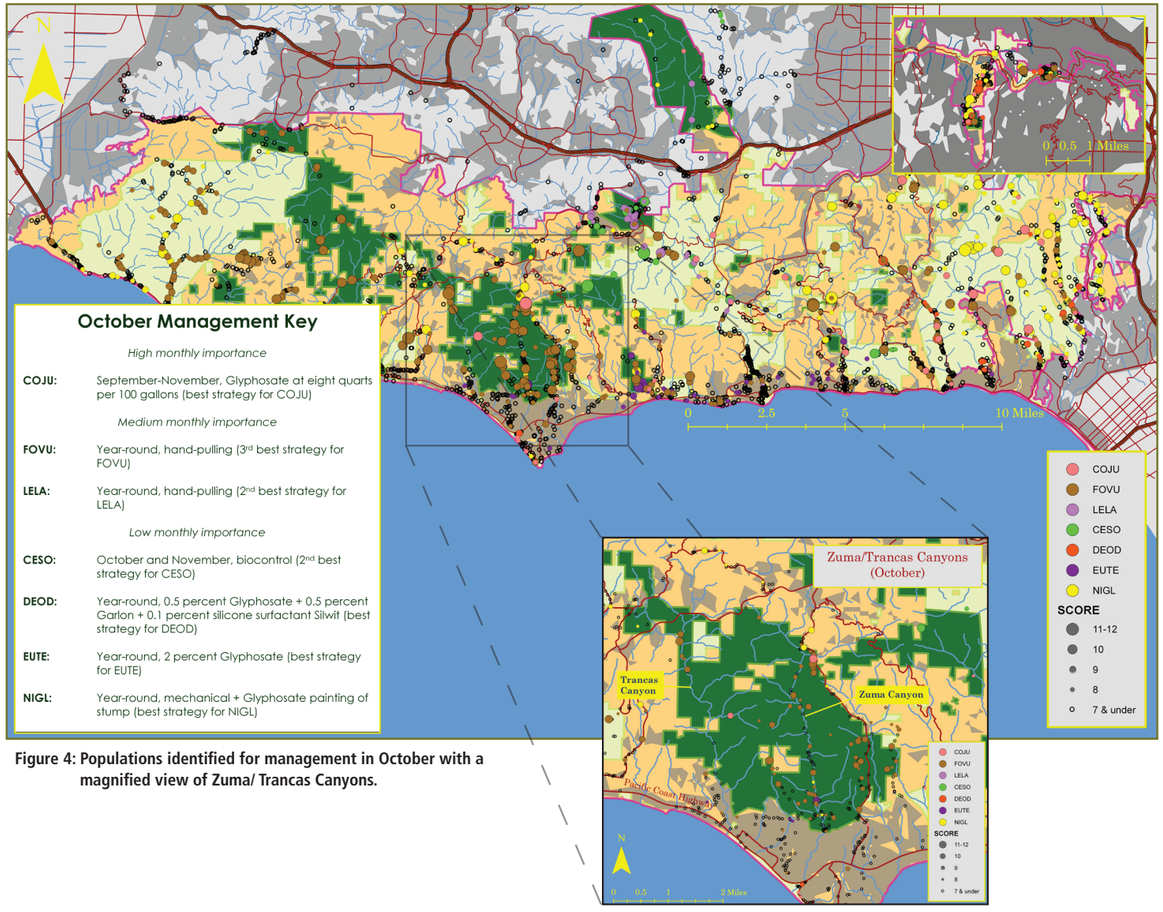

Figure 4: Populations identified for management in October with a magnified view of Zuma/ Trancas Canyons.

Canyons. Since fennel and pampas grass are both of high management importance for October, this area would be a recommended starting point for the month.

MANAGEMENT IMPLICATIONS

Our ETA, prioritization, and temporal analysis give managers at the SMMNRA a structure to make informed management decisions about invasive non-native species. Where prior decisions were made using a combination of expert opinion, informed intuition, and time constraints, this project provides a formal, data-driven method for devising long-term management strategies.

While the NPS has been given the specific results of our ETA, prioritization, and temporal analysis, ultimately the product of this project is a system to follow. In this way, our project will be valuable, not only in the SMMNRA, but in other locations as well. This project can be adapted to the needs of different areas, allowing managers the use of an adaptive management process to maximize efficiency and allow them to eliminate the most troubling threats over time.

For more information, visit our website at:
http://www.bren.ucsb.edu/~santamonica

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GROUP PROJECT BRIEF
SPRING 2007

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BIOLOGY & MANAGEMENT OF NON-NATIVE PLANT SPECIES IN THE SANTA MONICA MOUNTAINS NATIONAL RECREATION AREA

INTRODUCTION

BACKGROUND

The Santa Monica Mountains National Recreation Area (SMMNRA) is located in suburban Los Angeles and is bordered by the Hollywood Hills in the east, the Pacific Ocean in the south, the San Fernando Valley to the north, and the city of Los Angeles to the southeast. The SMMNRA is comprised of 150,000 acres and contains land managed by over 70 agencies, including the National Park Service (NPS), California State Parks, and Santa Monica Mountains Conservancy, as well as large tracts of private land (figure 1).

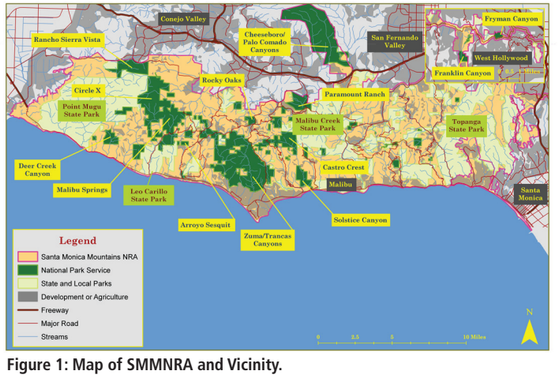

Figure 1: Map of SMMNRA and Vicinity.

Numerous vegetative habitats thrive within the SMMNRA, including chaparral, oak woodland, coastal sage scrub, and marsh. "Nearly 1000 species of native plants are found within these diverse habitats, along with 50 species of mammals, close to 400 bird species, and over 30 species of reptiles and amphibians" (NPS 2002).

Twenty-five species in the SMMNRA are known to be rare, threatened, or endangered, including steelhead trout (*Oncorhynchus mykiss*), Lyon's pentachaeta (*Pentachaeta lyonii*) and canyon wren (*Catherpes mexicanus)* (NPS 2002).

SIGNIFICANCE

Similar to other areas with Mediterranean climates, the Santa Monica Mountains are highly susceptible to invasion by non-native plant species (NPS 2002). In fact, the SMMNRA currently contains over 300 known species of non-native plants located in over 10,000 distinct populations.

Invasive non-native plants can out-compete and even completely replace native vegetation, which reduces the biodiversity of an area and can cause the extinction of rare species (Williams and West 2000). Additionally, invasive non-native species can alter ecosystem processes, such as the fire regime, water availability and nutrient cycling (Randall 1996).

Consequently, managing invasive non-native species is an integral part of maintaining the health of the ecosystems of the SMMNRA.

PROJECT GOALS:

- Create an exotic threat assessment for non-native species in the Santa Monica Mountains National Recreation Area (SMMNRA).
- Develop a method to prioritize invasive non-native populations for removal.
- Provide the prioritization in a format that can be modified and updated over time.

METHODS AND RESULTS

EXOTIC THREAT ASSESSMENT

Managers at the SMMNRA provided our group with a list of 19 non-native species suspected to be the most invasive (highest threat) based on expert opinion. However, given the nearly 300 additional non-native species present in the SMMNRA and the informality of the criteria used to generate the list, a more formal method for evaluating the threat of non-native species was necessary to determine which species should be a priority for management. Accordingly, we developed an exotic threat assessment (ETA).

Our ETA uses biological traits, history of invasiveness, environmental impact and management potential to rank the invasion threat of non-native species. We arranged our ETA in the following fashion:

Section 1: The General Threat of a Given Species Becoming Invasive

A. Biological Attributes
B. History of Invasiveness
C. Environmental Impact

Section 2: SMMNRA Specific Threat Assessment

A. Distribution within SMMNRA
B. SMMNRA Impact
C. Management Potential

Each sub-section contains questions to evaluate the species for a given criterion. The answers to each question were scored The number of high, medium and low scores a species received determined its overall ranking.

Using our ETA, we assessed the 19 species suspected to be the most invasive, plus eleven additional species. Of these thirty, seven were identified as species of high threat.

① yellow starthistle (*Centaurea solstitalis*) (CESO)
② pampas grass (*Cortaderia jubata*) (COJU)
③ German ivy (*Delairea odorata*) (DEOD)
④ false caper (*Euphorbia terracina*) (EUTE)
⑤ fennel (*Foeniculum vulgare*) (FOVU)
⑥ tobacco tree (*Nicotiana glauca*) (NIGL)
⑦ harding grass (*Phalaris aquatica*) (PHAQ)
⑧ Russian knapweed (*Acroptilon repens*) (ACRE)
⑨ perennial pepperweed (*Lepidium latifolium*) (LELA)

Due to lack of data, Russian knapweed (*Acroptilon repens*) and perennial pepperweed (*Lepidium latifolium*) were not identified as high threat by the ETA. However, we added them to the list of high threat species because they are suspected to be spreading quickly in the SMMNRA.

PRIORITIZATION

The populations of these nine invasive non-native species were then prioritized for management using a five step process.

1) We defined 28 criteria as indicators of a population's removal priority.

MAIN CRITERIA

- Quality of the area in which the population resides.
- The population's ability to become a source of new populations.
- The population's ease of control.
- Any public relation considerations for the area.

We then organized these criteria into a hierarchy (figure 2).

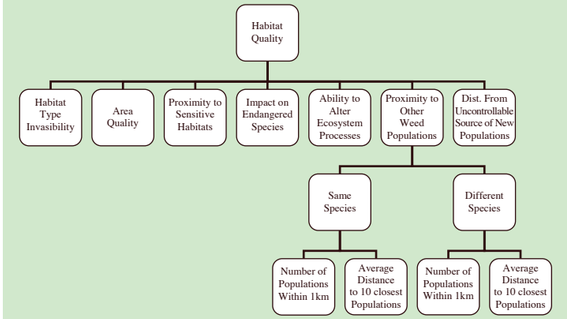

Figure 2: Habitat Quality Section of the Prioritization Hierarchy.

2) The 3,729 populations of the nine species were mapped and the essential information was collected using spatial analysis and the data provided by the park.

3) Using a 20 point scale, with a score of one representing the lowest priority and a score of 20 the highest, we developed a scoring system for each criterion.

4) The Analytic Hierarchy Process (AHP), a method of paired comparisons, was used to assign weights to each criterion.

5) Multiplying the score and weight for each criterion and adding the weighted scores together yielded a total priority for each population.

After assessing the populations using the prioritization, the final scores ranged from a high of 12.60 to a low of 3.56 (figure 3).

Individual prioritization scores are not indicative of a particular priority. For example, we are not able to designate a particular score as the "high priority" threshold. Instead, the scores must be interpreted in relation to each other.

Finally, we concluded by conducting a sensitivity analysis. This analysis determined that no one criterion had a disproportionately large effect on the results.

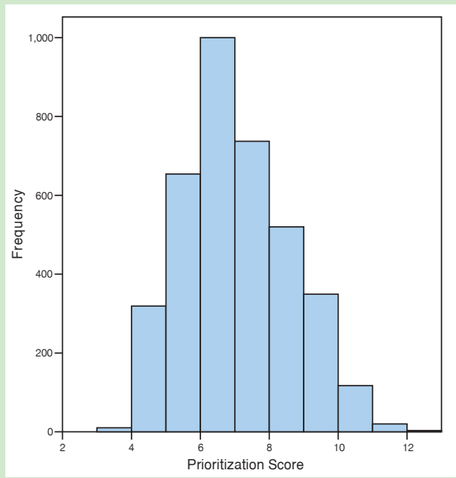

Figure 3: Distribution of Prioritization Score for all Populations in SMMNRA.

TEMPORAL ANALYSIS

After we prioritized the populations, we conducted a temporal analysis to evaluate timing limitations that could affect their control. A species' biology can limit the times of year it can be effectively managed, and certain management techniques work better during certain months or stages of a species' lifecycle.

We examined the biology and management of the nine species identified as high threat by the ETA to determine when and how they can be most effectively managed.

We then constructed maps that identified the species – and their corresponding populations – that could be effectively managed in each month (figure 4).

Using this information, mangers can easily identify areas in the SMMNRA containing high priority populations of species of high monthly importance.

For example, in October, there are a large number of high priority populations of fennel (*Foeniculum vulgare*) and pampas grass (*Cortaderia jubata*) in Zuma and Trancas