Managing Nesting and Foraging Habitats to Benefit Breeding Tricolored Blackbirds

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The Tricolored Blackbird (*Agelaius tricolor*) is a near-endemic California passerine that now forms the largest breeding colonies of any North American land bird, since the extinction of Passenger Pigeon (*Ectopistes migratorius*) in 1914 (Beedy and Hamilton 1999, Cook and Toft 2005).

Unlike their close relative, the widespread and territorial Red-winged Blackbird (*Agelaius phoeniceus*), the Tricolored Blackbird has a very limited geographic range and is nearly restricted to California. The number of Tricolored Blackbirds plummeted during the 20th Century due to a variety of factors, and the number of tricolors continues to decline due to on-going habitat losses through widespread conversion of natural habitats to agriculture and urbanization (Figure 1), chronic destruction of breeding colonies by the harvest of their nesting substrates, and shooting in autumn when causing depredation to ripening rice while in mixed-species foraging flocks.

This paper provides guidance to private landowners and public land managers to conserve and enhance breeding and foraging habitats to promote the recovery and long-term conservation of the species. We first summarize what is known of the Tricolored Blackbird's current range, its habitat requirements, and the causes and extent of its current population decline. We focus on the breeding season, as habitat management to create and manage wetland and upland breeding habitat with nearby foraging habitat is critical to enhance breeding by the species. We assume that Tricolored Blackbirds will continue to use agricultural and weedy fallow fields for nesting, so we also provide guidance on managing these agricultural habitats to maximize their value for "California's Blackbird."

CURRENT RANGE

Historical surveys did not include large portions of the species' currently known breeding range and consequently did not document its full extent. Tricolored Blackbirds are now known to occur at low elevation sites throughout the entire length of California. For more than seven decades, the largest number of breeding birds has occurred in the Central Valley (Neff 1937, Beedy and Hamilton 1999, Beedy 2008, Kyle and Kelsey 2011). However, the proportion

and absolute number of birds breeding in the Central Valley has recently declined precipitously (Meese 2014).

Figure 1. Before and after photographs of a Tricolored Blackbird breeding colony location in eastern Merced County that was planted to almonds. *Before* photograph taken in May 2006; *after* photograph taken February 2015. Almond trees planted autumn 2012.

Tricolored Blackbirds are fairly common but localized breeders in the western Sierra Nevada foothills up to about 500m (1,500ft) (Beedy and Pandolfino 2013; Airola, et al. 2015). Smaller numbers breed in coastal locations from Santa Barbara County north to Mendocino County and on the Modoc Plateau in northeastern California (Beedy 2008). Small numbers also breed at scattered locations in Oregon, one valley in Washington, a single site in western Nevada, and at several locations in northern Baja California, Mexico (Beedy and Hamilton 1999). Tricolored Blackbirds often exhibit "itinerant breeding," in which individuals move north after first nesting efforts (early March to late April) in the San Joaquin Valley to new breeding locations in the Sacramento Valley, low Sierra foothills, and northeastern California (Hamilton 1998).

Following the breeding season, Tricolored Blackbirds flock with other blackbird species and are primarily found in the Sacramento Valley. During winter, most Tricolored Blackbirds are found in the Sacramento-San Joaquin Delta, the southern Sacramento Valley, and widely dispersed in the San Joaquin Valley. The southern California population segment south of the Transverse Ranges is relatively sedentary, with movements mostly confined to southern California, although apparently some birds rarely move out of the Central Valley into southern California (Beedy and Hamilton 1999, Beedy 2008, Meese 2014).

HABITAT REQUIREMENTS

The Tricolored Blackbird's basic requirements for selecting breeding sites are: 1) a protected nesting substrate in flooded, thorny, or spiny vegetation; 2) an open accessible source of water for drinking and bathing; and, 3) a suitable foraging space providing insect prey (Beedy and Hamilton 1999, Beedy 2008, Cook and Toft 2005, Meese 2014).

Breeding colonies are found in a variety of nesting substrates, including freshwater marshes dominated by cattails (*Typha latifolia*) or bulrushes (*Schoenoplectus californicus*) in the Central Valley and in coastal locations, introduced Himalayan blackberry (*Rubus armeniacus*) surrounded by grazed annual grasslands and oak savannas in the foothills of the Sierra Nevada, and grain fields adjacent to dairies in the San Joaquin Valley and southern California. Ideal breeding habitats consist of a suitable nesting substrate surrounded by foraging habitats in annual grasslands, shrublands, or agricultural fields that produce large numbers of grasshoppers, dragonflies, and other large insects, with a source of surface water nearby (Beedy and Hamilton 1999, Meese 2014).

Wintering Tricolored Blackbirds often congregate in large, mixed-species flocks that forage in grasslands and agricultural fields with low-growing vegetation and at dairies and feedlots. Wintering birds are especially attracted to agricultural fields that are under active cultivation. They occur in large flocks with several other blackbird species and follow closely behind tractors and related farm machinery to feed on unearthed invertebrates and seeds (Beedy and Hamilton 1999, Beedy 2008). In early February, however, they segregate into pure Tricolored

Blackbird flocks, which may subdivide further into age-and sex-specific flocks. At this time, flocks roam across the landscape until they find a suitable nesting substrate.

CAUSES AND EXTENT OF CURRENT POPULATION DECLINE

Among the Tricolored Blackbird's numerous conservation challenges, the most insidious and widespread are the losses of breeding and foraging habitats. In most of the species' range, these habitat losses are due to conversion of native habitats to agriculture and urbanization, primarily of native habitats to perennial nut orchards, vineyards, and rice.

Rice cultivation produces an additional conservation challenge: in autumn, mixed flocks of Tricolored Blackbirds, Red-winged Blackbirds, other blackbirds, and European Starlings (*Sturnus vulgaris*) and are commonly found in rice paddies in the Sacramento Valley. Although Tricolored Blackbirds are listed as endangered under the California Endangered Species Act and may not be legally killed, the other blackbird species are exempted from protection under any state or federal law and are often shot in large numbers when causing depredations to ripening rice (DeHaven 1971, USDA 2012, Meese pers. obs.). Thus, an unknown number of Tricolored Blackbirds is shot each fall when they flock together with other blackbird species while foraging on ripening rice.

In addition to landscape conversions and losses in autumn, for several decades there have been widespread and sustained losses of eggs and nestlings due to normal agricultural activities. Since the 1980's, large numbers of Tricolored Blackbirds have nested in grain fields adjacent to dairies in the San Joaquin Valley and in southern California (DeHaven 2000). Most dairies are surrounded by large grain fields, primarily of triticale, a high-yield wheat (*Triticum*) X rye (*Secale*) hybrid grain grown to feed dairy cows. Due to their vigor and stiff stems, triticale plants, unlike other grains, are able to support Tricolored Blackbird nests.

Until recently, a vast majority of breeding Tricolored Blackbirds nested in triticale fields (Kelsey 2008). The number of birds nesting in these fields, however, has declined dramatically due to reproductive failures that resulted from the harvesting of their nesting substrates before young fledged from nests and to poor reproductive success in those grain-field colonies that were conserved (Meese 2009). Despite recent efforts to conserve these "silage colonies" by paying farmers to delay the harvest of their fields, this voluntary program has been only partially successful, and the breeding efforts of many hundreds of thousands of birds over several decades have been lost—a likely contributor to the species' overall decline (Meese 2009).

Due to their colonial nesting behavior, where hundreds or thousands of nests occur in close proximity to each other, mammalian and avian predators can take a large toll by consuming eggs and nestlings, especially from

freshwater marsh colonies. Raccoons (*Procyon lotor*) are the most serious mammalian predator of nesting Tricolored Blackbirds in wetlands but river otters (*Lutra canadensis*) may also cause widespread losses. Avian predators often seen around freshwater marshes include Northern Harriers (*Circus cyaneus*), Cooper's Hawks (*Accipiter cooperii*), Red-tailed Hawks (*Buteo jamaicensis*), Black-crowned Night-Herons (*Nycticorax nycticorax*), Cattle Egrets (*Bubulcus ibis*), White-faced Ibis (*Plegadis chihi*), and Common Ravens (*Corvus corax*). Marsh Wrens (*Cistothorus palustris*) cause additional losses by poking holes in blackbird eggs (Beedy and Hamilton 1999).

As a result of these and other factors, the number of Tricolored Blackbirds has been reduced by more than 90% in the past 80 years, and future conservation of the species will depend on active protection and management efforts. The non-regulatory efforts of many public agencies and private organizations over the past decade have failed to stem the decline and the persistent reproductive failures make the long-term prospects for the species, and its potential for recovery, uncertain. In response to the decline, the Center for Biological Diversity filed a petition to list the Tricolored Blackbird as "Endangered with Emergency Regulations" with the California Fish and Game Commission on 8 October 2014 (Center for Biological Diversity 2014), and the species was given emergency protection as endangered under the California Endangered Species Act in December 2014. If the listing eliminates the known sources of mortality (e.g., harvest of nesting substrates before young have fledged and autumn shooting in rice fields), this could increase the number of young produced while reducing the rate of adult mortality, and thereby stem the decline and help to increase the number of birds.

GUIDELINES FOR MANAGING WETLAND NESTING HABITATS

One critical component of the effort to recover the Tricolored Blackbird is to provide optimal nesting conditions by managing nesting substrates. The quality of many of the most common nesting substrates varies through time and it is hoped that active management will more consistently provide optimal nesting conditions and increase the number of young produced. The following management guidelines are intended to benefit Tricolored Blackbirds by describing the nesting habitat characteristics required by breeding birds and providing guidance to landowners and managers. While our emphasis is on nesting habitats, we also describe actions that may enhance foraging habitats, as both are required for successful reproduction.

Freshwater Marshes

Freshwater marshes are believed to have been the Tricolored Blackbird's primary nesting habitat throughout its evolutionary history (Orians 1961), and the first studies of the species found that over 80% of nests were constructed in freshwater marshes (Neff 1937). Nesting female Tricolored Blackbirds strongly

prefer large, continuous blocks of young, lush cattails and bulrushes that are in their first or second year of growth (Figure 2). Optimal marsh habitat conditions include emergent vegetation at least 1.3 m (4 ft.) high and submerged in shallow water 15-45 cm (6-18 in) deep. Cattail stands must be at least 50ft (15m) wide to support successful nesting by Tricolored Blackbirds.

Figure 2. Tricolored Blackbird colony in freshwater marsh, Los Angeles County. *Photo © Alice Wollman*

Although birds will nest in both cattails and bulrushes, they appear to prefer cattails due to their multiple, closely-spaced stems. Bulrush stands are less frequently occupied likely due to the relatively wider spacing of stems, and those that are occupied are, like cattails, typically in their first or second year of growth. Young, dense growth provides the multiple closely-spaced stems preferred by females both because they provide multiple supports for their woven grass nests and perhaps also because they help to hide their nests from mammalian predators. Of great importance is the condition of the cattails and bulrushes, as they must be maintained in a young and vigorous state to be attractive to nesting birds. When old, senescent stems begin to accumulate, these must be removed. Older stems are both less dense and are more likely to fall over, and when fallen stems accumulate, they provide less cover and may provide easy access to the nests for mammalian predators (Meese pers. obs.).

Creating and maintaining the conditions preferred by Tricolored Blackbirds nesting in wetlands may also provide significant benefits for many other special status wetland-dependent species, including: Yellow-headed Blackbirds

(*Xanthocephalus xanthocephalus*), White-faced Ibis, Least Bitterns (*Ixobrychus exilis*), Northern Harriers, California Red-legged Frogs (*Rana draytonii*), and Giant Garter Snakes (*Thamnophis gigas*). Thus, providing optimal nesting habitat for Tricolored Blackbirds may also enhance the habitats of several other sensitive or endangered species.

Freshwater marshes require relatively high levels of maintenance to maintain the vegetation conditions preferred by nesting Tricolored Blackbirds. Ideal management involves "refreshing" the marsh vegetation to return it to a youthful state of dense, rapidly-growing stems through effective water management plus regular removal of dead stems through burning, cutting, grazing, discing, or masticating.

Water Management. An easily accessible source of surface water is essential for both drinking and bathing, and for nest-building as females use mud to line and provide shape and structure to the nest bowls. In many cases, females will gather long grasses for their nests but wet the grasses prior to weaving them around the stems and leaves of the nest substrate. Water is also used to wet insects captured by adults prior to feeding them to the nestlings (Meese, pers. obs).

Tricolored Blackbirds use water provided in a variety of forms, including streams, ponds, farm canals or ditches, and in many agricultural areas water is provided when crops are flood-irrigated. In most cases, birds prefer to nest over or immediately adjacent to water, but in drier upland situations, they will nest hundreds of yards from water sources. If water is under the control of the landowner, it should be provided throughout the breeding season.

A water regime consisting of perennial flooding is preferred to produce and maintain optimal vegetation conditions that may last for 4 or 5 years. Seasonally-flooded wetlands must be actively maintained in an annual or biennial cycle if they are to provide the young, lush cattails preferred by nesting birds. The season of flooding should be timed so that: 1) the cattails are a minimum of 4 ft. tall by 1 April in southern California and the San Joaquin Valley and 1 May in the Sacramento Valley and coastal areas, and 2) the cattails remain flooded during the entire time that tricolors are present.

Thus, winter through spring flooding is required in southern California and the San Joaquin Valley and recommended in the Sacramento Valley. Standing water 6 to 12 inches (15-30 cm) deep should be maintained throughout the breeding season to minimize mammalian predation and to maintain a cooler microclimate around nests. Tricolors typically abandon breeding attempts if water is drawn off of wetlands before the young fledge. In addition to the flooding regime, a perimeter "moat" of deeper water, up to 1 m (3 ft.) deep and 10 m (30 ft.) wide is desirable, to discourage raccoons and other mammalian predators from entering the portion of the wetland occupied by breeding birds.

Waterfowl Brood Ponds. Waterfowl brood ponds (ponds with spring and summer water for the young produced by waterfowl) may provide Tricolored Blackbird breeding habitat and take best advantage of the costs of providing spring and summer water. A waterfowl brood pond may be managed as a summer water pond (flooded October–July), a reverse cycle wetland (flooded February–July), a seasonal wetland–summer water combination (flooded all year), or an upland–summer water combination (flooded February–July). The ideal flooding regimes for Tricolored Blackbirds are either a reverse cycle wetland or a large summer water pond, if the water is provided early enough to support cattail growth to the height preferred by nesting birds by the time of their arrival. We also stress that the recommended configuration of cattail patches for optimal Tricolored Blackbird breeding habitat differs from that for a typical waterfowl brood pond. Waterfowl brood ponds usually have small islands interspersed throughout the pond to maximize surface area of the cattail patches. Tricolored Blackbirds do not use small patches of cattails and so it is important to manage cattail patches to be large and continuous (see above), maximizing the internal area of patches, and to keep water on the site long enough into the summer for the Tricolored Blackbirds to finish nesting.

Burning. Burning is the preferred method to maintain wetland vegetation as it mimics natural conditions and rapidly and completely removes old, senescent stems while releasing nutrients that support the growth of new stems. Burning is best done in late autumn when the maximum number of senescent stems has accumulated, and preferably over water or well-saturated soil to protect the rhizomes and any young plants from being scorch-killed. Burning may be done as late as early February, but when wetlands are burned this late the cattail growth by the Tricolored Blackbird's breeding season is usually insufficient to be suitable for settling birds. Experience has shown that Tricolored Blackbirds will arrive at a wetland and remain in the area before settling if the cattails are shorter than the height preferred by nesting birds but are rapidly growing and reach the preferred height within 2-3 weeks following their arrival (Meese pers. obs.). Landowners may burn cattails, assuming any necessary air resource board permits are obtained, or they may be able to schedule a burn by federal, state, or county fire crews as part of their fire management training. Landowners are encouraged to consult with wetland managers at a local National Wildlife Refuge, a local Natural Resource Conservation Service (NRCS) office, or a California Department of Fish and Wildlife office for additional information and to discuss options for using fire to maintain wetland vegetation.

Cutting Cattails. This method is a more labor-intensive means of removing dead stems and may be suitable only for very small stands where fire is inappropriate due to nearby trees or other woody vegetation, air quality regulations, or where other concerns preclude its use. There are several different types of cutters, from tractor-mounted types (e.g., pak-flail mowers)

Figure 3. Freshwater marsh burning in autumn, Colusa County. *USFWS photo.*

to hand-held hedge trimmers. The use of hedge trimmers will result in the accumulation of cut stems which must then be removed by burning or mechanical harvest and disposal, whereas cutters typically produce a mulch of small stem fragments which may be left to degrade in the marsh and to slowly release their nutrients.

Grazing. Livestock grazing is an appropriate and effective means of removal of dead cattail stems if the water level of the wetland can be controlled and cattle can be allowed into the wetland for a brief interval of 1-4 weeks. Cattle will typically graze the stems down to the soil level (Figure 4). As with burning, grazing is best scheduled in late autumn following the annual period of growth and all cattle should be removed prior to growth resuming in late winter.

Discing. This is an appropriate management method to delay the re-growth of new cattails, to prevent their expansion, or when it is difficult to obtain a permit to burn. Discing is not recommended if the rapid re-growth of the wetland vegetation is desired and care is required so that discing does not result in mortality to cattail rhizomes (Figure 5). As with burning, discing is recommended in late autumn, as it requires dry soil and the cattails need three or more months of growth post-treatment to attain the characteristics preferred by nesting Tricolored Blackbirds.

Figure 4. Cattail marsh recently grazed by cattle. *Photo © Lee Metcalf, USFWS.*

Figure 5. Cattails recently disced. Kern County. *Photo © Bob Meese*

Mastication. This method involves the use of a specialized piece of equipment, the vegetation masticator, which is typically a tractor-mounted drum with large claws or teeth that shreds vegetation into small pieces (Figure 6). It may be useful in some instances where cattail and bulrush growth is especially thick and not easily maintained by other mechanical methods and/or in areas where burning is impractical or inappropriate. Vegetation masticators that are mounted on the end of a large mechanical arm may allow the maintenance of vegetation within 10-20' of the perimeter of a pond and not require that the pond be drained prior to use, whereas a tractor-mounted vegetation masticator would require that the water be drawn off and the soil in the basin be nearly dry. Care must be taken with this method as there is a risk that the vegetation masticator may dig too deeply into the soil and thereby destroy or pull out the underground rhizomes. Marsh management with vegetation masticators is typically done by vegetation management specialists.

Figure 6. Vegetation masticator, Monterey County. *Photo © Christy Wyckoff*

Stinging Nettles

Stinging nettles (*Urtica dioica*) are native plants confined to wet canyon bottoms, reservoir margins, and other saturated soils surrounded by uplands. Nettles provide well-protected nesting substrates due to the presence of sharp hollow spines on the stems and leaves that contain histamines and other

chemicals that produce a stinging sensation when contacted. Tricolored Blackbird colonies in stinging nettles are often found in regions of high topographic relief on the sides of the Central Valley but may occur in the Central Valley if the required saturated soils are present. Stinging nettles are annuals and require little maintenance, but in some instances it may be necessary to maintain a water supply to provide the required saturated soil.

Stinging nettles may occur naturally due to appropriate edaphic and hydrographic conditions, but both seeds and plants are widely available from commercial sources if it is desired to begin a stand in a new location. Stands of stinging nettles occupied by nesting birds are often small, only a few feet wide and tens to hundreds of feet long, and small 30'x30' blocks of stinging nettles grown successfully by gravel mine operators during land reclamation activities have been used by breeding Tricolored Blackbirds.

GUIDELINES FOR MANAGING UPLAND NESTING HABITATS

The upland breeding substrates most often used by nesting Tricolored Blackbirds are the non-native Himalayan blackberry and milk thistle (*Silybum marianum*). Less often they use a wide variety of other wild and cultivated plant species including: cheeseweed mallow (*Malva parviflora*), mustard (*Brassica spp.*), California blackberry (*Rubus ursinus*), giant cane (*Arundo donax*), bull thistle (*Circium vulgare*), prickly lettuce (*Lactuca serriola*), sandbar willow (*Salix exigua*), and cultivated fields of triticale and fava beans (*Vicia fava*; Beedy and Hamilton 1999, Meese 2011). Several of these species may occur together, as well as with cattails and bulrushes, and Tricolored Blackbirds colonies may occur in weedy fields with nests built in several different plant species in close proximity.

Upland habitats are easier to maintain than wetland habitats, as most plants used by nesting birds are perennials that require little if any maintenance or annuals that require little management but whose growth is often strongly influenced by the timing and quantity of annual precipitation or irrigation.

Himalayan Blackberry

Himalayan blackberry is a large and vigorous plant that is native to Eurasia and has become naturalized throughout North America where it was first introduced as a cultivated crop in 1885. By 1945 it had become well-established along the West Coast, including in California where it is now considered an invasive weed and may not be planted as any part of a federally-funded conservation project (California Invasive Plant Council 2014).

Himalayan blackberry is the predominant nesting substrate used by Tricolored Blackbirds in the lower elevation foothill grassland region between the Central Valley floor and the Sierra Nevada (Airola et al. 2015) and is widely used in the upper San Joaquin Valley and much of the Sacramento Valley.

Figure 7. Tricolored Blackbird colony in Himalayan blackberry, Yuba County. *Photo © Ted Beedy*

Nesting Tricolored Blackbirds use stands of Himalayan blackberry varying in size from a fraction of an acre to several acres, and from 1.6-3.3 m (5-10 ft.) tall (Figure 7). In most cases, Himalayan blackberry grows in long, narrow stands but its stature is highly variable and dependent upon local conditions. The plants have long canes that are protected by large, sharp thorns that provide a degree of protection to nesting birds that may be unmatched by any other nesting substrate. In most cases, the plants occur interspersed in open annual grasslands often in association with water sources such as leaking drainage ditches and canals and in irrigated pastures in the Central Valley floor, annual grasslands, and open blue oak (*Quercus douglasii*) savanna in the Sierra Nevada foothills. Tricolored Blackbirds seem to prefer the tallest Himalayan blackberry stands, especially those that are supported by barbed-wire fences and grow along fence-rows, but regularly occupy stands that are not associated with fences especially when these are near a reliable source of water. During severe, prolonged drought, such as that from 2011-2014, Himalayan blackberries may lose large amounts of foliage and thus be unattractive and largely unsuited to nesting Tricolored Blackbirds (Meese pers. obs.).

Himalayan blackberries may spread across pastures to such an extent that they reduce livestock forage production, thus some ranchers regularly control blackberries through mechanical pruning or mastication, burning, crushing, or spraying with herbicide and then burning. However, because many of the blackberry stands that conflict with grazing are not attractive to nesting Tricolored Blackbirds, they can be controlled while the most suitable stands for nesting are retained. Landowners with small stands of Himalayan blackberry who wish to attract nesting Tricolored Blackbirds should encourage their vertical growth while restricting their horizontal spread.

Weedy Fields

In many cases, a field occupied by nesting Tricolored Blackbirds is not dominated by a single species but may be composed of several weed species,

usually including milk thistle, mustard, and mallow, and nests may be constructed in all three (and perhaps other) species. To encourage the growth of such fields, either burn the field or cultivate the soil in autumn and rely upon winter and early spring precipitation to provide the water necessary to germinate seeds and sustain the weedy growth.

Figure 8. Tricolored Blackbird colony in triticale, Kern County.
Photo © Bob Meese

Triticale

Since the 1980s the largest Tricolored Blackbird breeding colonies have been located in fields of triticale (Beedy and Hamilton 1999; Figure 8). Triticale fields are not considered a desirable nesting habitat, as birds that settle to nest present farmers with a dilemma: typically, the triticale field is ready for harvest while eggs or young are in the nests, but delaying the harvest reduces nutritional value of the crop. Any farmer with Tricolored Blackbirds settling in to nest in a grain field is urged to contact the local Agricultural Extension Specialist, Fish and Wildlife officer, or nearby National Wildlife Refuge.

GUIDELINES FOR MANAGING FORAGING HABITATS

Foraging Requirements

Breeding female Tricolored Blackbirds require insects to provide the essential fatty acids and essential amino acids needed to form eggs, and nestlings require insects for their first nine days of life. Recent research has shown a strong correlation between insect abundance and reproductive success (Meese 2013). Tricolored Blackbirds eat a wide variety of insects and feed many kinds of insects to their young (Crase and DeHaven 1977). They appear to take advantage of many insect groups that may become locally abundant, but are known to prefer large insects that are locally super-abundant, including grasshoppers during "outbreak" years, caterpillars in years and locations where they are especially abundant (Payne 1969, Meese pers. obs.), and dragonflies, especially late in the season (July and August) when large numbers of dragonflies hatch (Meese and Beedy pers. obs.).

Breeding Tricolored Blackbirds forage in a wide variety of habitats, including dry and irrigated pastures, open rangeland, shrublands, grasslands, and rice paddies. Birds along the coast are often arboreal foragers, and take caterpillars (often called oakworms) of the California oak moth (*Phryganidia californica*) primarily from the boughs of coast live oak (*Quercus agrifolia*) trees (Meese pers. obs.). Breeding birds in the San Joaquin Valley and at some sites in Riverside County also forage on stored grains in dairy commodity barns, although too-great dependency on the stored grains is often associated with poor reproductive success and colony failure (Meese unpub. data).

Due to their wide-ranging foraging habits (i.e., regularly travelling up to 5 km [3 mi]) from active breeding colonies), Tricolored Blackbird foraging habitats are typically not under the direct control of landowners or managers. Where possible, however, in an agricultural landscape, the organic or pesticide-free culture of crops known to support large insect populations (including alfalfa [*Medicago sativa*], sunflowers [*Helianthus spp.*], and rice [*Oryza sativa*] can sustain nearby Tricolored Blackbird colonies, and birds have been observed to travel up to 5 km between their nests and suitable foraging substrates even in highly urbanized environments (e.g., a colony in Riverside County in 2014). Thus, any action that would decrease insect mortality and result in increased insect abundance within 5 km would benefit nearby breeding tricolors, and the breeding birds themselves may be an effective and inexpensive "ecosystem service" that removes the insects that insecticides would be applied to control. Similarly, breeding Tricolored Blackbirds may be beneficial in rangeland areas where grasshoppers compete for livestock forage, but where grasshopper control through application of insecticides is not economical.

Tricolored Blackbirds and Ranching

In most agricultural settings, Tricolored Blackbird conservation and agriculture are alternative and conflicting land uses; however, in California's rangelands, cattle ranching and Tricolored Blackbird conservation are mutually beneficial activities. Ranchers provide water that may encourage the growth of Himalayan blackberries that are used as nesting substrate and also create stock ponds that produce emergent marsh nesting habitat and the water required for drinking and bathing. Ranchers also provide hay and alfalfa that may provide seeds and insects (alfalfa may support relatively high insect abundances, especially if left unsprayed; Meese 2006). Ranchers benefit from nesting Tricolored Blackbirds when the birds eat grasshoppers and other herbivorous insects that consume the grasses and forbs eaten by livestock, since the cattle disturb insects while grazing and make them more available to foraging birds. Grazing also maintains the grasses to the shorter stature, below 40 cm (15"), which is preferred by foraging Tricolored Blackbirds.

CONCLUSIONS

On-going losses of breeding and foraging habitats, which may contribute to chronic low reproductive success, complete breeding failures in harvested agricultural fields, and mortality from autumnal shooting of birds in rice paddies, are believed to be the major causes of recent Tricolored Blackbird population declines. The recovery of this species will require the active and thoughtful management of breeding and foraging habitats in strategically located portions of the species' range and the participation of local landowners.

The management of nesting habitats for breeding Tricolored Blackbirds may in some cases present possible conflicts in conservation policy because birds often nest in invasive non-native plants (e.g., Himalayan blackberries, milk thistle [*Arundo donax*]) that are widely viewed as undesirable. Tricolor conservation efforts, however, must eliminate known sources of mortality while maximizing reproductive success, which requires management for non-native nesting substrates. Conservation actions must emphasize collaborative approaches and strategic land management of high priority sites. Agriculture and Tricolored Blackbird conservation may be mutually compatible land uses in cases where breeding habitats are near foraging habitats that may consist of crops (primarily alfalfa, sunflowers, and rice) that are raised organically or without the use of pesticides while the breeding birds are present. Ranching and Tricolored Blackbird conservation are mutually compatible land uses and the active management of freshwater marshes may benefit several conservation-dependent species.

Tricolored Blackbird populations may recover if they are provided sufficient habitat and these habitats are properly managed. We have seen many instances where the active and collaborative habitat management for

"California's Blackbird" creates a win-win situation for both birds and landowners.

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