Research Guidance to Address the Needs of Land Managers

Coastal Sage Scrub Natural Community Conservation Planning (NCCP)

NCCP Core Group Report
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For Further Information Contact:

Peter A. Stine, Ph.D.
California Science Center
Biological Resources Div.
U.S. Geological Survey

Forward: Several federal, state, and private organizations with responsibility for land use and resource management in Southern California are cooperating to protect coastal sage scrub areas through the development and implementation of Natural Community Conservation Planning (NCCP) programs in San Diego, Orange, and Riverside counties. The representatives of the state and federal agencies charged with oversight of the NCCP appointed a Science Research Committee to coordinate research and related land management activities. This committee in turn selected an ad hoc Core Group of representative researchers and managers from differing regions, sectors, and perspectives to advise them regarding improved methods for developing and disseminating ecological information needed for planning and management. The following draft report was prepared by the NCCP Core Group.

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1920 20th Street
Sacramento, CA 95814

Project Conducted by:

Science & Policy Associates, Inc.
E-mail:
scipol@access.digex.net

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NCCP Core Group Members

Core Group Members

Ed Almanza The Superpark Project	Mike O'Connell The Nature Conservancy
Jon Atwood Manomet Observatory for Conservation Sciences	Tom Oberbauer Department of Planning and Land Use County of San Diego
Peter Bowler Department of Ecology and Evolutionary Ecology University of California at Irvine	John Rotenberry Department of Biology University of California Riverside
Ted Case Department of Biology University of California at San Diego	Jerre Stallcup Ogden Environmental and Energy Services
Larry Eng California Department of Fish and Game	Peter Stine California Science Center Biological Resources Division U.S. Geological Survey
Gail Kobetich U.S. Fish and Wildlife Service	Mike Stroud Natural Resources Branch Department of the Navy
Rod Meade R.J. Meade Consulting	Sherry Teresa Center for Natural Lands Management
Patrick Mock Ogden Environmental and Energy Services	

Facilitators

Chris Bernabo Tom Carter Science & Policy Associates, Inc.	

Executive Summary

A Core Group of representative land managers and researchers from federal, state, local, and private organizations is working together to coordinate the development and dissemination of ecological information needed by all parties involved in implementing the Natural Community Conservation Planning (NCCP) areas for coastal sage scrub in Southern California. The group is exploring more effective and efficient mechanisms for addressing the ecological information needs of managers and decision makers involved in the NCCP. Their goals are to 1) reassess the research agenda intended to supply important new information to managers and 2) determine the most effective means for synthesizing new and existing ecological information into appropriate guidance for decision makers.

Through a series of working meetings, the group reached consensus on the general information needs most important to resource managers and identified the gaps in current research efforts needed to address those needs. They also made recommendations on how to develop more coordinated and effective organization and processes to enhance the ongoing coordination of research activities and the dissemination of the resulting information.

The group attempted to identify the general information needs of the managers and policy makers involved in the coastal sage scrub NCCP. They also listed the many recent and ongoing research activities that are relevant to CSS. By mapping the research activities to the information needs, the group identified gaps in which key information needs are not being addressed by current research. The group also prioritized the broad areas of information needs to help guide future research agendas. The broad categories to be addressed by research include:

- Fire
- Inventory and monitoring
- Species persistence/demographics/genetics
- Administration, socioeconomic considerations, and implementation
- Exotics and invasives
- Public use
- Biophysical processes/ecosystem function
- Reserve design/biogeography/landscape processes
- Restoration and enhancement
- General species, program-wide, and regional concerns
- Historical land use/succession
- Habitat management practices
- Influence of adjacent land uses

There currently is no broadly recognized formal mechanisms for research coordination and communication of existing and new information to managers. A team of four individuals (including representatives from Fish and Wildlife Service, California Department of Fish and Game, The Nature Conservancy, and the Biological Resources Division of U.S. Geological Survey) constitute a Science Research Coordinating Committee for the NCCP program. However they have insufficient time to carry out all the work identified for research corrdination and information dissemination. Therefore, the Core Group recommended that a more focused function or office be established to coordinate research

and information dissemination activities related to the coastal sage scrub NCCP. The proposed functions would be to:

Facilitate the identification of priority information needs of managers and the research and other efforts required to address those needs

- Provide assessment and synthesis of ongoing research and its ability to address management needs
- Communicate research results to managers and policy makers to effectively inform their decisions
- Assist in the development and coordination of databases needed to implement land management programs.

The crucial need that the focal point function would fill is to enhance the collective ability of participants of the NCCP program to address and gain access to the best scientific information available. Ideally this proposed function would interact with both public and private sector agencies and would have adequate budget to carry out its facilitation role. It would not, however, fund specific research projects, but simply serve to coordinate new reand ongoing research and facilitate the exchange of information between research and management. It should be staffed both by people with research experience and with management expertise.

The Core Group will communicate the research guidance and recommendations in this report to those organizations in the public, private, and NGO sectors involved in the NCCP program. Their goal will be to assist the Science Research Committee to coordinate research and information dissemination efforts and to broaden the dialog necessary for the implementation of their organizational recommendations.

This report will be a living document distributed for broad comment and then placed on the World Wide Web, where it will be open to ongoing comment and refinement. The purpose of the report is to catalog and coordinate research and information dissemination activities, priorities, results, and lessons learned. These will evolve over time, and the report will adapt to reflect that evolution.

Background

The organizations responsible for managing lands associated with the Natural Community Conservation Planning (NCCP) are faced with the challenge of breaking new ground in managing large, fragmented areas for multispecies protection at the population and ecosystem scales. Many of the habitat management decisions to be made have no precedent and limited technical information on which they can be based.

There are limited resources available for management of the ecological reserves established under the NCCP program and for research of coastal sage scrub (CSS) ecosystems. Therefore, representatives from key federal and state agencies and from The Nature Conservancy initiated an effort to coordinate relevant research activities and facilitate the production of technical information that can inform management decisions. The Science Research Committee--in collaboration with local governments, public utilities, the San Diego Zoological Society, and others--held a conference in September 1996 to share information on ongoing research activities related to CSS and to discuss how this research relates to managers' information needs.

A Core Group of fourteen representative researchers, land managers, and planners was selected by the Science Research Committee (see Foreword). The group was convened at the September conference to further identify land managers' information needs and examine how research can address those needs. Science & Policy Associates, Inc. (S&PA) was asked to facilitate the Core Group based on their extensive experience in assisting similar groups to link research with decision making. S&PA acted as a neutral broker with no vested interest in the NCCP issues or role in research or management. S&PA's activities were sponsored by Southern California Edison, the Metropolitan Water District of Southern California, and the Electric Power Research Institute.

At the Core Group's first meeting during the September conference they unanimously identified their mission as follows:

> **"To redefine the existing research agenda and develop a strategy for more effectively applying science to implementing NCCP policy and management."**

The Core Group held a two day working session October 31 - November 1, 1996 to forge ahead with this mission. At a third meeting on December 20, 1996, the group refined and revised its conclusions and recommendations. Figure 1 illustrates the genesis and activities of the Core Group.

Objectives

The Core Group had three primary objectives:

1. To identify and rank the priority information needs of decision makers responsible for managing the land and resources of coastal sage scrub and adjoining habitats.

2. To develop guidance for how research can address those information needs and inform the decisions of managers.

3. To recommend a function and process for ensuring ongoing communication between and among the research and management organizations involved in the NCCP program.

Approach

When the Core Group was convened at the September conference, two members agreed to complete key tasks in preparation for the October-November meeting. Larry Eng of the California Department of Fish and Game talked with "on-the-ground" managers to develop a framework list of information needs. Peter Stine of the Biological Resources Division of the U.S. Geological Survey (formerly the National Biological Service) organized a preliminary list of existing research activities and mapped them to the information needs elicited by Eng. Stine was assisted in his effort by staff from the San Diego NCCP office of the California Department of Fish and Game.

At the Core Group meeting, the preliminary list of managers' information needs was refined, reorganized, and prioritized. The list was then framed as potential research questions more completely mapped to the existing or recently completed research activities. This resulted in guidance on what research is needed to inform management decisions, and highlights those research needs not addressed by current research.

Finally the group developed recommendations for a needed function and process for coordinating research and information dissemination activities to serve each other most efficiently and effectively. This outcome was enhanced by the diverse perspectives and concerns of the group and by their willingness to discuss challenges, weaknesses, and opportunities candidly and openly. Figure 2 describes the primary outcomes of the Core Group's activities.

Inputs

Aside from the valuable knowledge and experience offered by the Core Group members, the two major inputs were the framework list of managers' information needs and the preliminary survey of research activities.

For the list of information needs, Larry Eng interviewed seven people. They included on-the-ground reserve managers, managers with responsibilities for multiple reserves, and managers with many years experience in identifying habitat lands for reserves. Each had experience in the Coastal Sage Scrub NCCP area. Three of the interviewees were from California Fish and Game, and one each were with the U.S. Fish and Wildlife Service, The Nature Conservancy, a public utility company, and another non-profit land management organization. Additional input from the Core Group enhanced the list, but it will require broad ongoing review and revision to become and remain comprehensive.

The resources managed by the interviewees included multiple purpose reserves, single or limited purpose reserves, urban reserves, and others. Some are responsible for day-to-day reserve management, while others deal with policy and funding issues. The needs identified reflected this variety. A common theme was the need for an assessment of what is currently

known: what is established fact? what is experimental or assumed? what is recommended? what is the "state of the art?"

The survey of research activities identified almost 100 recent, ongoing, and scheduled projects related to Coastal Sage Scrub. While this is only a partial list, it provided a useful representative sampling when mapped to the information needs identified by active managers. The conclusion of the preliminary mapping exercise was that some research activities related to specific needs, but that many categories of information needs, such as what level of public use can be accommodated on reserve land, were not being addressed at all by research. This is not a criticism of current research, most of which was not designed to address managers' needs, but provides clear guidance toward opportunities for future management-relevant research.

Findings on Research & Management Information Needs

Research/Management Categories and Priorities

The Core Group reorganized the framework list of managers' information needs into a taxonomy that would be useful to relate the needs of natural resource managers with distinct categories familiar to research funders and managers. The group developed the following list of categories of managers' research needs. The resource managers in the group assigned broad priorities to the categories using two considerations: urgency (short-term requirements) and importance (requirements related to issues with great potential impact). The rankings for each, with 1 signifying the highest priority and 3 the lowest, appear below.

Category of Information Need	Urgency	Importance
A. Fire	1	1
B. Inventory and Monitoring	1	1
C. Species Persistence/Demographics/Genetics	1	1
D. Administration, Socioeconomic Considerations, and Implementation	1	1
E. Exotics and Invasives	2	1
F. Public Use	2	1
G. Biophysical Processes/Ecosystem Function	3	1
H. Reserve Design/Biogeography/Landscape Processes	2	2
I. Restoration and Enhancement	2	2
J. General Species, Program-Wide, and Regional Concerns	3	2
K. Historical Land Use/Succession	3	2
L. Habitat Management Practices	3	2
M. Influence of Adjacent Land Uses	3	2

As with any list of priorities, those described above should be qualified. The categories of management information needs, the specific information needs, and the priorities assigned to them should be considered only in the context of the following qualifiers:

1. They are the result of consensus generalizations by a diverse group. For specific sites or issues, priorities may vary.

2. They represent a range of required research commitment. Some could be addressed by a single one-year study, while others could take decades.

3. They are stated broadly so that they can be tailored to specific situations.

4. The information needs and associated priorities will change over time as gaps are filled, needs refined, and new gaps identified.

Broad Research Gaps

Past and ongoing research partially addresses a small percentage of the managers' questions identified by the Core Group and others. Few, if any, managers' needs are fully addressed by current and planned research. For some of the broad areas listed above there are no research activities specifically related to the managers' needs.

Based on the priorities assigned to the categories of information needs and the lack of relevant research activities, the most significant information gaps are the following categories.

- Inventory and Monitoring
- Administration, Socioeconomic Considerations, and Implementation
- Species Persistence/Demographics/Genetics
- Fire

Appendix B contains a mapping of the ongoing research activities identified to the information needs elicited from managers. For each information need, relevant research activities are listed. Most of the information needs under the highest priority categories listed above are being addressed by none of the research projects listed (see pages B-2 through B-4). One of the fire questions is being addressed by several projects, but the remainder have only one activity that even partially addressed the need.

The next section summarizes the broad categories of information needs. Appendix A contains the complete list of managers' information needs identified to date under each of the 13 categories.

Managers' Information Needs

The Core Group produced a list of managers' information needs that can be addressed by research. This preliminary list will be revised and expanded through ongoing review. The list prepared by the Core Group is contained in Appendix A, and a list of current research activities is included in Appendix B. The research list is cross referenced to the information needs that each research activity could, at least in part, address. The following text describes the significance of each broad category of information need.

Most of the categories of information needs involve questions related to field management activities. However the category:Administration, Socioeconomic Considerations, and Implementation, is related to internal management.

A. Fire

For the last two decades, there has been a great deal of controversy among researchers regarding the frequency of occurrence of fire. This controversy involves those who feel that fires under natural conditions would have occurred with frequent regularity versus those who feel that fire was a more irregular event. Research to substantiate positions on either side has involved reproductive success in burned areas for Tecate Cypress and other chaparral plants.

It has also involved the examination of ecosystems in northern Baja California where uncontrolled fire is theorized to occur with a more natural frequency than in Southern California. Judging from the research that has occurred, the ramifications of the management for the wrong frequency of occurrence of fire could be serious enough to significantly alter the vegetation that occurs in an area, including the elimination of key species of plants and animals. Since the habitats that will remain in preserve systems that result from the Natural Community Conservation Planning will be only a portion of the natural landscape that previously existed, there will be little room for error when planning for fire. Furthermore, with larger human populations adjacent to the preserve systems, there will be continually more opportunity for unnatural fire starts. In addition, as fires do start, there is a necessity for land and fire managers to decide when it is important to risk lives to stop the spread of a fire through a preserve area in order to save particular natural resources. Therefore, it is imperative to understand the response of individual species and vegetation communities to fire conditions, frequency as well as seasonal temporality, in order to manage preserve systems in a manner that will perpetuate the species.

B. Inventory and Monitoring

Land managers and planners are faced with difficult land use decisions over an increasingly limited resource base in southern California. Large investments have been made to support the reserve systems being established, and long-term management is anticipated to fulfill the expectations of the reserve network. Managers should be warned of significant changes in the environment at the earliest opportunity, when options for addressing the problems are greatest. Moreover, land managers should be equipped with information and tools to detect and interpret ongoing changes in coastal sage scrub, both positive (e.g., restoration activities) and negative (e.g., declining populations).

Well designed strategies could help managers distinguish unacceptable levels of change in the system--often anthropogenic--from inherent changes due to stochastic variation, successional changes following disturbance, and cyclical variation. Managers should be able to identify the vital signs of the ecosystem that will allow efficient means of detecting these significant kinds of change. Regional monitoring strategies should enable managers to identify thresholds of change that would, in turn, trigger a management response. Individual monitoring programs should be able to contribute to an understanding of conditions throughout the range of a species of an ecological community. All efforts should establish a feedback mechanism that will enable a genuine adaptive management program shared by all federal, state, local, and private management concerns in the NCCP planning area.

In addition, it is important to recognize that inventory and monitoring -- if thoughtfully designed and coordinated-- can provide the best possible means of obtaining data to address all of the major topics important to land managers. NCCP preserves are ideal opportunities for in situ hypothesis testing. Routine inventories and monitoring, supplemented with focused data collection of specific variables relevant to ecological processes and interactions, should be a cornerstone in the strategy to cost-effectively meet land managers' information needs.

C. Species Persistence/Demographics/Genetics

Individual species, particularly listed species and/or certain species deemed to be targets for natural community conservation efforts, continue to be focal issues for conservation

programs. In order to manage for the long-term conservation of these species, managers need to understand the population demographics and ecological relationships of these species with their environment. This understanding applies to a given species and its ecological relationships at the landscape level, the intrinsic demographic variation of the species, and the genetic diversity among and within populations of the species. Depending on the species and its role in the conservation of a natural community, any of these issues may be relevant.

D. Administration, Socioeconomic Considerations, and Implementation

The Core Group identified several considerations to guide implementation of the framework list of information needs. Most of these relate to overall coordination of on-going and future research. Recognition of the need to enhance coordination among the many research efforts related to coastal ecosystems arises from two sources:

> (1) The desire--which the Group felt to be broadly held among the community of researchers and managers--to maximize the collection of valuable data, ensuring that field activities serve as many management-oriented research needs as feasibly possible; and
>
> (2) Regional management issues that require collation of geographically diverse data sets and some degree of macro-management of research.

These major concerns speak directly to an ever-present issue--the need to stretch management-supportive research budgets as far as possible to benefit coastal sage scrub management throughout southern California. Rather than introduce an additional layer of bureaucratic difficulties, the role of research coordination at the regional scale is conceived of as a means of seeking out opportunities to maximize efficiency of multiple, simultaneous research efforts. The key administrative information needs are described below.

1. There is a need to establish and maintain a regularly updated data base of information valuable to preserve managers. The data base should include major findings from past, ongoing, and future studies on the management-oriented topics identified in this framework. Information should be presented in a format that is user-friendly to managers. It should: 1) present findings on relevant topics, 2) assess the information (e.g., its applicability to one or more geographic subregions, and the relative certainty of its findings), 3) cross-reference similar studies and their findings, 4) synthesize findings with other findings, and 5) refer to other ongoing or planned research in the subject area. Findings should be presented in a manner that facilitates their application to making and implementing management decisions. The data base should include reference maps, ideally in GIS format, that identify research study sites, planning areas, and areas managed by specific entities, to facilitate coordination among managers and interpretation of research results. Maintenance of the data base should include mechanisms to update incorporate feedback frequently from managers on the applicability of research results.

2. In addition to management needs, the body of information generated by research should be made readily available to inform decisions related to preserve planning and establishment. This may require additional formatting or organization of the data base to facilitate extraction of information useful to front-end planning and preserve design.

3. The benefits of research should be synthesized, to the degree possible, to guide the decisions of managers and planners. Many questions posed by managers do not necessarily require new research but can be addressed by a synthesis of existing information. Synthesized information should inform an ongoing process of analysis that seeks to establish criteria for successful habitat management through interactive dialogue among researchers, managers, and administrators.

E. Exotic Plant and Animal Species, Invasives, and Other Problem Species

Invasive exotic plant and animal species pose threats to the ecological integrity of natural reserves. Within the NCCP reserve there are large areas dominated by black mustard, globe artichoke, non-native grasses, and other exotic plant species. Over seventeen percent of the California flora is comprised of non-native species, and within the coastal sage scrub community many stands are composed of over a third introduced taxa. In wetlands exotic presence often exceeds that of upland communities, ranging to above fifty percent non-native plant species, though not all are ecologically problematic.

Among the research challenges with non-native plants in the reserve are questions such as:

- Can communities created through restoration or mitigation actions resist and reverse the presence of exotics in heavily infested sites?
- Can existing stands be "recovered" to sustainable, non-deteriorating patches?
- What is the role of nutrient alteration in changing the competitive interactions and colonization rates of exotic and native plant species?
- What is the role of parasites, pathogens, nematodes, and other soil invertebrates on the population biology of specific plant and animal species?

Some exotic species compete for nutrients, food, or nest sites with sensitive native species, crowding out or overshading native species and ultimately excluding them. Argentine ants displace native ants, cowbirds are significant nest parasites of several native passerines, and starlings may compete for tree hole nest sites with woodpeckers. In riparian and other aquatic systems exotic predators have proven to be severe problems to several native amphibians and fish. Identifying the circumstances that cause some species in some situations to become pests in southern California biomes is an important research area, particularly since the edge around reserve fragments is so extensive and is occupied by exotic species which could be invasive. These artificial habitats are not the natural "edge" and serve as corridors and extended entryways for feral cats, non-native snails, and other aliens to invade stands at many points.

Feral species and human generated dominance of urban tolerant mesopredators is a concern in an edge-rich reserves. Some native species, such as opossums, raccoons, striped skunks, and coyotes, thrive in urban/suburban situations and may become problematic. Though among the native bird fauna only around a fourth are able to inhabit "urban forests," some native species such as ravens reach large numbers in urban/suburban settings. The effect that the higher abundances of these edge-thriving urban forest species *may* have on predator-prey dynamics and competition with more restricted and sensitive non-edge species is not known.

A significant problem lies in understanding the kinds of invasives that could lead to cascading community affects at higher trophic levels and recognizing the warning signs in monitoring programs so that these effects are detected rapidly and early in the invasion or

dominance cycle. It is important to recognize that "edges" are not just reserve boundaries, but can include roads, trails, firebreaks, and riparian and alluvial areas that run through reserves. Further study is needed to develop chemical and mechanical control methods for exotic plants within coastal sage scrub mosaics in reserves and to better understand their non-target effects.

F. Public Use

The process for creating open space preserves involves a high level of public input. If the preserve created through the necessity for mitigation of one or many development projects, it involves the nearby community groups as well as the public entity that ultimately approved the project. If the preserve was created through the use of publicly generated funds, it may have involved the input and positive vote in the ballot box by thousands of individuals. All of those involved in the creation of open space preserves have a feeling of ownership and a vision for what is appropriate for the preserve. In most cases, this translates into some form of demand for public use. Public uses which may be requested within a preserve include a diversity of activities which range from observation points for viewing wildlife, and of off-highway vehicle trails to hang-gliding landing and takeoff points. Furthermore, there are often requests for utility infrastructure to be allowed within preserve areas. However, natural communities and ecosystems which are intended to be protected within the preserve may be extremely sensitive to some forms of public use and the associated disturbance.

In order to fully understand the implications of particular uses within the preserve, there needs to be research which evaluates the various types of uses and the level at which they create unacceptable impacts. This type of research is critical because decision-makers are currently deciding the types of public uses to be allowed within a preserve. This type of research information is necessary to provide information to those decision makers so that uses that are harmful for the resources can be avoided or at least redirected to areas where they will be less impactive.

G. Biophysical Processes/Ecosystem Function

Although much of the emphasis on conservation management relates to maintenance or manipulation of biotic components (i.e., individual plant and animal species populations or communities), this management needs information on non-biological aspects of the local ecosystem as well to be fully effective. Although many ecosystem and associated physical processes may be beyond the ability of managers to manipulate, these processes set the context in which the biotic components respond (or not) to management efforts. For example, the interaction of precipitation with topography (two physical attributes of an ecosystem) determines the potential for soil movement or erosion, which in turn is both influenced by and influences local vegetation composition. Likewise, the apparently trivial observation that water moves down slopes has potential management implications. For example, sheetflow along surfaces can move propagules (e.g., seeds); if one is attempting to eradicate an invasive plant over a period of time, it makes more sense to work from the top of a slope down, so that recently cleared spaces do not become reinfested by input from above.

Nutrient cycling is one important feature that can also control ecosystem structure. In southern California, nitrogen cycles (which may strongly influence plant community composition and productivity) may be altered due to the greatly enhanced input of atmospheric nitrogen from air pollution. Plant species formerly limited by low nitrogen soils

may now achieve much higher abundances, and thus in turn negatively impact species with which they may be in competition.

The two examples given above also illustrate how understanding ecosystem and physical processes is interrelated with other information needs. Adjacent land uses, for example, can affect precipitation runoff (either increasing or decreasing it). Uses may also affect the potential for chemical contamination. Perhaps one of the most significant short term ecosystem processes is fire (both its frequency and intensity); this process is important enough to rate a category of its own.

Land managers are charged with sustaining more or less natural ecosystems. Emerging theory relating to ecosystem sustainability focuses on interactions among climate, soil resources, major functional groups of organisms, and disturbance. Feedbacks among these components within ecosystems damp major oscillations that might otherwise lead to ecosystem instability. Thus it is imperative that we understand how these components relate to each other in each of the systems we wish to preserve, so that we can make changes (e.g., alter present disturbance regime by changing fire management practices) that promote the long-term persistence of the ecosystem structure we desire.

H. Reserve Design/Biogeography/Landscape Processes

A landscape assessment, across an entire ecoregion or other regional context, provides a unique perspective that enables an evaluation of entire systems and their component species. Only from this perspective can a manager understand the consequences of any single management action upon an entire species or an entire community. In this era of ecosystem management and multi-species or multi-habitat conservation strategies a regional perspective is needed. This perspective becomes imperative if managers are to succeed in sustaining a network of natural reserves within a matrix of urban and agricultural lands, as will exist with the coastal sage scrub lands in southern California. Managers must be equipped with this knowledge so they are aware of the implications of their actions to species and ecological communities that span the network of wildlands within the NCCP planning area.

The fragmented nature of the reserve system in southern California is a compelling condition requiring a landscape perspective. Ecological systems have inherent gradients across the landscape as changes in climate, soil, elevation, and other physical environmental factors are manifested in the biological communities. These gradients are typically gradual under natural conditions and plant or animal species have evolved in response to such gradients. What managers face today, particularly in the southern California environment, is the challenge of maintaining self-sustaining systems on lands that adjoin radically different land uses (e.g., housing, industrial, agricultural uses) where gradients are abrupt and these adjoining uses pose threats to the ecological integrity of the natural lands. The emerging system of reserves in southern California will inescapably exemplify this phenomena, and managers must be equipped to handle the resulting problems.

Several other factors suggest a high priority for landscape analysis. Self-sustaining populations of plant and animal species depend on a variety of ecological factors under which these species have evolved. Dispersal capabilities, resiliency to natural perturbations, and environmental and demographic variation are among the ecological factors that influence the ability of a species to persist. To adequately understand how these kinds of factors effect species persistence requires a comprehension of the regional implications of local actions.

Remote sensing techniques, GIS technology, and regional monitoring strategies are among the methods now used to provide this perspective.

I. Restoration and Enhancement

Since major new land acquisitions to supplement the NCCP reserve are unlikely, a major potential for expanding habitat lies with the new field of restoration ecology. This field has the promise of providing corridors linking fragments and expanding natural stands of coastal sage scrub and other diminished natural habitats. Ecological restoration focuses upon whole community establishment and is distinct from reclamation, enhancement, rehabilitation and mitigation, as usually implemented. It is based upon emulation of an historic, indigenous habitat model. This approach to whole community recreation employs a monitored control site. The restoration site would be an accurate reflection of local natural species assemblages, condition, and function. Inevitably, since long-term processes like fire cycles have great impact on condition and function, this process will require many decades of monitoring and study.

Research challenges include producing habitat rapidly to sustain and provide alternative areas for sensitive taxa; instituting long-term successional and fire-resiliency functions in created habitats; and establishing enduring understory diversity and successional relationships. Other questions include:

- What are the precise habitat preferences for gnatcatchers and other target taxa?
- What will be the impacts of managing fire succession to sustain target taxa populations on habitat and non-target species?
- How can target and non-target species be monitored in the long term?
- How can site selection further the potential for colonization and other goals?
- How can restoration and mitigation projects be designed to maximize "new habitat" potential?
- How can large-scale salvage of coastal sage scrub assist in producing more viable habitats?
- To what extent can natural coastal sage scrub stands be transplanted?
- What is the viability of transplanted material?
- How can this approach most effectively supplement other conventional and larger-scale techniques, such as imprinting and hydroseeding?

J. General Species, Program-Wide, and Regional Concerns

Reserve systems in NCCP are being built within the constraints of fragmentation, urbanization and other local limitations. The effects of these parameters on the sustainability of reserves and viability of target species is important and has been identified as information needs in other sections. Information needed by managers of NCCP reserves at the program scale takes two forms: natural process issues and species/habitat issues.

There are some crucial broad-scale effects of natural processes on persistence of NCCP reserves that should be identified and addressed. These include but are not limited to system-wide effects such as nitrogen deposition and the hydrologic cycle. At an even broader scale, challenges such as the effects of global climate change on species distribution and abundance and persistence of habitat-types are important to identify and reconcile with the disjunct, urban nature of the preserve system.

In addition to processes in effect at a regional and program scale, there are program-wide issues for individual species and habitat-types that should be identified and researched to provide information useful to managers. These include resolution of taxonomic inconsistencies, describing ranges of variation within and among habitat-types that make up the natural community complex in NCCP, and the interfaces between habitat types and how they affect persistence of species. There are other examples of regional, program and species-wide concerns that will be identified through broad-range analyses intended to uncover common issues for all the subregions implementing NCCP plans.

K. Historic and Adjacent Land Uses

Former land uses can significantly alter potential for restoration, succession trajectories in plant and animal communities, and long-term preservation. The central research questions deal with the lingering effects of past agricultural practices and what was grown at a site, grazing by sheep and cattle, non-agricultural land disturbance through abandoned construction and mining, roads, or recreational abuse, and altered as opposed to natural fire histories.

Similarly, adjacent land uses can have substantive and diverse influences upon reserve lands. Suburban/agricultural developments are potential sources for exotic plants and feral animals (cowbirds, cats, exotic snails, and fish, Argentine ants, Arundo, pampas grass, tamarisk); they can lead to nighttime light pollution potentially interfering with the foraging activities of nocturnal foragers and the reproductive behavior of insects. Pollutant discharges and water run-off from agricultural/suburban neighbors can lead to contamination and erosion of soil and siltation of aquatic habitats.

Research dealing with the following subjects is needed:

- Direct and indirect intrusive impacts by light, noise, recreation, and pollution on neighboring natural lands;

- The use of agricultural/developed areas as corridors and reservoirs for exotic and invasive animals and plants that may move into natural reserves (e.g cowbirds, Argentine ants, feral cats, exotic fish, bullfrogs, pampas grass, Arundo, iceplant, tamarisk);

- Community changes in reserves due to human-requested "management" in neighboring lands to lessen fire threats, possible disease transmission, and large predator presence;

- The width and type of buffer zones that are necessary to moderate or eliminate the above threats.

Adjacent land use can potentially alter microclimate by changing albedo, natural airflow patterns, humidity, runoff from hardscaped environments (more water flowing rapidly through watersheds, with associated microclimate changes), dominance by exotics in wetlands, and the composition of insect communities, perhaps including pollinators.

L. Habitat Management Practices

Stewardship involves primarily the mimicking of natural processes we have altered through

decades or centuries of human land uses. Prescribed burns are to replace the wildfires we can no longer afford and now suppress. Grazing replaces the native herbivores that in many cases are no longer present. Exotics removal is an attempt to undo damage by organisms that we introduced. Restoration brings back habitat in an attempt to recreate self-sustaining ecosystems. Fences keep out off road vehicles, dogs or cattle; signs inform and educate.

Recognizing that we do not always know what is best for any system, we can, however, state with certainty that management of mitigation and conservation areas will be best when provided in a context of landscapes with interrelated habitats large enough to encompass and still allow a semblance of natural processes: predator-prey relationships, natural disturbances like fire and floods, vegetation and associated wildlife changes as communities progress through various successional stages and begin the cycle again.

The goal is to establish and maintain NCCP reserves that allow for natural disturbance processes (or a management-created surrogate) to continue. Disturbances, especially those that initiate ecological succession, are often critical in maintaining the natural structure and function of ecosystems.

Environmental constraints may be imposed by the physical or biological limits of a site, such as water availability, the presence of hazardous waste, or even the size and configuration of the preserve. For example, preserves of very small size (less than 50 acres) and with proximity to urban land uses can limit the ability of a manager to implement certain management strategies, such as grazing or burning. In this case, it may not be financially feasible for a lessee to graze such a small area, short of paying for the service. Alternatively, controlled burning is infeasible near residential areas because of effects on air quality as well as the risk of damage to property in the case of a wildfire.

Preserve management goals are characterized as measurable objectives to be determined by the purpose, characteristics and needs of the site. Ecological objectives are primary with respect to programmatic objectives.

1. *Maintenance of genetic variability within and among populations*
2. *Arresting or preventing species decline*
3. *Prevention of species extirpation/extinction*
4. *Maintenance/restoration of functioning ecosystems*
5. *Preservation, restoration or maintenance of natural or evolutionary processes*
6. *Implementing management solutions at the landscape level*
7. *Increasing scientific knowledge to improve management/understanding of natural systems*

Management strategies describe in detail the heart of the management program by enumerating the actions that must be taken to achieve the management objectives and the overall preserve management goal. In some cases, management strategies will consist primarily of obtaining sufficient information (through research, surveys, or monitoring) to determine the appropriate management action.

In any given case, it is likely that one management strategy will help to achieve more than one management objective and each objective will require several strategies to succeed. For example, control of invasive annual grasses in a preserve through the use of prescribed burning may (1) help arrest and prevent species decline, (2) prevent species extinction if rare

plants are present, (3) control invasive exotic annual grasses, and (4) restore a natural process. Likewise, another management strategy of controlled grazing could be implemented to diminish seed set of invasive exotic annual grasses and prevent buildup of thatch that inhibits germination of native forbs.

Properly designed habitat management practices should be structured to feed into an adaptive management strategy. Adaptive management is a process whereby results of management actions are regularly assessed by evaluating monitoring results to determine whether management objectives or defined "measures of success" are being achieved. If not, management practices are changed or modified as needed. Scientific research is indicated in some cases when information gaps are severely limiting management effectiveness or options. Scientific research and experiments in natural areas will usually be oriented toward answering specific management-related questions at the site, although in some cases sites may prove to be important resources for conducting basic research that contributes to our overall understanding of ecology.

Findings on Organization, Process, & Communication

The Core Group examined the existing capacities for effectively accomplishing the primary objectives summarized on page 2. This was a difficult issue because it is clearly not the intention of the group to support any additional bureaucratic layers or to supplant the discretion of local authorities or individual organizations developing and/or using new scientific information. However, we believe that if land managers and planners are to obtain the maximum potential value from existing and future scientific research, some additional means of enhancing communication and cooperation between and among both researchers and managers/planners is desirable.

In light of this, the Core Group considered some possible options to enhance our collective ability to achieve the stated objectives. A set of recommendations and additional steps were developed that could help fulfill the potential that research and information exchange offers to implementation of the NCCP program. We believe, in fact, that these recommendations could be applicable to the generic issue of effective communication between the ecological researchers and the land managers/land planners. There is no simple solution; however, the group of researchers and managers/planners involved in this effort discovered some useful common ground in the course of our discussions.

Status and Opportunities:

Existing mechanisms for addressing ecological information needs related to the NCCP currently have the following characteristics:

- Ad hoc organization
- Variable research budget
- No formal coordination of research or management
- No formal leadership
- A bottom-up approach
- Jurisdictional subdivisions
- Insufficient funding for processes, assessments, synthesis, or communication
- An emerging set of guidelines that is diffuse and inconsistent.

The strengths of NCCP research coordination, as currently operated, include the attention that top-level policy makers and experienced managers have given to the program. Although the structure is informal, there has been good cooperation and commitment, to the extent possible, from the involved parties. The program also has broad public support at the regional and state levels. The Core Group believes it is important to maintain strong coordination between policymakers and the research initiative.

The lack of a formal structure of the research initiative, however, presents a number of challenges. The people involved in implementing the program are too busy with other responsibilities to invest adequate time into the research and information dissemination efforts intended to assist the NCCP program. The lack of a well-defined process for sharing information limits the effectiveness and impact of the program and its many valuable contributions. The program is also making the transition from reserve design to management, and is still in the process of evolving into that new role.

The opportunities presented by the NCCP are:

- To develop a unified research agenda
- To enhance communication between land managers and researchers
- To meld scientific/management/policy objectives
- To coordinate effective adaptive management implementation with research feedback on a regional basis
- To create a model for similar programs elsewhere

Communication Needs

The NCCP program involves an intricate system of cooperation between several types of organizations and individuals, including researchers, research managers, land managers, planners, policy makers, and the general public. Figure 3 illustrates the need for communication within and among these groups. The bullets within each box list the type of information that should be communicated within a given community. Beside each arrow is the type of information to be communicated from one group to another.

Recommendations

The Core Group recommends the establishment or designation of a research coordinator to oversee or facilitate the coordination and communication of research and information dissemination activities related to the NCCP program. This should be situated within an institution with direct access (in both directions) to managers and other consumers of the needed information. The Core Group does not believe it is in a position to determine where or how this function should be established. This will be a decision to be lead by the resource and land management agencies in cooperation with planning partners. However, the group recommends that the research coordinator function should meet the following criteria:

- Act as an efficient central clearinghouse for technical information, rather than an additional bureaucratic layer
- Have research AND land management expertise
- Offer adequate time commitment of program officer-level director and administrative support
- Have adequate budget and resources from one or more sources (preferably a mix of public and private sector funders) to carry out facilitation functions
- Coordinate and link research ideas and funding from a variety of sources

The Core Group recommended that the individual or group responsible for coordination should have the following roles and responsibilities:

- Assess, synthesize, and communicate information from research results to managers and other users
- Keep and coordinate databases
- Identify ongoing management needs and research to address those needs
- Staff the Science Research Committee of the NCCP
- Maintain communication between sectors and communities and to the public (e.g., through Web pages, newsletters, conferences, and other fora)
- Promote the continuity of long-term research funding
- Assist with recovery plans and activities.

Next Steps

The long-term effect of this report greatly depends on whether or not its principal recommendation is implemented: establishment of a coordinator function to facilitate execution of the prioritized research agenda. The coordinator(s), in addition to fulfilling the above-listed functions, will play a much needed role in assisting local land entities in achieving their land management goals efficiently and cost-effectively. Local preserve managers face the challenge of making daily decisions that are potentially very costly in terms of dollars as well as the natural resources under their charge. They can be greatly assisted in their ground-breaking efforts through information sharing with researchers and managers of other preserves, and cost-sharing in gathering information of common value to managers region-wide. Many of the most prioritized management questions will benefit from field investigations outside the specific locations where they might be applied, such as information on recreation impacts on habitat. Other topics require pooling of resources over broad geographic areas because of the long-term nature or relative expense of collecting sufficient data. The coordinator function is intended to facilitate these kinds of cost-saving strategies. Rather than an added bureaucratic layer, or command and control research management, the role is conceived as an available resource to facilitate managers in finding the best way to obtain information they need.

Establishment of the coordinator function will ensure ongoing maintenance of a clearinghouse for data that will provide three important running lists: 1) of relevant past, ongoing, and planned research and research results, 2) of managers' information needs, activities, priorities, and lessons learned and 3) of the research still needed to address those needs. These will change over time, and the report will be revised to reflect that evolution. The lists will be made available on a World Wide Web home page so that they will be living documents to help coordinate and guide research and management efforts. Once again, where and how this function will be realized is a decision for the resource management agencies th make.

The report also will provide a blueprint and a rationale for the more formalized structure and process recommended. Through publication and briefings, the findings and recommendations of the Core Group will be communicated to the public and private sector decision makers with a stake in the success of the NCCP program and the resources to further support the effort.

Appendix A
Questions to Address Managers' Information Needs

The Core Group produced the following list of managers' information needs that can be addressed by research. A list of current research activities is included in Appendix B. The research list is cross referenced to the information needs that each activity could addressed, partially or completely.

A. Fire:

1. What are the characteristics of fire within a natural system, and when do human-induced changes to the natural fire regime exceed the tolerances of native plants and animals to re-establish after fire events?

2. What is the effectiveness of the following techniques to reduce or modify fuel loads:

    a. Fuel modification
    b. Prescribed burns
    c. Mechanical removal
    d. Chemical treatment
    e. Grazing

3. What is the effect of fire on small reserves which are isolated from other habitat areas?

4. What is the optimal frequency of fires for different vegetation types?

B. Inventory and Monitoring:

1. What are the criteria for success of the reserve system and how are they measured and monitored?

2. How can mitigation and monitoring programs for specific target species and habitat types be designed to yield maximize benefit to the plurality of management research needs identified in this document?

3. How can we coordinate monitoring and management activities to address within- and between-site variation? How can we collect data to enable comparisons with other studies and provide feedback to specific management efforts?

4. What potential research strategy would include establishment of coastal sage scrub control studies in northwest Baja California?

C. Species Persistence/Demographics/Genetics:

1. Can population viability analysis be used to improve estimates of temporal and geographic variability in demographic parameters and regularly reassess species

extinction risks?

2. What factors determine temporal and geographic variability in population demographics, and what are the implications relative to identifying source or sink populations?

3. How are demographic parameters (especially reproductive success, survivorship, dispersal behavior) affected by various edge effects (including adjacent land uses such as low density residential, high density residential, industrial, commercial, roads, landfills, recreational facilities)?

4. How are demographic parameters (especially reproductive success, survivorship, dispersal behavior) affected by human-related disturbances on the reserve itself (including recreational use, military activities, utilities maintenance)?

5. How are demographic parameters (especially reproductive success, survivorship, dispersal behavior) affected by different management activities (including grazing, fire, mechanical disturbances, etc.)?

6. What are the relationships between species persistence and environmental variables (examined at both local and landscape levels)?

7. What are ecological characteristics of functioning corridors that influence the persistence of selected species, and how is corridor effectiveness influenced by adjacent land uses?

8. What methods are appropriate for using baseline genetic data to study metapopulation structure and dispersal?

D. Administration, Socioeconomic, Implementation:

1. How can a regularly updated and available data base be best established?

2. How can the current state of knowledge be best synthesized and communicated for use by the managers who need it?

3. How can interactive processes among researchers, managers, and administrators be best established?

4. How can research inform management of the important issue peculiar to or largely focused on the urban/wildland interface zone?

5. How can consensus building, maps, criteria, and other tools be used in planning and establishing preserves?

E. Exotics and Invasives:

1. What are the impacts of exotics and invasives, particularly cowbirds, on species other than those that are threatened and endangered?

2. What is the role of exotics and invasives in community function?

    a. Which kinds of invasives potentially lead to cascading community affects at higher trophic levels?

    b. What are the warning signs for monitoring programs to detect these problems?

    c. How many of these invasives are really edge effects and how many can actually displace intact interior communities?

3. How can we develop and monitor methods for the control of exotic plants and animals (e.g., fennel, tocalote, tree tobacco, and black mustard)?

4. How can exotic vegetation be most effectively controlled, particularly in associated riparian areas?

5. What is the effect of predators on species of concern and the predator/habitat relationship?

6. How can future problems with invasives be prevented?

F. Public Use:

1. What is the impact of varying intensities of different types of human activity (such as equestrian, mountain bike, and pedestrian use) on coastal sage scrub resources?

    a. Is there a threshold level of public activity that has measurable negative impacts on CSS resources (e.g., on nesting success of any particular native species)?

    b. What are temporal factors (seasonal, time of day) that may make public uses compatible or incompatible with managing identified coastal sage scrub species and habitat types?

    c. What is the cumulative impact of multiple public uses on habitats?

    d. How can the effects of recreation use on priority species and habitats be monitored so that land managers can effectively manage public access based on empirical data?

2. What is the impact of the following public infrastructure projects on the viability of reserves of different sizes and how does reserve size effect the level of impact?

    a. Dirt roads
    b. Paved roads
    c. Utility corridors, such as buried pipelines and transmission lines
    d. Reservoirs
    e. Water transport system projects

3. What data can indicate the level of damage caused by requested uses?

G. Biophysical Processes/Ecosystem Function:

1. What is the extent of nitrogen deposition region-wide, and its effects on reserve management?

2. How do nutrients cycle through these ecosystems under "natural" conditions, what changes have occurred and what are the possible implications for land management?

3. How do individual species influence community dynamics within a system?

    a. What is the relationship of selected individual species to the community as a whole?

    b. What is the validity of "umbrella" species concept as applied to coastal ecosystems in southern California?

    c. How does specific-species management affect other species and overall community composition?

H. Reserve Design/Biogeography/Landscape Processes:

1. How do we apply information about metapopulation dynamics of species selected by managers to reserve planning and management?

2. How can we monitor the variation of these selected species within and between sites?

3. How does connectivity relate to conservation goals?

    a. How does the need for connectivity relate to reserve size for selected species?

    b. For selected species, what landscape features serve as movement corridors and what features act as barriers to movement?

4. How does fragmentation affect resources?

5. What is the relationship between minimum viable population and the size of reserves?

I. Restoration and Enhancement:

1. What are the comparative benefits and drawbacks of active vs. passive restoration?

2. Can we create or restore the cactus wren breeding habitat to increase viability of this species?

3. What are the biological and ecological feasibility of methods for restoring functioning coastal sage scrub that is able to withstand natural processes such as fire and drought over the long term?

4. What is the feasibility of propagating seed crops of native herbaceous annuals and fire

followers for use in coastal sage restoration efforts?

5. What can be done to increase the productivity of CSS habitats for identified species?

6. Can gnatcatcher habitat and populations be enhanced by manipulating plant species composition or structure?

7. Can coastal sage scrub habitat be enhanced by planting, mowing, pruning or other mechanical means?

8. Can and should water be added to the system artificially to make habitat more healthy?

9. Is there a place for created vernal pools or other wetlands in CSS?

10. Why do some areas support much denser populations of gnatcatchers and other species?

11. What is the effectiveness of prescribed burns as a tool in the restoration of coastal sage scrub?

12. What are the real costs and chances of success for restoration and revegetation?

J. General Species, Program-Wide, and Regional Concerns:

1. What species exhibit high levels of sensitivity to edge effects, and are therefore likely to be useful indicators for purposes of monitoring reserve integrity?

2. What umbrella species (broad distribution throughout CSS with limited distribution in other habitat types) could be used to evaluate overall health of community?

3. What species closely associated with coastal sage scrub require further autecological research?

K. Historical Land Use/Succession:

1. How does prior land use affect subsequent ability to establish or restore coastal sage scrub and associated habitats?

2. How can historical records help determine whether given areas are appropriate for protection of target species?

L. Habitat Management Practices:

1. What are the effects of livestock grazing (intensity and duration) on sensitive habitats?

    a. Under what circumstances can cattle grazing be accommodated on habitat (coastal sage scrub, annual grasslands, other habitat types)?

b. What are the circumstances where cattle grazing or perhaps other economic uses of land can be tolerated or even an effective management tool?

c. What are the responses of selected plant and animal species to grazing regimes?

2. What are the community succession characteristics of the major natural communities that occur within CSS areas throughout southern California?

3. What are the guidelines for when a particular resource goal should be attempted? When is it appropriate to manage for a single species or overall biodiversity?

M. Influence of Adjacent Land Uses:

1. What are the impacts of the following adjoining land uses on the viability of habitats within reserves?

   a. Golf courses and urban parks
   b. Agriculture
   c. Housing
   d. Industrial
   e. Others

2. What is the impact of the following factors on ecosystem health, and to what extent do surrounding land uses affect the minimum size of reserves necessary to retain habitat values and attain conservation objectives?

   a. Point source pollution
   b. Change in microclimate
   c. Altered densities of rodents
   d. Feral species (ants, cats, etc.)
   e. Noise
   f. Fire
   g. Light

3. What types of adjacent land use should be encouraged and discouraged?

Appendix B
List of Recent, Current, and Planned Relevant Research Activities

This appendix includes a preliminary list of research activities related to CSS and NCCP activities. Undoubtedly some research work may not be represented here because organizers of this list were not aware of some work. Those engaged in relevant research are encouraged to contact the address (email, street, or phone) noted on the title page and describe their work so it may be included.

First the activities that are relevant to the managers' information needs are organized in a structure parallel to the needs listed in Appendix A of the Core Group Report. Beginning on page B-6, a more comprehensive list of activities are contained in a structure described below. Both lists are preliminary compilations and are not be construed as complete listings. They will continue to expand as new research activities are identified and initiated.

The Natural Communities Conservation Planning (NCCP) program has been interested in the development of new research information to support the program since the development of the original conservation guidelines. The NCCP program wishes to resolve as much as possible unanswered questions that bear on the conservation of the coastal sage scrub (CSS) community and associate flora and fauna. The Scientific Review Panel (1993) recommended six interactive research tasks.

1. Biogeography and inventory of CSS.
2. Trends in biodiversity.
3. Dispersal characteristics and landscape corridor use.
4. Demography and population viability analysis.
5. Surveys and autecological studies of sensitive animals and plants.
6. Genetic studies.

Research Activities Relevant to Decision Makers' Information Needs

The following pages include research that is relevant to managers' information needs described in pages 5-12 of the Core Group Report. Some of the research activities are referenced only by the number assigned to them in the comprehensive list of activities starting on page A-6.

While the research activities listed below are relevant to a specific information need, it should not be assumed that the information produced by that research would completely address that need. In most cases, the research would provide some relevant information, but

not enough to effectively inform the decision of a manager or policy maker.

A. Fire:

1. A.1.a(1), A.1.2.b.(1)-(3), (5), B.2.c.(7), Atwood, J. L., D. R. Bontrager, and A. L. Gorospe. Use of refugia by California Gnatcatchers displaced by habitat loss. CalGnat Proceedings, in press., B.2.e.(1), G.3

2. a. *None*
   b. *None*
   c. *None*
   d. *None*
   e. *None*

3. *None*

4. *None*

B. Inventory and Monitoring:

1. *None*

2. *None*

3. *None*

4. *None*

C. Species Persistence/Demographics/Genetics:

1. Akakaya, H. R. and J. L. Atwood. A habitat-based metapopulation model of the California gnatcatcher. Conservation Biology, in press.

2. Akakaya, H. R. and J. L. Atwood. A habitat-based metapopulation model of the California gnatcatcher. Conservation Biology, in press.

3. *None*

4. *None*

5. *None*

6. Akakaya, H. R. and J. L. Atwood. A habitat-based metapopulation model of the California gnatcatcher. Conservation Biology, in press.

7. Work by Ogden Environmental associated with (1) MSCP, and (2) Otay Ranch

8. Work by Bob Zink and colleagues on California Gnatcatcher genetics work by ____ (San Diego State) on Cactus Wren genetics

D. Administration, Socioeconomic, Implementation:

1. *None*

2. For public use, some work has been done by the USFS Fire Lab., U.C. Berkeley, and the National Park Service

3. *None*

4. *None*

5. *None*

E. Exotics and Invasives:

1. B.2.c.(3); B.2.c.(13); Yosida: competition for nitrogen between Artemesia and annual grasses; Allen, Minnich, Bytnerowics, Grant: nitrogen, fire, and invasive annuals in CSS; much literature on exotics and invasives in systems other than CSS; monograph for California's exotic animals; Native Plant Society exotic threat list; CALEPPC; CA noxious week lists

2. A.2.b.(4)
   a. *None*
   b. *None*
   c. *None*

3. B.2.c.(2); B.2.d.(2); B.2.c.(3); B.2.c.(13); Yosida: competition for nitrogen between Artemesia and annual grasses; Allen, Minnich, Bytnerowics, Grant: nitrogen, fire, and invasive annuals in CSS; ongoing research for all these species documented in CALEPPC

4. Yosida: competition for nitrogen between Artemesia and annual grasses; Allen, Minnich, Bytnerowics, Grant: nitrogen, fire, and invasive annuals in CSS; CALEPPC on biological control of species such as tamarisk and giant cane

5. Crooks: native carnivores/feral cats

6. *None*

F. Public Use:

1. a. *None*
   b. *None*
   c. *None*
   d. Atwood, J. L., S. H. Tsai. C. H. Reynolds, J. C. Luttrell, and M. R. Fugagli. Factors affecting estimates of California Gnatcatcher use areas. CalGnat Proceedings, in press.

2. a. *None*
   b. B.2.c.(22)

c. California Gnatcatcher Impact Evaluation and Mitigation for Linear Utilities Construction and Maintenance, from Impact Evaluation Criteria Workshop for the California Gnatcatcher, San Diego Co. Water Authority, 1993.
d. B.2.c.(25)
e. *None*

3. *None*

G. Biophysical Processes/Ecosystem Function:

1. Allen

2. *None*

3. a. *None*
b. Work by John Lovio (?) at San Diego State; work by John Rotenberry
c. *None*

H. Reserve Design/Biogeography/Landscape Processes:

1. Akakaya, H. R. and J. L. Atwood. A habitat-based metapopulation model of the California gnatcatcher. Conservation Biology, in press; work by Ogden Environmental (Pat Mock) connected with the MSCP program

2. B.2.c.(4); Akakaya, H. R. and J. L. Atwood. A habitat-based metapopulation model of the California gnatcatcher. Conservation Biology, in press.

3. B.2.c.(4); work by Ogden Environmental (Pat Mock) connected with the MSCP program

4. Soule; Case

5. *None*

I. Restoration and Enhancement:

1. B.2.c.(9)

2. *None*

3. B.2.c.(9); B.2.c.(19); B.2.c.(28); B.2.c.(32)

4. B.1.b.(1); B.1.b.(2); B.2.c.(28); B.2.c.(32)

5. B.2.c.(19); B.2.c.(28); B.2.c.(32)

6. B.1.b.(1); B.1.b.(2); B.2.c.(28); B.2.c.(32)

7. B.2.c.(32)

8. *None*

9. Much literature outside CSS data base

10. B.2.c.(9); nearly all studies dealing with estimates of gnatcatcher reproductive success, especially including those by Braden, Atwood, Erickson, Deely, Mock, etc. etc. etc.

11. *None*

12. *None*

J. General Species, Program-Wide, and Regional Concerns:

1. Work by Doug Bolger

2. Work by Jon Rotenberry

3. *None*

K. Historical Land Use/Succession:

1. B.1.b.(3); B.2.c.(34); Allen, Davis and Hiedl; Marquez and Allen; Zink and Allen; Marquez; Davis, Eliason, and Allen; Beyers

2. *None*

L. Habitat Management Practices:

1. a. *None*
   b. *None*
   c. *None*

2. *None*

3. *None*

M. Influence of Adjacent Land Uses:

1. a. *None*
   b. Scott, Minnich, Allen
   c. *None*
   d. *None*
   e. *None*

2. a. Some work on nitrogen and on off-road vehicles
   b. *None*
   c. *None*
   d. B.2.c.(2), Crooks on carnivores

e. B.2.d.(2), B.3.(2)
f. *None*
g. *None*

3. B.2.c.(14), B.2.c.(14), B.2.c.(22), B.2.c.(32)

Comprehensive List of Coastal Sage Scrub Research Activities

This following list represents both specific NCCP initiated research as well as other associated research that would assist in the NCCP planning process. The list includes those research activities that are relevant to the managers' information needs and those activities that are not. This is an active "on-going draft compilation" list that will be updated through the review of this report and as an ongoing effort. The list should not be considered inclusive to all related NCCP research activities.

This information has been organized to provide a "map" to all the topics of research that would be of interest. The following is a proposed method of organizing and separating individual efforts into topics:

A. Physical Sciences
    A.1. Earth Sciences
        A. 1. a. Soils
    A. 2. Physical Processes
        A. 2. a. Erosion A. 2. b. Fire

B. Biological Sciences
    B. 1. Plants
        B. 1. a. General
        B. 1. b. Restoration
    B. 2. Animals
        B. 2. a. Mammals
        B. 2. b. Birds
        B. 2. c. Reptiles and Amphibians
        B. 2. d. Invertebrates
    B. 3. Ecosystems
        B. 3. a. Ecological processes
        B. 3. b. Habitat/Vegetation Communities
        B. 3. c. Invasive and exotic species
C. Social Sciences
D. Technology/tools

The following organization includes 71 research or monitoring programs that we are aware of currently. This is an ongoing process of discovery, more projects that others know about would be welcome. Some projects are repeated in this list if they address more than one major topic.

A. PHYSICAL SCIENCES

A. 1. EARTH SCIENCES

A. 1. a. SOILS

A. 1. a. (1). Interaction of nitrogen eutrophication and fire on invasive annuals in California coastal sage shrublands on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Edith Allen (Tel.909-787-2123), University of California, Riverside, CA 92521.

Co-Principal: Richard Minnich, University of California, Riverside, CA 92521.

A. 1. d. PUBLIC USE

A. 1. d. (1). Factors affecting estimates of California Gnatcatcher use areas.

Atwood, J.L., S.H. Tsai, C.H. Reynolds, J.C. Luttrell, and M.R. Fugagli. Factors affecting estimates of California Gnatcatcher use areas. CalGnat Proceedings, in press.

A. 2. PHYSICAL PROCESSES

A. 2. a. EROSION

A. 2. b. FIRE

A. 2. b. (1). Post-fire recovery of California coastal sage scrub (sites in San Diego, Orange, and Riverside Counties)

Principal: Jan L. Beyers, USDA Forest Service, Pacific Southwest Research Station, Forest Fire Laboratory, 4955 Canyon Crest Drive, Riverside, CA 92507;(909)276-6673; FAX(909) 276-6426.

Co-Principal: William O. Wirtz, II, Department of Biology, Pomona College, Claremont, CA 91711-6339;(909)621-8606 or 621-8555 ext.2950,FAX(909)621-8878.

Objective: To investigate changes in plant species composition and vegetation structure during managed and non-managed post-fire recovery in coastal sage scrub, including seed bank composition, and to identify the relationship of small mammal, bird, and reptile population structure to post-fire plant succession. Results of this study should aid agencies in making post-fire management decisions for coastal sage scrub.

Study Plan: Research has been underway at two sites since July 1992. Initial studies focused on Camp Pendleton; several other locations have been added in the beginning of calendar year 1995. Current study locations (as September 1994) include Lake Mathews in Riverside County and the San Diego Wild Animal Park and the upper San Diego River in San Diego County. Other locations being explored include Casper Regional Park, Orange County and Domenigoni Reserve, Riverside County.

A. 2. b. (2). Demographic patterns of post-fire recovery in coastal sage scrub and chaparral on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Jon Keeley, Department of Biology, Occidental College, Los Angeles, CA 90041. Tel. 213-259-2898, FAX 213-341-4974 e mail chap@oxy.edu

Objective: Assess the response of chaparral and coastal sage scrub plant communities to fire. A large number of sample sites are being investigated to determine the variation in response based on plant species composition and various physical environmental parameters.

A. 2. b. (3). Post-fire ecological study on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: John O'Leary, Department of Geography, San Diego State University, San Diego, CA 92182-4493. Tel.619-594-5511

Co-Principal: Robin Wells, The Nature Conservancy, Santa Rosa Plateau, Riverside County, CA. Tel.909-699-1856.

Objective: Tracking long-term patterns of species diversity, plant demography, and resilience at a range of ecological scales (domains). This research intends to provide quantitative information that describes post-burn reproductive strategies of a variety of coastal sage scrub plant associations.

Study plan: Research is being conducted in three main locations where fire has recently occurred; the Laguna fire area in coastal Orange County, the Shipley Reserve in southwestern Riverside County, and east of the Wild Animal Park. A total of 44 replicate plots, 25 X 25 m., have been established. Each 625 square meter plot has nested within it four 10 X 10 m. and twenty eight 1 X 1 m. subplots. Visual examination of plant cover, species composition, and plant structure is recorded after spring vs. fall burns. Plans are to collect data for at least five years to follow post-burn vegetation succession.

A. 2. b. (4). Interaction of nitrogen eutrophication and fire on invasive annuals in California coastal sage shrublands on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Edith Allen (Tel.909-787-2123), University of California, Riverside, CA 92521.

Co-Principal: Richard Minnich, University of California, Riverside, CA 92521.

A. 2. b. (5). Effects of fire on the ecology of the California Gnatcatcher, *Polioptila californica*, California sage scrub communities. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Wirtz, II, William O., and Audrey L. Mayer. Dept. Biol., Pomona College, Claremont, CA 91711.

B. BIOLOGICAL SCIENCES

B. (1). Bibliographies on coastal sage scrub and related malacophyllous shrublands of other Mediterranean-type climates. 1994. California Wildlife Conservation Bulletin.

Principals: John F. O'Leary, Sandra A. DeSimone, Dennis D. Murphy, Peter F. Brussard, Michael S. Gilpin, and Reed F. Noss.

Objective: Comprehensive bibliography on aspectes of coastal sage scrub. 1) Animals 2) Autecology 3)Biogeography, Evolution, and Systematics 4) Community Composition, Distribution, and Classification 5) Comparisons with other malacophyllous shrublands in Mediterranean climates 6) Conservation, Restoration, and Management, 7) Fire, Diversity, and Succession 8) Maps 9) Mediterranean systems (malacophyllous only) of other regions 10) Morphology, Phenology, and Physiology 11) Mosaics: coastal sage scrub/chaparral or grasslands 12) Productivity and Nutrient Use 13) Soils and Water Resources.

B. 1. PLANTS

B. 1. a. GENERAL

B. 1. a. (1). Post-fire recovery of California coastal sage scrub (sites in San Diego, Orange, and Riverside Counties)

Principal: Jan L. Beyers, USDA Forest Service, Pacific Southwest Research Station, Forest Fire Laboratory, 4955 Canyon Crest Drive, Riverside, CA 92507;(909)276-6673; FAX(909) 276-6426.

Co-Principal: William O. Wirtz, II, Department of Biology, Pomona College, Claremont, CA 91711-6339;(909)621-8606 or 621-8555 ext.2950,FAX(909)621-8878.

Objective: To investigate changes in plant species composition and vegetation structure during managed and non-managed post-fire recovery in coastal sage scrub, including seed bank composition, and to identify the relationship of small mammal, bird, and reptile population structure to post-fire plant succession. Results of this study should aid agencies in making post-fire management decisions for coastal sage scrub.

Study Plan: Research has been underway at two sites since July 1992. Initial studies focused on Camp Pendleton; several other locations have been added in the beginning of calendar year 1995. Current study locations (as September 1994) include Lake Mathews in Riverside County and the San Diego Wild Animal Park and the upper San Diego River in San Diego County. Other locations being explored include Casper Regional Park, Orange County and Domenigoni Reserve, Riverside County.

B. 1. a. (2). Demographic patterns of post-fire recovery in coastal sage scrub and chaparral on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Jon Keeley, Department of Biology, Occidental College, Los Angeles, CA 90041. Tel. 213-259-2898, FAX 213-341-4974 e mail chap@oxy.edu

Objective: Assess the response of chaparral and coastal sage scrub plant communities to fire. A large number of sample sites are being investigated to determine the variation in response based on plant species composition and various physical environmental parameters.

B. 1. a. (3). Post-fire ecological study on the Southwestern Riverside County Multi-

Species Ecological Reserve

Principal: John O'Leary, Department of Geography, San Diego State University, San Diego, CA 92182-4493. Tel.619-594-5511

Co-Principal: Robin Wells, The Nature Conservancy, Santa Rosa Plateau, Riverside County, CA. Tel.909-699-1856.

Objective: Tracking long-term patterns of species diversity, plant demography, and resilience at a range of ecological scales (domains). This research intends to provide quantitative information that describes post-burn reproductive strategies of a variety of coastal sage scrub plant associations.

Study plan: Research is being conducted in three main locations where fire has recently occurred; the Laguna fire area in coastal Orange County, the Shipley Reserve in southwestern Riverside County, and east of the Wild Animal Park. A total of 44 replicate plots, 25 X 25 m., have been established. Each 625 square meter plot has nested within it four 10 X 10 m. and twenty eight 1 X 1 m. subplots. Visual examination of plant cover, species composition, and plant structure is recorded after spring vs. fall burns. Plans are to collect data for at least five years to follow post-burn vegetation succession.

B. 1. a. (4). Smooth Tarplant studies on the Domenigoni Valley floor on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Patricia Gordon-Reedy (Tel.619-458-9044 FAX 619-458-0943) Ogden Environmental and Energy Services, 5510 Morehouse Drive, San Diego, CA 92121.

B. 1. a. (5). Local variation in floristics and distributional factors in California coastal sage scrub.

Principals: Sandy DeSimone and Paul Zedler (Tel.619-594-2896,FAX619-594-5676), San Diego State University, San Diego, CA.

Objective: Describe the floristic variation and the determining factors for it in coastal sage scrub.

B. 1. a. (6). Alluvial Fan Sage Scrub Conservation Plan Study

Prinicipals: Joan M. Stafford (Tel.909-869-2697 FAX 909-869-4460), Assoc. Professor, Dept. of Landscape Architecture; Ronald

Quinn (909-869-4056), Professor, Dept. of Biology, California State Polytechnic University, 3801 W. Temple Avenue, Pomona, CA 91768.

Objective: Collate existing RAFSS information.

B. 1. b. RESTORATION

B. 1. b. (1). Five year rare plant monitoring study on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Norm Ellstrand, Department of Biology, University of California, Riverside, CA 92521 .....

Objective: a) rare plant surveys for location, abundance, and distribution and b) relocation planting success

B. 1. b. (2). Genetics and fitness of transplantation in coastal sage scrub on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Norm Ellsworth, University of California, Riverside, CA 92521.

Co-Principals: Montalvo and Conrad...

B. 1. b. (3). Use of restored coastal sage scrub habitat by California Gnatcatchers in a park setting. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Karen L. Pluff, Adrian Wolf, and Robb Hirsch; CA Dept. of Parks and Recreation, 8885 Rio San Diego Dr. #270, San Diego, CA 92108, and CA Dept. of Parks and Recreation, Crystal Cove S.P., 8471 N. Coast Hwy., Laguna Beach, CA 92651.

B. 1. b. (4). A Test of Enhancement Methods For OHV-disturbed Diegan Coastal Sage Scrub.

Objective: To enhance and restore 5 acres of disturbed remnants of three sensitive communities: Diegan Coastal Sage Scrub, San Diego Mesa Vernal Pool (San Diego Mesa Hardpan), and Native Grassland. Various treatment combinations will be employed to assess most effective, low cost methods for enhancing or restoring these vegetation types.

Principal: Ellen T. Bauder, Department of Biology, San Diego State University, San Diego, CA 92182-4614. phone: 916-594-5032, FAX 916-594-5676, email ebauder@sunstroke.sdsu.edu

B. 1. b. (5). Salvage of Coastal Sage Scrub Habitats in Future Development Areas.

Objective: To transplant and re-assemble patches of adult CSS plants which include genetic rescue of CSS perennials, epiphytes, insect and arachnids, and mycorrhizae. This approach provides immediate habitat for target species and serves as a source of inoculum within larger matrices of imprinted or hydroseeded acreage. Numerous papers are in preparation.

Principal: P.A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine 92717; (714) 824-5183

Bowler, P.A., A. Wolf, H.V. Pham, M.A. Archer, A.S. Bak, M. Bedaux, A. Chhun, J.S. Crain, S. Feeney, A. Gloskowski, P. Golcher, C.J. Hodson, M.L. James, R.C. Johnson, M.S. Milane, V.H. Nguyen, R.S. Salazar, and C.R. Simonds. 1994. Transplanting Coastal Sage Scrub Seedlings from Natural Stands (California). Restoration and Management Notes 12 (1): 87-88.

B. 1. b. (5). Fire resilience in coastal sage scrub within mitigation and restoration areas.

Objective: To determine the ability of created coastal sage scrub habitats to recover after fire and to exhibit the postfire successional characteristics of natural coastal sage scrub stands.

Principal: P.A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine 92717; (714) 824-5183. pabowler@uci.edu

B. 1. b. (6). Whole community restoration of coastal sage scrub with a focus upon the understory.

Objective: To develop techniques which will allow restorationists and mitigation efforts to be able to meaningfully introduce the understory in coastal sage scrub restoration and mitigation projects. A paper in is preparation about initial efforts.

Principal: P.A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine 92717; (714) 824-5183

B. 1. b. (7). The use of CSS restoration and mitigation sites as they develop and grow by reptiles, amphibians, small mammals and birds.

Principal: P.A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine 92717; (714) 824-5183 and Ted Case (619-534-2312)

B. 1. b. (8). Mitigation for cactus wren habitat loss in burned areas by translocating adult coastal cholla (Opuntia prolifera) and coastal prickly pear cactus (Opuntia littoralis).

Objective: Develop and document ways to move mature cacti to restoration areas within fire damaged or other arenas where adult plants can supplement existing conditions.

This experiment is underway and preliminary results should be available in early 1997.

Principal: P.A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine 92717; (714) 824-5183

B. 1. b. (9). Habitat design improvements for restoration and mitigation projects: Direct emulation of model sites.

Objective: Improve mitigation and restoration site design. Exact, to-scale modelling of coastal sage stands can be implemented, allowing a more ecologically based mitigation or restoration design. This has been implemented along the San Joaquin Tollroad on the UCI campus; Bowler and Demerjian (1996) have a paper in press describing an easy way to develop habitat-based design.

Bowler, P.A. and R. G. Demerjian. 1996. Digitized Photography as a Direct Template in Habitat Emulation Design. Restoration and Management Notes (in press).

Principal: P.A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine 92717; (714) 824-5183

B. 2. ANIMALS

B. 2. a. GENERAL

B. 2. a. (1). Post-fire recovery of California coastal sage scrub (sites in San Diego, Orange, and Riverside Counties)

Principal: Jan L. Beyers, USDA Forest Service, Pacific Southwest Research Station, Forest Fire Laboratory, 4955 Canyon Crest Drive, Riverside, CA 92507;(909)276-6673; FAX(909) 276-6426.

Co-Principal: William O. Wirtz, II, Department of Biology, Pomona College, Claremont, CA 91711-6339;(909)621-8606 or 621-8555 ext.2950,FAX(909)621-8878.

Objective: To investigate changes in plant species composition and vegetation structure during managed and non-managed post-fire recovery in coastal sage scrub, including seed bank composition, and to identify the relationship of small mammal, bird, and reptile population structure to post-fire plant succession. Results of this study should aid agencies in making post-fire management decisions for coastal sage scrub.

Study Plan: Research has been underway at two sites since July 1992. Initial studies focused on Camp Pendleton; several other locations have been added in the beginning of calendar year 1995. Current study locations (as September 1994) include Lake Mathews in Riverside County and the San Diego Wild Animal Park and the upper San Diego River in San Diego County. Other locations being explored include Casper Regional Park, Orange County and Domenigoni Reserve, Riverside County.

B. 2. a. (2). Habitat affinities of less well known vertebrates in coastal sage scrub and the assorted variations of this type and adjoining chaparral types.

Principals: Dr. Ted Case (619-534-2312), herpetology/U.C. San Diego, Dr. John Rotenberry (909-787-3953) , Ornithology/U.C. Riverside, and Dr. Mary Price (909-787-3292), Mammalogy/U.C. Riverside. Work is being fully coordinated with companion research funded by the National Biological Service

Study Plan: Research has begun in the beginning of calendar year 1995. Six to twelve locations within San Diego, Orange, and Riverside Counties will be the site for intensive data collection. Each site will 10 to 30 trap arrays for herps, as well as transects for birds and small mammals.

B. 2. b. MAMMALS

B. 2. b. (1). Autecological studies of sensitive coastal sage scrub target birds and small mammals (sites in San Diego, Orange, and Riverside Counties)

Principal: John T. Rotenberry, Natural Reserve System and Department of Biology, University of California, Riverside, CA 92521;(909)787-3953, FAX(909)787-4286

Co-Principal: Mary V. Price, Department of Biology, University of California, Riverside, CA 92521;(909)787-3292, FAX(909)787-4286.

Objective: To establish quantifiable baseline information on habitat associations and

environmental variables that may be useful in predicting the presence or absence of a variety of birds and small mammals in coastal sage scrub of southern California.

B. 2. b. (2). Stephens' Kangaroo Rat habitat/management studies on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Michael J. O'Farrell, O'Farrell Biological Consulting, 2912 N. Jones Blvd., Las Vegas, NV 89108;(702)658-5222; FAX(702)658-0809.

B. 2. b. (3). Ecology of the San Bernardino Kangaroo Rat and Los Angeles Pocket Mouse

Objective: 1. Gather existing information on historical distribution and establish a data base. 2. Identify current localities for both species 3. Describe habitat attributes. 4. Develop protocol for live capture.

Principal: Robert L. McKernan, San Bernardino County Museums, County of San Bernardino, 2024 Orange Tree Lane, Redlands, CA 92347 Tel.(909)798-8570;Fax:909-798-8585.

B. 2. b. (4). Distribution and Habitat Affinities of the Pacific Pocket Mouse

Objective: 1. Survey for other possible populations of species. 2. Describe habitat attributes at selected sites.

Principal: David J. Germano, Wildlife Consultant, 3520 Sewell Street, Bakersfield, CA 93312 Tel.(805) 589-7846.

B. 2. b. (5). Studies of Pacific Pocket Mouse, Los Angeles Pocket Mouse, Dulzura Pocket Mouse, San Diego Pocket Mouse, and San Diego Woodrat.

Objective: Field research to further understand geographic range, population density, and habitat requirements.

Principal: William O. Wirtz, II, Pomona College, Department of Biology, 609 N. College Avenue, Claremont, CA 91711-6339.....

B. 2. b. (6). Longterm, ongoing, monitoring of the UCI Ecological Preserve California gnatcatcher and cactus wren populations.

Principal: P.A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine 92717; (714) 824-5183

B. 2. c. <u>BIRDS</u>

B. 2. c. (1). Autecological studies of sensitive coastal sage scrub target birds and small mammals (sites in San Diego, Orange, and Riverside Counties)

Principal: John T. Rotenberry, Natural Reserve System and Department of Biology,

University of California, Riverside, CA 92521;(909)787-3953, FAX(909)787-4286

Co-Principal: Mary V. Price, Department of Biology, University of California, Riverside, CA 92521;(909)787-3292, FAX(909)787-4286.

Objective: To establish quantifiable baseline information on habitat associations and environmental variables that may be useful in predicting the presence or absence of a variety of birds and small mammals in coastal sage scrub of southern California.

B. 2. c. (2). Mechanisms behind the deterioration of habitat suitability in fragmented coastal sage scrub habitat: coastal horned lizard and rufus crowned sparrow on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Ted J. Case (Tel.619-534-6231 FAX 619-534-7180),University of California San Diego, La Jolla, CA 92093.

Co-Principal: Doug Bolger (Tel. .....)

B. 2. c. (3). Cowbird trapping program on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: John and Jane Griffith...

B. 2. c. (3). Breeding success of the California gnatcatcher (*Polioptila californica*) in fragmented habitat surrounding Bonita Reservoir. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Maria Andros and Mari Schroeder (Tel.714-261-5414, FAX714-261-8950) Chambers Group, Inc., 16700 Aston St., Irvine, CA 92619-7002.

B. 2. c. (4). Distribution, dispersal, and population dynamics of California Gnatcatchers on the Palos Verdes Peninsula, 1993 - 1995. 1995 Symposium on the Biology of the California Gnatcatcher. CalGnat symposium proceedings.

Objective: To evaluate levels of annual variation in basic reproductive parameters (including dispersal behavior), and to use this information in development of population viability models. Project (but not the cited publication) also addresses Cactus Wren population dynamics. Begun in 1993, the project is anticipated to continue at least through 1997, and probably beyond.

Principals: Jonathan L. Atwood, Michael R. Fugagli, Carol H. Reynolds, and James C. Luttrell. Manomet Observatory for Conservation Studies, P.O. Box 1770, Manomet, MA 02345.

B. 2. c. (5). Differences in size estimates of California Gnatcatcher use areas. 1995 Symposium on the Biology of the California Gnatcatcher.

Objective: To evaluate quantitative methods of measuring California Gnatcatcher use areas, and the possible role of such estimates in assessing various habitat alterations on gnatcatcher behavior patterns.

Principals: Jonathan L. Atwood, Sophia Tsai, Carol H. Reynolds, James C. Luttrell, and Michael R. Fugagli. Manomet Observatory for Conservation Sciences, P.O. 1770, Manomet, MA 02345.

B. 2. c. (6). Dispersal capabilities of the California Gnatcatcher: a landscape analysis of distribution data. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Eric A. Bailey and Patrick J. Mock. Ogden Environmental and Energy Services Company, 5510 Morehouse Dr., San Diego, CA 92121.

B. 2. c. (7). Coastal sage scrub in relation to fire history and use by the California Gnatcatcher. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Jan L. Beyers, Ginger C. Peña, and William O. Wirtz, II. USDA Forest Service Pacific Southwest Research Station, 4955 Canyon Crest Dr., Riverside, CA 92507, and Dept. Biology, Pomona College, Claremont, CA 91711.

B. 2. c. (8). Short-term increases in California Gnatcatcher breeding densities in habitat refugia located adjacent to the 1993 Laguna Canyon fire. 1995 Symposium on the Biology of the California Gnatcatcher.

Objective: To pre- and post-fire gnatcatcher densities in habitat refugia, including persistence of elevated population densities following fire displacement.

Principals: Jonathan L. Atwood (508-224-6521), David R. Bontrager (508-224-6521), Amy L. Gorospe, and Edward Almanza (714-376-0428). 80645 Lost Creek Rd., Dexter, OR 97431; Manomet Observatory for Conservation Sciences, P.O. Box 1770, Manomet, MA 02345; Dept. Biology, Cal. State University, Long Beach, CA 90824; and Almanza & Associates, 422 Glenneyre, Laguna Beach, CA 92651.

B. 2. c. (9). California Gnatcatcher use of mulefat and coastal sage scrub restorations as a wetlands margin dispersal corridor. 1995 Symposium on the Biology of the California Gnatcatcher.

Principal: Peter A. Bowler, Dept. of Ecology and Evolutionary Biology, University of California, Irvine, CA 92717.

B. 2. c. (10). Detectability of *Polioptila californica californica* (Coastal California Gnatcatcher) in western Riverside County during the breeding and non-breeding seasons. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Gerald T. Braden, Eugene A. Cardiff, Stacey L. Love, and Mary Elizabeth Woulfe; San Bernardino County Museums, 2024 Orange Tree Lane, Redlands, CA 92374.

B. 2. c. (11). Habitat use versus availability for *Polioptila californica californica* (Coastal California Gnatcatcher) in western Riverside County during the 1992 - 1994 breeding seasons. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Gerald T. Braden and Stacey L. Love; San Bernardino County Museums, 2024 Orange Tree Lane, Redlands, CA 92374.

B. 2. c. (12). Life history of *Polioptila californica californica* (Coastal California Gnatcatcher) in western Riverside County, CA. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Gerald T. Braden, Robert L. McKernan, and Shawn Powell;

San Bernardino County Museums, 2024 Orange Tree Lane, Redlands, CA 92374 and 42 A Thayer Road, Greenfield, MA 01301.

B. 2. c. (13). Consequences of nest parasitism of *Polioptila californica californica* (Coastal California Gnatcatcher) by *Molothrus ater* (Brown-headed Cowbird) in western Riverside, CA. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Gerald T. Braden, Robert L. McKernan, and Shawn Powell.; San Bernardino County Museums, 2024 Orange Tree Lane, Redlands, CA 92372, and 42 A Thayer Road, Greenfield, MA 01301.

B. 2. c. (14). Saving the habitat and losing the birds: adjacent habitats, management, and natural history of the California Gnatcatcher. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Kurt F. Campbell, Richard A. Erickson, and Michael A. Patten; Campbell Biological Consulting, 600 Central Avenue, #118, Riverside, CA 92507-6512: LSA Assoc., One Park Plaza, Suite 500, Irvine, CA 92714; and Dept. Biology, University of California, Riverside, CA 92521.

B. 2. c. (15). Assessing the value of the California gnatcatcher (Polioptila californica) as an indicator of bird species density. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Mary K. Chase, John T. Rotenberry, and Michael D. Misenhelter; Dept. of Biology, University of California. Riverside, CA 92521.

B. 2. c. (16). Current status and history of the California gnatcatcher (*Polioptila californica californica*) in San Bernardino County. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Liam H. Davis, Robert L. McKernan, and James S. Burns; California Department of Fish and Game, Natural Community Conservation Planning, 4949 Viewridge Avenue, San Diego, CA 92123, San Bernardino County Museums, County of San Bernardino, 2024 Orange Tree Lane, Redlands, CA 92347, and U.S. Fish and Wildlife Service, Carlsbad Field Office, 2730 Loker Avenue West, Carlsbad, CA 92008.

B. 2. c. (17). Home range size in the California gnatcatcher: determinants and its effect on reproductive success. 1995 Symposium on the Biology of the California Gnatcatcher.

Principal: Robyn J. Deeley, Dept. of Biology, San Diego State University, San Diego, CA 92182.

B. 2. c. (18). An individual-based population model for the California gnatcatcher.

1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Randall Downer and Jonathan L. Atwood, Manomet Observatory for Conservation Sciences, P.O. Box 1770, Manomet, MA 02345

B. 2. c. (19). An example of successful California gnatcatcher habitat creation. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Richard A. Erickson and M.W. (Bill) O'Connell, LSA Associates, One Park Plaza, Suite 500, Irvine, CA 92714.

B. 2. c. (20). Four years of synchronous California gnatcatcher population fluctuations at two locations in coastal Orange County, California. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Richard A. Erickson and Karen L. Pluff; LSA Associates, One Park Plaza, Suite 500, Irvine, CA 92714; and California State Parks, 8885 Rio San Diego Drive, Suite 270, San Diego, CA 92108.

B. 2. c. (21). Vegetation use by California gnatcatchers. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Jennifer Ezovski, Tammy Stecher, and Eric J. Woehler, Dept. of Ecology & Evolutionary Biology, UC Irvine, CA 91717.

B. 2. c. (22). Occurrence and management considerations of Coastal California gnatcatchers within and adjacent to highway rights-of-way. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Peter Famolaro and Jeff Newman; Recon, 7460 Mission Valley Road, San Diego, CA and USFWS, 2370 Loker Avenue, Carlsbad, CA 92009.

B. 2. c. (23). The California gnatcatcher as an umbrella species. 1995 Symposium on the Biology of the California Gnatcatcher.

Principal: Scott Fleury, Dept. of Biology, University of Nevada, Reno, NV 89557.

B. 2. c. (24). Distribution and population estimates of the California gnatcatcher (*Polioptilia californica*) in Baja California, Mexico.

1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Paul Fromer and Jeff Newman; RECON, San Diego, CA 92108, and USFWS, 2730 Loker Avenue, Carlsbad, CA 92009.

B. 2. c. (25). The breeding biology of the California gnatcatcher (*Polioptilia californica*) at Siphon Reservoir. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: J. Paul Glavin, Maria Andros, and Mari Schroeder, Chambers Group, Inc., 16700

Aston St., Irvine, CA 92619-7002.

B. 2. c. (26). Nesting behavior of the California gnatcatcher at Rancho San Diego and vicinity. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Mary A. Grishaver, Patrick J. Mock, Kristine L. Preston, Eric A. Bailey, David F. King, and Lyndon B. Quon, Ogden Environmental and Energy Services Company, 5510 Morehouse Dr., San Diego, CA 92121.

B. 2. c. (27). A 1995 sighting of the California Gnatcatcher in Ventura County. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Cynthia A. Jones and Ruben S. Ramirez, Michael Brandman Associates, 17310 Red Hill Ave., Suite 250, Irvine, CA 92714.

B. 2. c. (28). Results of a five-year monitoring study for a Habitat Conservation Plan (HCP) designed to protect an isolated Coastal California Gnatcatcher population: successful management of a small population and breeding success in revegetated habitats. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: David Levine, Natural Resource Consultants, 20 Cystal Cove, Laguna Beach, California 92651.

B. 2. c. (29). Energetic constraints to the distribution and abundance of the California Gnatcatcher. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Patrick J. Mock, Ogden Environmental and Energy Services Co., 5510 Morehouse Dr., San Diego, CA 92121.

B. 2. c. (30). Habitat characteristics of California Gnatchatcher territories on Naval Air Station Miramar, California. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: John F. O'Leary (Tel.619-594-5511), Department of Geography, San Diego State University, San Diego, CA 92182-4493.

B. 2. c. (31). California Gnatcatcher (*Polioptila californica)* Habitat Capability Index model for western Riverside County. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: W. Douglas Parley, Pacific Southwest Biological Services, Inc., P.O. Box 985, National City, CA 91951-0985.

B. 2. c. (32). California Gnatcatcher distribution in western Riverside County, California 1985-1995. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: W. Douglas Padley, Shana C. Dodd, and Paul A. Hamilton, Pacific Southwest Biological Services, Inc., P.O. Box 985, National City, CA 91951-0985.

B. 2. c. (33). The use of museum collections to reconstruct the historic breeding biology

of the California Gnatcatcher. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Michael A. Patten and Kurt F. Campbell. Dept. Of Biology, University of California, Riverside, CA 92521 and Tierra Madre Consultants, 1159 Iowa Ave., Suite E, Riverside, CA 92507: Campbell Biological Consulting, 600 Central Ave., #118, Riverside, CA 92507.

B. 2. c. (34). Use of restored coastal sage scrub habitat by California Gnatcatchers in a park setting. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Karen L. Pluff, Adrian Wolf, and Robb Hirsch; CA Dept. of Parks and Recreation, 8885 Rio San Diego Dr. #270, San Diego, CA 92108, and CA Dept. of Parks and Recreation, Crystal Cove S.P., 8471 N. Coast Hwy., Laguna Beach, CA 92651.

B. 2. c. (35). California Gnatcatcher territorial and vocalization behavior at Rancho San Diego and Vicinity. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Kristine Preston, Mary Grishaver, Patrick Mock, Eric Bailey, and David King. Ogden Environmental and Energy Services Company, 5510 Morehouse Dr., San Diego, CA 92121.

B. 2. c. (36). Molt and plumage variation by age and sex in the California and Black-tailed gnatcatchers. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Peter Pyle and Philip Unitt; Point Reyes Bird Observatory., 4990 Shoreline Hwy., Stinson Beach, CA 94970, and San Diego Nat. Hist. Mus., P.O. Box 1390, San Diego, CA 92112.

B. 2. c. (37). Habitat preferences of the California Gnatcatcher in San Diego County. 1995 Symposium on the Biology of the California Gnatcatcher.

Principal: Ellen Raabe, USGS Center for Coastal Geology, 600 4th St. S, St. Petersburg, FL 33701.

B. 2. c. (38). Insect and plant assemblages of coastal sage scrub as indicators of habitat utilization by coastal California gnatcatchers. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Richard Redak, John Rotenberry, Andy McCollum and Tom Scott; Dept. Entomology, Dept. Biology, and Dept. Earth Sciences, University of California, Riverside, CA 92521.

B. 2. c. (39). Nesting requirements of California Gnatcatchers. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Julie Simonsen, Michelle Schroeder, and Eric J. Woehler, Dept. Ecology and Evolutionary Biology, UC Irvine, CA 92717.

B. 2. c. (40). Statistical considerations in the analysis of historical California

Gnatcatcher data. 1995 Symposium on the Biology of the California Gnatcatcher.

Principal: John R. Skalski. Center for Quantitative Science, University of Washington, Seattle, WA 98195-5230.

B. 2. c. (41). Variation and correlates of some nest-site and life-history traits in the California gnatcatcher. 1995 Symposium on the Biology of the California Gnatcatcher.

Principal: Keith W. Sockman, Dept. Biol., San Diego State University., San Diego, CA 92182.

B. 2. c. (42). Are computer-generated estimates of California gnatcatcher home range superior to hand drawn estimates made by biologists? 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Wayne D. Spencer, Patrick J. Mock, and Erik J. Pampalone, Ogden Environmental and Energy Services Co., 5510 Morehouse Dr., San Diego, CA 92121.

B. 2. c. (43). Distribution of the California Gnatcatcher within coastal sage scrub. 1995 Symposium on the Biology of the California Gnatcatcher.

Principal: Kenneth L. Weaver, 1113 Senwood Way, Fallbrook, CA 92028.

B. 2. c. (44). Effects of fire on the ecology of the California Gnatcatcher, *Polioptila californica*, California sage scrub communities. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Wirtz, II, William O., and Audrey L. Mayer. Dept. Biol., Pomona College, Claremont, CA 91711.

B. 2. c. (45). Dynamics of a population of California Gnatcatchers, 1991 to 1995. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Eric J. Woehler, Michelle Schroeder, Tammy Stecher, Julie Simonsen and Jennifer Ezovski, Dept. Ecology and Evolutionary Biology, UC Irvine, CA 92717.

B. 2. c. (46). The geography of mtDNA variation in the California Gnatcatcher (*Polioptila californica*). 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Robert M. Zink, Rachelle C. Blackwell, and George F. Barrowclough; Bell Museum, University of Minnesota, St. Paul, MN 55108, and Dept. of Ornithology, American Museum of Natural History, New York, NY 10024.

B. 2. c. (47). Demographics of California gnatcatchers in the San Joaquin Hills of Orange County.

Principals: Ed Almanza (Ed Almanza and Associates, 714-376-0488, Jonathan Atwood (Manomet Bird Observatory, 508-224-6521) and Dave Bontrager.

Purpose: This is item #4 in the NCCP program Conservation Guidelines research agenda. In order to simulate population performance of target species under different alternative reserve designs, time series data on basic biology is needed. Because of inherent annual variability in gnatcatcher birth, death, survivorship rates, etc., several years of data are needed to reduce relatively wide variance around mean population biology data. Data is also being used to create habitat suitability models.

Study Plan: Population density data have been collected in the San Joaquin Hills area for three years, 1996 is the first year for nest monitoring/reproductive success data. A minimum of twenty nests will be monitored from January to August. Current work is focused on the remaining unburned areas of the coastal portion of Orange County NCCP Coastal/Central planning area.

B. 2. d. REPTILES AND/OR AMPHIBIANS

B. 2. d. (1). Autecological studies of sensitive coastal sage scrub target herptofauna (sites in San Diego, Orange, and Riverside Counties)

Principal Investigator: Ted J. Case, Department of Biology 0116, University of California-San Diego, La Jolla, CA 92093;(619)534-6231,FAX(619)534-7180

Co-Principal Investigator: Robert N. Fisher, Department of Biology 0116, University of California-San Diego, La Jolla, CA 92093;(619)534-6231,FAX(619)534-7108.

Objective: To investigate the community characteristics of the sensitive herptofauna traditionally associated with coastal sage scrub, by using a quantitative sampling methodology that will capture cryptic species along with the more obvious sensitive species. Results will determine the effects of reserve design, corridors, and edge effects on the sensitive species, and the correlation between sensitive herptofauna and sensitive birds and mammals to determine if the "umbrella species" concept will work for regional planning.

B. 2. d. (2). Mechanisms behind the deterioration of habitat suitability in fragmented coastal sage scrub habitat: coastal horned lizard and rufus crowned sparrow on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Ted J. Case (Tel.619-534-6231 FAX 619-534-7180),University of California San Diego, La Jolla, CA 92093.

Co-Principal: Doug Bolger (Tel. .....) Dartmouth College

B. 2. d. (3). Conservation of the San Diego horned lizard on the Southwestern Riverside County Multi-Species Ecological Reserve

Principal: Allison Alberts (619-557-3955) Center for the Conservation of Endangered Species at San Diego Zoo.

Co-Principal: Lester Milroy (619-242-3370), Horned Lizard Conservation Society, 16377 Rancherias Rd., Apple Valley, CA 92307.

Objective: There is relatively little known about this subspecies. This study will use radio

telemetry to track individual lizards and document key elements of life history: foraging requirements, microhabitat preferences, and reproductive biology so that regional land conservation strategies can be designed to reflect the needs of this taxon. These data are also intended to contribute to understanding of management requirements. All research is initially planned for on the Western Riverside County Multi-species Ecological Reserve. Radio tracking will document habitat use, home range size, etc. Blood samples will be taken to document genetic differences among the population and with the northern subspecies and hormonal changes through the annual cycle. If eggs are located than incubation studies will be conducted.

B. 2. e. INVERTEBRATES

B. 2. e. (1). Arthropod recolonization of coastal sage scrub following fire on the Southwestern Riverside County Multi-Species Ecological Reserve>

Principal: Mark Redak...UC Riverside...

Co-Principal: John T. Rotenberry (Tel. 909-787-3953, FAX 909-787-4286), University of California, Riverside, CA 92521.

B. 2. e. (2). Insect and plant assemblages of coastal sage scrub as indicators of habitat utilization by coastal California gnatcatchers. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Richard Redak, John Rotenberry, Andy McCollum and Tom Scott; Dept. Entomology, Dept. Biology, and Dept. Earth Sciences, University of California, Riverside, CA 92521.

B. 3. ECOSYSTEMS

B. 3. (1). Preserve design parameters in the coastal sage scrub ecosystem of southern California.

Principals: Directed by Drs. Ted Case (U.C. San Diego), John Rotenberry, and Mary Price (U.C. Riverside). All work is being fully coordinated with companion research funded by California Department of Fish and Game.

Purpose: Item 2 and 3 of the NCCP program Conservation Guidelines research agenda recommend research to better understand the spatial characteristics of an adequate reserve design and the influences of reserve geometry on the viability of target species within the reserve.

Study Plan: Research has begun in the beginning calendar year 1995. The design will take advantage of the six to twelve locations within San Diego, Orange, and Riverside Counties for data collection on larger blocks of intact habitat. These study locations will be supplemented with additional locations selected to gather data specifically on the various effects of landscape fragmentation. Various landscape features will be investigated to help provide quantitative measurements of minimal reserve design parameters.

B. 3. (2). Protection of Natural Areas at the Santa Margarita Ecological Reserve.

Objective: Protect sensitive and rare habitats and research projects within the reserve: a. erect off-highway vehicle (OHV) closures at known areas of access to the reserve, b. protect rare communities and research projects such as a coastal sage scrub restoration site near the edge of the reserve, and c. generate educational materials and perimeter signs.

Principals: Paul Zedler, Director of Field Stations for San Diego State University (619-594-2896), Leslie Seiger, Post-Doctoral Fellow (619-594-7441), and Sedra Shapiro, Manager of Field Stations (619-594-5386 [SDSU lab] or 909-676-7571 [Santa Margarita Reserve]), San Diego State University, Biology Department, San Diego, CA 92182-4493.

B. 3. a. ECOLOGICAL PROCESSES

B. 3. b. HABITAT/VEGETATION COMMUNITIES

B. 3. b. (1). Historical decline of coastal sage scrub in the Riverside-Perris Plain, California. 1995 Symposium on the Biology of the California Gnatcatcher.

Principals: Richard A. Minnich, Dept. Earth Sciences, University of California, Riverside, CA 92521.

FIGURE 1
CORE GROUP GENESIS AND ACTIVITIES

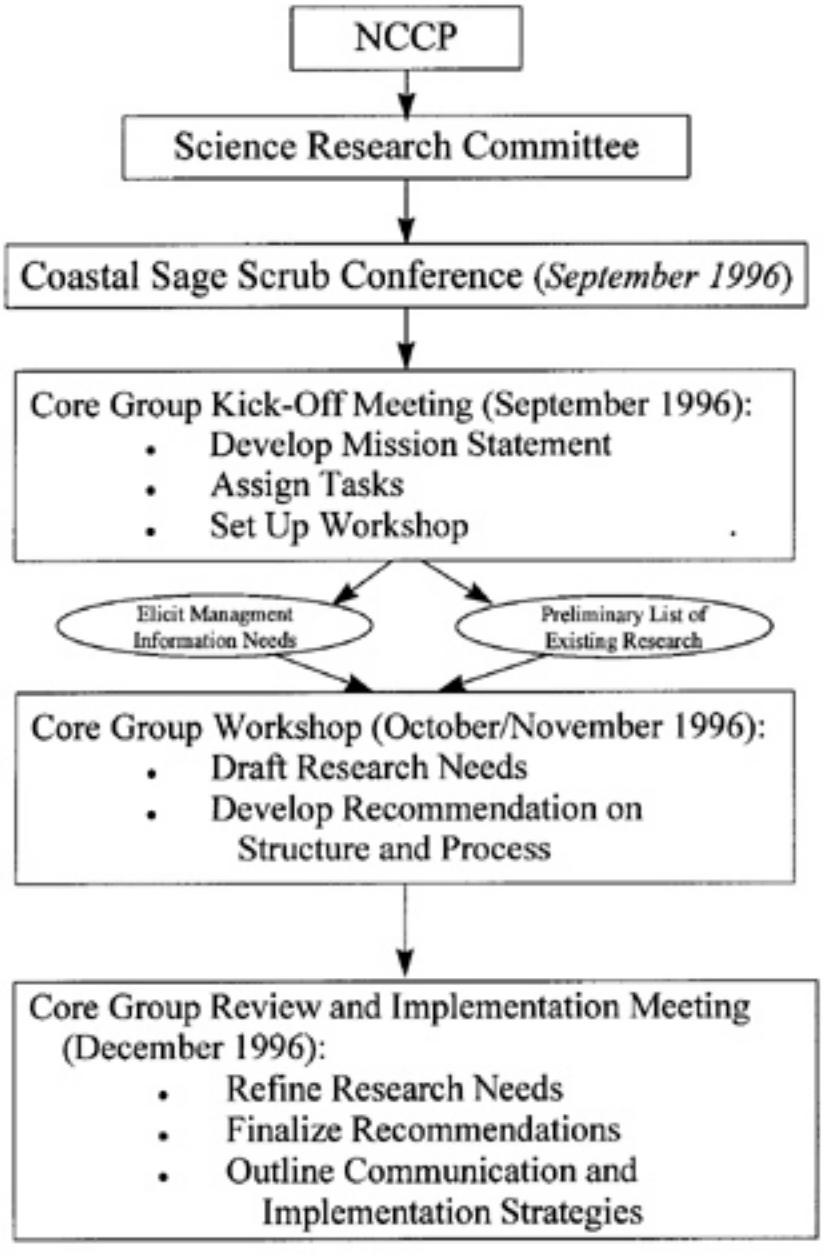

FIGURE 2
PRIMARY CORE GROUP OUTCOMES

- Consensus on of the general categories of managers' key information needs (page 5).
- Development of a taxonomy for information needs and research activities (Appendices A and B).
- Identification of research gaps (page 6).
- Agreement on the need for more structure and process in NCCP-related research programs to use scientific and information dissemination more efficiently (pages 16-18).

FIGURE 3
COMMUNICATION WITHIN AND BETWEEN
RESEARCH AND DECISION MAKING COMMUNITIES