



A-Jacks, erosion control devices in Lopez Canyon, San Diego County, used to check water flow and thus protect the habitat of the rare willowy monardella. All images used courtesy of City of San Diego, 2003.

SAVING A RARE PLANT IN AN URBAN ENVIRONMENT

by Keith Greer and Holly Cheong

For its size, San Diego County is blessed with one of the highest number of endemic species in the nation. Considered a hotspot for endangered species (Dobson et al. 1997), San Diego has also undergone waves of rapid urbanization since the 1950s. While recent conservation efforts have focused on protecting species and their habitats from direct impacts such as urban development, active land management is equally important to protect species on lands already preserved.

This paper describes efforts of the City of San Diego, in conjunction with the nonprofit Friends of Los Peñasquitos Canyon, to protect a population of the federal and state endan-

gered willowy monardella (*Monardella limoides* Gray ssp. *viminea* (E. Greene) Abrams; see sidebars) from changes in urban hydrology.

Willowy monardella occurs in the alluvial terraces and cobble bed of intermittent streams in Lopez Canyon, a part of the Los Peñasquitos Preserve located within south and central San Diego County. While Lopez Canyon is part of a city park managed for its natural and cultural resources, indirect impacts from watershed urbanization have threatened the existing monardella population. Since the mid-1970s the 4.5 square mile watershed of Lopez Canyon has been developed into the suburban community of Mira Mesa. Currently, 65% of the watershed has

been covered by impervious surfaces such as pavement or structures.

When urbanization spreads into undeveloped watersheds, the percentage of impervious land surface increases, resulting in changes to hydrology that include increased stream discharge and velocity due to urban runoff, as well as changes in the timing of these flows. White and Greer (2002) documented an annual 4% increase in stream discharge since 1972 due to watershed urbanization in nearby Los Peñasquitos Creek. This increased discharge and velocity has resulted in increased scouring of the streambed, undercutting the alluvial terraces in Lopez Canyon that support willowy monardella.

The loss of alluvial terraces and the

enlargement of the intermittent stream channel were predicted by Karen Prestegaard (1979) in her masters thesis. Current and pre-urbanization aerial photographs support Prestegaard's predictions, and can be seen in Figure 1. Since 1995 the Friends of Peñasquitos Canyon have documented the loss of several large patches of monardella after large storm events. Effective management for willowy monardella in Lopez Canyon requires managing the changes in hydrology caused by watershed urbanization.

Recognizing this problem, staff from the City of San Diego and volunteers from the Friends of Peñasquitos determined that there was a need for hydrologic structures to slow the water velocity and reduce scour. In addition, they determined that it would also be necessary to address changes in hydrologic condition in the entire watershed. This resulted in a two-phase approach: a long-term goal to address the hydrologic changes and a short-term goal of protecting the existing patches of willowy monardella.

Working with a diverse citizens advisory committee, the Cities of Poway, Del Mar, and San Diego began looking at a comprehensive, long-term approach that would create a watershed management plan for the area. Those involved have just started to identify areas of stream impairment and possible solutions, but what about the short-term?

In 2001, the City of San Diego re-

ceived grant funding from the California Department of Fish and Game and the California Coastal Conservancy to implement an erosion control project to protect willowy monardella in Lopez Canyon. The first task was to design the project. Several alternatives were investigated and rejected prior to settling on the final design.

The first alternative came from two California State Parks engineers who volunteered their time to survey the monardella sites in Lopez Canyon, along with a volunteer representing the Friends of Los Peñasquitos Canyon Preserve. They proposed a series of grade control structures including drop structures, weirs, gabions, and bank armoring. Ultimately this proposal was deemed infeasible because its cost exceeded the available funds.

The second alternative came from the Natural Resources Conservation Service (NRCS) of the USDA. Their engineers drafted plans for a simpler design involving cobble berms to protect the two major monardella sites from erosive wintertime flows. These plans were reviewed in a preliminary meeting with the federal and state resource agencies in 2002. The US Army Corps of Engineers (ACOE) argued that the berm for the downstream site would redirect a secondary channel flow, possibly causing a detrimental change in hydrology.

It became apparent that obtaining approvals from the Corps and the Regional Water Quality Control Board

(RWQCB) would be very time-consuming for the berm design. In addition, grant funding would have expired before the permitting process for those agencies could be completed. Also, the berm design could have possibly impacted an already eroded sewer line within the canyon. Instead of risking unforeseen negative impacts to the canyon, the project team decided to look for another solution.

After consulting with staff from many agencies, it was determined that a new form of erosion control, called A-Jacks, would be the best solution for Lopez Canyon. A-Jacks are concrete armor units designed to interlock into a flexible, water-permeable chain. A-Jacks help dissipate water velocity, protecting channel terraces from scouring and erosion, two problems experts knew they had to solve. A-Jacks also collect sediment within the water, minimizing impacts downstream from deposition, a third problem in the Canyon's waterways. Downstream deposition of sediment into Los Peñasquitos Lagoon had already caused significant impairment (California State Coastal Conservancy 1985). Collection of sediment would also help stabilize the terraces, provide additional habitat areas for willowy monardella, and hide the A-Jacks from view.

An engineering firm was contracted to draft a set of plans using A-Jacks to protect the population of monardella without significantly altering the hy-

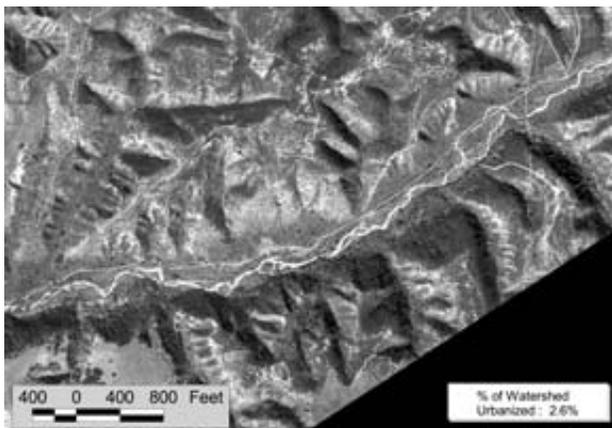


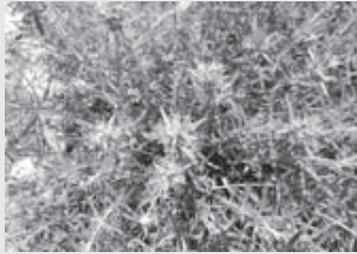
FIGURE 1A. Lopez Canyon, San Diego ca. 1969. Aerial photograph of the canyon prior to the development of the suburban community of Mira Mesa. Note the stream bed of Lopez Creek shown as a meandering white line crossing horizontally in the center of the photograph.



FIGURE 1B. Lopez Canyon, San Diego ca. 2002. Aerial photograph of the canyon after the development of the suburban community of Mira Mesa. Note the enlargement of the stream bed throughout the canyon. 2003 locations of willowy monardella are shown as white triangles.

WILLOWY MONARDELLA IN SOUTHERN CALIFORNIA

Willoway monardella (*Monardella linoides* Gary ssp. *viminea* (E. Greene) Abrams) is a state and federally endangered plant species that is found along drainages within central and south San Diego County. It is a



perennial herb that blooms between June and August. This plant species is in the mint family (Lamiaceae) and has a pleasant spearmint aroma.

Habitat for willoway monardella is extremely limited. This rare plant species is only found on terraces along natural drainage courses. As development has increased in San Diego County, willoway monardella has been threatened by

floodplain development, increased urban runoff, and invasion by weeds. Willoway monardella does not compete well with other plants and can be choked out by weeds which invade the streamside terraces. In addition, sparse riparian habitat can turn into thick riparian woodland with increased urban runoff, further decreasing habitat areas for willoway monardella. Urban runoff can also erode the streamside terraces where willoway monardella resides, washing the plant and its habitat downstream. The latter example is what has occurred within Lopez Canyon.

Due to habitat degradation, this plant species is becoming increasingly rare. Only six known locations continue to persist, with the largest population occurring on military land. Many populations in upper Lopez Canyon, Soledad Canyon, and other canyons throughout San Diego have been extirpated. It is extremely important that all remaining populations of willoway monardella be protected and managed. Recent taxonomic work by Andy Sanders and Mark Elvin supports the reclassification of willoway monardella to its own species (*Monardella viminea*), with a new species *Monardella stoneana* (Jennifer's monardella) being described from near the US-Mexican border (see *Novon* 13(4):426 (2003)).



Willoway monardella (*Monardella linoides* ssp. *viminea*), from Lopez Canyon, San Diego County.

drology of the adjacent channels. After consultations and site visits with involved agencies, this third alternative was deemed the most feasible.

Project construction began on August 11, 2003. Urban Corps of San Diego was hired to conduct the installation. This non-profit organization, which focuses on opportunities to conserve our natural resources, provides job training and educational opportunities for young inner-city men and women ages 18 to 25. Representatives from the Friends of Los Peñasquitos Canyon Preserve, Erosion Control Technologies, and a senior ranger for Los Peñasquitos Canyon Preserve, supervised and assisted with the A-Jacks installation.

A small Bobcat or hand tools were used to create the trench for the footing of the A-Jacks. Once the trench was completed, A-Jacks were installed on the site in a long, linked chain. A-Jacks weigh about 80 pounds each and had to be fitted together exactly to ensure proper functioning. The installation, which took about one week, was scheduled to take advantage of the dry summer season when Lopez Creek does not flow. Needless to say, it was a laborious process and the project team, including Urban Corps, maintained a great attitude during the hot summer.

Now that the project has been completed, City of San Diego staff and the Friends of Los Peñasquitos Canyon Preserve hope to preserve and enhance the natural populations of willoway monardella in Lopez Canyon. Annual surveys, started in 2000 (City of San Diego 2000), are documenting the effectiveness of the A-Jacks. These reports will be provided to the federal and state resource agencies and made available to the public.

If our program is successful, in a few years additional habitat for willoway monardella will be created in Lopez Canyon by the natural collection of sediment on the A-Jacks. When that occurs, the Friends of Los Peñasquitos Canyon Preserve expect to plant additional willoway monardella in Lopez Canyon to boost the population.

The City of San Diego staff were able to videotape the installation of the A-Jacks and interview some of the key members of the project team. This video documents the work that went

A BRIEF EXPLANATION OF THE *MONARDELLA LINOIDES* AND *M. ODORATISSIMA* ALLIES IN SOUTHERN CALIFORNIA

The genus *Monardella* consists of approximately 50 taxa of annual and perennial herbs that are found throughout western North America with almost all taxa occurring either partially or wholly in California. *Monardella* species vary mostly in their vegetative characters (as opposed to floral characters), notably pubescence and the size and shape of their leaves and bracts. Speciation in *Monardella* seems to be driven, in part, by a combination of isolation and vegetative and/or physiological adaptation to local conditions (personal observation, M. Elvin and A.C. Sanders).

Many taxonomic problems exist in *Monardella*. The *Monardella* populations in southern California are no exception. They appear to be very similar and it can be difficult to distinguish between the taxa; however, they can be separated into natural groups based on a series of shared characters. The *M. odoratissima* and *M. linooides* species groups are among the most difficult to distinguish in the genus. The taxa in these groups have regularly been confused in the field and herbaria, but can be recognized by small but consistent differences between them.

Plants in the *Monardella linooides* species group generally have narrow leaves (broadly linear) and herbage covered with a short dense pubescence. Their leaves have a winged petiole, an attenuate base, and a consistently narrowish blade that expands gradually to the widest point. The stems and leaves have a short dense pubescence in most cases, with mixed long and short dense hairs in a few populations (e.g., *M. robisonii*). *Monardella linooides* is represented in southern California by a number of taxa including several subspecies of *M. linooides*, *M. robisonii*, and *M. viminea* (a former subspecies of *M. linooides*).

Monardella viminea (willowy monardella) is a wispy low growing non-rhizomatous perennial with stems that drape out from the center, which is how it got its common name. It grows on secondary alluvial benches in ephemeral washes (drainages

with running surface water for 24 to 48 hours after a rain) that cut through cismontane marine and alluvial terraces of central San Diego within 20 km of the Pacific Ocean. *Monardella viminea* has a relatively sparse pubescence (especially compared to the closely related *M. linooides* ssp. *linooides*) and is conspicuously and rather densely glandular on the stems and leaves. The leaves are broadly linear to narrowly lanceolate with a length to width ratio of between 7 and 10 to 1. The inflorescence bracts are conspicuously longer than the calyces. *Monardella viminea* has a strong sweet scent of the sort typically associated with *Monardella*.

Plants in the *Monardella odoratissima* species group generally have wide leaves (lance-ovate) and glabrous to sparsely pubescent herbage. Their leaves have a distinct petiole, an acute base, and a relatively broad blade that expands quickly to the widest point. The stems and leaves are generally either glabrous or sparsely pubescent to sparsely short-villous. *Monardella odoratissima* is only represented in southern California by the derivative taxa *M. australis* and the new species, *M. stoneana* (which was recently published in *Novon* 13(4)).

Monardella stoneana (Jennifer's monardella) is a low, compact and non-rhizomatous perennial. It grows in intermittent streams that carry water for several weeks to months during and after the winter rainy season. It most often grows among boulders, stones, and in cracks of the bedrock of these intermittent streams in rocky gorges in the mountains just east of San Diego and into northern Baja California, Mexico. *Monardella stoneana* stems are rather stout compared to the other species in the genus. It is sparsely pubescent to almost glabrous and less glandular than both *M. odoratissima* and *M. viminea*. Its leaves are lanceolate to lance-ovate with a length to width ratio of between 3 and 5:1. The inflorescence bracts are noticeably rather small, of more or less the same length as the calyces. *Monardella stoneana* has a strong and pungent, minty scent.

—Mark Elvin

into this project and provides a valuable guide for anyone considering a similar project. The video, titled the "Lopez Canyon Willowy Monardella Protection Project," is available from the City of San Diego.

Although this project underwent a significant number of design changes, it was ultimately successful. One of the main reasons for its success is the incorporation of volunteers into the project. Without their assistance and

vision, this project might still be in the design and permitting stage. The hope is that this project will stop the onslaught of urban runoff on this sensitive plant species and stabilize the eroded terraces for future populations

of willowy monardella. Although the damage to the watershed will not be undone by this project, it will reduce further sediment deposition downstream and minimize erosion within Lopez Canyon.

Future projects included in the Lopez Canyon watershed management plan can build off of this effort to improve the quality of this canyon and its habitats.

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REFERENCES

- Dobson, A.P., J.P. Rodriguez, W.M. Roberts, and D.S. Wilcove. 1997. Geographic distribution of endangered species in the United States. *Science* 275:550–553.
- California State Coastal Conservancy. 1985. *The Los Peñasquitos Lagoon Enhancement Plan*. 90 pp.
- City of San Diego. 2000. *Summary of monitoring results for Monardella linoides ssp. viminea*. 8 pp.
- Prestegard, K.A. 1979. *Stream and lagoon channels of Los Peñasquitos watershed, California with an evaluation of possible effects of proposed urbanization*. Masters Thesis, University of California. Berkeley CA.
- White, M.D., and K.A. Greer. 2002. *The effects of watershed urbanization on stream hydrologic characteristics and riparian vegetation of Los Peñasquitos Creek*. Conservation Biology Institute Report. Available at www.consbio.org/cbi/pdf/san_diego/penasquitos.pdf.

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Clockwise from top: Completed installation of the erosion control devices. • The A-Jacks should trap sediment, as well as protect the alluvial terraces, allowing the devices to be partially buried from view in the future. • A-Jacks erosion control device. • Urban Corps of San Diego installing A-Jacks around the alluvial terraces supporting willowy monardella.