Research Proposal-Lower Boulder Creek

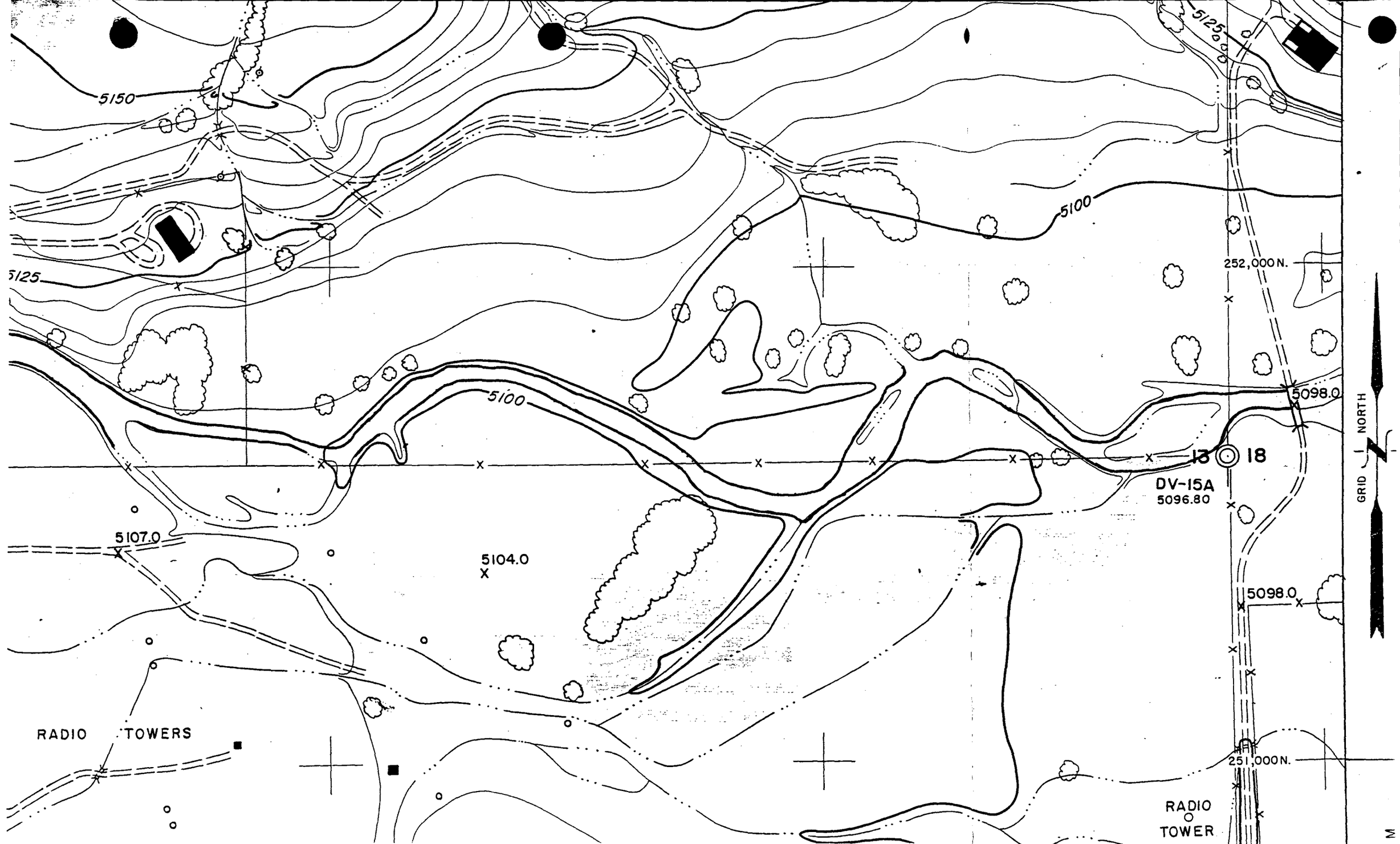
1. University of Colorado EPOB
   Jacob Bidar-graduate independent study 441-3251
   Dr. Alexander Cruz-faculty advisor 492-6685

2. Avian riparian survey and habitat use analysis along lower Boulder Creek. Comparison of diversity,density, and richness with Cottonwood Grove reference area.

3. The Cottonwood Grove(1975 Cruz) study on Boulder Creek identified 15 permanent residents, 30 breeding species and over 150 species total in a relatively unimpacted native riparian habitat. Historically, lower Boulder Creek has been heavily impacted from livestock,farming, and channelization.Presently, the City of Boulder Lower Boulder Creek Enhancement Project is involved in creek and riparian zone rehabilitation. This avian survey will assess avian habitat use in impacted areas and serve as a baseline for future avian studies.

4. Methods
   Variable Circular-Plot Method For Estimating Bird Numbers-Reynolds 1980
   A Fixed Radius Point Count Method For Nonbreeding and Breeding Season Use-Hutto 1986
   7 plots at least 100 meters apart along Boulder Creek on City of Boulder Open Space east of 75th street.
   6 week survey through May 1993-7 plots 4X/week at sunrise and 3X/week at sunset.

5. A final report- objective, methods, results and discussion- will be completed in June 1993.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AVIAN COMMUNITY COMPOSITION ALONG A HISTORICALLY GRAZED SECTION OF LOWER BOULDER CREEK

Jacob Bidar
EPOB 5840/6840
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Spring '93

In the arid west, riparian habitat harbors the greatest diversity and abundance of avian species. Limited in distribution and subject to multiple land uses, these areas are increasingly fragmented and degraded, reducing the habitat available to both permanent residents and migratory birds. In Colorado, riparian areas constitute only .2 percent (400 km^2) of the total land area (Miller and Choate, 1964), but are used by a greater diversity of birds than any other habitat type. In northern Colorado, 82% of all nesting species use riparian areas, and 78% (93 of 119) of the landbird species are neotropical migrants (Knopf, 1985). In the past century, western expansion established large populations that exert detrimental pressure on riparian areas. In Boulder County, extensive human activity significantly altered much of this habitat. The Boulder Creek watershed is no exception. The confluence of North Boulder Creek and Middle Boulder Creek creates a medium, fifth order coldwater mainstem stream that flows forty eight miles east to its confluence with St. Vrain Creek (downstream of 75th street, Boulder Creek is classified as warmwater -mean annual temperature greater than 20°C). Large tracts of fragmented, denuded riparian corridor mark the 23.6 miles from the mouth of Boulder Canyon to St. Vrain Creek, the product of urban and agricultural development. Seventy-seven percent of this stretch is channelized (historical stream diverted to straightened or dredged new channel), reducing stream channel length by 32% (Windell, 1987). East of the city, agricultural pressures dominate the landscape. Degraded riparian corridors are the product of extensive historic cattle grazing, the primary use of native rangelands in the western United States (Knopf et al., 1988). Past avian studies have documented the importance of Boulder Creek riparian habitat. In a survey of breeding bird habitat use on City of Boulder Open Space, breeding species richness was highest in riparian habitats (Thompson and Strauch, 1985). Cottonwood Grove, a thirty plus acre remnant of pre-settlement riparian forest

upstream of 55th street, is host to a wide array of birds. A preliminary report (Cruz and Bock, 1975) documented over 150 total species, 27 breeding species and 15 permanent residents. Further, a 1983 census (Cruz and Strong) of the area and an adjacent linear stretch established the importance of riparian habitat in general. The Cottonwood Grove contained 47 total species and 18 breeding species; the adjacent linear corridor contained 43 total species and 12 breeding species. Yet impacts of cattle grazing on riparian avifauna composition along Boulder Creek has not been assessed. Summer riparian grazing destroys understory and midstory vegetation. Driven to the streambanks by heat, cattle spend long periods grazing, browsing, rubbing and trampling understory growth. They prefer riparian areas for the quality and variety of forage, for their easy accessibility, for shade, and for a reliable source of water (Gillen et al., 1985). Previous regional studies have assessed avian response to grazing. Bock (1984) studied bird response to a 15 year livestock exclosure in southeastern Arizona. Winter avian densities were similar for grazed and protected areas, but the grazed areas had a greater summer abundance. Medin and Clary (1991) compared breeding bird communities in a grazed riparian habitat versus an adjacent comparable habitat protected from livestock for 11 years by an exclosure. They were unable to demonstrate differences in total bird density, or species richness and composition. Nor were they able to show any pronounced difference in avian guild structure. Yet comparison of formerly grazed areas with grazed areas can be misleading. Severe habitat deterioration can require very long recovery times, perhaps decades or more (Clary and Medin, 1990). Thus, formerly grazed areas that are then protected from grazing can exhibit grazed characteristics for many years. Since birds generally respond to changes in vegetation structure as a consequence of grazing rather than to the presence of cattle (Bock and Webb, 1984), these studies essentially limited comparisons to

sites subjected to varying amounts of grazing. Comparisons of grazed riparian areas with virgin tracts are more revealing. A study of the Arapahoe National Wildlife Refuge (Knopf, et al., 1988) described three avian response guilds -habitat generalists, intermediates, and specialists- relative to historical patterns of grazing. Generalists (eg. song sparrows, yellow warblers) and intermediates (eg. American robins, red winged blackbirds, brown headed cowbirds) exhibited similar densities between healthy and decadent (summer grazed) habitat, while specialists were rare or absent in decadent habitats. The objectives of this preliminary survey were: (1) to gather data on avian community composition (diversity, abundance) along a historically grazed section of lower Boulder Creek, (2) to gain census experience employing current methodology.

STUDY AREA

The study area (Maps 1&2) is in eastern Boulder County at an elevation of 1555 m. The riparian corridor (approx. 60x800m) lines a stretch of lower Boulder Creek that flows through City of Boulder Open Space (Kauffman Parcel) east from 75th street to the Weiser property line. Over the last century, this area has been summer grazed resulting in fragmented stands of riparian vegitation. The area is characterized by open canopy and an extensively degraded understory. In 1988, the Open Space Department installed high-tensile fencing south of the creeks riparian area, effectively eliminating livestock access. However, in the last five years, there has been minimal regeneration. The canopy is dominated by crack willow (*Salix fragilis*) and plains cottonwood (*Populus deltoides*); the understory is dominated by Russian-olive (*Elaeagnus angustifolia*), sandbar willow (~~*Girsium arvense*~~ *Salix exigua*), teasle (*Dipsacus sylvertris*), smooth brome (*Bromopsis inermis*), reed canary grass (*Phalaris arundinacea*), and cheat-grass (*Bromus tectorum*).

METHOD

I surveyed avian community composition in the study area using a fixed-radius point count method (Hutto et al. 1986). I established six forty-meter diameter plots within the riparian corridor, spaced at least 100 meters apart. Five stakes marked each plot: A center stake encircled by four stakes placed twenty meters from center at the four cardinal points -N, S, E, W. The official survey took place on fourteen days (without precipitation) over six weeks -March 28 through May 8. Thus, my survey generated fourteen counts per plot, totalling eighty four counts. I conducted all counts within three hours of sunrise. Each day, I began at a different plot and proceeded through a circuit of all six. The duration of each plot count was ten minutes from the time I reached the center. I recorded two parameters at each site: (1) the number of individuals of each species detected through vocal or visual cues within a twenty-meter radius from center (I included any birds flushed from the plot while approaching the center); (2) the abundance of individuals of each species detected outside of the twenty-meter radius but still within the riparian habitat. Further, in order to produce a representative species list, I recorded as present all individuals detected while walking between each study plot.

RESULTS

Thirty-three species occurred within the study plots during the six week census exhibiting a wide range of densities (Table 1). The nine most abundant species -Black-capped Chickadee(BCC), American Robin(AR), Blue Jay(BJ), Downy Woodpecker(DW), European Starling(ES), Yellow-rumped Warbler(YRW), Common Grackle(CG), Red-shafted Flicker(RSF), Black-billed Magpie(BBM) (Fig. 1)- comprised nearly 80 percent of the total abundance (Fig. 2). The four species with the highest densities -Black-capped Chickadee, American Robin, Blue Jay, Downy Woodpecker- accounted for over half of the

total abundance (Fig.3). Also, I identified a total of 47 species within the entire study area (Table 2).

DISCUSSION

Training.- The accuracy of any avian survey is largely based an observer competency. Knowledge of the birds being counted as well as good visual and audio acuity skills are essential components of a qualified observer. A short laboratory and field training program can significantly increase observer census skills (Kepler and Scott, 1981). Since I was both the sole investigator and a bird census novice, training was essential to the viability of this study. As a result, I spent over a month in preparation prior to conducting the official survey. I studied and reviewed relevant literature addressing an array of issues from life histories of expected species to methodology. Training with audio tapes was integral to improving my identification ability. Field training, in both the Cottonwood Grove and the study area was also beneficial. The Cottonwood Grove served as an excellent reference area, harboring a variety of permanent residents in a healthy habitat. One week before the actual survey, I conducted four trial counts in the study area in order to polish my routine. Finally, the time of year for this census proved beneficial both for training and for conducting the survey. Lack of foliage resulted in a significant amount of visual detection, either directly or as a followup to aural detection. Positive visual identification after aural detection was an excellent on-site affirmation of my observational skills.

Census Methodology.- Several factors influenced my decision to use a fixed-radius point count method in this study. The primary reason was the nature of the study habitat. The narrow, fragmented corridor limited the choice of radius length. The restricted width essentially precluded application of the variable-radius circular plot method (Reynolds et al., 1980). Establishing 20 meter radii allowed the largest possible plots that were uniformly contained within the

riparian habitat. Also, by clearly staking each plot, I avoided the inherent inaccuracy of estimating distances to detected birds, a process required by Reynolds' method and Emlen's variable width line transect (and its derivatives) (1971). Finally, by eliminating distance estimation, I was able to concentrate solely on bird detection and identification.

Vegetation.- The current vegetative community in the study area is the product of a century of varied human impact. Though livestock degradation is prominent, other human driven dynamics characterize the site. The dominant overstory trees are crack willow (an early 20th century exotic) and plains cottonwood. These trees are adapted to spring snowmelt flooding. Dispersal is dependent on large, limited viability(1 to 6 weeks), shade intolerant seed crops coincident with peak runoff flow. But water storage(eg Barker Reservoir) and diversion projects(eg irrigation ditches) have drastically altered the Boulder Creek flow regime over the past 100 years. Decreased flood frequency, reduced peak flows, and shifts in the timing and duration of high water levels have disrupted the survival strategy of these species (Howe and Knopf,1991). Supressed by grazing and a managed flow regime, the riparian area is now being invaded by the more viable Russian-olive, an exotic Eurasian tree introduced in North America in the late 19th C. Freed from its natural disease and insect pathogens, this popular tree has rapidly colonized the western United States. Promoted as a means of soil conservation after the 1930's Dust Bowl, and since the early 1950's as a wildlife planting, the Russian-olive now threatens to succeed native species in a variety of habitats. Utilizing the digestive tract of birds as a means of seed dispersal, the Russian-olive is firmly established in western riparian areas. With shade tolerant seeds viable from fall to spring, it has a competitive advantage over native species. As overstory trees die, poised understory Russian-olives fill the canopy gaps, eventually dominating the area. This type of dramatic structural

change, already present along some western rivers, is in the initial phases along lower Boulder Creek.

Avian Community Composition.- Nine species dominated the study area during the survey. Common to riparian habitat these generalists are able to utilize the limited resources of the impacted zone. The increased open forage clearly benefits the AR, ES, CG, and BBM. Further, though fragmented, the overstory provides suitable habitat for the BCC, BJ, DW, YRW, and RWF. Four of these dominants, the ES, CG, BBM, and BJ, are aggressive species which compete directly with a variety of other species: The omnipresent ES provide stiff competition to other hole nesting species (eg the RSF); the CG destroys nests of other species (eg Catbirds, Blue Grosbeaks); the BBM preys upon other birds, eating their eggs and young; and the BJ, pugnacious thieves that plunder the nests of other birds (Bailey, 1965). Two species, the DW and YRW, leave the area in May, breeding at higher elevations in the mountains. In addition, although this was not a breeding bird survey, I found evidence of nesting with the AR, BBM, BJ, and House Wren. Although I identified a total of 47 species, the study area essentially harbors a limited diversity of birds in great abundance, consistent with their habitat requirements. The high-edge, fragmented, degraded nature of the area precludes area sensitive and interior species. Also, species that nest and/or forage in understory vegetation are absent. With time, understory/overstory regeneration can reestablish habitat suitable for a greater diversity of species. Yet the presence of Russian-olive in the understory threatens to reduce the diversity of this regeneration, which will negatively impact future avifauna composition. Riparian communities dominated by dense stands of Russian-olive are projected to evolve over the next 50 to 100 years throughout the Rocky Mountains region (Knopf, 1989). Studies comparing avian communities among varied vegetative types reveal reduced diversity in

pure Russian-olive stands. Knopf and Olson (1984) documented reduced species richness and diversity in monotypic Russian-olive stands compared with native riparian areas in Colorado, Idaho and Utah. Species such as the Northern Flicker, House Wren, Cedar Waxwing, Warbling Vireo, and Black-headed Grosbeak, considered obligate residents of lowland (<2000m) native riparian tracts in the Rocky Mountain Region generally were absent from the Russian-olive community. Without intervention, sections of lower Boulder Creek will likely be taken over by Russian-olive. The City of Boulder is presently engaged in a lower Boulder Creek enhancement project that entails riparian restoration, including planting native tree species. Yet these plantings are limited in scope (constrained primarily by budget) and the project simply does not address long term competition between the Russian-olive and other riparian vegitation.

Data gathered during this six week spring census reveals an avian community limited in diversity due to the degraded habitat. A more exhaustive survey would entail a year round census of this area and additional reaches of Boulder Creek, including data on breeding birds. Also, quantifying vegetative types and other habitat parameters would result in a more comprehensive assessment of riparian health along Boulder Creek and provide a factual foundation from which sound management practices could be derived.

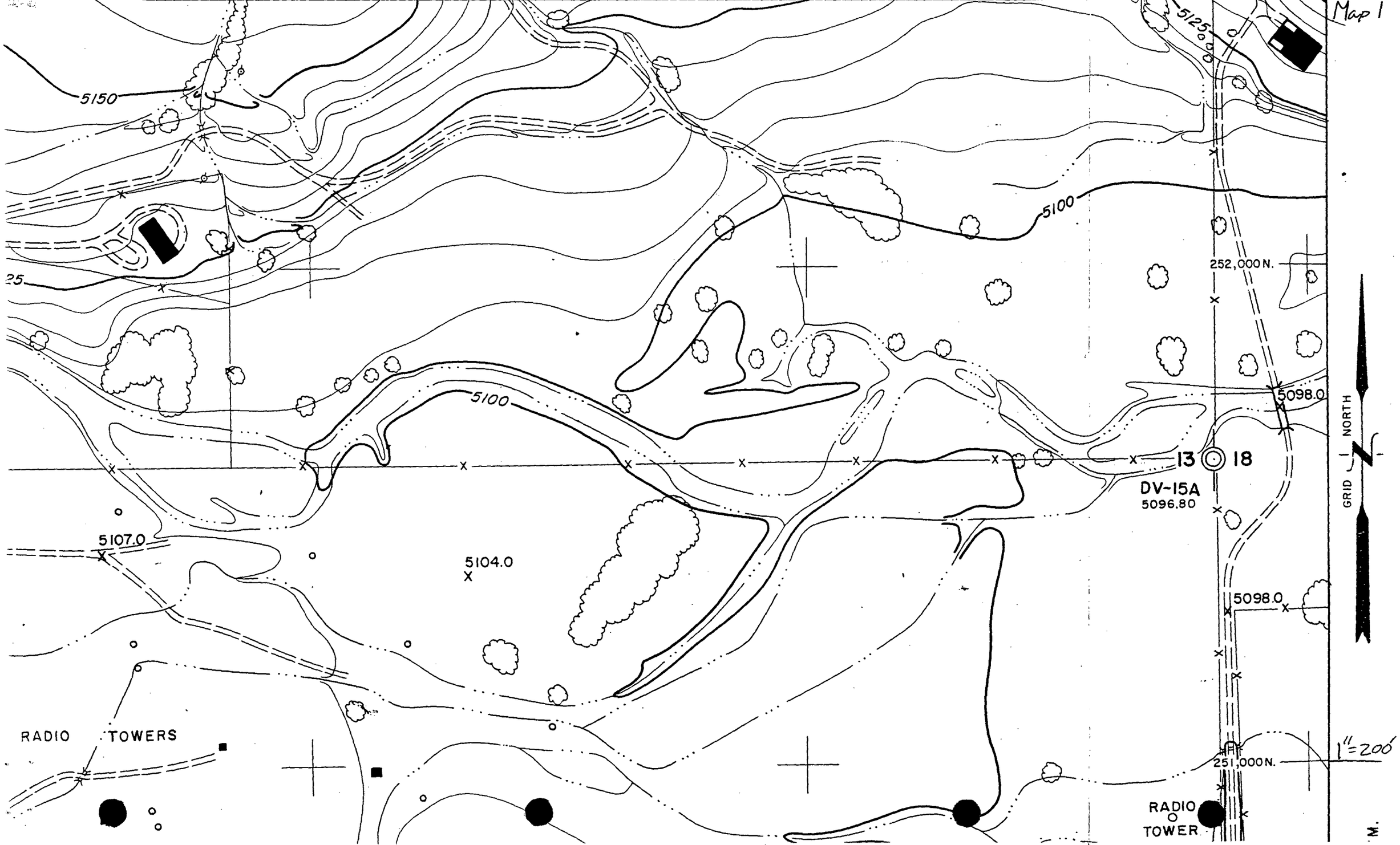
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TABLE 1: SPECIES WITHIN THE STUDY PLOTS

SPECIES	DENSITY[a] (birds/ha)	ST. DEV.[b]	VARIANCE[c]
American Crow	0.379	2.410	5.808
American Goldfinch	1.325	5.622	31.610
American Kestrel	0.714	2.205	4.860
American Robin	6.352	8.718	76.000
Audobon's Warbler	1.137	4.343	18.859
Barn Owl	0.190	1.206	1.455
Black-billed Magpie	2.273	4.254	18.094
Black-capped Chickadee	8.718	11.501	132.275
Blue Jay	5.969	8.370	70.043
Brewer's Blackbird	0.285	2.593	6.725
Brown Creeper	0.284	1.910	3.648
Common Grackle	2.274	6.371	40.591
Common Raven	0.474	3.079	9.479
Common Yellowthroat	0.284	1.910	3.648
Dark-eyed Junco	0.569	3.171	10.056
Downy Woodpecker	3.602	6.077	36.934
European Starling	2.559	6.241	38.957
Great Blue Heron	0.095	0.863	0.745
House Finch	0.379	2.412	5.820
House Sparrow	0.190	1.206	1.455
House Wren	1.422	4.448	19.780
Lesser Goldfinch	0.569	3.825	14.629
Mourning Dove	0.853	3.167	10.031
Red-breasted Nuthatch	0.095	0.863	0.745
Red-shafted Flicker	2.274	4.746	22.528
Red-tailed Hawk	0.284	1.460	2.130
Rock Dove	0.380	3.454	11.933
Song Sparrow	0.569	1.987	3.949
Swainson's Thrush	0.095	0.863	0.745
Turkey Vulture	0.095	0.863	0.745
Wood Duck	0.474	3.079	9.479
Yellow-rumped Warbler	2.559	8.220	67.568
Yellow Warbler	0.284	1.912	3.655

[a] Density was calculated using the following equation: total # birds in the plots/(14 days)(6 plots)
[b] Standard Deviation was calculated using the following equation: $\sigma_x = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n}}$
[c] Variance was calculated using the following equation: $Var_n = \frac{\Sigma(x_i - \bar{x})^2}{n}$

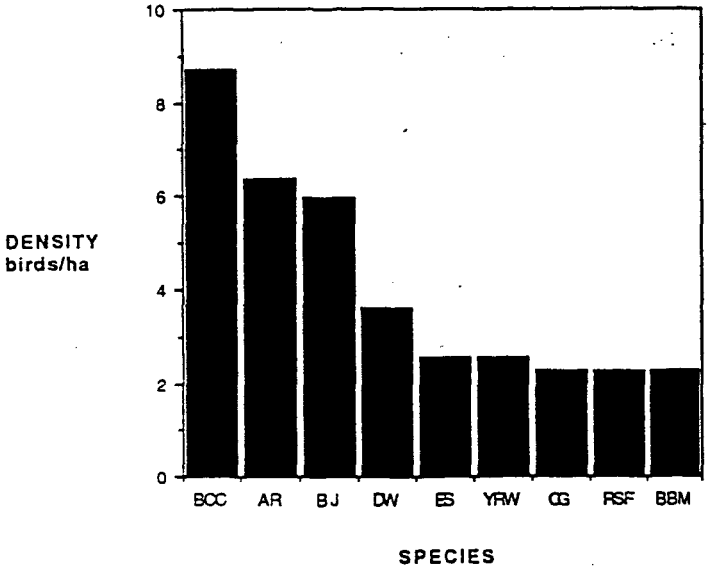

FIG. 1 TOP NINE SPECIES DENSITIES: BLACK-CAPPED CHICKADEE (BCC), AMERICAN ROBIN (AR), BLUE JAY (BJ), DOWNY WOODPECKER (DW), EUROPEAN STARLING (ES), YELLOW-RUMPED WARBLER (YRW), COMMON GRACKLE (CG), RED-SHAFTED FLICKER (RSF) & BLACK-BILLED MAGPIE (BBM).

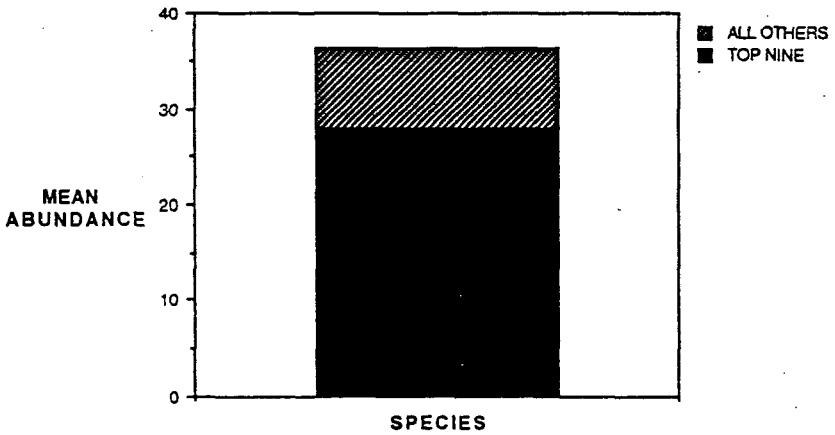

FIG. 2 ABUNDANCE OF HABITAT GENERALISTS -AMERICAN ROBIN, BLACK-CAPPED CHICKADEE, BLUE JAY, DOWNY WOODPECKER, EUROPEAN STARLING, YELLOW-RUMPED WARBLER, COMMON GRACKLE, RED-SHAFTED FLICKER & BLACK-BILLED MAGPIE IN RELATION TO ABUNDANCE OF ALL OTHER BIRDS.

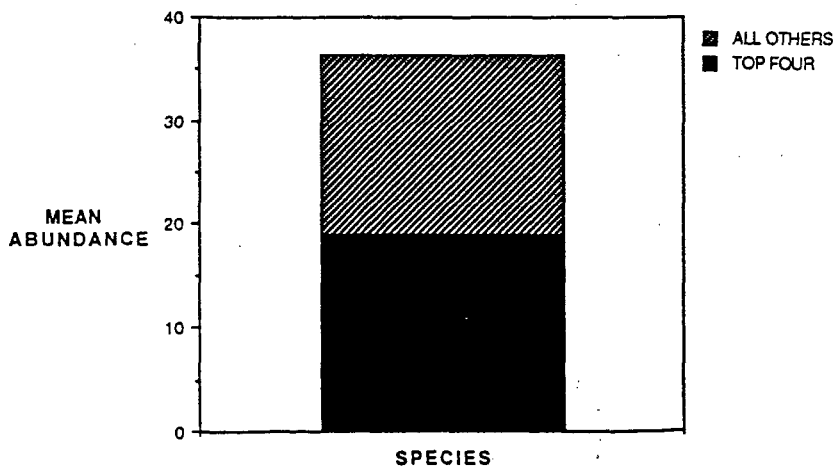

FIG. 3 ABUNDANCE OF HABITAT GENERALISTS -AMERICAN ROBIN, BLACK-CAPPED CHICKADEE, BLUE JAY & DOWNY WOODPECKER IN RELATION TO ABUNDANCE OF ALL OTHER BIRDS.

TABLE 2: TOTAL SPECIES LIST

American Crow *Corvus brachyrhynchos*
American Dipper *Cinclus mexicanus*
American Goldfinch *Carduelis tristis*
American Kestrel *Falco sparverius*
American Robin *Turdus migratorius*
American Wigeon *Anas americana*
Audubon's Warbler *Dendroica coronata*
Barn Owl *Tyto alba*
Belted Kingfisher *Ceryle alcyon*
Black-billed Magpie *Pica pica*
Black-capped Chickadee *Parus atricapillus*
Black-crowned Night-Heron *Nycticorax nycticorax*
Blue Jay *Cyanocitta cristata*
Brewer's Blackbird *Euphagus cyanocephalus*
Brown Creeper *Certhia americana*
Canada Goose *Branta canadensis*
Cinammon Teal *Anas cyanoptera*
Common Grackle *Quiscalus quiscula*
Common Raven *Corvus corax*
Common Snipe *Gallinago gallinagoGeothlypis*
Common Yellowthroat *Geothlypis*
Dark-eyed Junco *Junco phaeonotus*
Downy Woodpecker *Picoides pubescens*
Eastern Kingbird *Tyrannus tyrannus*
European Starling *Sturnus vulgaris*
Great Blue Heron *Ardea herodias*
Green-winged Teal *Anas crecca*
House Finch *Carpodacus mexicanus*
House Sparrow *Passer domesticus*
House Wren *Troglodytes aedon*
Killdeer *Charadrius vociferus*
Lesser Goldfinch *Carduelis psaltria*
Mallard *Anas platyrhynchos*
Mourning Dove *Zenaida macroura*
Northern Harrier *Circus cyaneus*
Red-breasted Nuthatch *Sitta canadensis*
Red-shafted Flicker *Colaptes cafer collaris*
Red-tailed Hawk *Buteo jamaicensis*
Red-winged Blackbird *Agelaius phoeniceus*
Rock Dove *Columba livia*
Song Sparrow *Melospiza melodia*
Swainson's Thrush *Catharus ustulatus*
Turkey Vulture *Cathartes aura*
Western Meadowlark *Sturnella neglecta*
Wood Duck *Aix sponsa*
Yellow-rumped Warbler *Dendroica coronata*
Yellow Warbler *Dendroica petechia*

MARCH 1993

S	M 1	T 2	W 3	Th 4	F 5	S 6
7	8	9	10	Training 11 Cottonwood Grove	12	Training 13 Cottonwood Grove
Training 14 Cottonwood Grove	15	Training 16 Cottonwood Grove	17	Training 18 Cottonwood Grove	19	20
Training 21 Kauffman Open Space	Training 22 Kauffman Open Space	23	24	Training 25 Kauffman Open Space	26	Training 27 Kauffman Open Space
28 Survey Count	29	30 Survey Count	31 Survey Count			

APRIL 1993

S	M	T	W	Th 1	F 2	S 3
4 Survey Count	5	6	7 Survey Count	8	9	10
11	12	13	14	15 Survey Count	16	17
18 Survey Count	19	20 Survey Count	21	22	23	24
25 Survey Count	26	27	28	29 Survey Count	30	

MAY 1993

S	M	T	W	Th	F	S 1
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

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