Literature review: Can airports be managed to both minimize bird strikes and protect vulnerable grassland bird species such as the streaked horned lark?

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This workshop addresses two potentially conflicting issues:

1. Airports present some of the best remaining habitat for grassland birds, including the vulnerable streaked horned lark, and
2. Birds are a known hazard to aircraft.

Reconciling these two issues requires an understanding of their current state of knowledge. This summary provides a summary of the scientific literature on the issues, and notes studies which address the intersection of the two.

1. Airports are some of best remaining habitat for grassland birds, including the vulnerable streaked horned lark

Many species of birds that depend on grassland or savanna habitats have shown substantial overall population declines in North America. During the last 25 years grassland birds have shown steeper, more consistent, and more geographically widespread declines than any other behavioral or ecological guild of North American bird species (Askins et al. 2007). Declines in grassland bird populations can be attributed to a wide variety of factors, including habitat fragmentation and degradation, nest parasitism, pesticides, invasion of woody vegetation, and agricultural intensification (Askins et al. 2007; Johnson & Igl 2001).

Airports and military installations often provide some of the largest areas of grassland habitats available and are therefore attractive to grassland birds (Blackwell et al. 2009; Seamans et al. 2007; Kershner & Bollinger 1996; Osborne & Peterson 1994; Vickery et al. 1994).They host some of the largest remaining populations of grassland birds such as upland sandpipers, grasshopper sparrows, horned larks and vesper sparrows (Seamans et al. 2007). As grassland disappears, airports will become increasingly important for managing grassland birds (Vickery et al. 1994).

Streaked horned larks are known to occur on only a small number of sites in the Pacific Northwest, and those sites include the Olympia Regional Airport, Shelton Airport, Corvallis Airport, Portland Airport, and Joint Base Lewis McChord (including McChord Airfield).

2. Birds are a known hazard to aircraft

Much literature exists on the hazard that wildlife, especially birds, presents to aircraft. It generally falls into three categories: historic strike data, species' rankings according to their strike risk, and how wildlife can be managed to decrease aircraft strike risk.

a. Strike Data

Summary. Wildlife strike data is compiled from reports filed with the FAA through a voluntary reporting program. Globally, wildlife strikes killed more than 219 people and destroyed over 200 aircraft between 1988 and 2007 (Dolbeer et al. 2009). Most air crashes occur when a bird hits the windshield or is inducted into the engine (Sodhi 2002). Civil and military aircraft strike most birds near airports: on takeoff, climb, descent, and landing. However, military aircraft also strike birds during low-level flight at training routes and bombing ranges (Zakrajsek & Bissonette 2005).

The threat of strikes is increasing due to the increased incidence of some wildlife at airports (such as geese), the global increase in air traffic, and the advent of faster and quieter aircraft (Dolbeer et al. 2008).

Wildlife involved. For the 19-year period 1990-2008, 89,727 wildlife strikes were reported to the FAA. Birds were involved in 97.4 percent of the reported strikes, with terrestrial mammals, bats and reptiles making up the remainder (Dolbeer et al. 2009).

Damage. Almost 80 percent of bird strike reports from 1990-2008 reported as to whether any damage resulted from the strike. Of these reports:

- 86 percent indicated the strike did not damage the aircraft;
- 7 percent indicated the aircraft suffered minor damage;
- 4 percent indicated the aircraft suffered substantial damage;
- 3 percent reported an uncertain level of damage; and
- less than 1 percent indicated the aircraft was destroyed as a result of the strike (Dolbeer et al. 2009).

Economic losses. For the 19-year period 1990-2008, reported losses from bird strikes totaled 393,521hours of aircraft downtime and $308.3million in monetary losses (Dolbeer et al. 2009).

Underreporting. Analysis of strike reports from USA airports and airlines indicated that less than 20 percent of all strikes were reported to the FAA. The information on the number of strikes and associated costs compiled from the voluntary reporting program is believed to severely underestimate the magnitude of the problem (Dolbeer et al. 2009).

Total estimated economic losses. Assuming a 20 percent reporting rate, the annual cost of wildlife strikes to the USA civil aviation industry is estimated to be in excess of 592,000 hours of aircraft downtime and $614 million in monetary losses (Dolbeer et al. 2009).

b. Species risk

Not all birds are equally hazardous to aviation. Airports need to understand the relative risk of birds and other wildlife so that they can prioritize their management actions. (Dolbeer et al. 2000; Dolbeer & Wright 2009) Generally, heavier bird species such as vultures and geese are more hazardous to aircraft than lighter species such as sparrows and swallows (Dolbeer et al.

2000). Also, flocking birds pose a greater risk – an aircraft striking a flock of birds is more likely to sustain damage than if it strikes a solitary bird (Dolbeer et al. 2000).

Based on 18 years' worth of strike data at civilian airports, Dolbeer & Wright compiled a wildlife strike risk ranking table showing the 89 species most commonly represented in strikes in the United States. Horned larks were ranked as #69, with a risk categorization of "Low". Of 659 reported strikes by horned larks during that period, 2 strikes were reported to have caused damage. 27 of the reported strikes involved multiple birds. (Dolbeer & Wright 2009).

An earlier study analyzed the wildlife hazard to military aircraft, based on U.S. Air Force records of wildlife strikes (Zakrajsek & Bissonette 2005). In that study, several smaller birds appeared higher in the rankings than they appear in Dolbeer & Wright's 2009 rankings, with the horned lark ranked 6th. The authors noted that this ranking was higher than civilian rankings, and theorized that perhaps these relatively small species are under-reported by civilian pilots, or perhaps differences in military and civilian airfield operations account for the difference (Zakrajsek & Bissonette 2005). They also noted that horned larks have a habit of foraging in flocks in the open areas that airports provide, and flying back and forth across the runways (Zakrajsek, pers. comm.; Bissonette, pers. comm.).

A 2007 study found horned larks to be the bird species 4th most struck at an Air Reserve Base over an 8 year period, but did not rank the species according to damage like the Dolbeer and Zakrajsek studies. The author noted that the exact numbers of swallows and horned larks struck is uncertain because these species tend to collide with aircraft as flocks and there are times when it is not possible to collect sufficient, recognizable remains to count the numbers of individuals involved. (Milroy 2007)

The FAA Wildlife Strike Database reports that 10 strikes in Washington have involved horned larks. Of those, three incidents occurred in Puget Sound – at SeaTac in 2002 and 2003. No damage was reported. Two of the incidents involved one bird, and the other incident involved 3 to 4 birds.

The FAA Wildlife Strike Database also reports 10 strikes in Oregon involving horned larks. Of those, three incidents occurred in the Willamette Valley in 2004 and 2005– two at Portland International and one at Mahlon Sweet Field. None of them resulted in any damage. All incidents involved only one bird.

c. Wildlife hazard management

The FAA/USDA manual *Wildlife Hazard Management at Airports* (Cleary and Dolbeer 2005) provides guidance to airport personnel in developing and implementing wildlife hazard management plans. Importantly, plans must be tailored to the conditions existing at individual airports. The first step in developing a wildlife hazard management plan is to assess the hazards posed by wildlife at the airport. Then airport managers must take appropriate actions, under the guidance of professional biologists trained in wildlife damage management, to minimize the risks posed by wildlife (Dolbeer et al. 2008).

Note that these requirements generally apply to "certificated" airports – airports approved by FAA for scheduled flights of aircraft with more than 9 passenger seats or unscheduled flights of aircraft with more than 30 seats. However general aviation (GA) airports in the USA generally are not required by the FAA to address wildlife hazard issues. GA airports face considerable challenges in managing wildlife hazards, as they often are located in rural areas with high densities of birds and other wildlife. Further, many GA airports have inadequate funding and few, if any, trained personnel available for wildlife hazard management. (DeVault et al. 2009)

Airports have experimented with many different management actions to deter wildlife. Generally, habitat alteration is believed to provide the most effective and lasting effect, but other more short-term actions are often used as part of an overall wildlife management plan. The following is a list of the more common wildlife management actions currently used at U.S. airports, along with their pros and cons.

Flight schedule alteration. Although not generally practical for regularly scheduled commercial traffic on larger airports, there may be various situations when flight schedules of some aircraft can be adjusted to minimize the chance of a strike with a wildlife species that has a predictable pattern of movement (Cleary & Dolbeer 2005).

Audiovisual Deterrents. Short term solutions generally rely on scaring birds with pyrotechnics, alarm calls, infrasound, and lasers. However, without direct association with an actual threat, birds rapidly habituate to scare techniques, reducing their effectiveness. (Anderson & Otter 2007)

Chemical Deterrents. Chemical deterrents that irritate birds have been used to deter birds from foraging on airports and croplands. However, their effectiveness requires that birds use the area for feeding, not just resting, and they also tends to be too costly for large-scale application. (Anderson & Otter 2007)

Infrared or Radar Beams. Infrared beams or modulation of high powered radar can cause birds to swerve out of the beam. However the power requirements for these systems, and their associated cost, make consideration of these as a feasible deterrent system somewhat prohibitive. (Anderson & Otter 2007)

Lethal Control. Shooting individual birds has been used effectively as a temporary measure. Without removal of the resources that initially attracted the animals, however, emigration of new individuals to replace those killed is likely. Thus, this technique is sustainable only with repeated culling of populations. Lethal control is usually not well accepted by the public, and it remains a reactive, short-term solution. (Anderson & Otter 2007)

Dogs. Dogs are perceived as a natural predator by terrestrial birds, which leave the area to seek more secure habitat elsewhere. Border collies have been used very effectively to scare birds off the runways because, unlike other scare tactics, they represent a real threat. Cost is the primary consideration in this technique, as specially-trained dogs can cost several thousand dollars, and require the assignment of permanent handlers and housing costs. (Anderson & Otter 2007)

Falconry**.** Falconry has also been used at airports to introduce a real threat to birds in a publicly acceptable matter. However, success of falconry programs appears to depend on a large number of uncontrolled variables, including airport layout, habitat, and weather, and success is not always directly correlated with effort. For this reason, it is generally recommended as part of a comprehensive management program rather than as the sole method of dispersing problem birds. (Anderson & Otter 2007)

Habitat Alteration**.** Long term mitigation tends to focus on habitat alteration. Although this does not deter birds that fly over the airport, it provides a more permanent solution to managing birds that use the airfield. Since most bird strikes occur in the 0 to 500 feet above the ground airspace, the problem is mostly thought to be birds that are using the airfield itself.

Habitat alteration can include application of netting (especially around eaves of buildings), replacement of grass with boulder fields, replacement of cattail marsh with shrubby marsh, and removal of attractive crops and garbage dumps. Nest or roost trees may have limbs removed if raptors are a problem. Marshlands attract waterfowl, so removal of standing water is important. One commonly used habitat alteration tool is managing grass height, discussed in the following point.

Grass height management. The management of an airport's airside ground cover to minimize bird activity is a controversial subject in North America. The general recommendation, based on studies in England in the 1960s and 1970s, has been to maintain a monoculture of grass at a height of 6-10 inches (Transport Canada) or 7-14 inches (U.S. Air Force). Tall grass, by interfering with visibility and ground movements, is thought to discourage many species of birds from loafing and feeding. (Cleary & Dolbeer 2005)

However, the limited studies conducted in North America have not provided a consensus of opinion on the utility of tall-grass management for airports (Cleary & Dolbeer 2005; Milroy 2007; DeVault et al. 2009). For example, a recent study found no difference in the number of birds using short- (9–15 cm) and tall-vegetation (15–30 cm) plots (Seamans et al. 2007).

In addition, maintenance of tall grass can result in increased rodent populations, a food source for raptors. Further, maintenance of monotypic, uniform stands of tall grass is difficult and expensive on many airports because of varying soil conditions and the need for fertilizer and herbicide applications. Arid regions in the western USA cannot maintain tall grass without irrigation. (Cleary & Dolbeer 2005)

The FAA/USDA Manual states that it will not issue general guidelines on grass height or vegetation type for airside ground cover until more research is completed (Cleary & Dolbeer 2005). Clearly, more work is needed to refine recommendations for grass height management in the U.S. (Milroy 2007; Seamans et al. 2007; DeVault et al. 2009)

3. **Can airports manage for both wildlife hazard management and vulnerable species conservation?**

Historic management for vulnerable species. Modifications in habitat management practices at military and municipal airports have already clearly benefited grassland birds. These practices include deferred mowing schedules and reduced vehicular traffic in grassland areas. For example, at a Massachusetts Air Reserve Base, populations of upland sandpipers and grasshopper sparrows have increased by more than 200% as a result of these management changes. (Askins et al. 2007) Similarly, a New Hampshire airport has altered its mowing regime to both meet airport guidelines and protect the upland sandpiper during nesting periods. During that time the population has remained stable. (Hunt & DeLuca 2005)

The most comprehensive study on this topic is currently being completed by researchers with the New Jersey Audubon Society. Preliminary results have been released (Peters & Allen 2010), and the final report is due in 2012. (Ms. Peters will present separately on her work at this workshop.) The preliminary results found that conservation-value species increased with vegetation height (20-24 inches), while strike-risk decreased within the same range of vegetation height (Peters & Allen 2010).

Sink population? A 1996 different study found a low level of nesting success on airports by grassland birds, suggesting that these areas are unproductive compared with most other grassland habitat. The study suggested that airports support sink populations, which are unable to sustain their populations. (Kershner & Bollinger 1996). The study found that the primary disturbance contributing to low nesting success was mowing. It stated that adjusting mowing schedules would be an optimal management plan to conserve vulnerable species, but that that is realistic only for large airports. For small rural airports, the authors believed the best management practice may be to discourage birds from attempting to nest by mowing the grass low. They suggest that small airports do not have enough room to both comply with FAA safety regulations regarding grass length requirements surrounding runways, and enhance grassland bird breeding. (Kershner & Bollinger 1996)

Conservation management techniques. Some techniques which may achieve both wildlife hazard prevention and rare grassland bird conservation are:

- Modifying aircraft flight times to avoid times of known bird movement
- Modifying the timing of mowing to avoid the breeding season (Milroy 2007)
- Using sickle-bar mowers or other equipment to reduce mower wheel "footprints", and thus bird and chick mortality (Milroy 2007)
- Planting vegetation that does not require mowing (Milroy 2007)
- Detailed analysis of the inter-specific variations in some processes that can affect local populations, such as density-dependence, behavioral responses to aircraft or aversive methods (speed of reaction, sensitization, habituation, etc.), and movement between suitable patches within and surrounding an airfield. Once this is established, airports could create buffer areas based upon the analysis. (Blackwell et al. 2009)

4. **Current listed species on airports and what management for them looks like – To be updated.**