# WORK PLAN FOR THE COMPLETION OF YELLOW-BILLED CUCKOO HABITAT EVALUATION AND ENHANCEMENT PLANS FOR BAKER AND HOGBACK CREEK AREAS

prepared for

**Los Angeles Department of Water and Power**
and
**Inyo County Water Department**

prepared by

**Ecosystem Sciences**

FINAL
April 22, 2004

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## Introduction

This work plan sets forth the tasks that will be performed by Ecosystem Sciences (ES) and their subcontractors to fulfill the requirements of Sections III.A and III.A.1 of the 1997 Memorandum of Understanding between the City of Los Angeles Department of Water and Power, the County of Inyo, the California Department of Fish and Game, the California State Lands Commission, the Sierra Club, and the Owens Valley Committee (MOU). For the purposes of this work plan, the agencies and organizations that are the signatories to the MOU are collectively called the "MOU Parties."

## MOU Direction and Goals

The MOU directs under Section III.A. (Studies, Evaluations, and Commitments) on Page 23, that --- "under the direction of DWP and the County, Consultants and their associates will conduct the following studies and evaluations. Except as otherwise provided in this section, these studies and evaluations will be completed within three years of the discharge of the writ. …"

1. Yellow-Billed Cuckoo Habitat.
   Consultants will conduct an evaluation of the condition of Yellow-billed Cuckoo habitat in the riparian woodland areas of Hogback and Baker Creeks shown on Figure 5 [of the MOU]. Based on that evaluation, Consultants will develop, as they deem warranted, Yellow-billed Cuckoo Habitat Enhancement Plans for these areas. Each plan will identify reasonable and feasible actions or projects to maintain and/or improve the habitat of the Yellow-billed Cuckoo. In developing the plans, the Consultants will consider the recommendations for these areas that were identified in the Distribution of Breeding Riparian Birds in Owens Valley, Inyo County, California (Laymon and Williams 1994) and will confer with DWP, the lessee for each area and the Parties.

Under the direction of DWP and the County, the Consultants and their Associates have five major assignments:

1. Evaluate the condition of the YBC habitat in the riparian woodland areas of Baker and Hogback Creeks within DWP lands.
2. Based on the evaluation, develop Yellow-billed Cuckoo Habitat Enhancement Plans, as they deem warranted, for these areas.
3. The plans will identify reasonable and feasible actions or projects to maintain and/or improve the habitat of the YBC.
4. In developing the plans, consider the recommendations for the Baker and Hogback Creek areas identified by Laymon and Williams (1999 and 1994).
5. In developing the two plans (Hogback and Baker creeks), confer with the lessee for each area and each of the MOU Parties.

As the MOU directs, the Consultants must consider the recommendations of Laymon and Williams (1994 and 1999) in the preparation of the plans, including the identification of enhancement alternatives. The Laymon and Williams 1999 report is provided in its entirety as Appendix 1 to this work plan. The recommendations contained in the 1994 and 1999 reports are provided in Appendix 2.

Further, the MOU provides that "Actions or projects recommended by these studies and evaluations will be presented to the Board of Water and Power Commissioners for approval and implementation as soon as possible following the completion of the study or evaluation and after compliance with CEQA."

## Budget

If after the approval of this work plan, before work is conducted that would incur additional expenses that cannot be covered by ES without exceeding the overall funds in the attached budget, concurrence on completing the work must be obtained by ICWD and LADWP. ES will contact LADWP and ICWD to discuss and resolve the issue.

## Phased Approach to Attain MOU Goals

The development of YBC habitat enhancement plans will be performed in three phases. During the first phase, existing site information regarding existing YBC habitat conditions at Baker and Hogback creek areas will be reviewed and new information will be collected as needed. Based on this information, in the second phase, alternatives will be developed to maintain and/or enhance YBC habitat in both areas. The alternatives will include monitoring and adaptive management measures and reporting protocols. Under the third phase, final habitat enhancement plans will be prepared for Baker and Hogback creeks. Phase II alternatives will be reviewed by the lessees for the areas and the MOU Parties. Following consultation with these parties, the Consultants, will finalize the content of the YBC plans. CEQA requirements will be determined and, following approval by LADWP's board, the plans will be implemented.

## Team Approach

In fulfilling the requirements of the MOU with regard to this project, Ecosystem Sciences will utilize a team of experts. This work plan describes the work that will be performed by each team member. Where the work plan calls for a team member(s) to prepare a report, the report will be released as written by the author(s).

## Phase I – Evaluation of YBC Habitat Conditions at Hogback and Baker Creeks

**TASK 1:** The following subtasks will be performed. Additional expertise as required to assist in the evaluation may be sought at the discretion of the Principal Scientists.

1. Steve Laymon and Otis Bay will review the existing vegetation maps, other data, and reports prepared by Whitehorse Associates and other maps and information previously collected and assembled by ES. Based on this review and field

verifications (if necessary), any additional information needed to accomplish the Phase II tasks will be identified.

The information to be reviewed will include:

ES Baker Creek Grazing Parcel Description
- Existing grazing
- maps

ES Hogback Creek Parcel Description
- Existing grazing
- Maps

ES Yellow-billed Cuckoo Enhancement: Methodology for Yellow-billed Cuckoo microhabitat suitability
- methods
- result tables
- maps

ES Sampling Protocols for the Yellow-billed Cuckoo habitat evaluation and enhancement plans for Baker and Hogback Creeks
- protocols overview
- vegetation plan maps for Baker and Hogback
- ES review of WHA plan mapping assessment
- WHA plan mapping assessment

ES Baker and Hogback Creeks Yellow-billed Cuckoo Enhancement Photographs and Associated Maps
- landscape photos and map
- recreational impacts and map
- transect fixed photopoints and map

ES 11x17 Maps of Baker Creek:
- aerial photo and locator
- vegetation community types
- YBC suitable habitat
- fire and rare plant parcels
- grazing fence lines and pastures
- recreation access roads, trails, and photo points
- data transects and data points
- landscape photo points

ES 11x17 Maps of Hogback Creek:
- aerial photo and locator
- vegetation community types
- YBC suitable habitat
- grazing fence lines and pastures
- recreation access roads, trails, and photo points

- data transects and data points
- landscape photo points
- topographic maps

WHA Baker Creek Area Inventory and Assessment, 2000 Conditions

WHA Hogback Creek Area Inventory and Assessment, 2000 Conditions

WHA 5.0 Enhancement Alternatives (for Baker Creek)

2. If it is determined that information in addition to that described above is needed, Steve Laymon or Otis Bay will direct or conduct the collection and presentation of the additional data.
3. Otis Bay, with assistance from Frank Smith, will prepare descriptions of vegetation conditions and vegetation maps. Whether the existing vegetation maps are used or new maps are developed, the final maps produced under this task will include the following information:
   - Quantification and delineation of aerial extent and width of forest stands
   - Polygons with assigned vegetation community names based on dominant species (to the association or series level), allowing for the distinction between black locust and native forest. Plant community polygons will be attributed with a species list.
   - Riparian forest polygons attributed with data on species composition, forest structure, understory conditions, and the status of recruitment of native and non-native trees and perennial understory vegetation.
   - The status of highlining within and on the edges of the forest patches, including the criteria used to make these determinations.
   - The location and extent of rare plants and any other unique ecological features (e.g. bogs).
   - Dominant soil types.

4. Using the vegetation maps and habitat data developed in the previous subtask, Steve Laymon will develop descriptive categories (high, medium, low, and unsuitable) for current YBC habitat using a habitat suitability model or other appropriate tools. A report describing the environmental characteristics used in the model as well as the results will be produced. A table will be included in the report that displays, for each forest patch, the index or measurement used for each characteristic and the model result.

5. Steve Laymon, with assistance from Ecosystem Sciences, will develop descriptions and GIS data layer maps of other site conditions for Baker and Hogback creeks that include:
   - Characterization of public access and uses, including any problems caused by these uses

- Existing grazing management

- Irrigation schedules and water sources based on past practices by the lessee

- Fire frequency and extent, including whether a fire was initially a prescribed burn, how long it took the forest to recover, whether some vegetation changes appear permanent, and the vegetation conditions prior to the fire (especially for the area north of the willow forest at Baker Creek)

- The role of natural and anthropomorphic hydrologic conditions in sustaining the existing vegetation and habitats

- Existing fences; springs, seeps, and streams; irrigation ditches and diversions; and areas where Yellow-billed Cuckoos have been observed

6. Steve Laymon and Otis Bay, with assistance from Frank Smith will jointly prepare a Task 1 report with maps describing all of the methods and results from the Task 1 subtasks. The maps will be provided as hard copies, pdf files, and ArcView shape files showing polygons attributed with vegetation data, including all species observed and their cover values. The report, all subreports, and any other work products requiring review will be concurrently submitted to LADWP, ICWD, and ES.

**TASK 2:** Ecosystem Sciences will prepare a Phase I report based on the work products from Task 1 and submit concurrently to LADWP, ICWD, Otis Bay, and Steve Laymon. Maps will be provided as hard copies, pdf files, and ArcView shape files showing polygons attributed with vegetation information described above. The Task 1 report will be included as an appendix to the Phase I report.

## Phase II – Recommendations and Alternatives

**TASK 1:** Steve Laymon and Otis Bay will evaluate the reports and maps prepared during Phase I and will also conduct field surveys as needed to assess the existing conditions at Baker and Hogback creeks. Based on this information, management alternatives to maintain and/or improve habitat for YBC at Hogback and Baker creeks will be identified. Additional expertise as required to assess alternatives such as appropriate planting (reforestation) practices and criteria may be sought. As part of this Task, each of the subtasks shown below will be performed.

- Steve Laymon, with assistance from Otis Bay, will describe and prioritize potential new habitats that could be developed and improvements that could be made to existing habitats, including areas that could support natural forest expansion and/or native tree planting based on depth-to-water, soil EC, soil type, and other pertinent environmental conditions.

- Otis Bay and Steve Laymon will identify management alternatives that would improve and expand YBC habitats at the Baker and Hogback creek areas. Each management alternative will:
  - Have clearly described habitat goals, objectives, and desired future conditions for Hogback and Baker creeks (goals will include both qualitative descriptions and quantitative measurements)
  - Be tailored to the blocks of contiguous vegetation and habitat, considering desired future conditions and allowing for the expansion of forest habitat
  - Be designed to promote recruitment and to improve the recovery of the burned forest at the Baker Creek area
  - Include, where appropriate, planting of willows and cottonwoods and understory vegetation
  - Take into account the need to preserve rare plant populations and unique ecosystems

- Otis Bay and Steve Laymon will evaluate the following management options identified by ES as additional actions to improve and enhance YBC habitat:
  - Change plant species composition from exotic species to a more diverse composition of native plants, i.e., plant cottonwood, willows and other native plant species.
  - Increase the overall extent of riparian habitat (native plant species) by planting willows and cottonwood.
  - Reduce the habitat fragmentation
  - Do not allow woodcutting in the Baker and Hogback Creek areas.
  - Following a fire, burned areas should be rested (no grazing) for at least 2 years.
  - Control public access to Baker and Hogback Creek areas.
  - Following a fire, selectivity thin black locust to decrease competition to native woody riparian plant species.
  - Prohibit grazing in pastures that are occupied by Cuckoos between June through September.
  - Rearrange pasture fences to manage livestock distribution and avoid overuse of riparian habitat.
  - Maintain the vegetation understory.

- Steve Laymon will explain how the management alternatives address each of the concerns and recommendations identified by Laymon and Williams (1994 and 1999) and presented in Appendix 2, or provide reasons why they should not be addressed.

- Otis Bay and Steve Laymon will describe monitoring, data analysis, and adaptive management measures for each recommendation. Monitoring will be capable of quantitatively assessing the effectiveness of management, determining whether goals are being met, and confirming compliance with management strategies. The purpose and methods of monitoring and data analysis should be described. The monitoring plans will identify triggers for implementing adaptive management.

- Otis Bay and Steve Laymon will describe a protocol for annual reporting to LADWP and ICWD the results of monitoring and data analysis, conditions and effectiveness of management, the basis and need for adaptive management measures, and monitoring and management planned for the coming year.

- Otis Bay and Steve Laymon will develop preliminary estimates of work required to implement each management alternative and associated monitoring and adaptive management measure.

Otis Bay and Steve Laymon will prepare a Task 1 report describing the methods and findings from the subtasks described above. The maps accompanying the report will be provided as hard copies, pdf files, and ArcView shape files. The report and any other work products requiring review will be concurrently submitted to LADWP, ICWD, and ES.

**TASK 2:** Ecosystem Sciences, with assistance from Steve Laymon and Otis Bay, will prepare a report providing the following supplemental planning information. The report will be concurrently submitted to LADWP and ICWD.

- Describe how management alternatives from Task 1 differ from existing management practices.
- Describe how evaluation and planning related to YBC habitat will be coordinated with and integrated into land management planning required under Section III.B of the MOU.
- Describe how the management alternatives will affect current lease operations.

**TASK 3:** Ecosystem Sciences, with assistance from Steve Laymon and Otis Bay, will prepare a Phase II report based on the work products from Task 1 and Task 2. Maps will be provided as hard copies, pdf files, and ArcView shape files showing polygons attributed with vegetation data. The report will describe the preliminary recommendations for management actions at Baker and Hogback creeks. The Task 1 and Task 2 reports will be included as appendices to the Phase II report. Submit the Phase I and Phase II reports concurrently to the lessees for Hogback and Baker creeks and to each of the MOU parties.

## Phase III – Habitat Enhancement Plans

**TASK 1:** Ecosystem Sciences, Steve Laymon and Otis Bay will jointly conduct (a) presentation(s) for the lessees and the MOU Parties presenting the results of the Phase I and Phase II work and preliminary recommendations as to the content of the YBC habitat enhancement plans for Baker and Hogback creeks, including the management actions and projects to be included in the plans, schedules, responsible parties, monitoring and adaptive management program, and reporting protocol. Seek input from the lessees and the MOU Parties concerning the content of the YBC habitat enhancement plans and if possible, reach agreement concerning the content of the enhancement plans. (The lessees and MOU Parties will be given two weeks following the presentation(s) to submit written comments.) Deliverables: (1) Document containing preliminary recommendations; (2) Report presenting written comments received during consultation(s) with lessees and MOU Parties, and describing the areas of consensus and/or disagreement.

**TASK 2:** Ecosystem Sciences, Steve Laymon and Otis Bay will prepare and present draft YBC habitat enhancement plans for Baker and Hogback creeks and concurrently submit to the MOU parties and lessees. The MOU Parties and lessees will be asked to submit written comments on the plans within two weeks of the distribution of the draft plans. Deliverables: (1) Draft YBC plans.

**TASK 3:** Ecosystem Sciences, Steve Laymon and Otis Bay will prepare final plan and responses to comments. Deliverables: (1) Final YBC plans, including an appendix presenting written comments received from lessees and MOU Parties concerning draft habitat enhancement plans and responses to the comments.

**TASK 4:** LADWP will describe the potential adverse impacts that could be associated with habitat enhancement actions either in terms of known, likely, or the level of risk to determine the most appropriate CEQA route. Deliverable: CEQA documents prepared by LADWP.

**TASK 5:** Ecosystem Sciences will revise grazing management plans for Baker Creek and Hogback Creek allotments to be consistent with final plans to enhance YBC habitat. Deliverable: Report describing modifications to grazing management plans for Hogback and Baker Creek leases.

**TASK 6**: Ecosystem Sciences and LADWP will develop and concurrently submit to each of the MOU Parties and lessees recommendations that will be presented to the LADWP Board of Water and Power Commissioners concerning the final YBC habitat enhancement plans for Baker and Hogback creeks.

## Budget

| LABOR | PERSON | MANDAYS | COST |
|---|---|---|---|
| | S. Laymon | By subcontract | $25,000 |
| | F. Smith | By subcontract | $3,000 |
| | Otis Bay | By subcontract | $89,870 |
| | W. Platts | 15 | $12,000 |
| | M. Hill | 30 | $24,000 |
| | Support Staff | 60 | $28,800 |
| **Labor Subtotal** | | | $182,670 |
| **EXPENSES** | | | |
| Lodging | | | $8,500 |
| Food | | | $3,250 |
| Mileage | | | $2,500 |
| Air Travel | | | $1,200 |
| Car Rental | | | $850 |
| Telephone/Fax | | | $250 |
| Reproductions | | | $750 |
| Printing | | | $3,500 |
| Photographic | | | $500 |
| Equipment Rental | | | $250 |
| Field Expenses | | | $500 |
| **Expenses Subtotal** | | | $22,050 |
| **TOTAL** | | | $204,720 |

# 2004 Time Line – YBC Habitat Enhancement Plans

| Week | 4/11 | 4/25 | 5/9 | 5/23 | 6/13 | 6/27 | 7/11 | 7/25 | 8/8 | 8/22 | 9/5 | 9/19 | 10/10 | 10/24 | 11/7 | 11/28 | 12/5 | 12/12 | 12/19 | 12/26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PHASE I** | | | | | | | | | | | | | | | | | | | | |
| Task 1 | | | | | | | | | | | | | | | | | | | | |
| Task 2 | | | | | | | | | | | | | | | | | | | | |
| Review | | | | | | | | | | | | | | | | | | | | |
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| **Phase II** | | | | | | | | | | | | | | | | | | | | |
| Task 1 | | | | | | | | | | | | | | | | | | | | |
| Task 2 | | | | | | | | | | | | | | | | | | | | |
| Task 3 | | | | | | | | | | | | | | | | | | | | |
| Review | | | | | | | | | | | | | | | | | | | | |
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| **Phase III** | | | | | | | | | | | | | | | | | | | | |
| Task 1 | | | | | | | | | | | | | | | | | | | | |
| Task 2 | | | | | | | | | | | | | | | | | | | | |
| Task 3 | | | | | | | | | | | | | | | | | | | | |
| Task 4 | | | | | | | | | | | | | | | | | | | | |
| Task 5 | | | | | | | | | | | | | | | | | | | | |
| Task 6 | | | | | | | | | | | | | | | | | | | | |

**Project Completion Dates**: Phase I completed on 4/16/04
Phase II completed on 11/12/04
Phase III completed on 12/30/04

LADWP, the County of Inyo and Ecosystem Sciences, Inc. have reviewed this work plan and have reached agreement on its contents.

_____ _____

Gene L. Coufal Date
Manager, LADWP Aqueduct Business Group

_____ _____

Greg James Date
Director, Inyo County Water Department

_____ _____

Mark Hill Date
Ecosystem Sciences, Inc.

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## Appendix 1: 1999 Report by Laymon and Williams

### YELLOW-BILLED CUCKOOS IN THE OWENS VALLEY

Prepared by: Stephen A. Laymon, Ph.D. and Pamela L. Williams, Ph.D. 30 April 1999

INTRODUCTION

Yellow-billed Cuckoos nesting in western North America have declined dramatically during the past eighty years (Roberson 1980; Gaines and Laymon 1984; Laymon and Halterman 1987, 1989a). This species was once widespread, inhabiting the formerly extensive riparian habitats that once lined the rivers and streams throughout the region. The Yellow-billed Cuckoo, however, no longer nests over much of its previous range, including southern British Columbia, Washington, Oregon, Idaho, and Nevada. Once a common breeding bird in California (Grinnell 1915), by 1940 the species was "...wanting in extensive areas where once found" (Grinnell and Miller 1944). The Yellow-Billed Cuckoo is now listed as: (1) endangered by the California Department of Fish and Game; (2) a sensitive species by the U.S. Forest Service; and (3) is under consideration for listing as endangered by the U.S. Fish and Wildlife Service.

A chronology of this decline indicates that the initial cause of decline was linked to the extensive loss of riparian habitat in the nesting areas of the cuckoo, which breeds in North America, but winters in South America (Gaines and Laymon 1984; Laymon and Halterman 1987, 1989a). During the late 1800's and early 1900's, large areas of virtually continuous riparian habitat were disrupted by human activities, including conversion to agriculture, submersion under reservoirs, and channelization for flood control. The remaining riparian habitat in the region exists as discrete patches of varying size, shape, and isolation. Additionally, the number of individuals in most sub-populations has reached such low levels that these sub-populations are in danger of stochastic extinction (Laymon and Halterman 1989a).

Historical accounts of Yellow-billed Cuckoos in the Owens Valley are few. This reflects more a scarcity of ornithologists rather than a scarcity of cuckoos. Records prior to 1977 consist of a cuckoo found in Bishop in August 1891 (Fisher 1893) and a specimen taken there in August 1956 (California State University, Los Angeles); two specimens taken near Independence in June 1917 (Museum of Vertebrate Zoology, University of California, Berkeley), one specimen taken between Bishop and Lone Pine in September 1928 (MVZ, UC, Berkeley), and one observation near Big Pine in July 1968 (Steven Cardiff pers. comm.).

In 1977, during the first statewide survey for Yellow-billed Cuckoos a small and apparently breeding population was found in the Owens Valley (Gaines and Laymon 1984). During that survey, Gaines found a single cuckoo at Hogback Creek and three cuckoos at Baker Creek including a pair that were either courting or nesting. In 1986, during the second statewide survey the species was again found in the Owens Valley, but this time only at Hogsback Creek (Laymon and Halterman 1987a). During 1991, Tom

and Jo Heindel surveyed the Baker Creek site weekly and found up to eight cuckoos, an all-time high for that location. Most of these cuckoos were unmated males, but one or two pairs may have bred that year. In 1992, the Heindels found only two cuckoos at the Baker Creek Site site. During 1993, Laymon and Williams (1994) found only one unmated male cuckoo at Baker Creek and none at Hogsback Creek.

The only other currently available nesting area in the Owens Valley is outside of the Lower Owens River Project (LORP) Area in the first 1.5 miles of river above Lake Tinemaha (Laymon and Williams 1994). This site was surveyed in 1977 but no cuckoos were found (Gaines and Laymon 1984). This site was not checked by Laymon and Halterman in 1986 and was not surveyed again until 1993. The two pairs found at this site in 1993 were apparently nesting and represent the only nesting cuckoos in the Owens Valley that year.

At present, a viable population of cuckoos does not exist in the Owens Valley. Laymon and Halterman (1989b) in their proposed habitat management plan for Yellow-billed Cuckoos in California recommended that the Owens Valley be designated as one of the areas where a viable population of cuckoos should be established. A self-sustaining sub-population of cuckoos in the Owens Valley would require at least 25 pairs. This population goal has been adopted by the California Partners-in-Flight, Riparian Habitat Joint Venture. At present there is approximately 200 ha (500 acres) of riparian habitat in the Owens Valley that is suitable for breeding cuckoos. Each pair of cuckoos occupies an average of 20 ha (50 acres) of habitat. An additional 440 ha (1100 acres) of suitable habitat would need to be created in the Owens Valley to reach this goal. This habitat could be created through a variety of means including restoration planting and removal of spring and summer grazing. At many locations, planting on sites with existing scattered trees could advance the restoration process.

In 1994, Laymon and Williams in their report to California Department of Fish and Game recommended the following:

1. There is every indication that Yellow-billed Cuckoos are occupying most of the suitable habitat in the Owens Valley. To increase the population to a minimum viable level of 25 pairs would require significant habitat restoration efforts combined with a reduction of grazing. Areas managed for cuckoos should include multi-layered forest patches greater than 50 acres in extent and greater than 100 m in width. These sites must have adequate ground or surface water to maintain vigorous foliage throughout the growing season. A mixture of Goodding's black willow and Fremont cottonwood should be planted. If possible, it would be advisable to expand existing riparian sites. A study of soils and ground water should be undertaken to determine the feasibility of restoration at selected sites. Specific recommendations for the seven sites shown on Figure 1 are as follows:

    A. Hogback Creek would benefit from additional planting of tree-form willows and cottonwoods to supplement the existing riparian vegetation. Spring and summer grazing should be reduced or eliminated at this site.

B. Baker Creek would benefit from additional planting of willows and cottonwoods to supplement the existing riparian vegetation. Replacement of the exotic black locust with native vegetation would also benefit riparian species. Spring and summer grazing should be eliminated at this site.
C. The Islands would benefit from additional planting and reduction of grazing. Most trees at this site show water stress and the most important factor for restoration at this site is maintaining adequate ground water levels to support riparian vegetation.
D. The vegetation between Steward Lane and Lake Tinemaha, especially in the area immediately upstream from Lake Tinemaha, is in excellent condition. It is possible that the riparian zone could be broadened here with additional planting. Monitoring of grazing is necessary so damage to the riparian vegetation does not occur.
E. The Owens River from Pleasant Valley to Bishop has excellent understory riparian habitat. This area would benefit from additional planting of tree-form willows and cottonwoods. Grazing pressure should be controlled so it does not damage riparian habitat.
F. A reduction in grazing pressure in the area downstream from Aberdeen Station Road would benefit the riparian habitat. This area is a candidate for additional planting between the existing trees.
G. At present the hydrology along the Owens River between Keeler Bridge and Owens Lake probably precludes any additional planting to widen the existing riparian habitat. Sustained flows in the Owens River in this region would be needed before restoration is undertaken.

## YELLOW-BILLED CUCKOO HABITAT REQUIREMENTS

Detailed descriptions of the habitat requirements of the Yellow-billed Cuckoo can be found in the Partners-in-Flight, Riparian Habitat Joint Venture Yellow-billed Cuckoo conservation plan (Laymon 1998) and the Habitat Suitability Index Model for Yellow-billed Cuckoos (Laymon 1999). The following is a summary of the information presented in these documents.

### Foraging Habitat

The California Yellow-billed Cuckoo feeds on a variety of large insect and small vertebrate prey. During 12 years of the study at the South Fork Kern River, 2420 prey items were identified as they were being fed to young cuckoos in 30 nests. The primary food items were green caterpillars (primarily sphinx moth larvae) at 44.9% of diet, tree frogs at 23.8%, katydids at 21.8%, and grasshoppers at 8.7%. They forage primarily in the foliage of trees, but they will dive out to catch flying insects or hop on the ground to capture tree frogs and grasshoppers (Laymon 1998).

At 11 foraging sites in the Kern River Valley of California that were found by radio telemetry, a mean of 1118 trees/ha was measured (Laymon and Halterman 1985).

The mean canopy closure was 83% and the mean foliage volume was 874 $m^3$/ha (range = 280 – 1,970 $m^3$/ha). The foliage composition by volume at these sites was 69% cottonwood and 31% other (primarily willow). The average canopy height was 12.3 m (range = 6.2 to 19.7 m). The high foliage volume of cottonwoods appeared to be an important characteristic of foraging sites. Researchers on the Colorado River have also found that high levels of foliage volume are important to Yellow-billed Cuckoos (Anderson and Ohmart 1984, Rosenberg 1980).

Nesting Habitat

Grinnell and Miller (1944) described the Yellow-billed Cuckoo's characteristic habitat as "riparian jungles of willows of fairly old growth, often mixed with cottonwoods, and with a tangled 'lower story' of blackberry, nettles, or wild grape. Such conditions obtain on the broad lower flood-bottoms of our larger streams." This description was based on their own observation and on early studies. Near Santa Rosa, California, Shelton (1911) found the species nesting along sloughs in areas covered with willows, ash and scrub oak and covered with vines. Near Los Angeles, Jay (1911) found cuckoos nesting in swampy areas surrounded by willows interspersed by grassy open areas. Along the Santa Anna River, Hanna (1937) located 24 nests and found the ideal habitat patches to be damp willow thickets mixed with cottonwoods and with a heavy understory of nettle, cattails and wild grape. Most of his nests were in willows (92%) and some were partly supported or concealed by wild grape..

Accounts of nest sites of cuckoos for more recent years come from the Sacramento River and the South Fork Kern River. Among eight pairs of cuckoos along the Sacramento River near Chico in 1980, five nested in a poorly maintained walnut orchard and three nested along a willow lined slough (Laymon 1980). Four of these nests were located, of which all were on densely foliaged horizontal branches with a live canopy both above and below the nest. There was no ground cover in the walnut orchard where three nests were found. The walnut trees had been planted 7.7-9.2 m apart and the tree canopies had grown together, providing a cool, moist microclimate, especially after irrigation. The walnut trees had been planted at a density of approximately 275 trees/ha.

At the South Fork of the Kern River vegetation surveys were conducted at 95 nests. All of the nests were in willows with the exception of one that was in a mistletoe clump in a Fremont cottonwood. Of the 94 nests in willows, 54 (57.4%) were in Goodding's black *willow (Salix gooddingii*) and 40 (42.6%) were in red willow (*Salix laevigata*). The average nest tree height was 9.4 m (SD=3.5, range 2.5 – 17.8 m). The DBH of the average nest tree was 25.4 cm (SD=18.7, range 3 cm - 90 cm) (Laymon et al. 1997). The average nest height was 4.8 m (SD=3.0) and ranged from a low of 1.3 m to a high of 13 m. Most nests (66, 69.5%) were place on horizontal branches, while 13 (13.7%) were placed in tree crotches and 16 (16.8%) were placed in vertical forks. Nests were placed closer to the tip of the branches than to the trunk of the tree (Laymon et al. 1997). Most nests (n=67, 72%) were placed on the east side of the nest tree. Estimated cover above the nest averaged 93.4% (SD=15.1, range 0% to 100%). Average canopy closure on the nest site vegetation sampling plot averaged 74.1% (SD=15.6, range 16.5%

to 98%). At the center of the plot under the nest the canopy closure averaged 96.8% (SD=7.3, range 63% - 100%). At 5 m from the nest the canopy closure averaged 75.1% (SD=18.1, range 17.5 - 100%) and at 10 m from the nest the canopy closure averaged 63.8% (SD=26.1, range 0% - 100%) (Laymon et al. 1997).

In developing the Habitat Suitability Model for the cuckoo, habitat suitability for reproduction is assumed to be optimum when average canopy closure was >70%, average canopy height is 7 to 10 m, basal area is 5 to 20 $m^2$/ha, and foliage volume is 30,000 to 90,000 $m^3$/ha. Intermediate habitat suitability occurs when the average canopy closure is between 50 and 70%, average canopy height is 5 to 6m and >10 m, basal area is 25 to 55 $m^2$/ha, and foliage volume is >90,000 $m^3$/ha. Low suitability occurs when the average canopy closure is between 30 and 50%, average canopy height is 4 to 5 m, basal area is 2 to3 $m^2$/ha and >55 $m^2$/ha, and foliage volume is 10,000 to 20,000 $m^3$/ha. Stands with an average canopy closure <30%, average canopy height <3 m, average basal area <1 $m^2$/ha, and foliage volume <10,000 $m^3$/ha are considered unsuitable (Laymon 1999).

Habitat Interspersion and Composition

Home range size of the Yellow-billed Cuckoo varies from 10 – 40 or more hectares (25-100 acres). On the Kern River in 1985, an average home range per pair of 10 ha was found for six pairs, while with the aid of radio telemetry, the average home range of two pairs was 17 ha (Laymon and Halterman 1985). In 1986, at the Kern River, the home range of eight pairs of cuckoos averaged 29 ha, while in 1987 the home range for all three pairs exceeded 40 ha per pair (Laymon and Halterman 1987b). On the Sacramento River, the average home range size for four pairs of cuckoos was 17 ha, of which on average, 10 ha was forested (Laymon 1980).

Patch size is a very important landscape feature for Yellow-billed Cuckoos. In California, away from the Colorado River, cuckoos occupied 9.5% of 21 sites 20 to 40 ha in extent, 58.8% of 17 sites 41 to 80 ha in extent, and 100% of 7 sites greater than 80 ha in extent (Laymon and Halterman 1989a). Gaines (1974) also concluded that cuckoos did not occur in areas where there was less than 10 ha of habitat, where a strip of habitat was less than 280 m long or 90 m wide, and where water was more than 90 m away.

On the Sacramento River, the extent of habitat in 8-km river stretches was used as a measure of habitat fragmentation and was found to be the second most important variable in determining the presence of cuckoos pairs ($r^2$=0.16, $p<0.005$) (Halterman 1991). The presence of low woody vegetation was used as measures of continuing habitat succession and was the most important variable in predicting the presence of cuckoos pairs ($r^2$=0.17, $p<0.005$) (Halterman 1991). A multiple regression model combining patch size, extent of habitat within an 8 km river stretch, presence of point bars, and presence of low woody vegetation explained 46% of the variance in location of cuckoo pairs on the Sacramento River.

Micro-climate may play a very important part in habitat selection. It is likely that Yellow-billed Cuckoos evolved in the humid eastern portion of North America and were only able to colonize the west along the humid river bottoms (Hamilton and Hamilton 1965). A study of temperature and humidity at nest sites, forest edges, and in the open on the Sacramento and Kern rivers showed a decrease in temperature and an increase in humidity closer to the nest (Launer et al. 1990).

At the South Fork Kern River, cuckoos are found more often at upland sites early in the season in wet years, but not in dry years. It is likely that flooding in wet years reduces the survival of the larvae of the preferred prey (katydids and sphinx moth) which winter underground. This forces the cuckoos to forage in upland areas that were not flooded until the prey base in the lower floodplain begins to recover later in the breeding season. The fact that most extant riparian habitat is in the primary floodplain could cause a large reduction in the prey base and be a major cause of the decline of cuckoos in the West. Restoration efforts should consider planting at least a portion of forests on upper terrace sites that do not regularly flood.

Areas of habitat of seemingly adequate size might not be used as breeding sites due to their isolation from other habitat patches. The need for larger rather than smaller habitat patches is derived from the increased proportion of occupancy by Yellow-billed Cuckoos as patch size increases. The distance a cuckoo can forage from the nest is limited by its need to return frequently to the nest. A habitat patch of 40 ha and 100 m wide and 400 m long might be unsuitable, while a square or circular patch the same size would be suitable.

## HABITAT EVALUATION

### Hogsback Creek

Hogsback Creek area, lying north of Moffat Ranch Road, is 1.5 miles in length and 0.5 miles in width. Within this area, there is a total of 111 acres of riparian vegetation, 50 acres of mesic meadow, and 2 acres of wet meadow. The riparian habitat is in two main corridors separated by an upland opening of 400 to 1000 feet in width. At the widest, the largest individual riparian-habitat patch is approximately 1400 feet in width and in 70% of the area the riparian habitat is 500 feet or less in width. The average habitat width is approximately 750 feet. The largest contiguous riparian-habitat patch is approximately 40 acres in size and the next largest patch is approximately 20 acres in size. The riparian habitat on the site appears to be primarily supported by seeps and springs rather than Hogsback Creek itself.

A wildfire, which started from a controlled burn designed for range improvement, burned much of the site in 1991 or 1992. In 1993, when the site was last surveyed for Yellow-billed Cuckoos, at least 50% of the 111 acres of riparian habitat was severely degraded from the fire. Most of the large trees had burned and were dead. A field

inspection in April 1999 showed that the riparian habitat in the area was recovering well, as a result of re-growth from root sprouting.

Yellow-billed Cuckoos have been found at the Hogsback Creek site on two of the three occasions that the site has been surveyed; during the statewide survey in 1977 and again during the statewide survey in 1986. Cuckoos were not found at the site during 1993 when the site was surveyed after the burn.

Hogsback Creek has at maximum habitat for two pairs of Yellow-billed Cuckoos. On average, a pair of cuckoos will use about 50 acres of habitat, but in some years with low food supply, the home range size can reach 100 acres. According to the most recent model of Yellow-billed Cuckoo habitat configuration, a site must be greater than 200 acres in extent and wider than 1950 feet to be optimal (Laymon and Halterman 1989b). The Hogsback Creek site does not meet either of these criteria. Suitable sites are 100-200 acres in extent and greater than 650 feet in width (Laymon and Halterman 1989b). The Hogsback Creek site meets these criteria and is therefore categorized as suitable habitat.

The Hogsback Creek site is isolated and is a great distance from other riparian habitat suitable for Yellow-billed Cuckoos. The site also only has habitat for one or two pairs. This isolation and small size will increase the likelihood that the site will not be occupied every year.

Baker Creek

Baker Creek area is approximately 1.5 miles west of Big Pine. The site is approximately 2 miles in length (north to south) and averages 0.4 miles in width (2112 feet) (east to west). Within this 350 acre area, there is a total of 60 acres of riparian habitat dominated by willows and cottonwood and 78 acres of habitat dominated by black locust for a total of 138 acres that is at present woodland. A minimum of 24 acres is mapped as recently burned woodland. The burned area is actually larger that what is shown on the GIS map of the area, possibly reaching 80 acres in extent. Most of the high quality willow dominated riparian woodland is south of Sugar Loaf Road. A large area, of 120 acres, on the north end of the site is an irrigated pasture.

The burn of 1998 caused extensive damage to much of the forested portion of Baker Creek. The area of the burn was one of the two main activity centers of Yellow-billed Cuckoos in this area. A cursory field inspection in April 1999 showed that the burned cottonwood, willows, and black locust had been killed above the ground, but were root sprouting over much of the burn. Trees that are reestablished from well-developed roots of older trees grow much more rapidly than newly planted seedlings or pole cuttings.

Yellow-billed Cuckoos have been found at the Baker Creek site on numerous occasions. They were first noted at the site in 1968. In 1977 a pair was seen carrying food and sticks and was undoubtedly nesting. They were not found at the site when it

was surveyed in 1986, but were found again in 1991 when eight cuckoos were recorded. One or two pairs may have bred during 1991. In 1992 only two cuckoos were found at the site and in 1993 there was only one unmated male. Currently, the Baker Creek site has habitat for no more than two pairs of Yellow-billed Cuckoos. If the current woodland habitat of 138 acres were in one block, it would provide habitat for a maximum of three pairs and a minimum of two pairs of cuckoos. The habitat however is in stringers with openings in between. In addition, some excellent habitat south of Sugarloaf Road is widely separated from the next suitable habitat to the north. The area south of Sugarloaf road is now marginal for cuckoos because of its size (approximately 33 acres of forested habitat).

On average, a pair of cuckoos will use about 50 acres of habitat, but in some years with low food supply, the home range size can reach 100 acres. According to the model of Yellow-billed Cuckoo habitat configuration, a site must be greater than 200 acres in extent and wider than 1950 feet to be optimal (Laymon and Halterman 1989b). With the recent fire, the Baker Creek site no longer would be considered optimal. The largest individual riparian-habitat patch, which lies along Baker Creek, is approximately 1000 feet in width and 3000 feet or less in length and is 69 acres in extent. This patch would be considered suitable habitat under the model. Approximately 90% of this area is forested with black locust. The next largest individual riparian-habitat patch, which is south of Sugarloaf Road, is approximately 2000 feet in length and averages 700 feet in width and is approximately 33 acres in extent. This patch would be considered marginal under the model. As a result of the fire, these two most suitable areas are now widely separated.

It is most likely that one pair would now breed at Baker Creek, because most of the habitat remaining after the fire is in the middle third of the area, making it difficult to pack two pairs in this relatively small area. This is down from habitat for up to three pairs before the fire. If the entire 350-acre area were forested with willows and cottonwoods, there would be habitat for four to seven pairs.

The Baker Creek site is isolated and is a great distance from other riparian habitat suitable for Yellow-billed Cuckoos. The site at present also only has habitat for one pair, though the potential for the area is greater. This isolation and small size will increase the likelihood that the site will not be occupied every year. As the site recovers from the burn over the next few years, the area will become more suitable and the likelihood of yearly occupation by cuckoos will increase.

## YELLOW-BILLED CUCKOO HABITAT ENHANCEMENT PLAN FOR HOGSBACK CREEK

The Hogsback Creek site is limited in regards to enhancements that can be done to make the site more suitable for Yellow-billed Cuckoos. Most of the site appears to be spring fed, rather than fed by Hogsback Creek. There is no apparent source of supplemental water available for the site. The grazing regime on the site is unclear, but from observation in 1993 and 1999 the habitat does not appear to be heavily overgrazed. It is our understanding that the site is primarily used as a holding area when the cattle are in transition from one area to another. At this time we do not know (1) time of year, (2) duration, or (3) number of cattle involved. All of these items can greatly impact the effect of the cattle on Yellow-billed Cuckoos and their habitat.

**Concerns –** Some cuckoos build their nests quite low to the ground and cattle in the riparian zone between 1 June and 1 September could actually destroy nests. Of the 104 nests found at the Kern River 13 (12.5%) were found between 3 and 6 feet above the ground, a height that could be easily adversely affected by grazing cattle. Twenty-seven additional nests (26%) were between 6 and 9 feet above the ground, in the height range that could possibly be adversely affected by grazing cattle. Twenty nests (19.4%) were in trees that were less than 4 inches DBH (three of these nests were higher than 3 m and therefore not covered by the height category). Cattle bumping these trees could dislodge cuckoo nests or knock eggs or young from the nests. A total of 43 nests (41.3%) at the Kern River study site were either low enough or in small enough trees that grazing cattle could directly impact the nesting cuckoos.

Intense grazing pressure causes highlining of willows as cattle are forced to switch from grass to tree leaves. We have not noted this to be a problem at Hogsback Creek, but the effects of grazing should be monitored if grazing is done while leaves are on the trees (1 April to 30 October in Owens Valley).

Cuckoos need a mix of tree species to provide them with the best variety of potential prey. In some areas, such as the Kern River study area, cuckoos forage preferentially in cottonwoods, rather than willows. This is because the prey, primarily sphinx moth larvae, tends to be found more frequently in cottonwoods than in willows. The Hogsback site, which is dominated by several willow species, has a shortage of cottonwoods.

The fire in the Hogsback Creek area in 1992 was started by a controlled burn, which was being done for range improvement in the adjacent uplands. The fire was not meant to burn in the riparian zone. The lack of control of controlled burns is an area of concern.

Recommendations

(1) Grazing should be excluded from the area during the cuckoo's breeding season (1 June – 1 September). This could be done by building a fence between the riparian zone and the adjacent uplands or by not having cattle in the vicinity.

(2) The short-term use as a holding area, between 1 September and 1 June does not appear to be a problem, as long as it is for a short enough duration and with few enough cattle that the understory vegetation and willows within and at the edge of the riparian zone are not highlined and trampled. Highlining and seedling survival should be monitored and grazing intensity should be kept to the point that damage does not occur. Grazing between 1 November and 31 March should not cause an adverse impact on the cuckoo habitat, but effects should be monitored.

(3) Controlled burns should be kept away from the riparian zone. This can be done by either not doing controlled burns in the vicinity of Hogsback Creek or by creating firebreaks between areas to be burned and the riparian zone.

(4) Cottonwoods should be planted at edge of the riparian zone to broaden the zone and provide more diversity of tree species to enhance foraging habitat for cuckoos. Cottonwoods need to have groundwater within 12 feet of the surface at the driest part of the year (usually October and November). Electro-conductivity levels should be 4 or lower for soil 4 feet below the surface and 4 or lower for ground water. The Cottonwoods can be planted either as poles with the lower end in the groundwater, or as rooted cuttings using drip irrigation for the first two years. Sites slated for restoration should be sampled for these factors.

YELLOW-BILLED CUCKOO HABITAT ENHANCEMENT PLAN FOR BAKER CREEK

The Baker Creek site has great potential in regards to enhancements that can be done to make the site more suitable for Yellow-billed Cuckoos. There appear to be possibilities for grazing and water management, as well as high restoration potential on the site. Much or all of the site is currently grazed at some times of the year. The grazing regime is not known at this time. From observations made in 1993, portions of the site are grazed during the breeding season of the cuckoo between 1 June and 1 September. At this time we do not know (1) time of year, (2) duration, or (3) number of cattle involved. All of these factors can greatly impact the effect of the cattle on Yellow-billed Cuckoo habitat. The site is dominated by black locust which are of unknown habitat suitability for cuckoos.

**Concerns** – Much of the riparian habitat at Baker Creek is dominated by black locust, a non-native, invasive tree. It is not known what use Yellow-billed Cuckoos make of this tree species. In general, native trees supply more insects to native bird species than non-native trees. For example, non-native salt cedar habitats in the Southwest tend to have less than 30% of the habitat value for birds than native willows and cottonwoods. Cuckoos at the Baker Creek site have been seen in and around the black locust habitat. More information is needed on how the cuckoos use this species of tree. Information on foraging and nesting sites are needed. This information could be used to develop recommendations on intensity and type of reforestation with native species that is needed.

Fire is problematic for riparian systems, which are not fire adapted. In some cases, if the fire does not burn too hot, cottonwoods and willows will sprout from the roots and regenerate quickly. This re-growth is happening in the burn at Baker Creek. It is not clear why people are intentionally setting fires in riparian zones and what can be done to discourage them from starting these fires. One possible reason for starting fires may be to get free firewood after the burn. One way to discourage this action would be to put Baker Creek off limits to salvage firewood harvesting.

Some cuckoos build their nests quite low to the ground and cattle in the riparian zone between 1 June and 1 September could actually destroy nests. Of the 104 nests found at the Kern River 13 (12.5%) were found between 3 and 6 feet above the ground, a height that could be easily adversely affected by grazing cattle. Twenty-seven additional nests (26%) were between 6 and 9 feet above the ground, in the height range that could possibly be adversely affected by grazing cattle. Twenty nests (19.4%) were in trees that were less than 4 inches DBH (three of these nests were higher than 3 m and therefore not covered by the height category). Cattle bumping these trees could dislodge cuckoo nests or knock eggs or young from the nests. A total of 43 nests (41.3%) at the Kern River study site were either low enough or in small enough trees that grazing cattle could directly impact the nesting cuckoos.

Intense grazing pressure causes highlining of willows as cattle are forced to switch from grass to tree leaves. We have not noted this to be a problem at Baker Creek,

but the effects of grazing should be monitored if grazing is done while leaves are on the trees (1 April to 30 October in Owens Valley).

Habitat fragmentation is another concern at the Baker Creek site. The site is highly fragmented by large openings, some over 100 acres in extent. Solid blocks of habitat, with small openings are best for Yellow-billed Cuckoos and as habitat blocks get smaller and more separated the site becomes less suitable. Restoration between existing blocks of habitat can be an effective means for increasing habitat suitability.

Recommendations

(1) During re-growth of habitat from the recent fire, in areas where both willow and cottonwood and black locust are growing, prune the black locust back to give the native vegetation a head start.

(2) Monitor the effects of grazing closely on the burned area. Remove livestock if browsing on cottonwood and willow seedlings occurs. It is possible that grazing may favor the non-native black locust over the native trees and shrubs, as its leaves appear to be less palatable and twigs are more thorny.

(3) Conduct soil and water tests to ascertain if conditions in the black locust dominated areas are suitable for reforestation with cottonwoods and willows. Cottonwoods need to have groundwater within 12 feet of the surface at the driest part of the year (usually October and November). Electro-conductivity levels should be 4 or lower for soil 4 feet below the surface and 4 or lower for ground water. The Cottonwoods can be planted either as poles with the lower end in the groundwater, or as rooted cuttings using drip irrigation for the first two years. Sites slated for restoration should be sampled for these factors.

(4) In conjunction with a statewide survey for Yellow-billed Cuckoos scheduled for the summer of 1999, a study should be undertaken to determine the activity centers and nesting sites of Yellow-billed Cuckoos at Baker Creek. Approximately 10-15 days by knowledgeable researchers would be required to conduct this study. This information will be vital in developing specific management plans for restoration and habitat management at the site.

(5) In conjunction with a statewide survey for Yellow-billed Cuckoos scheduled for the summer of 1999, a study should be undertaken to learn how Yellow-billed Cuckoos use black locust habitats. This study would include gathering information on foraging and nesting habits of cuckoos at Baker Creek. This study would require approximately 20 days by knowledgeable researchers. This information will be vital in developing specific management plans for restoration and habitat management at the site.

(6) Separate the forested and non-forested areas of Baker Creek by fences to aid in the separate management of grazing for these areas.

(7) Grazing should be excluded from the forested areas during the cuckoo's breeding season (1 June – 1 September). This could be done by building a fence between the riparian zone and the adjacent uplands and meadows or by not having cattle in the vicinity.

(8) The use of the area for grazing, between 1 September and 31 October and 1 April and 1 June does not appear to be a problem, as long as it is for a short enough duration and with few enough cattle that the understory vegetation and willows within and at the edge of the riparian zone are not highlined and trampled. Highlining and seedling survival should be monitored and grazing intensity should be kept to the point that damage does not occur. Grazing between 1 November and 31 March should not cause an adverse impact on the cuckoo habitat, but effects should be monitored.

(9) Develop restoration plans for open areas that are suitable for reforestation. Top priority should be given to broadening existing riparian habitat in areas where cuckoos are now likely to be nesting. A minimum goal of 250 acres of forested habitat should be established for the site. This would provide habitat for three to five pairs of cuckoos yearly, depending on food availability. Reforestation of the entire 350 acres should also be explored. This would provide habitat for four to seven pairs of cuckoos.

(10) Depending on the results of the Yellow-billed Cuckoo black locust study, develop a restoration plan to convert habitat from black locust to willow and cottonwood habitats.

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## Appendix 2: List of Concerns and Recommendations Compiled from Laymon and Williams (1994 and 1999)

Concerns and Recommendations Presented by Laymon and Williams in1994 and 1999 Regarding Hogback Creek and Baker Creek

1. Grazing should be excluded from the area during the cuckoo's breeding season (June 1 – Sept. 1). This could be done by building a fence between the riparian zone and the adjacent uplands and meadows or by not having cattle in the vicinity. This recommendation will prevent potential dislodging of eggs, young, or nests if trees are bumped or rubbed. It will also assist in maintaining the forest understory and reduce herbivory on low branches and young riparian trees.
2. Grazing between Nov. 1 and Mar. 31 should not cause an adverse impact on the cuckoo habitat, but effects should be monitored. Grazing should be monitored and managed to prevent highlining and trampling of understory vegetation and native trees within and at the edge of the riparian zone. Monitoring should also be used to prevent damage to tree seedlings.
3. Sites slated for cottonwood and willow planting should be sampled for depth to water and electrical conductivity (EC). Cottonwoods need to have the water table within 12 feet of the surface at driest part of the year (usually October and November). EC should be 4 $mScm^{-1}$ or lower for soil 4 feet below the surface and for ground water. Cottonwoods can be planted either as poles with the lower end in the water table, or as rooted cuttings using drip irrigation for the first two years.

Concerns and Recommendations Presented by Laymon and Williams in 1994 and 1999 Specific to Hogback Creek

4. The short-term use of Hogback Creek as a holding area, between September 1 and June 1 does not appear to be a problem, however, to maintain habitat preferences for the cuckoos,
    - It should only be for a short duration with few cattle such that the understory vegetation and willows within and at the edge of the riparian zone are not highlined and trampled.
    - Highlining and seedling survival should be monitored and grazing intensity should be kept to the point that damage does not occur.
5. Controlled burns should be kept away from the riparian zone. This can be done by either not doing controlled burns in the vicinity of Hogback Creek or by creating firebreaks between areas to be burned and the riparian zone. In the past, control burns have turned into wildfires that have burned the riparian forests.
6. Cottonwoods should be planted at the edge of the riparian zone to broaden the zone and provide more diversity of tree species. The cuckoos preferred food item is more frequently found in cottonwoods than willows. Hogback Creek has a shortage of cottonwoods.

Concerns and Recommendations Presented by Laymon and Williams in 1994 and 1999 Specific to Baker Creek

7. In the area of the 1998 fire:
    - Prune the black locust back to give the native vegetation a head start, thus providing an advantage to the native trees preferred by the cuckoos.
    - Closely monitor the effects of grazing on the burned area to provide suitable habitat as quickly as possible.
8. Remove livestock if browsing on cottonwood and willow seedlings occurs. It is possible that livestock may prefer native trees over the non-native black locust. This will enhance enlarging the forests thus reducing forest fragmentation. This process will increase the suitability of this habitat for cuckoos.
9. The Baker Creek area should be closed to salvage firewood collection to potentially eliminate one reason for intentionally setting fires.
10. Conduct soil and water tests to ascertain if conditions in the black locust dominated areas are suitable for reforestation with cottonwoods and willows. Native trees typically provide more insects to native bird species than non-native tree species.
11. Information is necessary for developing specific management plans for restoration and habitat management at the site. The results from these studies would provide information for developing further recommendations on the priority for reforestation with native trees. It would also aid in determining an optimal mix of species and density of planting. Therefore, studies should be undertaken to:
    - Determine the activity centers and nesting sites of Yellow-billed Cuckoos at Baker Creek. This study would require approximately 10-15 days by knowledgeable researchers.
    - Learn how Yellow-billed Cuckoos use black locust habitat. This study would include gathering information on foraging and nesting habits of cuckoos at Baker Creek. This study would require approximately 20 days by knowledgeable researchers.
12. Separate the forested and non-forested areas of Baker Creek by fences to aid in the separate management of grazing for these areas. These measures would enhance habitat suitability for cuckoos by preventing damage to the understory vegetation and young native trees, and prevent damage to nests or their contents during the breeding season.
13. The current grazing schedule, Sept. 1 - Oct. 31 and April 1 - June 1 does not appear to be a problem. However, grazing should be monitored and managed to prevent highlining and trampling of understory vegetation and willows within and at the edge of the riparian zone. Monitoring should also be used to prevent damage to tree seedlings.
14. Develop restoration plans for open areas that are suitable for reforestation. Top priority should be given to broadening existing riparian habitat in areas where cuckoos are now likely to be nesting. Priority should also be given to reducing habitat

fragmentation. A minimum goal of 250 acres of forested habitat should be established for the site. Reforestation of the entire 350 acres should also be explored. Habitat fragmentation is a concern at this site. Solid blocks of habitat with small openings provide optimal habitat for cuckoos. Restoration between existing blocks of habitat can be an effective means for increasing habitat suitability.

15. Depending on the result of the Yellow-billed Cuckoo black locust study, develop a restoration plan to convert habitat from black locust to willow and cottonwood habitats.