Ruderal Grasslands and Streaked Horned Lark Reserves in the Willamette Valley: Reviving a Unique Ecosystem and Recovering an Imperiled Pacific Northwest Bird

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Abstract
The loss of annual natural mechanisms to maintain ruderal grassland habitat in the Willamette Valley has been a primary factor in the decline and listing of the Streaked Horned Lark as a Threatened species under the U.S. Endangered Species Act. Extensive efforts to integrate lark conservation and recovery with other land uses have been unsuccessful (e.g., farming) or with limited success (e.g., vernal pools in prairie restoration) due to limited overlap of desired habitat conditions and land management that threatens lark productivity during the breeding season. The alternative to ensure annual representation of the ruderal grassland ecosystem and to meet objectives in the Draft Recovery Plan is the establishment of permanent Lark Reserves where ruderal grassland conditions can be maintained mechanically or manually through control of ground cover and vegetation growth. Just as restoration and establishment of wet prairie and upland prairie ecosystems has been a conservation priority, there is both an ecological and a listed species recovery priority to establish and maintain ruderal grasslands and Lark Reserves across the landscape of the Willamette Valley.

Streaked Horned Lark: Historical Perspective and Imperiled Status

The Streaked Horned Lark (*Eremophila alpestris strigata*; hereafter lark), an endemic Pacific Northwest bird, was originally listed as a Threatened species under the U. S. Endangered Species Act (ESA) in October 2013 (U. S. Fish and Wildlife Service [USFWS] 2013), with a continued listing as Threatened in April 2022 after a legal remanding (USFWS 2022). Approximately 72% of its estimated range-wide population of less than 2,000 birds occurs in the Willamette Valley of western Oregon, primarily associated with lands that are intensively managed with high threats to nesting birds (i.e., agricultural croplands and airports) (USFWS 2019). Range-wide recovery cannot be achieved without its recovery in the Willamette Valley (Henson 2014) where not only does most of the population reside, but there also is the greatest potential landscape characteristics to support increasing populations (USFWS 2016). All other ecoregions within the lark's range have much fewer birds (USFWS 2019) and a small, patchy distribution of the landscape characteristics required by the bird (USFWS 2016).

Larks nest and forage on the ground within large (e.g., hundreds of acres), open landscapes of low-statured herbaceous vegetation, a high percent of bare or sparsely-vegetated ground, and few to no trees or shrubs (Anderson and Pearson 2015). In the fertile soils Willamette Valley, most of these landscapes and conditions require some natural or purposeful disturbance to set-back succession to maintain the sparsely-vegetated herbaceous conditions. The two ecological processes that historically created and maintained these open landscapes were seasonal flooding and Native American burning (Chappel and Kagan 2001). The initial declines in lark populations were likely the consequence of the loss and alteration of those natural processes that occurred after Euro-American settlement (USFWS 2013).

Historically, lark breeding habitat likely occurred mostly on the poorly drained soils inundated from annual winter and spring flooding along the vast expanse of the Willamette River floodplain and its tributaries (Hulse et al. 2002). As waters receded during the spring and summer growing season, the exposed surface typically progressed from sparsely-vegetated ground that was suitable as lark habitat through stages of emerging herbaceous vegetation to conditions of a climax wet prairie ecosystem that

was not lark habitat. The rate at which this progression of vegetative cover occurred during the spring growing season was dependent on numerous local variables including water depth, spring rains, and composition of the seed bank.

Historically, lark non-breeding foraging habitat likely occurred mostly in upland prairies on well drained soils on both the valley floor and low foothills that were maintained by regular anthropogenic fires set by Native Americans mostly in late summer and early fall (Johannessen 1971, Boyd 1986). The rate of progression after fire from bare and sparsely-vegetated ground that was suitable as lark habitat through stages of emerging herbaceous vegetation to a climax upland prairie ecosystem that was not suitable lark habitat was completed during the fall and winter rainy season. Unless there was a new disturbance to those sites in early spring, vegetation growth had advanced to that of a prairie ecosystem and rendered the sites as unsuitable breeding habitat for larks.

There were several other situations that likely also supported historical breeding and non-breeding lark habitat. This included unique areas within wet prairie and upland prairie landscapes with naturally lithic (i.e., shallow) or rocky soils that inhibited plant growth throughout the growing season (e.g., areas of gravel deposition, slopes and terraces of hillsides and buttes), and sparsely-vegetated, sandy gravel bars in rivers maintained by river dynamics and sediment transport (USFWS 2019). Additionally, there were likely high use areas of regular disturbance by native peoples (e.g., encampments, trails) and wildlife (e.g., ungulate and geese grazing) that provided reduced vegetation growth and sparsely-vegetated ground.

Some of the historic conditions of suitable lark breeding habitat described above still annually occur in swales and depressions that are inundated by winter and spring rains and then follow the typical progression of herbaceous vegetation growth as waters recede, in a variety of anthropogenically-disturbed fields that provide ephemeral suitable lark habitat (e.g., agricultural cropland, development sites, initial disturbances and vernal pools at prairie restoration sites). However, most of these sites are small and can only support a couple pairs of larks, and some, especially agricultural cropland, also are subject to significant human disturbances during the breeding season that can negatively impact lark productivity and populations. Additionally, the composition of the seed bank today where flooding or disturbed fields occurs contains a dominant representation of invasive, non-native grasses and forbs with fast growth rates such that the conditions of sparsely-vegetated ground are of much shorter duration than historically. This is not true in the swales or depressions in agricultural fields that have been sprayed to exclude all but the desired crop seed which succeed slowly after receding water levels and maintain sparsely-vegetated conditions for a longer period of time. However, these locations are also subject to intensive land management during the lark nesting season (e.g., spraying, harvesting, tilling) and the agricultural land use that provided most of the suitable habitat conditions for larks in the Willamette Valley (i.e., rye grass fields) is rapidly declining and largely being replaced by unsuitable habitat for larks (i.e., filbert orchards) (Oregon State University 2019).

Ruderal Grassland: Distinct Ecosystem and Overlooked Status

The unique ecosystem described above of bare ground and sparsely-vegetated grasses and forbs has been referred to as a ruderal grassland (USFWS 2010, Nature Serve 2017). Ruderal grasslands in the coastal Pacific Northwest occur in the Southern Vancouverian Lowland Ruderal Grassland and Shrubland Group (USNVC 2025). They are usually disturbance-dependent and historically occurred after a significant disturbance of existing herbaceous vegetation cover either naturally (e.g., flooding, wildfire) or anthropogenically (e.g., agricultural activities, prescribed fire, human development). The spatial and temporal conditions of sparsely-vegetated ground in ruderal grasslands created a distinct ecosystem from prairies or other grasslands with unique ecological functions and species assemblages

(USFWS 2010). The feature that distinguishes ruderal grasslands from prairies is the dominance of sparsely-vegetated ground in ruderal grasslands and a dense cover of herbaceous vegetation in prairies.

It is important to acknowledge and identify ruderal grasslands as a distinct ecosystem and habitat type with ecological functions and species assemblages independent of prairies just as successional stages of forest are uniquely identified, managed, and conserved ecosystems (e.g., sapling forest, mature forest, old-growth forest). Although there are limited fauna associated with ruderal grasslands, one important species highly associated with ruderal grasslands is the Federally Threatened Streaked Horned Lark (USFWS 2010, USFWS 2018). Recognition of the ruderal grassland ecosystem and its importance to the lark was clearly emphasized when the lark was excluded from the *Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington* "because its preferred habitat is relatively bare, ruderal grasslands that differ from the native prairies occupied by other species addressed in this recovery plan" (USFWS 2010). This disassociation with prairie habitat was also part of the decision not to include the lark in the *Benton County, Oregon Prairie Conservation Strategy* (Benton County 2010).

Despite widespread recognition of ruderal grasslands as an ecosystem (USFWS 2010, Nature Serve 2017, USNVC 2025), they are generally not part of the ecological lexicon in the Pacific Northwest and are typically lumped as part of the prairie ecosystem they often precede successionally. Most of the misrepresentation of larks as a bird associated with prairie habitat in the Willamette Valley is due to their association with the ruderal grassland ecosystems that occur during initiation of prairie restoration activities. The occurrence of larks at these sites is not an association with a prairie ecosystem but an association with a ruderal grassland ecosystem created by the initial ground disturbance or largescale broadcast spraying to eliminate the residual crop and weed seeds in the soil and any follow-up ground disturbance and seeding.

Ruderal grasslands are primarily ephemeral and successional in the Willamette Valley, but in some locations, they can be permanent where poor soil conditions are not conducive to vegetation growth (e.g., shallow, rocky soils). They occur in a wet prairie landscape after a flooding event, upland prairie landscape after a fire, or in both after an anthropogenic disturbance associated with agricultural land management or in recent times conversion of agricultural fields as part of prairie restoration. The latter can maintain ruderal grasslands for a longer period of time (1-3 years) than historic annual seasonal succession to a prairie when there are repeated annual treatments to reduce existing vegetation and introduce native vegetation. Ruderal grasslands also occur in areas heavily disturbed by human activities or equipment.

The loss of ruderal grasslands in the Willamette Valley mirrors that of the loss of native prairies and it warrants the same level of concern, especially for its high degree of association with Streaked Horned Lark. Significant restoration effort has been expended on the permanent establishment of prairies over the last 25 years (Wold et al. 2011, WVOPC 2020), but the ruderal grassland ecosystem has been viewed as a conjoined part of those prairie restoration efforts, despite its unique ecological condition and function and its historic annual presence in the landscape of the Willamette Valley. However, the primary natural mechanisms that ensured an annual representative abundance of ruderal grasslands (i.e., fire and flooding) are now mostly absent from the landscape due to the extensive damming of the Willamette River and its tributaries and the cessation of prescribed fire by Native Americans (USFWS 2021).

Larks were likely historically more associated with ruderal grasslands in a wet prairie landscape than an upland prairie landscape because the occurrence of ruderal grasslands during the breeding season was primarily in wet prairie prone to spring flooding. The timing of ruderal grasslands in an upland prairie landscape was mostly during the post-breeding period in late summer and early fall after prescribed fire by native peoples. Although the historical natural disturbances that created ruderal grasslands for larks

have been mostly lost, mechanical and manual methods available today to create and maintain ruderal grasslands have multiple advantages. First, there is no seasonal dependence on when or where ruderal grassland habitat can occur. Additionally, although the historical occurrence of ruderal grasslands was mostly ephemeral and dependent on natural events, ruderal grasslands created mechanically or manually can be permanent with year-round habitat suitability for larks.

Lark Reserves: Marriage of a Unique Ecosystem and an Imperiled Bird

Recognition of the need to support lark recovery with sites dedicated to its conservation was well-defined in the *Draft Recovery Plan for the Streaked Horned Lark* (USFWS 2019). These sites were referred to as Core Sites and were considered the highest priority in lark recovery. They require lark-specific and lark-prioritized conservation goals and actions at a site with long-term or permanent conservation status and an approved management plan. Although ruderal grasslands was not a term used in the plan, the desired habitat conditions of Core Sites fully characterize the ruderal grassland ecosystem. Our designation of these sites as Streaked Horned Lark Reserves rather than Core Sites provides a more tangible nomenclature of their purpose and importance and greater appeal to conservation-minded supporters.

Since the ESA listing of the lark in 2013, recovery in the Willamette Valley has focused on trying to integrate lark habitat needs within the context of prairie restoration (e.g., vernal pools), agriculture, or other listed species or habitat conservation goals. This approach has largely proven to be unsuccessful for multiple reasons. The unique habitat requirements of the lark (i.e., dominance of sparsely-vegetated ground) have limited overlap with other species, ecological values, or land use objectives, even conservation objectives such as restoration of prairie habitat. Additionally, the dominance of lark populations on lands managed for other uses (e.g., airports, agricultural fields) results in conflicts with those uses during the breeding season that limit the potential for lark productivity. In effect, this integrated approach is trying to "work the margins" of lark conservation and recovery with a low potential return on investment that cannot address the primary need of large, resilient, and sustainable populations as identified in the Draft Recovery Plan.

In the Willamette Valley, Lark Reserves provide the highest confidence for sustaining large and resilient lark populations and the only strategy that can address the need for Core Sites. They are necessary because outside of Lark Reserves the options for integration of lark habitat objectives with other land uses at best results in small populations insufficient to meet recovery objectives for Core Sites and often conflicting management activities with other land uses that have the potential to negate even small potential gains. Lark recovery will require ruderal grassland habitat where lark-specific and lark-prioritized conservation goals can be maximized with the potential for a high return on investment of resources. Although single-species conservation is not a popular approach for recovery, there is no alternative in the Willamette Valley to achieve sustainable and resilient lark populations without the focused and prioritized effort of Lark Reserves. There may be some opportunities to secure other conservation values on Lark Reserves, but those should be secondary and complementary.

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