CHAPTER ONE
BACKGROUND AND COMPARISON OF METHODOLOGIES

A Breeding Bird Atlas (BBA) is an attempt to assess the status and distribution of breeding birds across a given geography during a specific time period. The first BBAs were organized in the United Kingdom in the 1960s and have since been conducted in many other countries and in nearly every U.S. state and Canadian province. The results of many of these have been published (statewide examples include: Andrle and Carroll 1988, Corman and Wise-Gervais 2005, Floyd et al. 2007). In addition, many BBAs have concentrated on a smaller area (published county-wide examples from California include: Hunter et al. 2005, Allen et al. 2016, and Rose and Rose 2019).

From 1988 through 1993 TM organized and led a Sacramento County BBA project. That project was completed and the data were all compiled, but the results were not published until now. During the intervening decades Sacramento County has seen significant changes in land use (and, to some extent, climate). Large portions of the county have been converted from agriculture or rangeland to urban and suburban development, or to more intensive agriculture, chiefly vineyards and orchards. During 2015 we recognized that this gave us an opportunity to conduct another BBA and assess changes in breeding bird diversity, status, and distribution in light of those land use changes. Beginning in 2016 we organized a new BBA, using eBird as the primary data source. Work on this new BBA was completed in 2020 and this publication is focused on comparing and contrasting the results of the old atlas (hereafter Atlas 1) with the new one (hereafter Atlas 2).

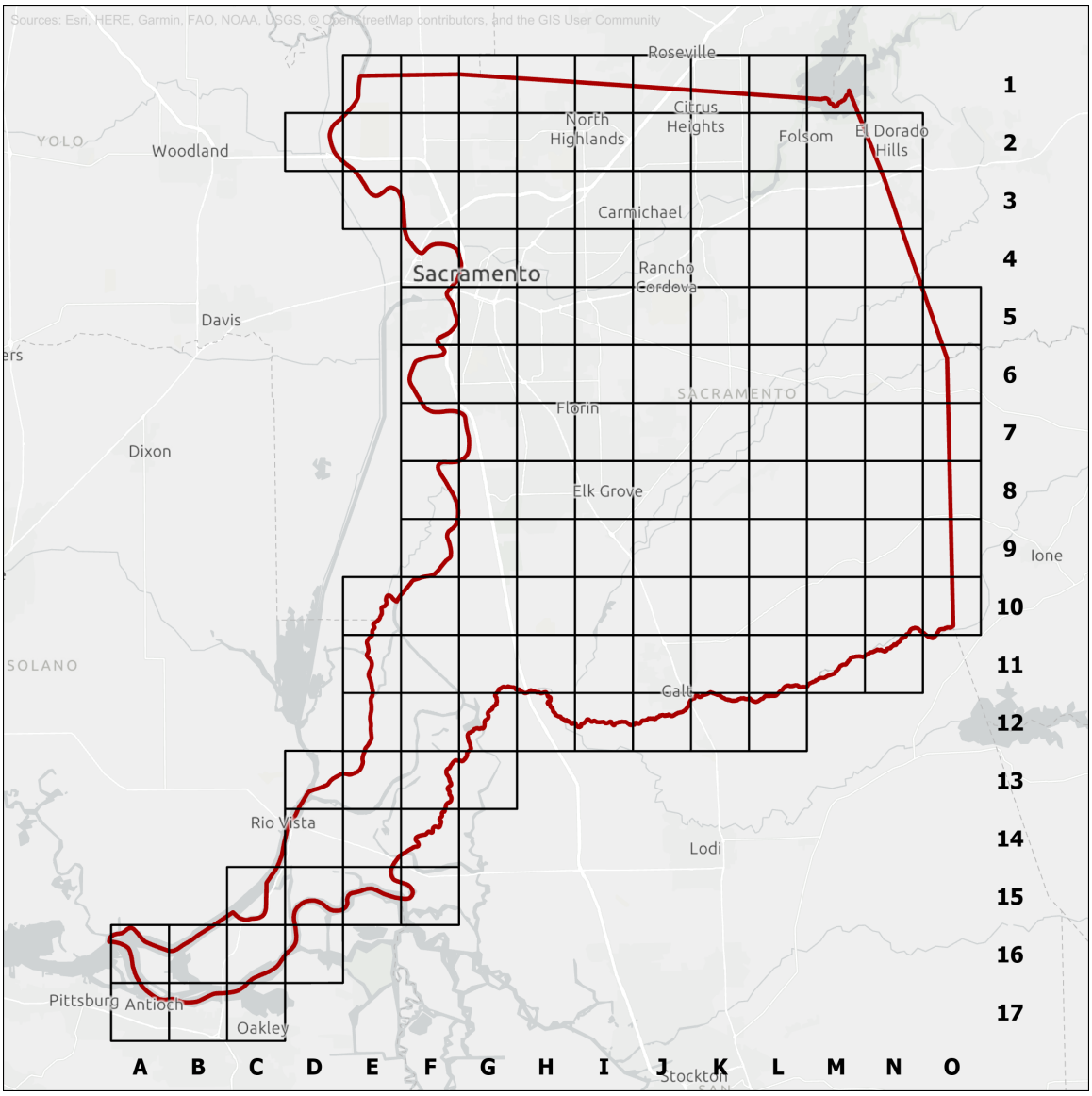
METHODOLOGIES

Sacramento County Atlas 1 was conducted using what we will call the traditional approach. That is, the county was divided into 136 separate 5-km square blocks (Figure 1-1). Individuals were recruited and assigned to focus on specific blocks. Each participant was urged to visit their block(s) several times during the breeding season and record all observed breeding behaviors for all species using a coding system (Table 1-1) for each behavior that allowed those behaviors to be put into one of three categories: possible breeder, probable breeder, or confirmed breeder. At the end of the BBA, each block is assigned to one of those three categories for each species, using the highest (most certain) evidence of breeding.

For Atlas 2, we used the same blocks as Atlas 1, but decided to take a different approach to data gathering. We chose to take advantage of the huge growth and popularity of eBird (www.ebird.org) to expand participation in this BBA. eBird allows users to enter codes for all breeding behaviors using a system very similar to the traditional codes (Table 1-1). We first recruited a Core Group of 16 local birders (including the authors) with knowledge of the area and good bird identification skills. However, we did not assign specific blocks to individuals, but encouraged everyone to use eBird breeding codes whenever they were in the field, and to cover as much of the county as possible. We then used the popular local listserv for the Central Valley (https://groups.io/g/centralvalleybirds) to encourage anyone birding the county to use eBird breeding codes during their birding. The Central Valley Bird Club created a dedicated web page for the atlas (www.cvbirds.org/birding-resources/sacramento-county-breeding-bird-atlas/), which we urged birders to visit. That site included maps, information about how to make observations, and the expected breeding periods for each species (i.e., "safe dates"). During the final two years of the atlas, we identified a subset of blocks that were poorly covered and urged the Core Group and all birders to focus breeding season efforts on those blocks.

At the end of each breeding season, we downloaded data from eBird (eBird Basic Dataset 2020) for the county, using entries that included breeding codes. These data were vetted to eliminate misapplied codes, excessively long transects, or exceptional records that were not well documented. We supplemented those data with specific observations

Figure 1-1. Grid of atlas blocks used for both atlases.



from some Core Group members who were not eBird users. We also scanned species maps in eBird for reliable entries that lacked breeding codes but indicated evidence of breeding or potential breeding by timing, location, comments, or uploaded photos.

Many other BBAs are now using eBird to collect data for their atlases to conduct second or third BBAs of their regions. Some statewide examples of atlases that have used, or are using, eBird to repeat a prior traditional atlas are in Table 1-2. In each of these cases, the atlas is using a combination of dedicated atlasers concentrating on particular blocks, in addition to using data from any eBird user (though some require data to be entered through a dedicated portal).

Mapping Observations

The data downloaded from eBird included geographic coordinates for each record in decimal degrees. These coordinates were plotted in ESRI ArcGIS Pro 2.5.2 and spatially joined to a layer of the Atlas blocks in order to assign a block to each record.

Taxonomy and Nomenclature

Species names and taxonomic order are based on the 61st Supplement to the American Ornithological Society Checklist (Chesser et al. 2020).

Table 1-1. Comparison of the breeding codes in a traditional BBA and eBird breeding codes.

Traditional Code	eBird Code	Definition[1]
Possible	**Possible**	**Possible**
√	H	male or female
X	S	singing male
Probable	**Probable**	**Probable**
P	P	pair
no code	M	7+ singing males
S	S7	song in same location over 7 days
T	T	territorial behavior
C	C	courtship or copulation
N	N	visiting probable nest
A	A	agitated behavior
B	NB[2]	nest building (wrens); excavation (woodpeckers)
Confirmed	**Confirmed**	**Confirmed**
CN	CN	carrying nest material
NB	NB[2]	nest building
PE	PE	in-hand evidence (e.g., brood patch)
DD	DD	distraction display
UN	UN	used nest
FL	FL	recently fledged young
ON	ON	occupied nest
CF	CF	adult carrying food
FY	FY	adult feeding young
FS	FS	adult carrying fecal sac
NE	NE	nest with eggs
NY	NY	nest with young

[1]In each case, the bird must be in suitable breeding habitat and during the likely breeding season.

[2]eBird uses the same code (NB) for nest building in all species, with some species that may exhibit nest building behavior outside of actual breeding coded as probable instead of confirmed.

Table 1-2. Examples of some statewide atlases being repeated using eBird.

BBA	Dates	Prior Atlas(es)	Data Entry
New York III	2020–2024	BBA I in 1980s, II in early 2000s	dedicated eBird portal
Maryland-DC III	2020–2024	BBA I 1983–1987, II 2002–2006	dedicated eBird portal
Connecticut II*	2018–2020	first atlas in early 1980s	share with specific account
Virginia II	2016–2020	BBA I in 1985–1989	dedicated eBird portal
Maine II	2018–2022	BBA I in 1978–1983	dedicated eBird portal

*This atlas is covering year-round bird status.

Potential Issues

Using eBird to compile BBA data has some inherent features that can confound any attempt to make quantifiable comparisons between successive atlases. One issue relates to data being assigned to the wrong block. All data from any eBird checklist are assigned to the point the user chooses for that checklist. They may choose a nearby Hotspot, a personal location, or allow the application to select their location from a map. In any of these cases, if the user is not careful to make sure that the checklist is being assigned to the proper block, some or all their observations may be misassigned. Another problem arises when the user travels outside a block but does not start a new checklist at a location in that new block.

To minimize these potential errors, we made sure that all Core Group users were aware of this issue and the need to verify that coded breeding bird behaviors were assigned to the block in which they occurred. To facilitate this, we identified several well-used Hotspots in the county that straddled two blocks and created new separate Hotspots to account for this. We also used messages to the Central Valley listserv and the instructions posted on the Sacramento County BBA web page to alert all potential contributors to this issue. In addition, we did not use checklists from non–Core Group users that exceeded 10 km in length. Of course, this cannot guarantee that some of the data used were not inadvertently assigned to an adjacent block, but every effort was made to minimize that outcome.

Another potential issue that could affect comparisons is the difference between typical birding effort and true, dedicated atlasing. It is likely that most contributors to a traditional BBA work their block with a specific focus on observing breeding behaviors, with the strongest emphasis on finding confirmatory behaviors. We can assume that most of our non–Core Group contributors for Atlas 2 were engaged in typical birding and not specifically focused on confirming breeding. Even some Core Group members may have been less diligent about trying to get confirmations than they might have been if engaged in a traditional BBA. However, we are confident that most breeders present would have been noted and breeding behaviors reported, at least by the Core Group.

It was discovered during Atlas 2 that focus on certain species outside of the atlas effort may have masked declines in imperiled species (see sidebar at the end of Chapter Six). Also, particular challenges were identified in comparing results for colonial waterbirds between the atlases. These are discussed in detail in the Appendix.

In any case, one must acknowledge that there are inherent difficulties in comparing effort between successive BBAs, even if a traditional approach was used for both (e.g., different skill or effort level from participants, changes in access to some areas). This issue is noted by Renfrew (2013) regarding comparisons between the first and second Vermont BBAs, both using traditional methods.

Comparing Effort between the two BBAs

Data for Atlas 1 was compiled between 1988 and 1993 using a team of 42 observers, each of whom was assigned to one or more blocks. In many cases, a single block was worked by more than one person. In addition, some incidental observations were included from other individuals without specific block assignments. A small number of observations was collected in 1987, and data from 1993 focused on particular blocks not well covered during preceding years. Two boat trips were made during Atlas 1 to visit otherwise inaccessible areas of the southwestern (Delta) portion of the county, and this was not repeated in Atlas 2. Observers made multiple visits to their block(s) attempting to obtain enough breeding behavior observations that at least 95% of the expected breeding species in their block(s) showed behaviors that reached or exceeded possible status, 75% of such species reached probable status, and 50% were confirmed as breeders. The goal for completing the full Atlas 1 project was to reach this level of completion for at least 50% of all blocks. By the end of the project 77 of the 136 blocks (57%) reached completion. Effort data (hours per block) were not systematically collected during Atlas 1.

For Atlas 2, we used observations from 959 different observers, compiling 18,236 separate checklists (eliminating duplicates from shared eBird checklists) which included observations of breeding behaviors. While the bulk of these data came from 2016–2020, we did recover eBird observations

going back as far as 2011. However, less than 4% of the total observations were prior to 2016. It is important to note that our Core Group of 16 observers contributed a hugely disproportionate share of these data. While constituting less than 2% of all observers, the Core Group accounted for 44% of all observations and 56% of all confirmatory observations. We used the same criteria for completion of a block and completion of the project as in Atlas 1, with 70 (51%) blocks completed during Atlas 2.

Atlas 2 observers spent a total of nearly 19,000 hours in the field, averaging 139 hours per block. However, given the nature of Atlas 2, there were large discrepancies between effort per block, with heavily birded blocks seeing many hours and other blocks seeing little or no observation time. In Atlas 2 seven blocks were never visited due to lack of access or the inclusion of only a small part of the county within one of the edge blocks. Atlas 1 also had no observations from five of those same seven blocks. One block (H-11, which includes much of Cosumnes River Preserve) saw 952 hours of observation time during Atlas 2.

Perhaps a better way to compare effective effort between the two atlases is to look at the number of species found per block. For Atlas 1, an average of 43 species per block were observed exhibiting at least possible breeding behavior (median 41 species). Atlas 2 found an average of 40 species per block (median 35). While some of the lower average seen in Atlas 2 may represent an actual reduction in species richness in blocks that have significant habitat conversion (much more on this in subsequent chapters), the difference in methodologies is almost certainly an important factor. The traditional BBA methodology results in a more even distribution of effort among blocks, with little or no effort being expended in a block once it reaches completion. The approach used in Atlas 2 produces less uniform distribution of observations, with those concentrated in frequently birded blocks. Also consistent with this supposition was the observation that the largest number of species reaching at least possible status in any block in Atlas 1 was 63; in Atlas 2 it was 74.

Thus, while comparing the results of these two atlases can yield some important observations about changes in distribution and/or species richness, one should be cautious about drawing conclusions for any but the most significant changes. In subsequent chapters when we compare results, we restrict such comparisons to species where our confidence is very high that those changes are real, and not the result of differences in methods between the two atlases.

The June Swoon and the Joys of Atlasing

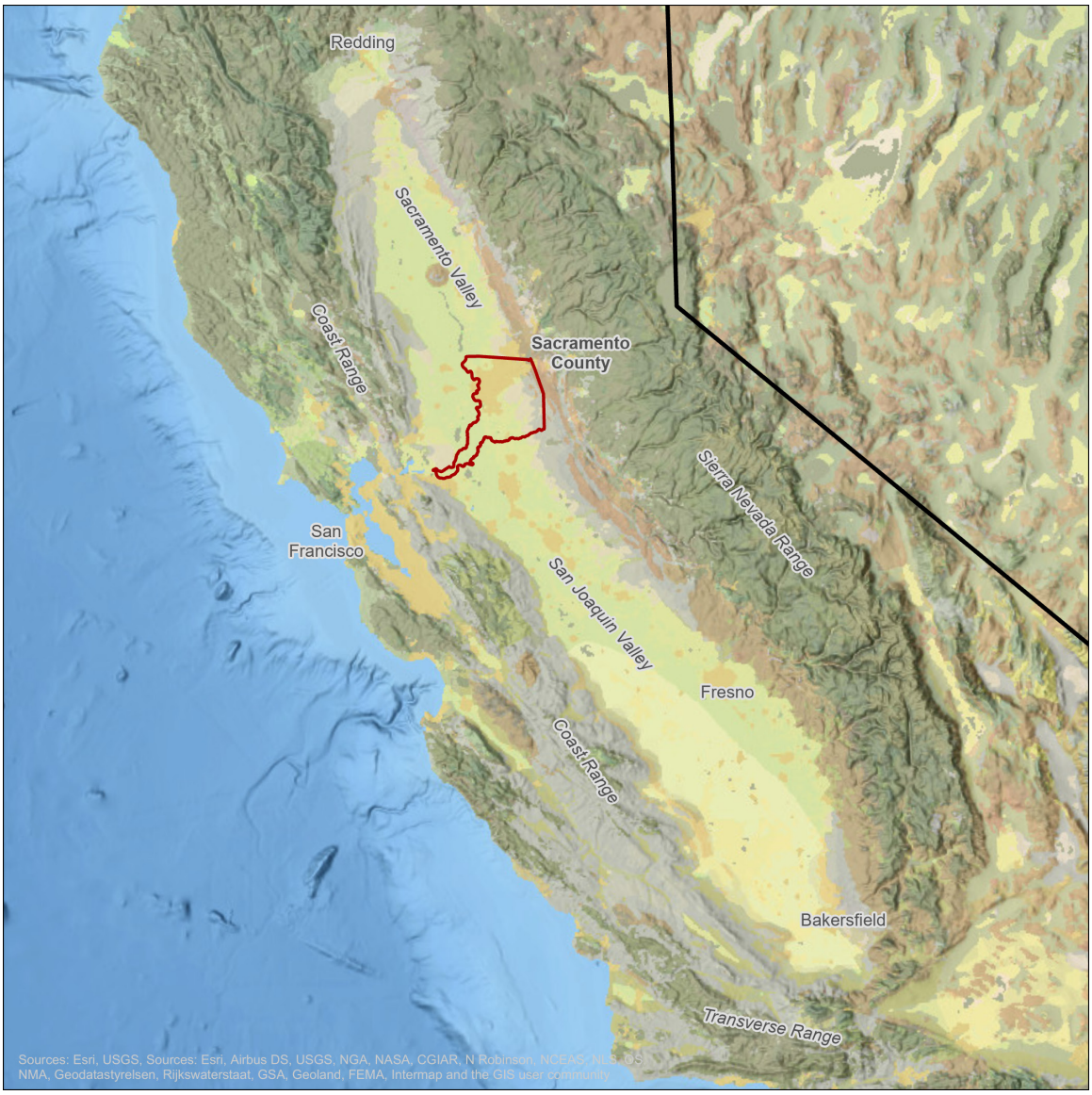
Truth be told, June can be one of the least exciting times for regular birding in Sacramento County. Nearly all of the spring migrants and the hoped-for rarities have moved through, and the anticipated return of shorebirds is at its most nascent stage. Many local birders abandon the heat of the lowlands to look for birds in higher and cooler locations or shift their focus to butterflies and dragonflies. But if you are working on a BBA, June is a great time to look for confirmatory behavior by local breeders. Perhaps the most easily-documented breeding confirmation, especially for songbirds, is a bird carrying food in its bill to take to young in a nest or recently fledged young. Finding a bird carrying an insect or other food item provides a satisfaction only an atlaser knows!

American Robin by Lily Douglas

SACRAMENTO COUNTY

Sacramento County is in the Great Central Valley, the largest single geographic feature of California,

Figure 1-2. Map of California's Central Valley showing the location of Sacramento County.



approximately 800 km long and ranging from 40 to 70 km wide along its length (Figure 1-2). The valley is composed of two large river valleys, the Sacramento Valley in the north and San Joaquin Valley in the south. The Central Valley is bordered on the east by the Sierra Nevada and Cascade ranges, on the west by the Coast ranges and the Klamath Mountains, and on the south by the Transverse Range. The two river systems that drain this valley, the Sacramento and the San Joaquin, flow into the Sacramento–San Joaquin Delta (Delta), one of the largest estuaries on the West Coast of North America.

Central Valley climate is characterized by hot, dry summers, mild springs and falls, and cool winters, when nearly all the year's precipitation occurs (Schoenherr 1992). Periods of extreme drought lasting a few to several years are not unusual. Occasional winters can be extremely wet with storm systems passing through in steady succession.

Sacramento County lies at the southern end of the Sacramento Valley and stretches from the edge of the Sierra Nevada foothills to the east, to the Sacramento River on the west, with a long southwestward projection into the Delta. The city of Sacramento, centered at the confluence of the Sacramento and American rivers, is the main urban area. Prior to the arrival of European settlers, habitats in the county included wide valley oak (*Quercus lobata*)–dominated gallery forests along

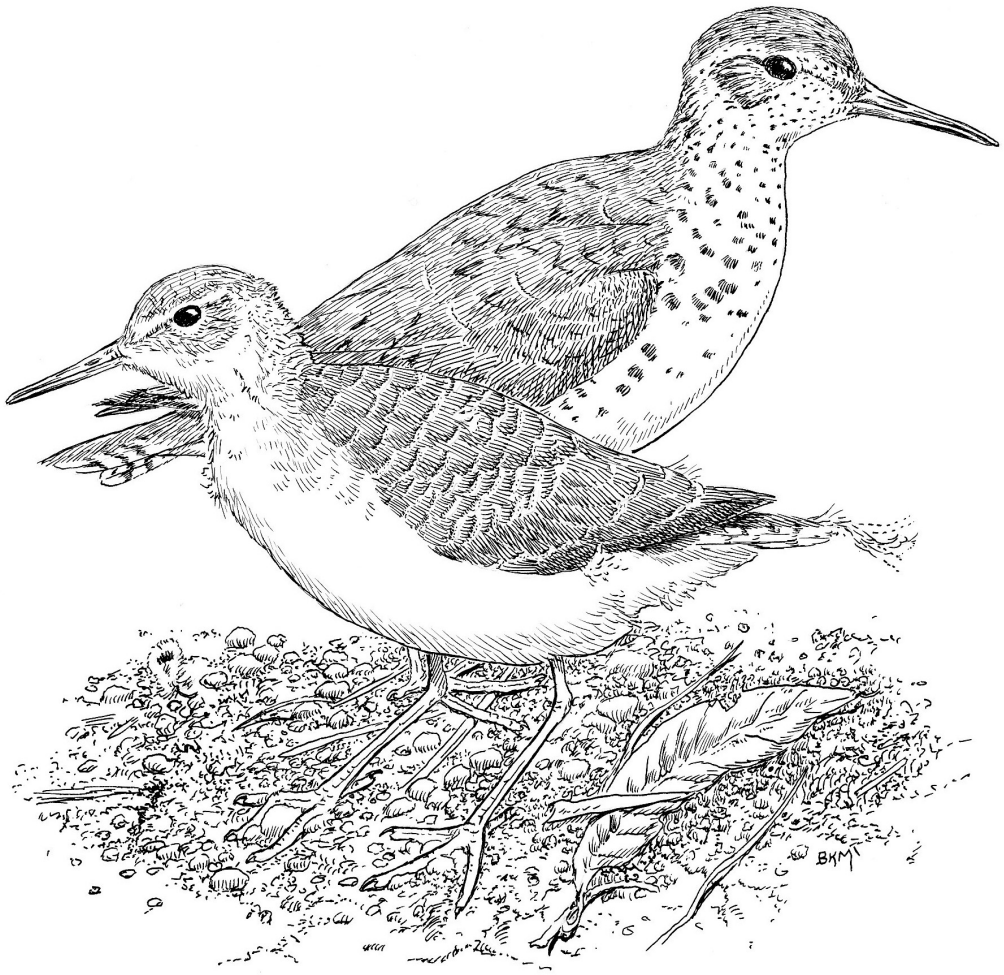
the Sacramento, American, and Cosumnes rivers. These rivers were prone to periodic floods, creating wide floodplains and numerous meanders and oxbows. Low-lying upland areas would flood in wet winters producing large seasonal wetlands. At slightly higher elevations grasslands were the main habitat, grading into oak savanna where adequate moisture could accumulate. Those savannas were dominated by valley oaks in much of the county, transitioning into blue oak (*Quercus douglasii*) savanna in the drier southeastern parts of the county (Schoenherr 1992). In addition, areas in this portion of the county, with shallow soils underlain by hardpan limit tree growth, resulted in extensive grasslands and concentrations of vernal pools (Reiner and Swenson 2000). The Delta area consisted of extensive tidal, brackish marshland intercut by deeper sloughs. One fairly common regional habitat type, chaparral, is almost completely missing from Sacramento County. The easternmost edge of the county, with a high point of only 252 m (the lowest county high point in the state), just reaches the western limit of the gray pine (*Pinus sabiniana*) of the Sierra Nevada foothills.

By the time of Atlas 1, most of the county had been converted to agriculture and development. The wide riparian forests were reduced to narrow ribbons of wooded habitat along the rivers. The Sacramento River had been dammed and diked to reduce flooding, eliminating most of the oxbow meanders and natural floodplains. The American River had also been dammed to control flooding. Most lowland areas that had been seasonal wetlands were drained and diked to allow for intensive agriculture on a massive scale. The footprint of development spread outward from the Sacramento-American river confluence northward, southward, and eastward, mainly along the American River watershed. Much of the Delta was diked and the sloughs channelized to permit agriculture on its many islands, most having subsided to slightly below sea level. While the introduction of nonnative grasses and forbs and intensive cattle grazing altered the grassland and savannas, these habitats still retained many of their pre-European features (Schoenherr 1992).

Throughout the text we commonly refer to specific features of the county (e.g., rivers, cities, wildlife refuges and preserves, geographic features). A map showing locations of most of those features can be found on the inside front cover of this volume.

Across the County Line

Two published atlases cover counties that border Sacramento County—Solano County (Berner 2015) and Contra Costa County (Glover 2009)—providing invaluable regional grounding for our effort. We feel fairly confident with our grasp on bordering San Joaquin, Yolo, Sutter, and Placer counties from a combination of personal experience and excellent contacts such as David Yee and Steve Hampton. But we could really use an atlas for adjacent Amador or El Dorado counties to the east, where the transition between Sacramento County's low foothills and the higher, "true foothills" climbing into the Sierra is less well understood. For example, where exactly do Purple Finches, Chipping Sparrows, and Dark-eyed Juncos start breeding to the east of the county line? This gap in our knowledge was partially filled by the newly published atlas for Nevada County (Rose and Rose 2019), giving atlas-level treatment to a county that transitions from the foothills to the higher Sierra. While not immediately adjacent to Sacramento (the boundary is just over 30 km north of Sacramento County), it is pretty close.



Spotted Sandpiper, adult and juvenile by Barry Kent MacKay