Willows in Urban Creeks: Revealing Ecological and Social Goals in Restoration

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Stream restoration projects are increasingly common in urban neighborhoods, offering a range of benefits from enhanced wildlife habitat to human recreation, which landscape architects are often called upon to coordinate (McGinnis 2000). Many early efforts involved removing accumulated trash, ‘daylighting’ buried creeks, re-meandering straightened channels, and creating ‘compound channels’ wherein the low-flow channels are flanked by vegetated floodplains with trails and picnic spots (Riley 1998, Purcell et al. 2002). Drawing upon the long history of urban stream restoration projects in the San Francisco Bay Region (Owens-Viani 2004, Mozingo 2005), we documented outcomes for streams restored in dense urban settings. Conflicts among experts and stakeholder groups occur frequently in stream restoration (Kondolf and Yang 2008), resulting from fundamental differences in attitudes and goals of different experts and user groups, as well as different notions of what is appropriate at a given site. One of the most frequent conflicts was over how to balance ecological goals with human access, recreation, and concerns for safety.

Urban creek restorations have often involved planting willow (Salix spp.), alder (Alnus spp.), or cottonwood (Populus spp.) to create riparian woodlands, to provide wildlife habitat, shading, and enhance channel complexity. Willows have been especially common in restoration projects, reflecting a ‘template’ of stabilizing banks with willow wattles, planted stems, or similar techniques. In fact, the planting of willows is never challenged as a ‘restoration’ technique; it has become an expected part of any restoration project. However, most natural ‘reference’ riparian sites are not dominated by willow, but by a mix of other plants (Kristen Van Damm, Urban Creeks Council, unpublished data).

However, dense riparian vegetation has been viewed negatively in many neighborhoods. A 1995 daylighting project on Blackberry Creek in an affluent section of Berkeley was controversial because many local residents objected to the willow thicket that established, and which was viewed as potentially hiding illicit activity (Gerson et al. 2005). These conflicts have been even more acute in low-income neighborhoods of Oakland, where advocates for ecological restoration have worked with neighborhood groups to get funding for projects, but then have been at odds over project design. A naturalistic aesthetic is implicitly expected in such projects, and proposals for straight lines have been opposed as unnatural – despite the rectilinear urban grid that forms context for the projects. Formerly trash-filled Courtland Creek in a disadvantaged neighborhood in Oakland illustrates the challenges and opportunities. In lieu of focusing on ‘naturalization’ of the creek itself (the approach that had been assumed by the NGO that secured the funding), work in the creek itself was minimal, and the project primarily created an active linear park in an abandoned rail right-of-way adjacent to the creek (Hood 1995). By bringing people into this park and making the area ‘safe’, illegal dumping was reduced and the deeply incised creek became more visible and thus less suitable for nefarious activities (Hester 2010:281-283). Residents resisted the NGO’s efforts to increase plantings in the creek itself, but embraced the linear park adjacent.

The willow thicket is an especially revelatory landscape feature: it can survive in wealthy neighborhoods only because it is generally perceived as benign and ecologically beneficial, whereas if it were established in poor neighborhoods with high crime rates, it would soon be cut down by nearby residents or city maintenance workers responding to concerns of police.

To effectively balance human uses and ecological habitat in urban stream restoration, we propose that the potential ecological and social benefits of alternative approaches be realistically assessed and clearly articulated. Many urban streams in Seattle support viable runs of Pacific salmon (Oncorhynchus spp.), and in these cases habitat quality is logically a primary objective; investments in restoring ecological function logically follow. Despite often large restoration investments in small streams draining urbanized catchments, these streams can never have a high ecological potential. There is commonly a tension between allowing human access and providing undisturbed habitat. We argue that unless the habitat potential is very high, in many urban streams the social and educational value of allowing children to play in the stream can outweigh the limited potential habitat value of dense riparian woodland.
References Cited


Author Bios
Walter Hood is an Oakland, California-based environmental designer, artist and educator. He is a professor at the University of California, Berkeley Department of Landscape Architecture and Environmental Design, which he chaired from 1998 to 2002. His studio practice, Hood Design, has been engaged in environmental design, urban design, art installations, and research commissions since 1992. Hood works in the urban civic realm, from small community-based places to large-scale landscape commissions. His studio recently completed a 1.1-megawatt photovoltaic array within the campus landscape at the University at Buffalo, the new Powell Street Promenade in San Francisco (which recently won an ASLA Honor Award), and the new Sculpture Terrace for the Jackson Museum of Wildlife Art in Wyoming. Hood Design was also responsible for the gardens and landscape of the Herzog & de Meuron–designed De Young Museum, in San Francisco. Earlier projects located in Oakland, such as Lafayette Square and Splash Pad Park, are regarded as transformative designs for the field of landscape architecture. Hood has served as a Goldman Sachs Design Fellow for the Smithsonian Institute and a MIT fellow for Robert Taylor in 2011 and was the 2009 recipient of the Cooper-Hewitt National Design Award for Landscape Design. He has exhibited and lectured on his professional projects and speculative works internationally.

G. Mathias (Matt) Kondolf is a fluvial geomorphologist and environmental planner, specializing in environmental river management and restoration. As Professor of Environmental Planning at the UC Berkeley, he teaches courses in hydrology, river restoration, and environmental science, and serves as Chair of the Department of Landscape Architecture and Environmental Planning. His research concerns human-river interactions broadly, with emphasis on management of flood-prone lands, sediment management in reservoirs and regulated river channels, and river restoration, with research in the Mekong, Lower Colorado, Trinity and Klamath Rivers, and Mediterranean-climate rivers in California and Europe. He has provided expert testimony before the US Congress, the California legislature, California Water Resources Control Board, the International Court of Justice (the Hague), and in various legal proceedings in the US. He has published extensively in international peer-reviewed journals and his book Tools in Fluvial Geomorphology (Wiley 2003, second edition forthcoming) is the reference work for methods in the field. A Merit Award winner from the Council of Educators of Landscape Architecture, Kondolf has been appointed Clarke Scholar at the Institute for Water Resources in Washington, fellow of the Landscape Architecture Foundation, Fulbright scholar (twice), and served on two National Academy of Science panels, and the Environmental Advisory Board to the Chief of the US Army Corps of Engineers, and Russian River Independent Science Board.
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EDUCATION SESSION OUTLINE
This session involves presentation of overall concepts, case studies, and a conversation between a designer and a scientist about the role of ecology in urban stream restoration.

I. Introduction: River-City Relations and Urban Stream Restoration
   a. Relations between rivers-cities, effect of scale
   b. Opportunities in urban rivers with changes in navigation, industry
   c. Growth of urban stream restoration projects
   d. Conflicts: among professionals, stakeholder groups, and between professionals and local groups

II. Urban-Rural Continuum
   a. Wilderness/rural: potential to restore dynamic process and ecology
   b. Urban: Ecological potential limited, but social high
   c. Essential to understand where you are on the continuum, scale effects

III. The Willow ‘Template’
   a. Tool for bank stabilization, and ‘instant’ habitat
   b. Natural reference sites not dominated by willow, more diverse
   c. Willow thickets in first 10-15 years
   d. Even in wealthy neighborhoods, willow thickets not popular
   e. In poor neighborhoods, willow thickets feared as hiding crime

IV. Blackberry Creek, Berkeley, California
   a. Daylighted 200-ft reach on school grounds in 1995
   b. Landscape architect drawing promised park-like setting
   c. Dense willow thicket in early years generated strong public reaction
   d. With time, willow trees matured and thinned

V. Courtland Creek, Oakland, California
   a. Badly abused section of creek, more a dump than creek
   b. Rather than apply typical approaches to ‘naturalizing’ creek,
   c. Project focused on revitalizing adjacent linear open-space (rail ROW)
   d. Active linear park animated this area, reduced illegal dumping in creek
   e. Key to success: not imposing an ecological restoration ‘template’,
   f. Meshing daily-use patterns of the neighborhood with creek restoration

VI. The Nile in Cairo, Egypt
   a. Natural processes utterly altered by Aswan High Dam
   b. Dense city lacking parkland/open space for residents, river used for waste
   c. Strategic plan: pedestrian/bicycle path along bank, enhanced ferry service
   d. Reconnecting adjacent neighborhoods to riverbank, more public access
   e. Focus almost entirely on social benefits, not ecological

VII. Conclusions & Key Concepts
   a. Recognize context of restoration – willows don't work in dense urban
   b. Understand scale – of river/stream, of city, neighborhood
   c. Do the concepts of ‘trail’ apply in urban environments?
   d. Protecting the creek/river by revitalizing the nearby spaces
Strengthening a Neighborhood Through Stream Restoration

Walter Hood

Sustainable design advocates argue that the greening of inner-city landscapes (through projects like community gardening, reclaiming streams and planting and maintaining trees) can strengthen urban ecosystems and connect them better to human communities. But in many communities, ecological concerns take a back seat to issues of employment, crime, safety and respect for cultural diversity. In these places, designers and environmental advocates must develop strategies that address social, physical and economic conditions as part of the ethic of sustainability.

The Courtlandt Creek project in Oakland uses stream restoration as a tool for strengthening a neighborhood. The project involves rehabilitating a five-block-long stretch of the creek and an abandoned streetcar right-of-way and melding them into a park. The park will provide a better physical link between the community and the creek, help residents (who are participating in planning and implementing the project) value their environment and validate cultural and ethnic identity (by promoting places that have multiple uses and interpretations).

The landscape features both riparian and street spaces that can be used by residents of all ages. The design embraces the idiosyncratic patterns and practices of the diverse community while using state-of-the-art restoration techniques to repair the creek and revegetate its damaged slopes.

Each intervention is multi-layered, teaching an awareness of place and environment through contact and use. For example, at corner “chillin’” or hanging out spots, historical markers will document the old trolley stops while new corner structures will make places for informal group socializing and feature details for water collection and drainage.

The slope restoration uses plant materials to stabilize stream beds. Techniques include brush layering (staking and layering plant material to build up damaged slopes) and wattling (bundling locally cut willow branches and placing them along stream contours to correct erosion). These methods provide temporary stability until the creek stabilizes its course.

The slopes are also designed with users in mind, in familiar patterns and allowing opportunities for access and play. Neighborhood residents will constantly be reminded of the presence — and fragility — of the creek.

The success of the project rests on the community’s willingness to claim ownership of the new park. A neighborhood organization has evolved into an administrative entity, tracking the project’s progress, making sure the community stays involved in decision making and expanding the community’s role in civic affairs. It sponsors neighborhood clean ups, tree planting and restoration workshops and block parties.

The park project has also kindled linkages among residents that are giving the neighborhood new strength. Neighbors who worked with each other in the park development process are organizing a community watch program. Police and city officials are a more common sight in the community.

Scientific research can help identify restoration strategies that will enable waterways like Courtlandt Creek to sustain themselves. But for the neighborhood and city, long-term sustainability depends on people being able to resolve conflicts, see beyond stereotypes, acknowledge a range of values and accept one another. The process of designing, building and managing the Courtlandt Creek park has created a framework for this kind of dialogue.
Planning River Restoration Projects: Social and Cultural Dimensions

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4.1 INTRODUCTION

Nationwide, since 1990, at least US$17 billion has been spent on restoration projects, a figure that is an underestimate because most reported costs do not include staff time and many projects did not report their costs at all (Bernhardt et al., 2005). In many areas, river restoration has become an industry, with nonprofit groups, government agencies and consulting firms now depending upon river restoration funds to support large components of their budgets. For example, over four fiscal years from July 2000 to June 2004, over US$100 million was disbursed by the California Department of Fish and Game to recipient groups and agencies in the Fishery Restoration Grants Program for restoration projects in coastal river basins (F. Sime, personal communication, December 2003), mostly to construct habitat enhancement structures in salmon-bearing rivers and streams. Elsewhere in California, stream restoration projects employ many in rural communities, including former timber cutters (Hamilton, 1993). In the city of Bozeman, Montana, there is sufficient business to support six firms specializing in restoring trout streams.

River and stream restoration can be viewed as a contemporary phase of the environmental movement. Unlike early phases of the movement, which tended to document and draw attention to the nature and extent of environmental degradation (Carson, 1962; Ehrlich, 1968) and which therefore tended to be negative or pessimistic in tone, restoring rivers and streams has a positive, pro-active connotation. This is especially true of streams in urban neighborhoods, where restoration projects can provide positive reinforcement and a sense of empowerment to local groups. In many respects, the greatest benefits to restoring local urban creeks are probably the social benefits that accrue through the process of community building and the public environmental education achieved.

Technical specialists often assume implicitly that restoration is a technical problem, and a glance at articles published in restoration-related journals shows a preponderance of papers addressing the scientific aspects of project design and planning. However, restoration can be viewed as fundamentally a social phenomenon, as it results from a societal decision to restore some functions to a river (Eden et al., 2000). Its goals and implementation approaches can be informed by science, but they are essentially social in nature. The very fact that restoration has become such a widespread activity reflects a change in public attitudes towards watercourses. The current attitudes are possible only thanks to past social investments in waste water treatment following passage of the Clean Water Act in the United States (Wolman, 1971) and comparable legislation in other developed countries. The resulting improvements in water quality now make human contact with urban waters desirable and ecological restoration feasible, which was not the case in the past when these channels were open sewers. As society and culture evolve, goals change and the realm of what is ‘feasible’ in river restoration can change dramatically, introducing uncertainties for restoration planning and design – uncertainties that do not lend themselves to technical engineering analysis.
This chapter considers social and cultural dimensions of river restoration, and related uncertainties for restoration planning and design. While recognized as important, they are probably less well understood by the agencies involved in designing and implementing restoration projects (FISCRWG, 1998). Systematic studies of public attitudes and expectations regarding river restoration (Tunstall et al., 2000) have been rare in light of the enormous societal investment in restoration projects. There is no way this short chapter can do justice to this broad topic, but herein we attempt to raise some issues relevant to the enterprise of river restoration, which we hope will be useful to scientists and practitioners in the field. We first briefly review some important social aspects of river restoration: the land-use context of restoration projects, underlying cultural preferences in river restoration design and the increasing importance of public participation in river management and restoration programs. We draw upon recent research to consider various human activities in urban streams and the conflicts among restoration goals of various professionals and stakeholder groups. Finally, we present two brief case studies from northern California, which illustrate social issues and attendant uncertainties in river restoration.

4.2 OVERVIEW OF SOCIAL ASPECTS OF RIVER RESTORATION

4.2.1 An Urban–Rural–Wilderness Continuum

Appropriate goals and the solutions possible vary widely with context, from near wilderness to dense urban settings (Figure 4.1). Where catchment processes are relatively unaltered and runoff and sediment load are virtually unchanged, a restoration project can logically seek to restore pre-disturbance channel conditions, either by giving floods and sediment transport the opportunity to recreate natural channel conditions (an approach often termed ‘passive restoration’) or by proactively re-construction of pre-disturbance channel form (the ‘carbon-copy’ approach of Brookes and Shields, 1996). A example would be a channel whose catchment land use has remained constant, but whose form was altered by channel straightening or by removal of bank vegetation and consequent instability. At this wilderness end of the continuum, it makes sense to either let natural processes accomplish the restoration or to use the pre-disturbance channel as a template, because the processes that supported the pre-disturbance channel will tend to support the same channel form again. In either case, to maintain ecological values, the channel should be permitted to migrate freely and to flood overbank areas (Ward and Stanford, 1995).

Moving towards the urbanized end of the continuum, land use change in the catchment has altered runoff and sediment load, so there is no reason to expect pre-disturbance channel dimensions to be maintained by current processes. At the extreme, urban development in the catchment increases peak flows such that the channel tends to incise, which, if uncontrolled, may lead to bank collapse and channel widening. However, encroachment of urban development to the channel margins means that incision and channel widening are socially unacceptable. At this urban extreme, restoration projects must be built to convey urban runoff without flooding adjacent lands and to withstand increased shear stresses of urban runoff without erosion. Here, restoration can be viewed as a form of gardening, in which the elements are deliberately chosen and maintained by human input, albeit one that

Figure 4.1 An urban–wilderness continuum in river restoration
requires hard structures to resist erosive forces of urban-runoff-augmented floods. In such cases, ‘naturalness’ in restoration may be viewed as more an aesthetic choice than a real design approach. Such channels can be highly successful in providing recreational and aesthetic amenities, linking communities through walking and biking trails, even providing for kayaking and canoeing. However, they may be viewed as ‘water features’ (to borrow a term from the field of landscape architecture) capable of conveying floodwaters within the channel and without eroding banks, rather than large scale, dynamic ecosystems. They can still provide ecological benefits at a local scale, but without rebuilding of the urban infrastructure these waterways are unlikely to support sensitive target species at a large scale. In these highly urban settings, the ecological potential from a restoration project can rarely be comparable to that achieved in a less urban setting, and thus urban restoration projects may be best justified by their potential social benefits as they respond to human needs and uses.

Many restoration projects can be seen to fall on a continuum between these two extremes, with constraints, but with the potential to restore some natural processes and functions. It is in these intermediate cases that the greatest uncertainties arise, as one person’s ‘constraint’ may be another’s opportunity to restore process. For example, if an upstream reservoir has eliminated the natural magnitude and frequency of floods, should we accept this as a constraint that effectively limits the degree to which natural ecosystem processes can be restored, or do we seek to alter the reservoir operation rules to more closely mimic natural flow patterns? Reservoir release patterns have been altered and aquatic ecological conditions improved on rivers such as the Green River, Kentucky (Postel and Ritcher, 2004), the St Mary River, Alberta (Rood and Mahoney, 2000) and Putah Creek, California (Marchetti and Molyne, 2001). Similarly, does the existence of human infrastructure or housing on a floodplain mean we cannot inundate this floodplain? Or should the restoration project include compensation for moving the urban infrastructure or housing on a floodplain? These are social/political decisions, which can be informed by science, but which cannot be predicted technically – adding substantial uncertainty to restoration planning.

4.2.2 Cultural Preferences in River Restoration Design

Unstated and often unacknowledged cultural preferences probably underlie many restoration design decisions. For example, grassy banks are preferred over shrubby or wooded banks along many restored streams in northern Europe, reflecting the long history of pastoral land use. Similarly, open park-like landscape seems to be broadly preferred in western culture (Appleton, 1975), and residents near urban stream restoration projects in northern California have complained when restored streams become too ‘bushy’ and woody riparian vegetation blocks visual access to the stream bed (Purcell et al., 2002). Similarly, large woody debris in channels imparts a messy look, to which most people have a negative reaction (Piégay et al., 2005).

In North America, restoration projects seeking to create stable, symmetrical-meandering channels have proliferated. In some cases, previously single-thread channels have been reconstructed in attempts to create a more ideal, symmetrical meandering form in the belief that these would be more stable (Smith and Prestegaard, 2005). In other cases, the channels have been reconstructed with the goal of converting braided rivers to single-thread, meandering rivers. In many cases, the streams so ‘restored’ were never single-thread meandering channels under natural conditions, and the projects can be viewed as essentially attempts to impose an idealized meandering form onto the river, as illustrated on Uvas Creek, California (Kondolf et al., 2001). Many of these channel reconstructions have washed out within months or years (Figure 4.2). Despite its mixed record of performance, the design approach underling most of these projects – application of the classification scheme of Rosgen (1994) (NRC, 1992) – continues to be popular among government agencies responsible for funding restoration projects. This is probably due to the ease with which the classification scheme can be used and applied by those without academic training in fluvial geomorphology, the availability of commercial short courses teaching users how to apply the scheme and – though largely unrealized and unacknowledged – the likelihood that the channel designs that result from applying the scheme satisfy a deep-seated cultural preference for stable, single-thread meandering channels.

Research on human responses to landscape form suggest that subjects (at least in western culture) tend to prefer the ‘deflected vistas’ in curved paths, rivers and valleys over straight lines (Appleton, 1975), in part because they elicited curiosity in subjects (Ulrich, 1983). Kaplan and Kaplan (1984) designated this landscape property as ‘mystery’, conveying the opportunity to explore and a promise to learn more with a changing vantage point as one moves more deeply into the scene. What is probably a (near-) universal attraction to the form of meandering channels was recognized in the 18th century by Hogarth (1753), who proposed that the ‘serpentine’ line provided
River Restoration: Managing the Uncertainty in Restoring Physical Habitat

the greatest aesthetic pleasure, and more so when actively moving. A river moving through a meandering channel thus has the elements needed for the experience of beauty under Hogarth’s theory. This preference also found expression in the work of late 18th century English landscape designers such as Capability Brown, who built serpentine channels on the estates of their wealthy clients.

Despite the evidence for a landscape preference for the meandering channel form, the justifications for meandering channels specified in river restoration projects in North America are almost always stated in terms of bankfull discharge, width-depth ratios, meander wavelengths etc. The fundamental question as to whether a meandering channel is appropriate at all is rarely addressed. Similarly, the notion that channels should be stable can be viewed as largely anthropocentric. Dynamic channels with variable flow regimes tend to support the greatest variety of habitats and best ecosystem function (Ward and Stanford, 1995; Poff et al., 1997). Yet the meandering channels constructed using the Rosgen approach have the outside of meander bends armored by root wads and boulders, with rock weirs at the crossovers to keep the main current away from the banks (e.g. Uvas Creek in Figure 4.2(a)). Indeed, the Rosgen scheme is used to select the ‘proper’ geometry for a site, ‘proper’ meaning it will be stable. We do not argue with the need to armor channels in dense urban areas or elsewhere when infrastructure is threatened by channel migration, but these restoration projects typically include armored banks even at sites where channel migration would not threaten human works. The armoring seems to be accepted in part because it consists of ‘natural’ materials (i.e. it is not concrete) and because those involved in funding and designing these projects hold a belief that a stable channel is preferable to an eroding channel, even if in a rural or park setting.

Finally, stable, meandering channels, flanked by grassy banks, probably appeal to our aesthetic senses in large part because they are ‘tidy’ landscapes. Natural riparian corridors are frequently inaccessible thickets, which, while great habitat for wildlife, are unappealing to our western aesthetic sensibility. Nassauer (1995) demonstrated that for such ‘messy’ ecosystems to be widely accepted, we must set them off within a frame that conveys to the viewer that the messiness is deliberate and not a sign of neglect. She demonstrated how ‘cues to care’ such as a neatly maintained fence around a yard of native prairie could make the otherwise messy bit of landscape acceptable within the context of a suburban street.

To the extent that public support for restoration is based on culturally-driven landscape preferences that are not recognized or articulated, this creates enormous uncertainty in river restoration projects, as public support cannot be predicted based on ‘logical’ analysis of how best to improve aquatic ecology or to manage floods. There is another factor, which cannot be predicted by technical experts. The topic of human preference in landscape is an area of active research. Many of the findings probably have relevance for river restoration, besides the few touched upon here.

4.2.3 Public Participation and Active Stakeholders

Today, public participation has become an institutionalized element in stream restoration. Public acceptance and support in many cases determines the ultimate success and sustainability of a project. For example, providing public access to a restoration plan can substantially increase public support for the plan (Bauer et al., 2002). Support for restoration is important not only in advocating for the proposed project, but also in its stewardship after construction. Stewardship can be developed by encouraging people to experience the restored natural areas (Ryan et al., 2002).

Figure 4.2 (See also colour plate section) Uvas Creek viewed downstream from Santa Teresa Road bridge: (a) January 1996, two months after completion of the channel reconstruction project; (b) July 1997, after the constructed channel washed out in February 1996 during an approximately six-year flow (Photo (a) courtesy of the City of Gilroy, (b) by Kondolf.)
Increasingly the role of stakeholders is not limited to providing review comments on draft documents, but to active participation in setting objectives and selecting implementation strategies. The success of such a collaborative planning process is often evaluated by whether or not agreement is reached among interest groups. This approach implicitly assumes that there is an optimal solution that satisfies all interests and is technically feasible. However, there is no a priori reason to assume that this is the case, and in fact there are good reasons to expect it frequently will not be. Accordingly, conflicts can arise among different actors, such as between stakeholder groups, between professionals in different fields and between design professionals and residents, all creating uncertainties for restoration planning. These are discussed in more detail in the following pages. Although water policy making and planning remains a much contended arena in California, collaborative planning or policy making has been documented as beneficial not simply based on whether or not consent is reached among various stakeholder groups, but through the long term, invisible outcomes in terms of collective learning and accumulation of social, political and economic capitals (Connick and Innes, 2003).

An important feature of river restoration today is the proliferation of local creek groups, known in the United States as ‘Friends of the local creek, in the United Kingdom as river ‘Trusts’ (e.g. the Eden Rivers Trust). In the San Francisco Bay Area, these groups have formed a significant force in shaping the fate of restoration projects. Friends groups not only voice their desires during restoration planning, but in many cases they have become the task force of implementing plans and management regimes. To the restoration project designer, the potential role of local creek groups is a source of uncertainty. If a local group is active, it is important to work closely with it, both to improve the project design with respect to its social functioning and to improve the chances of successful implementation and sustainability by virtue of the public support a local group can often provide.

There are also fundamental issues with representativeness in the stakeholder and public participation process. These processes can be drawn-out, and the long term active participants tend to be agency staff or industry representatives for whom participation is part of their job, or staff of NGOs who are often stretched thinly amongst many such processes. To actively participate, members of the public at large must have the time and energy to devote to meetings over a long period (often exceeding a year) at their own expense. Unless they are strongly motivated – often by an imminent threat such as stopping a development in their neighborhood – few can find the time to be active in the public participation process. This is reflected by the survey results of the ‘befriended’ watersheds in the San Francisco Bay Area. Neighborhoods with active ‘Friends’ groups have a much higher average income than areas that do not form creek groups (Mozingo, 2005), showing urban stream stewardship in the United States still serves a clientele biased toward the upper and middle classes.

### 4.3 HUMAN USES OF URBAN WATERWAYS

While the habitat requirements of fish have been extensively studied (Reiser and Bjornn, 1979) and are used as a basis for design of restoration projects oriented towards salmon and trout (Flosi et al., 1998), the habitat requirements of humans in the stream environment, broadly construed, are less well understood. Recent research into why certain activities occur spontaneously at certain parts of the stream suggests that there are fundamental characteristics of streams that encourage, and can be designed for, recreational use. Here we review a range of human uses of stream corridors, emphasizing urban and suburban settings.

#### 4.3.1 Camping by Homeless

Riparian corridors have long been preferred sites for camping by homeless people. River corridors were sites of large camps of migratory workers and tramps in North America during the depression of the 1930s, and homeless encampments are a common element along urban streams in California today, offering a relatively secluded refuge for the ‘down and out’. Homeless camps are often found under bridges, exploiting the shelter from rain, although these sites are more accessible and thus more likely to be visited by others and less private (Figure 4.3). A long Ledgewood Creek near Fairfield, California, a camp of fifty residents had tents with carpeted floors, furniture, and battery-powered television; the residents reportedly left during periodic police sweeps, only to return (Fagan, 2005).

Migrants from the provinces of Cuba have settled along the banks of the Almendares River in Havana, forming a squatter community known as ‘El Fangito’ (Figure 4.4). While the streets are mud, many of these dwellings feature cement or tiled floors, furniture and television sets. Although the settlement was illegal, utilities have hooked up electrical power and water; sewage flows mostly through buried pipes directly to the river. The floodplain occupied by El Fangito is flooded every few years. Residents take their television sets and leave for higher ground when the river begins to rise. The management plan of the Metropolitan Park of Havana (Fornes, 1994) calls for
The authors are aware of no studies focusing on homeless use of riverine spaces, but our field studies in California suggest that this user group has little tolerance for other user groups and vice versa. We have observed that no other users were present near homeless camps (usually under bridges and behind thickets on floodplains). In Sonoma, California, children were often warned off by parents or scared away when they accidentally invaded homeless territory (Yang, 2004). In Japan, while homeless people also frequently reside under bridges of urban streams, the tension was not as high, as homelessness in Japan is regarded mainly as a product of unjust industrial structure (Dohi, 1999), with little association with drug abuse and crime. In America, the flood of homelessness during the past four decades is largely attributed to the failure of 'deinstitutionalization,' a major initiative under the Community Mental Health program that started in 1963 (CCHR, 2004).

Occupation of river corridors by homeless can be an important source of uncertainty to the outcome of river restoration efforts. Use of stream corridors by homeless people has not (to the authors’ knowledge) been encouraged by designers. However, it is clearly one of the biggest uses along many urban rivers and streams. Because the presence of homeless people could discourage use by other groups, the actual use of a restored stream corridor may be very different from that anticipated by project designers, introducing uncertainties.

4.3.2 Fishing

Fishing is a traditional use of rivers and streams, ranging from subsistence fishing with traps and nets to purely sport fishing in which the fish is released back to the stream. Fisheries in urban channels range widely from wild, anadromous salmonids in urban channels in the Pacific Northwest of North America to warm water species pulled from the polluted waters of Asian cities. Fishing is usually well regulated by licensing and many streams are artificially stocked. Fishing is a well documented and well studied activity in rivers, a large subject well treated elsewhere and beyond the scope of this chapter. However, we point out that fishing has long been an important activity drawing people to rivers, similar to other activities we discuss below. Improving fish habitat is cited as a goal for many restoration projects and many funding sources are available to improve fisheries.

4.3.3 Water Sports

Urban rivers (if not so polluted as to be unpleasant) have long been used for canoeing and floating. On summer
weekends, the Chattahoochee River near Atlanta, Georgia, is packed with young people floating downstream on tire inner tubes or rafts. Increasingly, more active forms of kayaking and canoeing are being designed for in urban river restoration projects. For example, the steeper, upper reaches of the restored Boulder Creek in Boulder, Colorado, have been designed as a kayak course, and kayakers and canoeers commonly continue downstream through the town.

### 4.4 Spontaneous Uses of Urban Waterways

Although recreation is commonly cited as a goal of stream restoration projects, it is often treated perfunctorily compared to other goals such as flood control and habitat, except where its value can be expressed in monetary terms. In the context of cost and benefit analysis, emphasis on recreation necessarily narrows down to the licensed, quantifiable activities such as fishing and boating (NRC, 1992). In contrast to such vacation-orientated uses, there is a suite of more intuitive and unplanned activities, hereby named ‘spontaneous uses,’ that involve direct and active interaction with the landscape, such as skipping rocks, catching frogs, collecting nuts and swimming. When human uses are considered at all in urban stream restoration projects, the focus is typically on passive uses, such as trail walking and social gathering. The orientation is also often towards adults uses only, whereas children may have very different (and strongly felt) attitudes towards stream environments (Tunstall et al., 2004; Yang, 2004). However, a growing literature suggests that the more interactive activities are crucial to the forming of environmental awareness (Chawla, 1988; Harvey, 1989; Orr, 1992) and place attachment (Owens, 1988; Hester et al., 1988; Cooper-Marcus, 1992), and are beneficial for healthy human development (Nicholson, 1971; Kaplan, 1977; Cobb, 1977; Hart, 1979; Moore, 1986). Whether a restored channel encourages spontaneous use or not is a source of uncertainty to the ‘social’ success of a restoration project.

To understand the specific habitat characteristics that permit and encourage spontaneous uses, Yang (2004) reviewed the literature to identify probable habitat characteristics encouraging such uses and then undertook systematic field observations, especially of children, and interviews of children and adults in field areas in California and Japan. Although many of these interactions were engaged mainly by children, they were not enjoyed by children exclusively. Adults accompanying children, or even among a group of adults, appeared to fully enjoy such uses. From this research, we summarized the most common types of spontaneous interaction and their habitat requirements.

#### 4.4.1 Quiet and Secluded Use

Users who appreciate the stream environment in a transcendent way, go to the stream for a temporary escape, enjoy intimate relationships with significant others and those who pursue quiet reading, thinking etc., are commonly attached to a specific base-point. Their territory may seem small, but the quality demands are high and specific. Since such users can stay for hours, a certain comfort level (dry seating, foothold and shade) is normally required. A rock, tree root, log, or a soft grassy spot by water are particularly appealing. Yet more than anything else they need privacy, or visual/auditory seclusion from supervision or other users. Lewis (1995) highlighted the value of San Leandro Creek, California, as a secret hiding place and unsupervised play area, with many ‘first-time’ events of local youth. All his interviewees who played there appreciated this quality of nonsupervision. For this reason, they preferred detoured or inconspicuous access and a back screen.

The view toward dense foliage, open field or expression of water surface, the sound of trickling water, the appearance of wildlife and easy access to water all tremendously enhance the value of quiet and secluded base-points, as users cite these elements as bestowing the healing power of nature. Both adults and children have been found to seek out space for quiet and secluded use (Yang, 2004). Quiet and secluded base-points are easily lost, not only because privacy is often lost with increased urbanization, but also because planners and designers usually don’t design for such spots, operating instead on a design model of a cheerful park for adult socializing and playgrounds where all children play together.

#### 4.4.2 Adventures

Adventures connect known to unknown parts in the landscape, expanding cognitive and physical territory. Adventurers walk, bike, swim, leap, climb, creep and cross to ‘conquer’ a new piece of landscape. A system of base-points connected by diverse, usually three-dimensional paths, plays an important role in the process of expanding territory. Dirt paths apparently possess special values to adventurers. On Marsh Creek, California, some adults favor dirt paths for aesthetic reasons, but children preferred dirt paths for the practical reasons that they are usually avoided by adult bikers and runners, who are often impatient with children in their way, and the dirt path provides more interactive features (Yang, 2004). On dirt
paths children can jump on mounds, leap into muddy puddles, bend under low branches, or crouch to stare into a gopher hole. The mounds, puddles, low branches or gopher holes would all be considered undesirable and eliminated on a paved trail, but on a dirt path they provide tempting invitations for sensorial experiences.

Adventurers are particularly keen to find good stream crossing points. In smaller streams users search shallow and narrow spots with stepping rocks to set foot on or from which to build a bridge. In large rivers swimming across is a common game. If a rope and tree are available and the stream is narrow enough, they swing across the channel. Similarly, children in Turkey Brook, London, asked for ropes to swing on and logs to slide down (Tunstall et al., 2004). When the slope is right and the channel not too wide, bikers or skateboarders fly across on wheels.

Metal culverts are especially attractive to adventurers: it’s easy to make loud, eerie echoes in them, they are secret hide-outs, they offer the allure of a connection to somewhere else and they are perceived somehow off-limits.

4.4.3 Wildlife Contact

Wildlife contact can be by simple observation or active catching, two distinct modes of interaction. Observers are usually interested in all life forms they see, from little bugs to big animals such as otters and raccoons. They interact with the stream with a highly intensive but unintrusive way. Wildlife sightings often occur in unexpected, uncalculated moments, producing a ‘wow’ experience.

Catchers are more physically active and focus on certain target species, which are small enough to catch. Catching wildlife along creeks has traditionally provided subsistence, but in urban areas in developed nations today, catching is usually based upon affinity toward the target and a sense of achievement. Fish, frogs, tadpoles, shrimps, craw-dads, crabs and insects are fascinating creatures for users to match wits with. The habitats of catchers are as diverse as those of their target species and their spots correspond directly to those of their quarry. Children who actively catch wildlife tend to be agile and willing to access difficult sites, get wet or scratched and in general are highly adaptive to their environments (Figure 4.5). In Marsh Creek, crawdad hunters were often observed thriving at the least ‘user-friendly’ spots, such as among rugged riprap under road bridges or by grassy, muddy shores. Methods of catching are numerous, even for the same species. They range from the bare hand to highly elaborated means and tools. Catchers in various regions in Japan and California often stored captured fish or crawdads temporarily in a container or a little pond enclosed with sand or rocks. Most of the trapped creatures were set free after a short time, but some captures would become pets to be enjoyed at home until they expired. Many catchers have learned from experiences which animals ‘work better’ as pets (Yang, 2004).

Proficient catchers and observers are often knowledgeable; they can usually identify many species and know when and where to find them. Observers and catchers have similar habitat requirements: the environment needs to support a sufficiently high density of wildlife and a meaningful human/wildlife interface. Though the former is a widely claimed goal in restoration and greenway projects, the latter is usually discouraged. For spontaneous users, a meaningful wildlife/human interface provides plenty of chances for close-up observation and hands-on catching, without the need of specialized equipment beyond that which can be made at home or obtained from a grocery store. Examples of such interfaces are water edges framed by vegetation or porous structures where different species hide, or shallow water reaches adjacent to gravel bars where fry of amphibians and fish hatch. It is important that water edges designed to sustain a dense wildlife popula-
tion also remain accessible to users, except in cases (rare in urban areas) where protected species need to be isolated from human harassment. When physical access is not feasible, visual access can be provided from the bank, bridges etc.

4.4.4 Manipulating the Environment

The value of creeks and rivers for spontaneous use depends largely on their provision of loose parts – elements that can be easily manipulated in the environment (Nicholson, 1971). At least three categories of common uses rely on contact with rocks, plants, junk and other kinds of loose parts in stream environments: collecting, building and clever craft:

- **Collecting** allows one to discern treasures from the basically chaotic stream environment. Once purposely rummaged or fortuitously encountered, stones and other elements from the bed, plant parts and junk recovered from banks may be used in drama play, building, or in displays in the collector’s yard or room. Gravel bars are prized sources of stones for collecting and clay banks provide material for handcraft, mud ball fights and gray make-up.

- **Building** projects, whether big (e.g. tree houses, huts, bases, dams, bridges, ponds) or small (arranging rocks and sticks) are rooted in an innate attempt to create an impact on the landscape (Figure 4.6). Through building, users claim their ownership and adapt the stream to themselves. The result of spontaneous building usually is not durable enough to survive floods and other natural processes. Building may have practical purposes, but the process is all-important: many children build, destroy and rebuild.

- **Clever crafts**, the skillful manipulation of materials found in stream environments (Yang, 2004), is usually quite precise in terms of materials and surroundings. For example, to skip a rock (a trans-culturally popular trick), one needs a gravel bar containing platy stones with intermediate axes usually between about 30 and 70 mm, and a flat pool allowing satisfactory skips. Along Sonoma Creek in California, adults applied red algae to skin rash and children made flutes with deer grass. Along Kure River in Japan, smashed mugwort was used to heal scratches and defog goggles, while foxtail stalks were made into knots to trap frogs and shrimp.

4.4.5 Wading and Paddling

Small children and other users who don’t want to get very wet will wade in waters shallower than 0.5 m, with currents 20 cm/s or less, such as shallow margins or backwaters. The range of paddling by children is usually only a few meters from the water edge and the dry spot. In large streams, some hints of boundary around a smaller space (e.g. a cover or re-entrant in the bank or offshore bar) are needed to overcome the uneasiness induced by an unlimited expanse of water. Paddlers prefer gently sloping access to water (rather than grassy or upright banks) and sandy or clay bottoms (which provide comfortable footholds) (Yang, 2004).

4.4.6 Swimming, Flushing and Diving

Swimming occurs mostly in pool reaches more than 0.5 m deep, with velocities under 0.5 m/s and with gentle and gradual water edges at bars or ‘ledge’ banks protected by tree roots as entry points. In large or swift rivers, swimmers also require ‘stopover bases’ (island bars, bridge piers etc.) at which to rest. Warm surfaces such as big rocks, pebble beach, concrete blocks, asphalt roads etc. are valuable dry spots. Flushing makes clever use of locally concentrated flow (>0.5 m/s) and variations in bed form. Most commonly, flushing is done in riffles: the flusher would start at the end of the pool where the speed starts to pick up, allowing his body to be carried by the accelerating current downstream to be caught at the crest of riffle (if shallow) or carried through the riffle (if deeper) to the next pool. Hard structures in the streams such as bridge piers can also form concentrated currents for flushing.

Diving in larger streams and rivers with deep pools is popular on hot days, offering the thrill of a free fall and the sudden impingement of cool water on the body. The
dive height is limited by pool depth and the diver’s skill and nerve. We observed children diving from a 15-m high treetop in the Kagami River, Japan (Figure 4.7). In stream environments, a pool deeper than two meters is rare and considered enough for moderate-height diving. A good diving spot also has a landing spot with a gentler water edge, a path to connect landing and launch spots into a loop and, ideally, choices for different skill levels. Rock outcrops (adjacent to deep pools because they induce scour at high flow) provide steady footholds for the launch point and outcrops with complex form and multiple take-off points for different dive heights allow divers to practice and build their courage and skills gradually. Diving from the trees, one experiences the thrill of shaking footholds; diving from a rope swing, one challenges the arm strength, body balance and the timing to let go; diving at concrete levees, one needs to leap forward to avoid the concrete foundation jetting out beneath the mean water level (Yang, 2004). For ‘thrilling’ water contacts such as flushing and diving, routes that connect back to the set-in points are indispensable to support their repetitive characteristics.

4.5 CONFLICTS AMONG MULTIPLE GOALS AND OBJECTIVES

Everybody wants more nature but there has been persistent confusion about the meaning of ‘restoration’. The controversy over the term reflects disagreements over goals, even when considered only within the physical science realm. As causative agents, humans constantly change and control nature to ‘help’ it, leading to fundamental questions about goals. Given that nature is in constant flux and there is no single correct condition (Hull and Robertson, 2000), the choice of desired end state for restoration will perforce involve societal priorities. Because river restoration projects are now commonly undertaken with the involvement of multiple professionals and stakeholders, and because all the goals and objectives are essentially value-driven, three types of conflicts often arise in project implementation, creating uncertainties for the course of river restoration planning and implementation.

4.5.1 Conflicts among Professionals

Engineers, fluvial geomorphologists, ecologists and landscape architects are trained to see the stream differently (Figure 4.8). In the past, they have all shaped or reshaped streams with their particular value systems and disciplinary tools. Engineering has been the single most powerful profession in past stream transformation, altering rivers for flood control, water supply and navigation. Hydraulic engineers model flows under conditions where the variables are controlled, usually approximating channel shapes as simpler geometric entities. Deviations from clear water and Euclidean channel shapes are treated with adjustments in formulas. Fluvial geomorphologists tend to approach problems at larger scales and over longer periods. The engineer or manager may pose a question such as, ‘What kind of bank protection should we use along this reach of stream?’ The fluvial geomorphologist will tend to ask why the bank is eroding in the first place, whether it is simply part of the natural channel migration process or a result of changes in the catchment upstream. Especially in the latter case, it is likely that placing bank protection will not ‘solve’ the problem but will induce problems elsewhere.

Ecologists tend to view streams as organic compounds of habitats. They perceive fine details of leaf litter and its decomposition, moss on boulders, food chains, and cycles of nitrogen, carbon etc. Traditional biologists may see unspoiled natural process as the reference condition against which to measure degradation and a return to that condition as a restoration goal. Human activities are viewed as ‘impact.’ Adding a spatial structural perspective,

Figure 4.7 Children diving into the Kagami River, Japan (from Yang, 2004.)
they view streams as ‘corridors,’ a crucial element in landscape to allow movement of species and therefore to maintain biodiversity and long term genetic diversity. These professionals have long realized that to maintain a healthy ecosystem, a river needs floods (Poff et al., 1997; Junk et al., 1989). Developers and flood control agencies often resist losing developable lands to flood inundation and, through their influence on the political process, typically succeed in implementing flood control measures such as dams or levees that permit them to build on floodplains. Similarly, natural channel migration is an important process to create diverse habitats, but riverside developments are threatened by bank erosion, resulting in pressure to stabilize the river bank with hard structures. As a result, although ecologists and environmental scientists have been institutionalized into the planning process since the 1960s, they often remain ‘second-class citizens’ in affecting the design of urban stream channels (Riley, 1998).

A traditional tenet of landscape architects is to view landscape in abstract, formal, aesthetic terms: forms, lines, colors, textures and their inter-relationships (Daniel and Vining, 1983). Although visual aesthetics are usually the paramount ‘public’ goal, designers also emphasize the cultural and historical significance of urban streams, as well as the user’s experiences. Some landscape architects are well trained ecologically and effectively integrate ecological considerations in their designs; some are involved in successful efforts to redevelop urban waterfronts to revitalize downtown economies, attract tourists and provide recreation opportunities for urban residents (Otto...
et al., 2004). These projects provide chances to enhance physical and visual connection with streams by placing walkways along them, or by promoting vistas and facing commercial fronts to the streams (Jones and Battaglia, 1989). Landscape architects also transform floodplains to open spaces to accommodate civic activities such as exhibits, concerts, fairs or sports. The design of these open spaces, however, often takes its model from pastoral parks or architectural plazas and while they may provide effective urban spaces, the purported uses and the design schemes are often in conflict with the chaotic character of floods and organic quality of riparian habitats.

4.5.2 Conflicts Among Stakeholder Groups

Humans use rivers for many different purposes, so it should come as no surprise that human expectations and the demands of rivers often conflict. The same conflicts that manifest themselves in management of existing river channels tend to emerge when river restoration projects are conceived and scoped.

Some of the best documented such conflicts are in the Colorado River below Glen Canyon Dam, where cold water releases have allowed a rainbow trout (Oncorhyncus mykiss) fishery, highly valued by anglers, to become established. The rainbow trout are exotic to the river and would not have survived the high temperatures and high suspended sediment loads characteristic of the pre-dam river. The post-dam river is now unfavorable to native fish, such as humpback chub (Cila cypha) and razorback sucker (Xyrauchen texanus). The native fish are ugly and undesirable as sport fish, but they are native to the river and their numbers have dwindled such that several species are now listed as threatened or endangered (Schmidt et al., 1998). Where the exotic trout and native fish coexist, the trout may prey on the natives. Proposed actions to improve conditions for the native species have encountered resistance from trout fishing groups. It is well established that the reduction in high flows effected by Glen Canyon Dam has had numerous ecological effects on the reach downstream and thus deliberate high flow releases are planned in efforts to restore the reach. The first such release, a much-publicized flow of 1300 m$^3$ s$^{-1}$ in 1996, was only about one-third of the average annual pre-dam high flow. The flow was limited to avoid inundating a rare snail that had extended its range down the canyon walls during the post-dam period (Marzolf et al., 1998). Thus, restoration of a dynamic flow regime (with attendant benefits for the river ecosystem) was perceived to conflict with protection of the rare snail. A similar conflict among user groups is on the North Fork Feather River, California, where high flows released periodically to provide flows for rafters have scoured benthic macroinvertebrates, washing these and other organisms downstream (Garcia and Associates, 2005).

4.5.3 Conflicts Between Professionals and Local Groups

Perhaps the best documented example of a professional-local group conflict involves terrestrial habitat restoration, the Chicago prairie restoration controversy. Efforts to restore 7000 acres of the DuPage County forest reserves in the Chicago metropolitan area back to the historical oak savanna and tallgrass prairie condition were attacked by local groups and residents who opposed removing trees and brush. Ryan (2000) concluded that the discrepancy between restoration planners and neighborhood users stemmed from differences in attachment. While both groups were attached to nature, their attachment can be diverse and contradictory. Scientists and volunteers are attached to a particular type of original landscape, which is established through environmental criteria such as biodiversity and system integrity. Such attachment is not bound to a place – the same habitat image can be reproduced elsewhere and still be satisfactory. On the other hand, the attachment of local residents is intertwined in locale and context. Individual trees, albeit non-native, bear an identity in terms of furnishing the spot for children to play tag or a seat for quietness or framing a magnificent view toward sundown. In other words, the attachment of local residents is composed of life memories. A different conflict between professionals and a local group occurred in the northern Sierra Nevada of California in the early 1990s. In planning a restoration project on Jamison Creek in Plumas-Eureka State Park (the Park), a local nonprofit group active in implementing stream restoration projects (but without expertise in fluvial geomorphology) challenged the effective discharge analysis conducted by a university team, contending that the bank-full discharge was only about one-third that computed by the university team. Despite a thorough and well documented scientific report supporting the university team’s analysis, the Park rejected the analysis and sided with the local nonprofit group, stating that it preferred the smaller design discharge because ‘a smaller channel is better for fish habitat’. The Park also cited that fact that the local Coordinated Resource Management Program group (composed of local agency staff, landowners and staff of the nonprofit group (none of whom possessed expertise in fluvial geomorphology) had voted in favor of the lower design discharge.

The notion that one can arbitrarily choose a design discharge and build a stream channel to smaller dimensions
is a fascinating one, but not one supported by geomorphic science. Likewise, the notion that scientific questions should be put to a vote by a group without expertise in the field raises questions about the role of science in such a restoration design process. Ultimately, the Park had the authority and responsibility to design and construct the channel as it saw fit. The university team withdrew from the project and the local nonprofit group proceeded to design and build a channel reconstruction in 1995. The project was damaged by the high flows of 1996, repaired, and then completely washed out by high flows in 1997. In 2000, the Park sent out a call for proposals to reconstruct the channel once again.

4.6 CASE STUDIES

4.6.1 Baxter Creek, El Cerrito

Baxter Creek drains an 11-km² urban area of El Cerrito, California, debouching into San Francisco Bay at Richmond (Figure 4.9). In 1997, the City of El Cerrito replaced a 70-m reach of failing culvert (in a small neighborhood park) with an open channel (Figure 4.10). The open channel was stabilized with a series of boulder weirs (which dissipated energy from the 10% gradient) and the banks were planted with willow (Salix spp). Post-project appraisals in 1999 and 2004 (Purcell et al., 2002; Purcell, 2004) showed that the biotic condition of the restored reach was measurably better than an unrestored control section upstream and that the biotic condition did not improve further between 1999 (two years post-project) and 2004 (seven years post-project), indicating the stream may have reached its biotic potential within two years.

Purcell et al. (2002) conducted an attitudinal survey of the residents within one block of the daylighted section of Baxter Creek. Of the 45 responses received, most were positive overall about the restoration, but many expressed concerns that the willow trees, some of which had grown to over 6 m in height, blocked the view across the park and potentially provided hiding places for burglars. In a repeat survey of the neighborhood in 2004 (n = 45), Purcell found that about half of those who had moved to the neighborhood after the completion of the restoration did not realize the creek had formerly been in an underground culvert. Nearly all respondents reported they enjoyed living near the creek, many citing the sounds of the water, aesthetics, or accessibility for children or dogs. 69% perceived an improvement since the restoration was completed; 31% said conditions had worsened. Overall, the project was successful in creating a vibrant stream corridor where formerly there had been only a relatively sterile strip of lawn. The success of the project led to the formation of the ‘Friends of Baxter Creek’, a group which subsequently supported two other restoration projects in downstream reaches of Baxter Creek (Lisa Owens-Viani, personal communication, 2006).

Figure 4.9 Location map, Baxter (a) and Marsh Creeks (b), Contra Costa County.

Figure 4.10 Baxter Creek in Poinsett Park, El Cerrito, California. Photo by Alison Purcell, April 2007, about 10 years after construction. Note height of willows, some exceeding 6 m.
There was some negative reaction to ‘overgrown’ vegetation (Purcell, 2004), which is not unusual in urban stream restorations in northern California. Blackberry Creek in the Thousand Oaks School in Berkeley was removed from an underground culvert and replaced with an open channel in 1995. Some residents had negative reactions to the density of willow growth, which precluded access or seeing into the stream channel. In planning the 1990 restoration of Cortland Creek in Oakland, the plans by creek activists to extensively plant willows (for habitat) met with resistance from local residents, who did not want to create a place where criminals could hide (Walter Hood, personal communication, 1995). Though not as well documented as the Baxter Creek case, many other urban stream restoration projects have been marked by similar conflicts between planting willows to enhance habitat and the desire by residents and police to see into the channel to discourage criminals. This has been true especially in low-income neighborhoods, where concern about crime may be greater.

4.6.2 Marsh Creek, Brentwood, California

Marsh Creek drains 332 km², with its upper basin mostly woodland, rangeland and farmland, and its lower 15 km traversing a broad alluvial fan, which now supports the urban areas of Brentwood and Oakley, about 60 km northeast of San Francisco (Figure 4.9). As typical of Mediterranean-climate streams, runoff from the catchment was naturally intermittent in all but wet years. There is little record of the historical channel conditions in Marsh Creek in Brentwood, but historical maps from the late 1800s and early 1900s show multiple, sinuous channels and active channel migration (Robins and Cain, 2002) (Figure 4.11). As agriculture expanded onto the fertile soils in the early-mid 20th century, and in response to flooding of downtown Brentwood in the 1950s, the channel of Marsh Creek was straightened, the riparian corridor largely cleared and a flood-control reservoir constructed about 3 km upstream of Brentwood (Figure 4.12).

Brentwood has grown rapidly, increasing in population from 7500 in 1990, to 23 000 in 2000, to 33 000 in 2003 (Cain et al., 2003). Many of these residents commute (one-way travel times of over an hour) to jobs in the San Francisco Bay Region. As Brentwood has grown, interest has grown in enhancing the creek corridor for human uses, removing barriers to salmonid migration and improving stormwater detention. A watershed study (Cain et al., 2003) documented historical changes in physical and biological conditions, identifying significant effects of straightening on channel form and instream habitat, effects of the altered flow regime on habitat, effects of former mercury mining upstream and urban/agricultural runoff on water quality and the loss of native plant and animal species.

To better understand the perceptions and preferences of local residents, Yang (2004) surveyed 1800 residents living within 400 m of Marsh Creek in Brentwood to assess their perceptions (and ideal images) of the creek. The residents consistently presented an ideal image of the creek, identifying luxuriant woods, year-round running water, bountiful wildlife and easy access as features of the ‘natural’ or ‘original’ Marsh Creek. However, this idyllic image of the creek is largely inconsistent with the character of the creek as documented by historical evidence, with its Mediterranean-climate runoff regime. Similarly, many residents delighted in contact with wildlife, but did not realize that the most contacted species, i.e. crayfish, bullfrogs, bluegill and largemouth bass, are not native, but exotic generalists. Likewise, with vegetation, most subjects did not distinguish native from introduced plant species and even those who could tended to prefer vegetation that ‘looks natural without being overgrown’ regardless of origin (Yang, 2004).

The problems identified by the residents contrasted sharply with those presented by the professionals in the watershed report. By far the leading concern of surveyed residents was garbage and dumping in the creek. Many residents considered the summer water levels too low, evidently without understanding the highly seasonal nature of flow in Mediterranean-climate streams. Residents also regarded ‘mosquitoes/pests’ as more serious than ‘monotonous channel form’ and ‘poor habitat value,’ both major issues identified in the watershed report (Cain et al., 2003). Only ‘not enough shade’ was identified as a concern both by the surveyed residents and in the watershed report (Yang, 2004).

The substantial differences in perception and landscape preference between restoration scientists and local residents will be a source of uncertainty in setting restoration priorities and garnering public support for restoration projects. As funding becomes available to plan restoration projects in Brentwood, these gaps will need to be addressed in a participatory context so that conflicts in restoration goals can be reduced.

4.7 CONCLUSIONS

Uncertainties on the social and cultural fronts of stream restoration can be viewed as signifying forward progress in the field, rather than simply further impediments in implementing projects. Twenty years ago, when the notions of creek restoration first became widespread in the United States, many engineers regarded ecological concerns as obstacles to be overcome in the single-minded
pursuit of diking, channelizing, straightening and culverting streams. It was only when engineers started to confront other viewpoints that ‘uncertainties’ were introduced in their modus operandi. While conflicts between engineers and ecologists persist in restoration projects, by and large the engineering profession has embraced the need to work effectively with geomorphologists and biologists to achieve effective ecosystem restoration. Now we see increasingly that the ecological engineering approach is perturbed by the uncertainties introduced by social and cultural concerns. In other words, the current phenomenon of restoration professionals experiencing uncertainties on all fronts may be simply an indicator of a rapidly broadening viewpoint and recognition of problems without commensurate solutions.

Figure 4.11 Topographic map details of marsh Creek in Brentwood: (a) 1914 and (b) 1978. (Source: US Geological Survey topographic maps.)

Figure 4.12 (See also colour plate section) View of Marsh Creek channel in Brentwood (Photo by Kondolf, September 1991.)
Although the possible range of goals, values, perception, aesthetic taste, use and meanings of a population for a stream can be overwhelming, and conflicts sometimes unavoidable, the goal of sustainable stream restoration increasingly requires integration of diverse points of view. Institutionally, citizen groups have now become an integral part of many restoration efforts. Professionals have learnt that collaborative planning processes may not bring about a fast solution, but it may provide substantial long term benefits in terms of political and social capital, and may yield more sustainable restoration projects.

To be successful on a sustainable basis, stream restoration must be both technically sound and enjoy strong public support. Although decisions in stream restoration are essentially value driven, sound science is fundamental to constrain the range of possible solutions and evaluate possible alternatives. Without it, a Jamison Creek situation can result, in which the responsible agency selects a scientifically unsound option and the project fails. On the other hand, a technically sound restoration plan is unlikely to be funded and implemented without strong public support, and unlikely to be sustainable if built without local buy-in.

Where there are significant uncertainties on social and cultural aspects, these should probably be settled before proceeding to settle technical uncertainties. For example, until the values of large woody debris for fish or boaters are established, there may be little point in quantifying its catchment production and morphological qualities. In cities, we find that the recreational potential of spontaneous uses is often conspicuous in its absence from the agenda of stream restoration. Once their importance is recognized and spontaneous uses and their implied societal values are added to the restoration agenda, more precise research may be needed to assess them.

Cultural preferences (commonly unacknowledged) largely shape restoration goals. Building a culturally preferred form (such as a stable, meandering channel) is perfectly reasonable as a restoration goal, but we suspect that the field would benefit from an explicit recognition of this as motivation, rather than cloaking such projects in seemingly scientific details of channel morphology and (commonly vague) references to improved fish habitat. To the degree that cultural preferences remain unacknowledged, they introduce greater uncertainty in the trajectory of restoration projects. Cultural preference for tidy landscapes over messy landscapes (Piégay et al., 2005) should be acknowledged, so that ‘overgrown’ riparian zones can either be ‘framed’ (Nassauer, 1995) or simply avoided in urban areas. For ecological design to be truly successful and widely accepted, designers will need to find ways to make stream restoration compelling as designs (Mozingo, 1997). The concept of ‘eco-revelatory design’ suggests that by accepting humans into the restored ecosystem and designing the project to reveal ecological processes, we may achieve ecosystem restoration (to the extent possible in urban areas) while still gaining public acceptance (Galatowitsch, 1998).

4.8 ACKNOWLEDGEMENTS

The research on which this chapter is based was partially supported by a grant from the University of California, Berkeley, Department of Landscape Architecture Beatrix Farrand Fund. Shannah Anderson contributed substantially with supporting research, figure and manuscript preparation, and review comments. Louise Mozingo contributed valuable ideas and references. The chapter was improved through comments by anonymous reviewers and the volume’s editors, Dave Sear and Steve Darby.

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Cities that support ecological democracy will be radically different from present ones, but the transition must accommodate everyday patterns of life. Alternatives that are shocking, that threaten security, or that upset basic needs will likely be rejected. Other than for provocation, there is no place for design that says, “Let them eat utopia.” Nor is there a place for counterproductive or superficial changes, exterior decoration, or private jokes at public expense. Meaningful urban metamorphosis requires inspired everyday futures, which are defined as visionary ideas that are rooted in daily life and experience. Innovative transformations, even radical ones, that are recognizable and that accommodate and champion valued ways of living are more likely to be successfully implemented. As action toward ecological democracy becomes more rapid and dramatic, city design needs to be more and more deeply grounded in everyday life. Familiarity supports metamorphosis to a different future.

As a simple example, consider the restoration of Oakland’s Courtland Creek. The Urban Creeks Council of California, a nonprofit organization that is committed to the natural restoration of city streams, commissioned Walter Hood to reclaim a badly abused section of the creek. Hood discovered that most neighbors feared the creek; they considered it a dump site. Indeed, the creek appeared to be a trash dump and not a stream. Most recreation occurred along streets and vacant rights-of-way that were adjacent to the creek. Rather than trying to force a purely ecological restoration plan, Hood meshed the daily-use patterns that were particular to these central-city residents with creek reclamation. He proposed that an active linear park should be created parallel to the creek. The budget had to be supplemented by city funds, most of which were spent on this park, with little money spent on Courtland Creek itself. Seeing no ecological benefit to the street park, some restoration purists objected, but the park plan was implemented along with minimal stream revegetation. Since its completion, residents most use the promenade formed by a double row of flowering fruit trees, a lawn adjacent to the linear walkway, and a garden of flowers and vegetables that they
maintain. No significant increase in creek play has been observed, but the linear park generates so much activity that illegal dumping has been dramatically reduced. By championing everyday life, Hood's park protects the creek, accomplishing far more in ecological stream restoration than naturalistic improvements would have alone.

Everyday patterns suggested that an active linear park parallel to Courtland Creek was more likely to be valued by residents who feared the creek. The promenade is heavily used, and dumping in the creek has been reduced.
Four design strategies are important for creating an inspired everyday future: design for what people do all day, integrate present experience with change, mark time, and inspire visionary futures by the everyday.

**Designing for What People Do All Day**

Designing any landscape requires knowing what people do there now and what they might do there in the future. Consider the activities that might occur along an urban stream like Courtland Creek, a larger one like Compton Creek (a major tributary of the Los Angeles River), or even the Los Angeles River itself. Where would you expect to see young children playing, swimming, wading, building dams, and catching salamanders; scientists sampling water quality; teens seeking privacy or sex; classes studying nature and watching birds; people hiking, biking, picnicking, fishing, reading, sunbathing, or practicing the saxophone; kids taking a shortcut and racing bikes, motorcycles, or stolen cars; people performing Christian baptisms, doing drug deals, engaging in prostitution, collecting native plant materials, and dumping industrial wastes, construction debris, a murder victim, or dead pit bulls? Knowing these patterns leads designers to fit the situation and to understand situations when no design is going to succeed. The designer learns about these patterns of activity through four strategies: reading the research on similar people and places, listening to people, observing carefully, and wearing the empathic shoes of others.¹

An example is the work of Sydney Brower and others at the city of Baltimore's Department of Planning. Years ago, the planning staff was doing open-space improvements in the low-income Reservoir Hill area. Prior research suggested that central-city recreation occurred in developed playgrounds and parks. As a result, recreation improvements typically focused on parks. But the department's staff observed a distinctive pattern of everyday life in this neighborhood. Children played less in parks and playgrounds (10.5 percent) and more in streets, sidewalks, alleys, porches, and yards (89.5 percent). A quarter of teenage boys' recreation occurred in parks and playgrounds. Adult women recreated in parks and playgrounds less than 2 percent of the time. All groups recreated more around the home and nearby streets. Place-based research countered the prevailing literature. Consistent with local patterns, the planners proposed street-corner improvements, enlarging sidewalks to make places for sitting, congregating,