requirements, hares also receive adequate water. On a yearly basis, alfalfa loss from hares ingesting enough alfalfa to alleviate these deficits would amount to 56 lbs dry alfalfa per animal. This study measured alfalfa consumed by adult hares only, because reproductive activity occurs during the months of February through May, when the population relies exclusively on desert food sources. By June the majority of young rabbits produced during spring would be ingesting alfalfa at a rate exceeding 80% of adult intake.

Alfalfa consumed in a particular field depends not only upon the acreage of the alfalfa field, but on the total perimeter exposed to the desert. In general, relatively less perimeter is exposed by a large field and correspondingly less alfalfa loss per acre can be expected. Graph 2 shows this relationship for a population migrating up to 2.2 miles nightly from surrounding desert. Curves shown include density determined near the Lockhart Ranch (.131 hares per acre) and the .08 and .20 hare per acre levels which have been reported in the literature for yearly average density and spring density highs, respectively, for desert jackrabbits. The graph applies to square fields, but conversion to a more specific case should not be difficult. Yearly production (dry weight) for an average San Bernardino County acre of alfalfa was 13,980 lbs in 1973.

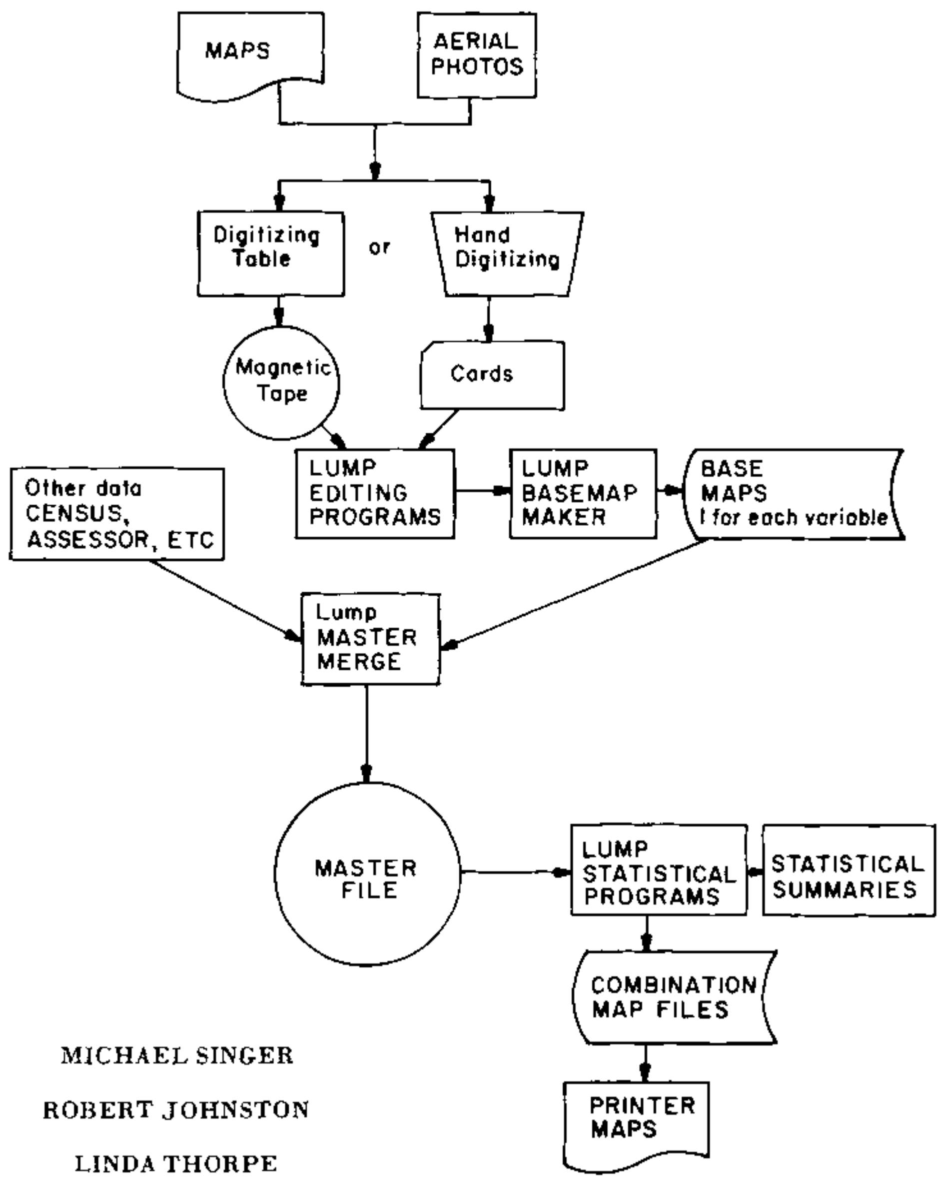
Jackrabbit control methods

Four-foot high one-inch mesh poultry wire offers complete protection from hare damage and should last five years before replacement is necessary. Cottontails may be discouraged by burying the bottom twelve inches of the fencing. Contrary to beliefs held by many producers, three-foot fencing will deter jackrabbits. At the cost of $1.00 per linear foot (including labor), fencing will be less expensive than damage by jackrabbits only at high jackrabbit population densities or in cases of small alfalfa fields. Graph 2 shows the relationship of field acreage to fencing cost assuming the 1973 price of $33.50 per ton of alfalfa. Stacks of baled alfalfa outside the fenced area are effectively protected by wraps of poultry wire or canvas. Other jackrabbit control methods include chemical repellants applied to crops or shooting and trapping, which are costly, aside from being ineffective as complete controls.

Philip Bickler is an undergraduate student and V. H. Shoemaker is Associate Professor, Department of Biology, University of California at Riverside.

LAND USE MAPPI

. . . computer help for land



MICHAEL SINGER

ROBERT JOHNSTON

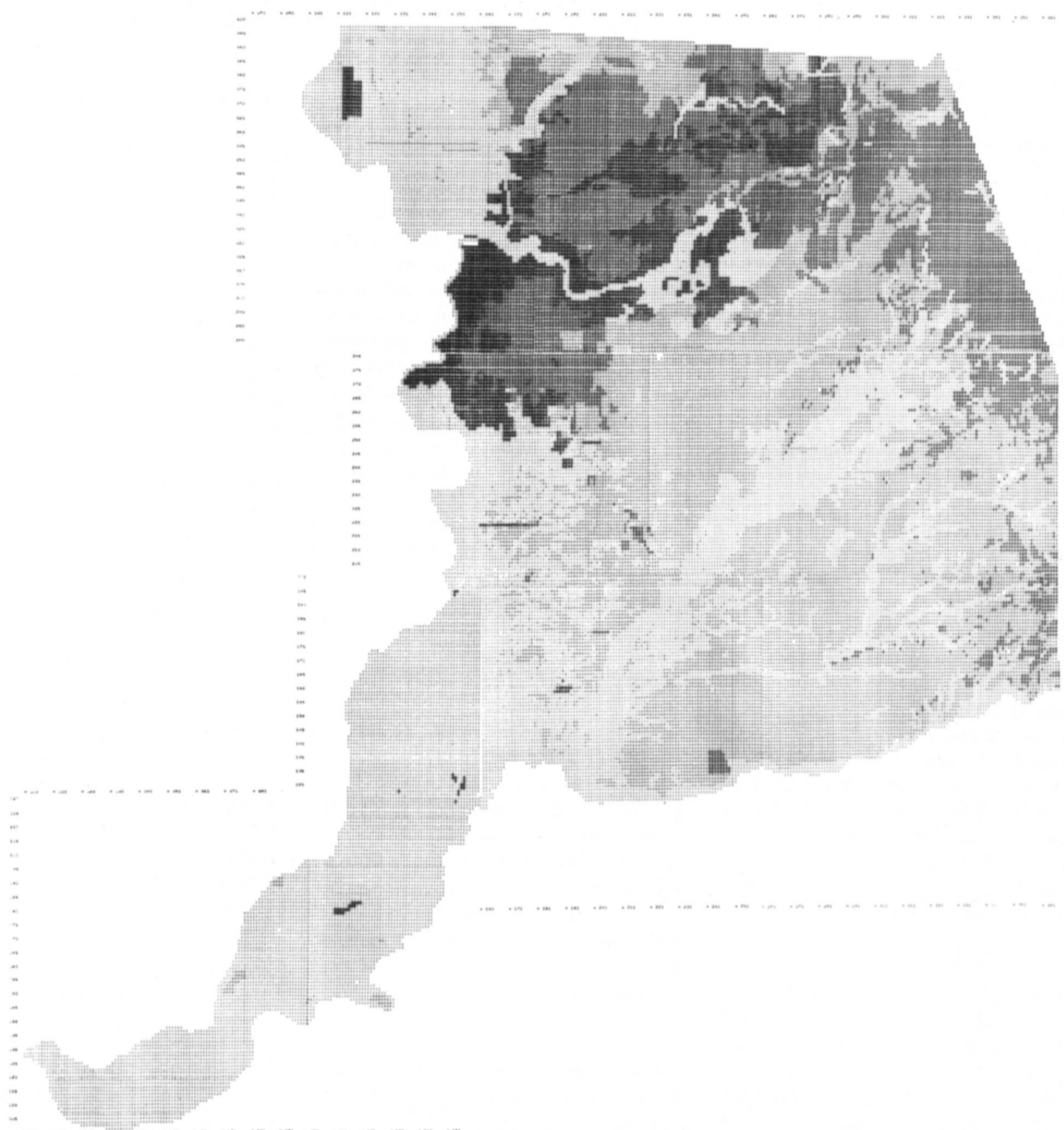
LINDA THORPE

A series of computer Land Use Mapping Programs (LUMP) is being developed to assist land use planners and decision makers in data interpretation vital to environmental planning. Forthcoming land use legislation will have important effects on individual land owners and on California agriculture. This system of programs is designed to be an inexpensive tool for the production of inventory, interpretive, combination and evaluation maps from social and physical resource data.

RECENT WORLD EVENTS have highlighted the thin margin which exists between starvation and sufficiency in the world food situation. In addition, rising food costs in the United States have stimulated renewed interest in maintaining and improving yields from agricultural land. New land, as well as land previously in agriculture but removed for various reasons, is being returned to agricultural production. Counter to these trends is the expansion of non-agricultural land uses onto agricul-

ING PROGRAMS (LUMP)

l use decision making



LEVEL		LOWER LIMIT	FREQUENCY	PERCENT	FERTILITY	LAND USE
01	IIIII	01.00	26478	40.6741	HIGH	NON-URBAN
02	XXXXX	02.00	22348	34.33	MEDIUM	NON-URBAN
03	#####	03.00	05655	08.69	LOW	NON-URBAN
04	#####	04.00	05636	08.66	MEDIUM	URBAN
05	#####	05.00	04882	07.50	HIGH	URBAN
06	UUUUU	06.00	00108	00.17	LOW	URBAN

SOIL FERTILITY = U
TOTAL NUMBER OF CELLS = 65107

tural land. This occurs when highways, industries, commercial enterprises, and homes extend outward from the urban fringe into farm land. The major reason for this competition in land use is that the best land for agriculture is often the best land for non-agricultural uses. "Best" generally means level and flat land with deep well-drained soils.

One result of this land use conflict, and similar ones, has been increased discussion on the federal, state, and local level about land use planning. Specialized land use legislation has been passed in California. Examples are the Williamson Act which allows counties to place agricultural land into "agricultural reserves" which get special tax treatment, and the Coastal Zoning Act which gives considerable control of land use in the coastal zone to regional boards. If last year's legislative session or the current one is any indication, more land use legislation on both national and state levels is likely.

Legislation

Whenever legislation is passed, some individuals lose some freedom and this will certainly remain true for land use legislation. It is imperative that the best possible information be available to legislators and land use planners before they make land use decisions. Among the paramount decisions which those interested in land use planning in California will have to make is that of what needs to be done to maintain and enlarge California's agricultural productivity. This can be translated into such questions as: Where is the best agricultural land in California? Where are areas which may be suitable for future agricultural expansion? Where are areas of prime agricultural land threatened by non-agricultural expansion?

Computer programs

Land Use Mapping Programs (LUMP) is a series of computer programs developed as a tool for storage, retrieval, and (most importantly) manipulation of land use planning data on a geographic base. The system provides a variety of input and output modes (see diagram). Input into the LUMP system is basically accomplished by digitizing information from maps either by hand or by using an automatic digitizing table.

Data may be input on a grid basis. For each geographic X, Y, coordinate there may be a number of associated variable Z values. Examples of Z variables for an area are soil types, present land use, geologic information, and social or political data. Data may also be input in polygons by outlining data boundaries on a digitizing table. Maps or air photos are suitable input sources. Any scale may be used for each series of maps if all composite maps share two or more common data points. Linear and point data as well as aerial data may be entered.

Choropleth maps, where values are associated with large areas rather than with individual grid cells, may be input. Grids can be generated from choropleth maps by digitizing and using an area identification number as a Z variable.

Data input

A third method of data input is from automatically gridded values resulting from the use of contouring programs. Values are known for discrete points scattered over a map and from these values an exhaustive grid is generated. Variables with a continuous nature such as rainfall may be entered by contouring.

Flexible input allows the planner (or researcher) to interface diverse information from many sources. An example is the combination of sociological information from census tapes and physical variables from soil maps into a common data file for each geographic area. In agricultural counties, interfacing gross or net income data with soils information could provide useful information on land productivity for tax and planning purposes. Similarly, conflicts in current land use can be shown (see map). A simple index of agricultural land productivity (soil fertility) was combined with two classes of current land use in Sacramento County (urban vs. non-urban). The combination map which resulted from the analysis clearly shows areas where current city expansion has removed fertile lands from production, and where future expansion should be directed to avoid continuation of this trend.

The output maps consist of shaded characters on a grid format (see map). In addition to the map, a computer printout gives frequencies of occurrences for all combinations of the variables. Three other map types are possible. Inventory maps which simply depict the input information can be produced. Interpretive function maps can be produced when the user defines a new variable as some function of variables included in the inventory data. One such map has been produced for Sacramento County for building loss hazard based on soil slope, soil shrink-swell characteristics, and depth to water table. Finally, evaluation maps can be created when the inventory and interpretive variables and states have been given weighted values for purposes of rating them for certain uses. All variable state values for each grid cell are assigned a function to give a total weight for each cell. Total weights can then be printed using different shading levels.

One example of the usefulness of the evaluation map is in determining where prime agricultural land exists. Soil, geologic, hydrologic and climatic data are input to the computer. Prime land is defined as a weighted or unweighted function of these variables and LUMP can generate a map locating the areas of interest.

The emphasis in designing this system of programs is to provide an inexpensive system for the manipulation of geographically based data. There are literally hundreds of kinds of data which need to be collected, stored, retrieved, and manipulated for land use plans and legislation to be successful. LUMP, which is actively being tested and evaluated with the support of Sacramento County and the Sacramento Regional Areawide Planning Agency, can serve as an important tool in the process. The net result will be better information for land use decision making in California. A copy of a report which describes the system and its use is available on request.

Michael Singer is Assistant Professor in the Department of Soil Science and Plant Nutrition. Robert Johnston is Assistant Professor, and Linda Thorpe is Computer Programmer, Division of Environmental Studies, University of California at Davis.

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Jerry Lester .... *Editor*
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