Chapter 10. Intended Versus Unintended Effects During Riparian Restoration Create High Quality Recreation Habitat

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Introduction

Many of the same features that are good for riparian ecology are good for people. Varying flow regimes, diversity of plants and animals, dynamic geomorphology that produces open beaches and shaded/sheltered areas, and most importantly, the presence of water—all are attractive for recreation, so human use can be an explicit part of the restoration equation.

But when we consider restoration of riparian ecosystems, it is easy to overlook its effects on recreation. The "recreation habitat" concept was introduced in Chapter 9 in this volume. While that chapter explored ways to minimize recreation impacts on riparian habitat through management, this chapter asks whether restoration can create recreation habitat as part of its design. To balance restoration goals with goals for recreation resources, we need to recognize the activities people are trying to pursue, the riparian characteristics they seek, and how restoration choices may impact recreation habitat.

This chapter discusses a typology of anthropogenic effects on riparian habitat, with one dimension considering whether impacts are intentional or unintentional, and another considering whether impacts are positive versus negative. We then discuss information from users about recreation habitat needs, preferences, and decision-making, using camping as an example. This helps evaluate outcomes from restoration efforts in terms of specific recreation resources. A final section provides other examples, using photos with extended captions.

Descriptive and Evaluative Components

Recreation use typically creates changes in biological and physical characteristics. For example, walking across a meadow may crush plants or compact soils, and these changes can be described objectively. But an evaluative dimension is also needed: What are the goals for recreation opportunities and ecological conditions, and are the specific biophysical changes acceptable within those frameworks? An 18-inch-wide band of lost vegetation and compacted soil may be acceptable if defined as a trail, while a wider band or multiple bands may not. Recreation management frameworks distinguish between these kinds of descriptive and evaluative information, encouraging resource managers to explicitly define the conditions they are trying to provide or avoid (Graefe et al. 1990; Manning 2001; National Park Service 1997; Shelby and Heberlein 1986; Stankey et al. 1985).

Applying such a framework to riparian changes, the descriptive component focuses on scientific relationships between restoration actions and different conditions (e.g., measurable changes in species diversity, erosion rates, or percent of bare ground), independent of whether those conditions meet goals or standards. An evaluative dimension (e.g., standards for "acceptable" species composition, channel dynamism, or amount of bare ground) is considered separately to assess whether a restoration project accomplishes specific ecological goals or end-states.

This concept seems simple, but in practice often it is not. Although ecologists may share implicit restoration goals (e.g., increase species diversity or geomorphic dynamism), there are often tradeoffs among outcomes, especially when those outcomes are tangible and specific (Schmidt et al. 1998). In Grand Canyon, for example, operational changes for Glen Canyon Dam could partially restore flood flow regimes that benefit some species (e.g., humpback chub and other native fishes, sub-tropical song birds), but adversely affect others (e.g., trout, the eagles that feed on them, and other birds such as the southwestern willow flycatcher).

Clarifying Goals For Restoration

Aside from these specific examples, several different restoration endpoints are possible, some of which are difficult to define (Cole et al. 2008). A commonly expressed goal is to restore "natural" conditions, but increasing consensus in the scientific literature indicates such conditions are dynamic (Wu and Loucks 1995) and often conflated with current and/or historical human activities (Cole and Landres 1996). We can no longer assume ecosystems are clearly defined, balanced, or self-regulating, or that previous conditions are the most appropriate target for "active management" (Leopold et al. 1963). Cole et al. (2008) examine a range of possible restoration goals from an ecological perspective. They conclude that historical fidelity, biodiversity, species conservation, ecological integrity, and ecological resilience are distinct goals (albeit with some overlap) that may be more or less appropriate, realistic, or measurable in different restoration situations.

Given this, projects to recover "damaged" or "degraded" ecosystems would benefit from explicit definitions of those terms, along with specific goals for improvements. Even the term "restoration" implies a value judgment that the existing condition is "bad" and the restored condition will be "better." In some cases, restoration goals refer to some idealized equilibrium that may never have existed or cannot be replicated. Cole et al. (2008) argue that other terms such as "intervention" or "redirection" better describe intentional actions to alter an ecosystem's path. Regardless of the terminology, these different end-states are human-defined and could include recreation habitat goals.

Restoration can occur at different scales, ranging from specific sites to segments, the entire river, or the watershed. For example, restoration may include rehabilitating specific locations like camps or visitor attraction sites; improving the connectivity of meadows; altering dam-regulated flow regimes that have reduced flooding or sediment deposition; changing widespread grazing; altering trophic cascade effects from species removal; or introducing nonnative species such as tamarisk beetles to reduce an earlier invasive.

This chapter adopts a more flexible definition of riparian areas than some of the technical delineations described in other chapters. On a desert river like the Colorado in Grand Canyon, for example, users may camp above the narrow riparian zone defined by dam-altered hydrologic regimes, often because riparian changes such as tamarisk invasion or beach erosion have constrained camp-able areas. In contrast, wetter environments may encourage camping close to the river on sand or gravel bars that are free of insects or vegetation. For recreation users, the riparian area may include sand beaches, gravel bars, rock cliffs, upland benches, and associated vegetation ranging from grasses to shrubs to large trees. People seek recreation habitats that support their activities, and they may not care about or even recognize formal ecological definitions.

Riparian Changes Due to Human Activity

Many riparian changes are caused by human activities, ranging from dams, grazing, or urbanization, to restoration projects designed to mitigate these kinds of stressors. The typology presented in figure 42 evaluates two orthogonal dimensions: whether the effect was intentional or unintentional, and whether it was positive or negative. We have included several phrases that might be used to describe actions in each quadrant, illustrating the range of ways scientists, practitioners, policy makers, or stakeholders account for different outcomes.

The typology recognizes that some negative changes can occur through unintentional oversight or neglect, while other manipulations have well-understood negative consequences that were intentional but considered acceptable because of other benefits or tradeoffs. For example, good snail habitat on the dam face or in downstream fluctuation zones is a fortuitous unintentional effect of Glen Canyon Dam, just as shade and screening within campsites are unintentional positive effects of tamarisk introduction (although pruning may be required). One could discuss similar questions about different aspects of tamarisk beetle introduction.

In all these cases, changes caused by humans (either positive or negative) are forms of “riparian engineering”; this term recognizes that humans are part of the equation and are responsible for many outcomes, regardless of intentions. As we work to restore riparian

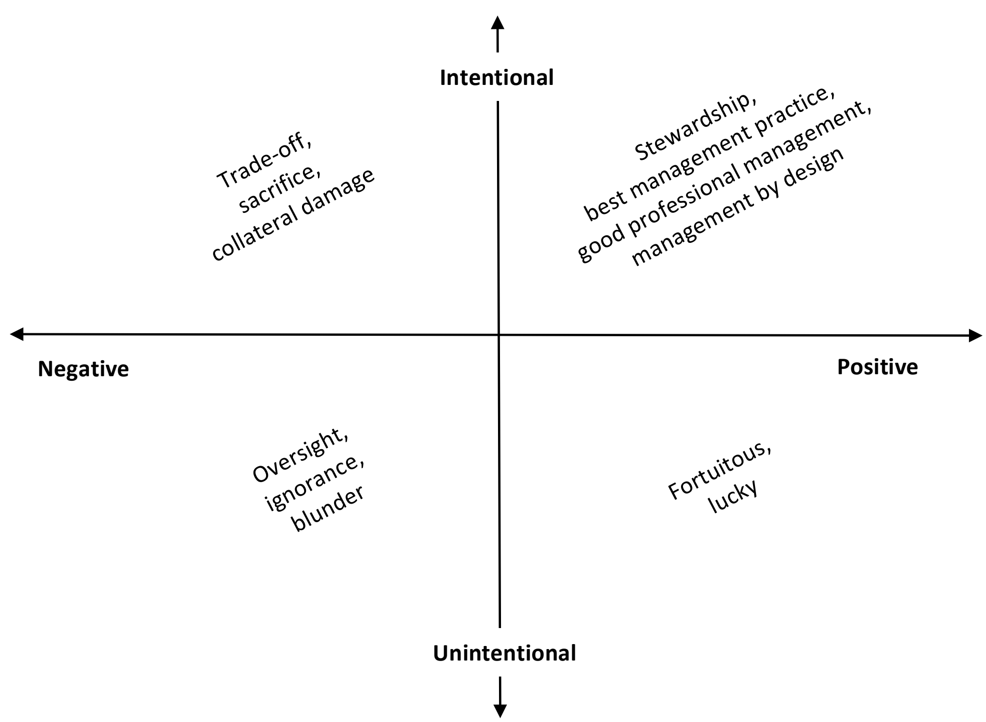

Figure 42—A typology of riparian effects due to human activity.

ecosystems from more negative states to more positive ones, we have the opportunity to consider, and perhaps intentionally improve, characteristics that benefit human activities like recreation. The result is recreation habitat "by design rather than by default" (Shelby and Shindler 1995; Shelby et al. 1992), with increased likelihood that outcomes will be intentional and positive rather than negative.

Creating High Quality Recreation Habitat: The Campsite Example

Campsites are an important riparian feature, particularly for rivers with multi-day trips. They are an excellent example of recreation habitat that can be affected by restoration projects on the orthogonal dimensions shown in figure 42.

Several studies have examined campsite choice in a range of settings to determine characteristics that are important to recreation users. A review developed three categories of campsite attributes (Brunson and Shelby 1990): *Necessity attributes* such as flat ground, nearby water, and shelter/shade are minimum requirements. *Experience attributes* such as screening from other sites, being out of sight/sound of other groups, or good scenery are secondary, although they enhance the overall experience. *Amenity attributes* are a final category of less-important characteristics that may be tiebreakers in the choice process; examples include the amount of bare ground or presence/size of fire rings.

To examine the choice model, Brunson and Shelby (1990) collected data from floaters on Oregon's Deschutes River, a desert canyon stream east of the Cascade Mountains. Summer flows are clear, cold, and fairly constant as a result of an upstream reservoir with power-generating and re-regulating dams. Camping most often occurs on a segment with several Class II-III rapids and a nationally known trout fishery that attracts highly specialized anglers.

As hypothesized, necessity attributes (flat ground, good boat tie-up, and shade) were rated most important. Experience attributes (good fishing water, screened site, and out of sight/sound of other sites) were less important and associated with desired experience outcomes such as "getting away from others." Amenity attributes (free of grazing, little bare ground, and distance from a railroad that runs along the river) were rated least important.

The study also explored alterations in the campsite choice process due to: differences in outcome goals (e.g., anglers care more about fishing water than non-anglers); the need to choose quickly because of competition from other users, fatigue, or threatening weather; and lack of information about sites that lie ahead (because non-motorized boaters approach sites sequentially and cannot go back upstream). Under ideal conditions, users go through the longer three-stage choice process, but constrained conditions may cut the process short any time minimum thresholds are met (similar to Simon's [1956] satisficing concept).

Campsite attribute needs and preferences suggest several priorities for restoration-related riparian engineering. Necessity attributes should be the first concern; the ability to access the site and tie-up, flat ground, and shade protection were most important to Deschutes River users. These attributes are clearly related to restoration options that affect the amount of beach, the type and size of vegetation, or availability of flat bench uplands.

A 1980s restoration project on the Deschutes provides an interesting example. Camps in Sections 1 and 2 are scarce because the left bank of the river is closed to camping by the Warm Springs Tribes. Many of the right-bank sites lack shade, a necessity attribute during hot dry summers. To create more and better camps, agencies and conservation groups cooperatively planted trees along river-accessible upland benches flat enough for camping. But with a long dry summer, growing trees required water. The solution was placing 5 gallon buckets with interpretive signs explaining the need to water trees until they developed deep roots. Tree growth was successful at several sites, although the choice of some tree species (e.g., Russian olive) introduced exotics with other restoration consequences, and cottonwoods created widow-maker hazards as they matured (L. Ripley 2016, personal communication). In short, there were some negative effects in spite of good intentions and a specific recreation habitat goal.

Riparian engineering may also affect experience attributes. Good fishing water was important for many Deschutes River floaters, and this is related to fish habitat goals for game and nongame species. Vegetation is another restoration variable that may provide screening within and between camp sites. Interestingly, amenity attributes such as bare ground and absence of grazing impacts were less important to Deschutes users, supporting the argument in our other chapter that recreation habitat may have dimensions that are different from biological habitat.

A similar campsite selection study of boaters in Hells Canyon on the Oregon/Idaho border showed similar results, with additional attributes related to daily flow fluctuations from power generation releases at Hells Canyon Dam (Shelby et al. 2002). Although floaters and power-boaters had some different needs for parking boats, both groups were concerned about getting stranded if water levels dropped over short periods (a negative outcome from an intentional change in flow regime).

Other Examples

To summarize, human-caused riparian restoration generally alters physical and biological ecosystems, probably changing characteristics that are important for recreation. This means that as we engineer physical or biological habitat, we are also engineering recreation habitat, either by default or by design. It makes sense to choose design, although we don't always. Using photos with extended captions (figs. 43-58), the following section provides a variety of examples, ranging from site-specific to watershed and regional scales.

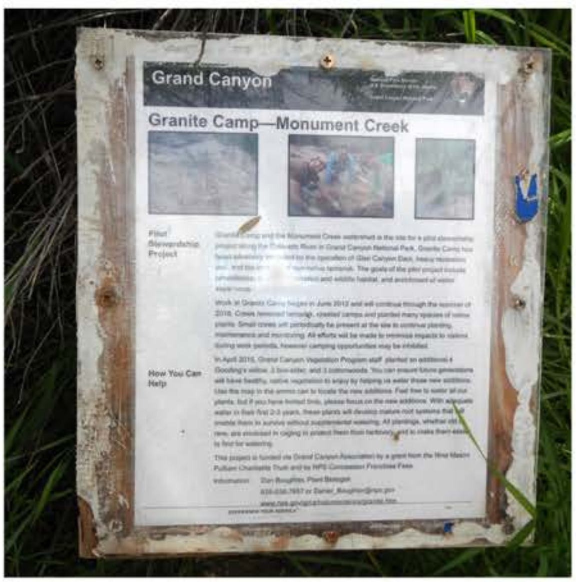

Figure 43—Granite Camp on the Colorado River (top) is a heavily-used "tamarisk camp," where trees have been pruned over the years to provide shade and screened sleeping areas. The restoration project described by this onsite sign (center left) is one of the few places in Grand Canyon where trees have been extensively planted and cultivated (center right, and in top photo) to replace tamarisk dying from introduced beetles (some trees have been cut and removed, bottom left). But it will be some time before these new trees reach the maturity of "old growth" tamarisk or replace its recreation benefits in terms of shade, shelter, or screening.

Figure 44—These tamarisk at Carbon Creek camp on the Colorado River are the best available shade and shelter for this kitchen setup, even though they are blackened and dying. In contrast to the cultivation at Granite Camp, most Grand Canyon camps (like this one) have no “engineered” vegetation to replace beetle-killed tamarisk. New vegetation may regrow spontaneously but may not provide good recreation habitat.

Figure 45—This Google Earth satellite photo shows the areas just above Phantom Ranch in Grand Canyon, with the Kaibab Trail and bridge crossing immediately downstream. There is high demand for Cremation Camp (on river left) because the 12-mile Inner Gorge area upstream has few camps per mile, and many parties want to camp near the Kaibab and Bright Angel Trails that provide access for passenger exchanges. In addition to resource protection goals, the site has been engineered to provide good recreation habitat for multiple groups. The “one party per camp” norm that exists in most of the Canyon is explicitly suspended here to increase capacity (insets show different landings that allow for camp-sharing).

Figure 46—This carefully engineered tent site at Crystal Camp in Grand Canyon provides excellent camping habitat. Data show visitors appreciate cues that identify where to camp and indicate that their activities are not causing unacceptable impacts. Such improvements protect the riparian area by keeping camps in the more resistant post-dam riparian zone and discouraging use in the more fragile native vegetation higher up the bank.

Figure 47—Funneling use to a single area that can then be hardened is an effective strategy to get visitors through sensitive riparian areas (Little Nankoweap camp on the Colorado River in Grand Canyon shown here). Top photos show steps from the boat landing to the camp area, soon after construction in 2005 (top left) and needing some work in 2016 (top right). Lower photos show the trail from camp up to Little Nankoweap Canyon and the Nankoweap granary, some of it in good shape (bottom left) and some not (bottom right).

Figure 48—Even in remote locations like the bottom of the Grand Canyon, riparian restoration may need to accommodate large amounts of recreation use, as suggested by parked boats at Deer Creek (top), Havasu (bottom left), and Elves' Chasm (bottom right). Almost all Grand Canyon trips stop at these popular attraction sites.

Figure 49—Good trail design provides hiking habitat by identifying routes that get people where they want to go (trail to upper Deer Creek in Grand Canyon shown here). At the same time, trails protect restoration projects by keeping vegetation loss and soil compaction at acceptable levels.

Figure 50—Techniques for identifying trails, keeping people on them, and minimizing impacts include those shown here: border rocks (top left), marking routes with cairns (top right and bottom left), and steps in steeper segments (bottom right). Photos are from Nankoweap and Carbon Creek areas in Grand Canyon.

Figure 51—This Google Earth satellite image of Nankoweap on the Colorado River in Grand Canyon shows where the Park Service developed and clearly marked a "best" trail for the popular hike to the Anasazi granary high on a cliff (lower inset), with a spectacular view down the Canyon (upper inset). Before this restoration, which included designating camps and day use areas, river runners created a web of dozens of trails.

Figure 52—Tamarisk has overtaken other riparian vegetation on many Southwestern rivers, creating dense stands that typically eliminate open space and flat ground needed for camping. Resource agencies have released tamarisk beetles to combat the species, a program claimed to be among the most carefully studied introductions ever. Although this is controversial, beetles have clearly reduced the amount of living tamarisk and probably its spread to other areas. But as shown in this photo from the Green River in Stillwater Canyon, impenetrable dead trunks and branches prevent recreation use and create fire hazards.

Figure 53—Piles of cut tamarisk (top photo) in Three Canyon camp at Trin Alcove Bend in the Green River's Labyrinth Canyon. Despite the extensive restoration effort, remaining stumps and uneven ground (bottom left) interfere with good camping habitat, and dense willow may quickly take over the area (bottom right). Some tent spots have been cleared in nearby oak uplands (center) and future high water may deposit enough sand to reduce the problem.

Figure 54—A Park Service/Canyon Country Youth Corps crew removes thickets of beetle-killed tamarisk at the confluence of the Green and Colorado Rivers (top left), part of what one crew-member described as a career goal to rid the area of this invasive. Trees up to 12–inches in diameter were cut with chainsaws (bottom left) and thrown in the river (top right and center right). Downstream, driftwood with saw-cut ends float on the river (center and bottom right), piles up on shore, or eventually winds up in Lake Powell. It is not clear whether this “new” form of driftwood is considered good, bad, or just a tradeoff of clearing invasive tamarisk, but regulations in some jurisdictions prevent river runners from using slash for firewood.

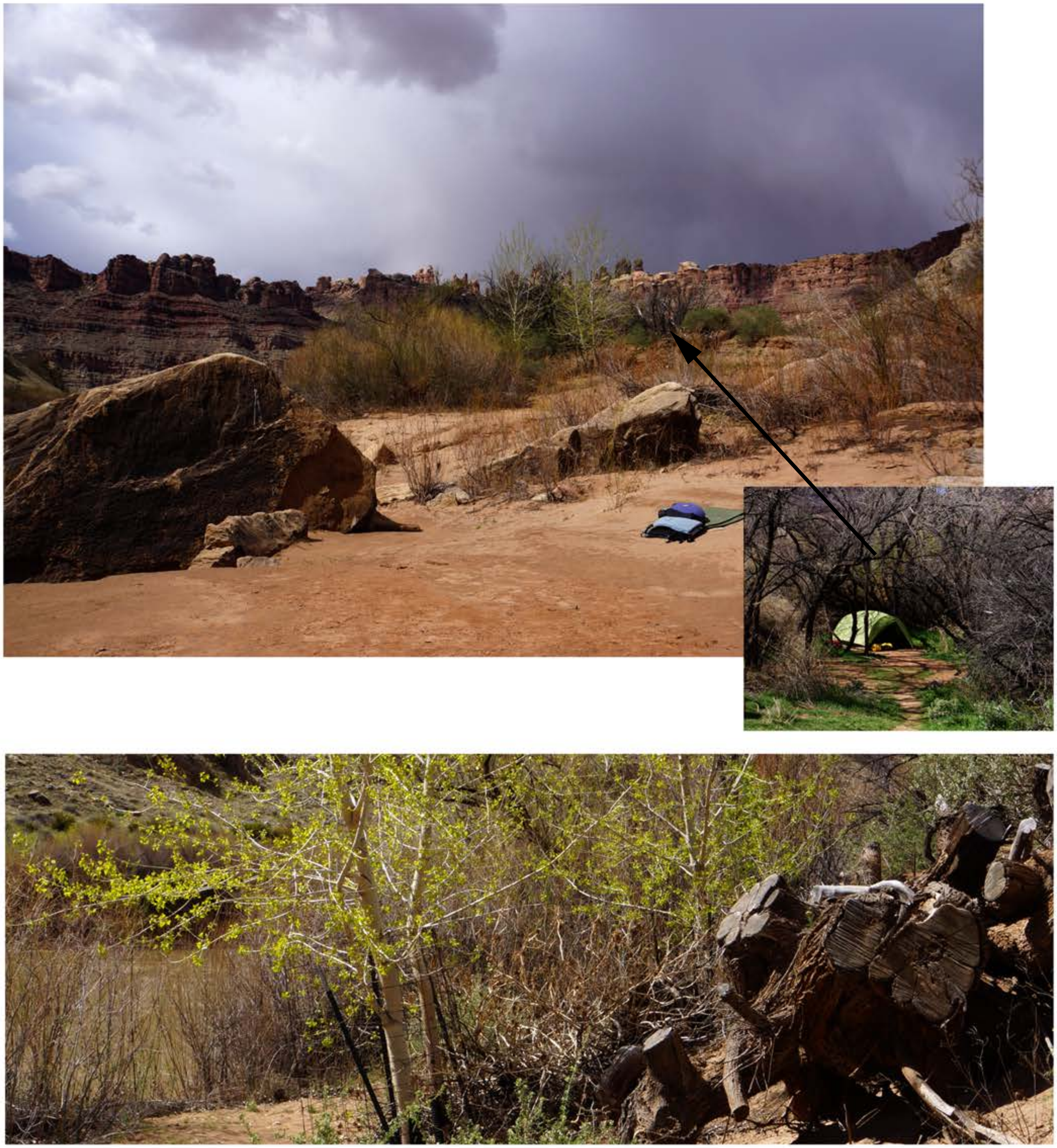

Figure 55—On a cold and stormy day at Spanish Bottom in Cataract Canyon below the Green/Colorado River confluence, even dead tamarisk with blackened trunks provide better camping habitat (inset) than a more aesthetically pleasing open beach (top photo) that was lashed by wind-driven sand and rain. Lower photo shows planted cottonwoods protected by staked wire cages; tamarisk stumps like those in the foreground remain after the trees have been cut and the slash removed. Although some cottonwoods were planted soon after beetle introduction, it will take many years before shade and shelter from these newer trees replace the "old growth" tamarisk (something this restoration project appears to recognize in its design).

Figure 56—A beach area recently protected from grazing on Oregon's John Day River (top photo, taken at a higher spring flow) shows willows establishing along the lower summer water line: willows may eventually take over or cut off access to the beach, decreasing recreation habitat. Mitigation for such effects can be included in riparian engineering during restoration projects. Pioneering restoration research has been done in the John Day and Deschutes River watersheds east of the Oregon Cascades. This work showed how riparian vegetation in historically grazed locations (center left) was markedly different from areas protected from grazing by roads or railroads (center right). Cottonwood plantings (background of lower right photo) are part of the effort, but a pleasant surprise has been dramatic recovery after removing livestock or simply installing watering tanks (on trailers with solar-powered pumps) higher in the riparian zone.

Figure 57—This whitewater park in Salida, Colorado, is a large-scale river restoration that includes extensive channel modifications as well as bank improvements. Specifically designed to provide hydraulic features for whitewater boating (ColoradoKayak.com photo, bottom left), the park creates diverse recreation habitats on and off the water, including pathways (top left), seating areas (top right and bottom right), and a “downtown restoration” setting for shops and restaurants (out of sight upstream on river right). Ironically, on-shore areas provide for much larger numbers of recreation-days, compared to boating and other water activities.

Figure 58—Signs marking restoration areas take many forms: short vs. long, less vs. more informative, friendly vs. more demanding instructions, and messages that sometimes appear incongruous (like "not a trail" with an obvious trail behind it, bottom right). The detailed sign at the Salida Whitewater Park (top) conveys an interdisciplinary message about habitat benefits for boaters, aquatic life, and riparian vegetation.

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