San Diego Rare Plant Monitoring Plan: Fiscal Year 2011

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I. Introduction

This document is intended to develop a strategy for the regional monitoring of rare plants in the San Diego region to establish regulatory compliance with the adopted regional habitat conservation plans and to inform land managers on the status of rare plants for potential management efforts. It is expected that this plan will be modified on an annual basis as additional species protocols are added. The results of the monitoring efforts help to refine adaptive management models, monitoring objectives, and management objectives, as well as further define the general distribution of the species. While it is the intent to apply these protocols (presented in Appendix C) toward a regional effort, the protocols are intended to be flexible enough to be used by individual land managers that wish to contribute information to the regional effort.

II. Background

The San Diego region is a hotspot for endemic plants; many of which are listed as endangered or threatened by the state and federal governments. Many of these rare plants have been included in the regional habitat conservation plans as "covered" species. Monitoring and management is required for all covered species. Two regional habitat conservation plans have been adopted (Multiple Species Conservation Plan (MSCP) and the Multiple Habitat Conservation Plan (MHCP)). A third (MSCP North) is underway but is not included in this document.

The San Diego MSCP rare plant monitoring program was designed in the early 1990s (Ogden Environmental 1996) and reviewed and revised slightly in 2001 (Conservation Biology Institute 2001), with the goal of determining population trends to demonstrate conservation success or identify populations at risk. Both the original Biological Monitoring Plan and the later review presented general monitoring techniques that could be tailored for individual species. Accordingly, agency staff developed monitoring strategies tailored for each species at their sites.

The MSCP and MHCP monitoring programs identified "Major" populations[1] for each of the rare plants in the monitoring plan specific to that species, and in the MHCP these major populations were specifically mapped. A major population was defined by the MSCP Standard and Guidelines (Ogden 1995) and the MHCP (Final MHCP Plan: biological analysis and permitting conditions, volume II, 2003) based upon the known distribution and size of the species at that time. The major populations became the critical conservation areas to protect, monitor, and manage under the MSCP and MHCP.

In 2006, Regan and others applied a systematic approach to prioritizing species for monitoring based on at-risk classifications from several sources, threats to species, and the spatial-temporal scale of the threats. For each species habitat associations and threats impacting the species we documented. They recommended that the Risk Group

[1] The MHCP also identified critical locations within major populations.

1 species (those most at-risk) populations be monitored directly, and as many Risk Group 2 and 3 species as resources allow. Subsequently, they also developed monitoring strategies based on threats and habitat associations. The U.S. Fish & Wildlife Service followed the recommendations of Regan and others (2006) and developed animal monitoring protocols for the Risk Group 1 (Winchell et al. 2008). These protocols have been used for monitoring California gnatcatchers (Winchell 2009), coastal cactus wrens, and western burrowing owls (Tracey and Winchell 2010).

The development of rare plant protocols has followed a different path. The rare plant monitoring protocols we present here follows over a decade of monitoring program development for the Multiple Species Conservation Program (MSCP). Rare plant monitoring efforts conducted under the MSCP were reviewed by McEachern and others (2007), who made recommendations on the overall approach (see also Greer and Johnson-Rocks, 2006). These recommendations were piloted for three years, and in 2010 McEachern and Sutter evaluated the accumulated information for 24 species covered by the MSCP with the goal of determining what trends were able to be shown by the data.

Several important conclusions were identified from their analysis, and we use them to guide the development of the core protocols for monitoring presented here. The monitoring objective for most species was to determine numbers of individuals in populations, either by counts or by sampling in plots for a statistical estimate of total numbers of plants at the site. Repeated monitoring over several years was expected to show trends in population size over time, a measure of conservation success articulated in the planning documents for the MSCP (Ogden Environmental 1998). However, McEachern and Sutter (2010) analysis indicated that the monitoring results do not show highly reliable estimates of total population size or population trends.

Based on the work by McEachern and others (2007, 2010), a new approach for monitoring rare plants is needed. Atkinson and others (2004) proposed a 9 step approach for creating a monitoring program (see side bar). The above referenced work helped to solidify steps of 1 – 3. We address step 4, which is to strategically divide the system and prioritize for monitoring program development, by applying the prioritization work by Regan et al. (2006) and a following the recommendations of the oversight committee (see Section II in this

STEPWISE APPROACH TO CREATING A MONITORING PROGRAM
(Atkinson et. al. 2004)

Step 1. *Identify the goals and objectives of the regional conservation plan*
Step 2. *Identify scope of monitoring program*
Step 3. *Compile information relevant to monitoring program design*
Step 4. *Strategically divide the system and prioritize for monitoring program development*
Step 5. *Develop simple management-oriented conceptual models*
Step 6. *Identify monitoring recommendations and critical uncertainties*
Step 7. *Determine strategy for implementing monitoring*
Step 8. *Develop data quality assurance, data management, analysis, and reporting strategies*
Step 9. *Complete the adaptive management loop by ensuring effective feedback to decision-making*

document and Appendix A) by focusing on perennial trees and shrubs. We further address steps 5 – 7 of Atkinson and others by proposing a general framework for monitoring (Section III), reporting (Section IV), and distribution (Section V), along with standardized forms and instructions for reporting (Appendix B) and species-specific monitoring protocols (Appendix C). Species-specific monitoring protocols include narrative (and in some cases, accompanying diagrammatical) conceptual models, conservation goals, management goals, and monitoring objectives, and detailed protocols for data collection and reporting. Step 8 is being addressed in greater detail by others (see Sections III and IV of this document).

Summary of Oversight Committee (FY 2011)

An oversight committee (Appendix A) was established to assist in the development of this document and the corresponding protocols. The oversight committee conducted field visits to sites occupied by rare perennial plants, provided expertise on plant species and monitoring, and evaluated plants based on the risk groups identified by Regan et al. (2006), assessment of threats, life-history, spatial distribution, local density, overall rarity, and existing monitoring that has occurred.

For the purposes of protocol development for rare plants, the oversight committee accepted the biological goal of MSCP Plan which is "*maintaining ecosystem functions and persistence of extent populations of covered species* (Ogden 1998, section 1.2.1)." Due to the high inter-annual variability in annual plant monitoring data described by McEachern and Sutter (2010), we have decided to focus in Fiscal Year 2011 on rare perennial shrubs and trees in Regan et al. (2006) Risk Group 1 and 2. Once monitoring is underway on the perennial species, the group will address annuals and perennial geophytes.

Five general themes were identified by the oversight committee:

1. The need for a consistent terminology when developing monitoring protocols and to standardize methodologies,
2. Protocols, when developed, will need to be either species specific (like the animal protocols prepared by USFWS) or guild specific (e.g., clay soil endemic annual),
3. The need for some testing of general method to determine bias/variation between observers (e.g., ocular estimated of percent cover estimates, different teams following the same protocols, being able to evaluate the same boundaries between teams),
4. Information on certain species is so lacking that more baseline field surveys are required prior to development of a monitoring protocol, and
5. For a few species, sufficient distribution data and monitoring efforts exists to attempt to develop a standardize protocol for testing in the spring of 2011.

Sections III, IV, and V and Appendix B attempt to address the oversight committee's recommendation to develop consistent terminology when developing monitoring protocols and to standardize methodologies. Table 1 and Appendices C.1 through C.13

address the various levels of understanding of species distribution, species-specific protocols.

Table 1: A summary of monitoring activities for rare perennial shrubs and trees in 2011.

Risk Group	Species	Description of Monitoring	Rationale	Appendix
1	*Arctostaphylos glandulosa* var. *crassifolia*	baseline surveys and collection for taxonomic identification	There is taxonomic uncertainty on the locations of this species, and a closely related subspecies and possible hybrids (Keeley, 2007).	C.1
	Baccharis vanessae	baseline surveys and population structure since it is dioceous	Only one location has been monitored for this species. Large gaps exist in its possible location and population size and structure.	C.2
	Cupressus forbesii	develop protocol that includes map populations and development of index plots for density estimates	Fires in 2003 and 2007 affected this species. Work done in 2009 and 2010 has developed crude distribution maps which can be refined in 2011.	C.3
	Nolina interrata	develop core protocols to map individuals including habitat assessment	No monitoring data exists on this species, but major populations exist of state and federal lands.	C.4
	Pinus torreyana ssp. *torreyana*	document existing protocols	Exhaustive work was done to census the entire naturally occurring populations of this species by Franklin and Santos (2007) and City of San Diego (2008).	C.5
	Rosa minutifolia	develop core protocol that includes monitoring individuals	This species only occurs in two locations both replanted from a single clone and both now occurring on land owned by City of San Diego.	C.6
2	*Agave shawii* ssp. *shawii*	baseline surveys	No monitoring data exists on this species, but major populations exist on local, state and federal lands.	C.7
	Cylindropuntia californica var. *californica*	develop core protocol	Monitoring data has been collected by City of San Diego. Additional populations occur on federal lands.	C.8
	Ericameria palmeri ssp.	baseline surveys	No monitoring data exists on this species, but major	C.9

	palmeri		populations exist of state and federal lands.	
	Lepechinia cardiophylla	baseline surveys	No monitoring data exists on this species, and it is known only from five locations.	C.10
	Lepechinia ganderi	baseline surveys	No monitoring data exists on this species, but major populations exist on federal lands.	C.11
	Monardella viminea	develop core protocol including conceptual management-oriented model	Multiple years of monitoring have occurred for this species by City of San Diego and USMC –Miramar. A five-year status review is also available. Sufficient data on threats and effects is available to develop and test a conceptual model.	C.12
	Senecio ganderi	baseline surveys	No monitoring data exists on this species, and major populations have not been identified.	C.13

III. Standard Terminology

Levels of Monitoring and Associated Terminology:

We will use terms such as quadrat, plot, photopoint, and transect as described in *Ecological Methodology* (Krebs 1989) and *Measuring and Monitoring Plant Populations* (Elzinga et al. 1998). Additional terms not defined in these references will be defined in this document. Following McEachern and Sutter (2010) we define four levels of monitoring:

1. Baseline Surveys (Table 2)
2. Core Monitoring (Table 3)
3. Core + Monitoring (Table 3 and Table 4)
4. Core + Effectiveness Monitoring (Table 3, Table 4, and Table 5)

Core + Monitoring expands on Core Monitoring; therefore, the monitoring activities for Core Monitoring also apply to Core + Monitoring. Likewise, Core + Effectiveness Monitoring expands on Core + Monitoring; therefore, the monitoring activities for Core Monitoring and Core + Monitoring also apply to Core + Effectiveness Monitoring.

Table 2: Description of Baseline Surveys.

Baseline Surveys:	Examples of Monitoring Activities
Purpose: Obtain an initial inventory of plant populations in a specific area for use in the later stages of a monitoring program.	Assign unique names clearly identifying each population; use these names consistently in all documents, maps and databases. Mapping occurrence locations and identifying general population areas of a species including an attribute for estimate of the site of the population or patch. Collecting samples for taxonomic identification, including: • Voucher specimens • Samples for genetic analysis

Table 3: Description of Core Monitoring.

Core Monitoring:	Monitoring Activities
Purpose: To characterize plant populations and their habitat over time and space.	Population Mapping: • Map the maximum area ever known to be occupied by the species at the site, mark boundaries in the field. • Clearly describe repeatable rules used to map boundaries of populations. • Map plants and patches of plants present (using sub-meter global positioning system (GPS) equipment) • Record metadata (or rules of thumb) for how patches were discerned and mapped, what spatial extent was covered in the searches for plants in the habitat, how accurate the GPS coordinates were as reported by the equipment at the time. • Assign unique names clearly identifying each site and patch mapped; use these names consistently in all documents, maps

and databases.

- Re-survey and map this entire area each monitoring year.

Characterize Populations with Count-based Monitoring

- If the population is small and the population will always be monitored with total counts of all individuals present, count all plants present in the mapped area.
- Define the specific area in which plants will be counted by the expected maximum extent of the populations based on mapped areas plus addition areas for potential future population expansion as determined for each specific species. (a “mega-plot”). Include map(s) and shapefiles.
- Mark the corners of the area in the field, to ensure that the same area is searched and counted each monitoring session.
- Provide a clear definition of the counting unit (individual plant, clump, etc.).
- Using data from baseline surveys and population mapping (from above), define areas in which individuals or patches will be assessed.
- Define method and indices for assessing the populations (e. g. counting, cover estimates, etc.),

Characterize Populations with Index Plot-based Monitoring:

- Establish at least 3 index plots within the population boundary where plants are reliably present every year, with the goal of 3 plots for each kind of variation in the site and population. The size of the plot will depend on the average spatial dispersion of the plants.
- Provide Index Plot locations including map(s) and shapefiles
    - Fixed (sentinel) plots
    - Variable plots, and which will be used in the current monitoring
- Criteria for selecting plots
- Size, shape, and orientation of plots and rules for altering

	these attributes based on terrain or other landscape features • Define what will be described or quantified in each plot (may include presence-absence, cover, density, or counts). Record metadata on how individuals were identified, and at what phenological stage the plants were monitored. Count all plants (or other defined counting unit) of the target species rooted within the plot.
	Characterize Habitat: • Describe the environment: Visually inspect the entire potential habitat area and fill out a habitat assessment form. • List the species present within the entire site. • Assess Threats. Threats to be considered include: habitat loss, invasive species, OHVs, recreation and human disturbance, altered fire regime, altered hydrology, habitat fragmentation, grazing and herb ivory, pollution, intentional removal by humans, military activities, mining (taken from Regan et al. 2006 Table 1). Should also consider disease, demographic and genetic stochasticity, and the rationale for why these are believed to be threats. Such threats based on population size may trigger a change to the Core + level of monitoring. Threats to be monitored for each species are identified in the conceptual models. • Photopoints: Photograph the site from 1-several permanent and staked photo monitoring points; record metadata on photo-point coordinates, compass direction, camera and lens used, focal length of the lens, etc. so that the exact same photo can be taken over many years.

Table 4: Description of Core + Monitoring.

Core + Monitoring:	Monitoring Activities
Purpose: To characterize plant	Monitor Plant Performance: • Survival and condition of plants.

populations and their habitat over time and space, document the range of plant performance (survival and fecundity), and relate environment to plant abundance and performance.	• Fecundity (flowering, fruit production, seed production, vegetative reproduction, etc.). • Growth; size, stage, or age structure • Sex and population sex ratio. Monitor Environmental Covariates: • Covariates to be considered include: rainfall (perhaps by month or other time interval), temperature (perhaps by month or other time interval; may include highs, lows, or mean), soil, elevation, slope (gradient and aspect), land form; other covariates may be considered for specific species based on conceptual models. • Some of these covariates are related to climate change or environmental stochasticity which may constitute threats to small populations. • Hypothesized relations between environmental variation and species abundance, distribution, and other responses should be represented in the conceptual model.

Table 5: Description of Core + Effectiveness Monitoring

Core + Effectiveness Monitoring:	Monitoring Activities
Purpose: To characterize plant populations and their habitat over time and space, document the range of plant performance (survival and fecundity), relate environment to plant abundance and	Perform Management Experiments: • Articulate the key management question(s) being addressed with the experiment. • Describe which management actions will be taken and where. • Describe desired management outcomes and how success will be determined (eg 10% more plants in 3 years, doubling of seed numbers, halving of flowers eaten in first year, etc.). Monitoring the Effects of Management Actions: • Develop a statistically valid experimental design in

performance, and evaluate the effectiveness of management actions.	consultation with experts • Identify what will be monitored to determine effectiveness. • Hypothesized responses should be represented in the conceptual models. • May include monitoring both before and after management actions are taken.

Definitions of Terms Related to Levels of Monitoring:

- ***Index Plot:*** An index plot is a clearly delineated area in which plants are monitored using counts, density estimates, cover estimates, or other quantities that are related to abundance within the plot. Other observations such as plant phenology, size, and health may also be made within index plots, depending on the level of monitoring effort. Index plots are not intended to be random or systematic samples that can be used to make inferences about the plant population. Therefore, any conclusions drawn are limited to the index plots themselves.
- ***Photopoint:*** Photopoints are locations at which consistent, comparable photographs are taken to so that changes in plant populations, habitat conditions, and disturbances can be compared qualitatively.
- ***Abundance:*** Number of individuals in an area.
- ***Density:*** Number of individuals per unit area.
- ***Pressure, driver, threat, stressor:*** These terms are used for elements or processes that affect species or their habitat in some way. Atkinson et al. (2004) used the more neutral term "pressure" in their conceptual models to refer to "agents that either promote or inhibit change in the state of the environment" and relate this to the terms *stressor*, *threat*, and *driver* used by others. Pressures can be natural or anthropogenic, and may relate to ecological constrains on the species (Atkinson et al. 2004). Regan et al. (2006) define *risk factors* (a. k. a. *threats*) as "activities or processes that threaten the viability of populations and cause negative trends in population size." Therefore, *pressures* or *drivers* are more general terms that relate to both natural and anthropogenic causes of either positive or negative changes, while *stressors* or *threats* generally indicate causes of negative changes.
- ***Covariate:*** Also called a *predictor variable* or *independent variable*, covariates are observed data for variables that are believed to be correlated with or have a casual effect on a *response variable* (also called a *dependent variable*) in a statistical model. As such, data related to pressures, threats, or drivers may be covariates.

Considerations for Protocol Development:

The two main parts of a species-specific protocol are (1) conceptual models and (2) detailed descriptions of monitoring methodology.

Conceptual Model Development:

Atkinson and others (2004) provide guidelines for the development of conceptual models for monitoring and adaptive management. They describe several important aspects of conceptual models:

- Conceptual models help summarize and communicate existing knowledge and hypotheses about a system, prioritize and select the components of the system for monitoring, and identify gaps in knowledge and areas of uncertainty.
- A conceptual model may consist of narrative that describes the components and explain the known or hypothesized relations among components and/or a diagram that illustrates the components and relations. In addition to describing current knowledge and hypothesized relationships, conceptual model narratives can provide an estimate of their level of certainty, identify alternative hypotheses, and identify describe gaps in knowledge.
- A conceptual model is designed for a specific purpose. Based on this purpose, some parts of the system may receive greater focus and be described in more detail by the conceptual model, while other parts of the system may receive less emphasis and be described in lesser detail. The level of focus and detail depends on which aspects of the program have the greatest uncertainty and anticipated difficulty in meeting program objectives.
- Based on the results of monitoring and research, conceptual models should improve through time.

Atkinson and others (2004) and Hierl and others (2007) provide suggestions for the content of conceptual models. Based on their recommendations, we describe the narrative component of the conceptual models (Table 6) and conceptual model diagrams (Figure 1) that we provide in the species-specific monitoring protocols (Appendix C).

Narrative Component of Conceptual Models:

In our species-specific protocols for rare perennial plants, we include the narrative elements of the conceptual model in the form of a table. The standard format of this part of the conceptual model is shown in Table 6.

Table 6: Guidelines for conceptual model narratives for species-specific monitoring protocols. The narrative summarizes what is known about a species, with an emphasis on information relevant to monitoring. As more monitoring is done for a species, we expect this information to develop.

Section	Includes
Heading	Species name (scientific and common)
	Regan et al. (2006) Risk Group Classifications in management plans (e. g. "Narrow Endemic")
	Monitoring year (e. g. "Monitoring Protocol for FY 2011")
Background	Known occurrences, major populations, and other populations (include a map). For many species, this information is already available. If it is not, this suggests that baseline surveys are the first step in monitoring.
	Taxonomic or identification issues.
	Life-history. This may also include life expectancy (annual, biennial, or perennial), reproductive ecology (pollinators, flowering period, annual variability in flowering, seed production, seed viability), seedling ecology (regularity of establishment, germination requirements, establishment requirements), dispersal patterns (Atkinson et al. 2004). Some parts of this can be drawn from tables we have already created.
	Threats believed to be important. This can be drawn from the tables we have already created.
	Other pressures (drivers) that are believed to be important.
	Conceptual model diagrams (if available and doing core + or core + effectiveness monitoring). The conceptual model diagrams can be developed from the preceding information on life-history, threats, and environmental covariates.
	Best times to monitor (e. g. when plants are most visible or easily identified) and other monitoring-related issues.
	Notes on reducing or eliminating disturbance to rare plants or their habitat during monitoring activities.
Species-specific Goals FY11	For this monitoring period, and how they relate to the overarching goal. These include (Hierl et al. 2007): • Conservation goal as set forth in the conservation plans,

	• Management goal, which may need to be defined, and • Monitoring objectives pursuant to the conceptual models to help inform land managers. Addresses <u>why</u> we are doing the monitoring activity.
	Rationale for the monitoring objective. If the protocol includes monitoring of threats, environmental covariates, or performance, we may not monitor all of them. Explain how we selected the ones that will be monitored (e. g. "We believe that invasive plants pose a serious threat to the survival of plants of species X and location Y.")

Conceptual Model Diagrams:

Elzinga et al. (2001), Atkinson et al. (2004) and Hierl et al. (2007) provide numerous examples of conceptual model diagrams. Here we present an example for California gnatcatchers (Figure 1) and describe its key elements.

The California gnatcatcher (*Polioptila californica californica*) conceptual model diagram (Hierl et al. 2007) contains:

- The species name and conservation goal:
  - Light orange box at the top left corner of the diagram.
  - Includes common and scientific name
  - The conservation goal should articulate an index of measurement to establish the target of conservation for the species.
- Monitoring Goal:
  - Described in the box at the upper right corner of the diagram.
  - Include a monitoring goal should describe how the monitoring activity helps to establish the current progress towards the conservation goal which may lead to defining management actions.
- Anthropogenic threats:
  - Shown in boxes on the left side of the diagram. Two classes of anthropogenic threats are shown:
    - Current threats: These may potentially be addressed through management.
    - Historical threats: These may have contributed to the current status of the species.
  - Referred to as *pressures* in Atkinson et al. 2004.
  - Indicate which variables that should be directly monitored.

- Natural drivers:
    - Presented by boxes in the middle of the diagram.
    - Boxes outlined in blue indicate variables that should be directly monitored.
- Target species and its habitat needs:
    - Represented as a green ellipse in the center of the diagram.
    - Boxes within the ellipse represent variables associated with the target species that should be monitored in order to evaluate if the goal being met and to assess responses to management.
    - Indicate which variables that should be directly monitored.
- Management objectives:
    - Represented as a gray box in the lower right corner of the diagram.
    - Describes potential management activities with letters that correspond to process in the diagram that each activity would affect. It is expected that the monitoring would help to identify the necessary management activities which would then be monitored.
- Processes:
    - Elements in the model are connected by arrows that show influence of one element on another.
    - The direction(s) of the arrow show the directions of influence.
    - Some processes are labeled with letters that correspond to management actions in the gray box at the lower right corner of the diagram.

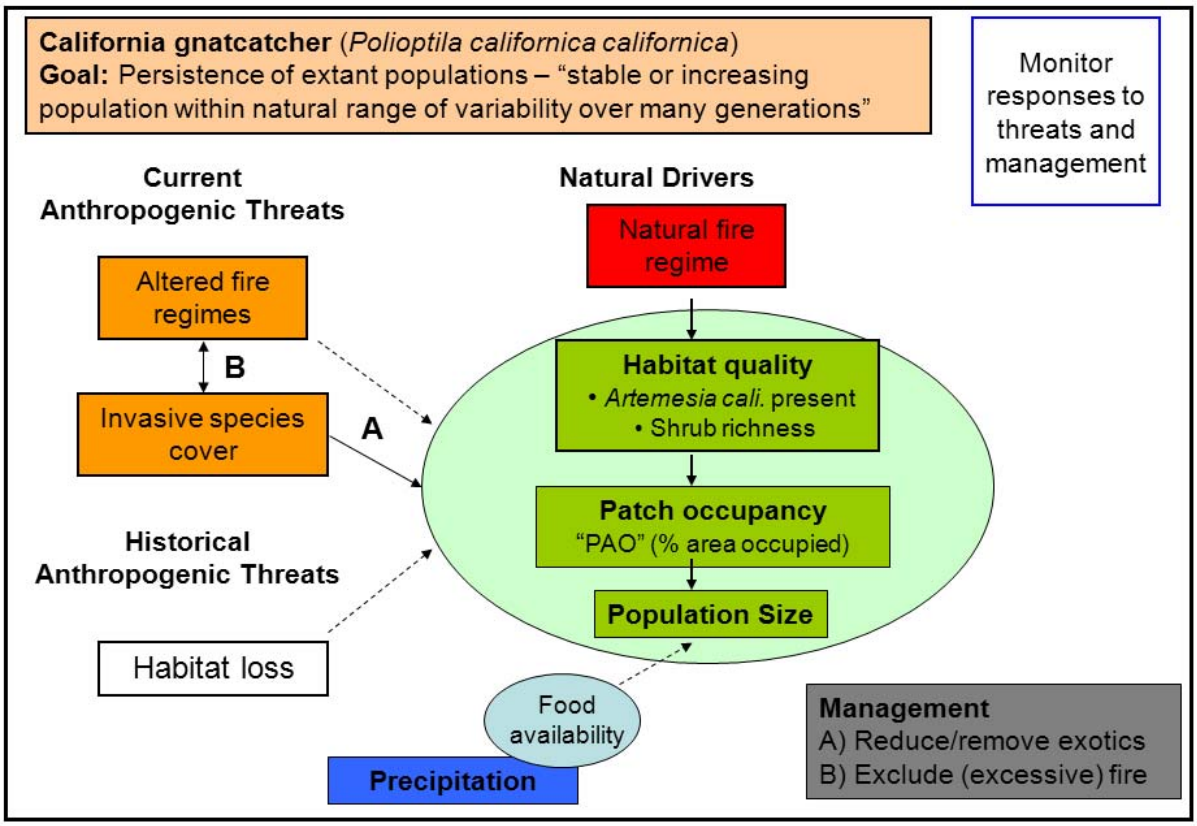

Figure 1: Conceptual model for California gnatcatchers (Hierl et al. 2007).

Note that specific parts of the conceptual model diagram and narrative are relevant to each level of monitoring:

- Current anthropogenic threats and population size are related to Core Monitoring.
- Natural drivers are related to Core + Monitoring. In addition, details on life history stages and threats or drivers that affect survival transitions between stages may be added as illustrated in the conceptual models by McEachern and Sutter (2010).
- Management is related to Core + Effectiveness Monitoring.

Descriptions of Species-specific Monitoring Methodology:

Specific methodologies will be given for each species in Appendix C. Examples of monitoring methodologies that may be used in the different levels of monitoring are given by Krebs (1989), Elzinga et al. (1998), the Conservation Biology Institute (2001), McEachern et al. (2007), and McEachern and Sutter (2010). Here, we provide general guidelines for the description of species-specific monitoring methods (Table 7).

Table 7: General guidelines for descriptions of species-specific monitoring protocols.

Part	Addresses	Includes
Spatial and Temporal Scale	Where will monitoring occur?	Provide specific details on where monitoring will occur. Provide maps of the overall study areas and element-specific maps (including shapefiles) such as areas in which plants will be counted or plots in which data will be collected. Provide site names that are clear, unique to each site and patch within a site.
	When will monitoring occur?	Provide a schedule for when monitoring will be done both within and among years. Specify if and how the sampling schedule will change if specific threat-related or environment-related events occur or thresholds are reached.
Methods	How will data be collected?	Describe in detail how data will be collected, recorded, QA/QCed, prepared for delivery, and delivered to SANDAG and others. Provide data sheets or PDA forms.
		If appropriate, describe in detail how samples will be collected. Describe how samples will be prepared, documented, stored, and delivered. Provide data sheets or PDA forms.
		Provide forms or data sheets (or possibly, PDA forms).
	How will data be analyzed?	The protocols will define analysis based on the goals, monitoring objective, type of data collected, species being monitored, baseline data, and previous monitoring data.
		What derived quantities must be calculated form the data? How will data (or derived quantities) be summarized and visualized? If appropriate, what methods of statistical analysis will be used?
		How will various kinds of data (mapping, plots or counts, threats, covariates, etc.) be used together?
		How will data across years and/or sites be used together?

Reporting	How will data be processed and delivered?	What data and analysis products will be delivered?
		What data sheets and electronic file formats will be used?
		What metadata will be documented?

IV. Reporting

Standardized data sheets for reporting are provided in Appendix B. These include index plot data sheets and instructions (Appendix B-1) and voucher specimen / genetic sample data sheets and instructions (Appendix B-2). Appendix B-2 also includes protocols for collecting voucher specimens and plant samples for genetic analysis. All metadata and data in electronic file formats such as shapefiles for spatial data or images for digital photography need to be provided as described in the species-specific protocols.

V. Distribution

Data generated from monitoring efforts need to be archived for future reference and analysis and provided to land managers for their efforts. Currently, no single centralized database exists. Staff from the USGS, USFWS and CDFG are working on establishing a database that will best serve the needs of the region.

While this database is being developed the hard copies and digital copies of the standardized data forms should be provided to the San Diego Management and Monitoring Program who will collect, collate, and input into digital format for inclusion into the state's Biogeographical Information and Observation System (BIOS). The information in BIOS will be made available to the public and other agencies through the internet. The California Natural Diversity Data Base (CNDDB) periodically mines BIOS for updates to their database, so inclusion into BIOS should serve to propagate both BIOS and CNDDB.

Hard copies of the information should also be provided to land manager of the property for their use and records.

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