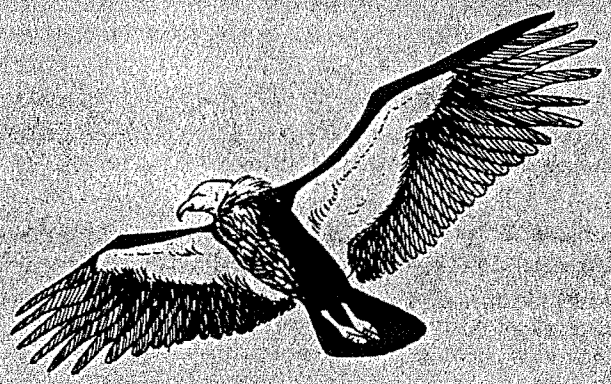

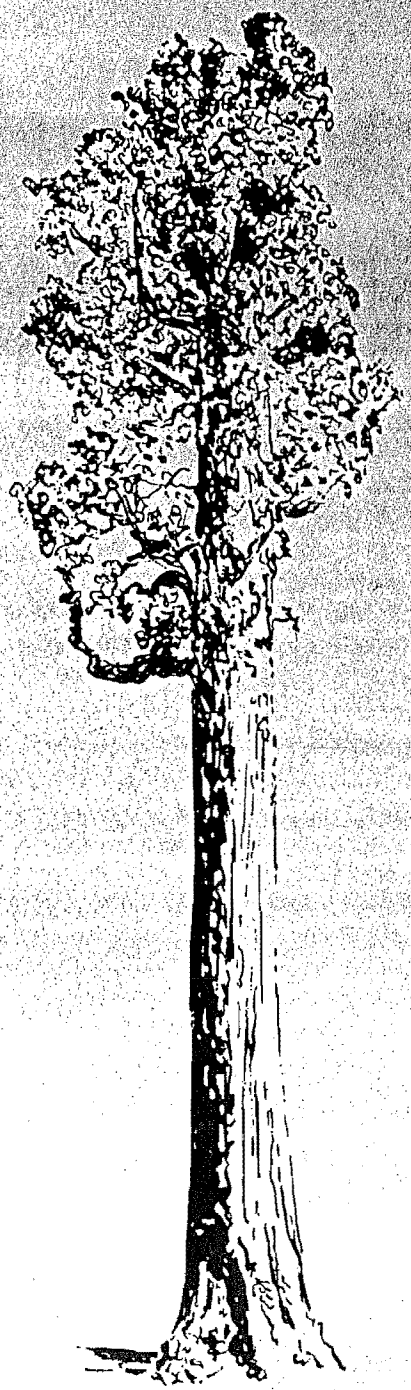

Cooperative National Park

RESOURCES STUDIES UNIT

Tech Report 44 5/91

Status of Natural Resources Databases in Natural Parks: Western Region

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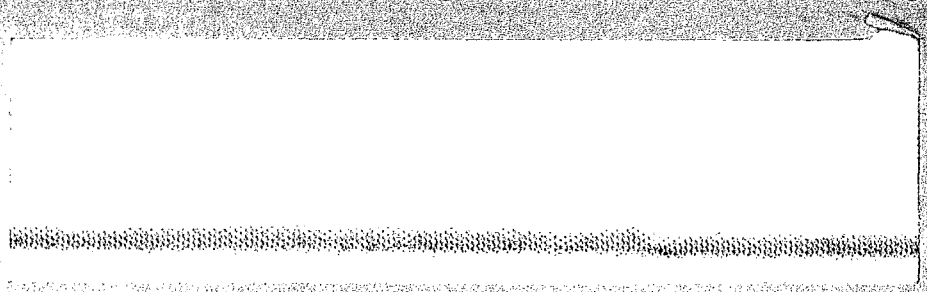
COOPERATIVE NATIONAL PARK RESOURCES STUDIES UNIT

University of California - National Park Service

The National Park Service and the University of California signed a Master Memorandum of Understanding on May 4, 1979, that provided for the establishment and operation of the Cooperative National Park Resources Studies Unit as an affiliate of the Institute of Ecology on the Davis Campus. On October 1, 1981, the Master Memorandum of Understanding was superseded by a Cooperative Agreement between the National Park Service and the University of California. This Unit is dedicated to development and facilitation of ecological, environmental and sociological programs of research and study in the interest of use, conservation, and management of natural areas and other components of the National Park System in California.

Unit personnel conduct research and assist National Park Service personnel in developing and coordinating research to provide information relevant to resource management in park areas. They provide direct support to N.P.S. resource managers in planning, conducting and monitoring resource management activities. They also support the broader goals of education and increasing the public awareness of the role of National Parks and similar natural area preserves as part of our national natural heritage.



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Technical Report No. 44

STATUS OF NATURAL RESOURCES DATABASES IN NATIONAL PARKS: WESTERN REGION

BY Thomas J. Stohlgren and James F. Quinn

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May 1991

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ABSTRACT

In conjunction with Phase I of the National Park Service (NPS) Inventory and Monitoring (I&M) Project, we conducted an inventory and evaluation of natural resources databases of 40 park areas in the Western Region of the NPS, which includes Arizona, California, Hawaii, Nevada, and several Pacific Trust Territories. Better information is available for vascular plants, mammals and birds than for other biological groups (reptiles, amphibians, fish, terrestrial invertebrates, aquatic invertebrates, and non-vascular plants). Although many parks have "species lists" for some biological groups, the accuracy and completeness of most of the lists are questionable. None of the lists resulted from park-wide systematic surveys. For nearly all parks and biological groups, the actual status of information is difficult to assess due to: (1) lack of readily available information on past studies of resources; (2) lack of standardization in recording procedures; (3) missing or poorly maintained voucher specimens; and (4) disproportionate attention to "popular" taxa. Most park herbaria are incomplete, inconsistent and poorly organized. Our knowledge of birds, mammals, reptiles and amphibians is based largely on poorly evaluated "wildlife observations" or on range maps not validated by within-park surveys. While 85%, 52.5% and 65% of the 40 parks surveyed had maps of vegetation, soils and geology, respectively, none of these maps have been systematically checked for accuracy.

Staffs of large parks tend to know more about their natural resources than those of smaller parks that historically have received less funding for research and resource management activities. We outline some strategic considerations needed to rank I&M needs, standardize recording techniques, test model I&M systems in selected parks, and develop a framework to synthesize I&M information over large spatial and long temporal scales.

INTRODUCTION

Knowing the resources of the National Parks is an essential element of the basic mandate for their protection as set forth in the 1916 enabling legislation (16 USC 1). This mission of the National Park Service (NPS) was eloquently interpreted in 1963, by the "Robbins Committee," an advisory committee to the Secretary of the Interior and the National Park Service. The report stated:

> "One of the first needs is a complete inventory of each of the national parks including information on such items as topography, geology, climate, water regime, soil, flora and fauna, land use and archeology, with distribution maps where appropriate. Insofar as historical records permit, the inventory should include past as well as present conditions. An inventory furnishes a base from which changes in biology and habitat can be judged and by which management practices can be planned. It supplies also a major part of the information by which a park and its significance can be presented (interpreted) to the public (National Academy of Sciences - National Research Council, 1963)."

More than twenty-five years later, this recommendation is a largely unfulfilled goal, but at least it is working its way into NPS Policy:

> "It is the policy of the National Park Service to assemble baseline inventory data describing the natural resources under its stewardship, and to monitor those resources forever; to detect or predict changes that may require intervention, and to provide reference points to which comparisons with altered parts of the home of humankind may be made (Draft NPS-75; Release #1, 1988)."

This report focusses on the present status of natural resources databases in Western Region parks and, again, documents the continuing failure to adequately inventory the natural resources under NPS stewardship. We must recognize that a critical function of national parks is the long-term maintenance of natural ecosystems and biological diversity, and that accurate assessments of the occurrence of species are essential (Quinn and van Riper 1990). Likewise, detailed information on natural resources is needed for making resource management decisions, for identifying additional research needs, and to design efficient and standardized monitoring systems. The first step in the inventory and monitoring (I&M) process is to document the status of each park's knowledge, to identify significant information gaps and to allocate resources for future I&M efforts.

In the Western Region, some park managers, most notably Channel Islands National Park, have developed extensive programs to inventory species and measure and evaluate long-term dynamics of selected ecosystems (Davis 1989). Nearly 500 species of the 2000 known from the park are being monitored for one or more

aspects of abundance, age structure, reproductive effort, recruitment, growth and mortality rate, and phenology. "Index" taxa include insects (200 spp.), terrestrial plants (156 spp.), marine invertebrates (41 spp.), birds (23 spp.), marine algae (16 spp.), fishes (16 spp.) and mammals, reptiles and amphibians (12 spp.). Unfortunately, this program is unique and limited funding has allowed implementation of only four of the twelve monitoring protocols (kelp forests, rocky intertidal, sea birds, and pinnipeds) in limited areas. The park has protocols for, but does not yet monitor, land birds, terrestrial vegetation, terrestrial vertebrates, terrestrial invertebrates, visitors, fisheries, weather and beaches.

There has been only one previous modern service-wide attempt to identify gaps in our knowledge of natural resources. The "Natural Resources Assessment and Action Program Report" (National Park Service 1988) sought to identify the status of information on external threats (e.g., air pollution, urbanization, non-native species invasion, etc.) to park ecosystems. Two major findings of the report were: (1) most parks have inadequate data to support management actions; and (2) better monitoring was the second largest need documented in park resource management plans (behind mitigation needs). The status of existing data on natural resources in Western Region parks remains poorly known.

As part of the service-wide initiative to inventory existing park data, we visited 40 Western Region park units and evaluated their natural resource databases. The primary objectives of the

survey were to:

(1) provide a qualitative assessment (categorical summary) of the status of species lists for various biological groups (vascular plants, mammals, birds, reptiles, amphibians, terrestrial invertebrates, aquatic invertebrates, and non-vascular plants);

(2) inventory mapped information on vegetation, soils, geology and other natural resources; and

(3) inventory image information such as photographic series, aerial and satellite imagery, and digitally processed information.

METHODS

After a pilot park unit (Lassen Volcanic N.P.) test and a week-long training session to standardize reporting procedures, four biological technicians each spent about a week in each of 10 parks interviewing key research or resource management personnel. They conducted the Biological Inventory Status (BIS) evaluation for each biological group and recorded the taxonomic, geographic, ecological and seasonal completeness of each group (Table 1). Information on the history of inventory, references, and status of voucher specimens also was recorded and relevant comments entered directly into laptop computers. The number of new (or recently discovered) species and number of confirmed or possible extirpations were recorded (Table 1). The data were self-reported by park staffs and reflect the state of their knowledge. Results were not verified. Thus, data that exist but were unknown to the park staff were reported as 'non-existent.' The numeric sum of taxonomic, geographic, and ecological completeness (on a scale of 1 to 6 or 7, with 1 being most complete) was used

Table 1. Biological Inventory Status Codes

PARK NAME: (specify the four letter park code, e.g., SHEN for Shenandoah NP)

BIOLOGICAL GROUP: (complete a record for each of these groups which are taken from Phase I requirements of the draft Biology Section of NPS 75)

1. vascular plants
2. mammals
3. birds
4. fishes
5. reptiles
6. amphibians
7. other (OPTIONAL, but please specify)

TAXONOMIC COMPLETENESS:

1. inventory probably taxonomically complete, covers all groups within this biological group
2. inventory >80% taxonomically complete, for this biological group
3. inventory 50%-80% taxonomically complete, ...
4. inventory < 50% taxonomically complete, ...
5. inventory contains good information about a few taxa such as Families, or Genera, ...
6. inventory poor to nonexistent, ...
7. inventory status unknown, ...

GEOGRAPHIC COMPLETENESS:

1. inventory has been generally throughout the park and adjacent lands for this biological group
2. inventory has been throughout >80% of the park, ...
3. inventory has been throughout 50%-80% of the park, ...
4. inventory has been limited to only a relatively few areas in the park,
5. collection has been sporadic with no areas being inventoried well, ...
6. status of geographical completeness in inventory is unknown, ...

ECOLOGICAL COMPLETENESS:

1. inventory has been completed in all major ecological/community types, in the park, for this biological group
2. inventory has been completed in >80% of the major ecological/community types
3. inventory has been completed in 50%-80% of the major ecological/community types, ...
4. inventory has been limited to only a relatively few of the major ecological/community types, ...
5. collection has been sporadic with no major ecological/community type being inventoried well, ...
6. status of ecological completeness in inventory is unknown, ...

Table 1 (continued). Biological Inventory Status Codes

SEASONAL COMPLETENESS:

1. inventory has been completed over all appropriate seasons, in the park for this biological group
2. inventory has been completed in some of the appropriate seasons, ...
3. inventory has been completed in only one of the appropriate seasons of the year, ...
4. collection has been sporadic with no season being inventoried well, ...
5. status of seasonal completeness in inventory is unknown, ...
6. N/A

HISTORY OF INVENTORY:

1. inventory/observations have been ongoing over the history of the park
2. inventory/observations have been ongoing over the last 10-20 years
3. inventory/observations have been ongoing over the last 5-10 years
4. inventory/observations have been ongoing over the last 5 years
5. inventory/observations have occurred more than once
6. inventory/observations have occurred only once
7. inventory/observations have never occurred
8. inventory/observations status is unknown
9. scattered observations over time

REFERENCES FOR THIS BIOLOGICAL GROUP IN PARK: (Provide author and date citations for references used to complete this particular record, although park/region may want to record full citation)

INVENTORY DATE: (YEAR e.g., 1966)

DOCUMENT DATE: (YEAR of checklist or report)

VOUCHER SPECIMENS: (enter number of voucher specimens in park)

VALIDITY OF INVENTORY STATUS:

NUMBER OF SPECIES

How many species are listed on the park's checklist for this biological group? (specify the number, enter 9999 if unknown)

NUMBER OF SPECIES CHECKED BY EXPERTS

NUMBER OF SPECIES CHECKED BY STAFF

NUMBER OF SPECIES UNCONFIRMED

Comments: _____

Table 1 (continued). Biological Inventory Status Codes

ADDITIONAL QUESTIONS ON VALIDITY OF INVENTORY STATUS:

NEW SPECIES IN THIS BIOLOGICAL GROUP ADDED TO LIST

How many species new to the park have been found in the past 10 years? (specify the number, enter 9999 if unknown)

When a qualified expert visits the park, and inventories several randomly selected sites, what percentage of the recorded inventory for the biological group is identified as being new to the park's known biotic inventory? Enter % accuracy (-1 for N/A, -9 for unknown).

NUMBER OF MISIDENTIFIED SPECIES

How many species were misidentified or incompletely identified when checked by experts.

CONFIRMED EXTIRPATION

How many species have gone extinct or have been extirpated from the park since park establishment?

POSSIBLE EXTIRPATION

How many species are thought to be extirpated from the park or extinct (unconfirmed). Also list species in comments sections.

as a "composite score" to summarize the status of knowledge on each biological group and to allow comparisons among parks and biological groups. A low score of 3 suggested much was known about the group, while a top score of 18 to 19 showed a considerable gap in our knowledge of that group.

Information on maps (thematic and cartographic) and imagery (aerial and digital) was catalogued and included map theme, date, investigator, and various map characteristics (Table 2). The question was asked whether the map had been systematically field checked after its development. Map "accuracy" was estimated by asking what percentage of 100 randomly located points would be correctly classified by the map. Information on map form, structure and repository also was recorded. Information on imagery included type, scale, format, comprehensiveness and repository (Table 3).

RESULTS

Overview of the Status of Information on all Biological Groups

Ten or fewer of the 40 parks surveyed had composite scores of 3 for vascular plants, birds, and mammals (Figure 1). Thus, only a few parks reported that their species inventories were "probably complete" (i.e., assumed to be at least 95% complete) taxonomically, geographically and ecologically. The number of composite scores greater than 7-9 indicated that species lists for mammals, reptiles, amphibians and fish generally were less than 50-80% complete. Most Western Region parks knew more about

Table 2. Codes for Mapped Information

PARK NAME: (list four letter code, e.g., SHEN for Shenandoah NP)

MAP THEME: (list theme, e.g., vegetation, landuse, DEM, DLG, etc.)

DATE: (specify year)

INVESTIGATOR: (surname)

BASE SCALE: (specify actual base scale)

DATA SOURCE:
1. aerial photos
2. satellite
3. field reconnaissance (i.e., not using standard cartographic methods)
4. derived from other mapped themes
5. other agency data (e.g., SCS, USGS, FWS, etc.)
6. unknown/uncertain

GEO-REFERENCED:
1. yes
2. no
3. unknown/uncertain

CLASSIFICATION SCHEME: (list type)

NUMBER OF CLASSES: (enter number of classes)

MINIMUM MAPPING UNIT: (enter smallest features recorded [area] or -1 for N/A or -9 for unknown/uncertain)

FIELD CHECKED:
1. spot checks
2. systematic check
3. unknown

ACCURACY: (enter % accuracy, -1 for N/A, -9 for unknown)

COMPREHENSIVENESS:
1. park and environs
2. park only
3. smaller than park

Table 2 (continued). Codes for Mapped Information

MAP FORM:
1. paper
2. stable base (e.g., mylar)
3. digital - GRASS
4. digital - SAGIS
5. digital - MOSS
6. digital - ARC-INFO
7. digital - OTHER

DATA STRUCTURE:
1. raster
2. vector
3. not applicable

REPOSITORY:
1. park
2. GIS Division - WASO
3. Region
4. University
5. other
6. unknown/uncertain

BACKUP COPIES:
1. park
2. GISD - WASO
3. Region
4. DSC - TIC
5. University
6. other
7. no duplicate copies exist
8. unknown/uncertain

USEFULNESS:
1. historical record
2. historical record and useful for contemporary management
3. current record and useful for contemporary management
4. useful but needs modification
5. marginal utility
6. not useful
7. unknown/uncertain

Comments - Map Name

L = Later

10

3/11/93

Table 3. Codes for Imagery Information

PARK NAME: (list four letter code, e.g., SHEN for Shenandoah NP)

IMAGERY: (describe imagery, e.g., aerial photo, satellite, etc.)

DATE: (specify year)

TYPE:
1. black and white
2. color
3. color infrared
4. LANDSAT/MSS
5. LANDSAT/TM
6. SPOT/MSS
7. SPOT/PAN
8. other
9. not applicable

SCALE: (actual)

FORMAT:
1. digital
2. analog
3. digital and analog

COMPREHENSIVENESS:
1. park and environs
2. park only
3. smaller than park

REPOSITORY:
1. park
2. region
3. GIS Division - WASO
4. DSC - TIC
5. USGS - EROS Data Center
6. university
7. other
8. unknown/uncertain

BACKUP COPIES:
1. park
2. region
3. GISD - WASO
4. DSC - TIC
5. USGS - EROS Data Center
6. university
7. other
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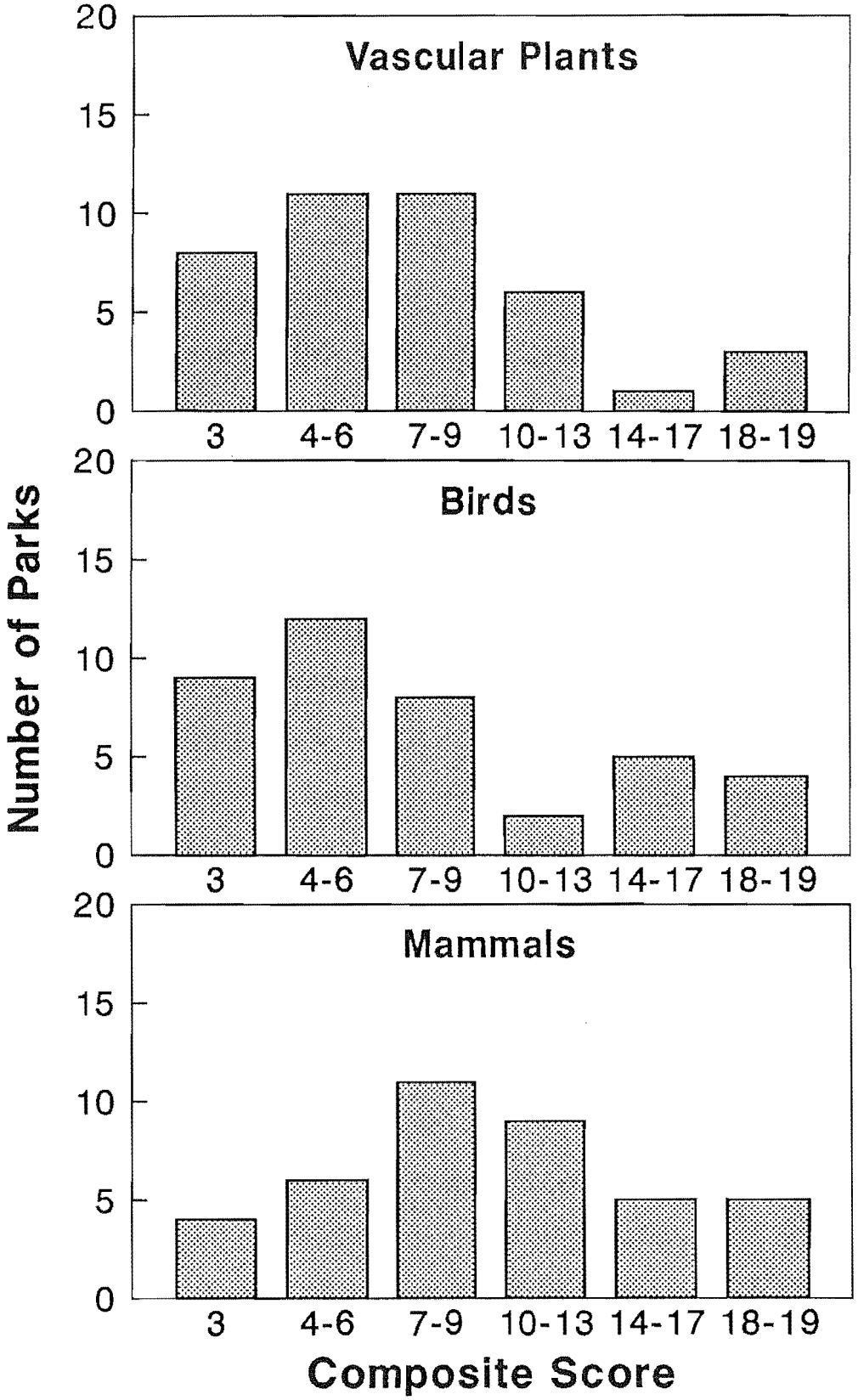

Figure 1. Composite scores (taxonomic + geographical + ecological completeness) for vascular plants, mammals and birds in Western Region park areas.

vascular plants and birds than about other groups, but a surprising number had larger gaps in their knowledge (i.e., high composite scores) of even these better known groups (Figure 1).

There are several caveats to this simplistic summary. We discovered (or rediscovered; see van Riper et al., 1990) many common problems in our synthesis of the data. First, nearly all parks lacked readily available information on previous studies of park resources, making it difficult for park staff to identify gaps in their information base. Only CHIS, GRBA and SEKI (Park Codes in Appendix I) had quickly accessible bibliographies of past research with key word indices.

Nearly all parks lacked systematic surveys for any of the biological groups. The systematic vegetation survey in Sequoia and Kings Canyon National Parks was the only one that is geographically broad, and it may miss many rare habitats and taxa (D. Graber, pers. comm.). Marine ecosystem monitoring at Channel Islands National Park is, taxonomically and ecologically, remarkably complete, but is restricted geographically.

Historic records and voucher specimens were poorly maintained in nearly all parks. Most park herbaria were incomplete, inconsistent among parks and over time within parks, and disorganized. Knowledge of birds, mammals, reptiles and amphibians was based largely on poorly scrutinized "wildlife observations," on range maps not validated by field study, or on biological surveys conducted in the 1930's.

Wildlife reporting procedures have not been standardized among or within parks (Sauvajot et al., 1990), and disproportionate attention has been given to some groups (plants, mammals, birds) or to taxa within groups (butterflies, trees, large mammals, etc.). Difficult-to-identify taxa (e.g., sedges, arachnids, fungi, etc.) have been largely ignored.

Lastly, few parks had developed strategies to fill information gaps. Although the status of existing data varied considerably among biological groups and parks (Appendix II), we now present selected examples and comments from our investigation, and briefly identify region-wide needs (or park-specific needs, where appropriate) to fill information gaps.

Vascular Plants:

* No park had completed a systematic survey of vascular plants.

* Only 9 of 40 parks reported their vascular plant lists were probably taxonomically, geographically, and ecologically complete. In all cases, these were compiled from a synthesis of individual studies of varying quality and completeness (Figure 1; Table 4).

* 24 of 40 parks reported knowing < 80% of their vascular plant species. The rate of discovery of unrecorded species in parks with active survey programs suggests that our knowledge of vascular plants can be greatly improved upon.

* Over the past 10 years even poorly funded inventory projects and localized research studies have added more than 1400 species to the plant lists of the 40 parks: current plant lists can hardly be considered complete.

* Only Pinnacles N.M. had a complete (95%+ complete) set of voucher specimens (properly identified and curated, pressed plants stored in an herbarium) on site; most parks had incomplete sets with partial sets at nearby universities or museums.

TABLE 4. STATUS OF VASCULAR PLANT DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
American Mem'l. Pk.	HA	1	1	1	3	2	128	128
Channel Islands NP	CA	1	1	1	3	1	751	0
Haleakala NP	HA	1	1	1	3	1	767	
Haleakala-pteridophy	HA	1	1	1	3	1	116	116
Kaloko-Honokohau NHP	HA	1	1	1	3	6	72	0
Point Reyes N Sea.	CA	1	1	1	3	1	827	1029
Puukohola Heiau NHS	HA	1	1	1	3	1	52	0
Pu'uhon. Honaunau HP	HA	1	1	1	3	1	126	0
Santa Monica Mt. NRA	CA	1	1	1	3	1	884	0
Death Valley NM	CA	1	2	1	4	1	977	
HA Volc-anchial pool	HA	1	2	1	4	3	37	0
Organ Pipe Cactus NM	AZ	1	2	1	4	1	522	502
Pinnacles NM	CA	1	2	1	4	1	533	1000
Sequoia/Kings NP	CA	1	2	1	4	1	1402	1341
Whisk-Shas-Trin NRA	CA	2	1	1	4	5	648	772
Yosemite-Botti list	CA	1	2	1	4	1		4500
Coronado N Mem'l.	AZ	2	1	2	5	1	301	127
Haleakala NP (rare)	HA	1	2	2	5	2	108	
Joshua Tree NM	CA	2	2	1	5	4	688	730
Death Valley NM(T&E)	CA	1	3	2	6	6	69	
Joshua Tree NM (T&E)	CA	1	4	1	6	6		
Lava Beds NP	CA	1	2	3	6	1	279	991
Puukohola Heiau(rare	HA	1	3	2	6	5	1	1
Saguaro NM	AZ	2	2	2	6	2	986	936
Tonto NM	AZ	2	2	2	6	2	270	259
Chiricahua NM	AZ	2	2	3	7	1	700	2000
Great Basin NP	NV	2	2	3	7	5	589	
Kalaupapa NHP (rare)	HA	1	3	3	7	5	12	0
Muir Woods NM	CA	3	1	3	7	2	180	0
Fort Bowie NHS	AZ	3	3	2	8	2	263	478
Grand Canyon NP	AZ	2	3	3	8	4	1400	
Kalaupapa NHP	HA	2	3	3	8	5	306	0
Lake Mead NRA	NV	2	3	3	8	1	816	
Lassen Volcanic NP	CA	2	3	3	8	2	777	
Redwood NP	CA	3	2	3	8	2	711	1285
Tuzigoot NM	AZ	3	3	3	9	2		75
Walnut Canyon NM	AZ	3	3	3	9	1	300	261
HA Volc. NP (rare)	HA	2	4	4	10	4	32	26
Casa Grande NM	AZ	3	2	6	11	3	152	
John Muir NHS	CA	3	4	4	11	1		0
Petrified Forest NP	AZ	2	3	6	11	5	346	301
Yosemite-Moore list	CA	4	3	4	11	2	1377	4500
War in Pacific NHP	GU	4	4	4	12	4	3	0
Cabrillo NM	CA	1	6	6	13	5	214	0
Montezuma Castle NM	AZ	3	4	6	13	2	310	0
Golden Gate NRA	CA	6	5	5	16	4		0
NP of American Samoa		6	6	6	18	5		0
USS AZ & Prl Hbr NHL	HA	6	6	6	18	6		
Hawaii Volcanoes NP	HA	7	6	6	19	5		

The status of vascular plant inventories varied greatly among parks (Table 4). Most parks with complete or near-complete species lists had benefitted from large park resource management programs and from regional science staff located in the park or at a cooperative park study unit. Parks with on-going inventories continue to find fairly large numbers of new (to the park) or unrecorded species.

Systematic field surveys also have resulted in growing lists of "unknown" or yet to be taxonomically identified specimens. Sequoia and Kings Canyon National Parks, for example, had over 1500 "unknowns," but lacked the expertise or funds to identify them. Parks with the greatest information gaps (i.e., those with the greatest composite scores) generally were smaller and had smaller resource management budgets (Table 4). Only three parks (SEKI, ORPI, PINN) reported storing voucher specimen data on the Automated National Catalog System (ANCS). Two parks relied on NPFLORA (National Park Service COMMON database) as their primary database for vascular plants. Most field offices cited difficulties in routinely updating the mainframe-based system, and thought the system was neither user-friendly nor flexible enough in reporting procedures to meet their needs. Only four parks (CHIS, PINN, PORE, REDW) had their entire species lists checked by outside experts.

Interviews revealed a variety of problems and concerns about vascular plant inventories in Western Region parks. Several parks were new to the system (KALA, GRBA, AMME, NASA) or have added new lands yet to be inventoried (CHIR, JOMU). Most parks complained

about inadequate funding and staff for "inventory work." Many lacked the physical space and staff to maintain an herbarium. One herbarium was described as "50? specimens were in a cardboard box in park, location unknown." And, most parks indicated that their plant lists were tentative and needed to be checked by experts. Especially for Hawaiian and Californian parks, where new taxonomic keys are available or are being developed, parks have had difficultly keeping up with taxonomic revisions.

Inventory needs for vascular plants in Western Region parks include:

(1) systematic vegetation surveys in each park;

(2) establishment or improvement of park herbaria using the Automated National Catalog System;

(3) expert checking of herbaria specimens for proper identification;

(4) in-park personal computer-based, standardized software for easy entry to NPFLORA or an equivalent common database, editing and reporting - preferably dBASE-compatible software for ease of use and for inter-agency exchange of information (see Robinson et al., 1990);

(5) a central "clearing house" (DSC) for handling taxonomic synonyms; predetermined museums, botanical gardens, or universities to house duplicate voucher specimens; and a centralized office for data management and information exchange;

(6) develop field techniques to assess the "completeness" of vascular plant lists (this is no small task).

Note, the above "needs" focus only on creating accurate species lists (i.e., assessing a species presence or absence). Many resource managers and scientists expressed a greater need for abundance and distribution data; population trend data for rare, threatened, or endangered species (and sub-populations); long-term

study plots; and integration of data into geographic information systems. In most cases, the information needed to meet these goals is not available. These same comments apply equally to the other biological groups we examined.

Mammals:

* Only Pinnacles N.M. had completed a systematic survey of mammals in major habitat types.

* Most parks developed species lists from wildlife observation cards, museum specimens, generalized range maps or limited field studies.

* No park knew how many mammal voucher specimens collected in their park were deposited at nearby universities or museums.

* Only four of 40 parks had species lists thought to be taxonomically, geographically and ecologically complete (Table 5, Figure 1).

Due to the nature and difficulty of animal surveys compared to plant surveys, previous mammal inventories have been confined to small areas within parks. Golden Gate N.R.A. reported that only 6,000 acres out of 75,000 acres had been surveyed, covering 2 of 9 major vegetation types. Better information was available for large mammals (also see Cook et al., 1990). Several parks wanted more information on bats. The Hawaiian parks were more concerned about the abundance, distribution, population dynamics and behavior of non-native mammals and native bats than were mainland parks.

TABLE 5. STATUS OF MAMMALS DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
Channl Islnd-pinnipd	CA	1	1	1	3	1	6	0
Channl Isld-cetacean	CA	1	1	1	3	1	30	0
Channel Islands NP	CA	1	1	1	3	1	64	0
Haleakala NP	HA	1	1	1	3	1	11	0
Lava Beds NP	CA	1	1	1	3	1	38	196
Santa Monica Mt. NRA	CA	1	1	1	3	1	51	
Lassen Volcanic NP	CA	1	3	1	5	1	63	
Organ Pipe Cactus NM	AZ	1	3	1	5	1	53	32
Chiricahua NM	AZ	2	2	2	6	5	71	16
Death Valley - T&E	CA	1	3	2	6	6	69	
NP of American Samoa		2	2	2	6	1	9	0
Tonto NM	AZ	2	2	2	6	2	28	14
War in Pacific NHP	GU	2	2	2	6	2	3	0
Grand Canyon NP	AZ	1	5	1	7	4	88	
Joshua Tree NM	CA	2	3	2	7	4	46	
Lake Mead NRA	NV	1	3	3	7	1	72	
Yosemite NP	CA	2	4	1	7	3	79	620
Channel Islands-land	CA	2	3	3	8	2	20	0
Channel Islands NP	CA	3	3	2	8	2	3	0
Fort Bowie NHS	AZ	3	2	3	8	1	47	
Pinnacles NM	CA	1	4	3	8	1	38	15
Redwood NP	CA	2	3	3	8	2	39	
Sequoia/Kings NP	CA	1	2	5	8	1	90	20
Channel Islands-bats	CA	1	4	4	9	2	8	0
Coronado N Mem'l.	AZ	3	3	3	9	4	60	0
Death Valley NM	CA	3	4	2	9	2	51	413
Puukohola Heiau NHS	HA	3	3	3	9	3	10	0
Saguaro NM	AZ	2	4	4	10	5	66	72
HA Volc-endang. vert	HA	1	5	5	11	4	1	5
Hawaii Volcanoes NP	HA	1	5	5	11	2	9	4
Kaloko-Honokohau NHP	HA	1	5	5	11	4	16	0
Kalaupapa NHP	HA	1	5	5	11	5	10	0
Point Reyes N Sea.	CA	1	5	5	11	4	81	11
Cabrillo NM	CA	1	5	6	12	2	11	0
Golden Gate NRA	CA	4	4	4	12	2	100	
Great Basin NP	NV	3	5	5	13	5	50	
Petrified Forest NP	AZ	4	4	5	13	4	48	26
Walnut Canyon NM	AZ	4	5	5	14	5	52	51
American Mem'l. Pk.	HA	6	5	5	16	5		0
Muir Woods NM	CA	6	5	5	16	4	26	
Pu'uhon. Honaunau HP	HA	6	5	5	16	5	8	0
Whisk-Shas-Trin NRA	CA	6	5	5	16	6		
Casa Grande NM	AZ	6	6	6	18	6	3	
John Muir NHS	CA	6	6	6	18	5		
Montezuma Castle NM	AZ	7	5	6	18	5	37	
USS AZ & Prl Hbr NHL	HA	6	6	6	18	5		
Tuzigoot NM	AZ	7	6	6	19	6	13	0

Sixteen parks had no voucher specimens, and most knew little about the numbers and locations of previous collections or voucher specimens. Tuzigoot N.M., for example, reported:

> "The park is using an old wildlife checklist for its mammals list. It lists 13 mammals. The author and date are unknown. The date is assumed to be 1940-50. There are no voucher specimens."

Inventory needs for mammals are nearly identical to those for vascular plants (see above). Local museums or universities may be better suited for maintaining voucher specimens.

Birds:

* Only Pinnacles N.M. had completed a systematic bird survey in major vegetation types.

* 17 parks reported having bird lists that were probably taxonomically complete (Table 6).

* Only 11 parks reported knowing less than 80% of the bird species in their parks.

* Field and recording procedures for bird use or abundance were not standardized among parks, so an inter-park comparison is impossible.

* Over 100 bird species were added to park lists during the past 10 years.

Parks generally had better presence-absence data for birds than for other biological groups (Figures 1, 2 and 3). However, Sauvajot et al. (1990) showed that in California, no two parks reported bird use or abundance in the same way. This is probably also true for the 40 parks we surveyed. Lacking "rules" for distinguishing among occasional, rare, accidental or uncommon species, it was impossible to compare species lists or to interpret information on possible historical extirpations.

TABLE 6. STATUS OF BIRDS DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
American Mem'l. Pk.	HA	1	1	1	3	1	8	0
Cabrillo NM	CA	1	1	1	3	1	346	0
Channel Islands NP	CA	1	1	1	3	1	315	0
Haleakala NP	HA	1	1	1	3	1	32	
Kaloko-Honokohau NHP	HA	1	1	1	3	5	33	0
Lava Beds NP	CA	1	1	1	3	1	23	25
Lassen Volcanic NP	CA	1	1	1	3	1	197	
Santa Monica Mt. NRA	CA	1	1	1	3	1	263	
Sequoia/Kings NP	CA	1	1	1	3	1	195	12
Muir Woods NM	CA	2	1	1	4	2	50	0
Yosemite NP	CA	1	2	1	4	2	132	464
Joshua Tree NM	CA	1	3	1	5	2	233	
Organ Pipe Cactus NM	AZ	1	3	1	5	1	277	94
Tonto NM	AZ	1	2	2	5	1	143	64
Chiricahua NM	AZ	2	2	2	6	5	207	30
Coronado N Mem'l.	AZ	2	2	2	6	1	166	0
Death Valley T&E	CA	1	3	2	6	6	69	
Grand Canyon NP	AZ	1	4	1	6	4	299	
Redwood NP	CA	2	1	3	6	2	370	
Saguaro NM	AZ	2	2	2	6	1	9	0
Tuzigoot NM	AZ	2	2	2	6	1	211	0
War in Pacific NHP	GU	2	2	2	6	2	12	0
Fort Bowie NHS	AZ	2	2	3	7	1	156	0
Lake Mead NRA	NV	1	3	3	7	1	343	
Pinnacles NM	CA	2	4	1	7	1	148	
Ch.Is.-Rocky Int.Tid	CA	3	3	2	8	2	19	0
Hawaii Volcanoes NP	HA	1	4	3	8	3	41	60
Puukohola Heiau NHS	HA	2	3	3	8	3	22	0
Pu'uhon. Honaunau HP	HA	2	3	3	8	3	12	0
Casa Grande NM	AZ	2	1	6	9	1	112	0
Death Valley NM	CA	2	4	3	9	1	346	
Golden Gate NRA	CA	3	4	4	11	2	370	
Hawaii Volcanoes NP	HA	1	5	5	11	4	4	5
Petrified Forest NP	AZ	2	3	6	11	5	180	48
Montezuma Castle NM	AZ	3	5	6	14	5	211	
Great Basin NP	NV	3	6	6	15	5	166	
John Muir NHS	CA	7	4	4	15	1	56	0
Walnut Canyon NM	AZ	3	6	6	15	5	117	22
Kalaupapa NHP	HA	6	5	5	16	5	8	0
USS AZ & Prl Hbr NHL	HA	6	6	6	18	5		
Whisk-Shas-Trin NRA	CA	6	6	6	18	5		
NP of American Samoa		7	6	6	19	5	55	0
Point Reyes N Sea.	CA	7	6	6	19	5		

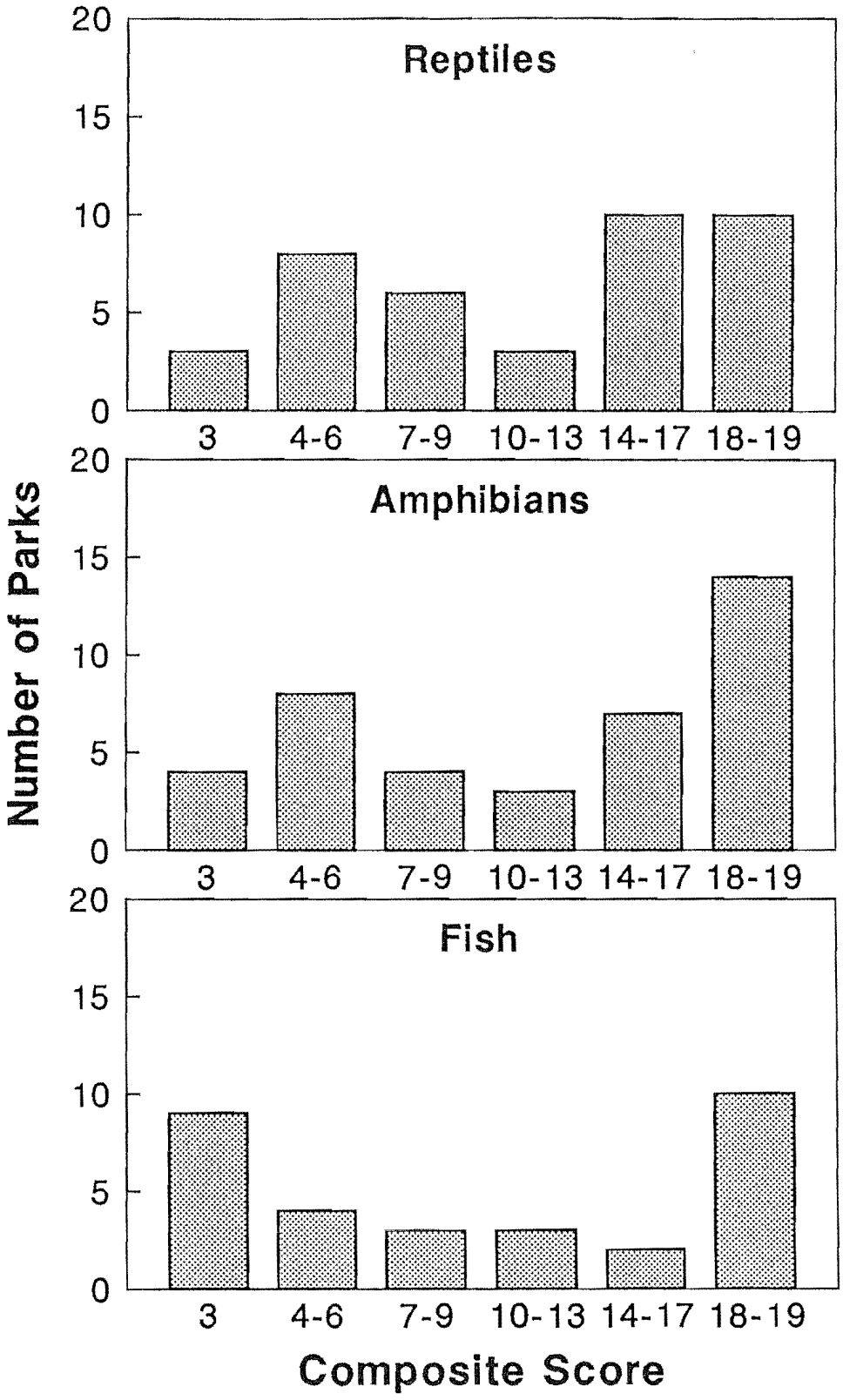

Figure 2. Composite scores (taxonomic + geographical + ecological completeness) for reptiles, amphibians and fish in Western Region park areas.

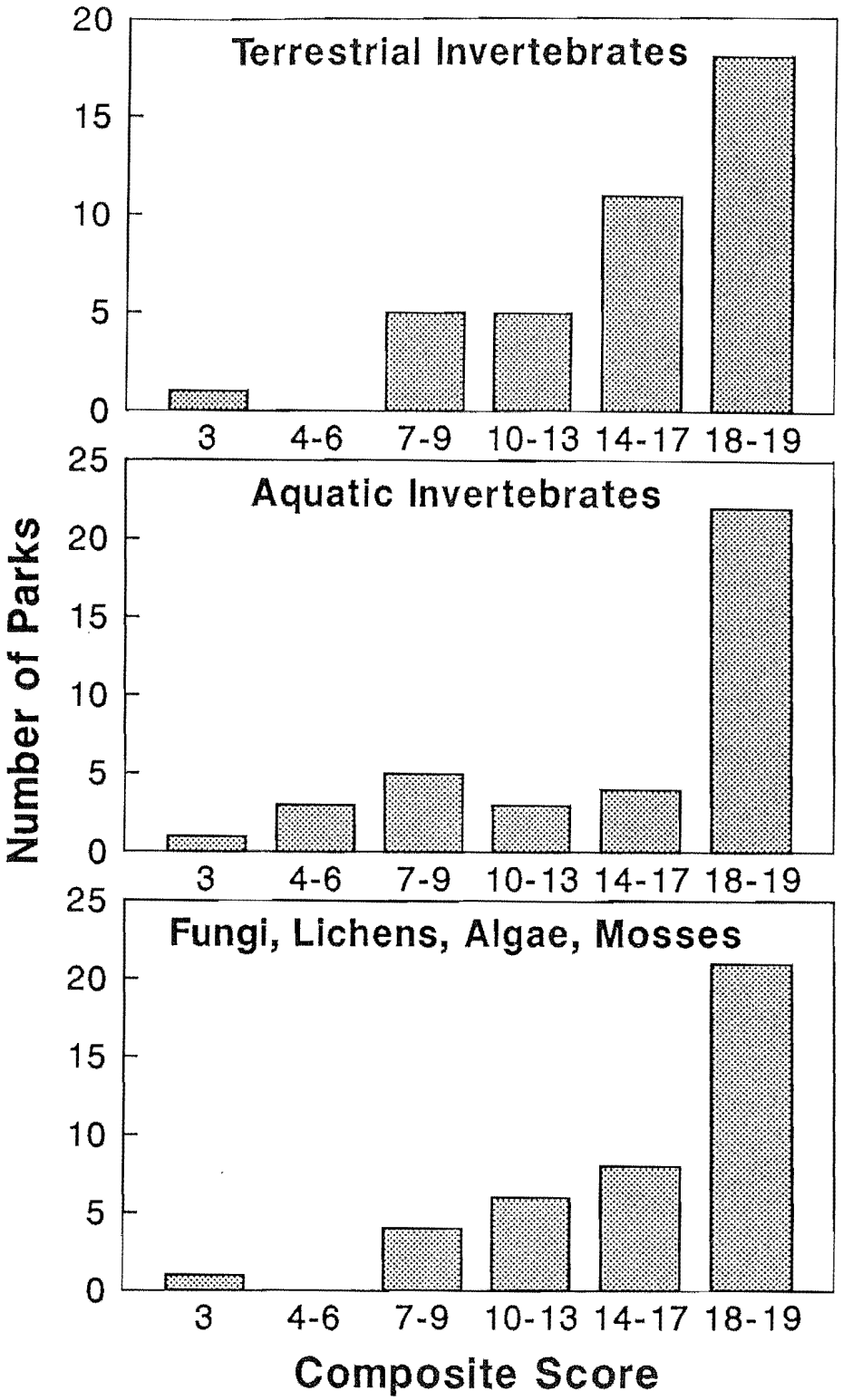

Figure 3. Composite scores (taxonomic + geographical + ecological completeness) for terrestrial invertebrates, aquatic invertebrates, and non-vascular plants in Western Region park areas. Completeness is based on limited taxa studied within these biological groups and, thus, may greatly overestimate the completeness of the entire biological group.

Some parks (e.g., CHIS, HAVO, PINN, SAMO) have conducted, or are conducting, systematic bird surveys in some habitats, but most bird lists were derived from casual observations. Because many wildlife observations are along roads, trails, and park facilities, remote areas may be poorly surveyed (e.g., GRCA, GRBA). An inventory of portions of rain forest areas of Waikolu, Waialeia and Waihanau valleys is an urgent need of Kalaupapa N.H.P.

Inventory and monitoring needs for birds may be more site-specific than for the other groups. Remote locations of most parks need attention. Threats to bird populations include air and water pollution, habitat destruction (near park boundaries), and invasion of non-native species (including diseases, and predators), and may produce rapid extirpation or migration from park areas. Thus, abundance and population dynamics information may be a higher priority for this biological group than mere presence/absence information.

More importantly, standardized survey and reporting protocols are needed (Sauvajot et al., 1990). A centralized (perhaps university CPSU-based) bird inventory could provide long-term support and easy access to standardized biological databases for researchers and managers in the field. This may be the only realistic solution to evaluating changes in migratory bird species.

Reptiles:

* One systematic survey of reptiles was completed in Santa Monica N.R.A. and there is one on-going study at Organ Pipe Cactus N.M.

* Only 3 of 40 parks reported complete species lists (Figure 2, Table 7).

* Over half the parks reported species lists that are taxonomically less than 50% complete.

Our best example of a reptile inventory comes from Santa Monica N.R.A., which conducted a systematic herpetological survey from 1981-86 that covered 50-80% of the park. Twenty-four species were found.

Several southwestern parks have rich reptile faunas including Death Valley N.M. (36 spp.), Saguaro N.M. (50 spp.), Grand Canyon N.P. (50 spp.), and Chiricahua N.M. (49 spp.). Yet, these areas have not been systematically surveyed. Most southwestern parks reported that systematic work would uncover new species and range extensions for their areas. Many parks have used range maps and field guides to develop species lists (e.g., PORE, CABR, CORO, GRBA, HAVO, HALE, PEFO), and many relied on casual observations. However, reptiles may be under-reported. Redwood N.P. reported no "observation cards" for reptiles, despite having hundreds for mammals and birds; Redwood only has about 6 reptile: 2 lizard, 2-3 snake and 1 turtle species.

Few parks have on-going reptile studies. CHIS, ORPI and SAMO are monitoring reptiles and amphibians. Sea turtles are monitored at HAVO and the ecology of reptiles and amphibians of ORPI is being studied.

TABLE 7. STATUS OF REPTILES DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHER
Kal.Hono.NHP-Marine	HA	1	1	1	3	6	2	0
Lava Beds NP	CA	1	1	1	3	1	6	11
NASA -amphibs/reptle		1	1	1	3	1	15	0
Sequoia/Kings NP	CA	1	1	1	3	1	25	2
Joshua Tree NM	CA	1	2	1	4	2	37	
Yosemite NP	CA	1	2	1	4	1	22	202
Channel Islands NP	CA	1	2	2	5	1	7	0
Organ Pipe Cactus NM	AZ	1	3	1	5	1	43	38
Death Valley-T&E	CA	1	3	2	6	6	2	
Pu'uhon. Honaunau HP	HA	2	2	2	6	5	6	0
Saguaro NM	AZ	2	2	2	6	1	50	
Santa Monica Mt. NRA	CA	1	3	2	6	1	24	
Tonto NM	AZ	2	2	2	6	1	32	0
Fort Bowie NHS	AZ	2	2	3	7	6	26	
Grand Canyon NP	AZ	3	2	2	7	2	50	15
Haleakala NP	HA	1	3	3	7	2	5	0
Lake Mead NRA	NV	1	3	3	7	1	41	
Montezuma Castle NM	AZ	2	3	2	7	2	32	
Pinnacles NM	CA	2	4	2	8	1	22	5
Hawaii Volcanoes NP	HA	1	5	5	11	4	1	5
HA Volcanoes-marine	HA	1	5	5	11	4	2	0
Point Reyes N Sea.	CA	1	5	5	11	4	15	0
Cabrillo-envcons rep	CA	1	6	6	13	2	5	0
Chiricahua NM	AZ	2	6	6	14	5	49	19
Coronado N Mem'l.	AZ	4	4	6	14	3	22	0
Golden Gate NRA	CA	6	4	4	14	2	22	
Petrified Forest NP	AZ	4	5	5	14	5	15	0
Cabrillo-reptiles	CA	7	4	4	15	3	6	0
Lassen Volcanic NP	CA	3	6	6	15	6	9	0
Great Basin NP	NV	6	5	5	16	4	19	
Grt Basin-rept/amphb	NV	6	5	5	16	5	20	
HA Volc. NP -Terrest	HA	6	5	5	16	5	7	0
Muir Woods NM	CA	6	5	5	16	4	11	
Puukohola Heiau NHS	HA	6	5	5	16	4	8	0
Death Valley NM	CA	7	5	5	17	4	36	0
Kaloko-Hono -terrest	HA	6	6	5	17	8	0	0
American Mem'l. Pk.	HA	6	6	6	18	5		0
Casa Grande NM	AZ	6	6	6	18	6		0
John Muir NHS	CA	6	6	6	18	5		0
USS AZ & Prl Hbr NHL	HA	6	6	6	18	6		
Walnut Canyon NM	AZ	6	6	6	18	5		0
War in Pacific NHP	GU	6	6	6	18	6		
Kalaupapa NHP	HA	7	6	6	19	5	6	0
Redwood NP	CA	7	6	6	19	5		
Tuzigoot NM	AZ	7	6	6	19	6	6	0
Whisk-Shas-Trin NRA	CA	7	6	6	19	5		

Inventory and monitoring needs for reptiles may be more species-specific than for the other groups. Monitoring of the threatened and endangered green sea turtle (Chelonia mydas) and hawksbill turtle (Eretomochelys imbricata) merits higher priority than systematic reptilesurveys in more protected park habitats. Possible extirpation of the red-sided garter snake and lyre snake at SAMO also deserves attention.

Use of the ANCS protocols for curating voucher specimens should be encouraged. Nineteen parks had no voucher specimens and only 8 had voucher specimens in the park. Petrified Forest N.P. reported having four reptiles in their collection, but gave them to an elementary school because the specimens were rotting.

Amphibians:

* Only two systematic surveys of amphibians have been conducted (ORPI 1990; SAMO 1981-86).

* Only four parks reported having complete species lists (Table 8, Figure 2).

* Over half the parks reported their species lists were taxonomically less than 50% complete.

* Eight parks reported not knowing the number of amphibian species.

The amphibian fauna is apparently less diverse than the reptile fauna, except at Redwood N.P. which has 19 species, primarily in old-growth forests. More than half the parks have less than 10 species. Nearly all our information on amphibians comes from range maps or casual observations with very little field work. Most parks felt their species lists were inadequate.

TABLE 8. STATUS OF AMPHIBIANS DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
Lava Beds NP	CA	1	1	1	3	1	2	0
NP Am.Samoa-amph&rep		1	1	1	3	1	15	0
Puukohola Heiau NHS	HA	1	1	1	3	1	1	0
Sequoia/Kings NP	CA	1	1	1	3	1	15	1
Joshua Tree NM	CA	1	2	1	4	2	2	0
Yosemite NP	CA	1	2	1	4	1	10	300
Channel Islands NP	CA	1	2	2	5	2	3	
Lake Mead NRA	NV	1	2	2	5	1	10	
Organ Pipe Cactus NM	AZ	1	3	1	5	1	4	4
Saguaro NM	AZ	1	2	2	5	1	8	
Santa Monica Mt. NRA	CA	1	3	2	6	1	10	
Tonto NM	AZ	2	2	2	6	1	4	0
Fort Bowie NHS	AZ	2	2	3	7	6	6	
Grand Canyon NP	AZ	3	2	2	7	2	8	4
Haleakala NP	HA	1	3	3	7	2	3	0
Montezuma Castle NM	AZ	2	3	3	8	2	4	0
Point Reyes N Sea.	CA	1	5	5	11	4	11	0
Cabrillo NM	CA	1	5	6	12	2	0	0
Redwood NP	CA	5	4	4	13	3	19	
Chiricahua NM	AZ	2	6	6	14	6	9	0
Coronado N Mem'l.	AZ	4	4	6	14	3	7	0
Golden Gate NRA	CA	4	5	5	14	3	14	
Petrified Forest NP	AZ	4	5	5	14	5	8	0
Great Basin NP	NV	6	5	5	16	4	10	
G.Basin-Rept&amphibs	NV	6	5	5	16	5	6	
Lassen Volcanic NP	CA	4	6	6	16	6	9	
Death Valley NM	CA	7	5	5	17	4	3	0
American Mem'l. Pk.	HA	6	6	6	18	5	0	
Casa Grande NM	AZ	6	6	6	18	6	0	0
Hawaii Volcanoes NP	HA	6	6	6	18	5		
John Muir NHS	CA	6	6	6	18	5		0
Kaloko-Honokohau NHP	HA	6	6	6	18	5	1	0
Kalaupapa NHP	HA	6	6	6	18	5		0
Muir Woods NM	CA	6	6	6	18	5		
Pu'uhon. Honaunau HP	HA	6	6	6	18	6		0
USS AZ & Prl Hbr NHL	HA	6	6	6	18	5		
Walnut Canyon NM	AZ	6	6	6	18	5	0	0
War in Pacific NHP	GU	6	6	6	18	5	0	0
Pinnacles NM	CA	7	6	6	19	5	8	
Tuzigoot NM	AZ	7	6	6	19	5		
Whisk-Shas-Trin NRA	CA	7	6	6	19	6		

Casa Grande N.M. reported "No inventory has been completed ... photos of a few toads from 1941."

Similar to the inventory and monitoring needs for reptiles, a species-specific approach might be a higher priority than extensive surveys. Several California parks (SEKI, YOSE, PINN, SAMO) suspected rapid declines in frog populations over the past 10 years. Potential causes for these declines include acid deposition and competition from non-native fish. Haleakala N.P. reported three exotic amphibian species. Thus, studies ofpopulation dynamics are urgently needed for these and other amphibian species of concern (e.g., Limestone salamander, Mt. Lyell salamander, Yosemite toad, red-legged frog and yellow-legged frog in YOSE; red-legged frog in SAMO). Because the ranges of many "special status" amphibians extend into several parks (e.g., red-legged frog in SAMO, YOSE and SEKI, yellow-legged frog in SEKI and YOSE, etc.), studies should be coordinated at the regional level.

Again, use of the standardized ANCS of handling voucher specimens is badly needed: only four parks had voucher specimens in the park.

Fish:

* Ten of 30 parks with fish had near-complete species lists (Table 9, Figure 2).

* Six additional parks reported having good surveys of particular streams, lakes or tidal zones, but inadequate information on remote water resources (e.g., remote streams, deep [greater than 100 ft.] oceanic waters).

* Eleven of 30 parks reported no previous inventory of fish.

Information on fisheries was highly localized. Channel Islands N.P., which has the foremost fish inventory and monitoring program in the Service (and perhaps the world), only includes the shallow depths (< 100 ft.) of the ocean. Golden Gate N.R.A. has good information for a few species (tidewater goby, stickleback and salmon) but large areas of the park (e.g., Tomales Bay, streams, etc.) have not been surveyed. Often, research has focused on single species (e.g., humpback chubs in GRCA, Devil's Hole pupfish in DEVA).

Many parks suffer from non-native fish impacting native populations of fish, amphibians and aquatic invertebrates. Fry of the native razor back sucker at Lake Mead M.R.A. are eaten by introduced game fish. Yellow-legged tree frog larvae throughout Sequoia and Kings Canyon and Yosemite National Parks are reportedly eaten by introduced trout species. Likewise, native aquatic invertebrates are eaten by introduced game fish.

Extirpations of fish species are difficult to assess. Candlefish, an anadromous smelt in Redwood National Park, has not been seen since 1981. However, steelhead trout were thought to be extirpated in the 1970's but were located again in 1981 and

TABLE 9. STATUS OF FISH DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
Casa Grande NM	AZ	0	0	0	0	0	0	0
Chiricahua NM	AZ	0	0	0	0	0	0	0
Coronado N Mem'l.	AZ	0	0	0	0	0	0	0
Fort Bowie NHS	AZ	0	0	0	0	0	0	0
John Muir NHS	CA	0	0	0	0	0	0	0
Lava Beds NP	CA	0	0	0	0	1	1	1
Petrified Forest NP	AZ	0	0	0	0	0	0	0
Saguaro NM	AZ	0	0	0	0	0	0	0
Tonto NM	AZ	0	0	0	0	0	0	0
Walnut Canyon NM	AZ	0	0	0	0	0	0	0
Channel Isd-kelp for	CA	1	1	1	3	3	107	0
Death Valley NM	CA	1	1	1	3	1	6	5
Grand Canyon NP	AZ	1	1	1	3	6	20	150
Lake Mead NRA	NV	1	1	1	3	1	22	
Muir Woods NM	CA	1	1	1	3	2	3	0
Organ Pipe Cactus NM	AZ	1	1	1	3	1	1	1
Sequoia/Kings NP	CA	1	1	1	3	1	12	0
USS AZ & Prl Hbr NHL	HA	1	1	1	3	6	25	0
Yosemite NP	CA	1	1	1	3	1	10	39
Redwood NP	CA	1	2	1	4	1	16	500
Death Valley-T&E spp	CA	1	3	2	6	6	69	
Point Reyes N Sea.	CA	1	1	4	6	2	17	
Puukohola Heiau NHS	HA	2	2	2	6	6	63	0
Pu'uhon. Honaunau HP	HA	2	2	2	6	5	121	0
Kaloko-Honokohau NHP	HA	3	2	2	7	6	166	0
Chnnl Isld-rock intd	CA	3	3	2	8	2	7	0
Channel Islands NP	CA	3	3	2	8	1	138	0
Lassen Volcanic NP	CA	3	3	3	9	6	12	
Haleakala NP	HA	3	4	3	10	4	4	0
Montezuma Castle NM	AZ	3	4	3	10	5	10	0
Pinnacles NM	CA	1	5	5	11	4	2	1
Golden Gate NRA	CA	5	4	5	14	2		
Hawaii Volcanoes NP	HA	6	5	5	16	6	7	0
American Mem'l. Pk.	HA	6	6	6	18	5		
Cabrillo NM	CA	6	6	6	18	5		
Joshua Tree NP	CA	6	6	6	18	5		
Kalaupapa NHP	HA	6	6	6	18	5		
Santa Monica Mtn NRA	CA	6	6	6	18	5		
Great Basin NP	NV	7	6	6	19	5		
NP of American Samoa		7	6	6	19	6		
Tuzigoot NM	AZ	7	6	6	19	6	89	0
War in Pacific NHP	GU	7	6	6	19	5		
Whisk-Shas-Trin NRA	CA	7	6	6	19	5		

have been observed since in yearly surveys.

Inventory and monitoring needs for fish may require a blend of extensive surveys and species-specific or site specific monitoring. Channel Islands, Kaloko-Honokohau, Kalaupapa, Puukohola Heiau, Pu'uhonua-O-Honaunau and Redwood require extensive surveys of marine (especially deep oceanic) aquatic resources. Listed species like the pupfish at DEVA, tide-water goby steelhead trout and salmon at REDW, roundtail at GRCA and Colorado squawfish at Lake Mead need continued monitoring.

Terrestrial and Aquatic Invertebrates:

* No park has attempted a systematic survey of all invertebrate groups.

* Several parks reported studies of particular groups (e.g., arthropods, mollusks, butterflies, etc.).

* Only five parks reported taxonomically complete lists of particular groups of invertebrates.

* Only four parks reported studies or surveys of particular groups of invertebrates over the history of the park.

* 30 and 24 of 40 parks reported knowing less than 50% of their terrestrial and aquatic invertebrate species, respectively.

Little is known about the biodiversity of terrestrial and aquatic invertebrates of parks in the Western Region and most information comes from taxa-specific studies or collections (Figure 3; Tables 10 and 11). Thus, summary Tables 10 and 11 list group-specific ratings. In a recent (1988) collection of beetles at Coronado N.M., for example, 80 specimens were collected including up to 20 species new to the monument. Grand

TABLE 10. STATUS OF TERRESTRIAL INVERTEBRATES DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
AZ/Pl.Hbr NH-Arthrop	HA	1	1	1	3	6	2	0
AZ/Pl.Hbr NH-Mollusc	HA	1	1	1	3	6	6	0
AZ/Pl.Hbr NH-Annelid	HA	1	1	1	3	6	4	0
Dth V NM-springsnail	CA	1	3	3	7	1	8	8
Organ Pipe Cactus NM	AZ	3	3	1	7	2		
Haleakala NP-Insects	HA	2	3	3	8	2		
Puuh.Hon.HP-Annelids	HA	3	3	2	8	2	2	0
Puuh.Hon.HP-Mollusca	HA	3	3	2	8	2	46	0
Ch.Is.NP-T.Arth&Snai	CA	3	3	3	9	2	750	0
Haleakala NP-Annelid	HA	3	3	3	9	2	11	
Haleakala NP-Arachnd	HA	3	3	3	9	2	90	
Haleak. NP-Molluscs	HA	3	3	3	9	2	47	0
Hal. NP-Platyhelmin.	HA	3	3	3	9	2	2	
Haleak. NP-Chilopoda	HA	3	3	3	9	2	5	
Haleakala NP-Diploda	HA	3	3	3	9	2	11	
HA Vol. NP- Inverts	HA	3	3	3	9	4		5000
Josh. Tr NM-Arthropd	CA	5	3	3	11	5	327	
Puuh.Hon.HP-Inverts	HA	4	4	4	12	5	150	0
Seq.Kings NP-Insects	CA	4	4	4	12	1	709	300
Seq.Kings NP-Btrfly	CA	4	4	4	12	1	76	50
Golden Gate NRA	CA	5	4	4	13	4	100	100
Lava Beds NP	CA	5	4	4	13	4		
Coronado N Mem'l.	AZ	5	4	5	14	3	100	80
Gr Bas NP-Land Snail	NV	7	4	4	15	5	10	10
John Muir NHS	CA	5	5	5	15	5		
Lassen Volcanic NP	CA	5	5	5	15	6		
Point Reyes N Sea.	CA	5	5	5	15	4		
S.Mon.Mt.NR-Btrflies	CA	3	6	6	15	5	80	
Yosemite NP	CA	5	5	5	15	4		4500
Muir Woods NM	CA	6	5	5	16	4		
Grand Canyon NP	AZ	5	6	6	17	6	247	
Petrified Forest NP	AZ	5	6	6	17	5	802	
Tonto NM	AZ	5	6	6	17	5	100	133
Walnut Canyon NM	AZ	5	6	6	17	3	639	
American Mem'l. Pk.	HA	6	6	6	18	5		
Chiricahua NM	AZ	6	6	6	18	5	625	
Fort Bowie NHS	AZ	6	6	6	18	6		
Kaloko-Honokohau NHP	HA	6	6	6	18	5		
Kalaupapa NHP	HA	6	6	6	18	5		
NP of American Samoa		6	6	6	18	5		
Pinnacles NM	CA	6	6	6	18	5		
Puukohola Heiau NHS	HA	6	6	6	18	5		
Redwood NP	CA	6	6	6	18	5		
Tuzigoot NM	AZ	6	6	6	18	6		
War in Pacific NHP	GU	6	6	6	18	5		
Whisk-Shas-Trin NRA	CA	6	6	6	18	5	87	408
Casa Grande NM	AZ	7	6	6	19	6	79	
Gr Bas NP-Butterfly	NV	7	6	6	19	5	88	88
Gr Bas NP-Mac.moths	NV	7	6	6	19	5		
Montezuma Castle NM	AZ	7	6	6	19	5	20	
Saguaro NM	AZ	7	6	6	19	5		

TABLE 11. STATUS OF AQUATIC INVERTEBRATES DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
Casa Grande NM	AZ	0	0	0	0	0	0	0
Fort Bowie NHS	AZ	0	0	0	0	0	0	0
Petrified Forest NP	AZ	0	0	0	0	0	0	0
Channel Isld-kelp	CA	1	1	1	3	3	455	0
USS AZ/Prl Hbr-spong	HA	1	1	1	3	6	12	0
USAR-Coelenterates	HA	1	1	1	3	6	3	0
USAR-Molluscs	HA	1	1	1	3	6	6	0
USAR-Urochordata	HA	1	1	1	3	6	6	0
USAR-Ectoprocta	HA	1	1	1	3	6	1	0
Redwood NP	CA	1	2	1	4	1	1000	
Montezuma Castle NM	AZ	1	3	2	6	1	57	0
Chnl Is-sand intrtid	CA	1	4	2	7	2	30	0
Chnl Is-rock intrtid	CA	3	3	2	8	2	110	0
Kalo.-Hono -marine	HA	2	3	3	8	6	33	0
Puho - Coelenterates	HA	3	3	2	8	2	5	0
Puho-sponges	HA	3	3	2	8	2	2	0
Puho-Bryozoa	HA	3	3	2	8	2	1	0
Puho-Echinodermata	HA	3	3	2	8	2	18	0
Puho-Molluscs	HA	3	3	2	8	2	46	0
Cabrillo-intertidal	CA	2	3	4	9	2	160	
Channel Islnd-marine	CA	3	3	3	9	1	500	0
Hale-Platyhelminthes	HA	3	3	3	9	2	2	
Haleakala - molluscs	HA	3	3	3	9	2	47	0
Haleakala NP-sponges	HA	3	3	3	9	2	1	
Organ Pipe Cactus NM	AZ	5	3	1	9	2	61	0
Joshua Tree-arthropd	CA	5	3	3	11	5	327	
Sequoia/Kings-insect	CA	4	4	4	12	1	709	300
Lassen Volcanic NP	CA	5	4	4	13	5		
Yosemite NP	CA	5	5	5	15	4		4500
Golden Gate NRA	CA	6	5	5	16	4		1
Lava Beds NP	CA	6	5	5	16	4		
Muir Woods NM	CA	6	5	5	16	4		1
American Mem'l. Pk.	HA	6	6	6	18	5		
Chiricahua NM	AZ	6	6	6	18	6		
Coronado N Mem'l.	AZ	6	6	6	18	5		
Grand Canyon NP	AZ	6	6	6	18	5		
Point Reyes N Sea.	CA	6	6	6	18	5		
Saguaro NM	AZ	6	6	6	18	6		
Tonto NM	AZ	6	6	6	18	5		
Tuzigoot NM	AZ	6	6	6	18	6		
Walnut Canyon NM	AZ	6	6	6	18	6		
War in Pacific NHP	GU	6	6	6	18	6		
Cabrillo -intertidal	CA	7	6	6	19	5	30	
Great Basin-zooplnkt	NV	7	6	6	19	5		
Hawaii Volcanoes NP	HA	7	6	6	19	6		
John Muir NHS	CA	7	6	6	19	5		
Kalaupapa NHP	HA	7	6	6	19	6		
NP of American Samoa		7	6	6	19	6		
Pinnacles NM	CA	7	6	6	19	5		
Puukohola Heiau NHS	HA	7	6	6	19	6		
Whisk-Shas-Trin NRA	CA	7	6	6	19	5		

Canyon has had some good work done on species of butterflies in 1950 but other insect collections are identified only to the family. Parks with active invertebrate surveys (e.g., CHIS, HALE, HAVO, JOTR, ORPI and YOSE) find many "new-to-the-park" species. ORPI is near completion of an intensive three year inventory and assessment of terrestrial invertebrates: the total number of newly identified species will be substantial.

For terrestrial invertebrates, 17 parks had some voucher specimens in their parks and 26 did not know the status of voucher specimens. For aquatic invertebrates, 10 parks had no voucher specimens in their parks and 24 parks did not know the status of voucher specimens.

Inventory and monitoring needs for terrestrial and aquatic invertebrates are difficult to assess and rank. It is unclear if we should adopt a mission to evaluate and maintain the biodiversity of invertebrates (an extensive, low resolution, presence/absence approach) or an indicator species approach (intensive, high resolution analysis of specific populations). At a minimum, some sites in each park should receive a complete invertebrate inventory to begin to assess the magnitude of our information gap. Secondly, a review of the literature should be conducted to identify possible indicator species and potential threats to those species. Third, a standardized method for storing voucher specimens should be developed with the means to manage the data within the framework of the Automated National Catalog System (ANCS). Lastly, a larger data management

framework, similar to NPFLORA, needs to be developed for invertebrates to summarize information among parks and between agencies collecting similar information.

Non-vascular Plants:

* No park has systematically surveyed all non-vascular plant groups.

* Only 4 of 10 parks reported taxonomically, geographically and ecologically complete lists of particular groups of non-vascular plants (Figure 3; Table 12).

* Several parks reported studies of particular groups (e.g., lichens, fungi, bryophytes, algae) in small areas within the parks.

* 29 of 40 parks reported knowing less than 50% of their non-vascular plant species.

Generally, little is known about the biodiversity of non-vascular plants in Western Region Parks. However, there are exceptions. Lassen Volcanic N.P. surveyed fungi almost every year for 40 years. Petrified Forest N.P. is now surveying lichens park-wide. Saguaro N.M. has benefitted from five lichen surveys between 1908 and 1966 and has a collection of 250 specimens with 37 yet to be identified. Hawaiian parks have received attention from Dr. Cliff Smith, lichenologist and CPSU Unit Leader at the University of Hawaii. Dr. Smith also has conducted lichen surveys at Pinnacles N.M. and a preliminary survey at John Muir N.H.S. Parks with marine resources, notably Channel Islands N.P. and Pu'uhonua-O-Honaunan N.H.P. have some detailed information on algal populations, in selected small areas.

TABLE 12. STATUS OF FUNGI, LICHEN, ALGAE AND MOSSES DATA (Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
Ch.Is. NP-kelp/alg.	CA	1	1	1	3	3	214	0
Lass. Vol NP-Fungi	CA	1	1	1	3	6	567	
Puuk. Heiau NHS-alg	HA	1	1	1	3	3	13	0
USS AZ/Pl H. NHL-alg	HA	1	1	1	3	6	4	0
Cabrillo NM-lichens	CA	2	1	1	4	5	29	
Hale NP-bryophytes	HA	2	1	1	4	1	185	185
St Mon Mt. NRA-fungi	CA	1	3	3	7	1	212	
St Mon Mt NRA-bryoph	CA	1	4	3	8	1	43	43
Pu'uh. Hon. HP-algae	HA	3	3	2	8	2	16	0
Ch.Is. NP-R.intertid	CA	3	3	2	8	2	112	0
Cabr. NM-In/tid.alg	CA	2	3	4	9	2	109	
Ch.Is. NP-N/vasc.pl.	CA	3	3	3	9	1	350	0
Muir Woods NM-fungi	CA	3	3	3	9	2	49	
Seq./Kings NP-lich	CA	3	3	3	9	1	207	60
Cabr. NM-In/tid.alg	CA	3	3	4	10	1	79	
Haleakala NP-lichens	HA	4	4	3	11	4	118	118
Pinnacles NM-lichens	CA	7	4	1	12	5	93	
Redwood NP-lichens	CA	4	4	4	12	4	48	
Seq/Kings NP-mosses	CA	4	4	4	12	1	60	60
Ha. Vol. NP-bryophy	HA	4	4	4	12	3	388	
Organ Pipe NM-lich	AZ	4	4	4	12	6	33	0
Puuk. Heiau NHS-lich	HA	4	4	4	12	4	3	0
Saguaro NM-lichens	AZ	1	6	6	13	5	250	287
John Muir NHS-lichen	CA	7	4	4	15	6		
Yosemite NP-fungi	CA	5	5	5	15	4		
Yosemite NP-lichens	CA	5	5	5	15	4		
Kal.Hon. NHP-lichens	HA	5	5	5	15	5	5	0
Lava Beds NP-fungi	CA	6	5	5	16	4		
Lava Beds NP-lichens	CA	6	5	5	16	4		
Haleakala NP-fungi	HA	6	5	5	16	4	5	0
Ha Vol. NP-lichens	HA	6	5	5	16	4	57	57
Ha Vol. NP-fungi	HA	6	5	5	16	4	26	26
Chiricahua NM-fungi	AZ	5	6	6	17	5	0	
Gold. Gate NRA-lich	CA	6	6	6	18	5		
Golden Gate NRA-fung	CA	6	6	6	18	5		
John Muir NHS-fungi	CA	6	6	6	18	5		
Muir Woods NM-lich	CA	6	6	6	18	5		
Pinnacles NM-fungi	CA	6	6	6	18	5		
Redwood NP-fungi	CA	6	6	6	18	6		
Whi-Sha-Tri NRA-fun	CA	6	6	6	18	6		
Whi-Sha-Tri NRA-lich	CA	6	6	6	18	6		
Casa Grande NM-lich	AZ	6	6	6	18	6		0
Casa Grande NM-fungi	AZ	6	6	6	18	6		0
Coronado NM-lichens	AZ	6	6	6	18	6		0
Coronado NM-fungi	AZ	6	6	6	18	6		0
Fort Bowie NHS-fungi	AZ	6	6	6	18	6		0
Fort Bowie NHS-lich	AZ	6	6	6	18	6		0
Grand Canyon NP-lich	AZ	6	6	6	18	6		
Kal-Hon. NHP-fungi	HA	6	6	6	18	6		0

TABLE 12 CONTINUED. STATUS OF FUNGI, LICHEN, ALGAE AND MOSSES DATA
(Ranked by composite score)

PARK	STATE	TAXA COMPL	GEOG COMPL	ECOL COMPL	COMPOS SCORE	SEAS COMPL	NO. SPP	NO. VOUCHERS
Kal-Hon. NHP-bryophy	HA	6	6	6	18	6	1	0
Org Pipe Cac NM-fung	AZ	6	6	6	18	5		0
Pet.For. NP-lichens	AZ	6	6	6	18	6		
Pet.For. NP-fungi	AZ	6	6	6	18	6		0
Puuk. Heiau NHS-bryo	HA	6	6	6	18	6	1	0
Puuk. Heiau NHS-fung	HA	6	6	6	18	6	1	0
Saguaro NM-fungi	AZ	6	6	6	18	6		0
Tonto NM-lichens	AZ	6	6	6	18	5		10
Tonto NM-fungi	AZ	6	6	6	18	6		0
Tuzigoot NM-fungi	AZ	6	6	6	18	6		0
Tuzigoot NM-lichens	AZ	6	6	6	18	6		0
Walnut Can NM-lichen	AZ	6	6	6	18	6		0
Walnut Can NM-fungi	AZ	6	6	6	18	6		0
War in Pac NHP-lich	GU	6	6	6	18	6	7	0
Lassen Vol NP-lichen	CA	7	6	6	19	6	25	
Pt Reyes N Sea.-fung	CA	7	6	6	19	5		
Pt Reyes N Sea.-lich	CA	7	6	6	19	5		
Chiricahua NM-lichen	AZ	7	6	6	19	6		84
Grand Canyon NP-fung	AZ	7	6	6	19	5		

Gaps in knowledge about non-vascular plants may be more serious than previously considered. Because they are bio-monitors for air pollution, systematic lichen monitoring could have been used to document the drastic decline in fruticose lichen species reported at Cabrillo N.M. and Santa Monica Mountains N.R.A. Only Pinnacles N.M. has established long-term study plots for lichens.

Lichens and fungi may also threaten cultural resources. Recently introduced lichens at Kalaupapa N.H.P. are considered noxious and pose a potential threat to archeological sites. In Lava Beds N.M., fungal growthdue to artificial lighting is obscuring petroglyphs in Mushpot and Fern caves.

Only 10 parks had collections of voucher specimens, but none were fully catalogued. Some parks cannot locate previous collections (e.g., CHIS, JOMU) or have reason to believe that earlier work included many misidentified species (e.g., CABR, SAGU). Most parks, however, simply have not been surveyed.

Inventory and monitoring needs of this biological group are identical with those for vascular plants.

Relationship of Mean Composite Score to Park Area:

Comparing mean composite score (of the nine biological groups tested) with park size (log of area in square miles), we found that small parks generally knew much less about their biotic resources than larger park units (Figure 4). The ideal mean composite score is three. CHIS, HALE, ORPI and SEKI came closest to this ideal value. Generally, small parks had large

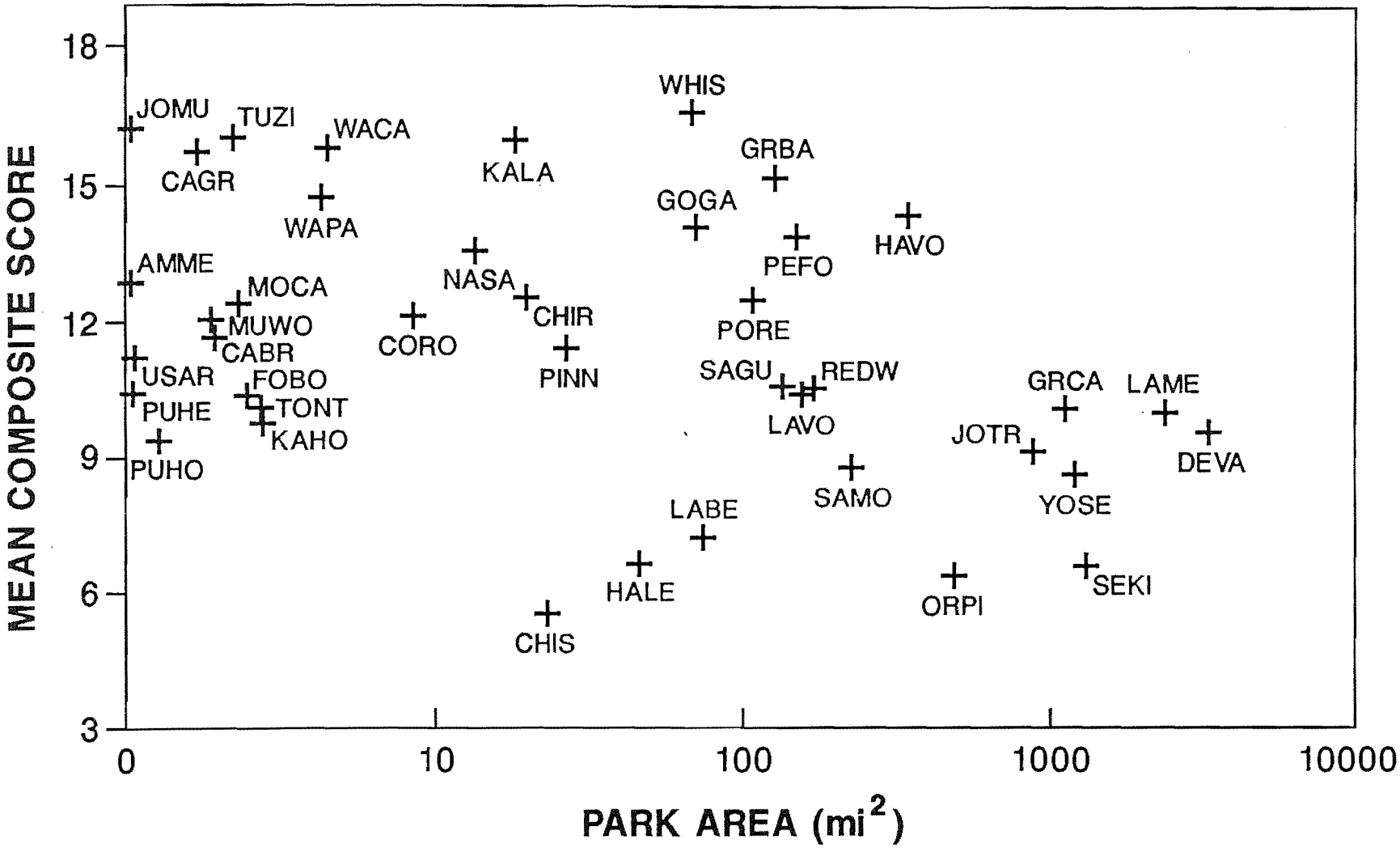

Figure 4. Relationship of park size (log scale) to mean composite score for the nine biological groups.

information gaps, large parks had small information gaps, and middle-sized parks were highly variable. Ranking parks by mean composite score is one way to: (1) set priorities for inventory and monitoring program; and (2) assess attainment of a minimum standard over time.

Status of Mapped Information:

* 34 parks had vegetation maps, 21 parks had soils maps, and 26 parks had geology maps (Table 13).

* Six of the vegetation maps, seven of the soils maps, and nine of the geology maps cover areas smaller than the parks.

* There has been no systematic check on any of the maps and many may be of questionable quality, accuracy or usefulness.

* Vegetation classification has not been standardized even among parks in similar biomes.

* Many soils and geology maps vary in resolution (smallest map unit, intensity of ground-truth sampling, etc.)

With few exceptions, maps of natural resources in Western Region parks were poorly organized, rarely covered the entire park, had low resolution, and have not been systematically field checked (Appendix III). No park had a list of mapped information. The Denver Service Center conducted a detailed inventory of maps for Lake Mead N.R.A., but no additional information was provided LAME staff on base scale, investigators, data sources, field checks, map accuracy or map data. Many parks recognized that maps were poorly maintained. Channel Islands N.P. reported "no one person has been responsible for keeping track of CHIS maps." Point Reyes N.S. reported "map information is available, but in a state of disorganization; the map index is

TABLE 13. STATUS OF MAPPED INFORMATION

	YEAR			ACCURACY			COMPREHENSIVENESS		
	VEGETATION	SOILS	GEOLOGY	VEGETATION	SOILS	GEOLOGY	VEGETATION	SOILS	GEOLOGY
AMME	1990						2		
CABR	1989	1973	1975				2	1	1
CAGR	1986	1917		90			2	1	
CHIR	1938	1979		90	90		3	3	
CHIS	1980	1979	1979				3	3	3
CORO	1989	1971	1985	90	90		2	1	3
DEVA	1984			85			3		
FOBO	1976			90			2		
GOGA	1975	1975	1975				1	1	1
GRBA	1990		1988	85			1		2
GRCA	1982		1980				2		2
HALE	1989		1989	75		90	2		2
HAVO	1985	1971	1967	25	60	90	3	1	1
JOMU	1976	1970					1	1	
JOTR	1990		1968	50			2		3
KAHO	1990	1990	1990	85	85	85	2	2	2
KALA			1947			75			1
LABE	1965		1965				2		2
LAME	1988		1988				1		1
LAVO	1980	1980	1980				2	3	3
MOCA	1990	1933					2	2	
MUWO	1978						2		
NASA	1981	1981	1981				1	1	1
ORPI	1979	1972	1980		95	95	2	2	3
PEFO	1978	1975	1981	90	50	80	2	1	1
PINN	1983	1969	1970				2	1	3
PORE	0	1968	0				2	3	1
PUHE	1977			85			3		
PUHO	1986			85			2		
REDW	1983	1988	1981	5	1	0	2	3	3
SAGU	1984		1989				3		1
SAMO	1988		1975	95			1		1
SEKI	1975	1986	1990		90		2	3	1
TONT									
TUZI									
USAR									
WACA			1970						1
WAPA									
WHIS	1973	1973	1964			0	1	1	3
YOSE	1982	1963	1985				2	3	3

lost."

Other parks have made great strides in converting maps to GIS images. The Pacific Area Office has developed extensive computer facilities and expertise to digitize several natural and cultural resource maps for some parks in Hawaii (e.g., KAHO, KALA, WAPA). Other parks are developing GIS capabilities using SAGIS (GRCA, LAME, REDW), GRASS (GRBA, SEKI, YOSE), ERDAS (CHIS), AUTOCAD (DEVA, ORPI) or other software (ORPI, SAMO). There were some surprising gaps in mapped information. For example, for GrandCanyon N.P., the high resolution geology map covers only 50% of the park. Likewise, the geology map of Pinnacles N.M. covers only 60% of the park. Point Reyes N.S., known for its diverse coastal vegetation, does not have a comprehensive vegetation map. Only 15 of the 40 parks had vegetation, soils, and geology maps.

Inventory and monitoring needs for mapped information must consider the accuracy of existing maps and the potential development and uses of GIS technology. Minimally, parks with significant natural resources should have accurate vegetation, soils, and geology maps. These must be properly geo-referenced and of appropriate scale and resolution to assure maximum utility in decision making. Maps must be reasonably current, particularly for vegetation. Many existing maps do not meet these criteria. The Lassen Volcanic N.P. vegetation map includes only dominant tree species in 1931. The Whiskeytown N.R.A. vegetation and soils map is a U.S. Forest Service timber type and timber site quality map of little utility to park managers.

Careful reexamination of the accuracy, resolution, and utility of existing maps is essential before incorporating them into a developing GIS. Often, developing new maps from satellite imagery (e.g., SPOT) may be more accurate and cost-effective than attempting to verify information on inaccurate old maps.

Many parks are developing GIS capabilities with little, if any, standardization among areas. Where the necessary mapped information is inaccurate or non-existent, this may be putting "the cart before the horse." The development of sound, ground-truthed, natural resource base maps may be a higher priority, albeit a more costly undertaking, than hardware and software purchases. This approach was success-fully adopted in Sequoia and Kings Canyon N.P. Also, this ap-proach would allow more time to develop a region-wide or service-wide framework for a consistent, coordinated effort to develop GIS capabilities in all parks with significant natural resources.

Status of Imagery Information:

* Only 5 parks lacked some type of imagery (i.e., black and white, color, or color infrared aerial photography) (Table 14).

* Three parks with imagery did not have complete coverage of park lands.

* Three park areas (YOSE, CHIS, GRBA) have incorporated satellite imagery into their GIS's.

Most parks have some type of imagery available for resource inventory purposes. Six parks (HALE, HAVO, LAVO, ORPI, REDW, and SAGU) have more than 10 sets of imagery, four parks have one set

TABLE 14. STATUS OF IMAGERY INFORMATION

	YEAR			COMPREHENSIVENESS			NUMBER OF SETS (PAST YEARS)			OTHER IMAGERY
	B&W	COLOR	COLOR IR	B&W	COLOR	COLOR IR	B&W	COLOR	COLOR IR	
AMME		1987			1					
CABR	1981	1982	1982	1	1	1	1			
CAGR	1976			1			3			
CHIR	1979			3			4			SATELLITE-1
CHIS		1988	1988		3	3			8	LANDSAT/TM-1
CORO										
DEVA	1982		1983	3		3	3			SATELLITE-3
FOBO	1965			3						
GOGA	1987									
GRBA	1972	1984	UNKNOWN	0	2	1	1			
GRCA										
HALE	1983	1978	UNKNOWN	1	1	1	14	7		
HAVO	1977	1979	UNKNOWN	3	3	1	85	2	4	OTHER-6
JOMU	NONE	IN	THE PARK							
JOTR	1970	1990		1	3				3	OTHER-1
KAHO	1988	1990	1988	2	2	1	6		1	
KALA	1990	1983	1990	1	1	1	8	1		
LABE	1975	1974	1978	3	2	1	3		1	BW-SERIES OF 17
LAME	1982	1979	1976	3	3	3	2			
LAVO	1981	1978	1988	3	3	3	16	1		
MOCA	1946	1987		2	1		5			
MUWO		UNKNOWN			3					
NASA			1990			3				
ORPI	1988	1984	1984	0	3	3	10	2	2	
PEFO	1986	1976		1	1		4	1		
PINN	1979		1983	2		2	1			
PORE	1965	1974	1984	0	0	2	7	1		
PUHE	1983		1974	1		1	1		1	
PUHO		1982			1					
REDW	1988	1981	1983	3	3	2	32	7	4	
SAGU	1986	1975		1	3		14			
SAMO	1977	1988	1984	3	1	1			1	LANDSAT/TM-3
SEKI	1989			1			1			
TONT	1967			1						
TUZI		1987			1			2		
USAR										
WACA										
WAPA										OTHER-1
WHIS	1985	1988		3	2		7	1		
YOSE	UNKNOWN		1982	2		2	1			

of aerial photographs, and five parks have none (Appendix IV). The only large natural area without aerial photography known to the park staff was Grand Canyon, although we now know that several sets of aerial photographs for the park are located at the Denver Service Center.

Image needs are park- and purpose-specific. Because Grand Canyon is currently developing an updated vegetation map and GIS (60% of which has been entered into SAGIS), aerial photography may be a higher priority than for smaller (cultural-resource) parks. Image needs, particularly for satellite imagery, will likely expand as GIS are being developed in other parks.

New (To Park) Species:

* In the past 10 years, 1439 vascular plant species, 111 bird species and 19 mammalian species were added to park species lists (Table 15).

* Seven parks actively searching for terrestrial invertebrates added a combined 859 new species to their park lists.

* Over 3085 plant and animal species were added to park lists over the past 10 years.

Current species lists are probably far from complete. Considering the paucity of funding for baseline inventories of park resources, finding so many new-to-park species indicates there is much work to be done. In Pinnacles N.M., for example, a six-year survey by volunteers added 300+ new-to-park vascular plant species in the past 10 years -- a 133% increase.

One way to set priorities for inventory work may be to concentrate first on parks with scores of 5 or 6 (low information

TABLE 15. NEW (TO PARK) SPECIES

PARK NAME	NEW VASC PLNTS	NEW BIRDS	NEW MAM	NEW REPT	NEW AMPH	NEW FISH	NEW AQ. INV.	NEW TER. INV.	NEW FUNG LICH ALGAE	PARK TOTAL
AMME	0	0								0
CABR	0	0	0	0	0		0	0	0	0
CAGR	0					*	*			0
CHIR	20					*			0	20
CHIS	100		0	0	0		0	500		600
CORO	70	27	3			*		0		100
DEVA	0	0	0			0				0
FOBO	0					*		*		0
GOGA	300		1					0		301
GRBA										0
GRCA	1	0				1	0			2
HALE	50	3	3	0	0	4	2	2	68	132
HAVO	17	0	0	0		7				24
JOMU	0	56				*			0	56
JOTR										0
KAHO	0	0	0	0		0	0		0	0
KALA	0	0	0						0	0
LABE		5	0	0	0	*				5
LAME		1				0				1
LAVO			1							1
MOCA							4			4
MUWO	1	1				1			4	7
NASA	0	0	0	0	0				0	0
ORPI	0	2	5	2	0	0	0	0	0	9
PEFO	64					*	*			64
PINN	300	6	1	0					93	400
PORE	0		1			17				18
PUHE	0	3								3
PUHO										0
REDW	350	0				1	2			353
SAGU	2	1				*			0	3
SAMO	100	1	0	0	0		0		0	101
SEKI	50	3	3	1	0	1	354	355	60	827
TONT	0		1			*				1
TUZI		0								0
USAR						25	6	2	4	37
WACA	14					*				14
WAPA										0
WHIS	0									0
YOSE	0	2	0	0	0	0				2
TOTAL	1439	111	19	3	0	57	368	859	229	3085

* Not applicable

status) in "ecological completeness" for particular biological groups. This might provide the greatest return (i.e., discovery of new species) for the investment (funding and search time).

Although there is no sure-fire sampling design to assure species lists are complete, this survey provides the impetus to field-test current techniques used to measure species-area-search time relationships. When the number of new-to-park species decreases sharply as search time and area searched increases, the species list may be considered effectively complete. However, questions remain about appropriate sampling design for increasingly rare (i.e., temporally or spatially rare) elements on the landscape. Because this is a somewhat new problem for field biologists, an experimental approach should be used.

Species Extirpation:

* Twenty-five species of vascular plants were reliably determined to be extirpated (in-park extinctions) in Western Region parks -- 24 species in Haleakala N.P. and one species in Golden Gate N.R.A. (Table 16).

* Ten species of mammals were reported as nominally extirpated but this list included nine species found on lands adjacent to parks (i.e., they may have been only occasional users).

* Six Hawaiian and five mainland bird species were confirmed extirpated from parks.

* The Colorado squawfish (GRCA) was the only fish extirpated from park waters.

* Twenty-two vascular plant species, 12 mammals, 4 fish, 12 birds, 3 reptiles, and 3 amphibians were listed as "possibly" extirpated.

TABLE 16. SPECIES EXTIRPATIONS IN PARKS

CHANNEL ISLANDS NATIONAL PARK:

Vascular Plants:
POSSIBLE EXTIRPATION:
1. Mimulus brandegei
2. Sibara filifolia

Birds:
CONFIRMED EXTINCTION:
1. Melospiza melodia ssp. graminea (listed subspecies of Song Sparrow)

Mammals:
CONFIRMED EXTIRPATION:
1. Enhydra lutrisnereisis (Southern Sea Otter)

CORONADO NATIONAL MONUMENT:

Mammals:
POSSIBLE EXTIRPATION:
1. Mexican Lobo

DEATH VALLEY NATIONAL MONUMENT:

Vascular Plants:
POSSIBLE EXTIRPATION:
1. Centauruim namophilum spp. namophilum - Spring Loving Century Plan

GOLDEN GATE NATIONAL RECREATION AREA:

Vascular Plants:
CONFIRMED EXTIRPATION:
1. Dune Tansy - Tanacetum camphoratum

GRAND CANYON NATIONAL PARK:

Fish:
CONFIRMED EXTIRPATION:
1. Colorado Squaw Fish
POSSIBLE EXTIRPATION:
1. Round Tail

Mammals:
CONFIRMED EXTIRPATION:
1. Wolf
2. River Otter - Lutra canadensis sonorae
POSSIBLE EXTIRPATION:
1. Prairie Dog
2. Badger
3. Raccoon

TABLE 16 CONTINUED. SPECIES EXTIRPATIONS IN PARKS

GREAT BASIN NATIONAL PARK:

Mammals:

CONFIRMED EXTIRPATION:

1. Elk

HALEAKALA NATIONAL PARK:

Vascular Plants:

CONFIRMED EXTIRPATION WITH DATE OF LAST SIGHTING:

1. Cyanea longissima (1927)
2. Cyanea pohaky (1919)
3. Huperzia halakalae (1841)
4. Schiedea implexa (1910)
5. Silene cryptopetala (1870s)
6. Silene degeneri (1927)
7. Stenogyne haliakalae (1937)
8. Tetramolopium lepidotum subsp. arbusculum (1841)

APPARENTLY EXTRIPATED FROM THE PARK BUT OCCUR OUTSIDE:

1. Argyoxiphium virescens (1959)
2. Asplenium kaulfussii (1919)
3. Asplenium leucostegiodes (1978)
4. Clermontia lindseyana (1919)
5. Clermontia peleana (1919)
6. Cyanea elliptica (1967)
7. Cyanea grimesiana (1919)
8. Gardenia remyi (1980)
9. Lindsaea repens var. macraena (1919)
10. Panicum tenuifolium (1937)
11. Phyllostegia bracteata (1918)
12. Platanthera holochila (1919)
13. Ranunculus hawaiensis (1945)
14. Ranunculus mauiensis (1945)
15. Solanum incompletum (1919)
16. Trichomanes (Vandenboschia) draytoniana (1919)

THREATENED WITH EXTRIPATION WITHIN THE PARK:

1. Claosylon sandwicense (SINGLE POPULATION)
2. Hillebrandia sandwicensis
3. Huperzia somae
4. Lagenifera maviensis
5. Myoporum sandwicense (4 SURVIVING INDIVIDUALS)
6. Nestegis sandwicensis (6 TREES SURVIVE)
7. Panicum pellitum
8. Pelea hawaiensis (2 TREES SURVIVE)
9. Pelea volcania (EAST KAUPO GAP POPULATIONS ONLY)
10. Pleomele auwahiensis (12-24 SURVIVING TREES)
11. Pouteria sandwicensis (10-15 TREES/SINGLE POP.)
12. Psychotria mauiensis (EAST KAUPO GAP POPS. ONLY)
13. Santalum ellipticum
14. Sicyos pachycarpus
15. Nothocestrum latifolium
16. Wikstroemia monticola
17. Wikstroemia oahuensis
18. Zanthoxylum kauaense (1 SURVIVING INDIVIDUAL)

TABLE 16 CONTINUED. SPECIES EXTIRPATIONS IN PARKS

Birds:
CONFIRMED EXTIRPATION:
1. Psittirostra psittacea (OU)
POSSIBLE EXTIRPATION:
1. Hemignathus lucidus (NUKU PU'U)
2. Loxops (MAUI AKEPA)
3. Melamproposops phaeosoma (POO-ULI)
4. Pseudonestor xanthoprys (MAUI PARROTBILL)

Mammals:
EXTRIPATED FROM THE PARK BUT OCCUR OUTSIDE:
*1. Lasiurus cinereus semotus (HAWAIIAN HOARY BAT)

HAWAII VOLCANOES NATIONAL PARK:

Vascular Plants:
POSSIBLE EXTIRPATION:
1. Clermontia peleana Rock
2. Crytandra ramosissima Rock
3. Neraudia ovata Gaud.
4. Nototrichium sandwichiensis (Gray) Hbd.
5. Ochrosia kilaueaensis St. John
6. Ophioglossum concinnum
7. Panicum colleii Endl.
8. Portulaca hawaiiensis Deg.
9. Spermolepis hawaiiensis Wolff
10. Stenogyne angustifolia Gray var. salicifolia Sherff
11. Stenogyne kaalae Wawra var. coriacea Deg & Sherff
12. Stenogyne sessilis Benth.
13. Zanthoxylum hawaiiensis Hbd. var. velutinosum Rock
14. Zanthoxylum maviense Man. var. anceps Rock

Birds:
CONFIRMED EXTIRPATION:
1. Corvus hawaiiensis (HAWAII CROW OR 'ALALA)
2. Moho nobilis (O'O)
3. Hemignathus munrois ('AKIAPOLA'AU)
4. Oreomystis mana (HAWAIIAN CREEPER)
5. Loxops coccineus (HAWAII 'AKEPA)
POSSIBLE EXTIRPATION:
1. Ciridops anna (ULA-AI-HAWANE)
2. Drepanis pacifica (HAWAII MAMO)
3. Hemignathus obscurus (AKIALOA)
4. Chaetoptila angustipluma (KIOEA)
5. Psittirostra psittacea (OU)

TABLE 16 CONTINUED. SPECIES EXTIRPATIONS IN PARKS

JOHN MUIR NATIONAL HISTORIC SITE:

Birds:
CONFIRMED EXTIRPATION:
1. Great Blue Heron

Mammals:
CONFIRMED EXTIRPATION:
1. Grizzly Bear
2. Tule Elk

POSSIBLE EXTIRPATION:
1. Mountain Lion

JOSHUA TREE NATIONAL MONUMENT:

Birds:
POSSIBLE EXTIRPATION:
1. Chukar
2. Elf Owl

LAKE MEAD NATIONAL RECREATION AREA:

Mammals:
POSSIBLE EXTIRPATION:
1. Wolf
2. Ord's Kangaroo Rat
3. Spiny Pocket Mouse

Fish:
POSSIBLE EXTIRPATION:
1. Colorado Squawfish

Amphibians:
POSSIBLE EXTIRPATION:
1. Las Vegas Valley Leopard Frog

LASSEN VOLCANIC NATIONAL PARK:

Mammals:
POSSIBLE EXTIRPATION:
1. Red Fox

LAVA BEDS NATIONAL MONUMENT:

Birds:
POSSIBLE EXTIRPATION:
1. Peregrine Falcon

Mammals:
POSSIBLE EXTIRPATION:
1. Red Fox
2. Black Bear

TABLE 16 CONTINUED. SPECIES EXTIRPATIONS IN PARKS

MONTEZUMA CASTLE NATIONAL MONUMENT:

Reptiles:
POSSIBLE EXTIRPATION:
1. Gila Monster

MUIR WOODS NATIONAL MONUMENT:

Vascular Plants:
POSSIBLE EXTIRPATION:
1. Elymus californica
2. Dudley's shield fern
3. Arctostaphylos virgata
4. Erysimum franciscanum ssp franciscanum

Mammals:
CONFIRMED EXTIRPATION:
1. Mountain Lion
2. Black Bear
3. Coyote

POSSIBLE EXTIRPATION:
1. Pine marten

PETRIFIED FOREST NATIONAL PARK:

Mammals:
CONFIRMED EXTIRPATION:
1. Black Bear - Ursus americanus
2. Black Footed Ferret - Mustela nigripes
3. Gray Wolf - Canis lupus

PINNACLES NATIONAL MONUMENT:

Birds:
CONFIRMED EXTIRPATION:
1. Peregrine Falcon
2. California Condor

Mammals:
CONFIRMED EXTIRPATION:
1. Black Bear

POSSIBLE EXTIRPATION:
1. Tule Elk
2. Pronghorn antelope

Amphibians:
POSSIBLE EXTIRPATION:
1. Yellow Legged Frog

TABLE 16 CONTINUED. SPECIES EXTIRPATIONS IN PARKS

REDWOOD NATIONAL PARK:

Vascular Plants:
POSSIBLE EXTIRPATION:
1. Lilium spp.

Birds:
CONFIRMED EXTIRPATION:
1. California Condor
2. Peregrine Falcon
3. Golden Eagle

Mammals:
CONFIRMED EXTIRPATION:
1. Grizzly Bear
2. Sea Otter

Fish:
POSSIBLE EXTIRPATION:
1. Candlefish

SANTA MONICA NATIONAL RECREATION AREA:

Reptiles:
POSSIBLE EXTIRPATION:
1. California Red Sided Garter Snake
2. California Lyre Snake

Amphibians:
POSSIBLE EXTIRPATION:
1. Red Legged Frog

SEQUOIA AND KINGS CANYON NATIONAL PARKS:

Birds:
POSSIBLE EXTIRPATION:
1. California Condor

Mammals:
CONFIRMED EXTIRPATION:
1. Grizzly Bear

Amphibians:
CONFIRMED EXTIRPATION:
1. Foothill Yellow-Legged Frog

WALNUT CANYON NATIONAL MONUMENT:

Mammals:
POSSIBLE EXTIRPATION:
1. Raccoon

TABLE 16 CONTINUED. SPECIES EXTIRPATIONS IN PARKS

YOSEMITE NATIONAL PARK:

Birds:
POSSIBLE EXTIRPATION:
1. Peregrine Falcon

Mammals:
CONFIRMED EXTIRPATION:
1. Grizzly Bear

Assessing extirpation is difficult. Locally extirpated plants may persist outside park boundaries or in the seed bank within parks. They may naturally recolonize or be transplanted back into park areas. However, as with other "reintroductions" they may or may not become viable, self-sustaining populations. With the exceptions of the California grizzly bear, sperm whale, and perhaps the gray wolf, most of the other mammals on the species list could naturally recolonize or be re-introduced into park areas. Habitat fragmentation, urbanization and other factors may severely reduce the potential for long-term success of these reintroductions. Natural extirpation may occur for stochastic reasons uninfluenced by human activity - NPS has no policy on this.

Some extirpations are state-wide or region-wide phenomena (e.g., plants and birds in Hawaii; wolves, grizzly bears and condors in California; Colorado squawfish in Colorado and Arizona). Elk were historically reported in, and are making a comeback near, Great Basin National Park and again may be park residents. Efforts to reintroduce large mammals (Tule Elk, black bear), native plants, or fish and birds with home-ranges larger than many parks, will require cooperation and coordination with state, federal, and private landowners.

The list of "possible extirpations" is growing for two reasons. First, we know little about the autecology of most species. Secondly, we do not have programs designed to monitor most species (Appendix V). Inventory and monitoring needs for

extirpated, "possibly extinct," and T&E species should focus on habitat requirements and population dynamics (including analysis of birth and death rates, migration, and immigration). External threats (non-native species invasion, non-native pathogens, air pollution and urbanization) and internal processes (habitat loss/degradation, habitat fragmentation, succession, etc.) must also be considered in the formulation of a long-term I&M strategy for rare species.

DISCUSSION

It is obvious that much of the work of establishing adequate resource inventories in Western Region parks lies ahead. Weaknesses in current inventories reflect not only historic funding levels that were grossly inadequate, but a general lack of clearly defined objectives or standards for data gathering and management. The result is that each park, to a large extent, has had to reinvent the wheel. Several parks have used the opportunity to develop creative I&M programs. However, apart from the cost in time and resources as individual investigators experimented with varying approaches, the lack of standardization has more generally led to serious incompatibility among park databases beyond the most fundamental level (e.g., species lists.) The time seems ripe for clarifying the goals of I&M programs, and for establishing standardized field protocols and support facilities available to all park researchers.

The Purpose of Biological Inventories

A universal theme among researchers we interviewed was uncertainty about the kinds of management questions I&M databases should and will be asked to address. One biologist expressed the situation as:

> When I asked what the manager wanted the database to do for him, he replied "I want it to give me options." What he meant was that he not only wanted it to give the right answer, he wanted it to be able to frame the right question.

Perhaps an ideal inventory database, containing maps of the occurrences of each individual of each species at each point in time could address questions about campground siting, backcountry use, or effects of global climate change with equal facility. Realizable databases are sure to be better suited to answer the management questions anticipated before data acquisition begins. For example, programs concentrating on population studies of large mammals may be relatively sensitive to effects of increasing backcountry use, but completely insensitive to effects of acid rain. Programs such as that in SEKI, sampling vegetation on a predetermined grid, are highly efficient in characterizing ecological communities on a geographic scale, but are inefficient at finding rare plant species or rare communities (unless grid points happen to fall on unique microhabitats.) If your sampling units comprise 10% of the park and the community occupies 1% of the park, the chances of locating plots in that rare community are very small. Programs to intensively monitor selected populations and sites, exemplified by CHIS, are effective at

detecting subtle local effects of long-term environmental change, at the expense of incomplete coverage of the full range of habitats and species represented in the park.

Such tradeoffs are inevitable. However the management consequences are hard to predict unless users of the data clearly articulate their information needs.

Completeness

In almost all cases, taxonomically complete inventories are unattainable. It may be possible in some cases to enumerate all the local species of groups where the number of species or the amount of suitable habitat is limited (e.g., freshwater fishes, bog plants). More usually, species continue to be discovered with expanded effort, typically at something like a logarithmic rate. (In other words, however much work has already been done, ten times the effort is likely to yield half again as many species.)

Consequently, a "complete" species list can only be considered complete in the sense that it is unlikely that any common or ecologically important species have been missed. This may be adequate to characterize habitat types, monitor successional changes (e.g., recovery from fire), or detect extrinsically driven environmental changes (if the most susceptible species are adequately sampled). It is not sufficient to identify and protect species threatened with local or regional extinction, which, by their nature, are the ones most likely to be missed in any sampling program.

Several techniques have been developed to estimate the number of rare species missed by any given level of sampling effort (e.g., Efron and Thisted 1976, Palmer 1990). These might be very useful in estimating the need for additional monitoring and the degree of uncertainty in applying the results of I&M studies to management decisions. To our knowledge, these approaches have not been directly applied in any park study.

It is also important to recognize that taxonomic completeness is a moving target. For example, over the last several years, over 200 new plant species have been described for California alone (F. Hrusa, pers. comm.). Increasing numbers of new species are cryptic species -- those differentiated by genetic or biochemical differences rather than visible morphological traits. Since few parks can support floristic (or other systematics) experts, much less DNA labs, it is increasingly important that high quality outside taxonomic expertise (especially molecular taxonomy) be available to support park studies. Such support in turn requires properly prepared and curated study material -- currently a problem for most taxa in most parks.

Database Standardization

Inventory and monitoring studies throughout the National Park Service have been hampered by the lack of concrete guidelines for information acquisition and retrieval. Some standards could be easily set and implemented at modest cost.

These include:

-- Taxonomic Nomenclature. Robinson et al. (1990) found that some 20% of the 6000+ vascular plant species reported from 19 parks in California represented different names for the same species. Standardized uses should be established, with computerized synonymy tables to convert lists from older studies. Once standardized, entries can typically be automatically updated to reflect new usages. (We should note, however, that reliably interpreting old lists often requires special expertise in the taxonomy of the group, and may necessitate reference to voucher specimens.)

In most regions, standard references works exist for many major taxa, and should at least be referenced in biodiversity databases. For birds, national standards for both taxonomy and population status are published by the American Ornithological Union.

-- Data Format. Computerized species lists are generally easily transferred among storage formats, so compatibility is not a large problem at the most basic level. Nevertheless a **de facto** standard of dBASE III+ appears to have emerged, and could easily be adopted for universal use in maintaining species lists and related inventory data. Geographic information is by its nature more demanding. Unfortunately, multiple GIS systems (e.g., GRASS, SAGIS, ERDIS) and other computerized mapping software (e.g., AutoCad) have been adopted by indi-vidual programs, making the development of compatible general use data formats and

support software and facilities virtually impos-sible. We think it is essential to identify a common flexible (upward compatible) mapping standard to be supported by all GIS programs before additional resources are dedicated to developing more incompatible local systems. The appropriate choice deserves further deliberation, but GRASS and ARC/INFO, which are widely used by other public land agencies, should be considered.

It is now feasible to routinely load satellite imagery onto GIS systems, properly geo-referenced and overlaid onto other thematic layers. Often, it is likely that developing reliable vegetation, soil, and related resource maps will be more cost effective starting from scratch using the new technology than would be updating and verifying old paper maps of dubious origin and accuracy. We recommend that funds be sought for such a standardized mapping program for all parks, perhaps best supported by facilities and expertise in the regional office or CPSU.

-- Voucher Specimens and Other Biodiversity Documentation. Few parks have adequate documentation of existing inventories (see Tables 4 to 12). Particularly with the increasing availability of molecular analyses, it is important that well-identified and properly stored biological materials be available to verify and update past analyses. It is even becoming increasingly feasible to use dried material to clone species or genetic types for reintroduction. Often, it is likely that particularly biological materials may be better deposited at

regional museums or universities.

A surprising shortcoming in documentation in many parks is the lack of photographic files. Photographs can provide valuable (and taxonomically acceptable) documentation of the occurrence of many rare species, particularly vertebrates, which increasingly can not be collected neither legally nor morally. Photographs can also provide extremely valuable reference materials for field identifications, especially by inexperienced personnel. A lending/copying library of photographic reference materials could be developed at modest cost.

Standardization of Field Protocols

A much more difficult issue is the standardization of data acquisition. Ideally, comparable (and relatively complete) I&M data from each park would allow managers to allocate resources to parks where environmental challenges were most pressing, and to plan new acquisitions to best complement existing park resources. In practice, no two parks have had the same I&M procedures, so that between-park analyses generally are meaningless.

It is infeasible, and probably undesirable, to conduct identical sampling programs in each park. For example it is unlikely that the same transect design would be maximally effective for assessing the health of sequoia forests in SEKI and kelp forests in CHIS. As programs become increasingly detailed, they must be tailored to local conditions and needs. Nevertheless, many important kinds of data from parks depend critically on sampling design. For example, few populations can be counted in their

entirety -- most yield only relative abundance, as estimated by such metrics as catch per unit effort or mark-recapture success. As a result, population trends cannot be compared unless trapping or marking procedures are standardized.

Identifying field procedures that will be maximally useful and can be widely implemented requires careful design. A particularly intensive example of such an approach is the standardized 50-hectare vegetation plots being established by the Smithsonian Tropical Research Institute in tropical forests throughout the world. Each is broken into a specified grid pattern, and vegetation, soil, fruitfall, and other physical characteristics are regularly measured from each. A similar approach on a much smaller scale has been taken on a kilometer grid in SEKI.

Realizing that biomes can be sufficiently different to require scaling up or down, design considerations for common-use protocols include such basic questions as:

-- plot size and spacing

-- which taxa are sampled?

-- are all species counted, or are more intensive studies of target species emphasized?

-- how are population sizes estimated?

-- what physical factors (rainfall, soil characteristics, etc.) should be measured?

-- if vegetation, soil, or other classifications are used, which classification scheme is appropriate?

-- how should data be documented?

-- how should the source and reliability of the data (for example, staff vs. visitor observation, or the experience and judgment of assistants) be evaluated and

recorded?

-- to what degree can or should protocols and databases be made compatible with those used by other agencies and conservation organizations?

We suggest that several small, intensive workshops to evaluate the goals and objectives of an extensive NPS I&M program and some of the issues above might more than pay for themselves in terms of better coordinating and targeting research dollars, and preventing expensive incompatibility problems later. Participants should include scientists directing the more active I&M programs, several knowledgeable managers and academics, and representatives of other organizations (e.g., the Forest Service, the Nature Conservancy) involved in similar research programs.

A Hierarchical Strategy

It is important to the overall mission of the National Park Service to insure that information about biological resources in all parks meet certain basic standards. At the very least, the base level ought to include reliable (if perhaps incomplete) species lists; basic habitat, vegetation, soil, and geological maps (preferably on a standardized GIS); and a screening for the occurrence and status of threatened, endangered or sensitive species. Ultimately, of course, park managers need information on population dynamics, species distributions, and detailed resource monitoring programs.

A few parks have the resources to gather increasingly detailed I&M data. A second level might consist of more detailed physical data, including localized meteorology, air, rainfall,

water chemistry, hydrology, and be gathered in all parks with staff researchers. Higher levels could include fixed transects and monitoring plots, radio-tagging programs, analyses of invertebrates and non-vascular plants, etc., and be conducted in only the small number of parks where workforce/expertise permit or in parks with the greatest needs.

An explicitly hierarchical approach has many advantages. The most detailed programs can act as experimental or pilot programs to develop and test research protocols for programs with fewer resources. They also provide a way to estimate the uncertainty in the results of inventories conducted at the more basic levels. (Except in areas with high rates of species invasions, the rate of discovery of unrecorded species in intensive surveys provides an estimate of the completeness of "standardized" survey techniques.) As a result, we believe that any efficient regional I&M strategy must incorporate both extensive (target parks) and expansive (all parks) research in essentially a nested experimental design.

CONCLUSION

On one hand, the status of biological inventory information in many parks is unsatisfactory, reflecting a history of underfunding, low priority treatment, and a lack of clearly articulated goals. However, the increasing national recognition of the importance of protecting biological diversity and the availability of new technological tools has created opportunities

to identify and map biological resources, and coordinate analysis and planning in a way never before possible. Doing so effectively will require explicit recognition that complete I&M databases are impossible to establish, so that priorities must be set early to best address the specific information needs of the major database users. Planning and analysis across multiple parks will require much greater standardization in nomenclature, computer technology, and sampling protocols than exist today. Nevertheless, it is essential to have some parks carry on more detailed programs than are feasible in most parks, both as pilot studies for establishing future standards, and as means of evaluating the uncertainties and risks inherent in applying incomplete ecological data to pressing problems in environmental management.

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LIST OF APPENDICES

APPENDIX I. LIST OF PARK CODES

PARK CODE	PARK NAME	STATE
AMME	American Memorial NP	HA
CABR	Cabrillo NM	CA
CAGR	Casa Grande NM	AZ
CHIR	Chiricahua NM	AZ
CHIS	Channel Islands NP	CA
CORO	Coronado N Memorial	AZ
DEVA	Death Valley NM	CA
FOBO	Fort Bowie NHS	AZ
GOGA	Golden Gate NRA	CA
GRBA	Great Basin NP	NV
GRCA	Grand Canyon NP	AZ
HALE	Haleakala NP	HA
HAVO	Hawaii Volcanoes NP	HA
JOMU	John Muir NHS	CA
JOTR	Joshua Tree NM	CA
KAHO	Kaloko-Honokohau NHP	HA
KALA	Kalaupapa NHP	HA
LABE	Lava Beds NP	CA
LAME	Lake Mead NRA	NV
LAVO	Lassen Volcanic NP	CA
MOCA	Montezuma Castle NM	AZ
MUWO	Muir Woods NM	CA
NASA	NP of American Samoa	
ORPI	Organ Pipe Cactus NM	AZ
PEFO	Petrified Forest NP	AZ
PINN	Pinnacles NM	CA
PORE	Point Reyes N Sea.	CA
PUHE	Puukohola Heiau NHS	HA
PUHO	Pu'uohonua O Honaunau NHP	HA
REDW	Redwood NP	CA
SAGU	Saguaro NM	AZ
SAMO	Santa Monica Mt. NRA	CA
SEKI	Sequoia & Kings Canyon NP	CA
TONT	Tonto NM	AZ
TUZI	Tuzigoot NM	AZ
USAR	USS Arizona & Pearl Harbor NHL	HA
WACA	Walnut Canyon NM	AZ
WAPA	War in Pacific NHP	GU
WHIS	Whiskey-Shasta-Trinity NRA	CA
YOSE	Yosemite NP	CA

APPENDIX II
BIOLOGICAL INVENTORY STATUS
WESTERN REGION NATIONAL PARKS
SUMMER 1990

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10	SP YR	NEW SP	CL	MIS ID	CONF EXT	POSS EXT
AMME	AMPHIBIANS	6	6	6	5	8		1989	0								0	0	0	0
AMME	AQUATIC INVERTS	6	6	6	5	7											0	0	0	0
AMME	BIRDS	1	1	1	1	4	1986	1989	0	8	0	0	0	0			0	0	0	0
AMME	MAMMALS	6	5	5	5	7		1989	0								0	0	0	0
AMME	REPTILES	6	6	6	5	8		1989	0		0	0	0				0	0	0	0
AMME	TERRESTRIAL INVERTS	6	6	6	5	0											0	0	0	0
AMME	VASCULAR PLANTS	1	1	1	2	1	1986	1989	128	128	128	0	0	0			0	0	0	0
CABR	AMPHIBIANS	1	5	6	2	6	1981	1981	0	0	0	0	0	0			0	0	0	0
CABR	BIRDS	1	1	1	1	9		1988	0	346				0			0	0	0	0
CABR	INTERTIDAL ALGAE	3	3	4	1	2		1982		79	79						0	0	0	0
CABR	INTERTIDAL ALGAE	2	3	4	2	5	1976	1976		109	109	0					0	0	0	0
CABR	INTERTIDAL INVERTS	7	6	6	5	2		1980		30	30			0			0	0	0	0
CABR	INTERTIDAL INVERTS	2	3	4	2	5	1976	1976		160	160	0		0			0	0	0	0
CABR	LICHENS	2	1	1	5	3		1987		29	29	0					0	0	0	0
CABR	MAMMALS	1	5	6	2	6	1981	1981	0	11		0		0			0	0	0	0
CABR	REPTILES	7	4	4	3	9	1980	1980	0	6	0			0			0	0	0	0
CABR	REPTILES	1	6	6	2	6	1981	1981	0	5		0		0			0	0	0	0
CABR	VASCULAR PLANTS	1	6	6	5	9		1989	0	214				0			0	0	0	0
CAGR	AMPHIBIANS	6	6	6	6	7	0	0	0	0	0	0	0						0	0
CAGR	AQUATIC INVERTS	*	*	*	*	*	****	*	*	*	*	*	*	*	*		*	*	*	0
CAGR	BIRDS	2	1	6	1	6	1938	1987	0	112		112							0	0
CAGR	FUNGI	6	6	6	6	7			0		0	0	0						0	0
CAGR	LICHENS	6	6	6	6	7			0		0	0	0						0	0
CAGR	MAMMALS	6	6	6	6	7			3		0	0	0						0	0
CAGR	REPTILES	6	6	6	6	7			0		0	0	0						0	0
CAGR	TERRESTRIAL INVERTS	7	6	6	6	8			79										0	0
CAGR	VASCULAR PLANTS	3	2	6	3	6	1986		152		152	0			0				0	0
CHIR	AMPHIBIANS	2	6	6	6	6	1975		0	9									0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10	SP YR	NEW SP	CL	MIS ID	CONF EXT	POSS EXT
CHIR	AQUATIC INVERTS	6	6	6	6	7													0	0
CHIR	BIRDS	2	2	2	5	9		1989	30	207									0	0
CHIR	FUNGI	5	6	6	5	6		1980		0		0							0	0
CHIR	LICHENS	7	6	6	6	6	1973		84		84	0	0						0	0
CHIR	MAMMALS	2	2	2	5	5	1979	1980	16	71									0	0
CHIR	REPTILES	2	6	6	5	8		1975	19	49									0	0
CHIR	TERRESTRIAL INVERTS	6	6	6	5	7			625		0	0	0						0	0
CHIR	VASCULAR PLANTS	2	2	3	1	5	1976	1990	2000	700		0	0		20			0	0	0
CHIS	AMPHIBIANS	1	2	2	2	2		1967		3	3	3	0		0	0		0	0	0
CHIS	BATS	1	4	4	2	5		1980	0	8					3	0		0	0	0
CHIS	BIRDS	1	1	1	1	1		1989	0	315						0		0	0	0
CHIS	CETACEANS	1	1	1	1	2		1987	0	30	30					0		0	0	0
CHIS	KELP FOREST SPP-MAMM	3	3	2	2	3	1986	1988	0	3	3	3				0		0	0	0
CHIS	KELP FOREST-AQINVERT	1	1	1	3	1	1986	1988	0	455						0		0	0	0
CHIS	KELP FOREST/ALGAE	1	1	1	3	1	1986	1988	0	214	214					0		0	0	0
CHIS	LAND MAMMALS	2	3	3	2	2		1967	0	20	20	20	1		0	0		0	2	0
CHIS	MAMMALS	1	1	1	1	1			0	64	64					0		0	0	0
CHIS	MARINE INVERTS	3	3	3	1	1	TEXT	1982	0	500	500	500				0		0	0	0
CHIS	NONVASCULAR PLANTS	3	3	3	1	1	TEXT	1982	0	350	350					0		0	0	0
CHIS	PINNIPEDS	1	1	1	1	4		1988	0	6	6	6	0		0	0		0	0	0
CHIS	REPTILES	1	2	2	1	2	1967	1980	0	7	7	7	0		0	0		0	0	0
CHIS	ROCKY INT.TIDAL-BIRD	3	3	2	2	3		1989	0	19		19				0		0	0	0
CHIS	ROCKY INTERTIDAL-MAM	3	3	2	2	3		1989	0	3	3	3				0		0	0	0
CHIS	ROCKY INTIDAL-ALGAE	3	3	2	2	3		1989	0	112		112				0		0	0	0
CHIS	ROCKY INTIDAL-AQINVT	3	3	2	2	3		1989	0	110		110				0		0	0	0
CHIS	SANDY INTIDAL-AQINVT	1	4	2	2	4		1990	0	30		30			40	0		0	0	0
CHIS	TERREST ARTH & SNAIL	3	3	3	2	2	1978		0	750	650	750	0		500	0		0	0	2
CHIS	VASCULAR PLANTS	1	1	1	1	1		1987	0	751	751				100	0		0	0	0
CORO	AMPHIBIANS	4	4	6	3	9	1979	1983	0	7	7								0	0
CORO	AQUATIC INVERTS	6	6	6	5	7										0		0	0	0
CORO	BIRDS	2	2	2	1	3	1974	1983	0	166		166	30		27	1		0	0	0
CORO	FUNGI	6	6	6	6	7			0		0	0	0						0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10 YR	SP	NEW SP CL	MIS ID	CONF EXT	POSS EXT
CORO	LICHENS	6	6	6	6	7			0		0	0	0					0	0
CORO	MAMMALS	3	3	3	4	2	1977	1985	0	60	26		23	3			2	0	1
CORO	REPTILES	4	4	6	3	9	1979	1985	0	22	22							0	0
CORO	TERRESTRIAL INVERTS	5	4	5	3	6	1988		80	100	80	0	20	0				0	0
CORO	VASCULAR PLANTS	2	1	2	1	3	1974	1983	127	301	127	75		70			5	0	0
DEVA	AMPHIBIANS	7	5	5	4	9			0	3	0	0	0			0	0	0	0
DEVA	BIRDS	2	4	3	1	5		1982		346				0		0	0	0	0
DEVA	MAMMALS	3	4	2	2	1	1988		413	51				0		0	5	0	0
DEVA	REPTILES	7	5	5	4	9		1972	0	36	0	0	0	0		0	0	0	0
DEVA	REPTILES, T&E	1	3	2	6	6	1979	1988		2						0	0	0	0
DEVA	SPRINGSNAILS	1	3	3	1	3	1987	1989	8	8	8	0	0	5		0	0	0	0
DEVA	T & E	1	3	2	6	6	1979	1988		3				0		0	0	0	0
DEVA	T & E	1	3	2	6	6	1979	1988		18				0		0	0	0	1
DEVA	T & E	1	3	2	6	6	1979	1988		6						0	0	0	0
DEVA	T & E	1	3	2	6	6	1979	1988		1						0	0	0	0
DEVA	VASCULAR PLANTS	1	2	1	1	2	1982			977				0		0	0	0	1
FOBO	AMPHIBIANS	2	2	3	6	6	1975	1976		6	6							0	0
FOBO	AQUATIC INVERTS	*	*	*	*	*	****	*	*	*	*	*	*	*		*	*	*	*
FOBO	BIRDS	2	2	3	1	6	1975	1976	0	156	156	24	0					0	0
FOBO	FUNGI	6	6	6	6	7			0		0	0	0	0		0	0	0	0
FOBO	LICHENS	6	6	6	6	7			0		0	0	0	0		0	0	0	0
FOBO	MAMMALS	3	2	3	1	2	1973	1976		47	47		18					0	0
FOBO	REPTILES	2	2	3	6	6	1975	1976		26	15		11					0	0
FOBO	TERRESTRIAL INVERTS	6	6	6	6	7												0	0
FOBO	VASCULAR PLANTS	3	3	2	2	5	1971	1977	478	263	478	478	0	0				0	0
GOGA	AMPHIBIANS	4	5	5	3	6	1974			14		25				0	0	0	0
GOGA	AQUATIC INVERTS	6	5	5	4	8				1	1					0	0	0	0
GOGA	BIRDS	3	4	4	2	3	1983	1974		370	80	80	20			0	0	0	0
GOGA	FUNGI	6	6	6	5	7										0	0	0	0
GOGA	LICHENS	6	6	6	5	7										0	0	0	0
GOGA	MAMMALS	4	4	4	2	5	1989	1974		100		100		1		0	0	0	0
GOGA	REPTILES	6	4	4	2	5	1989	1974		22		25				0	0	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10 YR	SP	NEW SP CL	MIS ID	CONF EXT	POSS EXT
GOGA	TERRESTRIAL INVERTS	5	4	4	4	5	1985		100	100		100	0			0	0	0	0
GOGA	VASCULAR PLANTS	6	5	5	4	3	1972		0	1070				300		0	0	1	0
GRBA	AMPHIBIANS	6	5	5	4	7				10		0				0	0	0	0
GRBA	BIRDS	3	6	6	5	9	NONE	1990		166						0	0	0	0
GRBA	BUTTERFLIES	7	6	6	5	2	VARY	1988	88	88		0				0	0	0	0
GRBA	LAND SNAILS	7	4	4	5	6	UNKN		10	10	10	0				0	0	0	0
GRBA	MACRO-MOTHS	7	6	6	5	4	VARY	1990				0				0	0	0	0
GRBA	MAMMALS	3	5	5	5	9		1988		50						0	0	0	0
GRBA	REPTILES	6	5	5	4	7				19		0				0	0	0	0
GRBA	REPTILES AND AMPHIBS	6	5	5	5	7				6		0				0	0	0	0
GRBA	REPTILES AND AMPHIBS	6	5	5	5	7				20		0				0	0	0	0
GRBA	VASCULAR PLANTS	2	2	3	5	1	VARY	1989		589						0	0	0	0
GRBA	ZOOPLANKTON	7	6	6	5	5	VARY	1988								0	0	0	0
GRCA	AMPHIBIANS	3	2	2	2	5		1982	4	8	7		1				0	0	0
GRCA	AQUATIC INVERTS	6	6	6	5	7								0				0	0
GRCA	BIRDS	1	4	1	4	1		1984		299			0	0				0	0
GRCA	FUNGI	7	6	6	5	8										0	0	0	0
GRCA	LICHENS	6	6	6	6	8										0	0	0	0
GRCA	MAMMALS	1	5	1	4	1		1986		88	74		0					2	3
GRCA	REPTILES	3	2	2	2	5		1982	15	50	40		0				0	0	0
GRCA	TERRESTRIAL INVERTS	5	6	6	6	9		1974		247	0	0						0	0
GRCA	VASCULAR PLANTS	2	3	3	4	1		1987	1400	1400		0		1				0	0
HALE	AMPHIBIANS	1	3	3	2	2	1980	1980	0	3	3	0	0	0		0	0	0	0
HALE	ANNELIDA (SEG WORMS)	3	3	3	2	2	1982	1990		11	11	0	2	9		0	0	0	0
HALE	ARACHNIDS	3	3	3	2	2	1980	1990		90	90	0	10	40		0	0	0	0
HALE	BIRDS	1	1	1	1	2	1980	1985		32	32	0	0	3		0	0	1	4
HALE	BRYOPHYTES	2	1	1	1	2	1980	1989	185	185	185	0	0	68		0	0	0	0
HALE	CHILOPODA	3	3	3	2	2	1980	1990		5	5	0	3	3		0	0	0	0
HALE	DIPLODA	3	3	3	2	2	1	1990		11	11	0	1	1		0	0	0	0
HALE	FUNGI	6	5	5	4	9			0	5	5	0	0	0		0	0	0	0
HALE	INSECTS	2	3	3	2	1	1990	1990		1523	1523	0	196	530		9	0	0	0
HALE	LICHENS	4	4	3	4	2	1980	1989	118	118	118	0	5	0		0	1	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10	SP YR	NEW SP CL	MIS ID	CONF EXT	POSS EXT
HALE	MAMMALS	1	1	1	1	1	1990	1990	0	11	11	0	1		3	0	0	0	0
HALE	MOLLUSCS	3	3	3	2	2	1970	1990	0	47	47	0	10		23	0	0	0	0
HALE	MOLLUSCS	3	3	3	2	2	1970	1990	0	47	47	0	10		23	0	0	0	0
HALE	PLATYHELMINTHES	3	3	3	2	2	1975	1990		2	2	0	0		2	0	0	0	0
HALE	PLATYHELMINTHES	3	3	3	2	2	1975	1990		2	2	0	0		2	0	0	0	0
HALE	PORIFERA (SPONGES)	3	3	3	2	2	1977	1990		1	1	0	0		1	0	0	0	0
HALE	PTERIDOPHYTES	1	1	1	1	2	1980	1989	116	116	116	0			0	0	0	0	0
HALE	RARE PLANTS	1	2	2	2	1	1986	1990		108	108	0	0		1	0	0	1	0
HALE	REPTILES	1	3	3	2	2	1980	1980	0	5	5	0	0		0	0	0	0	0
HALE	VASCULAR PLANTS	1	1	1	1	1	1990	1990		767	684	0	83		50	5	0	24	18
HAVO	AMPHIBIANS	6	6	6	5	8										0	0	0	0
HAVO	ANCH. POOLS-vasc plt	1	2	1	3	6	1988	1989	0	37	37	0	4		17	0	0	0	0
HAVO	AQUATIC INVERTS	7	6	6	6	8										0	0	0	0
HAVO	BIRDS	1	4	3	3	6	1977	1986	60	41	41	0			1	0	0	5	5
HAVO	BRYOPHYTES	4	4	4	3	9			388		100	288	388			9	9	0	0
HAVO	ENDANG. VERT-BIRDS	1	5	5	4	5	1990	1990	5	4	0	0	0		0	0	0	0	0
HAVO	ENDANG. VERT-MAMMALS	1	5	5	4	5	1990	1990	5	1	0	0	0		0	0	0	0	0
HAVO	ENDANG. VERT-REPT	1	5	5	4	5	1990	1990	5	1	0	0	0		0	0	0	0	0
HAVO	FUNGI	6	5	5	4	7			26	26	0	0	26			9	9	0	0
HAVO	INVERTEBRATES	3	3	3	4	2	1940		5000		4000	0	1000			9	9	0	0
HAVO	LICHENS	6	5	5	4	7		1966	57	57	0	57	57			9	9	0	0
HAVO	MAMMALS	1	5	5	2	9		1990	4	9	9	0	0		0	1	0	0	0
HAVO	MARINE REPTILES	1	5	5	4	5	1990		0	2	2	0	0		1	0	0	0	0
HAVO	RARE PLANTS	2	4	4	4	1		1988	26	32	24	2	0		6	1	2	0	7
HAVO	TERRESTRIAL REPTILES	6	5	5	5	7			0	7	0	0	7		0	0	0	0	0
HAVO	VASCULAR PLANTS	7	6	6	5	8									0	0	0	0	14
JOMU	AMPHIBIANS	6	6	6	5	9		1986	0							0	0	0	0
JOMU	AQUATIC INVERTS	7	6	6	5	8										0	0	0	0
JOMU	BIRDS	7	4	4	1	3	1982	1988	0	56					56	0	0	1	0
JOMU	FUNGI	6	6	6	5	7					0					0	0	0	0
JOMU	LICHENS	7	4	4	6	6	1990				100				100	0	0	0	0
JOMU	MAMMALS	6	6	6	5	9										0	0	2	1

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10	SP YR	NEW SP CL	MIS ID	CONF EXT	POSS EXT
JOMU	REPTILES	6	6	6	5	9		1986	0							0	0	0	0
JOMU	TERRESTRIAL INVERTS	5	5	5	5	9		1984								0	0	0	0
JOMU	VASCULAR PLANTS	3	4	4	1	5	1989	1989	0		10				0	0	0	0	0
JOTR	AMPHIBIANS	1	2	1	2	1		1979	0	2	0	0				0	0	0	0
JOTR	ARTHROPODS	5	3	3	5	9	60'S			327						0	0	0	0
JOTR	ARTHROPODS	5	3	3	5	9	60'S			327						0	0	0	0
JOTR	BIRDS	1	3	1	2	1		1982		233						0	0	0	2
JOTR	MAMMALS	2	3	2	4	9	70's			46						0	0	0	0
JOTR	REPTILES	1	2	1	2	1		1979		37						0	0	0	0
JOTR	T & E PLANTS	1	4	1	6	6	1987	1987								0	0	0	0
JOTR	VASCULAR PLANTS	2	2	1	4	1	1976	1977	730	688						0	4	0	0
KAHO	AMPHIBIANS	6	6	6	5	8			0	1	0	0	0			0	0	0	0
KAHO	BIRDS	1	1	1	5	1	1987	1990	0	33	0	0	0	0		0	0	0	0
KAHO	BYOPHYTES	6	6	6	6	5			0	1	1	0	0	0		0	0	0	0
KAHO	FUNGI	6	6	6	6	5			0		0	0	0	0		0	0	0	0
KAHO	LICHENS	5	5	5	5	1	1987	1990	0	5	5	0	0	0		0	0	0	0
KAHO	MAMMALS	1	5	5	4	1	1987	1990	0	16	0	0	0	0		0	0	0	0
KAHO	MARINE INVERTEBRATES	2	3	3	6	5			0	33	33	0	2	0		0	0	0	0
KAHO	MARINE REPTILES	1	1	1	6	1	1989	1990	0	2	2	0	0	0		0	0	0	0
KAHO	TERRESTRIAL INVERTS	6	6	6	5	0								0		0	0	0	0
KAHO	TERRESTRIAL REPTILES	6	6	5	8	1	9	9	0	0	0	0	0	0		0	0	0	0
KAHO	VASCULAR PLANTS	1	1	1	6	1	1987	1990	0	72	0	0	0	0		0	0	0	0
KALA	AMPHIBIANS	6	6	6	5	8		1990	0							0	0	0	0
KALA	AQUATIC INVERTS	7	6	6	6	8										0	0	0	0
KALA	BIRDS	6	5	5	5	9		1990	0	8					0	0	0	0	0
KALA	MAMMALS	1	5	5	5	9		1990	0	10	0	0	0	0		0	0	0	0
KALA	RARE & SIG. PLANTS	1	3	3	5	2	1989	1990	0	12	12	0	1	0		0	0	0	0
KALA	REPTILES	7	6	6	5	8		1990	0	6	0	0	0			0	0	0	0
KALA	TERRESTRIAL INVERST	6	6	6	5	0										0	0	0	0
KALA	VASCULAR PLANTS	2	3	3	5	1	1989	1990	0	306	306	0	0	0		0	0	0	0
LABE	AMPHIBIANS	1	1	1	1	1		1990	0	2					0	0	0	0	0
LABE	AQUATIC INVERTS	6	5	5	4	7										0	0	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW IO	SP YR	NEW SP CL	MIS ID	CONF EXT	POSS EXT
LABE	BIRDS	1	1	1	1	1		1990	25	23	0	25			5	0	0	0	1
LABE	FUNGI	6	5	5	4	7										0	0	0	0
LABE	LICHENS	6	5	5	4	7										0	0	0	0
LABE	MAMMALS	1	1	1	1	1	1982	1990	196	38	0	38			0	0	0	0	2
LABE	REPTILES	1	1	1	1	1		1990	11	6	0	11			0	0	0	0	0
LABE	TERRESTRIAL INVERTS	5	4	4	4	5										0	0	0	0
LABE	VASCULAR PLANTS	1	2	3	1	3	1989	1989	991	279		991				0	0	0	0
LAME	AMPHIBIANS	1	2	2	1	1	NOTE	1978		10						0	0	0	1
LAME	BIRDS	1	3	3	1	1	NOTE	1978		343					1	0	0	0	0
LAME	MAMMALS	1	3	3	1	1	70's	1978		72						0	0	0	3
LAME	REPTILES	1	3	3	1	1		1978		41						0	0	0	0
LAME	VASCULAR PLANTS	2	3	3	1	1	NOTE	1979		816						0	0	0	0
LAVO	AMPHIBIANS	4	6	6	6	9		1989		9		9				7	7	0	1
LAVO	AQUATIC INVERTS	5	4	4	5	9										5	7	0	0
LAVO	BIRDS	1	1	1	1	6		1980		197						1	7	0	0
LAVO	FUNGI	1	1	1	6	2	1982	1982		567	567					7	0	0	0
LAVO	LICHENS	7	6	6	6	9		1985		25	25					7	1	0	0
LAVO	MAMMALS	1	3	1	1	6				63		63			1	2	7	0	1
LAVO	REPTILES	3	6	6	6	8		1989	0	9		9	0			7	1	0	0
LAVO	TERRESTRIAL INVERTS	5	5	5	6	9										7	7	0	0
LAVO	VASCULAR PLANTS	2	3	3	2	1	1961	1984		777	600	100	77			7	7	0	0
MOCA	AMPHIBIANS	2	3	3	2	5	1965	1977	0	4		4						0	0
MOCA	AQUATIC INVERTS	1	3	2	1	5	1976	1989	0	57	57		0		4	1		0	0
MOCA	BIRDS	3	5	6	5	2		1985		211	0	0				0	0	0	0
MOCA	MAMMALS	7	5	6	5	6	1916	1977		37		37						0	0
MOCA	REPTILES	2	3	2	2	5	1965	1977		32								0	1
MOCA	TERRESTRIAL INVERTS	7	6	6	5	8				20						0	0	0	0
MOCA	VASCULAR PLANTS	3	4	6	2	5	1949	1989	0	310		61						0	0
MUWO	AMPHIBIANS	6	6	6	5	9										0	0	0	0
MUWO	AQUATIC INVERTS	6	5	5	4	7				1						0	0	0	0
MUWO	BIRDS	2	1	1	2	1		1982	0	50					1	0	0	0	0
MUWO	FUNGI	3	3	3	2	1	1976			49	43				4	0	0	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW IO	SP YR	NEW SP CL	MIS ID	CONF EXT	POSS EXT
MUWO	LICHENS	6	6	6	5	1		1966							0	0	0	0	0
MUWO	MAMMALS	6	5	5	4	9				26						0	0	3	1
MUWO	REPTILES	6	5	5	4	9				11						0	0	0	0
MUWO	TERRESTRIAL INVERTS	6	5	5	4	9										0	0	0	0
MUWO	VASCULAR PLANTS	3	1	3	2	1	1978		0	180					1	0	0	0	2
NASA	AMPHIBIANS & REPTILE	1	1	1	1	4	1986	1988	0	15	15	0	0		0	0	0	0	0
NASA	AMPHIBIANS & REPTILE	1	1	1	1	4	1986	1988	0	15	15	0	0		0	0	0	0	0
NASA	AQUATIC INVERTS	7	6	6	6	8										0	0	0	0
NASA	BIRDS	7	6	6	5	4	1986	1988	0	55	55	0	0		0	0	0	0	0
NASA	MAMMALS	2	2	2	1	4	1986	1988	0	9	9	0	0		0	0	0	0	0
NASA	TERRESTRIAL INVERTS	6	6	6	5	0										0	0	0	0
NASA	VASCULAR PLANTS	6	6	6	5	8		1988	0			0	0		0	0	0	0	0
ORPI	AMPHIBIANS	1	3	1	1	1	1937	1991	4	4	4	5	0		0	0	0	0	0
ORPI	AQUATIC INVERTS	5	3	1	2	5	1982	1982	0	61	61	0	0		0		0	0	0
ORPI	BIRDS	1	3	1	1	2		1988	94	277	277		0		2	0	0	0	0
ORPI	FUNGI	6	6	6	5	7			0		0	0	0		0		0	0	0
ORPI	LICHENS	4	4	4	6	6	1988	1988	0	33	33	0	0					0	0
ORPI	MAMMALS	1	3	1	1	1		1991	32	53	53	53	0		5	0	0	0	0
ORPI	REPTILES	1	3	1	1	1	1937	1985	38	43	43	43	0		2	0	0	0	0
ORPI	TERRESTRIAL INVERTS	3	3	1	2	5		1990					0		0		0	0	0
ORPI	VASCULAR PLANTS	1	2	1	1	1		1985	502	522	572	522	0		0	1	2	0	1
PEFO	AMPHIBIANS	4	5	5	5	1		1976	0	8		8						0	0
PEFO	AQUATIC INVERTS	6	6	6	5	8	0000	0	0	0	0	0	0		0			0	0
PEFO	BIRDS	2	3	6	5	1	1984	1984	48	180								0	0
PEFO	FUNGI	6	6	6	6	7			0									0	0
PEFO	LICHENS	6	6	6	6	7	TEXT	1991										0	0
PEFO	MAMMALS	4	4	5	4	8	1986	1986	26	48						0		3	0
PEFO	REPTILES	4	5	5	5	1		1976	0	15		8						0	0
PEFO	TERRESTRIAL INVERTS	5	6	6	5	8			802									0	0
PEFO	VASCULAR PLANTS	2	3	6	5	5	1980	1981	301	346		305			64	0		0	0
PINN	AMPHIBIANS	7	6	6	5	8		1987		8						0	0	0	0
PINN	AQUATIC INVERTS	7	6	6	5	8										0	0	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10 YR	SP	NEW SP CL	MIS ID	CONF EXT	POSS EXT
PINN	BIRDS	2	4	1	1	3	1983	1987		148	99	100		6		0	0	2	0
PINN	FUNGI	6	6	6	5	7										0	0	0	0
PINN	LICHENS	7	4	1	5	3	TEXT			93	93			100		0	0	0	0
PINN	MAMMALS	1	4	3	1	3	1984	1987	15	38	38	38		1		0	0	1	0
PINN	REPTILES	2	4	2	1	5	1985	1987	5	22	22	22		0		0	0	0	0
PINN	TERRESTRIAL INVERTS	6	6	6	5	7										0	0	0	0
PINN	VASCULAR PLANTS	1	2	1	1	3	1980		1000	533	99	100		300		0	0	0	0
PORE	AMPHIBIANS	1	5	5	4	9	none		0	11						0	0	0	0
PORE	AQUATIC INVERTS	6	6	6	5	8										0	0	0	0
PORE	BIRDS	7	6	6	5	1										0	0	0	0
PORE	FUNGI	7	6	6	5	8										0	0	0	0
PORE	LICHENS	7	6	6	5	8										0	0	0	0
PORE	MAMMALS	1	5	5	4	9		1985	11	81			1	1		0	0	0	0
PORE	REPTILES	1	5	5	4	9			0	15						0	0	0	0
PORE	TERRESTRIAL INVERTS	5	5	5	4	9	none									0	0	0	0
PORE	VASCULAR PLANTS	1	1	1	1	2	1975	1990	1029	827	0		0	0		0	0	0	0
PUHE	ALGAE	1	1	1	3	2	1976	1977	0	13	13	0	4	0		0	0	0	0
PUHE	AMPHIBIANS	1	1	1	1	5	1990	1990	0	1	0	0	0			0	0	0	0
PUHE	AQUATIC INVERTS	7	6	6	6	8										0	0	0	0
PUHE	BIRDS	2	3	3	3	5	1990	1990	0	22	0	22	22	3		0	0	0	0
PUHE	BRYOPHYTES	6	6	6	6	6	1990		0	1	1	0	0	0		0	0	0	0
PUHE	FUNGI	6	6	6	6	6	1990		0	1	1	0	0	0		0	0	0	0
PUHE	LICHENS	4	4	4	4	6	1990		0	3	3	0	0	0		0	0	0	0
PUHE	MAMMALS	3	3	3	3	5	1990	1990	0	10	0	0	0			0	0	0	0
PUHE	RARE PLANTS	1	3	2	5	4	1975	1977	1	1	1	0	0	0		0	0	0	0
PUHE	REPTILES	6	5	5	4	5	1990	1990	0	8	0	8	8			0	0	0	0
PUHE	TERRESTRIAL INVERTS	6	6	6	5	0										0	0	0	0
PUHE	VASCULAR PLANTS	1	1	1	1	1	1975	1989	0	52	50	0	1	0		0	0	0	0
PUHO	ALGAE	3	3	2	2	3	1957	1986	0	16	16	0	0	0		0	0	0	0
PUHO	AMPHIBIANS	6	6	6	6	8	1976	1976	0							0	0	0	0
PUHO	ANNELIDS	3	3	2	2	3	1957	1986	0	2	2	0	0	0		0	0	0	0
PUHO	BIRDS	2	3	3	3	7	1976	1976	0	12	0	0	0			0	0	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10	SP YR	NEW SP CL	MIS ID	CONF EXT	POSS EXT
PUHO	BRYOZOA	3	3	2	2	3	1957	1986	0	1	1	0	0	0		0	0	0	0
PUHO	COELENTERATES	3	3	2	2	3	1957	1986	0	5	5	0	1			0	0	0	0
PUHO	ECHINODERMATA	3	3	2	2	3	1957	1986	0	18	18	0	2	0		0	0	0	0
PUHO	INVERTEBRATES	4	4	4	5	1	1976	1976	0	150						0	0	0	0
PUHO	MAMMALS	6	5	5	5	1	1976	1976	0	8	0	0	0			0	0	0	0
PUHO	MOLLUSCA	3	3	2	2	3	1957	1986	0	46	46	0	4	0		0	0	0	0
PUHO	MOLLUSCA	3	3	2	2	3	1957	1986	0	46	46	0	4	0		0	0	0	0
PUHO	PORIFERA	3	3	2	2	3	1957	1986	0	2	2	0	0	0		0	0	0	0
PUHO	REPTILES	2	2	2	5	1	1976	1976	0	6	0	0	0			0	0	0	0
PUHO	VASCULAR PLANTS	1	1	1	1	4	1983	1986	0	126	0	0	0			0	0	0	0
REDW	AMPHIBIANS	5	4	4	3	5	1988			19						0	0	0	0
REDW	AQUATIC INVERTS	1	2	1	1	3	1980		1000			1000			2	0	0	0	0
REDW	BIRDS	2	1	3	2	2		1984		370		0			0	0	0	3	0
REDW	FUNGI	6	6	6	6	7										0	0	0	0
REDW	LICHENS	4	4	4	4	5		8684		48						0	0	0	0
REDW	MAMMALS	2	3	3	2	5	85-7			39	39	39	1			0	0	3	0
REDW	REPTILES	7	6	6	5	9		1964								0	0	0	0
REDW	TERRESTRIAL INVERTS	6	6	6	5	7										0	0	0	0
REDW	VASCULAR PLANTS	3	2	3	2	1	1970		1285	711	1006	1035	250	350		0		0	1
SAGU	AMPHIBIANS	1	2	2	1	5		1986		8	8						0	0	0
SAGU	AQUATIC INVERTS	6	6	6	6	7												0	0
SAGU	BIRDS	2	2	2	1	1		1985	0	9					1			0	0
SAGU	FUNGI	6	6	6	6	7			0		0	0	0					0	0
SAGU	LICHENS	1	6	6	5	6	1986	1987	287	250	250		37					0	0
SAGU	MAMMALS	2	4	4	5	1		1987	72	66							0	0	0
SAGU	REPTILES	2	2	2	1	5		1986		50	9							0	0
SAGU	TERRESTRIAL INVERTS	7	6	6	5	8												0	0
SAGU	VASCULAR PLANTS	2	2	2	2	5	1981	1985	936	986	986				2			0	0
SAMO	AMPHIBIANS	1	3	2	1	3	NOTE	1986		10	10				0	0	0	0	1
SAMO	BIRDS	1	1	1	1	1	NONE	1987		263					1	0	0	0	0
SAMO	BRYOPHYTES	1	4	3	1	1	1978	1978	43	43	43	43	0	0		0	0	0	0
SAMO	BUTTERFLIES	3	6	6	5	8		1985		80		0				0	0	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10 YR	SP SP	NEW CL	MIS ID	CONF EXT	POSS EXT
SAMO	FUNGI	1	3	3	1	2		1987		212	212					0	0	0	0
SAMO	MAMMALS	1	1	1	1	9		1989		51				0		0	0	0	0
SAMO	REPTILES	1	3	2	1	3	TEXT	1986		24	24			0		0	0	0	2
SAMO	VASCULAR PLANTS	1	1	1	1	1	NOTE	1986	0	884	884			100		0	0	0	0
SEKI	AMPHIBIANS	1	1	1	1	1	1990	1985	1	15	15	15	0	0		0	0	1	0
SEKI	BIRDS	1	1	1	1	1	1990	1990	12	195	195	195	0	3		0	0	0	1
SEKI	BUTTERFLIES	4	4	4	1	9		1989	50	76	76	0	0	76		0	0	0	0
SEKI	INSECTS	4	4	4	1	9		1989	300	709	709	0	709	355		0	0	0	0
SEKI	LICHENS	3	3	3	1	2		1986	60	207	207	0	0	125		0	0	0	0
SEKI	MAMMALS	1	2	5	1	1	1990	1989	20	90	90	90	0	3		0	0	4	0
SEKI	MOSSES	4	4	4	1	3		1988	60	60	60	0	0	60		0	0	0	0
SEKI	REPTILES	1	1	1	1	1	1990	1985	2	25	25	25	0	1		0	0	0	0
SEKI	VASCULAR PLANTS	1	2	1	1	1	1990	1990	1341	1402	1402	1402	0	50		0	0	0	0
TONT	AMPHIBIANS	2	2	2	1	2		1962	0	4	2	3	1					0	0
TONT	AQUATIC INVERTS	6	6	6	5	7												0	0
TONT	BIRDS	1	2	2	1	6		1963	64	143	142	0						0	0
TONT	FUNGI	6	6	6	6	7			0		0	0		0				0	0
TONT	LICHENS	6	6	6	5	8	1965		10		10	0		0				0	0
TONT	MAMMALS	2	2	2	2	6		1962	14	28	31	0	7	1			0	0	0
TONT	REPTILES	2	2	2	1	2		1980	0	32		19						0	0
TONT	TERRESTRIAL INVERTS	5	6	6	5	8	1963		133	100		0						0	0
TONT	VASCULAR PLANTS	2	2	2	2	5		1964	259	270				0				0	0
TUZI	AMPHIBIANS	7	6	6	5	8										0	0	0	0
TUZI	AQUATIC INVERTS	6	6	6	6	7										0	0	0	0
TUZI	BIRDS	2	2	2	1	5	1981	1985	0	211		211	6	0				0	0
TUZI	FUNGI	6	6	6	6	7			0		0	0	0					0	0
TUZI	LICHENS	6	6	6	6	7			0		0	0	0					0	0
TUZI	MAMMALS	7	6	6	6	7			0	13		13						0	0
TUZI	REPTILES	7	6	6	6	7		1945	0	6								0	0
TUZI	TERRESTRIAL INVERTS	6	6	6	6	7												0	0
TUZI	VASCULAR PLANTS	3	3	3	2	5	1941		75		50	25						0	0

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PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10 YR	SP	NEW SP CL	MIS ID	CONF EXT	POSS EXT
USAR	ALGAE	1	1	1	6	2	1988	1989	0	4	4	0	4	4		0	0	0	0
USAR	AMPHIBIANS	6	6	6	5	8										0	0	0	0
USAR	ANNELIDA	1	1	1	6	2	1988	1989	0	4	4	0	0	4		0	0	0	0
USAR	ARTHROPODS	1	1	1	6	2	1988	1989	0	2	1	1	1	2		0	0	0	0
USAR	BIRDS	6	6	6	5	8										0	0	0	0
USAR	COELENTERATES	1	1	1	6	2	1988	1989	0	3	0	3	0	6		0	0	0	0
USAR	ECTOPROCTA	1	1	1	6	2	1988	1989	0	1	1	0	0	1		0	0	0	0
USAR	MAMMALS	6	6	6	5	7										0	0	0	0
USAR	MOLLUSCA	1	1	1	6	2	1988	1989	0	6	6	0	3	6		0	0	0	0
USAR	MOLLUSCA	1	1	1	6	2	1988	1989	0	6	6	0	3	6		0	0	0	0
USAR	POIFERA	1	1	1	6	2	1988	1989	0	12	0	12	12	12		0	0	0	0
USAR	REPTILES	6	6	6	6	0										0	0	0	0
USAR	UROCHORDATA	1	1	1	6	2	1988	1989	0	6	0	6	6	6		0	0	0	0
USAR	VASCULAR PLANTS	6	6	6	6	7										0	0	0	0
WACA	AMPHIBIANS	6	6	6	5	8			0	0								0	0
WACA	AQUATIC INVERTS	6	6	6	6	7												0	0
WACA	BIRDS	3	6	6	5	1	1954	1985	22	117								0	0
WACA	FUNGI	6	6	6	6	7			0									0	0
WACA	LICHENS	6	6	6	6	7			0									0	0
WACA	MAMMALS	4	5	5	5	9	1973	1985	51	52		0				0		0	1
WACA	REPTILES	6	6	6	5	6		1968	0									0	0
WACA	TERRESTRIAL INVERTS	5	6	6	3	5	1963		639									0	0
WACA	VASCULAR PLANTS	3	3	3	1	5	1990	1990	261	300	250	50	40	14			2	0	0
WAPA	AMPHIBIANS	6	6	6	5	8		1983	0	0	0	0	0			0	0	0	0
WAPA	AQUATIC INVERTS	6	6	6	6	7										0	0	0	0
WAPA	BIRDS	2	2	2	2	8		1983	0	12	0	0	0	0		0	0	0	0
WAPA	LICHENS	6	6	6	6	8		1983	0	7	7	0	0	0		0	0	0	0
WAPA	MAMMALS	2	2	2	2	8		1983	0	3	0	0	0			0	0	0	0
WAPA	REPTILES	6	6	6	6	0										0	0	0	0
WAPA	TERRESTRIAL INVERTS	6	6	6	5	0										0	0	0	0
WAPA	VASCULAR PLANTS	4	4	4	4	8		1983	0	3	0	0	0			0	0	0	0
WHIS	AMPHIBIANS	7	6	6	6	8										0	0	0	0

APPENDIX II CONTINUED

PARK CODE	BIOLOGICAL GROUP	TAX COMP	GEO COMP	ECO COMP	SEAS COMP	INV HIST	INV YEAR	DOC YEAR	NUMB VOUCH	NUMB SPEC	EXP CHK	STAF CHK	UNCON- FIRM	NEW 10	SP YR	NEW SP CL	MIS ID	CONF EXT	POSS EXT
WHIS	AQUATIC INVERTS	7	6	6	5	8										0	0	0	0
WHIS	BIRDS	6	6	6	5	8										0	0	0	0
WHIS	FUNGI	6	6	6	6	7										0	0	0	0
WHIS	LICHENS	6	6	6	6	7										0	0	0	0
WHIS	MAMMALS	6	5	5	6	2										0	0	0	0
WHIS	REPTILES	7	6	6	5	8										0	0	0	0
WHIS	TERRESTRIAL INVERTS	6	6	6	5	8			408	87	0					0	0	0	0
WHIS	VASCULAR PLANTS	2	1	1	5	4		1986	772	648					0	0	0	0	0
YOSE	AMPHIBIANS	1	2	1	1	1	1920		300	10		300			0	0	0	0	0
YOSE	AQUATIC INVERTS	5	5	5	4	1			4500							0	0	0	0
YOSE	BIRDS	1	2	1	2	1	1920	1988	464	132		464			2	0	0	0	1
YOSE	FUNGI	5	5	5	4	1										0	0	0	0
YOSE	LICHENS	5	5	5	4	1										0	0	0	0
YOSE	MAMMALS	2	4	1	3	9	1920	1952	620	79		68	0	0		0	0	1	0
YOSE	REPTILES	1	2	1	1	1			202	22		202			0	0	0	0	0
YOSE	TERRESTRIAL INVERTS	5	5	5	4	1			4500							0	0	0	0
YOSE	VASCULAR PLANTS	4	3	4	2	4	1988		4500	1377	4500	4500			0	0	0	0	0
YOSE	VASCULAR PLANTS	1	2	1	1	1	1974	1990	4500		4500	4500				0	0	0	0

APPENDIX III. COMPLETE LIST OF MAPPED INFORMATION - PART 1

REPORT ON THE MAPS OF PARKS IN THE WESTERN REGION

PARK CODE	MAP THEME	1ST DATE	UP DATE	INVESTIGATOR	BASE SCALE	GEO REF	CLASSIFICATION SCHEME
AMME	VEGETATION	1990	1990	AMMME4.DWG	1"=200'	1	VEGETATION
CABR	GEOLOGY.	1975	0	USGS NPS STAFF.	1:3000	1	6 GEOLOGIC ASSOCIATIONS.
CABR	REGIONAL GEOLOGY.	1975	0	M.P. KENNEDY OF USGS	1:24000	1	MANY GEOLOGIC FORMATIONS VARY BETWEEN MAPS.
CABR	REGIONAL SOILS.	1973	0	USDA-SCS.	1:24000	1	MANY SOIL TYPES AND AG & URBAN DEVELOPMENT RATINGS
CABR	SOILS.	1973	0	USDA-SCS NPS STAFF	1:3000	1	9 SOIL TYPES
CABR	VEGETATION.	1989	0	CLARK,HALVORSON,ETC.	1:3000	1	10 "VEGETATION TYPES" INCLUDING EXOTIC AND DIST.
CAGR	SOIL & MOISTURE CNSR	1941	0	NPS	1:300	1	EROSION AREAS
CAGR	SOIL MAP	1917	0	USDA	1:1MILE	1	SOIL TYPES AND CONTOURS
CAGR	VEGETATION	1986	0	REICHHARDT	1:200	1	VEG TYPES
CHIR	SOIL MAP	1979	0	POST-CPSU/UA	1CENT=10 METERS	2	SOIL MAPPING UNIT
CHIR	VEG MAP	1937	0	UNKNOWN		3	
CHIR	VEG TYPE	1938	0	ROSEBERRY & DOLE	1=1/8	1	VEG TYPES
CHIS	FAULTS AND LANDSLIDE	1979	0	SEE NOTES (SENS PL).	VARY BY ISLAND.	3	FAULTS, MOVING FAULTS, LANDSLIDES, GEOLOGY, ETC.
CHIS	GENERALIZED SOILS.	1979	0	SEE NOTES (SENS PL).	VARY BY ISLAND.	3	SOIL TYPES 4=SMI, 3=AI.
CHIS	SENSITIVE PLANTS.	1979	0	SB BOTANIC SOCIETY.	1:46000	3	GEN. LOCATIONS OF SENSITIVE PLANT SPP SEV. SPP.
CHIS	SMI GEOLOGIC MAP.		0	WEAVER & DOERNER.	1:24000	1	FAULTS, CONTACT ZONES, GEOLOGIC FORMATIONS, ETC.
CHIS	VEG & LANDFORMS INV.	1971	0	CA NAVIG & OCEAN DEV	1:31680	1	GENERALIZED NATURAL VEG AND LANDFORMS ~10 CLASSES
CHIS	VEGETATION OF SCI.	1980	0	MINNICH, R.A.	1:24000	1	VEGETATION (PHYSIOGNOMIC) TYPES.
CHIS	VEGETATION OF SRI.	0	0	HALVORSON	1:24000	1	VEGETATION POLYGONS AND OTHER GROUND COVER.
CHIS	VEGETATION.	1979	0	SEE NOTES (SENS PL).	1:13000	3	VEGETATION TYPES.
CHIS	VEGETATION.	1980	0	NPS STAFF.	VARY BY ISLAND.	3	GENERALIZED VEG AND LAND COVER.
CORO	GENERAL SOILS MAP	1971	0	SCS	1:500000	1	SOILS
CORO	GEOLOGY	1959	0	MOORE, NPS	1=800'	1	GEOLOGIC
CORO	GEOLOGY	1985	0	DOE, MICHAEL		3	GEOLOGIC STRUCTURES
CORO	GEOLOGY MAP	1968	0	HAYES AND RAUP	1:48,000	1	GEOLOGIC
CORO	NATURAL HISTORY	1959	0	JACKSON, NPS		1	VEG AND BOUNDARY
CORO	VEGETATION	1989	0	RUFFNER, ESMP	1:6000	1	COMMUNITY TYPES & FIRE SPREAD
DEVA	ENDEMIC PLANT SPP	1972	1979	NPS STAFF	1:250000	1	ENDEMIC PLANT DISTRIBUTION POLYGONS 36 SPP.
DEVA	EXOTIC PLANT DIST.	1989		RES MGMT STAFF	1:250000	1	DIST OF SALT CEDAR AND ATHEL MAPPED AS POLYGONS.
DEVA	VEGETATION	1966		HUNT AND DURRELL '66	1:62500	1	17 DOM SPP ASSOCIATIONS WITHIN 4 VEG TYPES.
DEVA	VEGETATION	1984	0	PETERSON	CHECK AT UNLV	2	17 ASSOCIATIONS WITHIN 5 ZONES
DEVA	VEGETATION	1984	0	ANNABLE, C.R. 1984	1:62500	1	9 ASSOCIATIONS WITHIN 3 VEGETATION ZONES
DEVA	VEGETATION-HABITAT			NPS STAFF	1:250000	1	6 VEGETATION-HABITAT CLASSES INDICATED.
ECHI	GEOLOGY OF SRI.	1969	0	SONNEMAN, WEAVER,ETC	1:24000	1	GEOLOGIC FORMATIONS, FAULTS, LANDSLIDES, ETC.
FOBO	VEGETATION MAP	0	1976	WARREN & HOY, 1976	1"=500'	1	PLANT COMMUNITY TYPES
GOGA	GEOMORPHOLOGY	1974	1975	WAHRHAFTIG, SWA GROU	PUBL. 1:250000	1	MAJOR GEOLOGIC FEATURES (FAULTS, ROCK FORMATIONS)
GOGA	SOILS	1967	1975	SOIL CONS SERV /SWA	PUBL. 1:250000	1	SOIL TYPE / SERIES
GOGA	SURFACE & BEDROCK GE	1975	1975	HARDING-LAWSON, SWA	PUBL. 1:250000	1	ROCK TYPE / FORMATION, GENERAL GEOLOGIC AGE
GOGA	VEGETATION	1975	0	SWA GROUP	PUBL. 1:250000	1	MAJOR VEGETATION TYPES (e.g. GRASSLAND, REDWOOD)
GRBA	GEOLOGY	1969	0	WHITEBREAD OF USGS.	1:48000	1	DETAILED MAP OF NUMEROUS GEOLOGIC UNITS.
GRBA	GEOLOGY	1988	0	NPS STAFF	1:24000	1	13 GEOLGIC UNITS MAPPPED.
GRBA	RANGE SUIT & VEG	0	0	USFS STAFF.	1:20000	1	5 RANGE SUIT. CATEGORIES AND 10 GENERAL VEG TYPES.
GRBA	VEGETATION	0	1990	RAY JAINDL (OR ST U)	1:24000	1	GENERALIZED VEGETATION TYPES EMPHASIS ON RANGE.
GRCA	GEOLOGY	1980	0	BILLINGSLY& HUNTOON	1:62500	1	
GRCA	VEGETATION	1980	1982	WARREN ET AL.	1:62500	1	VEGETATION TYPES. BROWN,LOWE&PACE
HALE	GEOLOGY	1989	1989	PAAR	1:24000	1	VOLCANIC SERIES
HALE	VEGETATION	1980	1980	PARK	1:24000	1	VEGETATION DISTRIBUTION
HALE	VEGETATION	1985	1985	PARK	1:6000	1	VEGETATION DISTRIBUTION
HALE	VEGETATION	1989	1989	PAAR	1:24000	1	VEGETATION SCHEME DISTRIBUTION
HAVO	ALIEN SPECIES	1984	1990	PARK	1:12,000	1	LOCATIONS OF ~20 ALIEN SPECIES
HAVO	EAST RIFT AREA	1988	1988	PARK	1:24000	1	WEED, RARE PLANTS, VEGETATION TYPE, PIG ACTIVITY
HAVO	ERUPTIVE FISSURES	1986	1986	USGS	1:24,000	1	LAVA FLOWS, PREHISTORIC TO PRESENT
HAVO	GEOLOGIC	1963	1967	DONALD W. PETERSON	1:24000	1	LAVA FLOWS
HAVO	OLA'A TRACT	1988	1988	PARK	1:24000	1	WEED, RARE PLANT, VEGETATION TYPE, PIG ACTIVITY
HAVO	PLANT DISTRIBUTION	1984	1990	PARK	1:12,000	1	ALIEN SPECIES DISTRIBUTION

PARK CODE	MAP THEME	1ST DATE	UP DATE	INVESTIGATOR	BASE SCALE	GEO REF	CLASSIFICATION SCHEME
HAVO	RARE PLANTS	1973	1976	PARK	1:24000	1	DISTRIBUTION OF RARE PLANTS
HAVO	SEA AND RARE PLANT	1977	1990	GEO SURVEY	1:24,000	1	SEA AREAS AND RARE PLANT SITES
HAVO	SOIL	1971	1971	US DEPT AGRICULTURE	1:253440	1	SOIL TYPES
HAVO	VEGETATION	1978	1978	US FISH & WILDLIFE	1:48000	1	ECOLOGICAL COMMUNITIES
HAVO	VEGETATION	1977	1980	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1977	1980	US FISH & WILDLIFE	1:24000	1	VEGETATIN DISTRIBUTION
HAVO	VEGETATION	1977	1980	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1977	1980	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1976	1982	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION OVER TOPOGRAPHY
HAVO	VEGETATION	1977	1982	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1979	1982	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1982	1982	PARK	UNKNOWN	1	FOUNTAIN GRASS DISTRIBUTION
HAVO	VEGETATION	1977	1983	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1979	1983	US FISH & WILDLIFE	1:24,000	1	MAKAOPUHI CRATER VEGETATION, MAP# H-65
HAVO	VEGETATION	1979	1983	US FISH & WILDLIFE	1:24,000	1	KILAUEA CRATER QUAD VEGETATION, MAP# 57
HAVO	VEGETATION	1979	1983	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1979	1983	US FISH & WILDLIFE	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1979	1983	US FISH & WILDLIFE	1:24,000	1	KIPUKA PAKEKAKE QUAD VEGETATION, MAP# H-49
HAVO	VEGETATION	1985	1985	RESOURCE MANAGEMENT	1:24000	1	VEGETATION DISTRIBUTION
HAVO	VEGETATION	1986	1986	PARK	1:100000	1	FOUNTAIN GRASS DISTRIBUTION
HAVO	VEGETATION	1982	1990	US F&W, PARK	1:24,000	1	KAU DESERT VEGETATION, INCOMPLETE UP TO 1500'
HAVO	VEGETATION MAPS	1966	1974	SEE HAVOMAP NOTE A	1:52,000	1	VEGETATION TYPES, 31 MAJOR VEG TYPES DETERMINED
JOMU	SOILS	1970	0	STATE SOIL SURVEY	1:24000	3	SOIL SERIES
JOMU	WETLANDS	1976	0	USDI / FWS	1:65000	3	WETLAND TYPE / VEGETATION
JOTR	GEOLOGIC MAP	1938	0	JENKINS	1:500000	1	MANY GEOLOGIC UNITS MAPPED CA DIV OF MINES
JOTR	GEOLOGIC MAP	1967	0	ROGERS 67	1:250000	1	MANY GEOLOGIC UNITS MAPPED SEE NOTES CA DIV MINES & GEOL.
JOTR	GEOLOGIC MAP	1968	0	DIBBLEE, JR. '67-'68	1:62500	1	MANY GEOLOLGIC UNITS MAPPED CA DIV MINES & GEOL.
JOTR	HYDROLOGIC & GEOLOG.	1963	0	KUNKEL 63	1:62500	1	GEOLOGIC UNITS (4) FAULTS, WELLS, GROUND WATER ST
				USGS			
JOTR	VEGETATION	1977	1990	LEARY 77	1:62500	2	15 VEGETATION ASSOCIATIONS IN 4 COMMUNITIES.
JOTR	WELLS, SPRINGS, GEOL	1960	0	USGS	1:62500	1	GEOLOGIC UNITS (10) SPRING AND WELL LOCATIONS.
KAHO	GEOLOGY AND SOILS	1990	1990	NPS, KA008.DWG	1000' GRID	1	AGE AND TYPE OF LAVA FLOW
KAHO	VEGETATION TYPE MAP	1987	1990	J. CANFIELD	1000' GRID	1	VEGETATION
KAHO	VEGETATION TYPE MAP	1988	1990	KA021.DWG	200 FEET	1	VEGETATION OF AIHAKAPAP POND
KAHO	VEGETATION TYPE MAP	1990	1990	PAAR KA013.DWG	50 FEET	1	INDIVIDUAL PLANTS
KALA	TOPOGRAPHIC	1947	1947	USGS	1:625000	1	GEOLOGY, WATER RESOURCES, AND TOPOGRAPHIC
LABE	GEOLOGY	19	0	E JONES "FIG. 16"	2" = 1 MILE	3	LAVA FLOWS, ROCK TYPES, CINDER CONES, RIFTS
LABE	GEOLOGY/CAVES/ROADS	19	0	NPS?	1:40,000	3	CAVES, LAVA FLOWS, OTHER PHYSICAL FEATURES
LABE	LANDMARKS / VEGETATI	1936	0	NPS / PLANNING	1:6000	3	MAJOR PHYSICAL FEATURES / GENERAL VEGETATION
LABE	NAT HIST BASE / BIOL	1965	0	NPS / W OFF. DESIGN	1:48,000	3	VEGETATIVE COVER (SP &%). IMPORTANT MAMMAL SPP.
LABE	NAT HIST BASE / GEOL	1965	0	NPS / W OFF. DESIGN	1:48,000	3	GEOL FEATURES - CAVES, LAVA FLOWS & TUBES, FAULTS
LABE	VEGETATION	19	0	??	1:16,023	3	PLANT SPECIES / ASSOCIATION
LABE	VEGETATION	1933	1934	NPS / OFF CHIEF ENGI	2" = 1 MILE	3	DOMINANT PLANT SPECIES+
LAME	GENERAL VEGETATION.	0	1988	DSC -- SEE NOTES.		1	VERY GENERALIZED VEG ZONES: e.g., PRIMARILY BURSAGE
LAME	GEOLOGY.	0	1988	DSC -- SEE NOTES.		1	MANY GEOLOGIC ASSOCIATIONS, ROCK TYPES, ETC.
LAME	MINERAL OCCURENCES.	1980	0	SERVER ET AL.	1:250000	1	LOCAT. MINRLS (METALS, NONMETALS) LEASABLE MINRLS
LAVO	LIFE ZONES	1980	0	NPS / DSC	ca. 1:85,000	3	MERRIAM'S LIFE ZONES
LAVO	RECENT GEOLOGIC EVEN	1980	0	NPS / DSC	ca. 1:70,000	3	AREAS AFFECTED BY EJECTA, ROCKFALLS, MUDFLOWS ETC.
LAVO	SOIL LIMITATIONS	1980	0	NPS / DSC	ca. 1:85,000	3	SOIL SERIES, LIMITATIONS ON DEVELOPMENT AND USE
LAVO	STAND VEGETATION MAP	1966	0	GARY BUNNY, NPS	1:30500	1	STRUCTURE AND STAND COMPOSITION
LAVO	VEG. RECONAISSANCE	1934	0	COOK, L.F., NPS	1:48000	1	LOCATIONS OF PHOTOS, TRANSECTS & PLOTS FOR VEG MAP
LAVO	VEGETATION	1934	0	NPS	1:48000	1	COMMUNITY TYPES. 16 DOMINANT SPECIES INDICATED
LAVO	VEGETATIVE TYPES	1976	1980	NPS / DSC	ca. 1:120,000	3	DOMINANT TREE SPECIES
MOCA	BIOTIC COMMUNITY	1990	0	RUFFNER	1:2400	1	BIOTIC COMMUNITY TYPES
MOCA	SOILS MAP	1933	0	NPS	1:100	3	BOUNDARY LINES, SOME VEG, SOME CONTOUR
MUWO	VEGETATION	1935	0	NPS BRANCH OF FOREST	15:62,000	3	VEGETATION TYPE - PHYSIOGNOMY / DOMINANT SPECIES
MUWO	VEGETATION	1969	0	C J CORNELIUS, SONOM	1:6180	1	DOMINANT VEGETATION
MUWO	VEGETATION	1978	0	McBRIDE ET AL., UC BE	CA.1:4,800	3	DOMINANT VEGETATION - SPECIES / AGE
NASA	GEOLOGY	1981	1981	AM. SAMOAN GOV.	1000M GRID	1	5 PLATES OF DIFFERENT REGIONS

PARK CODE	MAP THEME	1ST DATE	UP DATE	INVESTIGATOR	BASE SCALE	GEO REF	CLASSIFICATION SCHEME
NASA	SOILS	1981	1981	AM. SAMOAN GOV.	1000M GRID	1	6 PLATES OF DIFFERENT REGIONS
NASA	VEG AND SOILS	1981	1981	AM. SAMOAN GOV.	1000M GRID	1	5 PLATES OF DIFFERENT REGIONS
ORPI	3 SPECIE VEG MAP	1984	0	UNKNOWN	1:62500	1	ELEPHANT TREE, SENITA & ACUNA DISTRIBUTION
ORPI	GEN VEG TYPES, H2O	1974	0	DSC	1:422400	1	VEG COMMUNITIES, WELLS, SPRINGS, BOUNDARY
ORPI	GEOLOGY	1980	0	MAY, PETERSON, ET AL.	1:62500	1	GEOLOGIC COMPOSITE
ORPI	PRIN MINES & PROSPEC	1974	0	DSC	1:422400	1	MINES, CLAIMS, BOUNDARIES, MINERALIZED AREAS
ORPI	SOIL MAP INDEX	1972	1988	UNKNOWN	1:168960	1	INDEX, 28 MAP SHEETS
ORPI	SOIL MAPS	1972	0	UNKNOWN	1:24000	1	SOILS
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, DIAZ PEAK SW
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, LUKEVILLE NE
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, DIAZ PEAK NW
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, QUITOBAQUITO NE
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, KINO PEAK NW
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, MT AJO SW
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, KINO PEAK, SW
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, KIMO PEAK NE
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:62500	1	VEGETATION ASSOCIATIONS
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, MT AJO NW
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, AGUA DULCE NE
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, LUKEVILLE NW
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, AGUA DULCE SE
ORPI	VEGETATION	1979	0	WARREN, NPS/UA	1:24000	1	VEGETATION ASSOCIATIONS, KINO PEAK SE
ORPI	WATER DEVELOPMENT	1940	0	UNKNOWN	UNKNOWN	1	WATER SOURCES, GEOLOGY
PEFO	GEOLOGY	1981	0	BILLINGSLEY & BREED	1:48000	1	GEOLOGIC STRATA UNITS
PEFO	SOILS	1975	0	SCS	1:31680	1	SOIL TYPE
PEFO	VEGETATION	1976	1978	UA - MILLER	1:24000	1	VEGETATIVE COMMUNITIES
PINN	EXOTIC PLANT DISTRIB	0	0	NPS - DeBenedetti	1:24,000	1	DISTR. OF CENTAUREA MELITENSIS & MARRUBIUM VULGARE
PINN	GEOLOGY	0	0	USGS		1	
PINN	GEOLOGY	1970	0	Vincent Matthews III	1:24000	3	ROCK TYPE, W/ DESCRIP. (eg WHITE, NON-PORPHYRITIC)
PINN	MONITORING SITES	1984	0	NPS - VAN RIPER, HAL	1:12000	3	VEGETATION TYPES / MONITORING STATIONS
PINN	SOILS	1969	0	USDA SOIL CONSERV SE	1:20,000	3	SOIL ASSOCIATIONS
PINN	VEGETATION	1983	0	DSC - SUSAN STITT	1:12000	3	STRUCTURAL VEGETATION CLASSES
PORE	GEOLOGY	0	0	USGS / GALLOWAY	1:24000	3	ROCK TYPE / AGE
PORE	GEOLOGY	0	0			3	
PORE	RARE PLANTS	0	0	PORE ??	1:48000	3	
PORE	RARE PLANTS	1983	1989	PORE - CLARK & FELLE	1:24000	3	RARE PLANT SPECIES DIST
PORE	SENSITIVE AREAS	1982	0	PORE/ CHARLESTON & H	1:48000	3	BIOLOGICAL, ENVIRONMENTAL, HISTORICAL IMPORTANCE
PORE	SOIL AND CAPABILITY	1968	0	USDA/SOIL CONSERV. S	1:7920	3	SOIL TYPE (KEY NOT FOUND)
PORE	TIMBER / LOGGING HIS	1963	1966	HAMMON, JENSEN & WAL	1:6000	3	SIZE / DENSITY OF TIMBER, LOGGING HISTORY
PORE	VEG - PIERCE PT.	1981	0	PORE. LATHROP & GOGA		3	
PORE	VEGETATION	0	0	PORE?	1:24000	3	VEGETATION TYPE, DENSITY
PORE	VEGETATION	1960	0	??	ca. 1:60000	3	DOMINANT VEGETATION AND SOIL TYPE
PUHE	TOPOGRAPHIC	1988	1988	NPS	1"=80'	1	TOPOGRAPHIC AND SOME VEGETATION
PUHE	VEGETATION	1977	1977	MACNEIL & HEMMES	1"=500'	1	VEGETATION DISTRIBUTION
PUHO	VEGETATION	1976	1986	MACNEIL & HEMMES	1:7800	1	VEGETATION DISTRIBUTION
REDW	BOUNDARY / TIMBER	1968	0	REDW	1:12000	1	BOUNDARIES, SIZE/DENSITY,LOGGING, DOMINANT SPECIES
REDW	EROSION, SEDIMENTATI	1982	0	J. PITLICK	LARGE SCALE	1	LANDSLIDES AND LOGJAMS RECORDED
REDW	FOREST CLASSIFICATIO	1966	0	HAMMON, JENSEN & WAL	1:24000	1	AGE/SIZE, DENSITY, SPECIES
REDW	GEOLOGY	1981	0	D. R. HARDEN ET AL.	1:62500	1	NAMED ROCK TYPE / UNIT (e.g., REDWOOD CREEK SCHIST
REDW	GEOLOGY	1964	1973	CAL DIV MINES & GEOL	1:250000	1	AGE AND TYPE OF ROCK
REDW	GEOLOGY / BEDROCK	1979	0	REDW/DSC	APP 1:75000	3	AGE / GENERAL ROCK TYPE
REDW	GEOMORPH/STREAM PROC	1984	0	M. A. MADEJ	1:6000	1	LANDSLIDES, LOGJAMS GRAVEL BARS RECORDED
REDW	LAND USE	1984	0	D. BEST & L. VANDER	1:12000	3	LAND USE CATEGORIES AND VEGETATION COVER TYPES
REDW	SOIL-VEGETATION	1959	1961	DELAPP, GLADISH, SKO	1:31680	3	SOIL SERIES / PLANT GROWTH FORM / DOMINANT SPECIES
REDW	SOILS	1979	0	REDW/DSC	APP 1:75000	3	GENERAL STABILITY, POSITION, AND ORIGIN
REDW	SOILS	1988	0	Popenoe	1:6000 DATA COL	1	SOILS
REDW	TIMBER STAND MAP	1967	0	HAMMON, JENSEN, WALL	1:12000	1	SIZE / DENSITY, LOGGING HISTORY, DOMINANT SPECIES
REDW	TIMBER STAND MAP	1974	0	DANIEL P. GAUT	1:12000	2	LOGGING INFORMATION (SELECTIVE, CLEARCUT, NO CUT)

PARK CODE	MAP THEME	1ST DATE	UP DATE	INVESTIGATOR	BASE SCALE	GEO REF	CLASSIFICATION SCHEME
REDW	TIMBER STAND MAP	1982	0	HAMMON, JENSEN, WALL	1:24000	1	SIZE / DENSITY, LOGGING HISTORY, "MERCHANTABILITY"
REDW	VEG - COASTAL	1984	0	Reed and Sugihara	1:6000 DATA COL	1	VEGETATION COMMUNITIES
REDW	VEG - LITTLE BALD MT	1988	0	Goforth and Veirs	1:10000	2	VEGETATION COMMUNITIES
REDW	VEG - OAK WOODLAND	1985	0	Sugihara and Reed	1:6000	1	VEGETATION COMMUNITIES
REDW	VEGETATION	1983	0	HEKTNER	1:24000	1	ASSOCIATION
REDW	VEGETATION TYPE	1983	0	REDW	1:30000	1	AGE / COMMUNITY
REDW	VEGETATION TYPE	1983	0	REDW	1:30000	1	AGE / COMMUNITY
SAGU	FISSURE PATTERN	1967	0	LEGER	1:7680	1	DIPS, FAULTS, CONTACTS
SAGU	GENERAL DRASTIC MAP	1989	0	AZ DEPT ENVIR QUAL	1:175000	1	HYDROGEOLOGIC SETTING
SAGU	GEOLOGIC MAP	1961	0	MCCOLLY	1:1/8	1	GEOLOGIC
SAGU	GEOLOGIC MAP	1967	0	LEGER	1:7689	1	GEOLOGIC
SAGU	NAT RES OVERLAYS	1987	0	CPSU/UA	UNKNOWN	1	VEG, RIPARIAN, LAND USE, ZONING
SAGU	VEGETATION MAP	1939	0	USFS ROSEBERRY&DOLE	1:1/2MI	1	VEG TYPES
SAGU	VEGETATION MAP	1984	0	NPS	1:24000	1	VEG TYPES
SAGU	VEGETATION TYPE	9999	0	NPS	1:30000	1	VEG TYPES
SAGU	VEGETATION TYPES	1963	0	LUND, NPS	1:2000	1	VEG TYPES
SAGU	VEGETATION TYPES	1958	1963	NPS	1:1/2	1	VEG TYPES AND MAMMAL DISTRIBUTION
SAMO	FAULTS & LANDSLIDES	0	0	STATE PARKS ???	1:24000	3	FAULTS, LANDSLIDE ZONES, GEOL. ZONES FOR ST PARKS.
SAMO	GEOLOGY	1975	0	CA DIV MINES & GEOL.	1:250000	1	GEOLOGIC UNITS FOR ENTIRE MTNS AREA & BEYOND.
SAMO	GEOLOGY QUADS	1980	0	YERKES & CAMPBELL.	1:24000	1	GEOLOGIC UNITS FOR EAST-CENTRAL SAMO ONLY.
SAMO	LANDSLIDES	1983	0	CA MINES & GEOL.	1:48000	1	LOCATIONS, AGES, TYPES, ETC. OF LANDSLIDES.
SAMO	RARE & ENDAN PLANTS	1987	0	NPS STAFF CNPS.	1:24000	1	POINT LOCATIONS OF R & E PLANT SPP.
SAMO	S.E.A. VEGETATION	1981	0	NPS STAFF	1:24000	1	GENERALIZED VEG TYPES FOR SIG ECOLOGICAL AREAS.
SAMO	SEISMIC RESPONSE	0	0	UNKNOWN	1:24000	3	SEISMIC RESPONSE TO HAZARDS FAULTS TYPES ETC.
SAMO	SENS PLANT & COMMUN.	1978	0	SAMO COMP PLANNING.	1:42000	1	SENSITIVE PLANT SPP & COMMUNITIES INDICATED.
SAMO	VARIOUS APPL. MAPS	0	0	NPS STAFF.	VARIOUS.	1	VARIOUS SPECIFIC APPLICATION MAPS WITHIN SAMO.
SAMO	VEG & LAND USE	1988	0	NPS STAFF.	1:12000	1	VEGETATION TYPES AND LAND USES (USGS STANDARDS).
SAMO	VEGETATION	0	0	ESRI FOR LA COUNTY.	1:24000	1	VEGETATION TYPES -- NO LEGEND, ONLY NUMBERED.
SAMO	VEGETATION	1939	0	WIESLANDER.	1:62500	1	VEGETATION TYPES W/ SPECIES INDICATIONS.
SEKI	GEOLOGY.	1990	0	JIM MOORE, USGS.	1:62500	1	GEOLOGIC UNITS.
SEKI	HISTORIC VEGETATION.	1935	0	FROST, W.T.	1:62500	2	PLANT COMMUNITIES.
SEKI	LAND COVER.	1984	0	NASA.	30 M RESOLUTION	1	TM UNSUPERVISED (VEG REFLECTANCE, SHADOWS, ETC.).
SEKI	SEQUOIA TREE INVENT.	0	0			3	
SEKI	SOILS.	1986	0	HUNTINGTON, G. (UCD)	1:24000	1	SOIL SUBGROUPS.
SEKI	VEGETATION.	1975	0	PRIVATE CONTRACTORS.	1:15840	1	PLANT COMMUNITIES, SIZE CLASS, DECADENCE.
TONT	PARKING AREA PLANT	1963	0	NPS	1:20	1	PLANT MATERIALS
WACA	GEOLOGIC MAP	1970	0	BENFER, JON	1:12000	3	STRATUM
WHIS	GEOLOGY	1964	0	USGS / CALIF. DIV. M	1:62500	3	GEOLOGIC FORMATIONS, FAULTS, ROCK TYPES
WHIS	GEOLOGY - MINERALS/M	1964	0	USGS / CALIF. DIV. M	1:62500	3	FAULTS, GEOLOGIC FORMATIONS, KNOWN MINES
WHIS	LIFE ZONE / COMMUNIT	19	0	NPS??	??	3	DOMINANT FOREST / VEGETATIONAL COVER
WHIS	SOIL / MOISTURE CONS	1973	0	SOIL CONSERVATION SE	1:37300	3	LOGGING HISTORY, SOIL STABILITY, REFORESTATION
WHIS	SOILS - GENERAL	19	0	SOIL CONSERVATION SE	1:20000	3	SOIL SERIES / PHASE?
WHIS	SOILS - GENERAL	1973	0	SOIL CONSERVATION SE	1:37300	3	SOIL SERIES / PHASE?
WHIS	SOILS AND VEGETATION	1973	0	USFS/SMITH, MALLORY	1:31680	1	SOIL SERIES, VEG SPECIES/COVER TIMBER SITE QUALITY
WHIS	TIMBER TYPE/LOGGING	1967	0	HAMMON, JENSEN & WAL	1:16000 (4"=1MI	1	SIZE CLASS, DENSITY, TREE SPECIES, LOGGING HISTORY
WHIS	TIMBER TYPE/LOGGING	1968	0	HAMMON, JENSEN & WAL	1:16000 (4"=1MI	1	SIZE CLASS, DENSITY, TREE SPECIES, LOGGING HISTORY
WHIS	WOODLAND SUITABILITY	1973	0	SOIL CONSERVATION SE	1:37300	3	SOIL SUITABILITY FOR WOODLAND
YOSE	GEOLOGY	1966	0	CALIFORNIA DIV OF MI	1:250,000	3	AGE AND ROCK TYPE
YOSE	GEOLOGY	1967	0	CALIFORNIA DIV OF MI	1:250,000	3	AGE AND ROCK TYPE
YOSE	GEOLOGY	1973	0	CAL DIV OF MINES	1:62,500	3	AGE AND ROCK TYPE / NAMED UNIT
YOSE	GEOLOGY	1973	0	CAL DIV OF MINES	1:62,500	3	AGE AND ROCK TYPE / NAMED UNIT
YOSE	GEOLOGY	1973	0	CAL DIV OF MINES	1:62,500	3	AGE AND ROCK TYPE / NAMED UNIT
YOSE	GEOLOGY	1975	0	CAL DIV OF MINES	1:48,000	3	ROCK TYPE
YOSE	GEOLOGY	1985	0	USGS	1:24,000	3	AGE AND ROCK TYPE
YOSE	GEOLOGY	1987	0	USGS	VARIES 1"=2-3MI	3	MAXIMUM EXTENT OF GLACIERS

PARK CODE	MAP THEME	1ST DATE	UP DATE	INVESTIGATOR	BASE SCALE	GEO REF	CLASSIFICATION SCHEME
YOSE	VEG./BLISTER RUST PR	1933	1969	YOSE / FORESTRY	1:7920 (8"=1MI)	3	DISTRIBUTION OF RIBES AND AREAS WHERE ERADICATED
YOSE	VEG./INSECT CONTROL	19	19	YOSE / FORESTRY	1:7920 (8"=1MI)	3	INSECT CONTROL WORK, BY AREA
YOSE	VEGETATION	1982	0	STEVE BOTTI / YOSE		3	VEGETATION TYPE - PHYSIOGNOMY / DOMINANT SPECIES
YOSE	VEGETATION	19	19	YOSE / FORESTRY	1:18000	3	CAMPGROUND VEGETATION SURVEYS
YOSE	VEGETATION	1930	1939	NPS BRANCH OF FOREST		3	VEGETATION TYPE - PHYSIOGNOMY / DOMINANT SPECIES
YOSE	VEGETATION / SOILS	1963	0	ZINCKE AND ALEXANDER	1:24000	1	SOIL CLASS/SERIES. SPECIES ABUNDANCE FOR TIMBER

APPENDIX III. COMPLETE LIST OF MAPPED INFORMATION - PART 2

REPORT ON THE MAPS OF PARKS IN THE WESTERN REGION

PARK CODE	MAP THEME	NO. CLS	MIN MAP UNIT	FLD CHK	ACC %	COMP	MAP FORM	DATA STRU	REP	BACK UP COPY	USE-FUL-NESS	COMMENTS
AMME	VEGETATION	1	9	1		2	0	2	6	8	3	COPY OF MAP LOCATED IN GENERAL MANAGEMENT PLAN
CABR	GEOLOGY.	6		1		2	2	3	1	1	3	DEVELOPED FROM REGIONAL 1:24000 USGS MAPS.
CABR	REGIONAL GEOLOGY.			1		1	1	3	1	6	3	INCLUDES ALL SAN DIEGO AREA; USED TO MAKE PARK MAP
CABR	REGIONAL SOILS.			1		1	1	3	1	6	3	COVERS ALL SAN DIEGO AREA; USED TO MAKE PARK MAP.
CABR	SOILS.	9		1		2	2	3	1	1	3	DEVELOPED FROM REGIONAL 1:20000 SCS SOILS MAPS.
CABR	VEGETATION.	10		1		2	2	3	1	1	3	ASK HALVORSON AND VEIRS ABOUT THIS MAP.
CAGR	SOIL & MOISTURE CNSR	4		3		2	1	0	1	8	1	
CAGR	SOIL MAP	16		3		1	1	0	1	6	1	ENTIRE GILA VALLEY
CAGR	VEGETATION	19		3	90	2	1	0	1	8	4	ALSO HERBARIUM STUDY
CHIR	SOIL MAP	4	0	1	90	3	0	0	6	8	7	ONLY OF BONITA CAMPGROUND
CHIR	VEG MAP			3		0	0	0	6	8	7	SAME AS 1939 VEG MAP
CHIR	VEG TYPE	33	1	2	90	3	1	0	1	6	1	DOES NOT INCLUDE PARK ADDITION
CHIS	FAULTS AND LANDSLIDE			3		3	1	3	1	8	7	SMI AND ANACAPA; FOLLOWS FORMAT OF SENS PLANT MAPS
CHIS	GENERALIZED SOILS.	0		3		3	1	3	1	8	7	SMI & ANACAPA; FOLLOWS FORMAT OF SENS PLANTS MAPS.
CHIS	SENSITIVE PLANTS.	0		1		3	1	3	1	8	7	WORK DONE PRIOR TO PARK ESTAB; SMI, AI, 1 MAP/SP.
CHIS	SMI GEOLOGIC MAP.	15		3		3	1	3	1	8	7	COVERS ONLY SAN MIGUEL ISLAND.
CHIS	VEG & LANDFORMS INV.	10		3		3	1	3	1	1	7	WEST EDGE OF SCI; PERIMETERS OF SMI, SRI, SBI AI.
CHIS	VEGETATION OF SCI.	8		1		3	1	3	1	1	7	PUBLISHED IN REDUCED FORM IN CA ISLANDS SYMP 1980.
CHIS	VEGETATION OF SRI.	21		2		3	7	0	1	1	3	ONLY INCLUDES SANTA ROSA ISLAND; PAPER & ERDAS.
CHIS	VEGETATION.	11		3		3	1	3	1	8	7	ANACAPA ONLY; FOLLOWS FORMAT OF SENS PL SPP MAPS.
CHIS	VEGETATION.	9		3		3	1	3	1	1	7	FROM RES MGMT PLAN; SMI AND ANACAPA.
CORO	GENERAL SOILS MAP	30		3	90	1	1	0	1	6	1	USEFUL FOR GENERAL PLANNING ONLY
CORO	GEOLOGY	16		3	90	1	1	0	1	8	1	
CORO	GEOLOGY	28		3		3	1	0	1	8	3	LIMITED TO MONTEZUMA'S CAVE
CORO	GEOLOGY MAP			1	90	1	1	0	1	6	1	COVERS HUACHUCA AND MUSTANG MTNS.
CORO	NATURAL HISTORY	11		3		3	1	0	1	8	1	SHOWS VEG TYPES AND NOTES MAMMAL AND BIRD OBSER.
CORO	VEGETATION	25	0	2	90	2	2	0	1	6	3	SOAR HAS COPIES; SHOWS PAST FIRE HISTORY
DEVA	ENDEMIC PLANT SPP	36		3	40	2	0	3	1	1	4	SPP RANGE NEEDS TO BE MORE ACCURATELY MAPPED.
DEVA	EXOTIC PLANT DIST.	1		1	85	2	1	3	1	6	3	SALT CEDAR MAY OCCUR ELSEWHERE.
DEVA	VEGETATION	17		2		3	1	3	1	6	1	OLD CLASSIFICATION SCHEME; VALLEY FLOOR ONLY.
DEVA	VEGETATION	17		2	85	3	1	3	4	8	3	GOOD CURRENT INFO; COTTONWOOD MTNS ONLY NOT HERE.
DEVA	VEGETATION	9		2	85	3	1	1	1	5	3	BEST CURRENT VEG INFO; ONLY COVERS FUNERAL MTNS.
DEVA	VEGETATION-HABITAT	6		3	50	2	0	3	1	3	5	POLYGONS ARE VERY GENERALIZED LARGE SCALE.
ECHI	GEOLOGY OF SRI.	20		3		3	1	3	1	8	3	PAPER IS TORN -- MAP IN POOR SHAPE SRI ONLY.
FOBO	VEGETATION MAP	17		1	90	2	1	0	1	7	2	PARK PROBABLY HAS ONLY COPY
GOGA	GEOMORPHOLOGY	5	40	3		1	1	3	1	6	3	UPDATED IN 'PRELIMINARY INFORMATION BASE' BY SWA
GOGA	SOILS	16	20	1		1	1	3	1	6	3	UPDATED IN 'PRELIMINARY INFORMATION BASE' BY SWA
GOGA	SURFACE & BEDROCK GE	14	20	3		1	1	3	1	6	3	UPDATED IN 'PRELIMINARY INFORMATION BASE' BY SWA
GOGA	VEGETATION	11	20	3		1	1	3	1	6	3	IN'PRELIMINARY INFORMATION BASE'-BASE MAP NOT SEEN
GRBA	GEOLOGY	46		1		3	1	3	1	6	3	ONLY SOUTHERN 2/3 OF PARK; N. PARTS WILL BE DONE.
GRBA	GEOLOGY	13		3		2	1	3	1	1	4	USGS MAP IS BETTER; UNKNOWN DATA SOURCES FOR THIS.
GRBA	RANGE SUIT & VEG	15		1		2	1	3	1	8	3	USED AS PRELIM DATA FOR NPS RANGE MGMT PLANNING.
GRBA	VEGETATION		1	2	85	1	3	1	5	1	3	NOT MUCH ON ALPINE & RIPARIAN FIELDWORK ONGOING.
GRCA	GEOLOGY	35		3		2	1	0	1	1	3	50% OF PARK
GRCA	VEGETATION	63		1		2	1	0	1	2	3	SAGIS-60% COMPLETE
HALE	GEOLOGY	6	1	2	90	2	0	2	6	1	2	DRAWING IN GENERAL MGT. PLAN DRAFT; 162-82008
HALE	VEGETATION	19	1	2	95	2	0	2	1	1	2	VEGETATION DISTRIBUTION OF CRATER DISTRICT
HALE	VEGETATION	40	1	2	95	2	0	2	1	3	2	VEG. MAP OF LOWER KIPAHULU VALLLEY, TECH REP#53
HALE	VEGETATION	6	1	1	75	2	0	2	6	7	3	DRAWING IN GENERAL MGT. PLAN DRAFT; 162-82009
HAVO	ALIEN SPECIES	3	1	2	75	2	1	2	1	8	2	PARK FILE/FIELD COPIES, NOT PUBLISHED
HAVO	EAST RIFT AREA	29	1	2	95	3	0	2	1	6	2	MAP WITH INFORMATION ON OVERLAYS
HAVO	ERUPTIVE FISSURES	5	1	1	80	2	1	2	1	8	4	NEEDS TO BE UPDATED FOR CURRENT FLOWS
HAVO	GEOLOGIC	27		2	90	1	2	1	6	1	2	
HAVO	OLA'A TRACT	28	1	2	95	3	0	2	1	6	2	MAP WITH INFORMATION ON OVERLAYS
HAVO	PLANT DISTRIBUTION	6	1	2	85	3	1	2	1	7	3	7 BASE MAPS TO BE IN 1990 TECH REPORT
HAVO	RARE PLANTS	9	1	2	70	3	1	3	1	1	1	RARE PLANTS OF MAKAOPUHI QUADRANLGE
HAVO	SEA AND RARE PLANT	12	1	2	90	3	1	2	1	8	3	8 MAPS
HAVO	SOIL	10		3	60	1	1	2	1	8	1	MAP SUGGESTS TO NOT USE FOR OPERATIONAL PLANNING
HAVO	VEGETATION	9		2	85	1	1	2	1	1	6	AREA IS OF LANDS ADJACENT TO PARK
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	VOLCANO, H-64
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	PUU MAKAALA QUADRANGLE OVERLAY

PARK CODE	MAP THEME	NO. CLS	MIN MAP UNIT	FLD CHK	ACC %	COMP	MAP FORM	DATA STRU	REP	BACK UP COPY	USE-FUL-NESS	COMMENTS
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	KULANI QUADRANGLE
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	VOLCANO QUADRANGLE
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	KALALUA QUADRANGLE
HAVO	VEGETATION	30	1	2	85	3	1	2	1	1	2	KAU DESERT QUADRANGLE, MAP# 60
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	KALAPANA QUADRANGLE
HAVO	VEGETATION	1	1	2	80	1	1	2	1	1	1	
HAVO	VEGETATION	30	1	2	85	3	1	2	1	1	2	KIPUKA PAKEKAKE QUADRANGLE, MAP# H-49
HAVO	VEGETATION	30		1	85	2	1	2	1	7	3	
HAVO	VEGETATION	30		1	85	2	1	2	1	7	3	
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	WOOD VALLEY, MAP# H-50
HAVO	VEGETATION	30		2	85	3	1	2	1	1	2	PUU ULAULA, MAP# H-48
HAVO	VEGETATION	30		1	85	2	1	2	1	7	3	
HAVO	VEGETATION	4		2	25	3	1	2	1	1	6	MAP OUT OF DATE, UP DATED MAPS EXIST
HAVO	VEGETATION	4	1	2	80	3	1	2	1	1	2	KAU DESERT AND COASTAL LOWLANDS
HAVO	VEGETATION	30	1	2	85	3	1	2	1	8	3	1982 MAP WITH OVERLAY UPDATE
HAVO	VEGETATION MAPS	56		2	75	2	1	1	1	6	2	25 AREA MAPS THAT ENCOMPASS THE PARK
JOMU	SOILS	45	4	3		1	1	3	1	6	7	CONTRA COSTA COUNTY - STATE SOIL SURVEY? SM. SCALE
JOMU	WETLANDS	42		3		1	1	3	1	6	6	U S FISH & WILDLIFE SERVICE NAT. WETLAND INVENTORY
JOTR	GEOLOGIC MAP	80		Y		1	1	3	1	8	2	OLDER MAP COVERING ALL OF SOUTHERN CA.
JOTR	GEOLOGIC MAP	71		3		1	1	3	1	1	3	
JOTR	GEOLOGIC MAP	19		Y		3	1	3	1	1	3	
JOTR	HYDROLOGIC & GEOLOG.			1		3	1	3	1	8	3	WORK DONE FOR NPS ONLY COVERS PINTO BASIN.
JOTR	VEGETATION	15		1	50	2	1	3	1	4	4	GOOD COM ANAL; POOR MAP; COMPOSITE BY DSC IN '90.
JOTR	WELLS, SPRINGS, GEOL			2		3	1	3	1	8	2	ONLY INCLUDES N. PORTION OF PARK; MINIMAL UTILITY.
KAHO	GEOLOGY AND SOILS	7	1	2	85	2	0	2	6	8	3	SEE NOTES
KAHO	VEGETATION TYPE MAP	14	1	2	85	2	0	2	6	8	3	SEE NOTES
KAHO	VEGETATION TYPE MAP	5	1	2	85	2	0	2	6	8	3	
KAHO	VEGETATION TYPE MAP	17	1	2	85	2	0	2	6	8	3	
KALA	TOPOGRAPHIC	16	1	1	75	1	1	2	1	1	2	COLOR MAP OF MOLOKAI
LABE	GEOLOGY	8	1	3		2	1	3	1	8	2	FILED LAVA BEDS GENERAL
LABE	GEOLOGY/CAVES/ROADS	0	5	3		1	1	3	1	8	7	MAP SHOWS LANDMARKS, MAJOR CAVES, LAVA FLOWS
LABE	LANDMARKS / VEGETATI	0		3		3	1	3	1	8	2	INCLUDES PETROGLYPHS SECTION
LABE	NAT HIST BASE / BIOL	20		3		2	1	3	1	8	2	MASTER PLAN MAP. FILED IN LAVA BEDS GENERAL
LABE	NAT HIST BASE / GEOL	4		3		2	1	3	1	8	3	MASTER PLAN MAP. FILED IN LAVA BEDS GENERAL
LABE	VEGETATION	39	1	3		2	1	3	1	8	3	FILED LAVA BEDS GENERAL. VERY DETAILED
LABE	VEGETATION	10	1	3		2	1	3	1	8	2	FILED LAVA BEDS GEN. KEY NOT WITH MAP. "LB-4931-A"
LAME	GENERAL VEGETATION.	5		3		1	0	3	1	4	4	EXTREMELY GENERAL ALSO HAS ROCK OUTCROP LAYER.
LAME	GEOLOGY.			3		1	4	2	2	1	3	DISK COPIES IN PARK -- CAN BE CONVERTED IF NEEDED.
LAME	MINERAL OCCURENCES.	43		3		1	2	3	1	6	3	19 METALS; 19 NONMETALS; 5 LEASABLE MINRL CLASSES.
LAVO	LIFE ZONES	4	300	3		2	1	3	1	5	7	PART OF FINAL EIS - GMP, JANUARY 1981
LAVO	RECENT GEOLOGIC EVEN	7	100	3		3	1	3	1	5	2	PART OF FINAL EIS - GMP, JANUARY 1981
LAVO	SOIL LIMITATIONS	12	200	3		3	1	3	1	5	4	PART OF FINAL EIS - GMP, JANUARY 1981
LAVO	STAND VEGETATION MAP		2	1	75	2	2	3	1	1	2	NEEDS A SYSTEMATIC CHECK
LAVO	VEG. RECONAISSANCE			3		1	1	3	1	5	2	GOES WITH VEG MAP AND PHOTO FILE & NOTES OLD FIRES
LAVO	VEGETATION	11	2	1	80	1	1	3	1	5	2	NOT SURE HOW CLASSES WERE DELINEATED
LAVO	VEGETATIVE TYPES	6	25	3		2	1	3	1	5	3	PART OF FINAL EIS - GMP, JANUARY 1981
MOCA	BIOTIC COMMUNITY	27		2		2	1	3	1	6	3	RUFFNER BACKUP
MOCA	SOILS MAP	15		3		2	1	0	1	7	1	
MUWO	VEGETATION	9	1	1		2	1	0	1	8	2	
MUWO	VEGETATION	8	1	1		2	1	0	1	4	3	PART OF M.S. THESIS (SEE REF.)
MUWO	VEGETATION	15	1	2		2	1	0	1	5	3	MIN. MAP 1/2 ACRE. SHOWS ALLUVIAL & OLD-GR. REDWOO
NASA	GEOLOGY	15		3		1	1	2	6	6	3	SEE NOTES
NASA	SOILS	35		3		1	1	2	6	6	3	SEE NOTES
NASA	VEG AND SOILS	11		3		1	1	2	6	6	3	SEE NOTES
ORPI	3 SPECIE VEG MAP	3		3		2	1	0	1	8	7	6-SHEET COMPOSITE KEYED FOR 3 SPECIES
ORPI	GEN VEG TYPES, H2O	11		3		2	0	0	1	8	7	FROM ENVIRON ASSESS MASTER PLAN, MAR 1975
ORPI	GEOLOGY	32		3	95	3	1	0	1	8	7	ONLY EXTREME WESTERN PORTION OF MONUMENT
ORPI	PRIN MINES & PROSPEC	7		3		2	0	0	1	8	7	FROM ENVIRON ASSESS MASTER PLAN, MAR 1975
ORPI	SOIL MAP INDEX			3	95	2	0	0	1	8	7	ONLY INDEX IS DIGITIZED
ORPI	SOIL MAPS	23		3	95	2	1	0	1	8	7	28 SOIL SHEET MAPS OF ENTIRE PARK
ORPI	VEGETATION	62		3		2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62		3		2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62		3		2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62		3		2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62		3		2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981

PARK CODE	MAP THEME	NO. CLS	MIN MAP UNIT	FLD CHK	ACC %	COMP	MAP FORM	DATA STRU	REP	BACK UP COPY	USE-FUL-NESS	COMMENTS
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/ TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	37	3		0	2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/ TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/US, 1981
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	VEGETATION	62	3			2	0	0	1	8	7	IN CONJUNCTION W/TECH REP, WARREN-NPS/UA, 1981
ORPI	WATER DEVELOPMENT	6	3			2	1	0	1	8	7	
PEFO	GEOLOGY	22	1	1	80	1	2	3	1	1	4	GOOD MAP; GEOLOGISTS HAVE TECHNICAL DIFFICULTIES
PEFO	SOILS	91	1	1	50	1	1	3	1	6	4	PUBLISHED COPY, PARK WOULD LIKE BETTER MAP
PEFO	VEGETATION	28	1	1	90	2	2	3	1	8	3	BACKUP MAY BE AT UNIVERSITY OF ARIZONA, UNSURE
PINN	EXOTIC PLANT DISTRIB	2	2			3	1	2	1	8	7	
PINN	GEOLOGY		3			0	0	0	6	8	7	GET INFO FROM DISTRICT RANGER?
PINN	GEOLOGY	13	1	3		3	1	3	1	5	3	COVERS 60% OF PARK. ALSO SHOWS 2 GEOL X-SECTIONS
PINN	MONITORING SITES		2			3	1	0	1	8	7	MONITORING SITES FOR MAMMALS, BIRDS, PLANTS
PINN	SOILS	5	5	3		1	1	3	1	6	7	USDA SCS MAP FOR SAN BENITO CO.
PINN	VEGETATION	18	1	1		2	2	3	1	4	4	HALVORSON - DESCRIPTION OF 5 MAJOR TYPES
PORE	GEOLOGY	9	5	3		1	1	0	1	8	7	ROCK TYPES OVERLAIN ON SERIES OF 1:24000 TOPOS
PORE	GEOLOGY		3			0	0	0	6	8	7	PUBL ON REGIONAL GEOLOGY
PORE	RARE PLANTS	25	0	3		2	1	0	1	8	7	GENERAL LOCATION MAP OF 25 RARE PLANT SPP AT PORE
PORE	RARE PLANTS		1	1	1	3	2	0	1	1	3	OTHER SOURCES ALSO - VOLUNTEERS, SEASONALS, RM
PORE	SENSITIVE AREAS	7	3			2	1	0	1	8	7	COMPILATION OF DATA FROM VARIOUS SOURCES
PORE	SOIL AND CAPABILITY	15	1	3		3	1	0	1	8	7	"MARIN COUNTY." ONE OF A SERIES COVERING STATE.
PORE	TIMBER / LOGGING HIS	15	1	3		3	1	0	1	8	7	DOUGLAS FIR ON BOLEMA PALISADES INC. PROPERTY
PORE	VEG - PIERCE PT.		3			3	0	0	6	8	2	TECHNICAL REPORT - 3000 ACRES
PORE	VEGETATION	15	10	3		2	1	0	1	8	7	SERIES OF MAPS COVERING PORE
PORE	VEGETATION	18	50	3		2	1	0	1	8	7	"GENERAL ECOSYSTEMS", INCLUDING BEACH, CLIFF, LAKE
PUHE	TOPOGRAPHIC	8	1	2	85	2	1	2	1	8	2	
PUHE	VEGETATION	5	1	2	85	3	1	3	1	6	2	MAP IN TECH REPORT #15, 1977
PUHO	VEGETATION	26	1	2	85	2	1	3	1	5	2	MAP LOCATED IN TECH REPORT #56
REDW	BOUNDARY / TIMBER	49	8	3	0	1	1	0	1	8	3	1 OF 2 MAPS COVERING ENTIRE REDWOOD NATIONAL PARK
REDW	EROSION, SEDIMENTATI	0	0	1	2	3	0	0	1	8	3	REDWOOD NATIONAL PARK TECH REPORT 8
REDW	FOREST CLASSIFICATIO	50	0	1	0	2	1	0	1	8	2	PROPOSED PARK AS OF 1966
REDW	GEOLOGY	14	0	1	0	3	1	0	1	6	3	HARDEN, KELSEY, MORRISON, AND STEPHENS
REDW	GEOLOGY	41	0	1	0	1	1	0	1	6	3	"WEED SHEET"
REDW	GEOLOGY / BEDROCK	11	0	3	0	2	1	0	1	4	3	RESOURCE MAPS SUPPL. TO ENVIRONMENTAL STATEM./GMP
REDW	GEOMORPH/STREAM PROC	0	0	1	2	3	0	0	1	8	3	REDWOOD NATIONAL PARK TECH REPORT 13
REDW	LAND USE	29	0	3	0	3	0	0	1	8	3	SEPARATE MAPS COVERING AREA BY TOWNSHIP. TECH RPT9
REDW	SOIL-VEGETATION	85	0	1	0	1	2	0	1	6	3	CAL DIV OF FORESTRY SOIL-VEG MAPS. SERIES OF 21
REDW	SOILS	5	0	3	0	2	1	0	1	4	3	RESOURCE MAPS SUPPL. TO ENVIRONMENTAL STATEM./GMP
REDW	SOILS	2	0	1	1	3	2	0	1	8	3	1988 ON. BASED ON 1:6000, FINAL 1:12000. SEE
REDW	TIMBER STAND MAP	49	8	1	0	3	1	0	1	8	3	FOR PROPOSED REDWOOD NATIONAL PARK
REDW	TIMBER STAND MAP	4	8	3	0	3	1	0	1	8	5	USES USFWS WETLAND DESIGNATIONS
REDW	TIMBER STAND MAP	33	8	3	0	3	1	0	1	8	3	COVERS REDW EXPANSION
REDW	VEG - COASTAL	7	2	1	2	3	2	0	1	8	4	
REDW	VEG - LITTLE BALD HI	4	2	1	1	2	1	0	1	8	3	
REDW	VEG - OAK WOODLAND	4	2	1	1	2	4	1	1	8	3	
REDW	VEGETATION	16	3	1	5	2	2	0	1	3	3	1983-84. SET OF 7. 15 VEG TYPES + BARE GROUND
REDW	VEGETATION TYPE	16	0	1	0	2	1	0	1	8	3	4 MAPS- ORICK, KLAMATH, JED SMITH, DEL NORTE UNITS
REDW	VEGETATION TYPE	16	0	1	0	2	1	0	1	8	3	INCL FIRE MGMT & PARK BOUND. REDWOOD & PRAIRIE CR
SAGU	FISSURE PATTERN	3	3			3	1	0	1	8	1	TANQUE VERDE RIDGE, WESTERN SLOPE OF RINCON DIST
SAGU	GENERAL DRASTIC MAP	6	3			1	1	0	1	6	1	INCLUDES TUCSON DISTRICT ONLY
SAGU	GEOLOGIC MAP	8	3			3	1	0	1	8	1	SHOWS ONLY WERTERN PARK OF RINCON DISTRICT
SAGU	GEOLOGIC MAP	6	3			3	1	0	1	8	1	WEST SLOPE OF RINCON MTN
SAGU	NAT RES OVERLAYS		3			1	2	0	1	6	4	OUTSIDE SAGU; PRELIMINARY PART OF BUFFER STUDY
SAGU	VEGETATION MAP	16	3		90	3	1	0	1	8	1	DOES NOT INCLUDE 1967 ADDITION OF TUCSON DISTRICT
SAGU	VEGETATION MAP	15	2			3	1	0	1	8	1	SHOWS TUCSON DISTRICT
SAGU	VEGETATION TYPE	26	3			3	2	0	1	8	1	SHOWS RINCON DISTRICT ONLY
SAGU	VEGETATION TYPES	11	3			3	1	0	1	8	1	TUCSON DISTRICT
SAGU	VEGETATION TYPES	7	3			3	1	0	1	8	1	RINCON DISTRICT

PARK CODE	MAP THEME	NO. CLS	MIN MAP UNIT	FLD CHK	ACC %	COMP	MAP FORM	DATA STRU	REP	BACK UP COPY	USE-FUL-NESS	COMMENTS
SAMO	FAULTS & LANDSLIDES		3			2	1	3	1	8	3	UNKNOWN DATA SOURCES, DATES.
SAMO	GEOLOGY		1			1	1	3	1	5	2	VERY LARGE SCALE MAP.
SAMO	GEOLOGY QUADS		1			3	1	3	1	6	2	ONLY WESTERN EDGE OF TOPANGA AND MALIBU AREAS.
SAMO	LANDSLIDES		1			1	1	3	1	6	2	
SAMO	RARE & ENDAN PLANTS		1	2	95	1	4	2	1	1	3	VERY ACCURATE LOCATION MAP FOR R & E PLANTS.
SAMO	S.E.A. VEGETATION	30	1			3	2	3	1	1	7	
SAMO	SEISMIC RESPONSE		3			1	2	3	1	8	3	UNKNOWN INVESTIGATORS, DATES, DATA SOURCES.
SAMO	SENS PLANT & COMMUN.		1			1	1	3	1	8	4	NEEDS TO BE UPDATED TO REFLECT CURRENT DATA.
SAMO	VARIOUS APPL. MAPS		3			2	4	2	1	1	3	SOILS, GEOL, WLDLFE CORR'S, ETC FOR SPECIFIC SITES
SAMO	VEG & LAND USE	60	1	2	95	1	4	2	1	1	3	GOOD VEG MAP JUST ARRIVED IN PARK.
SAMO	VEGETATION		3			2	2	3	1	6	7	ON USGS QUADS; NO LEGEND; ESRI MAPS.
SAMO	VEGETATION	12	2			2	1	3	1	8	1	MISSING WESTERN QUAD; FROM VEG TYPES OF CA (USFS).
SEKI	GEOLOGY.	120	12	2		1	3	2	1	6	3	FIELDWORK IS CURRENTLY BEING COMPLETED FOR PARK.
SEKI	HISTORIC VEGETATION.	50	1	2		3	1	3	1	3	1	GEO-REFERENCING PROBLEMS BEING WORKED ON NOW.
SEKI	LAND COVER.	139	30	0		1	3	1	1	2	4	THEME WILL REQUIRE LOTS OF CLASSIFICATION EFFORT.
SEKI	SEQUOIA TREE INVENT.		3			0	0	0	1	8	7	SEE TOM STOHLGREN ABOUT THESE.
SEKI	SOILS.	40	1	2	90	3	1	1	1	5	3	
SEKI	VEGETATION.	24	2	2		2	2	3	1	1	4	EACH PARK MAPPED SEPERATELY W/ DIFFERENT SCHEMES.
TONT	PARKING AREA PLANT	17	3			3	1	0	1	2	1	
WACA	GEOLOGIC MAP	4	3			1	1	0	1	8	7	MAP ON WALL IN LUNCH/CONFERENCE ROOM
WHIS	GEOLOGY	26	1	3	0	3	1	3	1	6	7	FRENCH GULCH QUAD. DETAILED GEOLOGY
WHIS	GEOLOGY - MINERALS/M	0	3		0	3	1	3	1	6	7	FRENCH GULCH QUAD. GENERALIZED GEOLOGY - MINERALS
WHIS	LIFE ZONE / COMMUNIT	4	5	3		2	1	3	1	8	7	DSC PLANNING MAP? "OVERLAY FOREST & LAND CLASSIF.
WHIS	SOIL / MOISTURE CONS	6	10	3		2	1	3	1	6	7	PRIORITIES FOR SOIL & MOISTURE CONSERVATION
WHIS	SOILS - GENERAL	40	1	3		2	1	3	1	8	7	APPARENT BASE MAP OF 1:37300 MAP. FILED MISC. MAPS
WHIS	SOILS - GENERAL	40	1	3		1	1	3	1	6	7	FILED UNDER "MISC. MAPS" IN FOLDER FROM USDA/SCS
WHIS	SOILS AND VEGETATION	50	1	3		1	1	3	1	6	7	4 MAPS COVERING WHIS. ACCOMPANIES MALLORY ET AL. 73
WHIS	TIMBER TYPE/LOGGING	16	1	1	0	2	2	3	1	6	7	INCLUDES CODES FOR VEG CLASS, DENSITY, TIMBER SPP.
WHIS	TIMBER TYPE/LOGGING	16	1	1	0	2	1	3	1	6	7	EASEMENT AREA S OF WHISKEYTOWN LAKE (S TO IGO)
WHIS	WOODLAND SUITABILITY	8	5	3		2	1	3	1	6	7	FILED UNDER "MISC. MAPS" IN FOLDER FROM USDA/SCS
YOSE	GEOLOGY	82	500	3		1	0	0	1	6	3	FRESNO SHEET. COPIES IN RESEARCH MUSEUM LIBRARY
YOSE	GEOLOGY	83	500	3		1	0	0	1	6	3	MARIPOSA SHEET. COPIES IN RESEARCH MUSEUM LIBRARY
YOSE	GEOLOGY	22	5	3		3	0	0	1	6	3	CHECK ADDITIONAL USGS GEOLOGY MAPS
YOSE	GEOLOGY	28	1	3		3	0	0	1	6	3	HETCH HETCHY QUAD. COPIES IN RESEARCH MUSEUM LIBRA
YOSE	GEOLOGY	22	5	3		3	0	0	1	6	3	KAISER PEAK QUAD. COPIES IN RESEARCH MUSEUM LIBR
YOSE	GEOLOGY	57	1	3		3	0	0	1	6	3	BODIE QUAD. COPIES IN RESEARCH MUSEUM LIBRARY
YOSE	GEOLOGY	12	1	3		3	0	3	1	6	3	COPIES IN RESEARCH MUSEUM LIBRARY
YOSE	GEOLOGY	0	3			1	0	3	1	6	3	COPIES IN RESEARCH MUSEUM LIBRARY
YOSE	VEG./BLISTER RUST PR	0	3			3	1	3	1	8	1	SECTION BY SECTION MAPS. PROJECT ENDED IN 1969
YOSE	VEG./INSECT CONTROL	0	3			3	1	3	1	8	1	SECTION MAPS. LITTLE INFO OF USE TO THIS PROJECT
YOSE	VEGETATION	29	0	1		2	0	0	1	8	7	
YOSE	VEGETATION	0	3			3	1	3	1	8	2	BOX 4 OF FORESTRY RECORDS.MAY BE VALUABLE FOR COMP
YOSE	VEGETATION	0	0	1		2	0	0	1	8	2	STD NPS VEG MAP (COFFMAN 1934). "1st set 1930-35"
YOSE	VEGETATION / SOILS	55	1	1		3	1	0	1	5	3	VALLEY. INCLUDES SOIL PROFILES. BEING UPDATED

APPENDIX IV. COMPLETE LIST OF IMAGERY INFORMATION

REPORT ON THE IMAGERY OF PARKS IN THE WESTERN REGION

PARK CODE	IMAGERY	DATE YEAR	TYPE	SCALE	COMP	REP	BACK UP COPY	COMMENTS
AMME	AERIAL PHOTO	1987	2	1:10,000	1	9	9	NUMBER 615999 1-15, STEREO IS 1-215
CABR	AERIAL PHOTO	1953	1	1:20000	1	1	7	USDA 1953 PHOTO SERIES.
CABR	AERIAL PHOTO	1981	1	APPROX 1:2000	1	1	1	BLOW-UP OF USGS 9" B/W PHOTO.
CABR	HIGH ALT AERIAL PH.	1982	2	APPROX 1:2000	1	1	5	NEGATIVES AND PRINTS AVAILABLE IN PARK.
CABR	HIGH ALT AERIAL PH.	1982	3	APPROX 1:2000	1	1	1	NEGATIVES AND PRINTS AVAILABLE IN PARK.
CAGR	AERIAL PHOTO	1970	1	1:20000	3	1	9	
CAGR	AERIAL PHOTO	1970	1	1:20000	3	1	9	
CAGR	AERIAL PHOTO	1976	1	UNKNOWN	1	1	9	
CAGR	AERIAL PHOTO	1976	1	UNKNOWN	1	1	9	
CHIR	AERIAL PHOTO	1958	1	1:15840	3	1	9	NO INFO OTHER THAN DATE & SCALE
CHIR	AERIAL PHOTO	1970	1	UNKNOWN	3	1	9	ONLY DATE ON PHOTOS, TWO SETS
CHIR	AERIAL PHOTO	1973	1	UNKNOWN	3	1	9	ONLY HAS DATE
CHIR	AERIAL PHOTO	1976	1	1:12000	3	1	9	NO OTHER INFO
CHIR	AERIAL PHOTO	1979	1	1:2400	3	1	7	COOPER AERIAL SURVEYS
CHIR	SATELLITE	1973	8		1	1	9	INFO????
CHIS	AERIAL PHOTOS		0	VARY...?	0	1	9	8 FILM ROLLS OF AERIAL PHOTOS; SEE NOTES.
CHIS	AERIAL PHOTOS	1988	2	1:12000	3	1	7	SANTA ROSA ISLAND AND SANTA CRUZ ISLAND ONLY.
CHIS	AERIAL PHOTOS.		3	UNKNOWN.	3	1	1	COVERS SCI; NO ADDITIONAL INFORMATION AVAILABLE.
CHIS	AERIAL PHOTOS.	1978	3	1:6000	3	1	7	COVERS SBI, SMI, AND ANACAPA ONLY.
CHIS	AERIAL PHOTOS.	1980	3	1:12000	3	1	7	COVERS SANTA CRUZ ISLAND ONLY.
CHIS	AERIAL PHOTOS.	1980	3	1:13440	3	1	7	EAST END OF SANTA CRUZ ISLAND USED IN VEG MAPPING
CHIS	AERIAL PHOTOS.	1981	3	1:24000	3	1	7	SANTA CRUZ, SANTA ROSA, SAN MIGUEL ISLANDS ONLY.
CHIS	AERIAL PHOTOS.	1983	3	1:12000	2	1	7	
CHIS	AERIAL PHOTOS.	1983	3	1:26000	3	1	7	SANTA CRUZ ISLAND ONLY.
CHIS	AERIAL PHOTOS.	1983	3	1:25350	3	1	7	SANTA BARBARA ISLAND AND ANACAPA ISLAND ONLY.
CHIS	AERIAL PHOTOS.	1988	3	1:12000	3	1	7	SANTA ROSA ISLAND AND SANTA CRUZ ISLAND ONLY.
CHIS	SATELLITE	1988	5	1:1000000 (?)	3	1	5	AVAIL FOR 3 ISLANDS; 30 X 30 M PIXEL; STNDRD SCALE
DEVA	AERIAL PHOTOS	1969	1	1:36000	1	1	4	IN STORAGE; NOT OFTEN USED BY RES MGMT.
DEVA	AERIAL PHOTOS	1976	1	1:24000&1:12000	2	1	9	MINING AREAS ARE 1:12000 WITH SOME IN COLOR.
DEVA	AERIAL PHOTOS	1977	1	1:8000	3	1	8	PHOTOS OF MINING AREAS WITHIN PARK; SOME COLOR.
DEVA	AERIAL PHOTOS	1982	1	1:24000	3	1	9	COVERS NEARLY ALL OF PARK; TWO INDEX MAPS.
DEVA	HIGH ALTITUDE PHOTOS	1983	3	APPROX 1:12000	3	1	5	9 PHOTOS IN PARK; OTHERS AVAIL FROM USGS-EROS.
DEVA	SATELLITE	1976	4	UNKNOWN	1	1	4	NEED TO CHECK WITH TIM COONAN ABOUT THESE.
DEVA	SATELLITE	1988	5	30-METER	1	4	7	WILL BE IN PARK IN APPROX. 6 MOS.
DEVA	SATELLITE		8	1:250000	1	4	7	DIGITAL ELEV MODELS SMALL SCALE; IN PARK IN 6 MOS.
FOBO	AERIAL PHOTOS	1965	1	1:2400	3	1	9	DOES NOT COVER ADDITIONS
GOGA	AERIAL PHOTO	1987	1	1:12000 ENL	0	0	0	ONGOING PROJ AT REDW. ENLARGED TO 1:3600
GRBA	AERIAL PHOTOS	1954	1	UNKNOWN	3	1	8	EXACT LOCATIONS NOT YET DETERMINED; 6 OLD PHOTOS.
GRBA	AERIAL PHOTOS	1972	1	1:125000	0	1	9	JUST ARRIVED; UNKNOWN COVERAGE AND USEFULLNESS.
GRBA	AERIAL PHOTO	1984	2	1:24000 (?)	2	1	0	STANDARD USDA (?) PHOTOS; ONLY SET FOR THE PARK.
GRBA	SATELLITE		3	1:24000	1	4	4	PAPER COPY IN PARK; USED TO DEVELOP VEG MAP.
HALE	AERIAL PHOTO		1	UNKNOWN	1	1	9	M-8 97-126
HALE	AERIAL PHOTO		1	1:16000	1	1	9	M-9 15-76; PUU ULAULA THRO KAUPO GAP
HALE	AERIAL PHOTO		1	1:16000	1	1	9	5 25-32, HOSMER GROVE THRU KOOLAU GAP
HALE	AERIAL PHOTO		1	UNKNOWN	1	1	9	M-8 30-69
HALE	AERIAL PHOTO	1965	1	UNKNOWN	1	1	9	1-27-65; EKN-2CC 3-5,29-32,157-161; 3CC 44-47
HALE	AERIAL PHOTO	1966	1	UNKNOWN	1	1	9	1-7-66; EKN-4CC 17-20
HALE	AERIAL PHOTO	1970	1	1:6600	1	1	9	8-14-70; 3 FLIGHT PATHS; 1 1-4, 2 1-9, 3 1-11
HALE	AERIAL PHOTO	1970	1	1:6600	1	1	9	8-21-70; 5 PATHS; 3-6,4 1-11,5 1-10,6 1-7,7 1-11
HALE	AERIAL PHOTO	1970	1	H=20000	1	1	9	2-19-77; 7 2-7; 7 10-13; 7 23-25; 7 29-34
HALE	AERIAL PHOTO	1976	1	H=25000	1	1	9	12-20-76; 1 PATH; 3 132-136; 157-163; 167-173; 7-32
HALE	AERIAL PHOTO	1977	1	H=22500	1	1	9	1-20-77; 1 FLIGHT PATH; 6 1-6
HALE	AERIAL PHOTO	1978	1	UNKNOWN	1	1	9	1-9-78; 10 100-105,108,113-116,119-123,130-135
HALE	AERIAL PHOTO	1978	1	1"=600'	1	1	7	8-3-78; KALE-KIP; 7 FLIGHT PATHS,28 PHOTOS
HALE	AERIAL PHOTO NEGAT.	1980	1	6"=9300'	1	9	7	KIPAHULU VALLEY; 7915 1-8
HALE	ORTHOPHOTO	1983	1	1:24000	1	1	1	HANA QUAD, 1 OF 6 FOR PARK
HALE	ORTHOPHOTO	1983	1	1:24000	1	1	1	KAUPO QUAD, 2 OF 6 FOR PARK
HALE	ORTHOPHOTO	1983	1	1:24000	1	1	1	KILOHANA QUAD, 3 OF 6 FOR PARK
HALE	ORTHOPHOTO	1983	1	1:24000	1	1	1	KIPAHULU QUAD, 4 OF 6 FOR PARK
HALE	ORTHOPHOTO	1983	1	1:24000	1	1	1	LAUILAILUA HILLS QUAD, 5 OF 6 FOR PARK
HALE	ORTHOPHOTO	1983	1	1:24000	1	1	1	NAHIKU QUAD, 6 OF 6 FOR PARK

PARK CODE	IMAGERY	DATE YEAR	TYPE	SCALE	COMP	REP	BACK UP COPY	COMMENTS
HALE	AERIAL PHOTO	1975	2	UNKNOWN	1	1	9	APPENDIX I-A,WAIHOKU VALLEY, VEGETATION DISTRIBUT
HALE	AERIAL PHOTO	1975	2	UNKNOWN	1	1	9	APPENDIX I-B; OHEO GULCH-SEVEN POOLS,VEGETATION DIS
HALE	AERIAL PHOTO	1975	2	UNKNOWN	1	1	9	APPENDIX I-D,CENTRAL PASTURE, 300-800 FT, VEGET.
HALE	AERIAL PHOTO	1975	2	UNKNOWN	1	1	9	APPENDIX I-E; PUU PALIKEA, VEGETATION DISTRIBUTION
HALE	AERIAL PHOTO	1975	2	UNKNOWN	1	1	9	APPENDIX I-F; KUKUI BAY TO OHAI POINT, VEGETATION
HALE	AERIAL PHOTO	1975	2	UNKNOWN	1	1	9	APPENDIX I-G; HWY 31 NEAR SEVEN POOLS, VEGETATION
HALE	AERIAL PHOTO	1975	2	UNKNOWN	1	1	9	APPENDIX I-H; PALIKEA STREAM, VEGETATION DISTRIB.
HALE	AERIAL PHOTO	1978	2	1"=600'	1	1	7	10-17-78; KALE-KIP-01C,02C, KIPAHULU DISTRICT/OHE'O
HALE	AERIAL PHOTO		3	UNKNOWN	1	1	9	
HAVO	AERIAL PHOTO	1943	1	UNKNOWN	3	1	9	LOWER AINAHOU EAST, M994.50-994.58 EVENS
HAVO	AERIAL PHOTO	1943	1	UNKNOWN	3	1	9	NAPAU TO AINAHOU, M994.63-994.71 ODDS
HAVO	AERIAL PHOTO	1943	1	1:1800	3	1	9	APUA TO WAHAULA,PRE-DEVELOPMENT,M994.1-994.13 ODDS
HAVO	AERIAL PHOTO	1943	1	UNKNOWN	3	1	9	KEAUHOU TO KAENA, M994.16-994.22 EVENS
HAVO	AERIAL PHOTO	1943	1	UNKNOWN	3	1	9	LOWER KALAPANA TRAIL, M994.26-994.30 EVENS
HAVO	AERIAL PHOTO	1943	1	UNKNOWN	3	1	9	KAHULEA TO HALAPE, M994.32-994.47
HAVO	AERIAL PHOTO	1945	1	6"=1 MILE	3	1	9	COMPILATION OF 32 PHOTOS OF KILAEUA CRATER AREA
HAVO	AERIAL PHOTO	1945	1	UNKNOWN	1	1	9	MISC. AERIALS OF PARK AREAS, 1945 AND BEFORE
HAVO	AERIAL PHOTO	1964	1	UNKNOWN	3	1	9	NALIIKAKANE POINT TO KIAUEA, EKL 5CC 1-10,ELG 7-9
HAVO	AERIAL PHOTO	1964	1	UNKNOWN	3	1	9	PUNALUU TO MAUNA LOA, EKL 4CC 90-98
HAVO	AERIAL PHOTO	1964	1	UNKNOWN	3	1	9	HAMAKUA, EKL 4CC 119-128
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	1	ENLARGEMENT EKL 10CC 103
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	GLENWOOD SUBDIVISION, EKL 6CC 24-28
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	1	ENLARGEMENT EKL 14CC 72-74
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	1	ENLARGEMENT EKL 7CC 118
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	H-11 TO STAINBACK HWY, EKL 6CC 33-38
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	MAUNA LOA RESERVE TO KALAPANA FOREST,EKL 8CC 55-65
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KALAPANA BOUNDARY TO KEAUHOU RANCH, EKL 10CC 32-37
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	PUU KULUA TO KEAUHOU RANCH, EKL 10CC 43-45
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	MAUNA LOA SUMMIT, EKL 10CC 83-91
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KILAUEA TO NORTH OF KULANI, EKL 10CC 105-117
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KILAUEA TO NORTH OF KULANI, EKL 10CC 140-152
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	H-11 TO OLAA TRACT, EKL 6CC 87-94
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KA'ENA POINT TO GLENWOOD SUBDIV,EKL 12CC 137-147
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KALAPNA TRAIL TO H-11, EKL 12CC 155-161
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KAHUE POINT TO KALAPANA TRAIL, EKL 12CC 160-167
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	APUA POINT TO H-11, EKL 12CC 169-179
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KAPAOO POINT TO KAKAKE, EKL 12CC 197-212
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KAUHU'ULA TO KAPAPALA BOUNDARY, EKL 12CC 216-231
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	NAHULU POINT TO KEAUHOU RANCH, EKL 10CC 70-75
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	PALIMA POINT TO NAPU'UKULUA, EKL 12CC 232-245
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	MAUNA LOA RES TO KALAPANA FOREST,EKL 13CC 150-158
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	PUNALUU TO MAUNA LOA RESERVE, EKL 13CC 161-183
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	NAHULUHU POINT TO KEAUHOU RANCH, EKL 13CC 186-210
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KAPAPALA BOUND TO KEAUHOU RANCH,EKL 14CC 148-154
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	NAHULUHU POINT TO KEAUHOU RANCH,EKL 14CC 172-174
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	NAPU'UKULUA TO PUU KULUA, EKL 14CC 176-183
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KALAIO TO WAIAKEA CAMP, EKL 14CC 186-193,235
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KEAUKAHA, EKL 12CC 72-79
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KALAPANA TO LILEWA CRATER, EKL 12CC 45-51
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KAMAKUNA POINT TO PUU KAUKA, EKL 12CC 91-98
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KA'LAE'APUKI PT TO GLENWOOD SUB,EKL 12CC 100-111
HAVO	AERIAL PHOTO	1965	1	UNKNOWN	3	1	9	KEAHUHOU TO VOLCANOM EKL 12CC 184-195
HAVO	AERIAL PHOTO	1969	1	1:6000	3	1	9	AINAHOU TO DEVIL'S THROAT, 151.96 A1-A8
HAVO	AERIAL PHOTO	1969	1	1:6000	3	1	9	MAKAOPUHI TO AINAHOU, 151.96 B1-B11
HAVO	AERIAL PHOTO	1969	1	1:6000	3	1	9	NEAR MAKAOPUHI-ALAE-AINAHOU, 151.96 C1-C7
HAVO	AERIAL PHOTO	1969	1	1:6000	3	1	9	KALAPANA TRAIL TO MAKAOPUHI, 151.96 D1-D8
HAVO	AERIAL PHOTO	1969	1	1:6000	3	1	9	MAKAOPUHI TO AINAHOU ROAD, 151.96 E1-E14
HAVO	AERIAL PHOTO	1972	1	6"=13100'	3	1	9	PUAHI TO ESCAPE ROAD, 5718 1-2
HAVO	AERIAL PHOTO	1972	1	UNKNOWN	3	1	9	POLIOKEAWE TO COAST, 5812 2-6
HAVO	AERIAL PHOTO	1972	1	UNKNOWN	3	1	9	HALAPE TO KALUA (COASTLINE), 229 1-5
HAVO	AERIAL PHOTO	1972	1	6"=11500'	3	1	9	KAHUE TO MAKAOPUHI, 5810 1-8
HAVO	AERIAL PHOTO	1972	1	6"=11500'	3	1	9	KAENA TO PUAIALUA, 5811 1-8
HAVO	AERIAL PHOTO	1972	1	6"=13100'	3	1	9	POLIOKEAWA TO PAUAHI, 5813 1-4
HAVO	AERIAL PHOTO	1972	1	6"-14000'	3	1	9	DEVIL'S THROAT TO ALAE, 5814 1-3
HAVO	AERIAL PHOTO	1974	1	6"=6600'	3	1	9	GREAT CRACK TO HALAPE, 6401 1-23

PARK CODE	IMAGERY	DATE YEAR	TYPE	SCALE	COMP	REP	BACK UP COPY	COMMENTS
HAVO	AERIAL PHOTO	1974	1	6"=7000'	3	1	9	KALAPANA MAUKA STRIP, 6192 1-16
HAVO	AERIAL PHOTO	1974	1	6"=6200'	3	1	9	KALAPANA MIDDLE STRIP, 6193 1-14
HAVO	AERIAL PHOTO	1974	1	6"=6100'	3	1	9	KALAPANA COAST, 6194 1-17
HAVO	AERIAL PHOTO	1974	1	6"=6600'	3	1	9	OPIHINEHE TO GREAT CRACK, 6402 1-11
HAVO	AERIAL PHOTO	1974	1	6"-7900'	3	1	9	PAHALA TO AINAHOU, 6399 1-26
HAVO	AERIAL PHOTO	1974	1	6"=7200'	3	1	9	POLIOKEAWA TO PAHALA, 6400 1-31
HAVO	AERIAL PHOTO	1975	1	6"=14800'	3	1	9	HALEMAUMAU TO KAMAKAIA HILLS KA'U DESERT, 6536 1-8
HAVO	AERIAL PHOTO	1975	1	6"=18000'	3	1	9	MAUNA LOA SUMMIT, 6680 1-15
HAVO	AERIAL PHOTO	1975	1	6"=18000'	3	1	9	MAUNA LOA SUMMIT, 6683 1-25
HAVO	AERIAL PHOTOS	1975	1	1:5000	1	9	8	12-18-75; 12 FLIGHT PATHS, R8-75HA-151 SERIES
HAVO	AERIAL PHOTO	1975	1	6"=18000'	3	1	9	MAUNA LOA SUMMIT, 6682 1-22
HAVO	AERIAL PHOTO	1975	1	1"=500'	3	1	9	KAONE TO BEYOND KA'U BOUNDARY, UAG 271 3-1 TO 3-49
HAVO	AERIAL PHOTO	1976	1	UNKNOWN	3	1	9	GS-VEEC 2 24-32, ENLARGEMENT OF 2-31
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 7 180-186
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 7 193-201, ENLARGEMENT OF 7-200
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 8 26-34
HAVO	ORTHOPHOTO	1977	1	1:24000	3	1	1	PAHALA QUADRANGLE, MAP# 67, 4 COPIES
HAVO	ORTHOPHOTO	1977	1	1:24000	3	1	1	NALIIKAKANI POINT, MAP# 68
HAVO	ORTHOPHOTO	1977	1	1:24000	3	1	1	KALALUA QUADRANGLE, MAP# 53, 4 COPIES
HAVO	ORTHOPHOTO	1977	1	1:24000	3	1	1	WOOD VALLEY QUADRANGLE, MAP# 59, 6 COPIES
HAVO	ORTHOPHOTO	1977	1	1:24000	3	1	1	KOKOOLAU QUADRANGLE, 5 COPIES
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 4 175-180, ENLARGEMENT OF 4-178
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 6 83-88, ENLARGEMENT OF 6-86
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 6 91-95
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	BY BOONE MORRISON, 77 A-M
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 6 147-151
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 7 110-117
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 7 119-128, ENLARGED COPY OF 7-126,122,127
HAVO	AERIAL PHOTO	1977	1	UNKNOWN	3	1	9	GS-VEEC 7 153-164, ENLARGEMENT OF 7-163
HAVO	AERIAL PHOTO	1978	1	UNKNOWN	3	1	9	HALAPE TO APUA POINT, 78K-N
HAVO	ORTHOPHOTO	1982	1	1:24000	3	1	1	KALAPANA QUADRANGLE
HAVO	AERIAL PHOTO	1977	2	UNKNOWN	3	1	9	BY BOONE MORRISON, 77 O-Z
HAVO	AERIAL PHOTO	1978	2	UNKNOWN	3	1	9	BY BOONE MORRISON, 78 A-J
HAVO	OBLIQUE AERIALS	1979	2	UNKNOWN	3	1	9	BY GREG VAUGHN, 40 PHOTOS THROUGHOUT PARK
HAVO	NASA PHOTO		3	UNKNOWN	1	1	9	KEAUHOU TO KAU COAST, E3001-3009
HAVO	NASA PHOTO		3	UNKNOWN	1	1	9	OLAA TO APUA POINT, B3076, C3011-3016
HAVO	NASA PHOTO		3	UNKNOWN	1	1	9	KEAUHOU TO HALAPE, D3043-3052, ENLARGEMENT 3049
HAVO	NASA PHOTO		3	UNKNOWN	1	1	9	MAUNA LOA SUMMIT, G3119-3120
HAVO	NASA PHOTO		3	UNKNOWN	1	1	9	MAUNA LOA SUMMIT, EAST SLOPE, F3086-3087
HAVO	ORTHOPHOTO	1977	8	1:24000	3	1	1	KILAUEA CRATER QUADRANGLE
HAVO	ORTHOPHOTO	1977	8	1:24000	3	1	1	PUU MAKAALA QUADRANGLE
HAVO	ORTHOPHOTO	1977	8	1:24000	3	1	1	KULANI QUADRANGLE
HAVO	ORTHOPHOTO	1977	8	1:24000	3	1	1	KIPUKA PAKEKAKE QUADRANGLE
HAVO	ORTHOPHOTO	1977	8	1:24000	3	1	1	KAU DESERT QUADRANGLE
HAVO	ORTHOPHOTO	1977	8	1:24000	3	1	1	VOLCANO QUADRANGLE
JOMU	AERIAL PHOTO	1988	0	1:12000	1	7	0	TYPE? OTHER AGENCY. COPIES NOT PRESENT AT PARK
JOMU	AERIAL PHOTO	1939	1	?	1	7	0	OTHER AGENCY. COPIES NOT PRESENT AT PARK
JOMU	AERIAL PHOTO	1986	1	?	1	7	0	OTHER AGENCY. COPIES NOT PRESENT AT PARK
JOTR	AERIAL PHOTOS	1970	1	1:12000	1	1	8	
JOTR	AERIAL PHOTOS	1985	2	UNKNOWN	3	1	1	PRINTS AND NEGATIVES; COXCOMB MTNS.
JOTR	AERIAL PHOTO (XEROX)	1985	2	1:3000	3	1	4	ROAD CORRIDOR COVERS APPROX 500 ACRES. KEYS VIEW.
JOTR	AERIAL PHOTOS	1985	2	UNKNOWN.	3	1	1	PRINTS AND NEGATIVES; OASIS OF MARA.
JOTR	AERIAL PHOTOS	1990	2	1:9600	3	1	1	25000 ACRES FOR HAZARD FUELS MAPPING; COMP 1991.
JOTR	ORTHO PHOTOS	1975	8	1:24000	3	1	1	COVERS SOME REGIONS OF PARK; USED BY RANGERS.
KAHO	AERIAL PHOTO	1965	1	UNKNOWN	1	9	9	EKL-7CC-112; TAKEN:1-17-65, BEFORE HARBOR
KAHO	AERIAL PHOTOS	1980	1	UNKNOWN	1	9	9	7798 23-26
KAHO	AERIAL PHOTO SERIES	1987	1	1"=1000',1"=600	1	9	1	LISTED IN KAHO PHOTO LOG AT PAAR
KAHO	ASH	1987	1	1"=400'	1	9	1	SERIES OF 3 PHOTOS
KAHO	ASH	1987	1	1"=50'	2	9	1	ENLARGEMENT OF AIOPIO FISHTRAP AREA
KAHO	ASH	1988	1	1"=1000"	1	9	1	SERIES OF 5 PHOTOS, ALSO 1 AT 1"=600' OF PARK
KAHO	AERIAL PHOTO SERIES	1988	1	NOT LISTED	2	9	1	PHOTOS TAKEN 2-18-88, NEGATIVE SET BH88-1-88
KAHO	SLIDES	1990	2	NONE	2	9	8	SLIDES HAVE BEEN TAKEN PERIODICALLY FROM 1971-1990
KAHO	ASH	1988	3	1"=500'	1	9	1	SERIES OF 6 IR PHOTOS
KAHO	ASH	1988	3	1"=1000'	1	9	1	SERIES OF 7 IR PHOTOS, ALSO 18X18" PANELS 1"=250'
KALA	ORTHOPHOTO	1967	1	1:24,000	1	1	9	KANAKAKAI QUAD MAP

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KALA	ORTHOPHOTO	1968	1	1:24,000	1	1	9	KAMALO QUAD MAP
KALA	AERIAL PHOTO	1975	1	1"=500'	1	9	9	MAY 25, 1-105 THRU 1-143
KALA	AERIAL PHOTO	1975	1	1"=500'	1	9	9	MAY 25, 1-105 THRU 1-143, ENLARGEMENT OF 1-121
KALA	AERIAL PHOTO	1977	1	1"=120'	1	9	9	SETTLEMENT, ROADS, MAJOR BUILDINGS, WALLS: KALA04
KALA	AERIAL PHOTOGRAPHY	1977	1	12:12	1	9	9	SERIES OF 24 PHOTOS, USGS
KALA	AERIAL PHOTO	1983	1	UNKNOWN	1	9	9	JUNE 27, 6 FLIGHT PATHS
KALA	AERIAL PHOTO	1990	1	1"=500'	1	9	9	MAY 28, 6 FLIGHT PATHS (B/W)
KALA	AERIAL PHOTO	1990	1	1"=500'	1	9	9	B/W, IR, PENNINSULA ONLY
KALA	AERIAL PHOTO	1982	2	1"=2000'	1	9	9	SERIES OF 7 PHOTOS, 1-62 THRU 1-68
KALA	AERIAL PHOTO	1983	2	UNKNOWN	1	9	9	JULY 1, 7 FLIGHT PATHS
KALA	AERIAL PHOTO	1990	3	1"=500'	1	9	9	MAY 29, 6 FLIGHT PATHS (COLOR IR)
LABE	AIR PHOTO		1	ca. 1:7900	3	1	9	NW CORNER "BIGHORN SHEEP AREA". FILED AERIAL PHOTO
LABE	AIR PHOTO	1944	1	ca. 1:22,000	2	1	9	NO INDEX. INCOMPLETE SET. E LINE FLOWN ON 9-8-46
LABE	AIR PHOTO	1964	1	ca. 1:7700	3	1	9	LARGE SCALE / PETROGLYPHS AREA. FILED AERIAL PHOTO
LABE	AIR PHOTO	1972	1	ca. 1:63,000	2	1	9	MISSING PART OF NE CORNER. INCL. PETROGLYPHS AREA
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TIMBER MTN NW ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MT. DOME SW ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MT. DOME NE ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TULELAKE SE ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MEDICINE LAKE NW ORTHOPHOTO QUAD. FILE AERIAL PHOT
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TULELAKE SW ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MEDICINE LAKE NE ORTHOPHOTO QUAD. FILE AERIAL PHOT
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MEDICINE LAKE SE ORTHOPHOTO QUAD. FILE AERIAL PHOT
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MEDICINE LAKE SW ORTHOPHOTO QUAD. FILE AERIAL PHOT
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MT. DOME NW ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TULELAKE NW ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	MT. DOME SE ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TIMBER MTN SW ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TULELAKE NE ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TIMBER MTN NE ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1975	1	1:24,000	3	1	5	TIMBER MTN SE ORTHOPHOTO QUAD. FILED AERIAL PHOTO
LABE	AIR PHOTO	1974	2	1:15600	2	1	9	NOMINAL SCALE 1"=1300 FT. 2 COPIES OF MOST OF SET
LABE	AIR PHOTO		3	ca. 1:120,000	1	1	9	NO DATE (POSS. 1981)
LABE	AIR PHOTO	1978	3	1:124,333	1	1	9	NASA/EROS DATA CENTER. S HALF PURCHASED, NOT FOUND
LAME	AERIAL PHOTOS.		1	1:2400	3	1	1	COVERS ONLY DEVELOPED AREAS; VARIOUS DATES.
LAME	AERIAL PHOTOS	1970	1	1:30000 (?)	3	1	4	NEED RECENT PHOTOS AT LARGER SCALE. NEED COLOR.
LAME	AERIAL PHOTO.	1982	1	1:5000	3	1	9	COVERS ONLY NORTH SHORE ROAD FOR ILLEGAL ORV USE.
LAME	AERIAL PHOTOS.	1979	2	1:6000 (?)	3	1	9	USEFUL, BUT ONLY COVER LAKESHORES.
LAME	SATELLITE USGS EROS	1976	3	UNKNOWN.	3	1	8	ATTEMPTS TO DERIVE VEG/GEOL UNSUCCESSFUL.
LAVO	360 PANORAMA	1934	1	GROUND LEVEL	3	1	9	TURNER MTN FIRE LOOKOUT PHOTO. POSS. REFERENCE USE
LAVO	360 PANORAMA	1934	1	GROUND LEVEL	3	1	9	MT LASSEN FIRE LOOKOUT PHOTO. POSS. REFERENCE USE
LAVO	360 PANORAMA	1936	1	GROUND LEVEL	3	1	9	LATOUR BUTTE FIRE LOOKOUT. POSS. REFERENCE USE
LAVO	360 PANORAMA	1936	1	GROUND LEVEL	3	1	9	WEST PROSPECT FIRE LOOKOUT. POSS. REFERENCE USE
LAVO	360 PANORAMA	1936	1	GROUND LEVEL	3	1	9	BROKEOFF MTN FIRE LOOKOUT. POSS. REFERENCE USE
LAVO	AERIAL PHOTOS	1941	1	1:18000	1	1	8	NO SCALE ON PHOTOS. EST SCALE 1:17500 OR 1:19500
LAVO	AERIAL PHOTOS	1952	1	1:20000	1	1	8	NO SCALE ON PHOTOS. EST. SCALE 1:20000 OR 1:21000
LAVO	AIR PHOTOS	1954	1	ca.1:19000	3	1	9	COVERS W SIDE OF PARK, INCL. SNAG & JUNIPER LAKE
LAVO	AIR PHOTOS	1956	1	1:15000	3	1	9	USFS. MOSTLY NON-LAVO. SOME COVERAGE OF SW PART
LAVO	AERIAL PHOTOS	1966	1	1:15840	1	1	8	
LAVO	AIR PHOTOS	1968	1	ca. 1:6000	3	1	9	LAKE HELEN / EMERALD LAKE AREA
LAVO	AIR PHOTOS	1970	1	1:4800	3	1	9	MANZANITA LAKE AREA. HAMMON, JENSEN, & WALLEN
LAVO	AIR PHOTOS	1974	1	1:13000	3	1	9	EDGE OF MANZANITA LAKE AREA. MOSTLY USFS LAND
LAVO	AIR PHOTOS	1978	1	ca. 1:11000	3	1	9	SULPHUR WORKS / SKI AREA
LAVO	AIR PHOTOS	1978	1	1:9600	3	1	9	OBLIQUE. MANZANITA LAKE / BLUFF FALLS CAMPGROUND
LAVO	AIR PHOTO	1979	1	1:30,000	2	1	9	V7 9SRW, 26 JUL 79. MISSES STRIP OF N SIDE OF PARK
LAVO	AIR PHOTOS	1981	1	ca. 1:24000	3	1	9	TOWN OF MINERAL
LAVO	AERIAL PHOTOS	1973	2	1:15840	1	1	1	
LAVO	AIR PHOTOS	1978	2	1:9600	3	1	9	SULFUR WORKS / SKI AREA. GENGE AERIAL SURVEY
LAVO	AERIAL PHOTOS	1988	3	1:20000	3	1	8	ONLY COVERS EASTERN 50% OF PARK
MOCA	AERIAL PHOTOS	1946	1		0	0	0	
MOCA	AERIAL PHOTOS	1987	2	1:1600	0	0	0	MOCA AND ENVIRONS
MOCA	AERIAL PHOTOS	1987	2	1:1600	0	0	0	MONTEZUMA WELL AND ENVIRONS
MOCA	AERIAL PHOTOS	1987	2	1:200	0	0	0	ENVIRONS
MOCA	AERIAL PHOTOS	1987	2	1:2400	1	1	9	MONTEZUMA WELL AND ENVIRONS; KENNEY AERIAL MAPPING

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MOCA	AERIAL PHOTOS	1987	2	1:2400	0	0	0	NATURAL COLOR; KEPT IN VC CONFERENCE ROOM
MOCA	AERIAL PHOTOS	1987	2	1:200	0	0	0	MONTEZUMA WELL AND ENVIRONS; 2 SETS OF MOWE(ALL)
MUWO	AIR PHOTOS		2	1:9600?	3	1	8	SCALE NOT GIVEN. AIRCR ELEV 1800. TRANSPARENCIES
NASA	AERIAL PHOTO	1990	3	1:10000	1	7	7	PHOTOS ARE FORTHCOMING, SHOULD BE AT PAAR 12/90
ORPI	AERIAL PHOTO INDEX	1961	1	1:62500	3	1	0	GROWLER PASS, TONOCA, NARIZ MTN #1 & #2
ORPI	AERIAL PHOTOS	1972	1	1:24000	2	1	0	14 SHEET PHOTOS USED FOR TOPO MAPS
ORPI	AERIAL PHOTOS	1976	1	1:24000	3	1	4	WARREN AND STEENBERGH' STUDY ON GRAZING
ORPI	AERIAL PHOTOS	1979	1	UNKNOWN	3	1	0	SHOWS NORTH BOUNDARY
ORPI	AERIAL PHOTOS	1979	1	1:30000	0	1	0	UNSURE OF COMPREHENSIVENESS
ORPI	AERIAL PHOTO	1984	1	1:300	3	1	0	
ORPI	AERIAL PHOTO	1984	1	1:500	3	1	0	
ORPI	AERIAL PHOTO	1984	1	1:300	3	1	0	
ORPI	AERIAL PHOTO	1984	1	1:160	3	1	0	
ORPI	AERIAL	1984	1	1:300	3	1	0	EROSION-EAST OF HDQTR & 85
ORPI	AERIAL PHOTOS	1988	1	1:5000	0	1	0	UNSURE OF COMPREHESIVENESS
ORPI	AERIAL PHOTO	1983	2	1:100	3	1	0	ONLY QUITOBAQUITO
ORPI	AERIAL PHOTO	1984	2	1:300	3	1	0	
ORPI	AERIAL PHOTO	1984	2	1:160	3	1	0	
ORPI	AERIAL PHOTOS	1979	3	1:25000	1	1	9	ONLY SHOWS SOUTH BOUNDARY AND THEN SOME
ORPI	AERIAL PHOTOS	1980	3	1:58000	3	1	0	PHOTO DATES RANGE FROM '80 TO 84'
ORPI	AERIAL PHOTO	1984	3	1:500	3	1	0	ONLY QUITOBAQUITO
PEFO	AERIAL PHOTOS	1954	1	1:54000	1	1	7	
PEFO	AERIAL PHOTOS	1956	1	1:54000	1	1	7	BT LITTLE CO RIVER
PEFO	AERIAL PHOTOS	1973	1	1:24000	1	1	7	STATE OF ARIZONA OTRHOPHOTOQUADS; SCAT CENTRAL 30%
PEFO	AERIAL PHOTOS	1979	1	?	1	1	7	SR SMOKEY FOOD SERIES 1 & 2
PEFO	AERIAL PHOTOS	1986	1	?	1	1	7	COOPER AERIAL SURVEY
PEFO	SATELLITE	1971	2	?	1	1	7	COVERS 75% OF PARK, EXCEPT NW & ENVIRONS 30MI S
PEFO	AERIAL PHOTOS	1976	2	?	1	1	7	OFFICE OF ARID LAND STUDIES; 80% ENTIRE PARK
PINN	AERIAL PHOTO	1959	1	1:20,000	2	1	9	24"X24" ENLARGEMENTS ALSO ON FILE
PINN	AERIAL PHOTO	1979	1	?? CHK YEAR	2	1	8	#s 06069-379 158R TO 163R & 06069-379 158L TO 164L
PINN	AERIAL PHOTO	1983	3	1:12,000	2	1	9	8-16-83
PORE	AERIAL PHOTO	1952	1	1:20000?	0	1	0	9/11-12/52 PART OF 1952-53 SERIES. (SEE FOLLOWING)
PORE	AERIAL PHOTO	1952	1	1:20000?	0	1	0	11/20/52 PART OF SERIES OF 1952-53. (SEE FOLLOWING
PORE	AERIAL PHOTO	1952	1	1:20000	0	1	0	8/16/52 PART OF SERIES OF 1952-53. (SEE FOLLOWING)
PORE	AERIAL PHOTO	1953	1	1:20000?	0	1	0	3/4/53. PART OF SERIES OF 1952-53. (SEE FOLLOWING)
PORE	AERIAL PHOTO	1953	1	1:20000?	0	1	0	3/22/53 PART OF SERIES OF 1952-53. (SEE FOLLOWING)
PORE	AERIAL PHOTO	1953	1	1:20000?	0	1	0	6/14/53 PART OF SERIES OF 1952-53. (SEE FOLLOWING)
PORE	AERIAL PHOTO	1963	1	1:60000?	0	1	0	8/14/63 & 9/24/63. INCOMPLETE SET?
PORE	AERIAL PHOTO	1965	1	1:12000	0	1	0	6/26/65. INCOMPLETE SET? PRIMARILY COASTLINE AREAS
PORE	AERIAL PHOTO	1965	1	1:12000	0	1	0	7/27/65. INCOMPLETE SET? DIFF. COVERAGE FROM PREC.
PORE	AERIAL PHOTO	1974	2	1:20000	0	1	0	6/6-7/74. SELECTED AIR PHOTOS PULLED FOR FIRE MGMT
PORE	AERIAL PHOTO	1984	3	1:12000	2	1	5	
PUHE	AERIAL PHOTO	1974	1	1"=200'	1	1	7	NPS-PUU-HE-1-1 THROUGH 1-6,2-1 THROUGH 2-5
PUHE	AERIAL PHOTO	1983	1	1"=200'	1	9	1	ONLY PHOTOGRAPHY OF PARK
PUHE	AERIAL PHOTO	1974	3	ALT 3550	1	1	9	NHS-PUU-HE-2-1 THROUGH 2-5
PUHE	AERIAL PHOTO	1974	3	1"=200'	1	1	9	NHS-PUU-HE-1-1 THOUGH 1-6
PUHO	AERIAL PHOTO	1982	2	1"=200'	1	9	9	ONLY IMAGERY FOR PARK
REDW	AIR PHOTOS	1936	1	1:24,000	3	1	9	75% OF PARK (PRIMARILY S). COPY, STEVE VEIRS FILES
REDW	AERIAL PHOTOS	1936	1	1:30000	3	1	0	SOUTH AREA
REDW	AERIAL PHOTOS	1954	1	1:20000	3	1	0	CENTRAL COAST. USDA, HUMBOLDT CO
REDW	AERIAL PHOTOS	1954	1	1:20000	3	1	0	UPPER REDWOOD CREEK. USDA, HUMBOLDT CO
REDW	AERIAL PHOTOS	1954	1	1:20000	3	1	0	LOWER REDWOOD CREEK. USDA, HUMBOLDT CO
REDW	AERIAL PHOTOS	1954	1	1:20000	3	1	0	SOUTH AREA. USDA, HUMBOLDT CO
REDW	AERIAL PHOTOS	1958	1	1:12000	3	1	0	ENTIRE REDWOOD CREEK. HUMBOLDT CO TIMBER ASSESSOR
REDW	AERIAL PHOTOS	1962	1	1:12000	3	1	0	SOUTH AREA. HUMBOLDT CO ASSESSOR
REDW	AERIAL PHOTO	1965	1	1:20000	0	1	7	USDA, AGRIC STABILIZATION & CONSERVATION SERVICE
REDW	AERIAL PHOTOS	1966	1	1:15000	2	1	0	ENTIRE PARK. HAMMON, JENSEN, WALLEN
REDW	AERIAL PHOTO	1966	1	1:12500	3	1	7	HUMBOLDT CO TIMBER ASSESSOR. ENTIRE PARK COVERED?
REDW	AERIAL PHOTOS	1968	1	1:15000	2	1	0	ENTIRE PARK. HAMMON, JENSEN, WALLEN
REDW	AERIAL PHOTOS	1970	1	1:12000	3	1	0	1970-71. SOUTH AREA
REDW	AERIAL PHOTO	1970	1	1:12500	3	1	7	HUMBOLDT CO TIMBER ASSESSOR. ENTIRE PARK COVERED?
REDW	AERIAL PHOTOS	1972	1	VARIES	3	1	0	CC - BLUE LAKE. SM AREAS (VALLEYS)
REDW	AERIAL PHOTOS	1972	1	1:5000	3	1	0	SOUTH AREA
REDW	AERIAL PHOTOS	1973	1	1:12000	3	1	0	SOUTH AREA
REDW	AERIAL PHOTOS	1974	1	1:10000	3	1	0	SOUTH AREA. AIR SURVEYS WEST, FORTUNA

PARK CODE	IMAGERY	DATE YEAR	TYPE	SCALE	COMP	REP	BACK UP COPY	COMMENTS
REDW	AERIAL PHOTOS	1975	1	1:10000	3	1	0	SOUTH AREA. AIR SURVEYS WEST, FORTUNA
REDW	AIR PHOTOS / NASA	1975	1	1:32,500	3	1	7	REDWOOD CREEK WATERSHED. COPY, STEVE VEIRS FILES
REDW	AERIAL PHOTOS	1975	1	1:10000	3	1	0	NORTH AREA. AIR SURVEYS WEST, FORTUNA
REDW	AERIAL PHOTOS	1976	1	1:10000	3	1	0	SOUTH AREA. AIR SURVEYS WEST, FORTUNA
REDW	AERIAL PHOTOS	1977	1	1:5000	3	1	0	1977-78. COASTAL AREA. AERIAL MAPPING CO., OREGON
REDW	AERIAL PHOTOS	1977	1	1:5000	3	1	0	1977-78. SOUTH AREA. AERIAL MAPPING CO., OREGON
REDW	PHOTO POINT	1978	1	ON GROUND	0	0	0	
REDW	AERIAL PHOTOS	1978	1	1:12000	3	1	0	SOUTH AREA OF PARK
REDW	AIR PHOTOS-NASA/EROS	1978	1	1:35,000	3	1	5	REDWOOD CREEK WATERSHED. COPY IN STEVE VEIRS FILES
REDW	AERIAL PHOTOS	1978	1	1:12000	3	1	0	SOUTH AREA OF PARK. CONTRACTOR AIR PHOTO INC.
REDW	AERIAL PHOTOS	1978	1	1:6000	3	1	0	2X ENLARGEMENTS. SOUTH AREA OF PARK. AIR PHOTO INC
REDW	AERIAL PHOTOS	1981	1	1:1000	3	1	0	HUMBOLDT & DEL NORTE CO. CHICKERING-GREENE, EUGENE
REDW	AERIAL PHOTOS	1982	1	1:1200 & 1:6000	3	1	0	FRESHWATER LAGOON
REDW	AERIAL PHOTOS	1984	1	1:31680	2	1	0	MAY COVER AREA OUTSIDE PARK ALSO. WAC CORP., EUGEN
REDW	AERIAL PHOTOS	1988	1	1:6000	3	1	0	BYPASS, DAVIS - CRESCENT CITY
REDW	AIR PHOTOS / NASA	1975	2	1:32,500	3	1	7	REDWOOD CREEK WATERSHED. COPY, STEVE VEIRS FILES
REDW	AIR PHOTOS	1977	2	1:5000	3	1	9	REDWOOD CREEK, LITTLE LOSTMAN CREEK. COPY, S VEIRS
REDW	AIR PHOTOS	1977	2	1:5000	3	1	9	REDWOOD CREEK, LITTLE LOSTMAN CREEK. COPY, S VEIRS
REDW	AERIAL PHOTOS	1978	2	1:6000	3	1	0	SOUTH AREA OF PARK
REDW	AIR PHOTOS-NASA/EROS	1978	2	1:35,000	3	1	5	REDWOOD CREEK WATERSHED. COPY IN STEVE VEIRS FILES
REDW	AERIAL PHOTOS	1978	2	1:6000	3	1	0	NORTH HALF OF REDWOOD CR BASIN
REDW	AERIAL PHOTOS	1978	2	1:6000	3	1	0	SOUTH HALF OF REDWOOD CR BASIN
REDW	AERIAL PHOTOS	1981	2	1:6000	3	1	0	SOUTH AREA OF PARK. CONTRACTOR AIR PHOTO INC.
REDW	AIR PHOTOS / NASA	1975	3	1:32,500	3	1	7	REDWOOD CREEK WATERSHED. COPY, STEVE VEIRS FILES
REDW	AERIAL PHOTOS	1977	3	1:5000	3	1	0	REDWOOD CREEK & LITTLE LOSTMAN CREEK. COPY, VEIRS
REDW	AIR PHOTOS-NASA/EROS	1978	3	1:35,000	3	1	5	REDWOOD CREEK WATERSHED. COPY IN STEVE VEIRS FILES
REDW	AERIAL PHOTOS	1983	3	1:12000	2	1	0	1983-4. EXCL BALD HILLS AREA. MAY COVER AREA OUTS.
SAGU	AERIAL PHOTO	1936	1	UNKNOWN	3	1	9	RINCON MTN DISTRICT
SAGU	AERIAL PHOTO	1954	1	1:40000	3	1	9	RINCON MTN DISTRICT
SAGU	AERIAL PHOTO	1958	1	1:15840	3	1	9	MICA MOUNTAIN ONLY
SAGU	AERIAL PHOTO	1966	1	1:25000	3	1	9	RINCON DISTRICT
SAGU	AERIAL PHOTO	1970	1	1:3000	3	1	9	UNSURE OF PARK INVOLVEMENT; DAMN GOOD PORTION
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	HAPPY VALLEY
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	RINCON PEAK
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	AVRA QUAD
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	BROWN MOUNTAIN QUAD
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	GALLETA FLAT
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	JAYNES QUAD
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	CAT MOUNTAIN QUAD
SAGU	AERIAL PHOTO	1972	1	1:24000	3	1	7	MICA MOUNTAIN AREA
SAGU	AERIAL PHOTO	1982	1	1=400	1	1	7	SHOWS ENTIRE TUCSON AREA, INCLUDES PARK
SAGU	AERIAL PHOTO	1986	1	1=1200	1	1	7	ALL TUCSON DISTRICT; ONLY EXTREME WEST RINCON DIST
SAGU	AERIAL PHOTO	1975	2	1:30000	3	1	9	RINCON DISTRICT ONLY
SAMO	ORTHOPHOTOQUADS	1977	1	1:12000	3	1	5	COVERS SOME QUADS FOR LA COUNTY.
SAMO	AERIAL PHOTOS	1988	2	1:12000	1	1	7	OBTAINED FROM LA & VENTURA COUNTIES.
SAMO	AERIAL PHOTOS	1980	3	1:12000	1	1	1	PRINTS AND TRANSPARENCIES AVAILABLE IN PARK.
SAMO	AERIAL PHOTOS	1984	3	1:24000	1	1	7	USED TO DEVELOP VEGETATION MAP.
SAMO	SATELLITE	1979	5	1:500000	1	1	5	PRINT FOR BANDS 4, 5, & 7 (INFRARED, BULE, GREEN).
SAMO	SATELLITE	1983	5	1:500000	1	4	5	30 X 30 M CELLS; ALL 7 BANDS OF TAPED SCENE.
SAMO	SATELLITE	1985	5	1:500000	1	1	5	30 X 30 M CELLS; ALL 7 BANDS OF DIGITAL SCENE.
SEKI	AERIAL PHOTOS.	1973	1	1:15840	2	1	3	ONLY SET OF COMPREHENSIVE AERIAL PHOTOS AVAIL.
SEKI	ORTHOPHOTOS.	1989	1	1:24000	1	1	5	PHOTO YEARS VARY THROUGHOUT 1980'S.
TONT	AERIAL PHOTOS	1967	1	UNKNOWN	1	1	7	KATHY DAVIS MAY HAVE ANOTHER SET OF PHOTOS
TUZI	AERIAL PHOTOS	1987	2	1:2400	0	1	0	KEPT IN VC CONFERENCE ROOM AT NOCA
TUZI	AERIAL PHOTOS	1987	2	1:200	0	1	0	ENVIRONS
TUZI	AERIAL PHOTOS	1987	2	1:1600	0	1	0	ENVIRONS
WAPA	ORTHOPHOTO	1975	8	1:4800 (1"=400'	1	9	9	ONLY IMAG AT PAAR
WHIS	AIR PHOTO	1980	0	1:24000	2	8	9	CH2M-HILL JOB # R13513.24. INDEX ONLY - NO PHOTOS
WHIS	AIR PHOTO	1952	1	1:6000	1	1	9	PRIOR TO CONSTRUCT. OF DAM. NO INDEX OR OTHER INFO
WHIS	AIR PHOTO	1952	1	1:6000	1	1	9	PRIOR TO CONSTRUCT. OF DAM. NO INDEX OR OTHER INFO
WHIS	AIR PHOTO	1965	1	1:12000	1	1	9	BU REC TRINITY RIVER PROJECT. WITH INDEX
WHIS	AIR PHOTO	1967	1	1:4800	3	1	7	CALIF. DIV. HIGHWAYS. US 299 CORRIDOR THROUGH UNIT
WHIS	AIR PHOTO	1967	1	1:15840	1	8	9	HAMMON, JENSEN & WALLEN.INDEX ONLY,PHOTOS NOT SEEN
WHIS	AIR PHOTO	1973	1	1:15840	2	1	9	CH2M-HILL. INDEX, ENLARGEMENTS, PHOTOMOSAIC
WHIS	AIR PHOTO	1979	1	CA.1:30,000	1	1	9	8 PHOTOS"V7 9SRW 178-2 27JUN79 SENIOR SMOKEY FOUO"

PARK CODE	IMAGERY	DATE YEAR	TYPE	SCALE	COMP	REP	BACK UP COPY	COMMENTS
WHIS	AIR PHOTO	1985	1	1:3000	3	1	7	CALTRANS. US 299 CORRIDOR IN N TIP OF WHIS UNIT
WHIS	AIR PHOTO	1988	2	1:8000	3	1	9	SPEC. AREAS - OAK BOTTOM, JUDGE CARR, TOWER HS,ETC
WHIS	AIR PHOTO	1988	2	1:15840	2	1	9	COMPLETE SET, WITH INDEX. VARA SYSTEMS FOR USFS
YOSE	AIR PHOTOS		1		2	1	8	FULL INFORMATION NOT GATHERED
YOSE	AIR PHOTOS		1		2	1	8	2ND 1970'S FLIGHT. FULL INFORMATION NOT GATHERED
YOSE	AERIAL PHOTO	1982	3		2	1	8	FULL INFORMATION NOT GATHERED

APPENDIX V

NOTES CONCERNING THE LIST OF PARKS WHICH DESIGNATED ENDANGERED, THREATENED AND RARE/SENSITIVE SPECIES

-The text file for each biological group was read, the hard copy of the species lists was examined and any disks brought back were scanned to obtain the following listing. Only lists with species clearly marked were counted as having done threatened and endangered species work. For example, if a park had a bird list with bald eagles listed but did not denote that they were an endangered species, then birds were not included for that park.

-Species that were State or Federally endangered or threatened, or that were category 1 or 2, were counted for the sake of this list.

-Several parks listed hypothetical threatened or endangered species; that is threatened or endangered species whose range includes the park, but there are no actual sightings of the species. These species were not included in the listing. Similarly, if a park definitely had a species, but the presence of the endangered subspecies was uncertain, then that park was not included.

-GOGA and WHIS have lists from the California Native Plant Society, which do not correspond to the Federal and State lists. (GOGA has 23 plants on their list and WHIS has 7 species on their list). GOGA has two other seperate lists, but one is of very limited scope and the other list the CPSU/UCD does not have. There is one other list for WHIS from an environmental assessment.

-The species lists which could not be included in this appendix due to space considerations are all available at the respective parks.

THREATENED, ENDANGERED OR RARE SPECIES FOUND IN 40 PARKS OF THE WESTERN REGION (ALL BIOLOGICAL GROUPS CONSIDERED)

PARK NAME	BIOLOGICAL GROUP	NO. SPP	REFERENCES AND COMMENTS
AMME	BIRDS, ENDNG	2	USFWS (1989) LISTS 2 ENDANGERED SPECIES: MARIANA'S FORM OF THE COMMON MOORHEN, NIGHTINGALE REEDWARBLER
AMME	MAMMALS, T&E	1	USFWS STUDIES, GENERAL MANAGEMENT PLAN 1989. Pteropus smaoensis (FLYING FOX)-CAT 2 SPP
CABR	BIRDS, ENDNG	2	WOODWARD-CLYDE CONSULTANTS, 1981. BOTH ARE ENDANGERED SPP: CA BROWN PELICAN & PEREGRINE FALCON
CABR	REPTILES, SENS	2	WOODWARD-CLYDE CONSULTANTS, 1981. BOTH ARE SPECIES OF CONCERN
CHIR	BIRDS, T&E	15	IN PARK LIST. T&E, CAT 1, CAT 2 SPP.
CHIR	REPTILES, SENS	1	TEXAS HORNED LIZARD, CATEGORY 2 SPP
CHIS	PLANTS, T&E	33	
CHIS	MAMMALS, T&E	16	
CHIS	BIRDS, T&E	10	
CHIS	REPTILES, T&E	2	
CHIS	AMPHIBIANS, T&E	1	
CHIS	TER. INVERTS., T&E	3	
CORO	REPTILES, SENS	3	3 SPP OF RARE RATTLESNAKES.
DEVA	AQUA INVERTS,T&E	3	GEN MGMT PLAN 1988. 3 SPP ARE ENDEMIC, SENS SPP
DEVA	BIRDS, T&E/SENS	1	GEN MGMT PLAN 1988. PEREGRINE FALCON
DEVA	FISH, T&E/SENS	5	GEN MGMT PLAN 1988. 1 ENDANGERED, THE OTHER 4 ARE SENSITIVE SPP
DEVA	MAMMALS, T&E/SENS	6	GEN MGMT PLAN 1988. NONE OF THE 6 ARE TRULY T&E - ALL ARE RARE/SENSITIVE SPP.
DEVA	PLANTS, T&E/SENS	18	HOLLAND AND SCHRAMM 79 (PLANTS) & GEN MGMT PLAN 1988. ONLY 1 T&E SPP, REST ARE CATEGORY 2
DEVA	REPTILES, T&E/SENS	2	GEN MGMT PLAN 1988. DESERT TORTOISE (THREATENED SP), PANAMINT ALLIGATOR LIZARD (PROTECTED SP)

THREATENED, ENDANGERED OR RARE SPECIES FOUND IN 40 PARKS OF THE WESTERN REGION (ALL BIOLOGICAL GROUPS CONSIDERED)

PARK NAME	BIOLOGICAL GROUP	NO. SPP	REFERENCES AND COMMENTS
GOGA	AMPHIBS, T&E/SENS	2	WHITE, 1974. TIGER SALAMANDER, RED-LEGGED FROG CATEGORY 2 SPP
GOGA	BIRDS, T&E/SENS	13	WHITE, 1974. T&E + CATEGORY 2 SPP.
GOGA	MAMMALS, T&E/SENS	4	WHITE, 1974. T&E + CATEGORY 2 SPP.
GOGA	PLANTS, SENS	?	THOMAS, 1986.
GOGA	PLANTS, T&E/SENS	4	WILMA FOLLETTE, MARIN CHAPTER, CNPS ONLY FOR AIR FORCE SITE ON MT TAMALPAIS
GOGA	REPTILES, T&E/SENS	3	WHITE, 1974. T&E + CATEGORY 2 SPP.
GRBA	FISH, T&E	1	CUTTHROAT TROUT, CANDIDATE
GRBA	MAMMAL, T&E	1	BIGHORN SHEEP (ROCKY MT.)
HALE	BIRDS, T&E	12	USFW 1/90 LISTING. 7 ARE TRUE T&E, 5 ARE CATEGORY 2 SPP
HALE	MAMMALS, T&E	1	PARK RECORDS/SIGHTINGS. ENDNG - HAWAIIAN HOARY BAT
HALE	PLANTS, SENS	108	IN HOUSE LIST, RARE/SENSITIVE PLANTS
HALE	REPTILES, T&E	2	NO REFS/RECORDS, JUST SIGHTINGS. 2 SPP: HAWKSBILL (ENDANGERED), GREEN SEA TURTLE (THREATENED)
HALE	TERR. INVERTS	13	NO REFS/RECORDS. MANY NEW SPP W/IN 10 YRS, COULD INCREASE AMOUNT OF RARE/T&E SPP
HAVO	BIRDS, ENDNG	3	RESOURCE MANAGEMENT SPECIALIST MADE LIST.
HAVO	MAMMALS, T&E	1	RESOURCE MANAGEMENT PLAN, AND PARK RECORDS ENDNG - HAWAIIAN HOARY BAT
HAVO	PLANTS, SENS	32	SPORADIC COLLECTIONS
HAVO	REPTILES, T&E	2	INCIDENTAL SIGHTINGS & NESTINGS RECORDED SINCE 1976. 2 SPP: HAWKSBILL (ENDANGERED), GREEN SEA TURTLE (THREATENED)
JOTR	PLANTS, T&E	?	LEARY 87 CPSU REPORT. NOT A SYSTEMATIC SURVEY, ONLY SEARCHED KNOWN OCCURRENCE AREAS.

BIANNUAL and ANNUAL REPORTS

Biannual Report No. 1, November 1979, **NOT AVAILABLE**

Biannual Report No. 2, March 1980

Biannual Report No. 3, September 1980, **NOT AVAILABLE**

Biannual Report No. 4, June 1981

Biannual Report No. 5, December 1981, **NOT AVAILABLE**

Biannual Report No. 6, June 1982

Biannual Report No. 7, December 1982

Annual Report No. 8, December 1983, **NOT AVAILABLE**

Annual Report No. 9, December 1984

Annual Report No. 10, December 1985

Annual Report No. 11, December 1986

Annual Report No. 12, December 1987

An Annual Report for 1988 was not published.

Proceedings of the First Biennial Conference on Research in California's National Parks: University of California, Davis, California, September 9-10, 1982. **NOT AVAILABLE**

Proceedings of the Third Biennial Conference on Research in California's National Parks: University of California, Davis, California, September 13-15, 1988.