CHAPTER TWO
COMPARISON OF CONDITIONS—CLIMATE AND LAND COVER

CLIMATE

We compared precipitation and average daily temperatures between the two atlases, using data from 1988–1993 for Atlas 1 conditions, and 2016–2020 for Atlas 2. All climate data came from the Local Climate Dataset for the Sacramento Executive Airport station (station WBAN, 23232), available at: www.ncdc.noaa.gov/data-access/quick-links#loc-clim.

Precipitation

The Sacramento Region receives most of its rainfall in winter and early spring. To look for possible effects of differences between the atlas periods we used total cumulative rainfall from the December prior to each atlas year, through May of the atlas year (winter-spring). Rainfall during this period is most likely to impact breeding birds from late winter into summer.

Cumulative precipitation was somewhat higher during Atlas 2, but the conditions were comparable (Figure 2-1). Two of the five years of Atlas 2 saw rainfall well above the 50-year average with two years just below average and one dry year. Atlas 1 had only one wet year, four years near average, and one very dry year. It may be worth noting that the period just prior to Atlas 2 (2012–2015) was very dry with precipitation in each of those years well below historical averages.

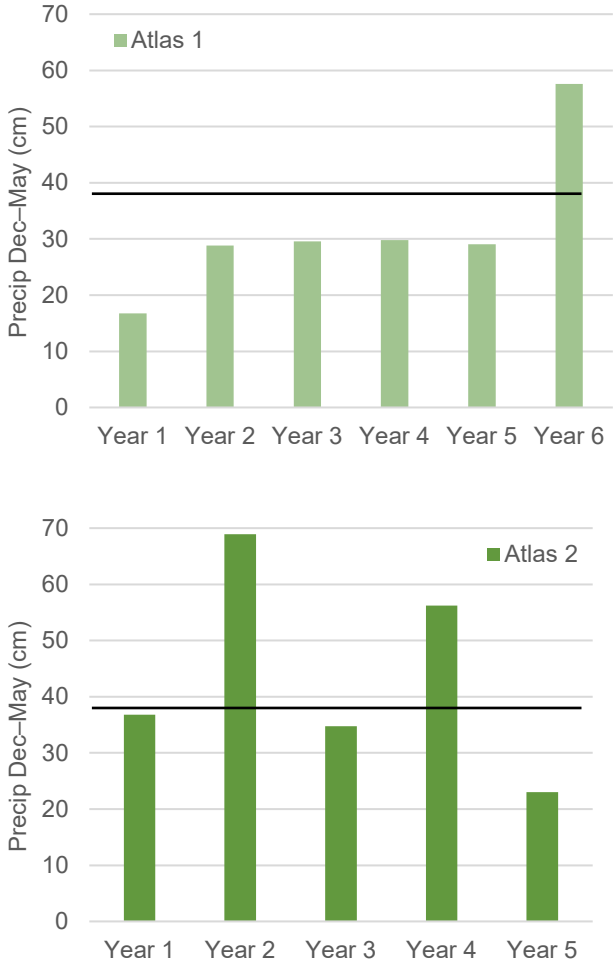


Figure 2-1. Comparison of precipitation (December–May) between Atlas 1 and Atlas 2. The horizontal line represents the 50-year average precipitation for Sacramento.

Temperature

We looked at the average daily temperatures for two time periods for each atlas: March through July (spring-summer) and the December prior to each atlas year, through February (winter) of the atlas year (Figure 2-2). While the spring-summer temperatures across atlas years were slightly warmer during Atlas 2, this difference was not significant. However, the winter periods were significantly warmer during Atlas 2. This is consistent with the long-term winter trends in our area (Figure 2-3; Hampton 2019). In a subsequent chapter we will discuss possible effects of these climatic differences on the breeding phenology of birds in this county.

LAND COVER

During the 20th century, California's Central Valley underwent transformations of land cover at a scale and to a degree perhaps unmatched in any other area of North America (Schoenherr 1992). During the first half of the century most of that change was conversion of wetland and riparian habitats to

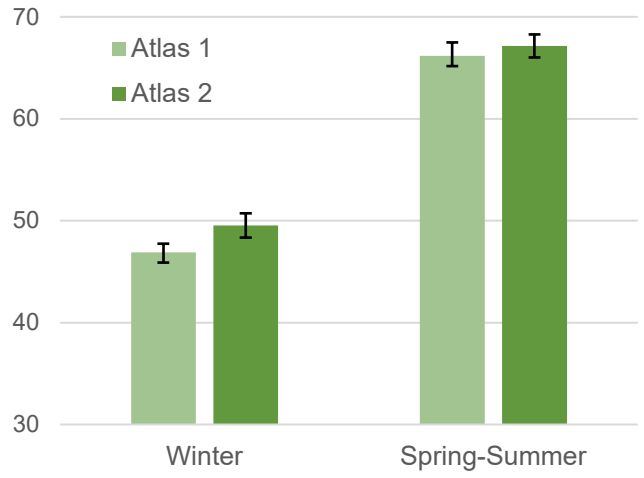


Figure 2-2. Comparison of average daily temperatures (degrees F) between Atlas 1 and Atlas 2. Winter is December–February, Spring-Summer is March–July. Error bars represent standard deviation from the mean.

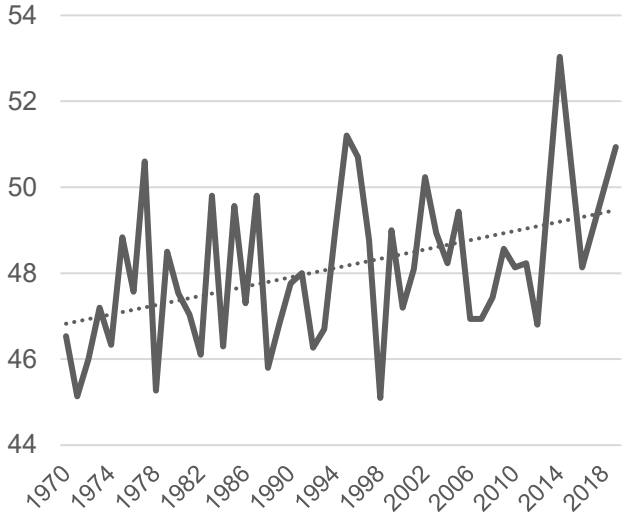


Figure 2-3. Trend in Sacramento winter (December–February) temperatures (degrees F) 1970–2020. Dotted line based on linear regression.

agriculture (Katibah 1984, Dawdy 1989, Dahl and Johnson 1991, Nelson et al. 2003, Garone 2011). Beginning in the 1970s, stronger environmental regulation slowed and even began to reverse some of those conversions (Fleskes et al. 2005, Garone 2011, Fleskes et al. 2018, CVJV 2020). Indeed, wetland restoration has been a particular focus in recent decades (CVJV 2020). From the 1980s continuing to the present, land cover changes in the Central Valley have focused mainly on conversion of grassland (including rangeland and irrigated pasture) to more intensive forms of agriculture (vineyards and orchards) and to urban development (Johnson and Hayes 2004, Leu et al. 2006, Cameron et al. 2014, DiGaudio et al. 2017).

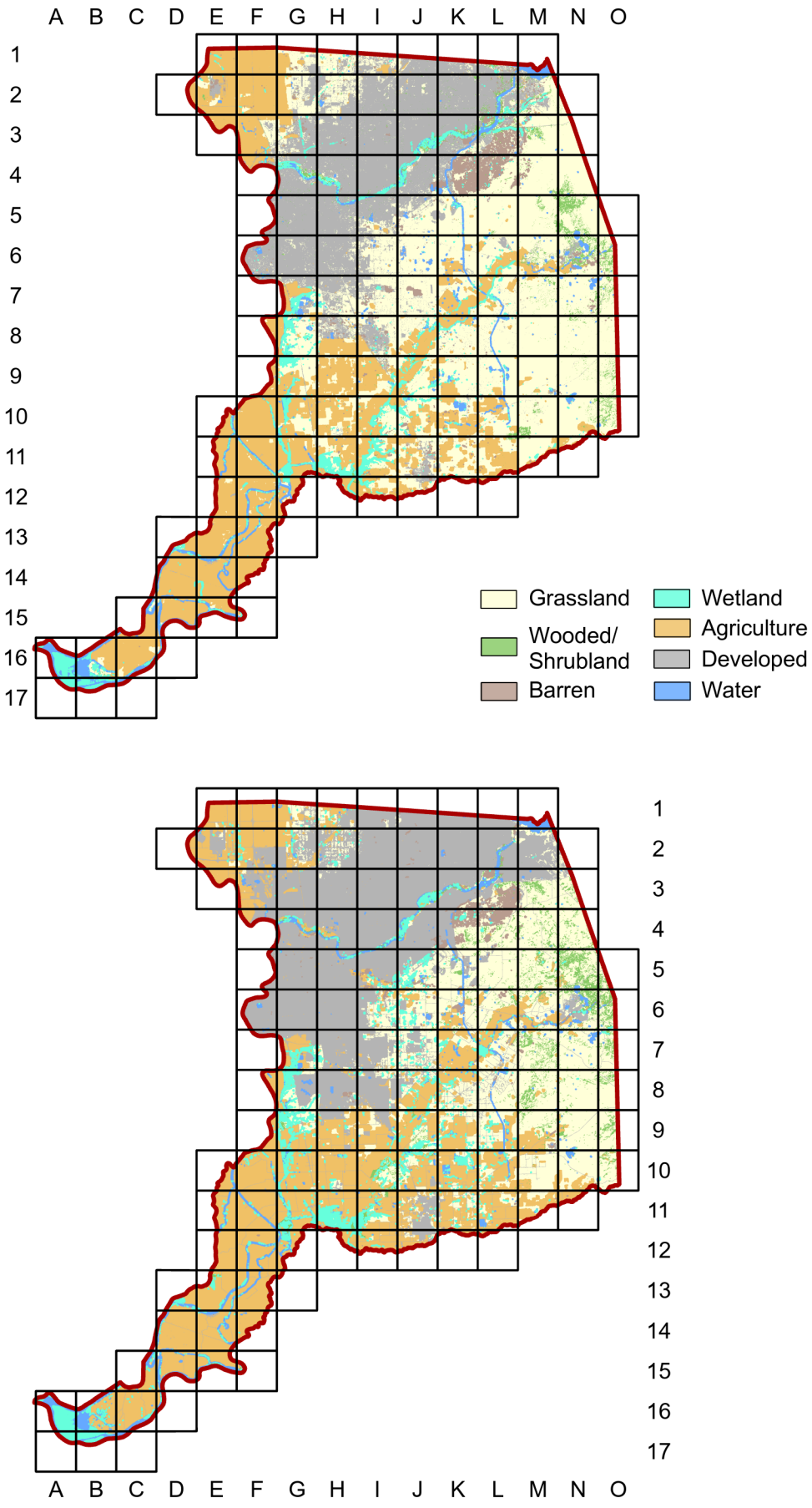
One can see this recent trend reflected in Sacramento County by comparing the land cover maps in Figure 2-4 (data from: Nakagaki et al. 2007, Yang et al. 2016). Developed areas have expanded, as has intensive agriculture, mostly at the expense of grasslands. Note that the apparent conversion of grassland to wooded/shrubland seen in the easternmost parts of the county in the 2015 map is an anomaly, likely the result of land cover definition changes. We have examined these areas in detail with current aerial maps, and those grassland areas shown as converted to wooded/shrubland remain grassland today.

These changes in land cover in Sacramento County between the two atlases are discussed in more detail below, and later chapters explore changes in bird species distribution considering those habitat changes.

Wetlands

As noted above, wetland preservation and restoration has been a Central Valley priority in the past few decades, and this is reflected in the changes seen between Atlas 1 and 2. While significant wetland restoration has occurred in the Sacramento–San Joaquin Delta (Delta) in recent years, there is uncertainty in the mapping of wetland cover types in the available land cover datasets for this portion of Sacramento County. Some of this uncertainty may be due to small changes in the wetland definitions between the two datasets. Also, differences in the timing of aerial surveys with respect to tides can produce anomalous results, particularly in the Delta. Outside of the Delta, increases in wetland are concentrated in two areas of the county. The Stone Lakes National Wildlife Refuge, designated in 1994, has undertaken wetland protection, restoration, and enhancement, evident as increases in blocks G-8, G-9, and G-10. The Cosumnes River Preserve, a unique conservation partnership conserving 18,000 ha of wildlife habitat, including

Figure 2-4. Sacramento Land Cover comparison—1992 vs. 2015.



Black-necked Stilt by Tim Manolis

wetlands, also contributed to increases, primarily in block H-11.

Grassland/Irrigated Pasture

In stark contrast to the restoration of wetlands noted above, grassland in Sacramento County has been severely reduced. Comparing land cover data from 1992 to 2015 (Nakagaki et al. 2007, Yang et al. 2016) showed that 35% of grassland had been lost. By 2015, grassland, the predominant land cover type in the county in 1992, had been overtaken by development, with intensive agriculture close behind (Figure 2-5).

While much of that grassland was converted to development (approximately 40%), even more (approximately 60%) was converted to intensive forms of agriculture. The conversion of grassland to intensive agriculture has been a long-term and significant issue throughout the Central Valley and the Coast Range (see Cameron et al. 2014 and citations therein). The most significant grassland conversions in Sacramento County were to vineyards, with smaller amounts converted to orchards (County of Sacramento 2018). Much of that conversion of grassland to vineyards was in the southeastern parts of the county (blocks I-11, J-10, 11, K-9 through K-11, L-10, and M-9). An increase in alfalfa (approximately 3,000 ha) may have also been at the expense of grassland. However, alfalfa provides significantly more avian habitat value than either vineyards or orchards (Estep 1989, Babcock 1995, Hartman and Kyle 2010, Pandolfino et al. 2011a, 2011b).

Losses of grassland to development were largely concentrated in three areas:

1. areas south of the city of Sacramento, Elk Grove, south Sacramento areas, and the Wilton-Grant Line Road area (blocks H-7 through H-9, I-7, J-7 through J-9, and K-8);
2. the Folsom-Orangevale-Citrus Heights area (blocks K-2, L-2, M-2, 3); and
3. Natomas Basin (blocks F-3 and G-2).

It is important to note that, while most of the development in the Folsom-Orangevale, Elk Grove, and Natomas areas was devoted to dense suburban and commercial uses, most of the development

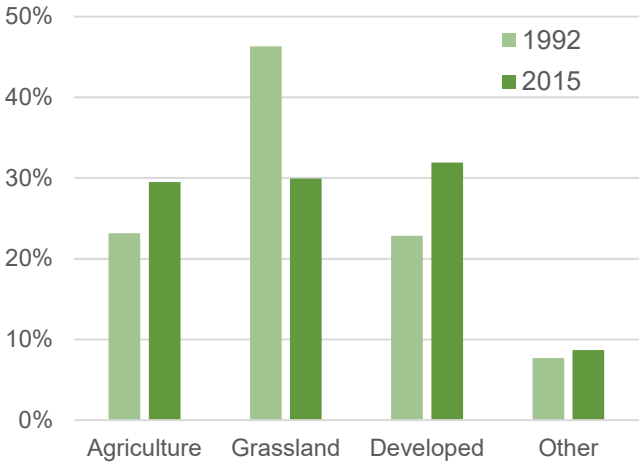
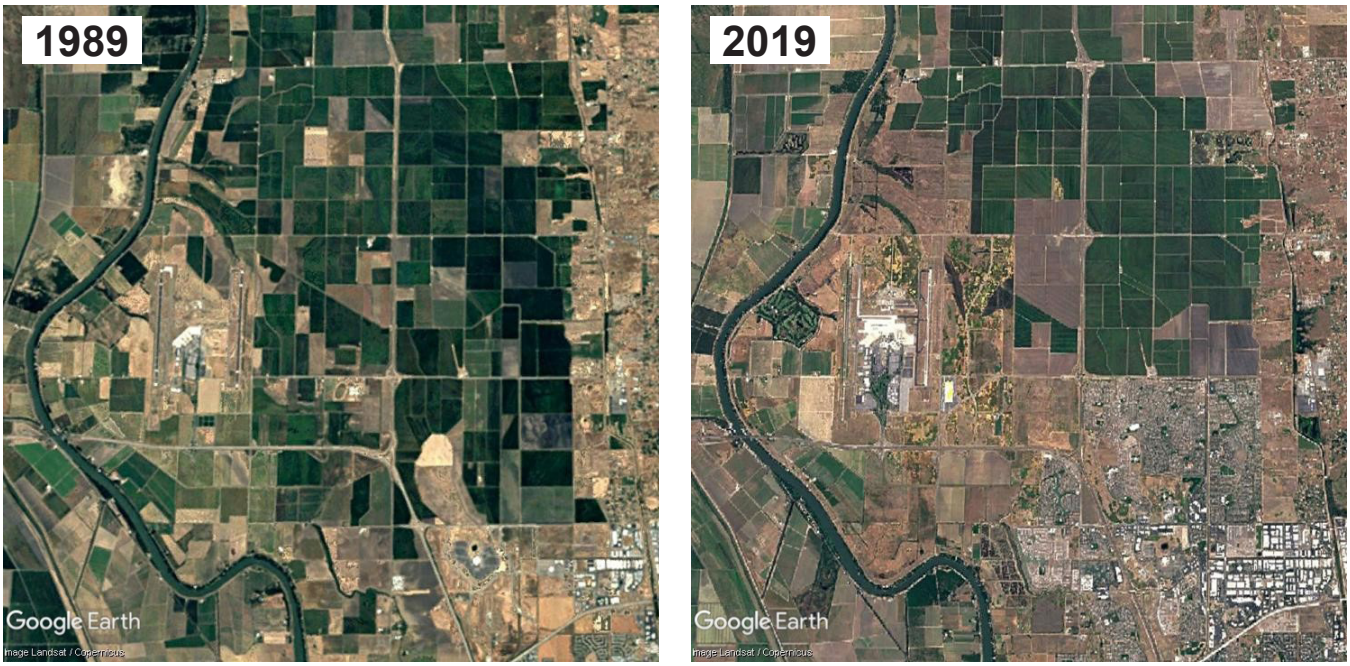


Figure 2-5. Comparison of Sacramento County land cover between Atlas 1 and Atlas 2 (by percent of total county area).

Figure 2-6. Natomas Basin Land Cover comparison—1989 vs. 2019.



just south of Sacramento (e.g., Wilton and vicinity) was conversion of rural/rural residential to more concentrated rural residential, and that area retains many fragments of open country.

Other Land Cover Types

Changes in riparian habitat in the county would have been interesting to evaluate, however the available land cover databases did not map this land cover type in any usable manner for Sacramento County during either time period. Jones et al. (2010) assessed changes in riparian habitats across the continental U.S. from the 1970s through the 1990s and noted small, but significant, increases in riparian habitat within riparian catchment areas in the Central Valley region for the period from the mid-1980s into at least the late 1990s. It seems likely similar changes occurred in Sacramento County, with the American River and Cosumnes River catchments enjoying better regulatory protection and restoration efforts (especially within the Cosumnes River Preserve system).

Rice is grown mainly in the northwestern portions of the county, and this land cover offers some avian habitat value, especially when flooded in winter. County agricultural data (County of Sacramento 2018) documented a decrease in rice from

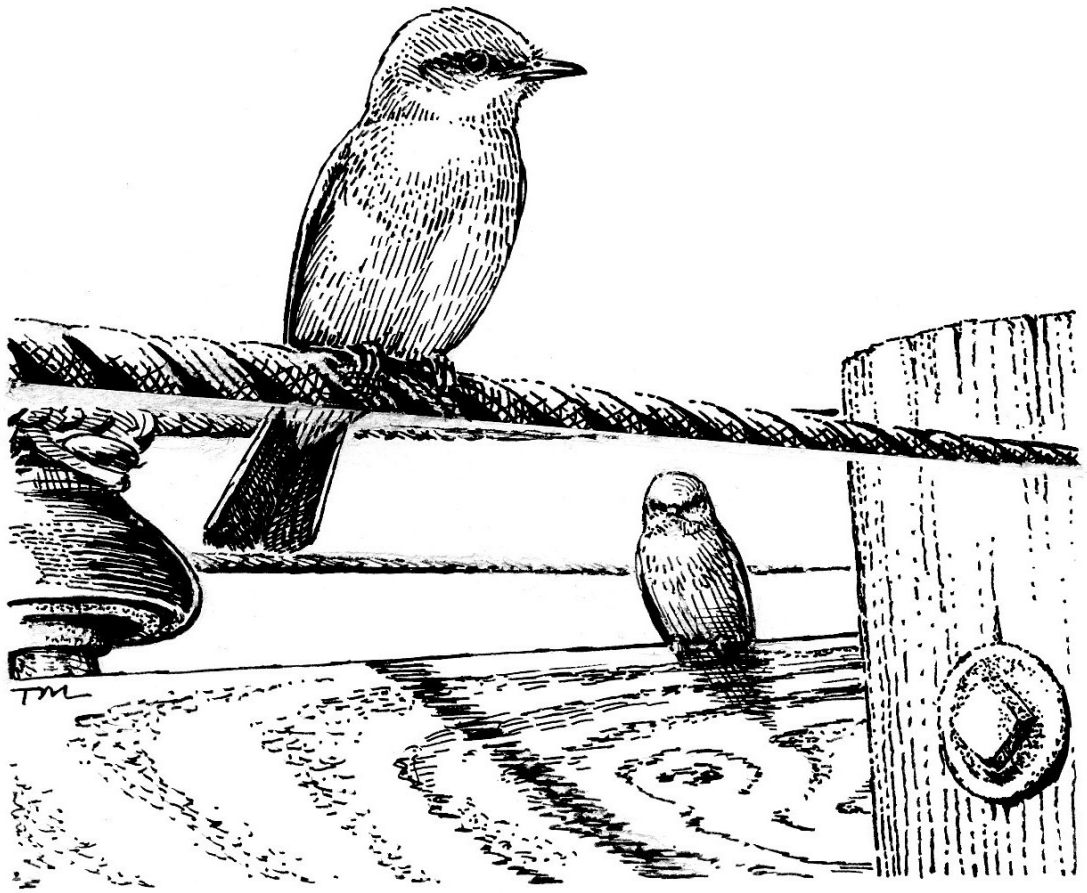
The Underappreciated Value of Scrubby Fields

Forests, with their majestic oaks and cottonwoods, and wetlands, with their teeming waterfowl and machine-gunning Marsh Wrens, get much of the attention they deserve. Grasslands, while underappreciated, and certainly under-protected, are widely recognized by those who care about bird conservation for their imperiled status. Another habitat is less recognized, but amazingly productive for an attractive suite of species: scrubby, weedy fields. In lower elevation portions of the county that can stay green well into the summer, stands of native and nonnative forbs can be swarming with activity. Mustard (*Brassica* sp.), cocklebur (*Xanthium strumarium*), poison hemlock (*Conium maculatum*), sunflower (*Helianthus annuus*), and, in lower sites, perennial smartweed (*Persicaria amphibia*) can host an impressive number of species, often in abundance. Common breeders in this weedy habitat include Song Sparrows, Red-winged Blackbirds, Blue Grosbeaks, Lazuli Buntings, and Common Yellowthroats. In fact, in wetter sites where these plants predominate, species like Blue Grosbeak and Common Yellowthroat can be positively common.

4,100 to 3,300 ha between the two atlas periods, a loss of 19%. This was lost mostly to urban/suburban development in the Natomas Basin, as well as expansion of the Sacramento International Airport and adjacent development (Figure 2-6).

Summary

In 1992, toward the end of Atlas 1, 23% of Sacramento County was devoted to development (urban, suburban, commercial, or rural residential). By the beginning of Atlas 2 in 2015, that proportion had increased to 32% of the county. In 1992, both the proportion of the county devoted to livestock grazing (grassland/irrigated pasture) and the proportion occupied by other, more intensive, forms of agriculture exceed the developed footprint. Grassland/irrigated pasture covered 46% of the area, with other agriculture accounting for 23%. By 2015, development accounted for 32% of county land use, grassland had decreased to 30%, and other agriculture had increased to 29% (with nearly all the increase coming from vineyards and orchards). These three land uses accounted for most of the county in both time periods, but with a sizeable shift toward development and intensive agriculture in recent years. Implications of these changes for Sacramento County's bird life are examined in subsequent chapters.



Western Kingbirds on telephone pole by Tim Manolis