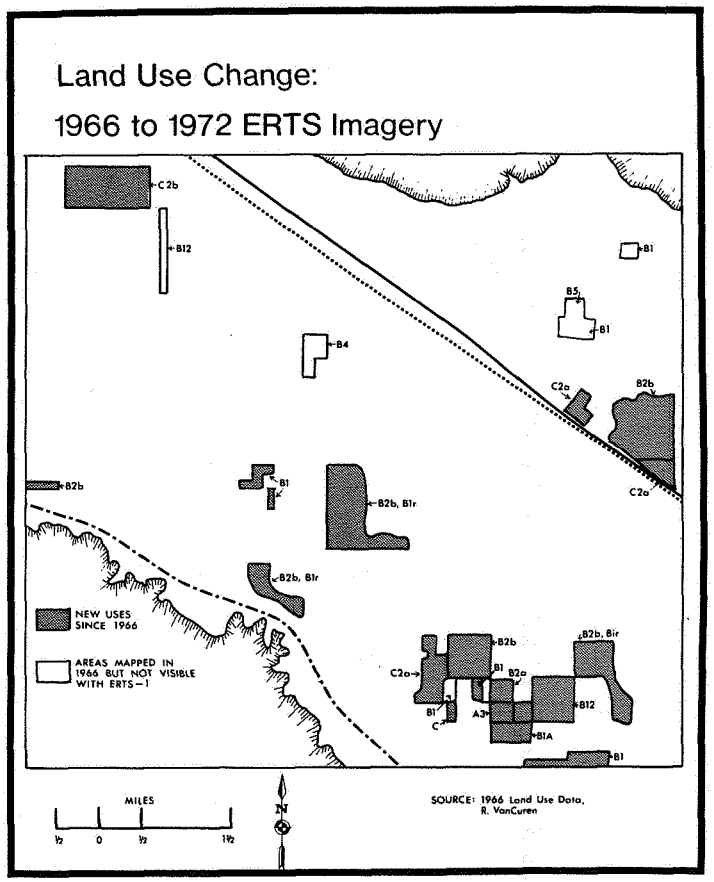

Figure 3. Change in the County