ATTACHMENT "D"

Appendix G.

Management of Livestock Grazing in the Recovery of the Southwestern Willow Flycatcher

A. Introduction

Breeding habitat for the southwestern willow flycatcher is restricted to riparian ecosystems. As a result of multiple factors, southwestern riparian ecosystems are among the most endangered in North America. In arid western North America, livestock overgrazing has detrimental effects on riparian ecosystems (Ames 1977, Knopf and Cannon 1982, Kaufman and Krueger 1984, Skovlin 1984, Fleischer 1996, Ohmart 1996, Belsky et al. 1999), including many of the attributes of southwestern willow flycatcher nesting habitat (USFWS 1995). However, the effects of livestock grazing vary over the range of the flycatcher, due to variations in grazing practices, climate, hydrology, ecological setting, habitat quality, and other factors. Also, other stressors affect the flycatcher's habitat to varying degrees, including water management practices, stream channel control, recreational use, and agricultural activities. In some situations, these and other factors may aggravate livestock impacts, and are sometimes difficult to separate from grazing effects. Livestock grazing has been a prevalent industry in the region for 200 years or more, but there exists a limited body of rigorous industry records or scientific research that documents livestock grazing affects on the environment (Larsen et al. 1998). Most of the available research has shown negative impacts to a host of biological resources. Addressing the issue of livestock management in the context of recovery of the southwestern willow flycatcher is therefore complicated.

Ideally, this issue would be approached by examining information that specifically compares the effects of various grazing practices on the southwestern willow flycatcher and its habitat. Because this information remains to be researched, the Technical Subgroup was compelled to approach the question indirectly by reviewing literature pertaining to grazing within riparian areas. Questions we tried to address included: What direct effects does grazing have on southwestern willow flycatchers? What are the effects of grazing on southwestern riparian ecosystems? On riparian vegetation specifically? On the plants and other habitat attributes that are key components of flycatcher habitat? On riparian birds that are ecologically similar to the flycatcher?

A large body of literature related to livestock grazing and impacts to riparian habitats, the willow flycatcher, and other riparian birds was reviewed. Much of this literature came from more mesic areas of the West where ecological conditions and riparian recovery potential differ from the arid Southwest. Convincing evidence from within and outside of the flycatcher's range comes from exclosure studies such as the San Pedro River (Krueper 1992), where after major stressors – principally livestock grazing – were removed, the riparian habitat, channel morphology, and riparian bird fauna improved substantially within five years (Figures 1- 4). Although these studies lack experimental rigor, they provide evidence that in riparian habitats where livestock grazing is the major stressor, exclosure may be the quickest method of accomplishing recovery. A critical question for the Technical Subgroup is – after full recovery of flycatcher habitat and

occupancy by flycatchers, what level of grazing (other than exclosure) may be compatible with the maintenance of the riparian habitat preferred by flycatchers?

Figure 1. Photopoint 22-B, Highway 90 and San Pedro River, San Pedro Riparian National Conservation Area, July 4, 1987. Photo courtesy of David J. Krueper, BLM.

Figure 2. Photopoint 22-B, San Pedro Riparian National Conservation Area, July 6, 1992, after five years of no grazing. Photo courtesy of David J. Krueper, BLM.

Figure 3. Photopoint 31, Greenbrush Draw and San Pedro River, San Pedro Riparian National Conservation Area, July 5, 1987. Photo courtesy of David J. Krueper, BLM.

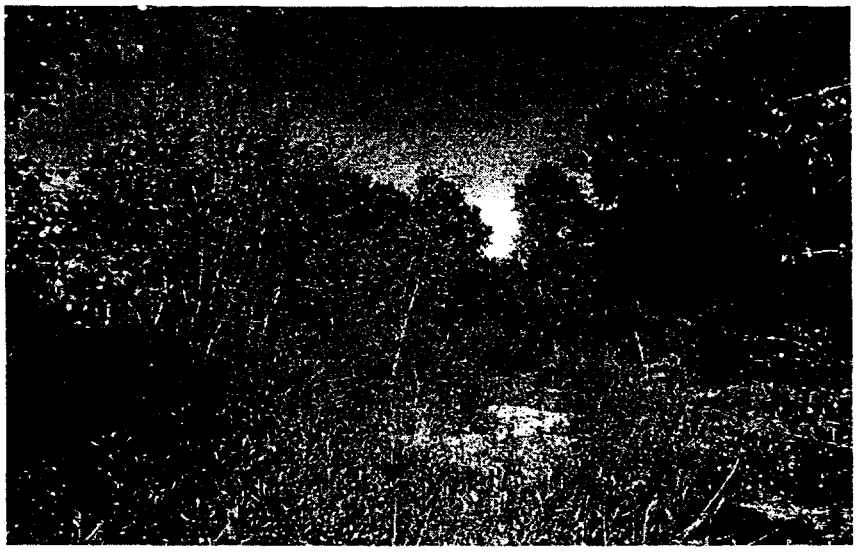

Figure 4. Photopoint 31, San Pedro Riparian National Conservation Area, July 17, 1992, after five years of no grazing. Photo courtesy of David J. Krueper, BLM.

While reading this document, it is important to remember that livestock grazing is not a single-faceted activity. Grazing has parameters of extensiveness (wide-spread), intensiveness (number of animals, season of use, various grazing systems), and species-specific (cattle, horses, elk, burros, sheep, goats, llamas, etc.). This discussion is intended to provide general concepts of potential impacts and management measures. The effects of each would vary among these parameters of livestock grazing. Concepts and recommendations expressed herein are derived principally from interpreting research on the effects of livestock on biological resources. The Technical Subgroup acknowledges that, as with domestic livestock, excessive utilization of herbaceous and woody vegetation can occur by ungulates such as elk (*Cervus elaphus*) (Kay and Chadde 1992, Singer et al. 1994, Wagner et al. 1995). Even in the absence of domestic livestock grazing, elk can over-utilize riparian areas if not properly managed (Treadaway et al. 1999), requiring some corrective measures to balance this pressure with maintenance of other ecological functions. Management of ungulates as game animals is the responsibility of State game agencies, and is largely beyond the scope of a livestock grazing review. This issue paper addresses grazing by domestic livestock; grazing and browsing by native ungulates will be discussed in the Southwestern Willow Flycatcher Recovery Plan.

B. How Livestock Grazing Can Impact Southwestern Willow Flycatchers

Impacts of livestock grazing on southwestern willow flycatchers and their habitat fall into several general categories. The primary impacts are on habitat availability and suitability. Of lesser severity are the impacts of destroying nests with eggs or young, and facilitating brood parasitism by brown-headed cowbirds. These impacts are discussed below.

1. Impacts on Habitat Availability and Suitability

Because livestock use riparian vegetation for forage, and because riparian plant structure largely defines southwestern willow flycatcher habitat, grazing can have a variety of effects on flycatcher habitat. Information on this impact exists in a variety of forms, and comes from a variety of sources and perspectives. This information fell into four general categories:

1. Overall effects of livestock grazing on southwestern riparian ecosystems.
2. The effects and/or sustainability of livestock grazing on selected plants.
3. Impacts of livestock grazing on willow flycatchers, other riparian birds, and their habitat.
4. Examples of southwestern willow flycatchers being present where livestock grazing also occurs.

Brief reviews of these information categories follow:

Effects Of Livestock Grazing On Southwestern Riparian Ecosystems

Improper livestock grazing has been a significant factor in the degradation of riparian habitats in arid western North America. Excessive grazing can change watershed hydrology, water quality, aquatic and riparian ecology, and structure and composition of riparian plant communities. In general, excessive grazing results in general drying of riparian areas, reduction in vegetation structure and volume, changes in vegetation composition, soil compaction, increases in sedimentation and water temperature, and other effects (see Bryant et al. 1972, Ames 1977, Carothers 1977, Evans and Drebs 1977, USDA Forest Service 1979, Platts 1982, Knopf and Cannon 1982, Rickard and Cushing 1982, Cannon and Knopf 1984, Kaufman and Krueger 1984, Klebenow and Oakleaf 1984, Skovlin 1984, General Accounting Office 1988, Clary and Webster 1989, Schultz and Leininger 1990, Elmore 1992, Fleisher 1996, Ohmart 1996, Belsky et al. 1999, and others). Excessive livestock grazing activities in uplands contribute to changes in surface runoff quantity and intensity, sediment transport, soil chemistry, and infiltration and water holding capabilities of the watershed; flood flows may increase in volume while decreasing in duration, and low flows may decrease in volume and increase in duration (Brown et al. 1974, Gifford and Hawkins 1978, Johnson 1992). However, Larsen et al. (1998) and Rinne (1999) point out that although a significant body of literature on the effects of grazing on riparian ecosystem components exists, very little of that literature is based on credible experimental research. Common problems include inadequate description of grazing practices under study, weak study design (e.g., lack of replicates, lack of random allocation of treatments, controls either absent or not independent from treatments), and lack of pre-treatment data. The last is an especially pernicious problem, because grazing has been a pervasive land use and recovery may take decades or longer. True controls are difficult to find.

The Technical Subgroup concluded that the preponderance of evidence indicates that excessive grazing is harmful to riparian habitats. Key attributes of southwestern willow flycatcher habitat (dense deciduous vegetation, high water tables) are among the riparian characteristics most affected by livestock grazing. Thus the evidence indicates that excessive livestock grazing is deleterious to flycatcher habitat. However, there are examples of breeding flycatchers existing with livestock grazing (see below). This presents the challenge, addressed by this document, of determining what types of grazing (including grazing intensity, season, and grazing systems) are compatible with conservation and recovery of the flycatcher.

Effects And Sustainability Of Livestock Grazing On Plants

On this topic, development of guidelines for grazing in flycatcher habitat is somewhat limited by lack of directly applicable data. Range science literature tends to examine livestock grazing from the perspective of economic and ecologic sustainability of livestock production, economic sustainability of key forage plants, physiological sustainability of certain forage plants or plant associations, and maintaining or enhancing overall range condition. It is difficult to translate these measurements of grazing into effects on the primary attributes of southwestern willow flycatcher habitat. For example, grazing effects on willows that are physiologically "sustainable" by individual plants may not sustain the type of willow foliage volume and structure that constitutes flycatcher habitat. To characterize a grazing system as "sustainable" by the survival of individual willows says nothing regarding the effects on other key factors such as regeneration, ground cover of

herbaceous plants, soil compaction, etc. Further, most literature on grazing effects and sustainability of riparian vegetation originates in regions other than the southwest, where differences in conditions of climate, hydrology, and regional flora limit their application in the southwest. For example, most southwestern willow flycatchers are not found in shrubby willows, but in higher-stature habitats dominated by tamarisk, tree willow, boxelder, or Russian olive. As true for ecosystem levels of assessment, studies on the effects of grazing (heavy versus light or no grazing) on riparian vegetation tend to be compromised by lack of true controls, weak methodologies, and inaccurate or overly broad quantification of grazing intensity and ecological effects (Larsen et al. 1998).

Willows can become a principal source of cattle browse as other more palatable forage resources are depleted or as the palatability of the alternate forage decreases (Kovalchik and Elmore 1992). While in Oregon most browsing damage to willows occurs in late summer (Kauffman et al. 1983, Smith 1982), in the arid southwest such damage may occur at other times, and at greater intensities, because of the more limited alternate forage (Skovlin 1984, Belsky et al. 1999). Willow seedlings may be a preferred forage. As long as palatable herbaceous forage is available in the riparian zone, willow utilization generally remains minor in Oregon (Kauffman et al. 1983). In Oregon, mid- to late-season grazing indicates that cattle begin utilizing the current annual growth on willows when riparian forage use reaches about 45% (4- to 6-inch stubble height), and cattle eat all the willows they can when herbaceous utilization is 85% or more (< 2 inches) (Kovalchik and Elmore 1992). Along the Verde River in Arizona, livestock use of woody shrubs and trees increased during dry winters when herbaceous forage was limited or upland range conditions were poor (Tonto National Forest, unpubl. data). During dry winters use of woody shrubs and trees increased greatly after bud break, which typically occurred in late February to early March (Tonto National Forest, unpubl. data). Cattle display a strong preference for remaining in riparian zones because of the availability of shade, water, and forage. This preference can lead to further habitat degradation that, typically, would not be captured in standard vegetation utilization monitoring. For example, stream bank alteration monitoring by the Tonto National Forest on the Verde River showed that the proportion of alterable stream banks showing degradation (e.g., bank sloughing, compaction, removal of vegetation) reached 100% well before use of woody vegetation by livestock reached the established threshold of 40% (Tonto National Forest, unpubl. data).

The available literature indicates that in some areas and depending on the type of herbaceous forage available, negative impacts on woody riparian vegetation (e.g., willows) can be avoided by not allowing stubble height of herbaceous vegetation to be reduced below 3 to 6 inches (Cook et al. 1967, Cook and Harris 1968, Clary and Webster 1989). Also, cattle generally prefer grasses and forbs to woody vegetation, at least when the herbaceous vegetation is green (Gillen et al. 1985, Holechek and Vavra 1983, Kovalchik and Elmore 1992, Vavra et al. 1980). Therefore, some use of palatable grasses and sedges can occur without undesirable browsing of riparian shrubs and streambank damage (Clary and Webster 1989, Kauffman and Krueger 1984, Kauffman et al. 1983, Kovalchik and Elmore 1992, Platts and Nelson 1989). Damage to stream banks can further be avoided by implementing guidelines established by Fleming et al. (2001). They recommend that the extent of alterable stream banks remaining un-vegetated should not exceed 10%. Alterable stream banks are those portions of banks containing exposed soil or vegetation and that are not composed of bedrock, boulders, or large cobbles.

The applicability of these observations to riparian habitat in the arid Southwest is limited by three factors: 1) The

majority of these studies originate outside the Southwest, in more cool and moist climates where upland forage is more abundant; 2) Herbaceous vegetation (understory) was not treated as a significant component of habitat but is sometimes a significant component of flycatcher habitat, so utilization by livestock equates to some reduction in this habitat attribute; 3) These studies concern themselves with avoiding excessive impacts or unsustainable use of woody vegetation. The criteria for defining these concepts (e.g., "excessive" or "unsustainable") are not always provided, and are not likely to be the same as the criteria for avoiding negative impacts to the woody vegetation component of flycatcher habitat.

Mosley et al. (1997) suggested the following guidelines for stubble heights in riparian systems in Idaho: 1) stubble height of 3 to 4 inches for sedges, tufted hairgrass, and similar species following the growing season; 2) two inches for Kentucky bluegrass; 3) four to 6 inches for large bunchgrasses; and 4) utilization of riparian shrubs should not exceed 50 to 60% during the growing season. However, some researchers caution against recommendations that call for a uniform level of utilization or stubble height to maintain riparian attributes because these recommendations ignore the inherent complexity of riparian systems (Green and Kauffman 1995).

Many riparian shrub species appear to be more tolerant of leaf and twig removal than shrubs inhabiting drier sites. For example, Lammon (1994) reported that planeleaf willow could sustain 58 to 70% utilization. Riparian shrubs are generally more tolerant of browsing because they benefit from greater water availability to support plant growth. However, as noted above, willows that can physiologically sustain these use levels may not ecologically sustain southwestern willow flycatchers. Also, the effect of grazing and browsing on willow reproduction is a concern because willow seeds are short-lived and are not stored in soil seed banks (Brinkman 1974, Densmore and Zasada 1983). First-year willow seedlings can be especially sensitive to browsing. Shoots and roots at this age are generally less than 12 and 8 inches in length, respectively. Browsing of first-year shoots often kills the entire plant, because the plants are easily pulled from the ground or are killed by trampling (Kovalchik and Elmore 1992). However, mature willows have been shown to reproduce well as long as herbaceous utilization in riparian systems does not exceed 70%; at greater utilization willow reproduction is compromised (Mosley et al. 1997).

Excessive livestock grazing can have a considerable effect on vegetation, resulting in depressed vigor, biomass, and altered species composition and diversity (Bryant et al. 1972, Evans and Drebs 1977, Knopf and Cannon 1982). Excessive grazing pressures in riparian zones can significantly reduce herbaceous vegetation (Kauffman et al. 1983, Marcuson 1977) and browse (Kauffman et al. 1983, Knopf and Cannon 1982). Within the riparian zone, livestock use of browse is related to availability and palatability of herbaceous vegetation, and the palatability of the available browse (e.g., tamarisk is generally considered to be relatively unpalatable to livestock). In addition, excessive grazing pressure can prevent the establishment of seedlings (Carothers 1977, Glinski 1977). By high-lining (consumption of forage up to the maximum height of the animal) riparian deciduous shrubs or trees, or removing low-level vegetation altogether, browsing reduces the vegetation's suitability for supporting nests, may increase nest detectability to predators, and reduces foraging options. This may be a greater problem in monotypic, shrubby type habitats than in higher-stature habitats. Changes are somewhat insidious as habitat at a gross scale may persist, and condition or trend may require several years to determine under continued livestock management.

Throughout their evolutionary history, willow flycatchers probably inhabited vegetation that was grazed and browsed by large herbivores (Burkhardt 1996, see also Appendix F). More than 20 now extinct large herbivorous mammals (>45 kg) inhabited the Western United States and Mexico during the Late Quaternary (Martin and Szuter 1999). These were in addition to the nine extant large herbivores. Thus, over evolutionary time, large herbivores used riparian zones to an unknown level but probably not to an intensity that significantly reduced habitat suitability. Platts (1991) asserted that prior to European contact, "wild ungulates usually grazed within the carrying capacity of the range. If forage produced by a given range suddenly became scarce or nonexistent, wild grazing animals either moved to more favorable ranges or perished, bringing populations into balance with range capacity." Additionally, migratory herbivores – by their behavior of migration – inherently yield rest periods for their forage (Frank 1998). Perhaps more importantly than forage/consumer feedback mechanisms, predators (including humans [Martin and Szuter 1999]) played an important role in the condition of vegetation. Kay (1998) asserts that during the Pleistocene, herbivores were predator limited, and not food limited. Over much of the West, large predators have been extirpated enabling large herbivores, including livestock, to over-use the range. Predator prey dynamics of large herbivores and carnivores can have marked effects on riparian bird populations mediated through changes in the habitats (Berger and Stacey, In prep.).

The ecological equivalency of native large herbivores during the Pleistocene to domestic livestock is open to debate. Livestock management is characterized by constraints on movement (fencing) and predator control. Cattle are not frequently herded (Platts and Nelson 1989), and thus will concentrate activity in streamside zones during the spring and summer growing periods.

The Technical Subgroup concluded that the scientific literature on browsing of riparian shrubs and trees, in particular, was inadequate to determine levels of browse that are detrimental or acceptable for flycatcher habitat. Shrub and tree survival do not directly equate with suitable willow flycatcher habitat, particularly with consideration of the flycatcher's preference for dense foliage from the ground up. No studies evaluated or tested grazing levels with habitat metrics such as foliage volume or foliage height diversity.

Effects Of Livestock Grazing On Willow Flycatchers, Other Riparian Birds, And Their Habitats

At this time, specific effects of livestock grazing on southwestern willow flycatcher habitat have not been defined through experimental research. The effects are inferred from more general investigations. Southwestern willow flycatcher habitat is generally typified by high plant density and moist conditions; grazing in riparian habitats can result in reduction of plant density and a drying of riparian habitats. Not all riparian areas in the southwest are southwestern willow flycatcher habitats. However, because grazing can negatively impact riparian ecosystems in general, it follows that southwestern willow flycatcher habitat can be affected. Therefore, the Technical Subgroup concludes a negative correlation between prolonged or heavy grazing and presence of quality flycatcher habitat is probable.

Another strategy to help define the impacts of livestock grazing on the flycatcher is to examine the documented effects of grazing on other willow flycatcher subspecies, other riparian birds that are often associated with and/or ecologically similar to the flycatcher, and their habitats. We reviewed published information on the effects of livestock grazing on riparian birds, and evaluated those findings for their relevance to managing for recovery of the southwestern willow flycatcher (Table 1). As noted above regarding the general literature on environmental effects of grazing, the studies summarized are somewhat compromised by inadequate description of grazing practices, including level of grazing, intensity, lack of replication, and lack of pre-treatment data. With that qualification, the studies show that improper grazing is deleterious to many riparian birds. That southwestern willow flycatchers probably fall into the group that are harmed is supported by the fact that the Great Basin willow flycatcher (*Empidonax traillii adastus*) was harmed. Within the range of grazing practices examined, winter grazing and lighter grazing intensities had lesser negative effects than heavier grazing, summer grazing, or year-round grazing. Similarly, riparian habitats were rehabilitated most quickly and/or completely with no grazing (Ohmart 1996), and more quickly with light and/or winter grazing than with heavy, summer, and/or year-long grazing. Certainly, more research is needed to evaluate differences in rates of riparian recovery under total exclusion versus fall-winter, winter, and early spring grazing regimes. As with the literature on overall ecological effects of grazing, much of the literature on effects of grazing on riparian birds originates from outside the Southwest - generally from the Great Basin and Sierra Nevada. However, this literature is considered relevant because riparian habitats in the arid range of the southwestern willow flycatcher are more vulnerable to livestock impacts than these more mesic regions. As shady, cool, wet areas providing abundant forage, they are disproportionately preferred by livestock over the surrounding warm, xeric uplands (Ames 1977, Johnson 1989, Kauffman and Krueger 1984, Belsky et al. 1999). The negative effects of livestock grazing are typically more severe in warmer, drier environments.

Southwestern Willow Flycatchers Coexisting With Livestock Grazing

In some locations, southwestern willow flycatchers breed at sites which experience some degree of livestock grazing. The sites described below are located in exceptionally large floodplain riparian areas, where riparian conditions are of distinctive quality and extent. These examples indicate that under certain circumstances, flycatchers can exist with livestock grazing. Although both livestock and flycatchers occur together, specific data on grazing practices are not yet available, effects on riparian vegetation are not documented, and long-term trends (>10 years) of the resident flycatchers are either fluctuating or unknown. The lack of experimental data on the impacts of grazing to habitat and consequent responses by flycatchers leaves questions of coexistence, suitability, and compatibility unanswered. Translating these examples into refined management prescriptions that allow both grazing and flycatcher recovery will require improved documentation and monitoring of grazing practices, research into effects on riparian habitats, and continued monitoring of flycatcher populations.

The South Fork of the Kern River, California

A relatively large population of southwestern willow flycatchers occurs on the Kern River in south-central California. This population has fluctuated from 44 pairs in 1989 to 27 pairs in 1992, 38 in 1997, 26 in 1998, and 12 in 2000 (Whitfield et al. 1998 and pers. comm.). The variation in these numbers, and that they have been supported in part by cowbird trapping since 1993 (Whitfield et al. 1998), suggest that while the population persists, it may not be stable. The South Fork of the Kern River presents a nearly ideal setting for extensive, high-quality flycatcher habitat. It is a low-gradient broad floodplain with perennial stream flow and a high water table. Riparian habitat is present as a kilometer-wide cottonwood-willow forest with extensive marshy conditions. The Kern River Preserve was established in 1981, and grazing was significantly reduced in that year. Harris et al. (1987) believed that terminating grazing along parts of the South Fork of the Kern River resulted in increases in riparian vegetation and, consequently, nesting southwestern willow flycatchers (Figures 5 and 6).

Livestock presence now varies from year to year with roughly 70% of the flycatcher population occurring in areas grazed at least occasionally. All flycatcher areas that have grazing have light to moderate winter grazing. Except for removing spring/summer grazing, researchers do not believe that flycatcher numbers were significantly affected by the different grazing regimes (M. Whitfield pers. obs.). Data from grazed and ungrazed areas on the Kern River are not comparable because the areas are intrinsically different. Three components of this situation merit mention. First, grazing at the Kern River Preserve is not part of an annual grazing scheme but is conducted at the preference of the Preserve Manager, who determines ecological conditions, as well as on and off dates for livestock. Second, the Preserve comprises 1,127 acres which allows close monitoring of ecological conditions and efficient removal of livestock when conditions warrant removal. Third, forage production of perennial grasses on property adjacent to the Preserve has been measured at a level of biomass that is rarely found in other riparian systems within the range of the southwestern willow flycatcher. During a recent "wet" year, production estimates from a wet meadow on this property were approximately 4,000 and 11,000 pounds/acre in April and June, respectively (M. Whitfield pers. comm.). In the same year, production estimates from an alkaline meadow on the

property during April and June were about 2,700 and 2,400 pounds/acre, respectively.

Figure 5. Kern River Preserve driveway in 1988 following about 6 years of no grazing. Photo courtesy of M. Whitfield, Kern River Preserve.

Figure 6. Kern River Preserve driveway in 1998 following about 16 years of no grazing. Photo courtesy of M. Whitfield, Kern River Preserve.

Table 1. Summary of literature examining effects of livestock grazing on riparian birds.

Citation	Location	Site information	Study objectives	Methods & parameters measured	Conclusions	Relevance to southwestern willow flycatcher habitat	Other
1,2	Arapaho NWR, Colorado	Elevation: 2,500 m (8200 ft) Sage-brush outside of flood plain. 8 spp of *Salix*.	Avian community response to differences in seasonal (winter vs. summer) grazing patterns. Both seasons experienced heavy grazing.	2-year study, avian community surveys; multiple vegetation measurements at bird-centered and random points	Bird community segregated into groups that were sensitive, insensitive, and benefited by summer grazing. Sensitive species (e.g.,WIFL') used locations based on bush spacing. Grazing impacts primarily through the horizontal patterning of the vegetation community.	WIFL' density 0.2/ha in winter grazed, absent in summer grazed. Significant correlations include height of bush (+,2/2), mean height of nearest bushes (+,½), standing biomass of herbaceous layer (-,½), distance to nearest bush (-,2/2), # of dead stems (+,2/2).	Suggests willows in winter-grazed are healthy, summer grazed are decadent; due in part to drier soils and vegetation. BHCOs' more common in summer-grazed. Downplays height relationship as biased by territorial behavior, not necessarily important in patch selection.
3	Lower Truckee River, Nevada	Elevation and adjacent vegetation not reported; pictures suggest sagebrush,	Compare breeding bird abundance between 1868 (Ridgway) and 1972-76.	Ridgway's undefined "rare, common, abundant" categories compared with more-clearly defined categories from multiple transect (2x2 km) surveys and 25 km survey.	Both + and – changes in the avifauna, WIFL' common in 1868, not detected in the 1970-80 samples.	Identifies multiple assaults on riparian system since 1868. Protection of 1 site from grazing, troubled by persistent trespass, shows some habitat recovery.	Some interpretation problems, lack of any information on livestock grazing intensity, uncontrolled for other practices.
4	Mountain Meadows	generic	literature review and recommendations			Relative to grazing, recommends eliminating grazing or delaying it until mid-August.	

Table 1. Summary of literature examining effects of livestock grazing on riparian birds.

Citation	Location	Site information	Study objectives	Methods & parameters measured	Conclusions	Relevance to southwestern willow flycatcher habitat	Other
5 & 6	Malheur National Wildl. Refuge, Oregon	Southeastern Oregon, fenced and irrigated pastures.	Response of yellow warbler and willow flycatcher' abundance to changes in grazing intensity.	Bird density and grazing intensity. Two bird data sets: BBS routes over 10-years and 9 strip surveys for 2 years within pastures under different livestock management.	On Breeding Bird Survey (BBS) routes, abundance of WIFLs' increased from nearly 0 during 1" 5 years to 18-30 during last 4 years of a 10-year period when AUM's decreased by about 75% (120k to 30k AUM) over the same period. When the transects are ordered by frequency of cattle grazing on an annual basis, clear negative correlation.	Reduced grazing increases willow production and enhances bird productivity. WIFL' #s not substantial until shrub volume > ≈900 m' / 100m transect.	Removal of willows by grazing appeared to be the mechanism. WIFL's' habit of nesting within 2 m of the ground made them especially vulnerable.
7	Central Sierra Nevada, California	Elevation: 1525-2285m (5000-7500 ft) Montane meadows.	Document livestock grazing impacts and protection measures.	Bird territory and nest monitoring over multiple years in three meadows. Two study sites fenced to restrict livestock except during early spring and late-fall drop-off and round-up.	Livestock directly caused 20% WIFL' nest loss, and damaged another 20% post-fledging. Reduced stocking (40%) and delayed on-date (after July 15) for 75% of remaining livestock eliminated nest losses.	Areas grazed intensively for drop-off and round-up provided nesting habitat. Controlling stock numbers and retarding on-dates reduce conflicts apparently because forage remains more abundant away from nesting areas, thus diminishing the attractiveness of the wet meadow area later in the season.	Prior to the grazing management change, WIFL' nests were destroyed by livestock from early July through mid-August. Nests were not destroyed earlier in the season, presumably due to the abundance of succulent forage, drinking water and cool climate earlier in the season and the wetness of the meadows earlier in the summer.

Table 1. Summary of literature examining effects of livestock grazing on riparian birds.

Citation	Location	Site information	Study objectives	Methods & parameters measured	Conclusions	Relevance to southwestern willow flycatcher habitat	Other
8	Southeast Wyoming	Elevation: 2225-2380 m (7300-7800 ft)	Compare birds and habitat at two willow riparian sites with different grazing history: 1) AUMs from >5,000 in 1920s to 900 after 1967, July 1- 30 Sept. season of use; 2) currently (and recent) 1,750 AUMs from 6 June to 30 Sept (prior grazing "overuse").	3-year study, random shrubs and bird species-defined shrubs as point centers to compare shrub density and tunneling effects.	Where grazing intense, *Empidonax* spp used shrubs in density the same as available (ca. 950/ha), whereas where grazing lighter, *Empidonax* spp. used shrubs in less dense (mean about 950/ha) areas than available (ca 2000/ha). Tunnel heights lower on lighter-grazed area, but no relationship with grazing discussed.	Suggests that flycatchers select for a patchy distribution of willows, a condition for which livestock can be used to achieve. However, distribution needs to be controlled to prevent detrimental effects.	SPECIES OF EMPIDONAX NOT DISCLOSED. However, other species discussed are WIFL associates. Tunnel floors were covered by grasses and sedges, suggesting the grazing intensity was relatively low.
9	Nevada & Idaho	Elevation: 1875-1966 m (6150-6450 ft) sagebrush surroundings.	Compare birds in 2 paired grazed (grazing intensity not reported) and un-grazed (excluded for 11 years, light trespass grazing) of high elevation riparian zones.	Measured vegetation cover by growth form. Willow clumps recorded average stem diameter and average stem height, biomass estimated by equation. Birds were spot-mapped from > 10 visits both in 1988 and 1989.	Herbaceous plants differed significantly between grazed and un-grazed. Aspen differed significantly. A large difference between willow standing crop biomass was masked by extreme variation. Non-willow, large shrub biomass was significantly greater in grazed than un-grazed. No meaningful differences in bird species richness, total bird density, and bird biomass between grazed and un-grazed. *Empidonax* spp, presumed to be dusky flycatchers had slightly higher (45.3) on grazed vs. (33.8 pairs/40 ha) un-grazed sites.	Mid-to-late summer grazing (intensity unknown) caused significant changes in herbaceous vegetation and aspen regeneration, and perhaps modified willow standing crop. Differences in riparian bird community were slight.	Only one location had willows. By written description and bird species identified, the other area unlikely to have been WIFL' habitat. The discussions here refer only to the more potentially suitable pair of study plots. Small mammal communities differed between the grazed and un-grazed areas.

Table 1. Summary of literature examining effects of livestock grazing on riparian birds.

Citation	Location	Site information	Study objectives	Methods & parameters measured	Conclusions	Relevance to southwestern willow flycatcher habitat	Other
10	Carson Range, Nevada	Elevation: 1920 m (6298 ft) Montane meadow, surrounded by lodgepole and Jeffrey pine and white fir.	Compare vegetation structural differences between a 30-year rested and summer-grazed (cattle and sheep, typically 24 cow-calf units) area; both between 25-30 ha. Compare differences in predation rates on active and artificial nests. No grazing during year of study; thus, differences suggested to be the result of grazing-induced habitat change on predators, and not on the presence of the livestock per se.	Cover within quadrants classified by growth form and the height of the top vegetation layer. Nest searches and monitoring at 4-5 day intervals. Artificial nests experiments in three designs; 1) simulating natural placements of habitat generalists [n = 30 ground and 30 above-ground each]; 2) in willows within 15m of channel [15 ground and above-ground each]; and 3) willows distant (>100m) to stream [15 ground and 15 above-ground nests, each]	Willows more abundant within 15 m of stream on un-grazed. Artificial nests were more successful on un-grazed than grazed plot in all above-ground, but not in the on-ground nests in experiment 1 & 2. Real nests were significantly more successful when grouped, but not for on-ground or above-ground categories.	Long-term grazing may alter productivity via changes in predation pressure; i.e., changes in abundance and make-up of predator community; changes in predator behavior or nest detectability; or decreasing the nesting opportunities of nesters.	No replications in study.
11	Multiple	Various	Literature review and meta-analysis of 9 published empirical grazing/breeding bird studies. Grazing intensity not specified.	Species assessed in >1 study; differences between treatments > 25%, and majority in same direction (harm, benefit)	Eight species benefit from grazing, 17 impacted, and 18 unresponsive or inconsistent responses. Species impacted were nesters and/or foragers in heavy shrub or herbaceous ground-cover, and/or vulnerable to nest parasitism.	Grazing (unspecified intensity, system, etc.) has detrimental effects on some riparian species – especially those occupying the vegetation utilized by WIFLs.	Literature review.

Table 1. Summary of literature examining effects of livestock grazing on riparian birds.

Citation	Location	Site information	Study objectives	Methods & parameters measured	Conclusions	Relevance to southwestern willow flycatcher habitat	Other
12	San Pedro River, Arizona	Elevation: 1097-1280m (3600-4200 ft) Ecotone between Sonoran and Chihuahuan Deserts	Case study of riparian community recovery and changes in bird density.	4 years after livestock exclusion, under-story vegetation increased (documented with before/after picture). Spot mapping of bird populations.	No grazing, more under-story vegetation, marked increase (consistent and > 2x) in most (7) of the neotropical migrants studied (10).	Species positively responding in density are likely associates of WIFLs[c]. Remove grazing, habitat improvement measurable within 4 years.	Uncontrolled case study.
13	See 5 & 6	See 5 & 6	Response of avian community to changes in grazing intensity.	See 5 & 6.	Willow volume significant negative correlation with frequency of grazing, positive correlation with the time since last grazing. Passerine abundance correlated with shrub volume and shrub heights between 2-6 m, but not for shrubs 1 m high. Same for bird species richness.	WIFLs' only present on 4 areas: most WIFLs' (average 14.3-18.0 males) where livestock excluded for 40 years & maximum shrub volume. Second average 10.3-12.3 males) was 6-yeas of exclusion (1 winter graze) and 2nd greatest shrub volume. Other 2 (averages; 3.7-4.0 males and 0.7-1.3 males, respectively) sites were 7th & 4th in terms of shrub volume. No WIFL' use in most recently grazed or impacted units.	One site had reduced passerine abundance than expected based on shrub volume. Accounted for by the heavy camping pressure on the site.

Table 1. Summary of literature examining effects of livestock grazing on riparian birds.

Citation	Location	Site information	Study objectives	Methods & parameters measured	Conclusions	Relevance to southwestern willow flycatcher habitat	Other
14	Western US	Various	Summarize impacts of livestock grazing on fish & wildlife resources of riparian habitats.	Literature review & pertinent personal observations.	Demonstrable effects of grazing on all forms of wildlife. Suggests impacts to migrants as well as residents (unsupported).	[page 270] "The best way to manage riparian habitats is not to graze them. [Page 272] "With total rest, most systems...show tremendous change within 8-10 years. & "with managed grazing riparian healing time is twice and maybe 4 times longer than exclusion."	Brief discussion of livestock as management tool – but notes that examples of [well] managed riparian grazing are so few and [poor] unmanaged grazing so common that this tool is meaningless. Identifies a couple of cases of good riparian habitat under some grazing regimes.
15	Northeast California, Northwest Nevada	Great Basin	Compare bird and small mammal densities in "heavily" grazed and un-grazed examples of 6 habitat types; one of which (Aspen) appears (based on plant and animal species encountered) to be possibly relevent to WIFLs'. The un-grazed Aspen site had livestock exclusion for 87 years.	Vegetation sampled in twenty 1m² plots every 5 m along line transects. Height and species composition of the canopy, mid-story and under-story, % cover and count of rooted species. Birds inventoried on 1-mile strip census on 3 consecutive mornings.	Relative to grazed site, un-grazed had lush 1-m deep under-story of forbs. Young aspen and willow in the mid-story. Mid-story almost absent on grazed. Litter 2x as deep on un-grazed site compared with grazed. *Empidonax* sp. density was 21/100 acres on un-grazed, and 8/100 acres on grazed. Total avian density was 792 and 385 birds / 100 acres on the un-grazed and grazed site, respectively. Both treatment and control had a group of unique species.	"Heavy" grazing eliminated the mid-story (shrubby vegetation. Bird species community reflected these changes.	Sites were paired based on its equivalent site potential (as per Daubenmire), not proximity. No replicates. Besides "heavy," grazing not quantified.

[a] Great basin willow flycatcher, *Empidonax traillii adastus*

[b] Brown-headed cowbird, *Molothrus ater*

[c] Southwestern willow flycatcher, *E. t. extimus*

1. Knopf et al. 1988.
2. Knopf, F. 1999. Pers. comm
3. Klebenow and Oakleaf 1984
4. Sanders and Flett 1989.
5. Taylor and Littlefield 1984.
6. Taylor and Littlefield 1986.
7. Valentine et al. 1988.
8. Krueger and Anderson 1985.
9. Clary and Medin 1992.
10. Ammon and Stacey 1997.
11. Bock. et al. 1993.
12. Krueper 1993.
13. Taylor 1986.
14. Ohmart 1996.
15. Page et al. 1978.

The Cliff-Gila Valley, New Mexico

In the Cliff-Gila Valley of the Gila River in southwestern New Mexico, the largest known population of southwestern willow flycatchers exists. With roughly 200 nesting pairs, this area constitutes a substantial portion of the subspecies' total numbers. This reach of the Gila River presents a unique combination of natural and manmade factors affecting flycatcher habitat. The area has highly favorable hydrological conditions for flycatcher habitat - a broad floodplain with perennial low-gradient streamflow. Some streamflow is diverted onto the floodplain to irrigate pastures, and ranch operators have allowed extensive riparian vegetation to develop along field edges, irrigation ditches, and return flow courses (Figure 7). Although water is diverted from the Gila in this area and upstream, the river is not regulated by dams upstream. Significant floods occur periodically, as in the El Niño events of 1979, 1983, and 1993, and a 1997 flood caused by Pacific typhoon Nora (Stoleson pers. obs.). Thus, natural hydrological functions like floodplain wetting, scouring, flushing of salts, and sediment deposition still occur. During the 1997 event for example, streambanks were damaged in a few areas but in general much sediment was deposited, which has resulted in substantial regeneration of riparian vegetation. Some sediment beds from earlier floods support more advanced regeneration, some of which has become occupied by flycatchers recently (S. Stoleson pers. comm.).

The majority of the Cliff-Gila population is contained in 20 riparian patches on a private ranch. Of these, two are grazed nearly year-round, seven are in a pasture grazed in late fall and winter, and the remaining 11 have had grazing excluded since approximately 1993 but are adjacent to pastures that are grazed periodically throughout the year (S. Stoleson pers. comm.). It is difficult to characterize the grazing in this area. It is closely managed; there are no fixed rotations or stocking rates, rather cattle are rotated among pastures based on visual assessments of range quality. Half of the floodplain pastures are used for off-season grazing only, and the other half are used year round. Pastures are a variety of irrigated permanent pastures, dry pastures, and fields planted in forage crops. The relative proportions of these pasture types varies from year to year. It is possible that the irrigated pastures, which are used extensively in the dry months of May and June, provide the cattle with better quality forage than they might extract from riparian vegetation. Cattle often seem to enter the riparian patches only to drink and seek shade, but not to forage (S. Stoleson pers. comm.).

A significant change in management that provided a potential short-term benefit to flycatcher habitat was the increase in water diversions to irrigate pasture and forage cropland. In approximately 1993, ranch operators experienced an increase in water available for diversion. The additional water was used to rehydrate old irrigation ditches to irrigate several pastures and fields. Stoleson (pers. comm.) suspects that any increases in flycatchers in recent years are directly related to the increase in hydration of the floodplain and corresponding changes in vegetation. The two habitat patches with the most flycatchers (49 and 41 pairs in 1999) are adjacent to irrigated fields where water runs off and produces a densely vegetated, swampy area.

Figure 7. Cliff-Gila Valley, New Mexico, October 1998. Photo taken by S. Sferra, USBR.

The Technical Subgroup is unable to conclude that the livestock management activities at the Kern River and Gila Valley are, on the whole, either detrimental or beneficial to the flycatcher. Similarly, it is unclear whether current management will sustain suitable habitat in the long-term. It is difficult to draw conclusions in the absence of better quantitative and/or experimental data. In both situations, livestock operators have access to alternative pastures in addition to the riparian areas discussed, so their ability to relieve pressure on the riparian areas is increased. Water is relatively abundant in both areas. This factor illustrates that with sufficient water, options for managing flycatchers and other resource uses are substantially increased, and conflicts are likely to be reduced. With sufficient water, riparian and aquatic ecosystems are more resilient and more capable of supporting multiple demands. Despite the above uncertainties, the Technical Subgroup commends these landowners and livestock managers for considering the flycatcher in decisions regarding grazing. The current grazing programs appear to be compatible with the current flycatcher population levels. The Technical Subgroup also commends these managers for enabling researchers to study these important populations. These areas present opportunities for continuing and refining very important research.

2. Destroying Nests with Eggs or Young

In some habitats, livestock may contact flycatcher nests or supporting limbs while watering, foraging, shading, or resting in riparian areas. This may result in destruction of the nest, or loss of eggs or nestlings. This impact is probably most common in high-elevation (1800 m or 6000 ft), low-stature monotypic willow stands. In the Sierra Nevada (the little willow flycatcher, *Empidonax traillii brewsteri*) Valentine et al. (1988) observed four of 20 studied nests destroyed by livestock prior to the young fledging. Additionally, four other nests were destroyed by livestock within days after they fledged young - demonstrating that more nests were susceptible. Strikingly, some of the losses occurred in cattle exclosures that were not adequately maintained. Susceptibility of the nests to livestock was attributed to their low height within the shrubs (approx. 1.5 m or 5 ft), small diameter of their supporting limbs, proximity to water, low branch density near the nests, and proximity to shrub edges. However, the height to which livestock can affect willow flycatcher nests is unknown (Valentine et al. 1988). Loft et al. (1987) illustrated that heavy grazing can reduce the cover attributed by willow up to at least 1.5 m (5 ft). Because southwestern willow flycatcher nest heights vary considerably, so does the magnitude of this threat. For example, southwestern willow flycatcher nests have been reported at heights from 0.6 to 18 m (1.9 to 59 ft) (Sogge et al. 1997). Herbivores have probably always grazed riparian zones over the willow flycatcher's evolutionary history, suggesting that the source of loss is not unique to domestic livestock; however, its frequency may now be out of the species range of variation, especially in low stature habitats. The grazing intensity over that pre-European contact period may well have been sufficiently different from that experienced under current livestock management. Clearly, the biological significance of livestock toppling of nests is large when the entire flycatcher population is low and the number of habitats occupied is few.

3. Facilitating Brood Parasitism by Brown-headed Cowbirds

Livestock grazing can facilitate brood parasitism by brown-headed cowbirds (*Molothrus ater*). Livestock grazing in and adjacent to riparian habitat may provide cowbirds with greater access to southwestern willow flycatcher nests, improve foraging opportunities, and establish foraging areas closer to flycatcher nesting areas. Cowbirds can impact southwestern willow flycatcher productivity even when the grazing is remote (> 8 km or 5 mi) from the flycatcher's nesting habitats (Curson et al. 2000, Rothstein et al. 1984). However, these impacts are variable and site specific. Because cowbird parasitism varies geographically and temporally, data on cowbird abundance, distribution, and levels of nest parasitism must be gathered locally. These data are essential to determine the extent to which cowbird control or cowbird habitat management via livestock management efforts are justified (see Appendix F; cowbird parasitism and management).

C. Measures That Can Be Taken To Alleviate Livestock Impacts

The fundamental approach to recovering an endangered species is to remove the threats to its existence, whether they are contamination, persecution, loss of habitat, or others. In the case of livestock grazing and the southwestern willow flycatcher, our approach was to examine the available information to determine as specifically as possible the degree and the conditions under which livestock grazing is compatible or incompatible with flycatcher recovery. This effort was undertaken because of a desire to avoid recommending undue or unnecessary restrictions on a widespread, traditional land use industry.

With the southwestern willow flycatcher, the effort to fine-tune recovery recommendations with respect to livestock grazing is worthwhile, as livestock operators, biologists, and management agencies increasingly learn that much can be accomplished by working together. However, the primary responsibility of the Technical Subgroup is to chart the recovery of the southwestern willow flycatcher. The goal of a recovery plan is to recommend actions that will bring about recovery of a species. The evidence and field examples indicate that with respect to livestock grazing, southwestern willow flycatcher recovery would be most assured, and in the shortest time, with total exclusion of livestock grazing from those riparian areas that are deemed necessary to recover the flycatcher and where grazing has been identified as a principal stressor. There is also evidence that under the right circumstances, certain types of grazing are likely to be compatible with recovery. While the data are insufficient to identify specifically what grazing systems are compatible in which specific circumstances, exploring the levels of grazing that may be compatible with maintenance of suitable flycatcher habitat is warranted.

During five separate meetings with Implementation Subgroups associated with the Recovery Team, individuals representing the ranching industry repeatedly underscored the importance of maintaining flexibility within livestock management operations. Evaluation of the current system of public lands grazing leads to the conclusion that there is little or no flexibility because allotments are either all committed to permittees or have been withdrawn from grazing for various conservation or other purposes. When permittees find themselves in a situation where the allotment needs rest, their choices

may be limited to selling their livestock, finding alternative pastures or private land to graze, and/or continuing to graze the allotment. There is no grass bank for public lands grazing. Also, contemporary public land managers are frequently compelled to manage livestock grazing and a variety of other resource uses and values without adequate staff and funding. In some cases, livestock grazing is conducted in the context of management unit boundaries that may be constraining to flycatcher recovery and inappropriate for the complexities of modern ecosystem-based resource management. Modifications to these management unit boundaries may be necessary to achieve recovery goals. Therefore, in addition to specific recommendations (Table 2), the following general recommendations are made, encouraging Federal land managers to undertake a major conservation planning initiative to:

1. Identify the most important riparian areas for the recovery of the southwestern willow flycatcher and riparian and aquatic organisms in general.
2. Identify the most appropriate areas for permitting livestock grazing given the biodiversity concerns for the particular land management unit.
3. Reconfigure grazing pasture boundaries to reflect the true productivity of rangelands associated with important flycatcher recovery areas, and allow differential management of units of varying ecological sensitivity.
4. Exclude livestock from sites where exclusion would result in the greatest ecological improvement and least economic loss.
5. If monitoring is less than annual, establish livestock use numbers based on drought years, not the average or wettest years, to provide for livestock operations that are viable given this region's propensity to experience prolonged drought. With annual monitoring, adjust livestock levels in response to reduced forage availability, poor vigor and physiological stress on forage plants, and/or decreased cover brought on by drought conditions.
6. Establish an adequate number of ungrazed areas at different elevation and geomorphic settings. These will provide land management agencies and researchers with a much-needed series of sites against which to compare the condition of grazed watersheds (Brinson and Rheinhardt 1996) (see #8 below).
7. Institute and/or improve record-keeping and documentation of grazing practices, retroactively where possible, so that the ecological effectiveness of various grazing practices can be more scientifically evaluated (see #8 below).
8. Work with state universities, private colleges, and research institutions to fund and facilitate research that better defines the ecological and hydrological effects and sustainability of livestock grazing in southwestern ecosystems, particularly southwestern riparian ecosystems.

These recommendations strive to promote flexibility within the confines of conserving willow flycatchers. With flexibility and proper grazing management, grazing may be compatible with recovery and conservation of the southwestern willow flycatcher and other riparian species. This conservation planning effort and adjustment of managing public lands grazing should be completed within the next five years. In the interim, the Technical Subgroup is challenged with providing

specific recommendations that will begin the process of recovery. After thoughtful and thorough review of the scientific literature, and much deliberation, the Technical Subgroup is confident there is common ground between the needs of the livestock manager and the southwestern willow flycatcher. Both prosper from efforts that sustain the quality of the landscape. The preponderance of evidence indicates that conservative stocking rates and light-to-moderate utilization levels are generally effective in maintaining range condition while increasing individual animal (livestock) performance (Johnson 1953, Klipple and Costello 1960, Paulsen and Ares 1962, Martin 1975, Houston and Woodward 1966, Holechek 1992, Winder et al. 2000). In all cases, the uniqueness of each area needs to be recognized and considered in developing a management strategy.

Accepting that conservative management is a logical beginning point, the Technical Subgroup recognizes that the spatial and temporal flexibility remaining within the context of conservative management will, by necessity, be further reduced for purposes of recovering the critically endangered southwestern willow flycatcher and the riparian habitats upon which it depends. Recommendations the Technical Subgroup believes will begin the process of recovery while promoting ecologically sustainable grazing practices are presented below (Table 2). A precept of these recommendations is that grazing has been identified as the major stressor, or one of the major stressors. Recommendations are based on the best information available on the effects of livestock on southwestern riparian ecosystems, on selected plant types, and on willow flycatchers and other riparian birds. Because of the impacts discussed in this document, this information in general points toward cessation of grazing to accomplish recovery. However, the information reviewed here also suggests some degree of compatibility between grazing and flycatcher recovery, under certain circumstances. This table explores the variability in southwestern willow flycatcher habitats, grazing systems, and ecological considerations of plant phenology. Southwestern willow flycatcher habitats are allocated to two broad categories. These are the lower stature willow habitats often found at higher elevations (>1,830 m or 6,000 ft), and taller stature habitats found at lower elevation typically comprised of willow, cottonwood, boxelder, tamarisk, and associated trees and shrubs. Grazing is separated into growing season and non-growing season of woody riparian vegetation (non-growing season is from leaf drop to bud break of common woody riparian species).

The recommendations do not address the myriad other grazing variations. This issue paper does not address specific locations where these recommendations should be implemented, but rather identifies management for general categories of sites. Therefore, the recommendations for domestic livestock grazing presented in Table 2 should be interpreted as general guidelines that should be applied according to site-specific conditions (see summary on page G-31). Specific watersheds or portions of watersheds for implementation of recovery actions are identified in the main body of this plan, in the form of recovery goals (e.g., total number of flycatchers, acres of habitat, and distribution of these across the range).

The intent of these general grazing guidelines is to promote recovery of the southwestern willow flycatcher while allowing conservative livestock grazing where appropriate and to provide flexibility for adaptive management in order to maintain or enhance southwestern willow flycatcher habitat. We recognize that private lands will play an important role in the recovery of the flycatcher, and that coordination and cooperation with private landowners and public grazing permittees

is critical to the success of this recovery effort. In order to provide incentives for private landowners and public grazing permittees to improve and manage for southwestern willow flycatcher habitat, flexibility through adaptive management must be an integral part of the recommended grazing guidelines. Therefore, if a particular grazing system is improving southwestern willow flycatcher habitat (e.g., grazing system is not preventing regeneration of woody and herbaceous riparian vegetation), then that particular grazing system should be allowed to continue provided it is appropriately monitored and documented.

Table 2. General guidelines for domestic livestock grazing in southwestern willow flycatcher habitat.

Site Conditions			**Site-Specific Guidelines**	
Habitat Status	**Flycatcher Status**	**Season**	**Low-Stature Habitat: 3-4m shrubby willow**	**All other habitat types ≤1830 m or 6000 ft elevation**
1. Restorable or Regenerating Habitat[1]	1A. Unoccupied	Growing Season[2]	No grazing.	No grazing.
	1B. Unoccupied	Non-Growing Season	No grazing.	Provisional grazing[3] (assumes grazing is not a major stressor).
2. Suitable Habitat	2A. Unoccupied	Growing Season	No grazing.	No grazing, but at discretion of USFWS, provision for a limited number of small-scale, well-designed experiments to determine levels of pre-breeding season grazing that do not adversely affect southwestern willow flycatcher habitat attributes. Grazing not to exceed 35% utilization of palatable, perennial grass or grass-like plants in uplands and riparian habitats, and extent of alterable stream banks showing damage from livestock use[4] not to exceed 10%.[5]
	2B. Unoccupied	Non-Growing Season	Conservative grazing with average utilization not to exceed 35% of palatable, perennial grasses and grass-like plants in uplands and riparian habitats, and extent of alterable stream banks showing damage from livestock use not to exceed 10%. Woody utilization not to exceed 40% on average.	Conservative grazing with average utilization not to exceed 35% of palatable, perennial grasses and grass-like plants in uplands and riparian habitats, and extent of alterable stream banks showing damage from livestock use not to exceed 10%. Woody utilization not to exceed 40% on average.
	2C. Occupied	Growing Season	No grazing.	No grazing until research in comparable unoccupied habitat demonstrates no adverse impact; if unoccupied habitat becomes occupied habitat, continue existing management (grazing should not exceed 35% of palatable, perennial grasses and grass-like plants in uplands and riparian habitats, and extent of alterable stream banks showing damage from livestock use not to exceed 10%).

Table 2. General guidelines for domestic livestock grazing in southwestern willow flycatcher habitat.				
	2D. Occupied	Non-Growing Season	No grazing.	Conservative grazing with average utilization not to exceed 35% of palatable, perennial grasses and grass-like plants in uplands and riparian habitats, and extent of alterable stream banks showing damage from livestock use not to exceed 10%. Woody utilization not to exceed 40% on average.
3. Uplands & Watershed Condition [6]	3. Occupied & Unoccupied	For any season of use	Average utilization of palatable, perennial grasses and grass-like plants not to exceed 30-40%. Use stubble height guidelines: 3" for short grass, 6" for midgrass, 12" for tall grass. Determine monitoring species prior to grazing.	Average utilization of palatable, perennial grasses and grass-like plants not to exceed 30-40%. Use stubble height guidelines: 3" for short grass, 6" for midgrass, 12" for tall grass. Determine monitoring species prior to grazing.

[1]"Restorable" means riparian systems that are degraded but have the appropriate hydrological and ecological setting to be restored to suitable flycatcher habitat, and could be restored with reasonable costs and actions. Lack of regeneration due to grazing is one factor contributing to habitat degradation; conditions in each habitat should include adequate plant regeneration to ensure habitat sustainability into the future. At these sites, flycatcher habitat is precluded largely or solely by livestock impacts. "Restorable" habitats are those that would be suitable if not for grazing, alone or in combination with other major stressors. This means cessation of grazing is a necessary, but not necessarily a sufficient action.

[2]Growing season is defined as bud break to leaf drop for cottonwood and willow species. Non-growing season is defined as leaf drop to bud break for cottonwood and willow species.

[3]Grazing should only be conducted if it is not a major stressor and does not preclude satisfactory progress toward suitability.

[4]Damage to stream banks from livestock use includes: bank chiseling, trampling, trailing, soil compaction, breakage of vegetation, bank sloughing, etc.

[5]Alterable stream banks are those portions of banks containing exposed soil or vegetation and not composed of bedrock, boulders, or large cobbles (Fleming et al. 2001).

[6]Uplands and watersheds, or portions of watersheds, associated with areas identified as restorable, regenerating, or suitable southwestern willow flycatcher habitat. General guidelines should be implemented unless site-specific data clearly indicate that deviation from the guidelines will not prevent or slow progression toward suitability and/or maintenance of suitable habitat conditions.

The guidance provided in Table 2 is based on the current endangered status of the southwestern willow flycatcher. Flexibility will increase with the eventual downlisting of the flycatcher to threatened status. Overall, the best available information suggests that flycatcher recovery is most assured with no grazing in its habitat during the growing season. In some situations, some light to moderate levels of grazing during the non-growing season may be compatible with flycatcher recovery , if carefully managed and closely monitored. Where grazing is indicated in Table 2, the following set of conditions apply:

1. All grazing is to be accompanied by monitoring. If funding is not sufficient to allow monitoring, then grazing should be discontinued. Monitoring should include exclosed areas, where possible, in riparian habitat on allotments or pastures where grazing has been discontinued, as well as allotments or pastures where grazing is allowed to continue.
2. The target for total utilization of palatable, perennial grasses and grass-like plants should not exceed 35% (±5% to accommodate sampling error) in upland and riparian habitats. Utilization of 35% not only includes direct consumption, but also includes other factors associated with herbivory (e.g., trampling, trailing, bedding). With monitoring, stocking rates may be adjusted to current forage production each year (White and McGinty 1997).
3. Stubble height baselines should have a forage/acre figure associated with them, if possible, so the baseline is not established for areas that are too poor to graze.
4. Annuals are excluded from the forage base because reliance on annuals indicates overuse of perennial grasses and grass-like plants and woody riparian vegetation.
5. The target for utilization of woody vegetation at the pasture level is 40% (±10% to accommodate sampling error), meaning the removal of 40% of the biomass of the current year's growth. This not only includes direct consumption but also includes other factors associated with herbivory (e.g., trampling, breakage of vegetation).

Consideration of uplands is essential. Elmore and Kaufman (1994) reported that "simply excluding the riparian area (from grazing) does not address the needs of the upland vegetation or the overall condition of the watershed. Unless a landscape-level approach is taken, important ecological linkages between the uplands and aquatic systems cannot be restored and riparian recovery will likely be limited." Livestock grazing may alter the vegetation composition of the watershed (Martin, 1975, Savory 1988, Valentine 1990, Popolozio et al. 1994). It may cause soil compaction and erosion, alter soil chemistry, and cause loss of cryptobiotic soil crusts (Harper and Marble 1988, Marrs et al. 1989, Orodho et al. 1990, Schlesinger et al. 1990, Bahre 1991). Cumulatively, these alterations contribute to increased erosion and sediment input into streams (Johnson 1992, Weltz and Wood 1994). They also contribute in changes to infiltration, water holding capacity of the watershed, and runoff patterns, thus increasing the volume of flood flows while decreasing their duration (Brown et al. 1974, Gifford and Hawkins 1978, Johnson 1992). As a result, groundwater levels may decline and surface flows may decrease or cease (Cheney et. al. 1990, Elmore 1992).

1. Narrative Interpretation of Table

Row 1A (Unoccupied restorable habitat in growing season):

Low Stature Habitat: 3-4 m monotypic shrubby willow at high elevation (> 1,830 m or 6,000 ft)

At sites where the goal is to restore habitat to suitable for flycatchers no grazing is recommended, because most of the nesting structure is within the zone of direct livestock impact. This habitat type is highly susceptible to direct impacts, and slow to recover due to the short growing season. With a goal of restoring habitat, the best possible conditions for hydrological recovery, regeneration, and growth of vegetation are desired. The literature indicates exclusion of grazing will facilitate this. For this habitat and the next three (through row 1B), note that the transition from "restorable" habitat to "suitable" habitat will be a regulatory decision made by USFWS with input from land managers, based on habitat attributes discussed in Appendix D.

All other habitat types < 1,830 m or 6,000 ft.

At sites where the goal is to restore habitat to suitable for flycatchers, no grazing is recommended. With a goal of restoring habitat, the best possible conditions for hydrological recovery, regeneration, and growth of vegetation are desired. The literature indicates exclusion of grazing will facilitate this.

Row 1B (Unoccupied restorable habitat in non-growing season):

Low Stature Habitat: 3-4 m monotypic shrubby willow at high elevation (> 1,830 m or 6,000 ft)

The goal is to restore habitat to suitable for flycatchers. No grazing is recommended, because this habitat type is highly susceptible to impacts. With a goal of restoring habitat, the best possible conditions for hydrological recovery, regeneration, and growth of vegetation are desired. The literature indicates exclusion of grazing will facilitate this.

All other habitat types < 1,830 m or 6,000 ft.

The goal is to restore habitat to suitable for flycatchers. No grazing is preferred, but provisional grazing is considered possible if grazing is not a major stressor. With a goal of restoring habitat, the best possible conditions for hydrological recovery, regeneration, and growth of vegetation are desired. Grazing must not preclude satisfactory progress toward suitability. In situations where other significant stressors occur, those should be removed, and the significance of grazing as an additive or synergistic stress should be considered.

Row 2A (Unoccupied suitable habitat in growing season):

Low Stature Habitat: 3-4 m monotypic shrubby willow at high elevation (> 1,830 m or 6,000 ft)

The goal is to maintain and/or enhance flycatcher habitat attributes. No grazing is recommended, because this habitat type is highly susceptible to fragmentation and impacts. With a goal of maintaining and enhancing habitat, the best possible conditions for maintaining hydrological integrity, and maintenance, regeneration, and growth of vegetation are

desired. The literature indicates exclusion of grazing will facilitate this.

All other habitat types < 1,830 m (6,000 ft)

The goal is to maintain and/or enhance flycatcher habitat attributes. No grazing is recommended, because with a goal of maintaining and enhancing habitat, the best possible conditions for maintaining hydrological integrity, maintenance, regeneration, and growth of vegetation are desired. The literature indicates exclusion of grazing will facilitate this.

Regarding grazing research, the intent is to collect information that may allow changes in these recommendations, if appropriate. This grazing research offers a reasonable complement to excluding grazing from most of the sites in this category, and is crucial to refining our understanding of grazing effects on riparian ecosystems. Here as elsewhere, documentation and monitoring of grazing systems and effects is important.

Row 2B (Unoccupied suitable habitat in non-growing season):

Low Stature Habitat: 3-4 m monotypic shrubby willow at high elevation (> 1,830 m or 6,000 ft)

The goal is to maintain and/or enhance flycatcher habitat attributes while providing an alternative to no grazing. Grazing is allowed at specified intensities because literature from the Pacific Northwest and other areas indicates these rates of utilization on herbaceous and woody plants can be sustained by the plants. Effects on flycatcher habitat characteristics are not known. Grazing utilization rates must be monitored with emphasis on collecting data that will provide an opportunity to modify this and other recommendations in the future.

All other habitat types < 1,830 m (6,000 ft)

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Row 2C (Occupied suitable habitat in growing season):

Low Stature Habitat: 3-4 m monotypic shrubby willow at high elevation (> 1,830 m or 6,000 ft)

The goal is to maintain and/or enhance flycatcher habitat attributes, and protect nesting flycatchers. All current breeding flycatchers are important to recovery. No grazing is recommended, because this habitat type is highly susceptible to fragmentation and impacts, and flycatcher nests are vulnerable to direct disturbance. The literature indicates exclusion of grazing will avoid these impacts.

All other habitat types < 1,830 m (6,000 ft)

The goal is to maintain and/or enhance flycatcher habitat attributes, and protect nesting flycatchers. All current

breeding flycatchers are important to recovery. No grazing is recommended, because effects of heavy grazing are known to be deleterious. Effects of light or moderate growing-season grazing on flycatcher habitat are not specifically known. The literature indicates exclusion of grazing will avoid these impacts. Some field examples (e.g., Cliff-Gila Valley) indicate that under some circumstances, flycatchers persist with grazing during the growing season. However, the general effects are unknown. Research is needed to define the relationships and thresholds involved. If research is completed on comparable unoccupied sites, grazing may be considered, at intensities below thresholds that degrade flycatcher habitat.

Row 2D (Occupied suitable habitat in non-growing season):

Low Stature Habitat: 3-4 m monotypic shrubby willow at high elevation (> 1,830 m or 6,000 ft)

The goal is to maintain and/or enhance flycatcher habitat attributes. All current breeding sites are important to recovery. No grazing is recommended, because this habitat type is highly susceptible to fragmentation and impacts. This habitat type may be particularly vulnerable in the non-growing season when snow covers alternate forage plants. Effects of heavy grazing even in non-growing season are known to be deleterious. Effects of light or moderate grazing on flycatcher habitat are not specifically known. The literature indicates exclusion of grazing will avoid these impacts.

All other habitat types < 1,830 m (6,000 ft)

The goal is to maintain and/or enhance flycatcher habitat attributes. All current breeding sites are important to recovery. Conservative grazing is allowed at specified intensities because literature from the Pacific Northwest and other areas indicates these rates of utilization on herbaceous and woody plants can be sustained by the plants. Effects on flycatcher habitat characteristics are not known. Several field examples (e.g., Kern River) demonstrate that flycatchers persist with this grazing system in some situations.

Row 3 (Uplands and watershed condition, all seasons):

Low Stature Habitat: 3-4 m monotypic shrubby willow at high elevation (> 1,830 m or 6,000 ft)

The goal is to rehabilitate and maintain uplands and watersheds in conditions that will facilitate restoration of southwestern willow flycatcher riparian habitat. Evidence suggests this conservative grazing regime will achieve this goal (see Table 1). Monitoring species must be determined prior to grazing, and monitoring must take place.

All other habitat types < 1,830 m (6,000 ft)

The goal is to rehabilitate and maintain uplands and watersheds in conditions that will facilitate restoration of southwestern willow flycatcher riparian habitat. Evidence suggests this conservative grazing regime will achieve this goal (see Table 1). Monitoring species must be determined prior to grazing, and monitoring must take place.

*2. **Summary:***

This issue paper does not address specific locations where recommendations contained herein should be implemented, but rather identifies management for general categories of sites. Because of the variability associated with riparian systems, these recommendations should be interpreted as guidelines that must be applied according to site-specific conditions. The uniqueness of each area needs to be recognized and considered in the development of site-specific management strategies. Specific watersheds or portions of watersheds for implementation of recovery actions are identified in the main body of this Recovery Plan (e.g., total number of flycatchers, acres of habitat, and distribution of these across the range).

The Technical Subgroup recommends against growing-season grazing in southwestern willow flycatcher habitat. Within the range of grazing practices examined, winter grazing and lighter grazing intensities had lesser negative effects than heavier grazing, summer grazing, or year-round grazing. Similarly, riparian habitats were rehabilitated most quickly and/or completely with no grazing, and more quickly with light and/or winter grazing than with heavy, summer, and/or year-long grazing. Research is needed to define the relationships and thresholds involved. A reasonable complement to excluding grazing is to provide for a limited number of small-scale, well-designed, and adequately funded experiments to determine appropriate levels of pre-breeding season grazing. This grazing research is crucial to refining our understanding of grazing effects on riparian systems.

Development of refined management prescriptions that allow both grazing and flycatcher recovery will require improved documentation of grazing practices. The need for monitoring is fundamental. The Technical Subgroup recommends that grazing be discontinued if not accompanied by monitoring. Monitoring should include exclosed reference areas in riparian habitat, where possible, on allotments or pastures where grazing has been discontinued, as well as allotments or pastures where grazing is allowed to continue.

D. Literature Cited

Please see Recovery Plan Section VI.