CONSERVATION ISSUES

The Use of Historical Data in the Restoration of the Avifauna of the Ballona Wetlands, Los Angeles County, California

Daniel S. Cooper[1]

Cooper Ecological Monitoring, Inc.
15 So. Raymond Ave., 2nd Floor
Pasadena, CA 91105

[1] Corresponding author:
dan@cooperecological.com; 323-397-3562

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ABSTRACT: The historical Ballona Wetlands in coastal Los Angeles County were once one of the most significant coastal wetland systems in southern California, but were greatly reduced in extent and ecological function by the mid-1900s. Starting around 1900, the Ballona area saw the near-complete elimination of two major vegetation types (riparian scrub and freshwater marsh), and during the early 1960s, it experienced the loss of most of its tidal salt marsh to a major development, Marina del Rey. Attempts to recreate lost habitat, all since 1990, have achieved mixed results in terms of restoring lost natural communities, including birds. Of the 38 bird species known to have been extirpated from the valley as breeding or winter resident species since 1900, only 11 have become reestablished. Remarkably, all of the reestablished species are characteristic of a single, recently-restored habitat type, freshwater wetland. By contrast, species dependent on other native habitats of the area (notably grassland, coastal scrub, and salt marsh) have registered only extirpations, with essentially no reestablishment despite recent habitat restoration. Though some of these extirpated species no longer occur in coastal Los Angeles County, those that do should be afforded special consideration in future restoration efforts.

Index terms: Ballona Wetlands, bird communities, extirpation, historical data, Los Angeles County

INTRODUCTION

One of the main requirements of successful habitat restoration is an understanding of the original ecological features of the system being restored (SER 2004). As these data are often difficult to obtain, restoration ecologists often rely on conditions at nearby reference sites to set goals and measures of success. However, these reference sites may not necessarily reflect historical species use of a given restoration site, particularly in regions of exceptionally high species endemism (Longcore et al. 2000), across large geographic areas (Neckles et al. 2002), or where distinct ecosystems have been extensively altered or totally eliminated (Hobbs et al. 2006). Indeed, in a recent review of 468 published ecosystem restoration studies, Ruiz-Jaen and Aide (2005) found that most restoration assessments measured just three major attributes: diversity, vegetation structure, and ecological processes. Historical species composition of restoration sites prior to disturbance was virtually never addressed, presumably because this requires time-consuming research, assuming the data exist. Instead, studies of bird community recovery at restoration sites typically infer this change by comparing modern species composition with that of remnant/undisturbed sites in the surrounding landscape (e.g., Patten 1997; Gardali et al. 2006). Though clearly preferable to no assessment of local species composition at all, this approach still falls short of showing that restoration has actually occurred at a given site.

In most situations, historical information on species status and distribution is limited to scattered specimens or sightings. For birds, however, the recent-historical record is often well documented, affording ecologists a variety of sources, including specimen records, published sightings, and unpublished field notes (Mayfield 1979). These may be used to piece together the original species composition of a particular natural community on a scale at least as specific as a river valley, a wetland complex, or a range of hills. The published record of bird occurrence at the Ballona Wetlands in coastal Los Angeles County, California, is remarkably complete, extending back over 100 years (Grinnell 1898; von Bloeker 1943; Cooper 2006). The history of land use change is also well documented over a similar period, and includes the conversion of Ballona Creek into a cement flood-control channel, the wholesale destruction of most of the tidal marsh for a marina complex, and the ongoing replacement of grassland with urban development, followed by limited attempts at habitat restoration and creation. Only one of these restoration sites (Ballona Freshwater Marsh, described below) has included an ongoing monitoring component for vertebrates – in this case for breeding, migrant, and wintering birds – the only such effort in the Ballona region.

The objective of this paper is to trace the history of habitat loss and bird species disappearance in the Ballona Valley and to identify those species whose future reestablishment may be used to evaluate restoration success. As extirpated bird spe-

cies return following habitat improvements, they may be afforded special attention through monitoring and adaptive management. Given longstanding and ongoing interest in the restoration of the Ballona Wetlands, particularly its avifauna (Cooke 1946; National Audubon Society, unpubl. data), this information will be crucial in developing restoration goals for the region, and may serve as a model for developing benchmarks to assess the recovery of other impacted ecosystems.

STUDY AREA

I considered the Ballona Valley to include all low-lying lands along Ballona Creek between the Baldwin Hills and the Pacific Ocean, west (coastward) of Interstate 405 (Cooper 2005, 2006). This area lies just north of Los Angeles International Airport, and includes the Ballona Wetlands, Lower Ballona Creek, the Westchester Bluffs, and Marina del Rey. Here I divided the history of ecological change in the Ballona Valley since the turn of the last century into three main periods: early, middle, and late.

Early period (1900-1940)

Historical photos and early written accounts of the mouth of Ballona Creek describe a system of dunes extending north-south along the immediate coast, separated by a long, brackish lagoon. Roughly 800 ha of saltmarsh and tidal channels extended from the dunes east to the mouth of Ballona Creek, a typical seasonal coastal drainage that flooded over a wide area after heavy rainfall (von Bloeker 1943; Fuller 1955; J. Robertson, unpubl. data; Worsfold, undated). Several duck clubs that featured impoundments where fresh water was pumped in during fall and winter provided additional wetland habitat. These were established along the eastern edge of the marshes in the late 1800s and persisted into the 1950s (H. Clarke, long-time resident of Glendale, Calif., pers. comm.).

Ballona Creek was transformed into a cement flood-control channel in several stages, the first involving containment of the streambed within levees in the early 1920s in response to chronic flooding of agricultural lands (Robinson 1939; Caughman and Ginsberg 1987). The bulk of the Ballona salt marsh, including the mouth of Ballona Creek, was largely unaltered through the early 1930s (J. Robertson, unpubl. data; J. Lamm, Ballona Creek Renaissance, pers. comm.); in 1935, the U.S. Army Corps of Engineers began to replace the earthen banks of the creek with cement, completing the channelization of the entire length by 1937. Even with the channelization of the creek, small amounts of rain would leave shallow pools on agricultural fields that would develop characteristics of seasonal wetlands, a phenomenon that continued into the late 1990s when the former fields were developed.

Middle period (1940s-early 1960s)

Housing construction for aerospace and defense industry workers throughout the Los Angeles Basin accelerated through the 1950s, by which time most of west Los Angeles and Santa Monica, which bordered the Ballona Valley, was completely transformed with residential and commercial development. However, the bulk of the Ballona Wetlands remained, as did a significant amount of remnant coastal dune scrub and about 400 hectares of cropland to the southeast (Corey 1992; Crockett, undated; H. Clarke, pers. comm.). Even with the remaining wetlands intact, the elimination of flooding with the channelization of Ballona Creek exacerbated the desiccation of the salt marsh vegetation by depriving it of tidal flow; for 70 years, the wetlands have since received water only by rainfall, resulting in hyper-saline conditions on exposed soil within the marsh (Zedler 1982; Boland and Zedler 1991).

The most dramatic loss of salt marsh began in late 1957, when work started on the sprawling 320-ha Marina del Rey complex (County of Los Angeles, undated). Finally completed in 1965, the marina project had the immediate effect of eliminating at least 60% of the remaining salt marsh in the Ballona area, including nearly all of the active tidal channels and mudflats. Unfortunately, no formal environmental documentation was performed, and the only mitigation attempt for either action was the dedication of a small debris basin at the edge of the Marina del Rey development ("Oxford Basin") heavily landscaped with invasive, non-native trees and shrubs and ironically posted as a "Bird Conservation Area" (County of Los Angeles 1976).

Late period (1980s-present)

Well into the 1980s, the eastern half of the Ballona Valley still featured cultivated fields as well as open ruderal grassland, at least some of which persisted into the early 2000s when it was finally eliminated by construction of the sprawling Playa Vista development. Just inland, the ecological connection with the native scrubland of the extensive Baldwin Hills to the east was further degraded by the expansion of large shopping centers in Culver City in the 1980s. During the early 2000s, all of the remaining grassy bluff-top habitat in the area was replaced by housing tracts, with damage compounded by landscaping along the face of the Westchester Bluffs in the eastern Ballona Valley that included inappropriate, non-indigenous species (e.g., Toyon *Heteromeles arbutifolia*; see Mattoni and Longcore 1997).

Other sources of degradation during this late period included the proliferation of the introduced red fox (*Vulpes vulpes*), an effective predator of terrestrial birds and other wildlife, apparently originating locally from a deliberate introduction event at Los Angeles International Airport in the 1970s (Jurek 1992). Periods of drought further degraded the remaining Ballona Wetlands by depriving the dominant plants (*Salicornia* spp.) of water, and several recent wet winters appear to have facilitated an invasion of non-native shrubs and trees onto the remaining wetland and riparian habitat (especially by *Myoporum laetum*, *Acacia longifolia*, *Chrysanthemum coronarium*, and *Cortederia selloana*); the fruits of *Myoporum* are eaten by the introduced red fox (pers. observation), and thus spread throughout the area.

During the early 1990s, the first of several local habitat enhancement projects was initiated when volunteers began removing

non-native vegetation and planting native shrubs at the remnant coastal dune system on the western edge of the remnant saltmarsh, and in 1996, native landscaping was installed around the 7.6-ha Ballona Lagoon in Marina del Rey. In 2002, a de facto restoration was inadvertently launched at 5.2-ha Del Rey Lagoon when broken tidal gates were repaired, thus transforming a formerly stagnant pond into a dynamic tidal estuary. In 2003, the 10.4-ha Ballona Freshwater Marsh was installed at the southwest corner of Lincoln Ave. and Jefferson Blvd., featuring a freshwater lagoon, riparian and coastal scrub plantings, and reedbeds (*Typha* sp., *Scirpus* sp.), thus creating the most significant expanse of freshwater marsh in the Ballona Valley in over seven decades. Three additional projects may be completed in the next few years, including: (1) an expansion of the Ballona Freshwater Marsh; (2) the creation of about 10 hectares of riparian habitat along the base of the Westchester Bluffs; and (3) the restoration of tidal flow or irrigation of a portion of the remaining saltmarsh of the Ballona Wetlands (M. Small, California Coastal Conservancy, pers. comm.).

METHODS

Cooper (2006) provided a list of regularly wintering, summering, and year-round resident bird species in the Ballona Valley. Species order follows the American Ornithologists' Union Checklist of North American Birds and the most recent supplements (American Ornithologists' Union 1998). I drew from a variety of published and unpublished sources for bird records, including museum holdings of specimens and egg sets (primarily the Natural History Museum of Los Angeles County and the Western Foundation for Vertebrate Zoology), sight records published in Bird-Lore/Audubon Field Notes/(North) American Birds and the Western Tanager (newsletter of the Los Angeles Audubon Society), data from the Audubon Christmas Bird Count and the Los Angeles County Breeding Bird Atlas, and the detailed field notes of a small group of active observers that date back to the early 1970s (see Acknowledgments). I considered current breeding species to include those for which one or more pairs have nested successfully for at least two consecutive recent years (since 2000), and current winterers to be those for which two or more individuals have been present through the winter months (November-February) for at least two consecutive recent years. Taxa were considered "extirpated" if they once maintained consistent breeding or non-breeding populations in the Ballona Valley but have not done so since 2000. "Reestablished" taxa have been extirpated in at least one role (winter, summer, or both) for a period of several decades but have resumed this role and are extant today (generally since 1950, the start of regular record-keeping). I did not treat the distinctive avifauna of the outer jetties and inshore waters along the coast, and omitted those species for which there are simply too little data to judge whether they were ever present (see Cooper 2006).

RESULTS AND DISCUSSION

Prior to 1900, avian decline at Ballona was generally attributed to hunting rather than to habitat destruction, with waterfowl hunting continuing in local marshes into the 1920s (Bird-Lore 23:315, Splitter 1951) and even later at the duck clubs (though regulations prohibited indiscriminant shooting by mid-century). By the early 1900s, local naturalists were attributing declines in bird populations at Ballona to both the draining of freshwater wetlands for agriculture and to an increase in human activity on formerly undisturbed beaches, as nearby communities like Santa Monica transformed from sleepy coastal villages into small towns (Chambers 1936; von Bloeker 1943). Not surprisingly, most of the birds believed lost during this early period are waterbirds typical of freshwater marsh habitats (Table 1), including wintering populations of white-faced ibis (*Plegadis chihi*) and yellow-headed blackbird (*Xanthocephalus xanthocephalus*), and breeding/summering populations of the following species: northern pintail (*Anas acuta*), cinnamon teal (*Anas cyanoptera*), ruddy duck (*Oxyura jamaicensis*), least bittern (*Ixobrychus exilis*), green heron (*Butorides virescens*), American avocet (*Recurvirostra americana*), and common moorhen (*Gallinula chloropus*) (Cooper 2006).

Other wetland species considered extant by von Bloeker (1943) during the 1930s were unrecorded in subsequent decades, so it is likely these, too, vanished during this early period. These include breeding/summering populations of the following: snowy plover (*Charadrius alexandrius*), Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), American coot (*Fulica americana*), and marsh wren (*Cistothornus palustris*). Three coastal waterfowl species, the canvasback (*Aythya valisineria*), redhead (*Aythya americana*), and common merganser (*Mergus merganser*), apparently also disappeared after the 1930s; according to von Bloeker (1943), all three favored the large coastal lagoon which was greatly reduced in size and function by the channelization of Ballona Creek by the 1940s.

Most riparian species lost at Ballona in the past century also disappeared during this early period; several present during the 1930s have not been recorded since, including breeding/summering populations of the northern flicker (*Colaptes auratus*), yellow-breasted chat (*Icteria virens*), black-headed grosbeak (*Pheucticus melanocephalus*), and American goldfinch (*Carduelis tristis*), and wintering Hutton's Vireo (*Vireo huttoni*); the chat, the grosbeak and the goldfinch all are still found in Los Angeles-area riparian habitats (Garrett 1993; Long 1993; Cooper 2000; Heindel 2005).

Waterfowl continued using the Ballona Wetlands in large numbers into the early 1950s (T. Doheny, long-time resident of Beverly Hills, Calif., pers. comm.), but not surprisingly, the loss of 320 hectares of intact coastal wetlands and tidal channels by the 1960s affected both species presence and natural avian phenomena, with species of salt marsh and mudflat habitats hardest hit during this middle period. Birds essentially absent except as transients or vagrants since the construction of Marina del Rey in the late 1950s include the following species: brant (*Branta bernicla*), northern shoveler (*Anas clypeata*), northern pintail (wintering population), northern

Table 1. Known avian extirpations and reestablishments, Ballona Valley, 1900-present (from Cooper 2006). BFM = Ballona Freshwater Marsh.

Species	Role	Former habitat	Period Extirpated	Reestablished
Brant[1]	Wintering	Wetlands	Middle	-
Cinnamon teal	Breeding	Wetlands	Early	-
Northern shoveler	Wintering	Wetlands	Middle	2003, BFM
Northern pintail[1]	Breeding	Wetlands	Early	-
Northern pintail	Wintering	Wetlands	Middle	2003, BFM
Canvasback[1]	Wintering	Wetlands	Early	-
Redhead	Wintering	Wetlands	Early	2003, BFM
Common merganser[1]	Wintering	Wetlands	Early	-
Ruddy duck	Breeding	Wetlands	Early	2003, BFM
California quail	Resident	Coastal scrub	Late	-
American bittern	Wintering	Wetlands	Middle	-
Least bittern	Summering	Wetlands	Early	2003, BFM
Green heron	Breeding	Riparian/Wetlands	Early	1995, Marina del Rey
White-faced ibis[1]	Wintering	Wetlands	Early	-
Turkey vulture	Wintering	Grassland	Late	-
Northern harrier	Breeding	Wetlands	Middle	-
Northern harrier	Wintering	Wetlands/Grassland	Late	-
Clapper rail	Resident	Wetlands	Middle	-
Virginia rail	Breeding	Wetlands	Early	-
Virginia rail	Wintering	Wetlands	Middle	2003, BFM
Sora	Breeding	Wetlands	Early	-
Sora	Wintering	Wetlands	Middle	2003, BFM
Common moorhen	Breeding	Wetlands	Early	-
Common moorhen	Wintering	Wetlands	Early	2003, BFM
Ameircan coot	Breeding	Wetlands	Early	2003, BFM
Pacific golden-plover[1]	Wintering	Grassland/Wetlands	Late	-
Snowy plover	Breeding	Beach	Early	-
Snowy plover	Wintering	Beach	Late	-
Black-necked stilt	Breeding	Wetlands	Middle	1998, Playa Vista
American avocet	Breeding	Wetlands	Early	-
American avocet	Wintering	Wetlands	Late	-
Long-billed curlew	Wintering	Wetlands/Grassland	Late	-
Burrowing owl	Resident	Grassland	Late	-
Short-eared owl[1]	Wintering	Grassland/Wetland	Late	-
Northern flicker[1]	Breeding	Riparian/Urban	Early	-

continued

Table 1. Continued.

Species	Role	Former habitat	Period Extirpated	Reestablished
Loggerhead shrike	Breeding	Grassland	Late	-
Hutton's vireo[1]	Wintering	Riparian	Early	-
Horned lark[1]	Resident	Grassland/Beach	Late	-
Rock wren[1]	Resident	Coastal scrub	Early	-
Marsh wren	Breeding	Wetlands	Early	-
Yellow-breasted chat	Breeding	Riparian	Early	-
"Large-billed' savannah sparrow	Wintering	Beach	Middle	-
Black-headed grosbeak	Breeding	Riparian	Early	-
Yellow-headed blackbird[1]	Wintering	Wetlands	Eary	-
American goldfinch	Breeding	Riparian	Early	-

[1] Largely extirpated from/irregular in this role on coast of southern California (see Cooper 2006).

harrier (*Circus cyaneus*; breeding population), American bittern (*Botarus lentiginosus*), clapper rail (*Rallus longirostris*), sora (wintering), Virginia rail (wintering), black-necked stilt (*Himantopus mexicanus*; breeding population), and "Large-billed" savannah sparrow (*Passerculus sandwichensis rostratus*). Another shallow-wetland species, the American avocet, declined sharply after the 1950s as a winterer but did not disappear entirely until the 1970s and 80s (Cooper 2006).

As dramatic as the species losses during this middle period was the disruption of migration phenomena – in particular the loss of large flocks of wintering and migrant waterfowl and shorebird species once plentiful at the wetlands. Important early-published accounts include:

- Northern shoveler: 200 birds on 05 Feb. 1947 (Western Tanager 13:28); 100 on 17 Jan. 1955 (Western Tanager 21:34)
- Northern pintail: Up to 2000 in the 1940s and 1950s (various; see Cooper 2006)
- Green-winged teal (*Anas crecca*): 250 on 22 Feb. 1948 (Audubon Field Notes 2:189)
- Eared grebe (*Podiceps nigricollis*): 69 on 06 Nov. 1950 (Audubon Field Notes 4:34)
- Snowy plover: 100+ on beach in late July 1926 (Bird-Lore 28:355)
- Willet (*Catoptrophorum semipalmatus*): 10,000 on 18 Oct. 1953 (Audubon Field Notes 8:42); 1800 on 20 Aug. 1951 (Audubon Field Notes 5:39)
- Wilson's phalarope (*Phalaropus tricolor*): 180 on 30 July 1949 (Audubon Field Notes 3:252).
- Red-necked phalarope (*Phalaropus lobatus*): "hundreds" on several occasions during Aug. and Sept. in the 1920s, 1940s, and 1950s (e.g., 09 Sept. 1949, Western Tanager 16:8)

Modern counts of each of the above species have been a fraction of these numbers (Cooper 2006), as most waterfowl apparently have since shifted their main migration routes and wintering grounds inland to the San Jacinto Valley and the Salton Sea or to more extensive wetlands in neighboring Ventura, Riverside, and Orange counties (Garrett and Dunn 1981).

Though the construction of the Marina del Rey was felt by many to have "finished off" the bird community at Ballona (indeed, many local birders and naturalists mourned its loss and stopped visiting altogether between the 1960s and the opening of Ballona Freshwater Marsh in 2003; H. Clarke, pers. comm.), an equally dramatic (but little-noticed) wave of local extinctions occurred during the 1970s and 1980s, with grassland and open-country species especially impacted. The following species were known to be present through the 1970s but gone by the end of the 1990s: northern harrier (wintering), turkey vulture (*Cathartes aura*; wintering), California quail (*Callipepla californica*), Pacific golden-plover (*Pluvialis fulva*), long-billed curlew (*Numenius americanus*), burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), loggerhead shrike (*Lanius ludovicianus*; breeding population), and horned lark (*Eremophila alpestris*). Additionally, a distinctive grassland mammal, the black-tailed jackrabbit (*Lepus californicus*), also went extinct at Ballona by the early 1990s (K.L. Garrett, unpubl. data).

This late period saw an unprecedented number of bird species colonizing the Ballona Valley, as large tracts were transformed from fields and marshes into a semi-tropical woodland of non-native trees and shrubs within residential neighborhoods. Of the 27 species known to have newly-colonized or that have become reestablished here since the 1950s, nearly half (13) have done so only since 2003, occurring almost exclusively at one site, the new Ballona Freshwater Marsh (Cooper 2006).

Turnover in the bird community of the Ballona Valley has been influenced by regional population status of each species, local habitat conditions, and the ability of certain species to persist in degraded habitats and to take advantage of novel ones. Environmental laws enacted in the 1970s (especially the California Environmental Quality Act) have strongly discouraged subsequent wetland destruction at Ballona and elsewhere in the region, and are no doubt responsible for the persistence of local breeding populations of the federally endangered California least tern (*Sternula antillarum browni*) and the state endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingii*), the former nesting at a fenced exclosure on a popular beach. Recovery of the more sensitive species in the Ballona system (e.g., breeding snowy plover), may require a public education program and a major commitment by public agency staff and volunteers similar to that which has been afforded the tern and the sparrow. The reestablishment of at least one characteristic wetland species, the clapper rail, may warrant a reintroduction program, given its sedentary habitats and the dearth of records here in the five decades since its extirpation (Cooper 2006) – provided its habitat can be re-created.

Just as all bird species did not disappear at the same time, they are not recolonizing all habitat types equally at Ballona. Freshwater marsh has been remarkably successful at attracting previously extirpated species back to the Ballona Valley; every one of the 11 once-extirpated species that have been reestablished at Ballona since 1950 is characteristic of freshwater marsh habitat (Garrett and Dunn 1981; Cooper 2006), with all but two appearing since the creation of the Ballona Freshwater Marsh in 2003 (Table 1).

By contrast, reestablishment has been practically non-existent for birds extirpated from habitats other than freshwater marsh, such as riparian, grassland, scrub, and coastal habitats (Table 2). For certain grassland and marsh species lost during the late period, including the California quail, clapper rail, and burrowing owl, their terrestrial and sedentary habits have left them particularly vulnerable to predation by the introduced red fox and domestic cats (*Felis catus*). The spread of non-native evergreen shrubs has no doubt reduced the extent of short grass and bare ground for other grassland and salt marsh species at Ballona, a few of which (e.g., short-eared owl) are now approaching extirpation as breeders and/or winterers on the entire coastal slope of southern California (Allen and Garrett 1995; Hamilton and Willick 1996; Gallagher 1997; Cooper 2004; Garrett and McCaskie 2004; Unitt 2004; Smith et al. undated). Therefore, their reestablishment in the Ballona Valley may be unlikely, regardless of restoration and management actions.

However, those that are persisting locally in these habitats in the Los Angeles area or in coastal areas of neighboring counties should be considered priority species for restoration, including wintering populations of the American avocet and long-billed curlew, which should be considered most likely to return to Ballona through salt marsh restoration (Table 3). Freshwater marsh species expected to become reestablished here soon, including breeding populations of the cinnamon teal, sora and Virginia rail, and marsh wren, all persist in similar roles elsewhere in the Los Angeles Basin (Long 1993; Heindel 2005) (Table 3). For riparian species, the maturation of habitat at the Ballona Freshwater Marsh and the ongoing construction of a riparian corridor nearby should be monitored for the return of breeding black-headed grosbeak and American goldfinch – both still extant in willow clumps just east of the Ballona Valley (Garrett 2001).

For extirpated birds dependent on grassland and dune scrub, the fact that more of this habitat is unlikely to appear in the region in the future means they may be lost forever, regardless of their status in the surrounding region. It also emphasizes the importance of protecting populations of open-country species before they become extirpated, which is still possible for the American kestrel (*Falco sparverius*), blue grosbeak (*Passerina caerulea*), western meadowlark (*Sturnella neglecta*), and other grassland birds. Aggressive and large-scale habitat manipulation, such as a concerted effort to control Chrysanthemum and non-native shrubs in grassland, might assist them, but the trends are not encouraging at small restoration sites in the region. More than 10 years of non-native plant removal and native scrub plantings on the remnant coastal dunes at the western edge of the Ballona Wetlands and at the Ballona Lagoon have not led to the reappearance of any extirpated bird species here (B. Courtois, National Audubon Society, unpubl. data.; C. Almdale, unpubl. data), nor has the return of tidal flow to Del Rey Lagoon seen the reestablishment of any waterbird populations or numbers of migrants close to historic levels (pers. observation).
Of course, this should not suggest a complete failure of restoration efforts;

Table 2. Habitat preferences and timing of extirpated and reestablished taxa (1900-present)[1].

	Habitat type				
	Beach	Wetlands	Riparian	Grassland	Coastal scrub
Extirpated					
Early period	1	17	6	0	1
Middle period	1	9	0	0	0
Late period	1	5	0	8	1
Reestablished	0	11	1	0	0

[1] From Table 1; species typical of two habitat types (e.g., Green Heron) are counted for each habitat where extirpated.

Table 3. Likely candidates for recolonization in the Ballona Valley, based on persistence in region. BFM = Ballona Freshwater Marsh.

Species	Role	Former habitat	Location
Cinnamon teal	Breeding	Wetlands	BFM
California quail[1]	Resident	Coastal scrub	All
American bittern	Wintering	Wetlands	BFM
Turkey vulture	Wintering	Grassland	N/A (aerial)
Northern harrier	Wintering	Wetlands/Grassland	Ballona Wetlands
Clapper rail[1]	Resident	Wetlands	Ballona Wetlands
Virginia rail	Breeding	Wetlands	BFM
Sora	Breeding	Wetlands	BFM
Common moorhen	Breeding	Wetlands	BFM
Snowy plover	Breeding	Beach	Playa del Rey/ Venice Beach
Snowy plover	Wintering	Beach	Playa del Rey/ Venice Beach
American avocet	Breeding	Wetlands	Ballona Wetlands
American avocet	Wintering	Wetlands	Ballona Wetlands
Long-billed curlew	Wintering	Wetlands/Grassland	Ballona Wetlands
Burrowing owl	Resident	Grassland	Ballona Wetlands
Loggerhead shrike	Breeding	Grassland	Ballona Wetlands
Marsh wren	Breeding	Wetlands	BFM
Yellow-breasted chat	Breeding	Riparian	BFM/ "Riparian Corridor"
"Large-billed" savannah sparrow	Wintering	Beach	Playa del Rey/ Venice Beach
Black-headed grosbeak	Breeding	Riparian	BFM/ "Riparian Corridor"
American goldfinch	Breeding	Riparian	BFM/ "Riparian Corridor"

[1] Non-migratory; re-introduction probably necessary for reestablishment.

undoubtedly, they have improved local conditions for numerous species dependent on native habitat by affording them more foraging and roosting choices, and have perhaps even staved-off the local extirpation of sensitive and declining taxa. Rather, it illustrates the difficulty of retaining and restoring bird communities through habitat restoration and creation alone, and emphasizes the importance of preventing extirpations in the first place.

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Daniel S. Cooper is a staff ecologist for the Puente Hills Native Habitat Authority and runs his own ecological consulting business in the Los Angeles area and in Latin America. Until 2005, he was the California Director of Bird Conservation for the National Audubon Society. His research focuses on current and historical bird communities of the Los Angeles area, and he holds degrees from Harvard University and the University of California, Riverside.

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