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Inventory of Available Data Elements for the San Bernardino, California Region

Interim Report

Jerald Christenson
Russell Michel

Environmental Systems Research Institute

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Inventory of Available Data Elements for the San Bernardino, California Region

Interim Report

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Prepared for
Ames Research Center
under Contract NAS2-10741

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INTRODUCTION

This report addresses the elements of the data sets that are available to be integrated for the San Bernardino Vertical Data Integration project. Each of the individual data sets has specified for it the ownership, validity, accuracy, and the technical requirements for integration. The validity of the data refers to how current the data is, how reliable the data collection methodology was, and how appropriate the data elements are for the study. The accuracy refers to the mapping scale, number of classes and class breakdown, and the mapping resolution.

This summary shows the available data sets being utilized for integration in this effort:

Number	Owner	Date	Data Set Description	Geographic Area
1	SCE	1974	Land Use, Communities	East Valley and Mountain
2	SCE	1979	Land Use Update	East Valley
3	USFS	1976-77	Terrain Units (Slope, vegetation, landform, geology)	San Bernardino National Forest
4	USFS	1976-77	Recreation Inventory	San Bernardino National Forest
5	SBC	1979	Parcel Ownership File	Yucaipa 7½' Quad
6	SBC	varies	General Plan Support Data	East Valley and Mountains
7	SBC	current	GBF/DIME (geo-coded address and census geographic unit matching system)	Urbanized portions of County
8	SCE	1980	Census Tracts	Urbanized portions of County
9	Ames	1980	Integrated Terrain Units (Land cover, geology, soils, etc.)	San Bernardino Valley

Data Set Number 1 - SCE 1974 Land Use

Owner - Southern California Edison, Land Division
Rosemead, California

Date - Base map work valid for 1974

Data Set Description - Land use at the community level. Automated PIOS files at ESRI

Geographic Area - East San Bernardino Valley and adjoining mountains

Validity - The data was compiled for the 1974 data base and as such represents the starting point or base data for subsequent change detection mapping. Earthsat Corporation performed the photo interpretation work with no field checking using black and white air photos.

Accuracy - The mapping scale is 1:24,000. The black and white photos were interpreted for a mapping resolution of 5 acres for rural land use and 3.5 acres for urban land use.

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Data Classes - Codes	1974 Land Use Classification Scheme Category
110	**Residential**
111	Single Family-detached single family/duplex dwellings
112	Multi-Family-attached single family row housing (condominiums, garden apartments, etc.)
113	Mobile Home and Trailer Parks
114	Residential (lots 2.5 acres or greater)
120	**Commercial and Services**
121	Central Business Districts
122	Regional Shopping Centers
123	Neighborhood Shopping Centers
124	Strip or Roadside Commercial Developments
125	Drive-In Theatres, Stadiums, Race Tracks, Amusements, Fairgrounds
126	Wholesale Services, including trucking companies, warehousing and building materials (i.e., lumber yards, masonry yards, etc.)
127	Hotels and motels not otherwise classified above.
130	**Industrial**
131	Light industry, manufacturing and industrial areas, including associated warehouses, storage yards, parking areas, not associated on-site heavy industry.
132	Heavy Industry - Foundaries, scrap yards, primary metals, mechanical processing, chemical processing, etc., and associated facilities.
140	Extractive - Sand and gravel pits, stone quarries, oil and gas wells, etc., associated storage and tailings areas, and associated facilities.
150	**Transportation and Utilities**
151	Airports (non-military, including runways, parking areas, hangars, and associated facilities).
152	Railroads, including yard, terminals and rights-of-way exceed 210 feet ground distance.

153	Freeways, highways, and major arteries whose rights-of-way exceed 210 feet ground distance.
154	Electric power, including line rights-of-way, stations, and generation facilities, as appropriately provided as collateral data by the buyer to the seller.
155	Other utilities, gas, water, sewage, and solid waste and sanitary land fill areas and facilities, as appropriately provided as collateral data by the buyer to the seller.
<u>160</u>	<u>Public</u>
161	Government institutional facilities, including offices, Fire Stations, Police Stations, etc., as appropriately provided as collateral data from the buyer to the seller
162	Health care facilities, as appropriately provided as collateral data from the buyer to the seller.
163	Elementary Schools and associated facilities.
164	Junior High Schools and associated facilities.
165	Senior High Schools and associated facilities.
166	Colleges and Universities and associated facilities.
167	Military establishments, including bases and camps, airports and supporting facilities.
168	Other institutional including religious facilities, cultural and social facilities. etc.
<u>170</u>	<u>Open Space</u>
171	Golf Courses
172	Parks and recreation areas and associated facilities.
173	Cemetaries
174	Other open and green space including wildlife preserves and sanctuaries, as provided by the buyer as collateral data.
175	Undeveloped/Improved
<u>210</u>	<u>Agriculture</u>
211	Grain, seed and truck crops.
212	Orchards and vineyards.

213	Pasture and rangeland
214	Dairy and livestock feed lots, and associated facilities.
215	Poultry operations and associated facilities.
216	Other agricultural land uses in non-incorporated areas.
<u>220</u>	<u>Water</u>
221	Open water, including lakes and reservoirs.
222	Streams and waterways, including associated floodplains and flood control facilities (the latter shall be appropriately provided as collateral data by the buyer to the seller).
223	Other
<u>230</u>	<u>Undeveloped and Forest</u>
231	Undeveloped 0-12% slope
232	Undeveloped 12-16% slope
233	Undeveloped 16-24% slope
234	Undeveloped 24% + slope
235	Deciduous and evergreen forest areas, the crown cover of which exceeds 30% ground area.

Technical Requirements for Integration - Compilation of the photomapped land use polygons into an automated data format is the first major step in the integration process. This is accomplished by digitizing the polygons into a common coordinate structure called digitizer inches. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of polygon Information Overlay Programs (PIOS) or converted to a grid file. The cell size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

This 1974 SCE land use data was mapped and automated on a 7.5 minute module basis. The polygons of land use were digitized in digitizer inch coordinates and then processed through ESRI's 'BILINE' or bilinear program to provide the data in State Plane Coordinates. These land use files are being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to pick the element of greatest occurrence which is then flagged as the cover code for the new four acre cell. If all four cells are different or two are in group A and two are in group B, the program utilizes a user defined look-up table to assign the desired land cover code. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

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Data Set Number 2 - SCE 1979 Land Use Update

Owner - Southern California Edison, Land Division

Rosemead, California

Date - Update work from 1974 base, valid for 1979

Data Set Description - Land Use Update Study

Automated PIOS files at ESRI

Geographic Area - East San Bernardino Valley

Validity - The update work was photo interpreted by Aerial Information Systems (AIS) using Fall 1979 black and white photographs. Field checking was conducted by AIS and SCE at twenty control points.

Accuracy - Mapping scale was 1:24,000. A mapping resolution of 5 acres for rural land use and 3.5 acres for urban land use. One new class was added to the single family residential (SFR) class mapping SFR on less than 0.5 acres, greater than 0.5 and less than 2.5 acres, and greater than 2.5 acres (dispersed).

Data Classification -

Major Class	Code	Class
Residential		
	110	Residential, RS < ½ acre
	111	Residential, RS > ½ acre
	112	Residential, MF
	113	Mobile Homes
	114	Rural Residential (2.5 acres)
Commercial		
	121	Regional and General Commercial
	122	Commercial Strip
	123	Neighborhood Strip
Industrial/Extractive		
	131	Light Industry
	132	Heavy Industry
	133	Extractive
Other Committed Uses		
	151	Transportation/Communication
	152	Utilities
	153	Military
	154	Water
Public/Institutional		
	161	Public/Institutional
	162	Schools
Open Space/Recreational		
	171	Greenspace - Irrigated
	172	Recreation - Non-Irrigated

Data Classification (cont.) -

Agriculture

210	Vineyards - Irrigated and Non-Irrigated
211	Row and Truck, Crops, Grain and Seed Irrigated
212	Orchards - Irrigated
213	Pasture, Field Crops - Irrigated
214	Dairies and Feedlots
215	Poultry Operations
216	Other Agriculture

Vacant

231	Vacant with < 24% clope
232	Vacant with > 24% slope
233	Vacant with Improvements

Technical Requirements for Integration - Compilation of the photomapped land use polygons into an automated data format is the first major step in the integration process. This is accomplished by digitizing the polygons into a common coordinate structure called digitizer inches. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of Polygon Information Overlay Programs (PIOS) or converted to a grid file. The cell . size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

This 1979 SCE land use update data was mapped and automated on a 7.5 minute module basis. The polygons of land use were digitized in digitizer inch coordinates and then processed through ESRI's 'BILINE' or bilinear program to provide the data in State Plane Coordinates. These land use files were being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to pick the element of greatest occurrence which is then flagged as the cover code for the new four acre cell. If all four cells are different or two are in Group A and two are in Group B, the program utilizes a user defined look-up table to assign the desired land cover code. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

Data Set Number 3 - USFS Terrain Units

Owner - U.S. Forest Service, San Bernardino National Forest
144 N. Mtn. View Avenue, San Bernardino, California 92408

Date - Data base materials were compiled for 1976 and 1977 time frames.

Data Set Description - A computer automated integrated environmental data base for systematic analysis and modeling of the impacts associated with recreational planning process for the Forest.

Geographic Area - Approximately 825,000 acres lying within the boundaries of the S.B. National Forest, California

Validity - The data base elements were current as of September, 1978. U-2 color infra-red imagery was used for interpretation of land use, vegetation and for boundary definition. Work was completed by ESRI/AIS of Redlands, California. Basic geographic data related to such phenomena as landform, geology, slope, and vegetation were integrated into homogeneous terrain units. These terrain units have direct applicability to the needs of the Vertical Integration Project. The data base is consistent and compatible with existing Forest Service Systems called RIMS and FOCUS.

Accuracy - Eight manuscripts were developed and automated at a scale of 1:62,500 on standard topographic quadrangles. Data elements were gridded from polygons to a ten acre grid cell. The photo-mapping resolution was 50 acres.

Data Classes - Eight separate computer files were created. These contained a total of some forty separate code categories. The files and categories are identified as follows:

Circulation Patterns File

- Road Ownership
- Road Use Intensity
- Road Surface Quality
- Scenic Roads and Trails
- Road Inventory Numbers
- Trail Use Intensity
- Trail Special Use Designation
- Fuel Breaks

Recreation Sites File

- "RIMS" Number
- General Recreation Type

Land Ownership File

- General Pattern of Ownership

Administrative Districts File

- San Bernardino National Forest Districts
- Counties
- Roadless Area Review and Evaluation Units (RARE II)
- Key Fire Areas
- Timber Compartments
- Range Allotments
- Burro Territories
- Sheep Camps
- Special Use Areas
- Watersheds
- Shooting Closures

Special Features File

- "Sensitive" Animal Habitat
- "Sensitive" Plants
- Historic Sites
- Archaeologic Sites
- Mining Operations
- Scenic Points
- Environmental Nuisances

Water Course Lines File

- Flow Permanence
- Stream Order
- Fishing Streams

Integrated Terrain Units File

- Vegetative Type or Land Cover
- Geology
- Percent Slope Class
- Land Form

Land Use Map File

- General Pattern of Land Use

Data Codes for Vegetation and Land Use File -

ITUM Vegetative Type or Land Cover

01 = Douglas Fir & Big Cone Douglas Fir

02 = Ponderosa & Jeffrey Pine

04 = White Fir

07 = Sugar Pine

08 = Lodgepole Pine

09 = Incense Cedar

11 = Coulter Pine

12 = Pinon Pine

14 = Juniper

15 = Limber Pine

16 = Deciduous Woodland

17 = Live Oak Woodland

18 = Joshua Tree Woodland

19 = Ceanothus Chapparal (Scrub Oak Inc.)

20 = Chamise Chapparal

21 = Manzanita Chapparal

22 = Red Shank Chapparal

23 = Juniper - Scrub Oak - Pinon Woodland

24 = Coastal Sage

25 = Great Basin Sage

26 = Riparian, Live Oak

27 = Riparian, Alder-Willow-Aspen

28 = Riparian, Sycamore-Cottonwood

29 = Desert Scrub Veg. (Cresote)

30 = Grassland

31 = Barren, Urban, or Agriculture

32 = Wilderness

33 = Water Body

34 = Interior Live Oak Woodland (Emergent)

Land Use

1 = Residential

2 = Commercial

3 = Ski Areas

4 = State Park

5 = County Park

6 = Proposed County Park

Technical Requirements for Integration - Compilation of the photomapped land cover polygons into an automated data format is the first major step in the integration process. This is accomplished by digitizing the polygons into a common coordinate structure called digitizer inches. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of polygon Information Overlay Programs (PIOS) or converted to a grid file. The cell size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

This USFS land cover data was mapped and automated on a 15 minute module basis. The polygons of land use were digitized in digitizer inch coordinates and then processed through ESRI's 'BILINE' or bilinear program to provide the data in State Plane Coordinates. These land use files are being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to pick the element of greatest occurrence which is then flagged as the cover code for the new four acre cell. If all four cells are different or two are in group A and two are in group B, the program utilizes a user defined look-up table to assign the desired land cover code. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

Data Set Number 4 - USFS Recreation Inventory

Owner - U.S. Forest Service, San Bernardino National Forest

144 N. Mtn. View Avenue, San Bernardino, California 92408

Date - Data base materials were compiled for 1976 and 1977 time frames.

Data Set Description - An environmental atlas comprised of 110 maps plotted on translucent mylar at a scale of 1:62,500 shows the patterning of basic environmental phenomena such as landform, vegetation, and land use within the Forest. The map atlas and associated data tabulations are designed to serve on-going planning activities. A set of nine analytical models were developed for analyzing and interpreting environmental opportunities and constraints within the Forest. The models deal with such diverse phenomena as fire hazards, ecological importance, and outdoor recreation experience levels. The model output, expressed in a map form, is intended to serve on-going planning and management functions.

Geographic Area - Approximately 825,000 acres lying within the boundaries of the S.B. National Forest, California.

Validity - The data base elements were current as of September, 1978. U-2 color infra-red imagery was used for interpretation of land use, vegetation, and for boundary definition. Work was completed by ESRI/AIS of Redlands, California. Basic geographic data related to such phenomena as landform, geology, slope, and vegetation were integrated into homogeneous terrain units. These terrain units have direct applicability to the needs of the Vertical Integration project. The data base is consistent and compatible with existing Forest Service Systems called RIMS and FOCUS.

Accuracy - The original photo-mapping resolution was 50 acres. The eight single-variable polygon files developed from the photo interpreted manuscripts were used to create a multi-variable grid file for the Forest. A uniform grid with a cell size of ten acres was superimposed atop the data in the computer. Data stored in the point, line and polygon format were transferred to the grid structure. The ten acre grid provided for the capture of all point and line data and the close approximation of natural polygon boundaries. Computer mapping was done in both formats, the polygon files being used to create a map atlas of basic environmental data, the grid file being used for the land capability/suitability analysis and mapping.

Data Classes - A point, line, and polygon map atlas of basic environmental data was produced for the Forest. It contains one hundred and ten maps, these representing a number of different data variables for each of the eleven map modules comprising the Forest. The data variables provide coverage for both cultural and natural phenomena. They are identified as follows:

Map Variable Number	Description
1	Vegetation
2	Slope Gradient
3	Landform
4	Geology
5	Surface Hydrology
6	Land Use
7	Land Ownership
8	Roads and Trails
9	Special Features

A number of theoretical models for the analysis and definition of land capability/suitability within the Forest were developed. Their application to the computerized data bank resulted in the production of a series of nineteen interpretive maps. These maps, which were plotted on a grid format at a scale of 1:62,500 were designed to provide content and direction to the processes of land allocation and planning. In effect, they were designed as a vehicle for determining the availability of suitable recreation lands within the Forest. Two levels of analysis and mapping were employed. The first centered on the definition and delineation of natural opportunities and constraints. The second centered on the identification of lands suitable for select recreation activities. The latter process was based on the analysis of basic environmental conditions and some interpretive characteristics. The models are identified as follows:

Environmental Opportunities/Constraints Models

- Model/Map 1: Geologic Hazards
- Model/Map 2: Erosion Potential
- Model/Map 3: Fire Hazards
- Model/Map 4: Flooding
- Model/Map 5: Ecological Importance
- Model/Map 6: Non-Recreation Resource Uses
- Model/Map 7: Visual Resources
- Model/Map 8: Outdoor Recreation Experience Levels
- Model/Map 9: Outdoor Recreation Attractions

Land Capability/Suitability Models and Maps

- Model/Map 10: Suitability for Developed Picnicking
- Model/Map 11: Suitability for Developed Camping
- Model/Map 12: Suitability for Buildable Land
- Model/Map 13: Suitability for Interpretive Site
- Model/Map 14: Suitability for Alpine Skiing
- Model/Map 15: Suitability for Winter Sports
- Model/Map 16: Suitability for Trails
- Model/Map 17: Suitability for Roads
- Model/Map 18: Suitability for Fishing
- Model/Map 19: Highest Recreation Suitability

Technical Requirements for Integration - Compilation of the photomapped land use polygons into an automated data format is the first major step in the integration process. This is accomplished by digitizing the polygons into a common coordinate structure called digitizer inches. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of polygon Information Overlay Programs (PIOS) or converted to a grid file. The cell size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

This USFS Recreation Inventory was mapped and automated on a 15 minute module basis. The polygons of land use were digitized in digitizer inch coordinates and then processed through ESRI's 'BILINE' or bilinear program to provide the data in State Plane Coordinates. These land use files are being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to pick the element of greatest occurrence which is then flagged as the cover code for the new four acre cell. If all four cells are different or two are in group A and two are in group B, the program utilizes a user defined look-up table to assign the desired land cover code. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

Data Set Number 5 - San Bernardino County Parcel Ownership File

Owner - San Bernardino County Assessor's Office

Date - Updated through 1979

Data Set Description - Assessors plots for Yucaipa, California. Map data has not been automated by County.

Geographic Area - Mapped area corresponds with Yucaipa 7½ minute topographic quadrangle.

Validity - One original project concept was to utilize the parcel/ownership file for the compilation of Landsat and collateral data by those units. This data is not currently automated so compilation in an automated mode is not possible.

Data Set Number 6 - San Bernardino County General Plan Support Data

Owner - Available from San Bernardino County Planning Office, Mill Street, San Bernardino, California

Date - Dates vary. General Plan was adopted in June, 1979.

Data Set Description - The East Valley portion of the plan contains three maps for land use, circulation (highways), and Health and Safety Considerations.

Geographic Area - East Valley portion of San Bernardino Valley, California

Validity - Land use map identifies groupings of permitted land use. Map shows land uses projected for the next 5 to 20 years. Interpretations of categories shown on the map must be made using the General Plan text material. The circulation map is a graphic representation of County Policy. It also identifies the general location and classification of existing regional roads within the County. The map should be utilized in association with the General Plan Text. The Health and Safety Considerations Map contains generalized boundaries for conditions which may modify the circumstances under which development can occur. The map should be utilized in association with the General Plan Text.

Accuracy - The map examples that are provided with the General Plan are printed at approximately 1:62,500.

Data Classes - The classes for the land use map are:

- Residential*
- Agricultural
- Public
- Incorporated Sphere
- Mountain Communities and/or Desert Communities Boundary
- Rural Living*
- Commercial
- National Forest Boundary
- West/East Valley Boundary
- Rural Conservation
- Industrial

The classes for the circulation map are:

- Freeway
- Divided Major Highway
- Major
- Secondary

The classes for the Health and Safety Map are:

- Potential Seismic Risk (1)
- High Fire Hazard (3)
- Airport Proximity (5)
- Agricultural Preserves (7)
- Scenic Route Corridors (9)
- Potential Noise Exposure (2)
- Flood Hazard (4)
- Potential Landslide Areas (6)
- Wilderness Areas (8)
- National Forest Boundary

The actual code structure for the manuscripts is:

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* All residential designations are followed by a number giving the maximum number of dwelling units allowed per acre in that area (ex: Res-4). All rural designations are followed by a one and the number equivalent to the minimum parcel size allowed in that area (ex: Rul-1/2.5=1 dwelling unit per each 2½ acre parcel).

VERTICAL INTEGRATION

SAN BERNARDINO COUNTY

GENERAL PLAN LAND USE

1000 = Residential

1001 = 1 dwelling unit maximum per acre
1002 = 2 dwelling unit maximum per acre
1003 = 3 dwelling unit maximum per acre
1004 = 4 dwelling unit maximum per acre
1005 = 5 dwelling unit maximum per acre
1006 = 6 dwelling unit maximum per acre
1007 = 7 dwelling unit maximum per acre
1008 = 8 dwelling unit maximum per acre
1009 = 9 dwelling unit maximum per acre
1010 = 10 dwelling unit maximum per acre
1011 = 11 dwelling unit maximum per acre
1012 = 12 dwelling unit maximum per acre
1013 = 13 dwelling unit maximum per acre
1014 = 14 dwelling unit maximum per acre
1015 = 15 dwelling unit maximum per acre
1016 = 16 dwelling unit maximum per acre
1017 = 17 dwelling unit maximum per acre
1018 = 18 dwelling unit maximum per acre
1019 = 19 dwelling unit maximum per acre
1020 = 20 dwelling unit maximum per acre
1021 = 30 dwelling unit maximum per acre
1022 = 36 dwelling unit maximum per acre
1023 = 43 dwelling unit maximum per acre
1024 = 45 dwelling unit maximum per acre
1025 = 90 dwelling unit maximum per acre

1100 = Rural Living

1101 = 1 acre minimum parcel size allowed
1102 = 2.5 acre minimum parcel size allowed
1103 = 5 acre minimum parcel size allowed
1104 = 10 acre minimum parcel size allowed
1105 = 20 acre minimum parcel size allowed

1200 = Commercial

1300 = Industrial

1600 = Public

2100 = Agriculture

2300 = Rural Conservation

Technical Requirements for Integration - Compilation of the mapped land cover polygons into an automated data format is the first major step in the integration process. This is accomplished by digitizing the polygons into a common coordinate structure called digitizer inches. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of polygon Information Overlay Programs (PIOS) or converted to a grid file. The cell size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

This land cover data was mapped and automated on a 15 minute module basis. The polygons of land use were digitized in digitizer inch coordinates and then processed through ESRI's 'BILINE' or bilinear program to provide the data in State Plane Coordinates. These land use files are being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to pick the element of greatest occurrence which is then flagged as the cover code for the new four acre cell. If all four cells are different or two are in group A and two are in group B, the program utilizes a user defined look-up table to assign the desired land cover code. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

Data Set Number 7 - San Bernardino County
GBF/DIME (geo-coded address and census geographic unit matching system)

Owner - Census Bureau/S.B. County Planning Department

Date - 1980 Updates

Data Description - The GBF/DIME file provides an x,y coordinate chain file for spatial cross-reference between many types of census urban data. The record layout of a GBF/DIME file contains 300 characters including such information as street name, type, and direction; left- and right-hand side addresses; block, tract, and other geographic codes; ZIP code; node numbers as well as their latitude and longitude.

Geographic Area - Urbanized portions of the study area

Validity - 1980 census data statistics will be available in mid-June, 1981.

Accuracy - Tract Polygons were automated from 1:24,000 base maps by the Census Bureau. The placement of the tract boundary is tied to observable features on both the ground and on the topo base map.

Data Classes - The GBF/DIME files have housing and population counts compiled by census tract for the 1980 Census.

Technical Requirements for Integration - Compilation of automated tract files is initially accomplished by converting the DIME file into State Plane Coordinates. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of polygon Information Overlay programs (PIOS) or converted to a grid file. The cell size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

These polygon files are being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to identify if one of the four cells has a positive reading for the presence of a tract element. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

Data Set Number 8 - Census Bureau's Census Tracts

Owner - Southern California Edison, Land Division, Rosemead, California

Date - 1980 Updates have been incorporated into file.

Data Description - The census tract boundaries are computer automated x,y coordinate data files that have been automated by ESRI from the Census Bureau's 1:24,000 Metropolitan Map Series. The tracts are the basic compilation unit for census related statistics such as population and housing counts. There are 65 tracts in the study area.

Geographic Area - The valley portion of the study area is tracted.

Validity - The preliminary 1980 adjustments have been made. The census tracts are a major framework utilized by the County for the purpose of identifying population and housing statistics. Therefore, the environmental models that are processes for the other data elements will be interfaced with the census statistical data to provide a broader picture of the region of study.

Accuracy - The census tract polygons were automated from 1:24,000 base maps called the Metropolitan Map Series. The placement of the tract boundary is tied to the observable features on both the ground and on the topo base map.

Data Classes - The tracts are boundary polygons that contain only the tract number.

Technical Requirements for Integration - Compilation of automated tract files is initially accomplished by converting the DIME file into State Plane Coordinates. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of polygon Information Overlay programs (PIOS) or converted to a grid file. The cell size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

These polygon files are being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to identify if one of the four cells has a positive reading for the presence of a tract element. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

<u>Data Set Number 9</u> - Integrated Terrain Unit Map for the Valley

Owner - NASA-Ames contracted for Vertical Data Integration Project

Date - 1980 updates were incorporated from collateral material.

Data Description: A series of computer automated integrated environmental data planes at 1:62,500. The variables include:

<u>Integrated Terrain Unit Map</u>

- Land Cover
- Geologic Type
- Percent Slope
- Landform
- Soils
- Surface Configuration
- Geologic Hazards
    - Alquist Priolo Fault Zones
    - Landslides
    - Landslide Susceptibility
- Depth to Groundwater
- Flood Prone Areas

<u>General Plan Map</u>

- General Plan Designation

<u>Lines Map</u>

- Transportation
    - Circulation
    - Roads Classified by Intensity of Use Grouping
    - Roads by General Surface Qualities
    - Railroads
- Streams
    - Stream Order
    - Flow Characteristics
    - Channelization
- Faults
- County General Plan Data

Geographic Area - Valley portion of the data base

Validity - The data elements were mapped using 1980 aerial photography and the most current collateral data. This data base was designed specifically to support the programmatic requirements of the Vertical Integration Project.

Accuracy - The terrain unit manuscripts were developed on a USGS 1:62,500 topographic map base. The black and white photographs were 1:24,000. The photo interpretation and map integration work was performed by ESRI/AIS.

Data Classes and Codes -

Land Cover, Column 1 and 2

Forest

01 = Douglas Fir and Big Cone Douglas Fir

02 = Ponderosa and Jeffrey Pine

04 = White Fir

07 = Sugar Pine

08 = Lodgepole Pine

09 = Incense Cedar

11 = Coulter Pine

12 = Pinon Pine

14 = Juniper

15 = Limber Pine

16 = Deciduous Woodland

17 = Live Oak Woodland

18 = Joshua Tree Woodland

19 = Ceanothus Chapparal (Shrub Oake Inc.)

20 = Chamise Chapparal

21 = Manzanita Chapparal

22 = Red Shank Chapparal

23 = Juniper - Scrub Oak - Pinon Woodland

24 = Coastal Sage

25 = Great Basin Sage

26 = Riparian, Live Oak

27 = Riparian, Alder-Willow-Aspen

28 = Riparian, Sycamore-Cottonwood

29 = Desert Scrub Veg. (Cresote)

30 = Grassland

31 = Barren, Urban, or Agriculture

32 = Wilderness Area

33 = Water Body

<u>Geologic Type, Column 3 and 4</u>

00 = Water

01 = Quaternary alluvium-sands, gravels, and clays in active stream or lake beds or on active fans

02 = Quaternary landslide deposits-debris deposited by landslide movement

03 = Quaternary talus rubble-talus piles on steep slopes deposited by mass wasting

04 = Quaternary older alluvium-partially consolidated sand and gravel deposits currently above base level

05 = Quaternary glacial till-unsorted angular fragments carried downslope and deposited by Pleistocene glaciers

06 = Pliocene sedimentary deposits-sandstone, conglomerates, minor mudstones, and rare associated volcanic rocks

07 = Pre-Pliocene Tertiary sedimentary deposits-sandstones, conglomerates, minor mudstones and rare associated volcanic rock

08 = Tertiary volcanic rocks-basalt flows and dikes

09 = Mesozoic plutonic rocks-granodiorite, diorite, gabbro, quartz diorite, quartz monzonite, quartz latite porphyry, and granite

10 = Pre-Tertiary gneiss or schist-gneissic or schistose metamorphic rocks and old (pre-Mesozoic) metamorphosed plutonic rocks

11 = Pre-Tertiary quartzite-quartzite and meta-sandstones

12 = Pre-Tertiary marble-marble and meta-limestone

13 = Artificial fill-solid waste disposal sites and earth filled dams

14 = Wilderness-all areas within a wilderness area

15 = Wind blown sand areas and sand dunes-areas of eolian deposition

Percent Slope, Column 5

1 = 0-8% Slope

2 = 8-15% Slope

3 = 15-30% Slope

4 = 30-50% Slope

5 = 50% Slope and over

6 = Water Body

7 = Wilderness

Landform, Column 6 and 7

00 = Water Body

01 = Rock outcrops-areas underlain by crystalline or well consolidated sedimentary rocks not covered by soil or debris

02 = Mountain or ridge top-areas on the tops of mountains or ridges with slopes less than 15%

03 = Mountain sideslopes-areas underlain by crystalline or well consolidated sedimentary rock with downslope moving venier of soil or rock debris and slopes greater than 30%

04 = Badlands-areas underlain by poorly consolidated sedimentary rocks undergoing rapid erosion in characteristic badlands pattern (high number of drainage courses per unit area).

05 = Bench or terrace-areas with slopes less than 30% above the current erosional base and below higher, steeper lands

06 = Glacial deposits-morian lands-areas underlain by glacial till

07 = Colluvial land-areas underlain by talus rubble

08 = Valley bottom-areas underlain by crystalline or well consolidated sedimentary rock with slopes less than 30% at the bottom of a valley

09 = Alluvial fans-Badja-areas underlain by poorly or moderately consolidated sedimentary rocks deposited as fans at the mouths of canyons

10 = River lands (canyon bottoms)-areas underlain by poorly to moderately

11 = Artificial fill-solid waste disposal sites and earth filled dams

12 = Wilderness-all areas within a wilderness area

13 = Mountain Uplands-areas underlain by crystalline or well consolidated sedimentary rock with venier of soil or rock debris and slopes less than 30% and not a valley bottom, mountain or ridge top, or bench

14 = Landslides-areas underlain by landslide deposits

15 = Wash-ephemeral river channels

16 = Floodplain-areas adjacent to river which is subjected to frequent flooding

17 = Sand Dune, Sand Sheet-areas of eolian deposition

18 = Hills-isolated sloping areas with less than 500 feet of local relief

Soils, Column 8 and 9

01 = Alo clay, 30-50% slopes (AaF)

02 = Chino silt loam (Cb)

03 = Chualar clay loam, 0-2% slopes (CkA)

04 = Chualar clay loam, 2-9% slopes (CkC)

05 = Chualar clay loam, 9-15% slopes (CkD)

06 = Cieneba sandy loam, 9-15% slopes (CnD)

07 = Cieneba-Friant sandy loams (Cp)

08 = Cieneba-Rock outcrop complex (Cr)

09 = Crafton-Rock outcrop complex, eroded (Cs2)

10 = Delhi fine sand (Db)

11 = Fontana clay loam, 15-30% slopes (FoE)

12 = Fontana clay loam, 30-50% slopes (FoF)

13 = Friant Rock outcrop complex (Fr)

14 = Garretson very fine sandy loam, 2-9% slopes (GaC)

15 = Gaviota-Rock outcrop complex (Go)

16 = Grangeville fine sandy loam (Gr)

17 = Grangeville fine sandy loam, saline-alkali (Gs)

18 = Greenfield sandy loam, 2-9% slopes (GtC)

19 = Greenfield sandy loam, 9-15% slopes (GtD)

20 = Greenfield cobbly sandy loam, 5-15% slopes (GuD)

21 = Hanford coarse sandy loam, 2-9% slopes (HaC)

22 = Hanford coarse sandy loam, 9-15% slopes (HaD)

23 = Hanford sandy loam, 0-2% slopes (HbA)

24 = Hilmar loamy fine sand (Hr)

25 = Merrill silt loam (Me)

26 = Metz coarse sandy loam, 2-9% slopes (MgC)

27 = Monserate sandy loam, 2-9% slopes (MoC)

28 = Nacimiento clay loam, 9-30% slopes (NaE)

29 = Nacimiento clay loam, 3-050% slopes (NaF)

30 = Oak Glen sandy loam, 2-9% slopes (OaC)

31 = Oak Glen gravelly sandy loam, 9-15% slopes (OgD)

32 = Oak Glen gravelly sandy loam, 15-30% slopes (OgE)

33 = Psamments and Fluvents, frequently flooded (Ps)

34 = Ramona sandy loam, 2-9% slopes (RmC)

35 = Ramona sandy loam, 9-15% slopes (RmD)

36 = Ramona sandy loam, 15-30% slopes, eroded (RmE2)

37 = San Emigdio sandy loam, 9-15% slopes (SaD)

38 = San Emigdio gravelly sandy loam, 2-9% slopes (SbC)

39 = San Emigdio fine sandy loam, 0-2% slopes (ScA)

40 = San Emigdio fine sandy loam, 2-9% slopes (ScC)

41 = San Timoteo loam, 30-50% slopes, eroded (SgF2)

42 = Saugus sandy loam, 30-50% slopes (ShF)

43 = Soboba gravelly loamy sand, 0-9% slopes (SoC)

44 = Soboba stony loamy sand, 2-9% slopes (SpC)

45 = Soper gravelly loam, 15-30% slopes (SrE)

46 = Soper gravelly loam, 30-50% slopes (SrF)

47 = Sorrento clay loam, 0-2% slopes (StA)

48 = Sorrento clay loam, 2-5% slopes (StB)

49 = Tollhouse sandy loam; 30-50% slopes (ToF)

50 = Tujunga loamy sand, 0-5% slopes (TuB)

51 = Tujunga gravelly loamy sand, 0-9% slopes (TvC)

52 = Vista-Rock outcrop complex (Vr)

Surface Configuration, Column 10

1 = Simple

2 = Undulating

3 = Complex

Geologic Hazards, Column 11, 12 and 13

Alquist Priolo Fault Zones, Column 11

1 = Area not within fault zone

2 = Area within fault zone

Landslides, Column 12

1 = Not a known landslide

2 = Known landslide

Landslide susceptibility, Column 13

1 = Generally devoid of landslides

2 = Low to moderate

3 = Moderate to high

Depth to Groundwater, Column 14

1 = 0-100'

2 = 100-200'

3 = 200-300'

4 = 300-400'

Economic Geology, Column 15

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Flood Prone Areas, Column 16

AWAITING COLLATERAL

LINES MAP

Transportation, Column 1, 2, 3, 4 and 5

Circulation, Column 1

1 = Not a road

2 = State road

3 = County road

4 = National Forest Service road

Roads Classified by Intensity of Use Grouping, Column 2

1 = Not a road

2 = Arterial

3 = Collector

4 = Local

Roads by General Surface Qualities, Column 3

1 = Not a road

2 = Paved

3 = Not paved

Railroads, Column 4

1 = Not a railroad

2 = Major railroad

Streams, Column 5, 6 and 7

Stream Order, Column 5

Stream order 1-5

Flow Characteristics, Column 6

1 = Intermittent Flow

2 = Perennial Flow

Channelization, Column 7

1 = Not Channelized

2 = Channelized

<u>Faults, Column 8</u>

0 = Not a fault

1 = Accurately located strike slip fault

2 = Well located strike slip fault

3 = Cancealed strike slip fault

4 = Accurately located thrust fault

5 = Well located thrust fault

6 = Cancealed thrust fault

7 = Fault inferred from seismic activity

Technical Requirements for Integration - Compilation of the photomapped land cover polygons into an automated data format is the first major step in the integration process. This is accomplished by digitizing the polygons into a common coordinate structure called digitizer inches. From this format, the polygon data can be rescaled to one of several coordinate systems: integrated with other polygon data sets using a series of polygon Information Overlay Programs (PIOS) or converted to a grid file. The cell size of the grid is based on the output modeling requirements and the size of the geographic area involved. See Appendix "A" for more detailed development of this topic.

This 1980 land cover data was mapped and automated on a 7.5 minute module basis. The polygons of land use were digitized in digitizer inch coordinates and then processed through ESRI's 'BILINE' or bilinear program to provide the data in State Plane Coordinates. These land use files are being reprocessed through the GRIPS program to convert the polygon data to one acre grid cells. Next, the data will be processed through GRDPST to create four acre grid cells. This is accomplished by passing a two by two array over the one acre cell data base and using a routine to pick the element of greatest occurrence which is then flagged as the cover code for the new four acre cell. If all four cells are different or two are in group A and two are in group B, the program utilizes a user defined look-up table to assign the desired land cover code. At this point, all elements will be in alignment with all other elements in the common data base and their individual column alignment will be tied to a specific geographic location on the map base.

Appendix A

Technical Requirements for Integration -

General Methodology

The process of developing, automating and utilizing an environmental data system with the focus towards supporting the County's regional planning needs may be described in a series of tasks. The process involves four general steps: data acquisition; data integration; data automation; environmental mapping and analysis which is a second level of integration; and data presentation. For the purposes of this discussion, the two stages of data integration will be developed.

The initial step of data acquisition establishes the general scope and direction of the environmental mapping and assessment effort. It normally involves the acquisition of aerial imagery, basemaps, and basic environmental data and the conduction of a field reconnaissance survey. Landsat imagery, conventional aerial imagery, and standard topographic quadrangles are normally acquired from pertinent source agencies. Documents, reports, and maps which are current and authoritative and which provide full coverage of the region are collected from public and private sources.

These materials are compiled into the proposed structure and classification of the environmental data base.

Data Integration

This step results in the interpretation, standardization, and enhancement of the environmental data assembled for the region. A set of topographic quadrangles is compiled as a number of map modules which collectively provide full coverage for the region. These serve as the fundamental spatial reference for the mapping effort.

The integration and mapping of geographic data is derived from the processes of field survey, data acquisition, and photo interpretation. Data are normally resolved, integrated and mapped in relation to the general patterns evident on the imagery and are registered to known features and coordinates on the topographic base maps. Environmental data which have broad and apparent expression are commonly subject to a high level of integration in the mapping process. Fundamental geographic units, termed "terrain units", serve as the basis for the integration, resolution, and delineation of a wide range of geographic attributes. Terrain units and their boundaries are normally defined by a set of basic and homogeneous physiographic, geologic, pedologic, and vegetative conditions. Data integration and, in particular, terrain unit mapping, provides for a higher level of spatial resolution and accuracy than is otherwise inherent in the overlay of diverse collateral data. Essentially, the process involves the resolution of all data to natural patterns which are evident or interpretable on the aerial imagery and on the topographic base maps. The terrain unit maps, like other maps displaying geographic data, are manually drafted on stable mylar and are coded for automation. The diverse data encompassed within the terrain unit manuscript are structured in such a manner that they can be easily segregated and mapped as independent phenomena after the process of data automation is complete. Integration provides for a high level of resolution for each of the mapped phenomena as well as for a high level of efficiency

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in the process of data automation. It is important to note that the general process of designing and drafting maps which will be suitable for automation differs radically from that of preparing maps which will be suitable for presentation. The manuscripts for automation are typically designed to maximize the data and minimize the lines which will be automated. In addition, they are typically characterized by a much higher level of conceptual rigor, interpretive consistency, and planimetric accuracy.

The process of data integration and manual mapping results in the creation of manuscript maps and codes which are suitable for automation. Point phenomena are typically coded and sometimes numbered. Thus, all archaeologic or historic sites could have the same code. They could also have individual numbers if there were particular attributes which had to be referenced. Line data are commonly coded and sometimes numbered. Thus, stream courses could have numeric codes identifying their size and flow character. They might be individually numbered in instances where specific data related to such things as water quality samples can be associated. Polygons are normally numbered and coded. In the case of integrated terrain unit polygons, the code series may be extensive depending upon the number of geographic variables encompassed within each unit.

Data Automation

This task involves the automation of the manuscript maps which were manually prepared. Mapped data are automated by a means which preserves and records their spatial integrity. A digitizer is used to automate the x,y coordinates of all mapped points, lines, and polygons. Geographic data are thus retrievable for display and analysis in their natural form.

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In addition, they are transformed into a grid format for alternate and complementary display and analysis. A uniform grid is overlayed atop the data in the point, line, and polygon files and all of the computerized data are automatically transferred into the grid structure. A grid cell size considerably smaller than the minimum polygon resolution for the project is employed. This provides for the preservation of the scale and quality of the point and line data and the capture of the general form and boundaries of the polygons. Once completed, the grid files join the existing point, line and polygon files in comprising the fundamental geographic data bank for computer mapping and analysis.

Integration of the Environmental Map Elements

The environmental data assembled, mapped, and integrated are automated by a process which includes the following: digitizing, editing, and final file creation. The digitizing process, which centers upon the recording of x,y coordinates and numeric codes for phenomena spatially expressed as polygons, lines, and points, results in the accurate and efficient automation of geographic phenomena. Initial recording by polygon, line, and point coordinates and numeric codes promotes the capture and retention of a high degree of detail, discreteness, and accuracy in the automated data bank. By means of a select computer program (GRIPS), the polygon data files can be used to create grid data files which generalize, structure, and output the recorded data in terms of any selected grid scale. Such a composite data bank could be recalled or manipulated in either the polygon or grid form. Mapped data could be displayed in either the polygon or grid form.

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Two final data file structures are typically created for an automated data bank. These would represent data stored and retrievable in terms of both x,y coordinates and grid cells.

The automated data, organized according to base map modules, then can be used for polygon analysis and plotter mapping. The data in the coordinate files matches the original points, lines, and polygons taken from the original maps. For this reason, the coordinate files are maintained as master files. These master polygon files are used to create individual grid files at a scale and degree of detail appropriate to any particular need or application. In addition, a master grid file is created which covers all of the variables in the study area. This master file can be used for general purpose analysis and mapping. As such, it has a constant grid cell size based on the following considerations:

> The cell size will show all basic variation in the smallest and most complex polygons without losing substantial detail.
>
> The size will be appropriate for anticipated land use/environmental planning, both for general planning and specific evaluations.
>
> The size will be small enough for evaluation of "intervariable" data relationships.

As indicated, point, line, and polygon data are automated by a means which preserve their spatial integrity. When the terrain unit is being developed, each terrain unit polygon is numbered and is defined and characterized by a given set of vegetation, geologic, slope and landform conditions. Each polygon number references a set of descriptor codes identified on the accompanying code listing produced on a computer printer. A special series of computer programs which results in the dropping of extraneous lines,

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enables the components of the terrain unit map to be displayed independently. Thus, individual maps of vegetation, geology, slope, and landform can be created once the terrain unit data are automated.

The land capability/suitability analysis and output display is normally conducted in relation to three phenomena: basic geographic data; interpreted environmental opportunities and constraints; and select types of planned human activity. The effort culminates the long process of data selection, classification, mapping, analysis, and interpretation. It represents the basic step in the application of environmental considerations in the process of land planning. Theoretical models are designed to provide for the legible and systematic ranking of areas within a study region in relation to select classes of human activity. In the case of a general regional planning study, land capability/suitability analyses are normally carried out in relation to the following: urbanization; agriculture; forestry; recreation; conservation; and roads.

In the case of a more specific study, such as one for recreation, models might be created to determine land capability/suitability for specifc activities such as picnicking, camping, hiking, boating, or skiing. The development of land capability/suitability models requires a thorough understanding of the environmental requirements and demands of each activity type. Each land capability/suitability model is developed by means of an interactive process in which both environmental and planning expertise is required. The application of each final model to the automated data base normally results in the creation of a map displaying four levels of land capability/suitability for the particular activity: high, moderate, low, and unsuitable.

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Together with the area calculations for each of the classifications, these maps serve as the fundamental input in the determination of land supply in the process of land allocation and planning.

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16. Abstract

The San Bernardino County project is one of several carried out under the NASA sponsored California Integrated Remote Sensing System (CIRSS) ASVT. The report describes a range of data sets for possible inclusion in a vertically integrated data base to be created in the project. The vertical data integration concept emphasizes integrating a number of data sets created by a range of agencies and business for a given geographic area.

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