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ScienceDirect
Agriculture, Ecosystems and Environment 124 (2008) 252–258
Agriculture Ecosystems & Environment
www.elsevier.com/locate/agee

Factors influencing farmland habitat use by shorebirds wintering in the Fraser River Delta, Canada

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Received 7 July 2006; received in revised form 19 October 2007; accepted 23 October 2007
Available online 26 December 2007

Abstract

Like many other coastal regions of the world, open-soil agricultural lands in the Fraser River Delta provide roosting and feeding habitat for non-breeding shorebirds that supplements intertidal habitat. Focusing on dunlin (*Calidris alpina pacifica*), black-bellied plover (*Pluvialis squatorola*), killdeer (*Charadrius vociferus*), and their avian predators (raptors), diurnal and nocturnal high tide surveys were conducted across the non-breeding period, October–April (1998–2000). All three shorebirds showed positive relationships with laser leveling, and recent manure and fertilizer application. Day length was negatively related to field use by dunlin, but positively related for black-bellied plover and killdeer. Amount of recent precipitation was positively related to dunlin and negatively related to black-bellied plover and killdeer field use. Results suggest that providing a mosaic of different crop types, autumn mowing, laser leveling, application of fertilizer and manure, and minimizing habitat fragmentation through maintenance of large fields are habitat management strategies that may enhance farmland for shorebirds during the non-breeding season in this region.

Keywords: Waders; Non-breeding; Agricultural land; Weather; Farming practices; Supra-tidal habitat

1. Introduction

The Fraser River Delta, the largest estuary on Canada's Pacific Coast, provides valuable wildlife habitat and rich soils for agriculture. This delta has one of the mildest climates in Canada, with average daily temperatures above freezing year-round, and mean total annual rainfall of approximately 1055 mm. The delta supports internationally significant numbers of shorebirds during the non-breeding season (Butler and Campbell, 1987; Butler, 1994) including circa 40,000 dunlin (*Calidris alpina pacifica* L.) and 2000 black-bellied plovers (*Pluvialis squatorola* L.) hereafter ''plover'' and smaller numbers of killdeer (*Charadrius vociferus* L.). Adjacent to the approximately 257 km^2 of tidal mudflat is an approximately 127 km^2 area of farmland created in the late 1800s, when salt marshes were diked and drained. Overwintering raptors whose winter diet includes shorebirds also abound in the delta, including northern harriers (*Circus cyaneus* L.), red-tailed hawks (*Buteo jamaicencis* Gmelin), and peregrine falcons (*Falco peregrinus* Tunstall). Winter field cover ranges from bare soil to tall unharvested grasses and bushy crops that remain fairly stable for the duration of the shorebird over-wintering period. Farmland represents the largest terrestrial component (about 41%) of the Fraser Delta's landscape. Although recently designated a Western Hemisphere Shorebird Reserve Network site of hemispheric importance, less than

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0167-8809/$ – see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.agee.2007.10.004

5% of the delta is currently protected for wildlife. A proportion of the delta was designated as an Agricultural Land Reserve (ALR) in the 1970s in recognition of the high quality soils and the threat of encroaching urban development (BC Land Reserve Commission, unpublished data). Nevertheless provincial ALR designation does not protect the land from conversion to greenhouses, a trend that has eliminated more than 2% of previously open-soil farmland over the past decade (Corporation of Delta, unpublished data). ALR designation can also be challenged, in some cases allowing encroachment of urban development (Campbell, 2006). Motivated by the need to set conservation priorities and enhance farmland value for shorebirds, study objectives were to investigate the extent to which spatial and temporal variation in field use could be predicted by environmental, biological, landscape, and farming factors.

2. Methods

Data were collected from October to April in 1998–1999 and 1999–2000 in fields within the Fraser River Delta, British Columbia, Canada (49°10′N, 123°05′W). Eighty-one fields were surveyed in year one and 57 in year two. Over the two field seasons, 2278 (range 50–302 per month) field visits by day and 2410 (range 51–329 per month) field visits at night were made. Table 1 outlines the number of fields of each cover type, and summarizes farming practices. Cover types (type of crop or residue present) across the delta were determined by visually surveying all fields in early October, after harvesting, and later confirming crop type with farmers. During the first year of study (1998–1999), the distribution of winter cover types across the delta in early October was as follows: grass/pasture typically comprised of orchardgrass (*Dactylis glomerata* L.) and tall fescue (*Festuca arundinacea* Schreb.) (35%), bare earth (24%), winter cover crops (typically winter cereals planted in late August or early September) (18%), grassland set-aside and old fields (comprised of senescent perennial grasses, broadleaved plants and a small amount of new growth) (8%), horticultural crops such as winter cabbage and kale (*Brassica* spp.) and strawberries (*Fragaria* spp.) (6%), corn (*Zea mays* L.) fields harvested for whole crop silage leaving approximately 15-cm tall corn stalks (3%), turf and golf courses (3%), bush berries such as currants (*Ribes* spp.), cranberries, blueberries (*Vaccinium* spp.) (2%), and greenhouses (2%). Fields in this study region are typically bounded by drainage ditches, and in some cases field margins include tall grasses or hedgerows, or both.

Data on field size and distance from shore were from an Agriculture and Agri-Food Canada GIS base map. In 1998–1999, a random sample of fields was surveyed (Cochran, 1977), stratified by field size, distance from shore, and cover type, and selected in proportion to their availability. Many of the 1998–1999 fields were never used by the shorebirds (25% for dunlin, 34% for plover, and 72% for killdeer), so 1999–2000 surveys focused on a ''high use'' area of fields within 1 km of the shore. In the second field season, surveys were conducted based on a transect design, with the inclusion of nearby fields that had been surveyed in the previous year. The total area surveyed over the two field seasons constituted approximately 10% of the agricultural land in the region.

Table 1
Number of fields of each cover type that were sampled in each year, and summary of farming practices data

Year/winter cover type	Fields (no.)	Field size (ha)[a]	Distance from shore (km)	Crop establishment (years)	Vegetation height (rating)[b]	Fertilizer past year (% fields)	Manure past year (% fields)	Manure past 5 years (% fields)	Laser leveled (% fields)
1									
Bare	25	8.1 (1.1)	1.96 (0.34)	1.6 (0.8)	0.04 (0.04)	24	12		20
Cover crop	17	7.0 (0.0)	1.59 (0.30)	0.3	1.02 (0.15)	29	24		24
Grassland set-aside	4	6.7 (3.3)	1.75 (0.48)		2.00 (0.00)				
Grass/pasture	21	7.4 (1.0)	2.00 (0.32)	2.9 (0.6)	1.10 (0.10)	24	33		14
Tall corn	2	1.4 (0.6)	1.00		2.00 (0.00)				
Winter vegetables	6	4.4 (1.5)	1.33 (0.33)	0.3	0.67 (0.21)	33	17		17
Berries	2	7.3 (1.0)	2.00 (1.00)	10.0	2.50 (0.50)	50	0		50
Greenhouse	1	15.5	1.00		1.00				
Turf/golf course	4	22.7 (13.5)	4.25 (1.65)		1.00 (0.00)				
2									
Bare	28	7.8 (0.9)	1	0.1 (0.0)	0.25 (0.10)	46	25	36	39
Cover crop	18	6.4 (1.0)	1	0.1 (0.1)	0.82 (0.21)	33	11	33	33
Grassland set-aside	7	7.5 (1.7)	1	0.6 (0.1)	1.70 (0.08)	14	0	0	0
Grass/pasture	7	6.5 (0.8)	1	0.4 (0.1)	0.88 (0.32)	43	43	43	0
Winter vegetables	4	4.7 (1.7)	1	1.8 (1.3)	1.50 (0.28)	50	50	50	50
Berries	2	3.9 (1.8)	1	0.5	2.00	50	50	50	50

[a] S.E.s are in bracket immediately to the right of corresponding means.
[b] Mean of vegetation height rating scale.