Unpaving Paradise: The Green Visions Plan

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Southern California is a compelling region. Since the late 1800s millions of people hungry for the American Dream have arrived seeking its economic opportunities, social diversity, temperate climate, and abundant natural resources. Yet Southern California is perhaps the nation's most challenging urban region in terms of socioecological planning and environmental restoration. The metro area retains the distinction of having the most polluted air in the United States and suffers serious freshwater, groundwater, and coastal water pollution. Water supply shortages are growing worse, and the region is an endangered species hotspot. Deep-seated environmental injustices have yet to be remedied, and as a result of a long history of flood control the Los Angeles River is one of the most channelized rivers in the nation.

Awareness of the need for fundamental changes in urban development has grown rapidly in recent decades. Why?

- Long-overdue enforcement of the federal Clean Water Act, leading to tough new Total Maximum Daily Load restrictions, which in turn have engendered a push for integrated watershed management
- Conflicts over endangered species, with resulting defeats of major development projects
- Passage by voters of bonds to fund water quality projects and parks/recreational open space for metropolitan areas (not solely wilderness land acquisitions), as a means to address urban watershed health and park access goals
- The campaign to restore the Los Angeles River
- Concerns about the lack of open space for active living in the face of a looming obesity epidemic

- Passage of the Sustainable Communities and Climate Protection Act in 2009, which increases pressures on localities to increase densities and better integrate land use and transportation

A historical legacy of weak regional governance stands as a major barrier to reweaving the green fabric of the region and enhancing its socioecology. The metropolitan planning organization, the Southern California Association of Governments, has a say in transportation planning and fund allocation, but little else; regional agencies such as the state's Regional Water Quality Control Board regulate but have limited resources for analysis; the counties and cities have strong powers of land-use control but few resources to engage in scientific analysis or detailed planning and limited project funding; the U.S. Army Corps of Engineers has initiated some major studies but focused solely on major river channels; and nonprofit organizations have made significant headway in terms of raising awareness but can mount only limited scientific projects. The result is a paucity of scientific study of the region's ecological and watershed health or geographically disaggregated data that would allow scientific, needs-based decisions on where to make strategic investments. The Green Visions Plan (GVP) for 21st Century Southern California launched in 2003 sought to fill some, if not all, of these gaps.

For state land conservancies, including the Coastal Conservancy, Rivers and Mountains Conservancy, Santa Monica Mountains Conservancy, and the small but centrally located Baldwin Hills Conservancy, the status quo constitutes a major chal-

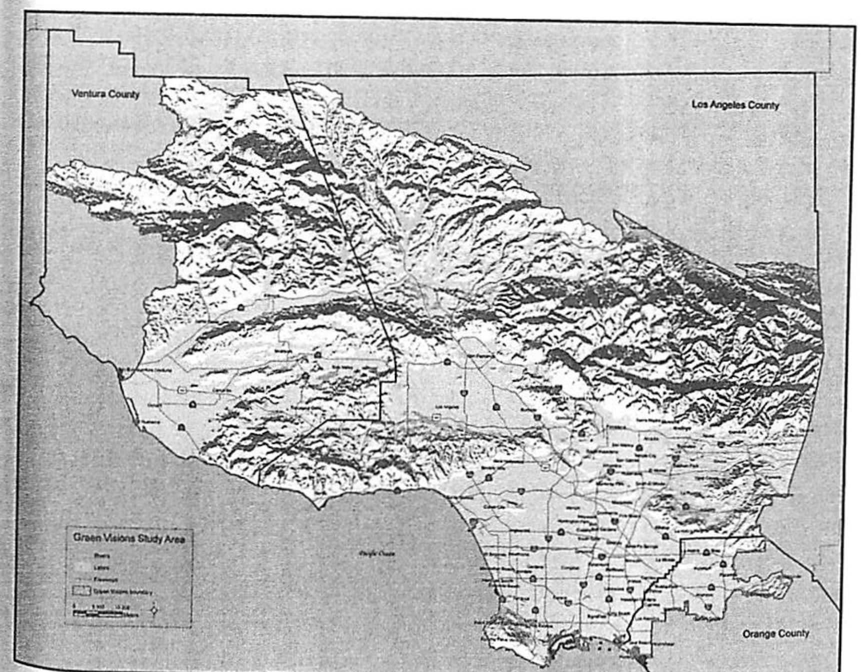

Figure 6.16. Map of the Green Visions study area

lenge. With large amounts of state bond funds to allocate, habitat protection duties, shared responsibilities for integrated watershed management planning, and a mandate to increase recreational open space access, the conservancies have long needed better science and planning tools to do their jobs well. Moreover, most state and local project funding has been based on competitive proposals, thereby disadvantaging poorer communities with fewer staff or consulting resources. Since such communities often have the worst park access, the least amount of natural habitat and open space, and the most polluted water, the seemingly merit-based, competitive resource allocation model actually serves to reinforce or even deepen environmental inequalities. Thus a motive for conservancy support of the GVP was to create data and planning tools as common-good resources, thereby leveling the playing field across communities with disparate abilities to produce the technical analyses needed to gain access to funding.

Curiously, LA has a unique history of powerful socioecological planning efforts. In the early 1930s, the Los Angeles Chamber of Commerce commissioned well-known landscape architects Olmsted and Bartholomew to create a regional plan for "parks, playgrounds, and beaches." Though the plan was never implemented, in the mid-1990s it resurfaced and became a beacon, stimulating a renewed vision for an ecological city connected by green corridors and major parklands. (See Hise and Deverell, this chapter.)

One outgrowth of this was the GVP with its study area covering 11,240 square kilometers and almost 11 million residents. Funded by a collaborative partnership among the region's land conservancies led by Belinda Faustinos of the Rivers and Mountains Conservancy, the purpose of the GVP was to use the best science and data available to characterize the major watershed, habitat, and recreational open space assets of the region and design a web-based planning tool for a variety of stakeholders. The tool was to offer a data-rich context for planning and a set of static and dynamic analytic capabilities for the exploration of alternative multibenefit projects that could further major social and ecological goals at regional and local planning scales.

Along the way, the GVP encountered many challenges including inadequate data, lack of appropriate scientific models, and political obstacles. Both the successes and limitations of the GVP offer a unique window into the challenges, complexities, and opportunities of using place-based science and planning to "unpave paradise." Here we provide an overview of the GVP analytic framework, the scope of empirical and modeling work, and web-based tool development. We conclude with lessons for future planning practice.

The Green Visions Plan Framework

The prospect of drafting an urban conservation plan for the three-county, multiwatershed GVP area was daunting and inspiring. The study area's many natural communities range from disturbed urban sites to wilderness, and stakeholders abound. Our objective was to create a template for "needs-based" conservation funding rather than "proposal-based" allocation of resources, which results in a mosaic of projects that may not achieve synergistic conservation goals. The GVP analytic framework and its Geographic Information System (GIS)–based methods had four parts: (1) habitat conservation; (2) watershed health; (3) recreational open space; and (4) a GIS toolkit.

Habitat Conservation

The LA region presents a dilemma for conservation planners. The least disturbed natural lands are found in the mountain ranges that ring and bisect the metropolitan areas while the most disturbed lands are found in the valley bottoms and large alluvial plain. Based on the current distribution of parklands, the mountains and foothills have historically received significant conservation attention, while the river valleys and plains have not. Greater emphasis is now being placed on the valleys and plains. This emphasis has evolved out of a desire to reclaim rivers as a part of public space, an increasing need to undertake watershed planning to meet regional water-quality goals, and proposals to increase access to open space.

The GVP habitat conservation component sought to build on this renewed attention to valleys and plains, as well as mountains and foothills. For the entire study area, we focused on species recovery, restoration based on historic and current conditions, maintenance of natural or seminatural disturbance regimes, and an incorporation of the scale-dependent nature of urban connectivity and its implications for harnessing the urban matrix for biodiversity. Methods included identifying and modeling target species ranges, historical analysis to promote representation of natural communities, and the development of tools to support the design of metropolitan corridor-reserve systems (Rubin, Rustigian, and White 2006, Stein et al. 2007, Longcore et al. 2011).

The use of target species is helpful since they act as surrogates for biodiversity, either directly or indirectly; provide guidelines for the spatial configuration (e.g., size, connectivity, and habitat types) of a reserve system to maintain biodiversity in wild to urban situations; and serve as benchmarks for evaluating the effectiveness of the plan over time. As a result, target species for urban conservation planning include some native species that have become increasingly rare as native habitats diminish in size and connectivity. We developed a modeling tool that predicts the distribution of the chosen target species based on the size and isolation of vegetation types predicted to support the species. These models produce predictive maps of habitat quality for each of the target species, which are then overlaid to produce a map of target spe-

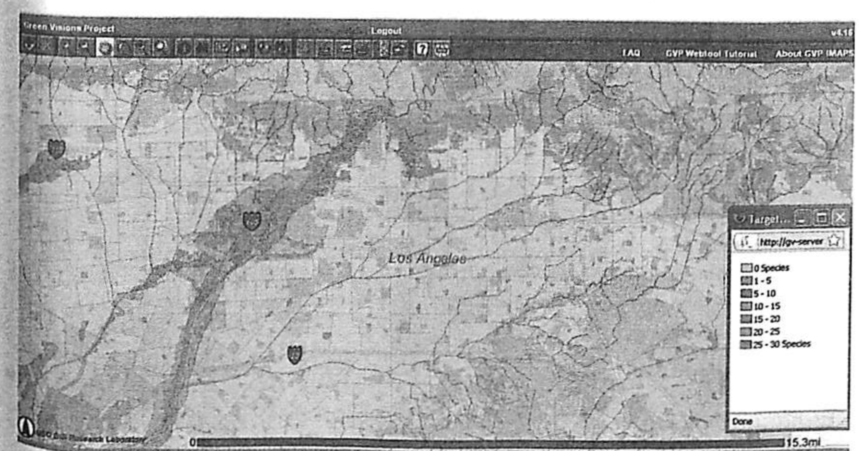

Figure 6.17. Target species map

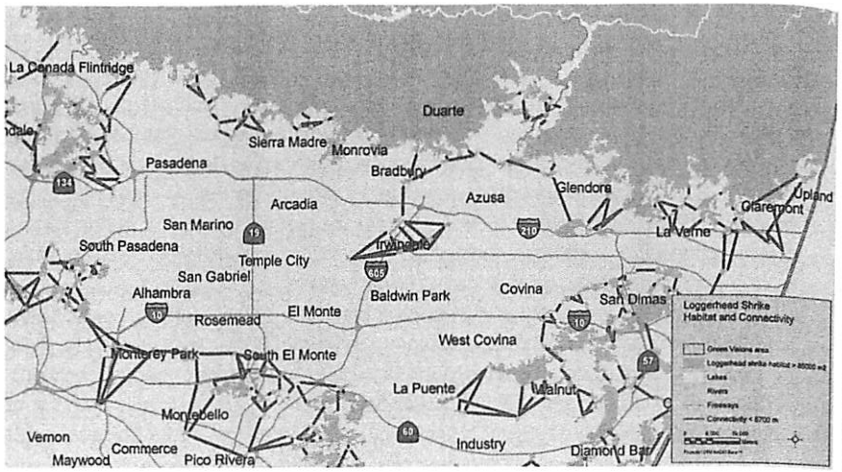

Figure 6.18. Map of the habitat and connectivity of the loggerhead shrike

cies density for the planning region that can be used to prioritize open space acquisition and reserve monitoring (Rubin, Rustigian, and White 2006).

Connectivity is an important goal to ensure long-term viability of sensitive species in fragmented reserve systems. Planners often focus on connectivity for large predators in intact landscapes, but such an approach provides little guidance for species that depend on natural fragments within urban landscapes. Planning for species that have less restrictive needs is appropriate to identify and plan for connectivity within cities.

We used the GVP area as a case study to identify and implement a connectivity analysis for five native species that persist in protected lands across the region and that are relatively tolerant of human proximity and urbanization (Longcore et al. 2011). The results allow open space planners to prioritize acquisition of a reserve system that provides connectivity for species appropriate to an urban region. Using these results, open space planners can prioritize acquisition of a reserve system that could provide connectivity for species. Further calculations, using habitat suitability assessment, could be used for the five species to identify those areas that are within existing corridors or are relativiely easy to traverse, and those most isolated from habitats.

Connectivity in this application does not necessarily require contiguous habitat but rather can includes habitat stepping-stones that increase the probability that more mobile species (e.g., birds, coyotes) can traverse between larger habitat blocks. Findings can inform land acquisition decisions, develop corridor development strategies for key linkage areas, and create habitat stepping-stones within recreational open space or watershed projects.

Watershed Health

The natural hydrology in Southern California has been extensively modified and largely replaced by a paved drainage system that quickly carries away water following storm events while increasing discharges of reclaimed wastewater and other surface

discharge—including lawn watering overflow and streetside car washing—into the regions' waterways, dramatically altering stream flow regimes and hence the nature and quality of downstream habitat. The GVP watershed health component focused on multiple-use project designs that would help to restore the scenic, recreational, and habitat values of streams and rivers, maximize groundwater detention and infiltration to reduce polluted runoff and enhance groundwater supplies, and reduce discharge of pollutants through source controls (e.g., Bina and Devinny 2006, Sayre, Devinny, and Wilson 2006). The methodological approach relied on a series of spatially explicit models implemented at a variety of regional and subregional scales to characterize the current flow and water quality conditions and evaluate the restoration potential of alternative projects based on a set of watershed and related metrics (Sheng and Wilson 2008).

For assessments of watersheds, GVP utilized the high-resolution National Hydrography Dataset (NHD), a geographically referenced spatial data system developed for this purpose that constitutes a major advance in detail and accuracy over previous such datasets. However, the "fitness for use" of these types of datasets varies with the choice of analytical tools and landscape settings, and we encountered problems with data describing stream features and flow patterns that occurred frequently but unevenly across this heavily urbanized landscape. GVP implemented several strategies for correcting errors and ultimately generated a superior, single-line natural flow network for the metropolitan LA area (Sheng et al. 2007).

Using the corrected NHD data, plus supplementary information, we assessed conditions in five Southern California watersheds (Sheng and Wilson 2009a–e). For each watershed, descriptions of general characteristics and hydrologic conditions are followed by an analysis of stream networks, watershed attributes, hydrologic features (dams, reservoirs, flood control facilities, debris basins, spreading grounds, etc.), flow and flood dynamics, and groundwater characteristics. Stream segments were linked

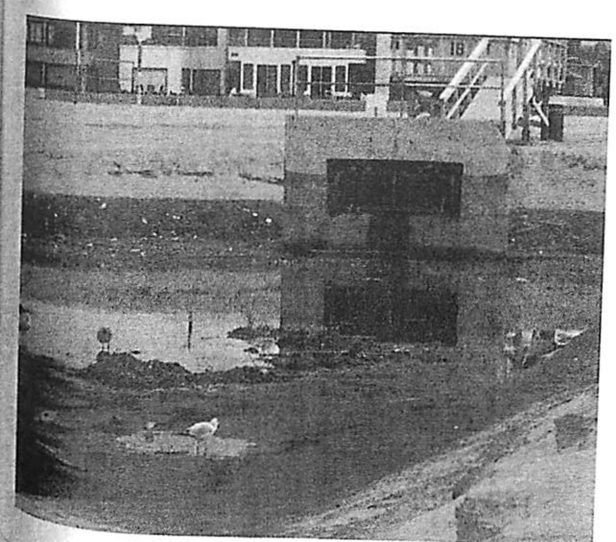
Figure 6.19. Assessing water quality is a critical part of the Green Visions Plan.

with their catchment and flow data from selected stream gauge stations to characterize annual mean daily discharge and flood magnitudes with different recurrence intervals (Sheng and Wilson 2009f). Not surprisingly this assessment showed a radically altered stream network with few remaining natural riparian landscapes, suggesting the need for headwater preservation, conservation and restoration of open space areas, a cadre of projects to improve water quality and mitigate urban flood magnitudes, and a modified approach to regional groundwater extraction and recharge to improve hydrological health throughout this rapidly changing region.

Finally, we developed a series of catchment-level water quality models to allow planners to simulate the hydrological cycle over metropolitan regions. The complications arising from extensive human modification of land cover and land use along with a lack of long-term hydrological monitoring records made this task more challenging and led to results that incorporate substantial uncertainty. We employed customized water-quality models for planning, using data and case studies from the GVP study area. The resulting model highlights current water quality problems and identifies those areas that produce the most contaminants. Such models can describe the region's spatial heterogeneity to some extent, offering reasonably good representations of its hydrologic system, but the many data gaps reduce accuracy and limit the success of hydrologic modeling as well as water quality model results.

Parks and Recreational Open Space

The GVP parks and recreational open space component highlighted environmental justice for communities with inadequate access to green space. Our framework sought to help planners achieve several goals: enhance access to recreational open space in communities of color; maximize connectivity of trail/bikeways to promote physical activity and access to nature; and connect beaches to inland communities. We also sought to make it easier to develop multibenefit park projects by incorporating data on habitat and watershed conservation features associated with existing and potential park sites.

First, we developed a detailed audit instrument and methodology to characterize parks and open space along key dimensions (Byrne et al. 2005). Some aspects were derived from remote data sources, while other features were obtained through use of a field audit instrument, created to characterize a random stratified sample of parks and open space in the GVP. The instrument covered facilities and amenities, landscape features, and condition and safety and was designed for a variety of recreational settings (e.g., campgrounds, beaches, piers, marinas). Questions were included on specific landscape features that could be used to evaluate conservation and restoration potential. A version of the audit tool was used to perform web audits for all existing facilities not field audited.

We used two approaches to quantify access to parks: (1) the traditional radius technique that identifies a distance threshold inside which populations are deemed to have access, and (2) the park service area approach, which assigns residents to their closest park and quantifies potential park congestion for every park (Sister, Wilson, and Wolch 2007, 2008). The radius analysis revealed that minority and low-income groups were as likely to have access as high-income groups or whites, while the park service area approach showed that Latinos and blacks had up to six times less park

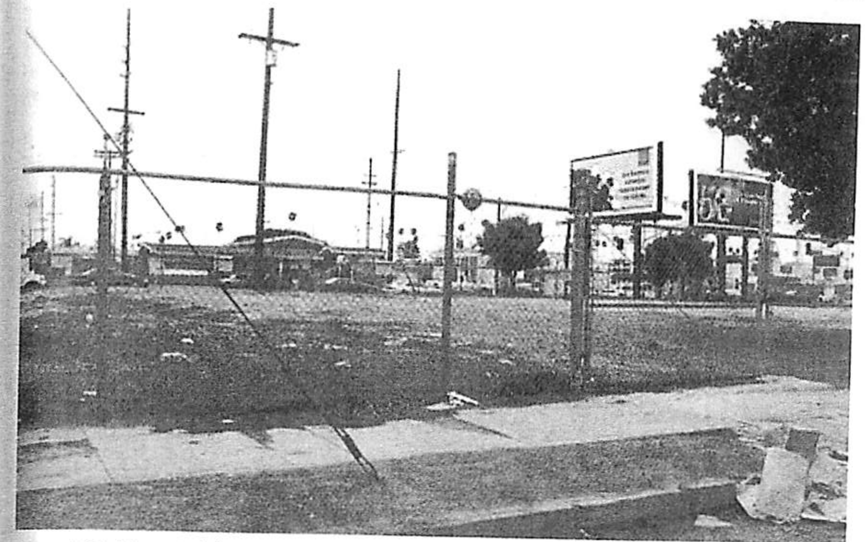

Figure 6.20. No one's definition of a high-quality park

acreage per capita compared to whites. Similarly, low-income and poor residents were park-poor (Sister, Wolch, and Wilson 2010).

The park service area approach facilitated the identification of areas with greater park need and provided a pragmatic way to redress existing disparities in park access. Built into the GVP web-based planning toolkit (described below) this approach uses "on-the-fly" features that can be utilized by a wide spectrum of users, including community-based nonprofits and other stakeholders involved in park provision.

The GVP park planning strategy, with its emphasis on multibenefit projects, raised questions about nature and culture in the megalopolis. What are the consequences of successful urban conservation efforts for people and wildlife when they try to share urban hydrological systems and native assemblages of plants and wildlife? What are the consequences of the repopulation of urban space by wildlife and its simultaneous use by humans? Restoration and associated recreation initiatives can generate positive and negative interactions with urban planning and management tools (see Seymour 2005 and Seymour et al. 2006 for additional details).

The GVP Web-Based GIS Toolkit

The result of the analysis was the development of the GVP Toolkit 1.0, a web-based GIS mapping system. The toolkit integrates these three focus areas and the accompanying data into scenario planning features, allowing users to interactively visualize and explore synergies and trade-offs (Ghaemi et al. 2009) as they consider the planning and development of multibenefit projects that could provide habitat conservation, watershed health, and recreational open space benefits (Newell et al. 2008). Its dynamic analysis tools allow planners to conduct "what if" assessments of alternative parks or open space sites, to ensure their projects have maximum impact.

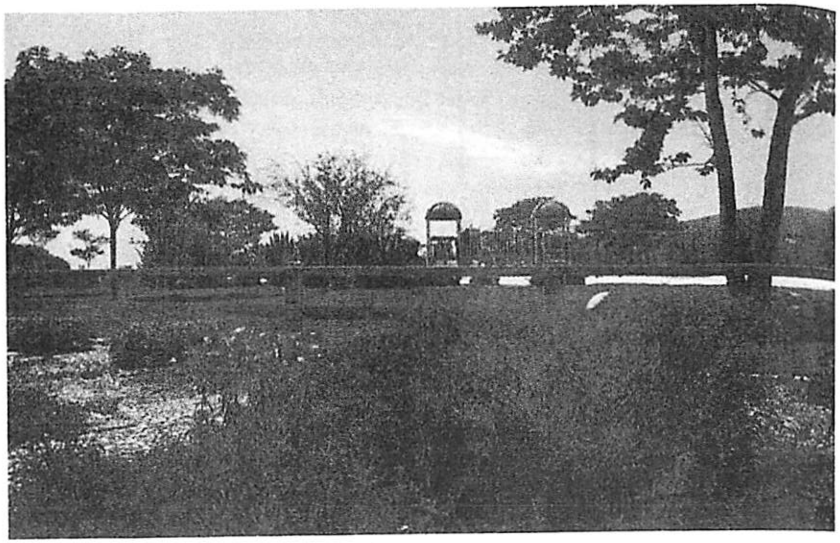

Figure 6.21. A more useful and appealing park

The GVP Planning Toolkit website consists of a map viewer, customized toolbars, and approximately 80 GIS data layers in addition to dynamic analysis tools that provide on-the-fly reports for specific parcels, stream segments and catchments, parks, and modeled native wildlife diversity. For example, the park analysis tool allows users to identify a specific parcel that could become a park and conduct an analysis of the extent to which its conversion to park space would relieve user congestion in existing parks in neighboring areas. By comparing alternative sites, project developers are better able to select the site that will have the largest benefits for park accessibility. Similarly, the habitat conservation tool can rank locations by their contribution to wildlife linkages across the region and calculate what target species would be supported by the area's restoration.

Prospects for Unpaving Paradise: Lessons from the Green Vision Plan Experience

Urban ecological and watershed scientists are only just developing the theoretical models and empirical research base that will allow planners tasked with making important investment and management decisions to conduct metropolitan socioecological analysis and scenario assessments. For example, most ecological corridor studies ignore cities, yet creating "local linkages" for mobile species can revivify the city and enhance biodiversity. Similarly, watershed analysis has focused on wildland stream networks, avoiding the complexities of modeling urban hydrological dynamics and water quality that are ever more critical to making cities more resilient. And park equity studies are narrowly focused, using metrics focused on park acres rather than facilities, condition, or potential for multibenefit projects.

As local and regional planners, community organizations, and scientists use the findings and tools derived from the GVP, four challenges are emerging, three of which

are operational, the other scientific. Operational challenges include the fragmentation of responsibility for planning and analysis, severe gaps in data on habitat and hydrology in urbanized areas, and the need for collaborative structures for data and web-tools maintenance. The key scientific challenge is how to integrate place-based science across time-space scales; for example, how do we link models of nutrient cycling or estimates of ecosystem services to larger landscape dynamics scenarios such as river restoration or habitat corridor-reserve configuration alternatives?

First, no one agency has authority over planning in Southern California. This fragmentation has led to a proliferation of one-off mapping systems and GIS tools. Some systems are extraordinarily basic in terms of their science and rely on inadequate information yet are marketed aggressively by engineering or planning consultants. Most systems are designed for idiosyncratic purposes and are not part of any larger framework since there is insufficient collaboration around data sharing and updating. Decision makers are confused by the multiplicity of systems. The situation calls out for strong local-regional coordination around data quality, maintenance, and modeling.

Second, the data gaps are profound. Scholars, activists, and policy makers trying to think regionally have to work across many jurisdictions, each with its own data collection systems and quality standards. The technical problems of data integration are significant, while some types of data simply are not available. For example, Los Angeles County's Department of Public Works only recently created digital files of the county's underground water infrastructure system. Moreover, crafting models that account both for natural runoff and runoff patterns over the surface of the city's built environment is complex. Similarly, detailed mapping and habitat suitability assessment of the area's wide variety of habitats, much of it dominated by exotic vegetation but still supportive of biodiversity, are seldom conducted. Our knowledge of urban wildlife dynamics remains patchy and inadequate for restoration planning.

Third, GVP immediately raised unanswered questions regarding collaborative structures to maintain and update datasets, models, and tools. As the project moved toward completion in the late 2000s, the economic recession and attendant fall in public funding deeply affected land conservancies and local governments. This situation left open how the GVP toolkit would be maintained and kept up-to-date and how users across the public, nonprofit, and private sectors would be trained.

Finally, socioecological processes span time and space. We currently lack both robust microlevel ecological models that can generate estimates of regional ecosystem services and analyses of urban water quality at the watershed level that can provide sufficient detail on which water quality projects to prioritize on the ground. Similarly, we need agent-based models of park utilization behavior that can inform public park investment and, in turn, how investments—or lack thereof—drive use or avoidance of open space in the city. The development of multiscale models that allow easily visualized scenario planning will be an increasingly important part of the planners' toolkit as we seek to build more resilient, fair, and ecologically sustainable metropolitan regions.

PLANNING LOS ANGELES

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