EXHIBIT A — SCOPE OF WORK

MONITORING AND ADAPTIVE MANAGEMENT OF BURROWING OWL ON CONSERVED LANDS IN SOUTHERN SAN DIEGO COUNTY

January 1, 2011 to December, 2011

San Diego's Multiple Species Conservation Program (MSCP) intends to conserve the diversity and function of the ecosystems in southwestern San Diego County through preservation and adaptive management of habitat. The MSCP also aims to conserve 85 specific "covered" species. The reserve system currently includes over 127,000 acres of land. Monitoring and management responsibility for this large network of land lies with multiple jurisdictions, particularly the County and City of San Diego, and participating wildlife agencies such as U.S. Fish and Wildlife Service, California Department of Fish and Game, and U.S. Geological Survey.

The MSCP covers an ambitious list of 85 species. A prioritization scheme implemented by Hierl et al. (2006) identified 26 species at highest risk of loss or extinction. These include 15 plants species (e.g. Otay Mesa mint - *Pogogyne nudiuscula,* San Diego ambrosia - *Ambrosia pumila,* and the Torrey Pine - *Pinus torreyana*) and 11 animal species (e.g. burrowing owl - *Speotyto cunicularia*, Thorne's hairstreak – *Mitoura thornei*, and Coastal Cactus Wren - *Campylorhynchus brunneicapillus sandiegensis*).

The western burrowing owl is also a species of special concern as identified by the state of California (Shuford and Gardali 2008). California is an important wintering ground for the species, and San Diego County supports both resident and migratory populations (Gervais et al. 2008). In San Diego, occurrence records indicate that burrowing owls previously inhabited a higher number of locations in the county than are presently occupied (Unitt 2004). Declines and local extinctions have been recorded through surveys in southern and coastal locations undergoing urbanization (Gervais et al. 2008, Manning 2009). Local population declines have also been reported in locations outside of California (Desmond et al. 2000).

In southern California, efforts to maintain and augment remaining populations are hindered by uncertainty about the ecosystem drivers limiting owl population growth. At present it is unknown whether population change is driven by reproduction rates, juvenile or adult mortality, habitat selection, or dispersal. Burrow availability is a key limiting resource for burrowing owls in southern California (Figure 1). However, burrowing owls are subject to a complex array of interactions with predator and prey species as well as with the numerous burrowing species they associate with, and the drivers of population dynamics may vary among populations or change through time. Populations may alternatively be limited by prey availability, predation, disease, habitat loss, or human activities such as road maintenance

(Figure 1). In addition, anecdotal evidence of burrowing owl utilization of foraging sites such as the Tijuana airfield suggests that in San Diego County, owls may not only forage around the burrow, but may utilize areas with structures that enhance nocturnal foraging success, such as maintained open grounds, lights, and fences.

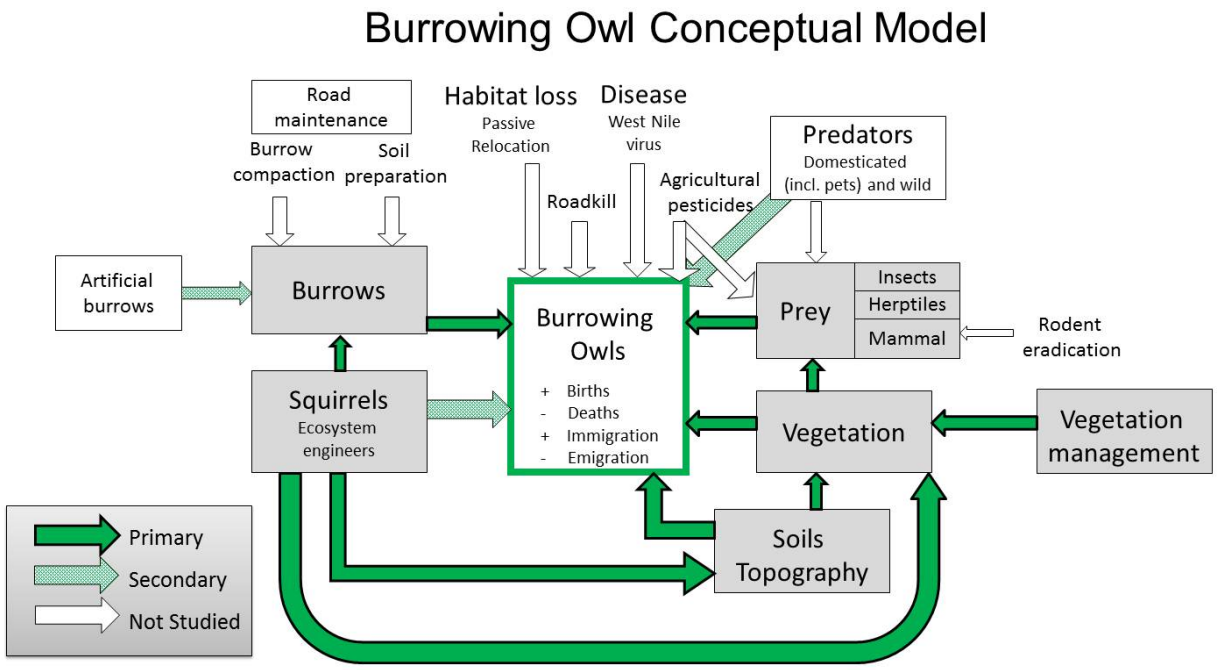

Figure 1. Burrowing Owl Conceptual Model

We propose a comprehensive monitoring and management program that will resolve critical uncertainties about the Burrowing Owl in southern San Diego County. The proposed work will also test the efficacy of habitat enhancement techniques for supporting populations that are sustainable in the long-term. This program will include evaluating many of the potential drivers of burrowing owl dynamics. As shown in Figure 1, we will primarily focus on burrow availability, the role of ground squirrels as ecosystem engineers, prey availability, and the impact of vegetation and site factors such as soils and topography.

Collaborative project development and stakeholder participation

This program has been designed as a collaborative effort to combine the respective areas of expertise of two partner organizations, the Institute for Ecological Modeling and Management at San Diego State University (IEMM at SDSU) and the San Diego Zoo's Institute for Conservation Research (ICR). The goals of this project were developed in consultation with an interagency group of south county land managers, scientists, and regulators (US Fish and Wildlife Service, CA Department of Fish and Game, San Diego Management and Monitoring Program, IEMM, and ICR).

The tasks were co-developed by the IEMM and ICR and are interdependent. IEMM scientists will evaluate habitat utilization and prey availability. We will collaborate with ICR to conduct habitat enhancement and will evaluate the efficacy of habitat enhancements. ICR's focus will be on behavioral and ecological studies of burrowing owls using GPS tracking, and establishing a successful ground squirrel translocation program to create self-sustaining burrowing owl habitat. We will also collaboratively track nesting success of the existing population as a joint task and conduct data analyses with ICR based on a common database and shared expertise. The experimental design for all aspects of this adaptive management program will be co-developed to ensure that the projects and resulting data can be seamlessly integrated. At critical junctures during program development, works-in-progress will be shared with the full stakeholder group for input.

Task A: Resolve Critical Uncertainties about Burrowing Owl Success in Southern San Diego County

Responsible Entity: Douglas Deutschman, IEMM (SDSU)
Schedule: Jan 2011 – May 2011

Burrowing owls in southern San Diego are few and live in a disturbed and fragmented landscape. It is not clear what drives population changes, whether by changes to reproduction rates, juvenile or adult mortality, or dispersal. These critical uncertainties need to be resolved to inform management.

We will work with ICR, California Department of Fish and Game, U.S. Fish and Wildlife Service, and the south county land managers to identify suitable areas for burrowing owl and nest studies. A sample of points at occupied burrows will be established that represents utilized nesting habitat. Nesting habitat points will be paired with non-utilized sites to enable comparison while accounting for variance due to land use history, topography, and vegetation community. We will characterize habitat structure and species composition at these points. In addition, we will coordinate with ICR to conduct regular nest observations of adult and offspring numbers, utilization of prey items, and activity budgets. ICR will track foraging movement of owls with GPS tracking units. Once the GPS tracking method has been proven, we will utilize the spatial dataset of owl movements to conduct habitat characterization of foraging areas. We will also conduct owl pellet analysis if possible.

Task A Deliverable:

IEMM will provide a brief field report that will include study locations (GIS locations and maps), field protocols, and a record of sampling dates for vegetation and nest observations. If possible, photos and maps will be made available to the BuOw partnership and posted on the SD MMP website.

Task B: Habitat Enhancement

Responsible Entities: Douglas Deutschman, IEMM (SDSU)
and Tom Zink, SDSU Research Foundation
Schedule: Mar 2011 – Sep 2011

Burrowing owls face numerous problems from lack of burrows to degraded and overgrown habitat. The fossorial mammal most important to burrowing owls in this region is the California ground squirrel (*Spermophilus beecheyi*). However, squirrels have been targeted by control efforts and have been eradicated in many locations. In addition, many vegetation communities in otherwise suitable locations are dominated by non-native grasses that form tall, dense thickets and mats of thatch. The increased ground cover may negatively impact burrowing owl foraging use, reduce the ability of owls to detect predators, and also may negatively impact the ability of squirrels to maintain sustainable populations.

We will work with ICR, California Department of Fish and Game, U.S. Fish and Wildlife Service, and the south county land managers to identify suitable, secured areas for a habitat enhancement field experiment. Primary consideration will be given to the priorities of local managers. For this task we will choose sites, establish plot boundaries and set up permanent photo points. We will establish up to 9 pairs of plots across 3 sites. The plots will be treated with two treatments (mowing, mowing plus soil aeration) and a control (Figure 2).

The manipulation will be coordinated with ICR to ensure that timing of the vegetation and soil treatments enhances squirrel translocations and supports the probability of successful establishment of squirrels.

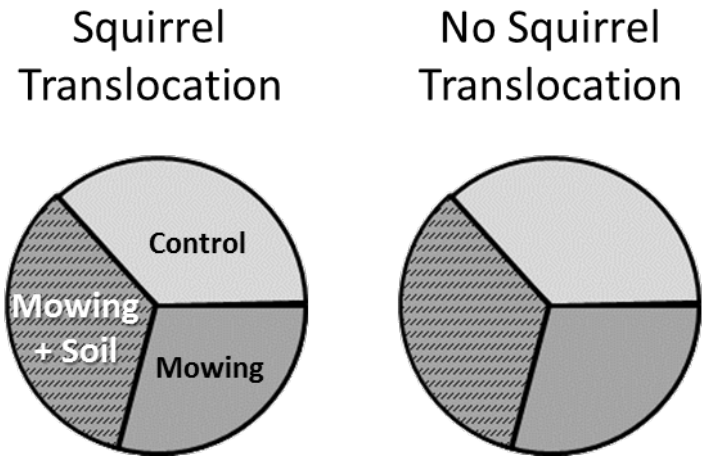

Figure 2. Paired design of the habitat enhancement / squirrel translocation experiment.

Task B Deliverable:

IEMM will provide a report detailing the experiment which includes the locations of final selected sites, the size of plots, details of the mowing and soil aeration methodologies, and the dates that treatments were carried out. The report will also include pre- and post-manipulation photos of all of the plots. Some of the summaries, data analyses, graphics, photos, and video clips will be made available to the SD MMP for inclusion on their website.

Task C: Efficacy of Habitat Enhancement

Responsible Entity: Douglas Deutschman, IEMM (SDSU)
Schedule: Mar 2011 – Oct 2011

Adaptive management is often invoked, but rarely done at all or done well. This experiment is a replicated and controlled field experiment designed to address management needs. It is also an opportunity to build an adaptive management framework around burrowing owl management in southern San Diego County and to initiate the process of iterative feedback.

The efficacy of the treatments will first be documented through pre- and post-manipulation photo points. We will conduct a pre-treatment habitat assessment to characterize vegetation composition and structure. The assessment will also include measures of the soil profile, including compaction. After the plot manipulations have been carried out, we will conduct a post habitat assessment of vegetation composition, structure, and the soil profile. The assessment will also include measures of squirrel activity (such as burrow density) and impact, in coordination with ICR.

Task C Deliverable:

We will provide a brief field report. The report will include final sample size, details of spatial coverage including a revised map of suitable sites, a list of sampling dates, final protocols and datasheets used, and details of the database structure utilized. We will develop our database to be compatible with the regional conservation database (e.g. the multi-taxa database) as much as possible. This will facilitate data sharing between the IEMM and ICR as well as long-term data storage in the regional database.

Task D: Data Analysis and Synthesis

Responsible Entity: Douglas Deutschman, IEMM (SDSU)
Coordinated with Ron Swaisgood, ICR
Schedule: May 2011 – Dec 2011

Burrowing owl populations can be impacted by many factors as shown in the conceptual model (Figure 1). The key challenges for management are (1) to identify major processes in the sites slated for management and prioritize their management requirements and (2) to develop effective management strategies.

We will work collaboratively with ICR in order to integrate and evaluate data representing different aspects of the conceptual model. This will include analysis of population dynamics, habitat suitability, and the prey base in existing nesting sites. We will also evaluate the habitat enhancement experiment to identify potential interactions of vegetation composition, habitat structure, and squirrel presence and activity. To fulfill this task we will hold biweekly coordination meetings with ICR, and share developed protocols and data.

Task D Deliverables:

At the end of the grant period, we will provide a comprehensive report. The report will synthesize the materials from the previous interim reports on habitat characterization and the enhancement field experiment in order to reduce the number of critical uncertainties surrounding burrowing owl management. A primary goal of the reporting will be to provide feedback in the iterative adaptive management framework. The report will detail the current existing knowledge of burrowing owls in southern San Diego. It will also identify and prioritize potential further steps to address the scientific and management concerns about this species.

Summary data will be made available to SANDAG as well as with the regional conservation databases (e.g. multitaxa database or similar) along with the report. Raw data will be deposited to the database within 1 year of the completion of the report. The Raw data will include information on QaQc procedures and supporting metadata.

Timeline:

Task	Start	End	Description
Task A:	Jan 2011	May 2011	Resolve Critical Uncertainties
Task B:	Mar 2011	Sept 2011	Habitat Enhancement
Task C:	Mar 2011	Oct 2011	Efficacy and Assessment
Task D:	May 2011	Dec 2011	Data Analysis and Synthesis

References

Desmond, M. J., J. A. Savidge, and K. M. Eskridge. 2000. Correlations between burrowing owl and black-tailed prairie dog declines: A 7 year analysis. Journal of Wildlife Management **64**:1067-1075.

Gervais, J. A., D. K. Rosenberg, and L. A. Comrack. 2008. Species accounts: Burrowing Owl.*in* W. D. Shuford and T. Gardali, editors. California Bird Species of Special Concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Manning, J.A. 2009. Burrowing owl population size in the Imperial Valley, California: Survey and sampling methodologies for estimation. Final report to the Imperial Irrigation District. 193 pages.

Shuford, W. D. and T. Gardali. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Unitt, P. 2004. San Diego County bird atlas. Proceedings of the San Diego Society of Natural History **39**.