

Appendix M.

Potential Recreation Impacts on Southwestern Willow Flycatchers and Their Habitat

A. Introduction

When conservation ethics and outdoor recreation were evolving, they were initially thought of as mutually beneficial. Recreation activities were considered compatible with the environment, especially when compared to timber harvesting, mining, development, and grazing (Knight and Gutzwiller 1995). Recreation demands on riparian areas may have been the single most important factor in motivating management agencies to reduce consumptive use in flood plains (Johnson and Carothers 1982). However, as recreation activities increase and persist over time, the damage they sometimes cause can no longer be ignored. Conservation ethics and outdoor recreation are often in conflict, requiring recreation management (Flather and Cordell 1995). Some experts believe the primary natural resource management issue for this century will revolve around conflicts between recreation and wildlife (Knight and Gutzwiller 1995).

Some subspecies of the willow flycatcher (*Empidonax traillii*) are known to be suburban nesters, breeding along roads and freeways and in areas of low to moderate recreation use. Although the southwestern subspecies (*Empidonax traillii extimus*) does not occur as a suburban nester, it may be more likely to persist in suitable habitat adjacent to recreation than some other endangered species. For example, unlike a species like the bald eagle (*Haliaeetus leucocephalus*), which has a large home range and is often sensitive to human proximity during the breeding season, the flycatcher has a small home range and does not appear to be overly sensitive to low level human activity outside of its' breeding patch.

Although there is little evidence of direct impacts on southwestern willow flycatchers or their habitat, the projection of recreation use into the future is cause for concern. Increasing human populations, coupled with the attraction of limited riparian areas for recreation, make willow flycatcher habitat a vulnerable resource.

To truly understand the breadth of the potential impacts, we must first acknowledge that recreation is a growing and economically profitable business that produces outdoor experiences for the public. The recreation industry, which includes the government, caters to users by providing hiking trails, campgrounds, picnic areas, resorts, marinas, and stocked rivers. These amenities allow visitors diverse experiences such as hiking, camping, motorboating, whitewater rafting, kayaking, and sportfishing. Visitors patronize the recreation industry by purchasing equipment, food, fuel, lodging, permits, and commercial tours.

Despite the fact that their cumulative activities can degrade riparian habitat, recreationists are important

advocates for riparian conservation. As individuals or organized groups, they support habitat acquisition, review management plans, and generate funds. Recognizing the unintentional negative impacts recreation can bring about, user groups provide stewardship by sponsoring riparian clean-up, trail maintenance, restoration, monitoring, and education programs. In other words, it is important to recognize that recreation users can have positive impacts.

B. Current and Future Recreation Use

As the Southwest becomes increasingly urbanized, there will be greater demand to escape to natural environments. Population growth during 2000 to 2025 is expected to increase from 48,161,345 to 68,692,000 people for Arizona, California, Colorado, Nevada, New Mexico, and Utah combined. This is an increase of an additional 30% (U.S. Census Bureau 2001). These trends clearly indicate impacts are likely to escalate in the absence of recreation planning.

The growth in recreation activity from 1983 to 1995 exceeded growth of population, based on National Recreation Surveys (Cordell et al. 1999). Birding, hiking, backpacking, downhill skiing, and primitive camping were the five fastest growing activities in the country in terms of percentage change in number of participants between 1983 and 1995. Outdoor recreation activities involve more than 25% of the country's population.

Based on analyses of public recreation visitor surveys (Table 1), significant increases in future recreation activities will likely result in increased use of formerly undisturbed or lightly disturbed areas. People will increasingly enter wildland areas in search of a more natural and less crowded experience (Flather and Cordell 1995).

Table 1. Projected indices of growth in recreation trips between years 2000 and 2040 in the United States. The baseline index for all activities was set at 100 for the year 1987. These projections assume that recent trends in facility development, access, and services for outdoor recreation will continue into the future. This table was adapted from Flather and Cordell (1995).

Activities	Projected Participation Index by Year				
	2000	2010	2020	2030	2040
Day hiking	123	144	168	198	229
Bicycling	124	146	170	197	218
Developed camping	120	138	158	178	195
Horseback riding	114	125	135	144	149
Primitive camping	108	115	122	130	134
Off-road vehicle use	104	108	112	118	121
Nature study	99	101	103	107	108
Rafting	123	151	182	229	267
Canoeing/ Kayaking	113	126	138	153	163
Swimming	108	118	128	140	152
Motorboating	107	114	122	131	138

C. Recreation Use in Riparian Areas

Riparian areas already receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Not surprisingly, riparian areas near cities receive greater use than those farther away from development (Turner 1983). The demand for recreation in riparian areas will continue to increase in proportion to increasing human populations.

Impacts can be even more devastating in the Southwest, where riparian habitat tends to be more linear, narrow, and dissimilar to adjacent habitat than in other parts of the country. Where there is no buffer between adjacent habitats, impacts are more significant.

1. Examples of High Use Recreation in Southwestern Riparian Habitat

To illustrate the magnitude of public demand for recreation, we provide two examples of intensive use currently challenging managers.

Typical holiday use on the Imperial National Wildlife Refuge, along the lower Colorado River in southern Arizona, was estimated for Memorial Day, 1999. A 30-mile stretch of river from Martinez Lake north to Cibola National Wildlife Refuge was estimated to be inhabited by at least 2,790 people and their 951 boats and personal watercraft (e.g., jetskis). More than half of this use was concentrated on a sandbar nicknamed "zoo island," with an estimated 1,550 users and their 523 boats and personal watercraft. Nearby Cibola National Wildlife Refuge receives less recreation pressure while Havasu National Wildlife Refuge has 2-3 times as many recreation users as Imperial National Wildlife Refuge (J. Record pers. comm.).

The 135-mile Lake Mead National Recreation Area, on the border of Arizona and Nevada, receives over 200,000 visitors on a summer holiday weekend. A summer holiday weekend day averages 5,385 boats and personal watercraft (J. Holland pers. comm.). Activities include swimming, camping, waterskiing, fishing, hiking, and use of personal watercraft. Almost half of the overnight visitors camp along the shoreline (Grafe and Holland 1997). Most recreation occurs on the lakes or along shoreline habitat, currently unsuitable for nesting willow flycatchers (J. Holland pers. comm., K. Turner pers. comm.).

D. Types of Recreation Impacts

1. Overview

Wildlife can be affected by recreation in a variety of ways: 1) direct mortality, 2) indirect mortality, 3) lowered productivity, 4) reduced use of habitat, 5) reduced use of preferred habitat, and 6) aberrant behavior/stress that in turn results in reduced reproductive or survival rates (Purdy et al. 1987). These impacts are not easily measured and different species may not react to them the same way. A review of nonconsumptive recreation impacts on wildlife was conducted, using results of 166 journal articles on the subject (Boyle and Samson 1985, DeLong and Schmidt in prep). Although this review did not quantify the type or intensity of impact, negative effects on birds were detected in 77 of these studies (Table 3). Table 4 lists the kinds of recreation impacts in riparian habitat in the southwestern United States.

Table 3. Number of citations in 166 journal articles on “nonconsumptive” outdoor recreation impacts on North American wildlife. Birds were the most common subject of study (61%), followed by mammals (42%), and herpetofauna (4%) respectively (Boyle and Samson 1985, DeLong and Schmidt in prep).

Type of recreation	Impact on birds			Impact on mammals			Impact on herpetofauna		
	+	-	0	+	-	0	+	-	0
Hiking and camping	4	17	6	5	24	4			
Boating		25	9		1	2		1	
Wildlife observation and photography		19	2	1	5	4			
Off-road wheeled vehicle use		7	2		5	2		7	1
Swimming and shore recreation		6	2						
Spelunking					8				
Rock climbing		2	3		1	1			
Snowmobiles		1	1	1	7	3			
Total	4	77	25	7	51	16	0	8	1

“+” = positive impact, “-” = negative impact, “0” = no impact or unknown impact

Table 4. Recreation impacts in riparian habitat in the southwestern United States. Adapted from Cole and Landres (1995).

Loss of surface soil horizons

Soil compaction

Altered soil moisture and temperature

Altered soil microbiota

Habitat fragmentation

Reduced dead woody debris (fuelwood gathering)

Altered plant species composition

Altered foliage height diversity

Reduced plant density/cover

Lack of plant regeneration

Erosion

Increased sedimentation/turbidity of water

Altered organic matter content of water

Altered water chemistry

Altered flow regimes

Pollution (air and water)

Increased risk of accidental fire

Increased trash

Increased human waste and diseases

Increased feral and pet dogs and cats (exotic predators)

Increased native predators, scavengers, brown-headed cowbirds (*Molothrus ater*)

Displacement of wildlife by facilities, roads and trails, human presence and noise disturbance

2. Fire Risk

As the number of recreation users increases, so does the probability of an accidental fire. Over 95% of fires on the lower Colorado River are caused by recreation users (J. Swett pers. comm.) (see Appendix L). This high cause-and-effect factor greatly increases the cumulative impacts of recreation on the environment. If recreation use is to persist, fire risk can be reduced by confining campfires to certain locations, using fire boxes, restricting campfires during high fire danger conditions, or prohibiting campfires. In some cases, fires may be fairly inevitable, but even in these cases, the amount of damage can still be reduced with proper planning. The risk of damage can be managed as much as possible with current fire response plans, operable equipment, and available personnel.

3. Frequency, Intensity, Location, and Type of Use

Although there are few cases where outdoor recreation caused direct major impacts, such as outright willow flycatcher habitat destruction, indirect effects should not be underestimated. Actions that affect the behavior, survival, reproduction, and distribution of wildlife may be as damaging as direct impacts (Cole and Landres 1995). Animals displaced by recreation are less likely to survive and reproduce where habitat is unfamiliar or inferior (Gutzwiller 1995).

The potential for the recreational activity to produce negative impacts depends on the frequency, intensity, location, and type of use. For example, a hiking trail placed outside of suitable habitat is less likely to impact willow flycatchers than a trail and campground placed within suitable habitat. A trail that receives daily use is likely to result in greater habitat damage and impacts to local wildlife than one that receives occasional use. As the frequency

and intensity of use increase we can expect to see increases in multiple trailing, soil compaction, vegetation loss, erosion, trash and human waste, pollution, scavengers, predators, brown-headed cowbirds (*Molothrus ater*), noise disturbance, and development of physical facilities like parking lots (Boyle and Samson 1985, Tellman et al. 1997, Monz 1998).

Infrequent, but unpredictable recreation without pattern can be just as or more damaging than frequent, predictable use. Activities with pattern, such as hiking on established trails, may cause birds to nest away from a frequently used area. Activities without pattern, such as target shooting, fishing, picnicking, or wildlife observation, can create more of an impact per event. Because these kinds of recreation are often conducted off established trails, they are more likely to startle nesting birds or damage habitat.

4. Habitat Impacts

Unlike direct recreation impacts on wildlife, impacts on soils and vegetation are easier to measure and are well documented. Changes in the structure, density, and composition of vegetation can occur from recreation induced soil compaction and erosion (Lutz 1945, Harper et al. 1965, Dotzenko et al. 1967, Hopkins and Patrick 1969, Merriam and Smith 1974, Snyder et al. 1976, Manning 1979, Webb 1983, Cole 1986, Hammitt and Cole 1987, Briggs 1992, Briggs 1996, Cole and Spildie 1998, Deluca et al. 1998, Monz 1998). Macroporosity, water infiltration rates, and available nutrients are reduced once soil is compacted (Harper et al. 1965, Frissell and Duncan 1965, Settergren and Cole 1970, Young and Gilmore 1976, Cole 1986). Activities contributing to these changes include hiking, horseback riding, off-road vehicle use, camping, recreational shooting, and day use (Willard and Marr 1970, Manning 1979, Briggs 1996, Cole and Spildie 1998). Off-road vehicles can produce noticeable changes in the environment after just one pass (Webb 1983) and can cause runoff to be nearly eight times greater than in an undisturbed area (Snyder et al. 1976).

Current recreation may be preventing suitable flycatcher breeding habitat from developing where trampling and soil compaction are impeding regeneration. Trails, campgrounds, and facilities can fragment habitat to the point where it cannot become suitable. Where vegetation is sparse, even light use can prevent further development of dense lower stratas which are important to willow flycatchers. Cottonwood and willow often establish on open, unvegetated sand or gravel bars, which are also attractive to off-road vehicle users (Turner 1983, Stromberg 1997).

Increased water turbidity, bank erosion, water pollution, noise disturbance, and overwater movement resulting from watersports like swimming, tubing, fishing, and boating reduce suitability of habitat (Tellman et al. 1997).

5. Increase in Predators, Scavengers, and Nest Parasites

Where humans appear, an entourage of other animals causing disturbance soon follow (Ward et al. 1973, Aune 1981). Unleashed dogs chasing wildlife, barking, and digging up animal burrows can cause as much or more disturbance as their owners. Food and garbage left behind by recreation users attract scavengers, predators, and nest parasites including feral cats and dogs, jays, common ravens (*Corvus corax*), great-tailed grackles (*Quiscalus mexicanus*), brown-headed cowbirds, skunks, ringtails (*Bassariscus astutus*), lizards, rodents, and squirrels (Aitchison 1977, Foin et al. 1977, Carothers et al. 1979).

Horses can attract brown-headed cowbirds and potential predators, especially if a stable or corral is near the riparian area. The combination of an increase in brown-headed cowbirds and predators can significantly reduce willow flycatcher nest success (see Appendix F).

6. Decline in Bird Species Diversity and Richness

Birds disturbed during the breeding season may abandon nests or young, especially if eggs have not yet hatched, resulting in reproductive failure. Recreation can also alter parental attentiveness that increases predation risk, disrupts feeding patterns, or exposes the young to adverse environmental stress (Speight 1973, Gotmark 1992, Knight and Cole 1995).

Recreation can reduce environmental structure and complexity, which causes a decline in species diversity and richness (Hammit and Cole 1987). Vegetation changes in and near campgrounds can cause bird species diversity to shift to more common and generalist species, while rarer and specialist species such as the willow flycatcher decline (Aitchison 1977, Guth 1978). Reduced shrub and tree densities, woody debris, and litter depth in campgrounds cause ground, shrub, and small tree nesters to decline (Blakesley and Reese 1988). Changes in vegetation at or near campgrounds result in loss of lower vegetation strata and regeneration, both important components to willow flycatcher habitat.

Day use can reduce the density of breeding birds. Park visitor activities (primarily pedestrians and cyclists) negatively affected breeding bird densities for 8 of 13 species in a study in the Netherlands (van der Zande et al. 1984). In a different study on the effects of shoreline recreation (boaters, cyclists, walkers, moped riders), 11 of 12 bird species were less abundant in areas of high vs. low use. The lower abundances were associated with between 8 and 37 simultaneous visitors per hectare (van der Zande and Vos 1984, Knight and Cole 1995).

Passerine abundance was strongly positively correlated with the volume of willows in a study in Oregon (Taylor 1986). However, results at one site were contrary to this trend. It had a low relative abundance of birds compared to the amount of vegetation. A large number of campers extensively used the riverbanks during May. Willow flycatchers were absent from this campground site, but were present at a number of other noncampground sites in this study.

E. Examples of Effective Long-term Recreation Management on other Endangered Species

Where heavy recreation use occurs, intervention has proven to be successful in reducing negative impacts to some wildlife species. Although expensive and time consuming, this may be the only alternative enabling recreation to co-exist with some wildlife species. The bald eagle breeding population has persisted near the Phoenix metropolitan area for the last 22 years primarily through the efforts of an active management program. Seasonal closures near nest sites, combined with around-the-clock monitoring help reduce impacts. This multi-agency program provides funding for a coordinator and seasonal “nestwatchers.” During two bald eagle breeding seasons, 13,999 human activities and nearly 4,000 gunshots were recorded within 3/4 mile of 13 nests along major rivers in central Arizona (Arizona Game and Fish Department in prep.). Season-long nestwatchers help increase bald eagle nesting success by educating the public and guiding activity away from nests. With the increasing growth of communities in central Arizona and accompanying recreation, the future of the bald eagle breeding population is dependent on intensive management.

In New Mexico, conflicts between recreational mountain climbers and nesting peregrine falcons were eliminated by educating climbers and enforcing strict seasonal closure of climbing routes at nesting cliffs (S. Williams pers. comm.).

F. Current Recreation Use in Occupied Willow Flycatcher Habitat

The impact of current recreation use on occupied willow flycatcher habitat can be evaluated from two perspectives: 1) displacement and 2) effects on the existing population. We focus on the latter and what we can do as managers to protect birds and habitat, recognizing that some displacement of willow flycatchers by recreation activities and associated facilities may have already occurred. We identify the recreation impacts and management challenges at these sites.

1. San Luis Rey River, California

Nesting willow flycatchers occur in a day use area on the Cleveland National Forest along the San Luis Rey River, California. As with many recreation use sites, some nesting habitat was probably physically displaced by the parking lot and foot bridge. This area receives light use during the week, but heavy use on summer weekends, usually after mid-morning. Fortunately, most of the human use occurs later in the morning than the peak period for willow flycatcher activity. Much of the habitat is protected from direct human contact because a large proportion of the nests are placed in the naturally thick and thorny shrub layer or higher in the trees (W. Haas pers. comm., K. Winter pers. comm., Kus et al. 1999). However, recreationists did impact this site. One of 13 nest failures in 1999 was caused by human disturbance. The branch supporting a nest was cut (Kus et al. 1999). Recreation use can also potentially impact this site through accidental fire, increased predation by predators and scavengers attracted to trash cans, and increased use by anglers after stocking trucks empty fish into the river (W. Haas pers. comm.).

2. Kern River, California

The South Fork Wildlife Area supports a significant willow flycatcher population that is patrolled by Sequoia National Forest staff. When Lake Isabella rises, boaters and users of personal watercraft have access adjacent to the nesting habitat. A five mile-per-hour speed limit is enforced on Lake Isabella to control disturbance to nesting birds. Willow flycatchers are also nesting along a trail near the Kern River Preserve headquarters office. California Audubon closes this trail during the breeding season (M. Whitfield pers. comm.).

3. Mill Creek, San Bernardino National Forest, California

Nesting willow flycatchers occur at the Thurman Flats picnic area along Mill Creek on the San Bernardino National Forest, California. The willow flycatchers nest in the blackberry (*Rubus ursinus*) understory and in white alder trees (*Alnus rhombifolia*). The primary impacts to these nests are 1) disturbance by blackberry pickers and 2) predation by common ravens (*Corvus corax*), western scrub-jays (*Aphelocoma californica*) and Steller's jays (*Cyanocitta stelleri*):

- 1) The lush tangle of blackberries that would ordinarily protect nests from off-trail hiking attracts fruit pickers. The San Bernardino National Forest provides a weekend employee to monitor activities at this site and educate users during the blackberry season. In addition, part of the site is closed during the nesting season. Flagging is used to mark the perimeter and closure signs are placed around the nesting habitat informing users that this is a sensitive wildlife area.
- 2) Ravens and jays may have increased at this site, attracted to the picnic area and adjacent communities of

Forest Falls and Mountain Home. Some nests at this site have failed because of predation from jays or ravens (S. Loe pers. comm.).

4. Grand Canyon, Arizona

The Colorado River in the Grand Canyon is a popular rafting destination for 20,000 people each year (R.V. Ward pers. comm.). The National Park Service closed access to beaches adjacent to habitat where willow flycatchers were found during the breeding season, in an attempt to minimize disturbance. Tour companies and private permit holders were informed of the closures prior to beginning their river trips. Some of these beaches had been regularly used by commercial rafting companies, private kayakers and rafters, and backpackers (Tibbitts and Johnson 1999). Although closing beaches has not yet resulted in an increase in willow flycatchers at these sites, it demonstrates a significant positive action an agency initiated to protect this bird. Within the last few years, that policy changed because willow flycatchers did not reoccupy some previously occupied sites. Beaches are now closed only after willow flycatchers are found. For example, the beach at river mile 50.5 was closed after surveyors found willow flycatchers at the beginning of the 1999 field season. All commercial and private groups are required to check in with the Lees Ferry Ranger Station at the beginning of each trip. Each group is given current information on the status of nesting willow flycatchers and beach closures prior to each trip (R.V. Ward pers. comm.).

5. Hassayampa River Preserve, Arizona

Willow flycatchers have nested near a popular hiking trail at The Arizona Nature Conservancy's Hassayampa River Preserve for several years. The Nature Conservancy closes the trail during the nesting season to minimize disturbance to the willow flycatchers. In 1999, this trail remained closed during the nesting season as a protective measure even though no willow flycatchers were documented from surveys. Nesting probably did occur locally, because juvenile willow flycatchers were caught in mist nets in late July (M. Rigney pers. comm.).

6. Roosevelt Lake, Tonto National Forest, Arizona

Two willow flycatcher breeding populations at the inflows to Roosevelt Lake are managed by the Tonto National Forest. Disturbance from boaters is minimal, because they primarily use the lake area away from the currently occupied breeding populations. However, this area is heavily used by visitors from nearby Phoenix and the potential for recreation conflicts is significant. The Forest Service maintains a vehicle and fire closure at these sites, with perimeter fencing and signs. These closures substantially reduce the potential disturbance caused by off-road vehicles, day use, and camping (C. Woods pers. comm.). One newly occupied area outside the current closure is threatened by impacts from anglers and campers, with increased trailing and fire risk from campfires. Additional

measures may be taken to reduce risk in this new area.

7. San Pedro River Preserve, Arizona

The San Pedro River Preserve, managed by The Nature Conservancy, was established to protect southwestern willow flycatcher habitat. Patrolling and maintaining the perimeter fence to prevent off-road vehicle and cattle trespass have been the most effective ways of protecting habitat and promoting regeneration.

G. Management Recommendations

Managing recreation can be accomplished by altering visitor behavior to minimize impacts. Recreation user control ranges from complete restriction to some acceptable level of use (Moore 1989, Briggs 1996). This can be accomplished in a number of ways, including requiring permits, collecting user fees, limiting number of visitors, constraining visitor access or activities, instituting zoning or periodic closures, and limiting the frequency and duration of use (Cullen 1985, Purdy et al. 1987, Klein et al. 1995, DeLong and Schmidt in prep). We provide the following management guidelines to reduce recreation impacts on southwestern willow flycatchers and their habitat:

1. Provide protected areas.

Keep campsites and heavily used day use areas away from areas to be developed or maintained for flycatchers. Ensure protected areas are large enough to encompass breeding, foraging, and post-fledging habitat. Discourage unauthorized off-road vehicle use in riparian habitat with fencing or physical barriers.

Direct vehicles, boating, swimming, tubing, and fishing away from unoccupied and occupied suitable habitat, especially during the breeding season, where impacts are likely to negatively impact habitat or flycatcher behavior. Where potentially suitable habitat has been identified as future southwestern willow flycatcher habitat, these activities should be minimized to allow habitat to develop.

2. Reduce impacts from recreationists by promoting stewardship, educating users and maintenance workers, reducing unpredictable activities, reducing motorboat impacts, providing visual barriers, and reducing noise disturbance. Examples of how this can be accomplished are provided below:

Promote stewardship

Encourage individual recreationists and user groups to support riparian conservation, review management plans, and generate funds. Support their efforts to sponsor riparian clean-up, trail maintenance, field trips,

on-site monitors, and development and distribution of interpretive materials.

Educate users and maintenance workers

Sponsor programs and post signs that educate users about the value of riparian habitat to sensitive species. Clearly mark trails, campgrounds, and revegetation areas. Educate equestrians, boaters, and tubers about the value of overhanging branches to nesting birds. Encourage them to avoid trimming overhanging branches. Discourage campers and day users from feeding birds, to prevent increases in jays, ravens, and cowbirds.

Reduce negative impacts of annual or periodic maintenance

Ensure all facilities and grounds workers conduct activities compatible with protecting riparian habitat and species. Conduct annual or periodic maintenance outside the breeding season.

Reduce unpredictable activities

Design wildlife recreation activities that are predictable for wildlife (DeLong and Schmidt in prep). For example, provide well-marked trails or boardwalks to a) encourage controlled and predictable use, and b) discourage off-trail hiking and creation of alternate routes.

Reduce motorboat impacts

Reduce rapid overwater movement and loud noise, such as wake and noise from motorboats through speed limits and designated use areas (DeLong and Schmidt in prep).

Provide visual barriers

Increase distance between disturbance and wildlife or provide visual barriers (DeLong and Schmidt in prep). Provide a natural vegetation buffer in day use areas and along trails.

Reduce noise disturbance

Minimize noise disturbance near southwestern willow flycatcher breeding habitat. Birds are sensitive to vibration, which occurs with low-frequency noise (Bowles 1995). Such efforts include rerouting trails and day use areas away from occupied habitat, controlling the number of visitors, relocating designated shooting areas, and discouraging the use of electronic equipment (radios, "boom boxes") and off-road vehicles near breeding locations.

3. Confine camping areas.

Evaluate whether confining camping to a small concentrated number of campsites is less detrimental to wildlife and habitat than dispersal over a wide area. Institute fire bans when danger is high or where habitat is vulnerable, e.g., areas dominated by tamarisk (*Tamarix* spp.) See Appendix L for further guidelines. If campfires are authorized, confine them to fire boxes. Limit or prohibit fuel wood collecting in riparian areas.

4. Ensure fire plans are current, operable, and enforced.

Ensure fire fighting equipment and personnel are available.

5. Restore habitat impacted by recreation.

Where needed, post signs that explain the importance of habitat restoration, fence habitat, and/or temporarily close trails and use areas (Craig 1977). Because restoration of recovering habitat can be impeded by recreation, it is important to evaluate its potential for success before forging ahead with a project. For example, in a study of 27 riparian restoration projects, recreation was at least partly responsible for ecological deterioration of two sites and impeding recovery efforts at two other sites (Briggs 1992, Briggs 1996).

6. Place designated recreation shooting areas away from riparian areas.

Designated shooting areas used for target practice should be located away from riparian areas to minimize physical destruction of habitat and noise disturbance.

7. Minimize attractants to scavengers, predators, and brown-headed cowbirds.

Where recreation users congregate, provide adequate waste facilities (covered trash receptacles, restrooms) and regular collection service. Place horse stables away from suitable and occupied habitat. Avoid use of bird seed feeders that use cowbird preferred seeds such as millet.

8. Provide on-site monitors and enforcement where recreation conflicts exist.

Where potential recreation conflicts exist and total closure is not practical, provide on-site monitors to educate users and control use. Increase surveillance and/or impose fines for habitat disturbance or damage.

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I. Literature Cited

Please see Recovery Plan Section VI.