A SURVEY OF PLAINS RIPARIAN VEGETATION
IN
BOULDER COUNTY, COLORADO

Prepared By:
Boulder County Parks and Open Space
Boulder County Nature Association

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**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Purpose of Study</td>
<td>3</td>
</tr>
<tr>
<td>Methods</td>
<td>4</td>
</tr>
<tr>
<td>Study Area</td>
<td>4</td>
</tr>
<tr>
<td>Aerial Photo Survey</td>
<td>4</td>
</tr>
<tr>
<td>Vegetative Survey</td>
<td>4</td>
</tr>
<tr>
<td>Results and Discussion</td>
<td>6</td>
</tr>
<tr>
<td>Summary</td>
<td>7</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>8</td>
</tr>
<tr>
<td>Literature Cited</td>
<td>12</td>
</tr>
<tr>
<td>Appendix I - Vegetation Survey Data</td>
<td>14</td>
</tr>
<tr>
<td>Appendix II - Common and Scientific Names</td>
<td>41</td>
</tr>
</tbody>
</table>
A SURVEY OF PLAINS RIPARIAN VEGETATION
IN
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INTRODUCTION

Plains riparian habitats, characterized by mature cottonwood stands and dense shrub understories, are some of the richest wildlife habitats in Colorado as more than 43% of the wildlife species found in the state have been recorded there (Scott 1986). Wildlife disproportionately use riparian zones more than other habitat types (Thomas et al. 1979, Beidleman 1954). These areas are also important for a host of other values such as water quality, flood control, and erosion control (Tiner 1984).

Studies conducted by the Colorado Division of Wildlife indicate that the cottonwood-willow association along most of Colorado's rivers are in a state of decline (Scott 1986). Impacts from farming, grazing, woodcutting, and control of stream water have decreased both mature trees and regeneration. A comparison of 1937 and 1985 aerial photos of a portion of the St. Vrain Creek in Boulder County revealed a 48% decline in riparian habitat, much of the loss caused by sand and gravel operations (McKinley et al. 1986). Furthermore, an historical review of the status of breeding birds in Boulder County revealed that willow flycatcher, loggerhead shrike, northern mockingbird and brown thrasher, all breeders in shrub understories of riparian zones, have numerically declined (Boulder County Parks and Open Space Department 1988).

PURPOSE OF STUDY

The study had two main purposes. The first was to quantify the amount of riparian vegetation existing along the major streams of Boulder County.

The second purpose was to measure the quality of the riparian vegetation relative to tree canopy, shrub understory and tree regeneration. It has been suggested that there is a relationship between wildlife species diversity (particularly birds) and foliage height diversity, foliage volume and other habitat characteristics (Willson 1974, Balda 1969, MacArthur and MacArthur 1961).
METHODS

Study Area

A study was conducted of the plains riparian zones of the following streams in Boulder County, CO: Boulder Creek, Coal Creek, Fourmile Creek, Lefthand Creek, Rock Creek, St. Vrain Creek and South Boulder Creek (see Figure 1). Using 1984 aerial photos (scale 1"=400'), stands of riparian vegetation were identified. Notices were sent to property owners of these stands and studies were conducted in those areas where opposition to the study was not expressed.

Aerial Photo Survey

Using the 1984 aerial photos, linear measurements were made of the extent of riparian forests existing along the seven streams. Forests were not considered to exist along the stream if, for more than a 100 m length, tree density was less than .5/100 m².

Vegetation Survey

Within each surveyed riparian stand, vegetation was sampled at 25 m intervals (minimum of 20 points surveyed in each stand) along both sides of the stream. Survey lines perpendicular to the stream were established at the 25 m interval points. The point-centered quarter method was used to measure overstory species composition, size-class distribution and basal area. The method was used at the stream bank and every 25 m along each survey line perpendicular to the stream until the edge of riparian vegetation was reached. Additionally, within a 2 m band centered on the survey lines, all saplings (less than 10 cm dbh) were identified and measured for height while shrubs were identified, measured for height and stems counted. Due to difficulties in identifying willow (Salix spp) tree saplings from shrubs, they were lumped into a single category. Dominant ground cover vegetation was estimated and notes were made regarding presence or impacts from agriculture, recreation, dwellings, grazing and channelization.

The field work was conducted by teams of 1-6 individuals during the summer of 1985 and 1986 (see acknowledgements). Teams were comprised of staff from Boulder County Parks and Open Space Department or volunteers from Boulder County Nature Association or the Volunteer Naturalist program of Boulder County Parks and Open Space.
Figure 1

A Survey of Plains Riparian Vegetation
RESULTS AND DISCUSSION

The seven creeks studied totaled over 74 miles of stream on the plains of Boulder County (Table 1). Boulder Creek was the longest and Fourmile Creek the shortest. Forested riparian habitat existed along 60% of the total stream mileage. Over 90% of Fourmile and Lefthand Creeks exhibited forest habitat. Only 25% of the length of Rock Creek had adjacent riparian forests while other streams ranged from 50-70%.

The vegetation of 27 stream segments was surveyed by volunteers with the number of sampled areas on each stream as follows: Boulder Creek - 6, Coal Creek - 6, Fourmile Creek - 2, Lefthand Creek - 2, Rock Creek - 4, St. Vrain Creek - 3, South Boulder Creek - 4. The surveyed segments equaled almost 40% of the forested riparian plains habitat in Boulder County.

The forests were dominated by plains cottonwood, narrowleaf cottonwood and willow (crack, golden and peachleaved). St. Vrain and Coal Creeks showed heavy dominance by cottonwoods, Boulder Creek's tree overstory was primarily willows, and the remaining creeks were co-dominated by cottonwoods and willows.

The widest riparian zones were found along Boulder Creek, Coal Creek and South Boulder Creek. Rock Creek was the narrowest zone.

Approximately half of the surveyed segments had a significant shrub understory. Willow, chokecherry, hawthorn, plum and boxelder were the most common tall shrubs (greater than 1 m) that provided vegetative diversity to the forested riparian areas.

Rose, snowberry and locust were actually the most dominant shrubs throughout all the segments. They were particularly common in heavily grazed or disturbed plots and added little structural diversity to the vegetation due to their low-lying growth forms.

The segments along South Boulder Creek, St. Vrain Creek and the west half of Coal Creek exhibited the best examples of shrub understory.

Almost half of the surveyed segments showed signs of regeneration of cottonwoods or willows (in willow dominated stands). South Boulder Creek, St. Vrain Creek, Lefthand Creek, Coal Creek and the central portion of Boulder Creek had the greatest amount of regeneration. Most regeneration was occurring in those segments closest to the foothills.
Table 2 attempts to numerically summarize the data gathered from the vegetation surveys in terms of structural diversity. The best stands for wildlife have an overstory (ideally many sizes of trees including large-diameter trees important to nesting raptors and cavity-nesters), a shrub understory (willows and/or other shrubs), regeneration and good width. The data for each surveyed plot was placed into a 0-2 scale, with 2 being the higher tree, willow, shrub and regeneration densities or zone width, and 0 the lower.

The surveyed plots of South Boulder Creek, St. Vrain Creek, Lefthand Creek, the western half of Coal Creek, and the central part of Boulder Creek exhibited the best structural diversity. Rock Creek exhibited poor development of riparian vegetation which may be related to the small size and low water flow of the stream.

SUMMARY

There has been an expressed concern about the decline of plains riparian vegetation in Colorado. Studies in Boulder County, CO, have shown some significant losses of vegetation adjacent to streams and a general decline in breeding birds dependent on riparian shrub vegetation.

This study examined seven plains streams in Boulder County. Analyzing aerial photos, it was found that only 60% of stream length was bordered by riparian forests. This ranged from over 90% on Lefthand and Fourmile Creeks to only 25% on Rock Creek. Vegetation analysis of structural diversity in 27 stream segments (minimum 2 segments on each stream) resulted in half showing signs of shrub understory and half showing signs of regeneration. In general, this indicates that only 30% of the plains riparian zone in Boulder County has good structural diversity or signs of regeneration. The segments on South Boulder Creek, St. Vrain Creek, Lefthand Creek, the western half of Coal Creek, and the central portion of Boulder Creek exhibited the best examples of structural diversity while Rock Creek had the poorest development of riparian vegetation.
ACKNOWLEDGEMENTS

This study was financially supported by Boulder Audubon Society, Boulder County Nature Association and Boulder County Parks and Open Space Department. Special thanks to the following individuals who volunteered their time to conduct the field survey: Ann Armstrong, Carolyn Beezley, Garret Campbell, Kathy Carsey, Ann Cooper, Lin Folsom, Dave Hallock, Tina Jones, Laura McKinley, Nita Rauch, Ellen Steiner, Dave Wilkerson, and Diane Woelfel. Thanks to the following Boulder County Parks and Open Space staff for field work, organization and typing: Randy Coombs, Doug DeVries, Sue Galatowitsch, Pam Leland, Pat Reed, and Barry Shook. Thanks to Nancy Lederer for assistance in editing this report.
Table 1

Length of Stream
and Forested Vegetation
for Seven Creeks in Boulder County

<table>
<thead>
<tr>
<th>Creek</th>
<th>Total Length On Plains (miles)</th>
<th>Length of Forested Vegetation (miles) (%)</th>
<th>Forested Plots Surveyed (miles)</th>
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<tbody>
<tr>
<td>Boulder</td>
<td>15.8</td>
<td>8.0</td>
<td>51%</td>
</tr>
<tr>
<td>Coal Creek</td>
<td>12.0</td>
<td>6.9</td>
<td>57</td>
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<tr>
<td>Fourmile</td>
<td>4.8</td>
<td>4.4</td>
<td>92</td>
</tr>
<tr>
<td>Lefthand</td>
<td>10.4</td>
<td>9.5</td>
<td>91</td>
</tr>
<tr>
<td>Rock Creek</td>
<td>10.4</td>
<td>2.6</td>
<td>25</td>
</tr>
<tr>
<td>St. Vrain</td>
<td>13.6</td>
<td>8.2</td>
<td>60</td>
</tr>
<tr>
<td>South Boulder</td>
<td>7.3</td>
<td>5.1</td>
<td>70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>74.3</td>
<td>44.7</td>
<td>60%</td>
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Table 2

Vegetation Ratings in 27 Plots on 7 Streams in Boulder County

<table>
<thead>
<tr>
<th>Plot</th>
<th>Width</th>
<th>Trees</th>
<th>Regeneration</th>
<th>Willows</th>
<th>Shrubs</th>
<th>Total</th>
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<tr>
<td>Boulder Cr. 1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>1</td>
<td>5</td>
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<tr>
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<td>1</td>
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<td>5</td>
</tr>
<tr>
<td>Boulder Cr. 4</td>
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<td>2</td>
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<td>6</td>
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<td>Boulder Cr. 5</td>
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<td>Coal Cr. 1</td>
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<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Coal Cr. 2</td>
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<td>2</td>
<td>1</td>
<td>2</td>
<td>7</td>
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<td>6</td>
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<td>Fourmile Cr. 2</td>
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<td>Lefthand Cr. 4</td>
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<td>6</td>
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<tr>
<td>Rock Cr. 1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
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<td>Rock Cr. 2</td>
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<td>4</td>
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<td>0</td>
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<td>2</td>
<td>2</td>
<td>2</td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>S. Boulder Cr. 1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>S. Boulder Cr. 2</td>
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<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>S. Boulder Cr. 3</td>
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<td>2</td>
<td>1</td>
<td>2</td>
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<td>7</td>
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<tr>
<td>S. Boulder Cr. 4</td>
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<td>1</td>
<td>8</td>
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### Table 2 (continued)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>&gt;40 m</th>
<th>20 - 40 m</th>
<th>&lt;20 m</th>
<th>All ages present</th>
<th>Less than 40% of points without trees</th>
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</thead>
<tbody>
<tr>
<td>Average width of riparian zone:</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Tree Canopy Structure:</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regeneration Density:</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willow Density:</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shrub Density:</td>
<td>2(1)</td>
<td>1(2)</td>
<td>0(3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) If 75% <1 m tall, then = 1
(2) If 50% >1 m tall, then = 2
    if 75% <1 m tall, then = 0
(3) If 50% >1 m tall, then = 1
LITERATURE CITED

Boulder County Parks and Open Space Department. 1988. Comparative status of the breeding birds of Boulder County. Pages 3-86 - 3-97 in Boulder County Comprehensive Plan Environmental Resources Element.
Areas with dense vegetation are considered good wildlife habitat as the structural diversity provides a variety of niches. The vegetation also shades the stream, producing better water quality for fish.

Many cottonwood stands exhibit a mature overstory with little shrub understory or regeneration, often due to grazing practices.
Appendix I

Boulder Creek #1

Vegetation Survey Data

1. Width of Riparian Area
   Average - 11 m  Range - 1-29 m

2. Absolute Density of Trees
   Mean Distance - 8.37 m
   Trees/100m² - 1.43  3% without trees

3. Relative Frequency of Tree Species
   Willow - 94%
   P. Cottonwood - 6%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willow</td>
<td>5%</td>
<td>7%</td>
<td>45%</td>
<td>33%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>P1. Cotton</td>
<td></td>
<td></td>
<td>50%</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>5%</td>
<td>6%</td>
<td>45%</td>
<td>34%</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m²  0.0
   Height: >2m 0%  1-2m 0%  <1m 0%

6. Number of Willows/100m²  0.28
   Height: >2m 100%  1-2m 0%  <1m 0%

7. Number of Shrubs/100m²  2.89
   Height: >2m 5%  1-2m 33%  <1m 62%

8. Relative Frequency of Shrubs
   Ash - 62%  Boxelder - 5%
   Juniper - 28%  Russian Olive - 5%

A Survey of Plains Riparian Vegetation  14
1. Width of Riparian Area
   Average - 110 m  Range - 40-204 m

2. Absolute Density of Trees
   Mean Distance - 6.8 m
   Trees/100m² - 2.16  13% without trees

3. Relative Frequency of Tree Species
   Willow - 72%  Black Locust - 2%
   Boxelder - 14%  Am. Elm - 1%
   Green ash - 5%  N. Cottonwood - 1%
   P. Cottonwood - 5%  Other - 1%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willow</td>
<td>13%</td>
<td>54%</td>
<td>18%</td>
<td>13%</td>
<td>1%</td>
<td>1%</td>
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<tr>
<td>Boxelder</td>
<td>95%</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Green Ash</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. Cotton.</td>
<td>8%</td>
<td>31%</td>
<td>23%</td>
<td>31%</td>
<td>8%</td>
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<tr>
<td>B. Locust</td>
<td>83%</td>
<td></td>
<td>17%</td>
<td></td>
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<tr>
<td>Am. Elm</td>
<td>100%</td>
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<tr>
<td>N. Cotton.</td>
<td>100%</td>
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<tr>
<td>Other</td>
<td>100%</td>
<td></td>
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<tr>
<td>TOTAL</td>
<td>32%</td>
<td>41%</td>
<td>14%</td>
<td>10%</td>
<td>1%</td>
<td>1%</td>
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5. Number of Cottonwood Saplings/100m²  0.01
   Height: >2m  0%  1-2m  50%  <1m  50%

6. Number of Willows/100m²  0.86
   Height: >2m  14%  1-2m  44%  <1m  42%

7. Number of Shrubs/100m²  29.85
   Height: >2m  5%  1-2m  4%  <1m  91%

8. Relative Frequency of Shrubs
   Snowberry - 58%  Boxelder - 3%
   Raspberry - 18%  Sage - 2%
   Rose - 9%  Gooseberry - 1%
   Green Ash - 7%  Other - 1%
1. **Width of Riparian Area**
   - Average: 25 m
   - Range: 1-68 m

2. **Absolute Density of Trees**
   - Mean Distance: 9.20 m
   - Trees/100m²: 1.18
   - 26% without trees

3. **Relative Frequency of Tree Species**
   - Willow: 69%
   - P. Cotton: 22%
   - Boxelder: 5%
   - Apple: 1%
   - Hackberry: 1%
   - P. Cotton: 22%
   - B. Locust: 1%

4. **D.B.H. Size Classes (inches)**

<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
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<tbody>
<tr>
<td>Willow</td>
<td>31%</td>
<td>31%</td>
<td>24%</td>
<td>10%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>P. Cotton</td>
<td>75%</td>
<td>56%</td>
<td>25%</td>
<td>19%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boxelder</td>
<td>100%</td>
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<tr>
<td>Apple</td>
<td></td>
<td>23%</td>
<td>30%</td>
<td>12%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>B. Locust</td>
<td>28%</td>
<td>28%</td>
<td>30%</td>
<td>12%</td>
<td>5%</td>
<td>1%</td>
</tr>
</tbody>
</table>

5. **Number of Cottonwood Saplings/100m²**
   - Height: >2m: 69%
   - 1-2m: 23%
   - <1m: 8%
   - Total: 1.07

6. **Number of Willows/100m²**
   - Height: >2m: 48%
   - 1-2m: 17%
   - <1m: 35%
   - Total: 8.66

7. **Number of Shrubs/100m²**
   - Height: >2m: 1%
   - 1-2m: 3%
   - <1m: 96%
   - Total: 62.38

8. **Relative Frequency of Shrubs**
   - Snowberry: 91%
   - Currant: 4%
   - Locust: 1%
   - Rose: 1%
   - Boxelder: 1%
   - Other: 2%

---

A Survey of Plains Riparian Vegetation
Boulder Creek #4

1. Width of Riparian Area
   Average - 17 m  Range - 1-76 m

2. Absolute Density of Trees
   Mean Distance - 7.32 m
   Trees/100m² - 1.87  22% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 56%  S. Poplar - 3%
   Willow - 30%  Boxelder - 1%
   R. Olive - 6%  G. Ash - 1%
   C. Elm - 3%  N. Cottonwood - 1%

4. D.B.H. Size Classes (inches)
   \[
   \begin{array}{cccccc}
   \text{Species} & 4-10'' & 11-20'' & 21-30'' & 31-40'' & 41-50'' & 50+ \\
   \hline
   \text{P. Cotton} & 71\% & 17\% & 1\% & 7\% & \text{3\%} \\
   \text{Willow} & 55\% & 26\% & 11\% & 6\% & 2\% \\
   \text{R. Olive} & 80\% & 20\% \\
   \text{C. Elm} & 100\% \\
   \text{S. Poplar} & 100\% \\
   \text{Boxelder} & 100\% \\
   \text{G. Ash} & 100\% \\
   \text{N. Cotton} & 100\% \\
   \text{TOTAL} & 69\% & 19\% & 4\% & 6\% & 1\% & 2\% \\
   \end{array}
   \]

5. Number of Cottonwood Saplings/100m²  3.29
   Height:  >2m 98\%  1-2m 0\%  <1m 2\%

6. Number of Willows/100m²  39.45
   Height:  >2m 37\%  1-2m 44\%  <1m 19\%

7. Number of Shrubs/100m²  13.27
   Height:  >2m 12\%  1-2m 18\%  <1m 70\%

8. Relative Frequency of Shrubs
   Snowberry - 64\%  Gooseberry - 3\%
   Rose - 10\%  G. Ash - 2\%
   R. Olive - 7\%  S. Poplar - 2\%
   Boxelder - 5\%  Other - 7\%

A Survey of Plains Riparian Vegetation  17
1. Width of Riparian Area
   Average - 40 m   Range - 1-130 m

2. Absolute Density of Trees
   Mean Distance - 7.41 m
   Trees/100m² - 1.82   35% without trees

3. Relative Frequency of Tree Species
   Willow - 69%   Am. Elm - 5%
   P. Cottonwood - 10%   C. Elm - 3%
   N. Cottonwood - 8%   Hackberry - 1%
   R. Olive - 5%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willow</td>
<td>74%</td>
<td>24%</td>
<td>1%</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. Cotton</td>
<td>90%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. Cotton</td>
<td>50%</td>
<td>25%</td>
<td>13%</td>
<td>12%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. Olive</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Am. Elm</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Elm</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hackberry</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>77%</td>
<td>19%</td>
<td>2%</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m²
   Height: >2m 17%   1-2m 59%   <1m 24%
   .71

6. Number of Willows/100m²
   Height: >2m 15%   1-2m 30%   <1m 55%
   22.03

7. Number of Shrubs/100m²
   Height: >2m 9%   1-2m 4%   <1m 87%
   2.86

8. Relative Frequency of Shrubs
   Snowberry - 81%   Gooseberry - 4%
   Am. Elm - 4%   Hackberry - 4%
   G. Ash - 4%   R. Olive - 1%

A Survey of Plains Riparian Vegetation 18
Boulder Creek

1. Width of Riparian Area
   Average - 37 m  Range - 1-69 m

2. Absolute Density of Trees
   Mean Distance - 9.84 m
   Trees/100m² - 1.03  38% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 91%  R. Olive - 1%
   Willow - 8%

4. D.B.H. Size Classes (inches)
   Species  4-10"  11-20"  21-30"  31-40"  41-50"  50+
   P. Cotton  4%  53%  38%  3%  1%  1%
   Willow  40%  50%  10%
   R. Olive  100%
   TOTAL  7%  52%  35%  4%  1%  1%

5. Number of Cottonwood Saplings/100m²
   Height: >2m 0%  1-2m 0%  <1m 100%

6. Number of Willows/100m²
   Height: >2m 0%  1-2m 0%  <1m 0%

7. Number of Shrubs/100m²
   Height: >2m 0%  1-2m 0%  <1m 100%

8. Relative Frequency of Shrubs
   Snowberry - 84%  Rose - 5%
   Sage - 11%
Coal Creek #1

1. Width of Riparian Area
   Average - 25 m   Range - 12-39 m

2. Absolute Density of Trees
   Mean Distance - 8.14 m
   Trees/100m² - 1.51  31% without trees

3. Relative Frequency of Tree Species
   N. Cottonwood - 64%
   P. Cottonwood - 36%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11'-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Cotton</td>
<td>96%</td>
<td>4%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. Cotton</td>
<td>77%</td>
<td>23%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>89%</td>
<td>11%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m² - 9.80
   Height: >2m 65% 1-2m 59% <1m 12%

6. Number of Willows/100m² - 7.68
   Height: >2m 28% 1-2m 59% <1m 12%

7. Number of Shrubs/100m² - 15.94
   Height: >2m 28% 1-2m 59% <1m 12%

8. Relative Frequency of Shrubs
   Locust - 41%  Gooseberry - 5%
   Chokecherry - 21%  Ash - 1%
   Hawthorn - 20%  Skunkbrush - 1%
   Shrub Sp. - 11%
Coal Creek #2

1. **Width of Riparian Area**
   - Average: 28 m
   - Range: 14-50 m

2. **Absolute Density of Trees**
   - Mean Distance: 6.38 m
   - Trees/100m²: 2.46
   - 14% without trees

3. **Relative Frequency of Tree Species**
   - N. Cottonwood: 100%

4. **D.B.H. Size Classes (inches)**
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Cotton</td>
<td>79%</td>
<td></td>
<td>21%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. **Number of Cottonwood Saplings/100m²**
   - 17.45
   - Height: >2m 62% 1-2m 30% <1m 8%

6. **Number of Willows/100m²**
   - 7.55
   - Height: >2m 43% 1-2m 38% <1m 19%

7. **Number of Shrubs/100m²**
   - 43.70
   - Height: >2m 40% 1-2m 26% <1m 33%

8. **Relative Frequency of Shrubs**
   - Serviceberry: 42%
   - Locust: 7%
   - Hawthorn: 26%
   - Skunkbrush: 4%
   - Shrub Sp.: 11%
   - Ash: 1%
   - Rose: 10%

**A Survey of Plains Riparian Vegetation**
Coal Creek #3

1. Width of Riparian Area
   Average - 94 m Range - 52-125 m

2. Absolute Density of Trees
   Mean Distance - 5.48 m
   Trees/100m² - 3.33 6% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 70%  P. Willow - 12%
   N. Cottonwood - 16%  Ash - 2%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11'-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Cotton</td>
<td>90%</td>
<td>9%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>N. Cotton</td>
<td>86%</td>
<td>14%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>P. Willow</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>90%</td>
<td>9%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td></td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m² 12.56
   Height: >2m 97%  1-2m 3%  <1m 0%

6. Number of Willows/100m² 4.72
   Height: >2m 84%  1-2m 8%  <1m 8%

7. Number of Shrubs/100m² 4.95
   Height: >2m 0%  1-2m 15%  <1m 85%

8. Relative Frequency of Shrubs
   Locust - 82%  Rose - 7%
   Ash - 11%

A Survey of Plains Riparian Vegetation
Coal Creek #4

1. Width of Riparian Area
   Average - 51 m  Range - 29-75 m

2. Absolute Density of Trees
   Mean Distance - 7.21 m
   Trees/100m² - 1.92  4% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 77%  R. Olive - 3%
   N. Cottonwood - 11%  Ash - 4%
   P. Willow - 5%

4. D.B.H. Size Classes (inches)
   Species 4-10"  11'-20"  21-30"  31-40"  41-50"  50+
   P. Cotton 91%  7%  2%  0%  0%  0%
   N. Cotton 100%  0%  0%  0%  0%  0%
   P. Willow 33%  67%  0%  0%  0%  0%
   Ash 67%  33%  0%  0%  0%  0%
   R. Olive 100%  0%  0%  0%  0%  0%
   TOTAL 89%  7%  0%  0%  0%  0%

5. Number of Cottonwood Saplings/100m²  3.66
   Height: >2m 100%  1-2m 0%  <1m 0%

6. Number of Willows/100m²  1.88
   Height: >2m 58%  1-2m 21%  <1m 21%

7. Number of Shrubs/100m²  5.24
   Height: >2m 13%  1-2m 25%  <1m 62%

8. Relative Frequency of Shrubs
   Honeysuckle - 60%  R. Olive - 11%
   Locust - 26%  Shrub Sp. - 2%
Coal Creek #5

1. Width of Riparian Area
   Average - 24 m  
   Range - 18-28 m  

2. Absolute Density of Trees
   Mean Distance - 7.25 m  
   Trees/100m² - 1.90  
   0% without trees  

3. Relative Frequency of Tree Species
   P. Cottonwood - 100%  

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>10'20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Cotton</td>
<td>72%</td>
<td>28%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m²  
   Height: >2m 100% 1-2m 0% <1m 0%  

6. Number of Willows/100m²  
   Height: >2m 0% 1-2m 0% <1m 0%  

7. Number of Shrubs/100m²  
   Height: >2m 0% 1-2m 17% <1m 83%  

8. Relative Frequency of Shrubs
   Locust - 67%  
   Rose - 16%  
   Honeysuckle - 17%
Coal Creek #6

1. Width of Riparian Area
   Average - 66m  Range - 45-95 m

2. Absolute Density of Trees
   Mean Distance - 7.77 m
   Trees/100m² - 1.65  11% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 74%  P. Willow - 6%
   Boxelder - 19%  R. Olive - 1%

4. D.B.H. Size Classes (inches)
   
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11'20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Cotton</td>
<td>83%</td>
<td></td>
<td>4%</td>
<td>4%</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Boxelder</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. Willow</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. Olive</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>88%</td>
<td>3%</td>
<td>3%</td>
<td></td>
<td>6%</td>
<td></td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m² .57
   Height:  >2m 100%  1-2m 0% <1m 0%

6. Number of Willows/100m² 0
   Height:  >2m 0% 1-2m 0% <1m 0%

7. Number of Shrubs/100m² 10.9
   Height:  >2m 33% 1-2m 22% <1m 45%

8. Relative Frequency of Shrubs
   Honeysuckle - 45%  Boxelder - 10%
   Plum - 41%  R. Olive - 3%
Four Mile Creek #1

1. Width of Riparian Area
   Average - 26 m
   Range - 20-30 m

2. Absolute Density of Trees
   Mean Distance - 11.00 m
   Trees/100m² - .83
   5% without trees

3. Relative Frequency of Tree Species
   P. Willow - 68%
   P. Cottonwood - 32%

4. D.B.H. Size Classes (inches)

<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Willow</td>
<td>62%</td>
<td>38%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. Cotton</td>
<td>33%</td>
<td>67%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>53%</td>
<td>47%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m² - 0

6. Number of Willows/100m² - 0

7. Number of Shrubs/100m² - .77
   Height: >2m 0% 1-2m 0% <1m 100%

8. Relative Frequency of Shrubs
   Locust - 100%

A Survey of Plains Riparian Vegetation 26
Four Mile Creek #2

1. **Width of Riparian Area**
   - Average: 62 m
   - Range: 15-90 m

2. **Absolute Density of Trees**
   - Mean Distance: 6.93 m
   - Trees/100m²: 2.08
   - 8% without trees

3. **Relative Frequency of Tree Species**
   - P. Willow: 57%
   - Boxelder: 11%
   - P. Cottonwood: 30%
   - Elm: 1%

4. **D.B.H. Size Classes (inches)**
   - Species | 4-10" | 11-20" | 21-30" | 31-40" | 41-50" | 50+
   - P. Willow | 40% | 32% | 20% | 4% | 4% | -
   - P. Cotton | - | 8% | 54% | 31% | 8% | -
   - Boxelder | 100% | - | - | - | - | -
   - Elm | 100% | - | - | - | - | -
   - TOTAL | 36% | 20% | 27% | 11% | 4% | -

5. **Number of Cottonwood Saplings/100m²**
   - 0

6. **Number of Willows/100m²**
   - Height: >2m 100% 1-2m 0% <1m 0%
   - .32

7. **Number of Shrubs/100m²**
   - Height: >2m 11% 1-2m 33% <1m 56%
   - 22.43

8. **Relative Frequency of Shrubs**
   - Currant: 60%
   - Boxelder: 4%
   - Honeysuckle: 24%
   - Ash: 3%
   - Serviceberry: 9%
   - Elm: 1%

A Survey of Plains Riparian Vegetation
Left Hand Creek #4

1. Width of Riparian Area
   Average - 22m  Range - 2-68m

2. Absolute Density of Trees
   Mean Distance - 6.02m
   Trees/100m² - 2.76
   38% without trees

3. Relative Frequency of Tree Species
   C. Willow - 47%
   P. Cottonwood - 31%
   R. Olive - 20%
   P. Willow - 2%

4. D.B.H. Size Classes (inches)
   Species      4-10"  11-20"  21-30"  31-40"  41-50"  50+
   C. Willow   54%    39%    22%    17%    6%   2%
   P. Cotton.  39%    17%    22%    17%    6%   2%
   R. Olive    83%    17%    22%    17%    6%   2%
   P. Willow  1%    27%    10%    5%    2%
   TOTAL      56%    27%    10%    5%    2%

5. Number of Cottonwood Saplings/100m²  2.28
   Height:  >2m  73%  1-2m  7%  <1m  20%

6. Number of Willows/100m²  3.41
   Height:  >2m  38%  1-2m  36%  <1m  27%

7. Number of Shrubs/100m²  10.55
   Height:  >2m  59%  1-2m  26%  <1m  59%

8. Relative Frequency of Shrubs
   Snowberry - 61%  Lead Plant - 1%
   Chokecherry - 16%  Rose - 1%
   R. Olive - 16%  Poplar - 1%
   Elm - 4%
Left Hand Creek #5

1. Width of Riparian Area
   Average - 21m  Range - 0-50m

2. Absolute Density of Trees
   Mean Distance - 7.56m
   Trees/100m² - 1.75  32% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 55%  P. Willow - 9%
   R. Olive - 23%  Elm - 2%
   Honeylocust - 11%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Cotton.</td>
<td>8%</td>
<td>21%</td>
<td>25%</td>
<td>25%</td>
<td>8%</td>
<td>12%</td>
</tr>
<tr>
<td>R. Olive</td>
<td>60%</td>
<td>40%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honeylocust</td>
<td>100%</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>P. Willow</td>
<td>75%</td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elm</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>39%</td>
<td>20%</td>
<td>16%</td>
<td>14%</td>
<td>5%</td>
<td>7%</td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m²  7.86
   Height: >2m  0%  1-2m  0%  <1m  100%

6. Number of Willows/100m²  9.05
   Height: >2m  0%  1-2m  66%  <1m  34%

7. Number of Shrubs/100m²  6.67
   Height: >2m  0%  1-2m  21%  <1m  79%

8. Relative Frequency of Shrubs
   Shrub Sp. - 93%  Honeylocust - 3%
   Rose - 4%
1. Width of Riparian Area
   Average - 2 m   Range - 1-5 m

2. Absolute Density of Trees
   Mean Distance - 7.7 m
   Trees/100m² - 1.69   62% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 100%

4. D.B.H. Size Classes (inches)
   ![](image)

5. Number of Cottonwood Saplings/100m²
   Height: >2m 0% 1-2m 40% <1m 60%

6. Number of Willows/100m²
   Height: >2m 0% 1-2m 0% <1m 0%

7. Number of Shrubs/100m²
   Height: >2m 0% 1-2m 22% <1m 78%

8. Relative Frequency of Shrubs
   Snowberry - 52% Other - 2%
   Locust - 46%
1. **Width of Riparian Area**
   Average - 2 m
   Range - 1-14 m

2. **Absolute Density of Trees**
   Mean Distance - 6.79 m
   Trees/100m² - 2.17
   70% without trees

3. **Relative Frequency of Tree Species**
   P. Cottonwood - 54%
   R. Olive - 1%
   C. Willow - 45%

4. **D.B.H. Size Classes (inches)**

<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
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<tbody>
<tr>
<td>P. Cotton</td>
<td>14%</td>
<td>17%</td>
<td>36%</td>
<td>25%</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>C. Willow</td>
<td>40%</td>
<td>57%</td>
<td>3%</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. Olive</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>25%</td>
<td>36%</td>
<td>21%</td>
<td>13%</td>
<td>3%</td>
<td>2%</td>
</tr>
</tbody>
</table>

5. **Number of Cottonwood Saplings/100m²**
   Height: >2m 0% 1-2m 100% <1m 0%
   .23

6. **Number of Willows/100m²**
   Height: >2m 4% 1-2m 27% <1m 69%
   15.72

7. **Number of Shrubs/100m²**
   Height: >2m 1% 1-2m 20% <1m 79%
   360.80

8. **Relative Frequency of Shrubs**
   Snowberry - 54%
   W. Plum - 1%
   Locust - 38%
   Hawthorn - 1%
   Rose - 6%
1. **Width of Riparian Area**
   - Average - 3 m
   - Range - 1-10 m

2. **Absolute Density of Trees**
   - Mean Distance - 5.61 m
   - Trees/100m² - 3.18
   - 78% without trees

3. **Relative Frequency of Tree Species**
   - C. Willow - 68%
   - P. Cottonwood - 32%

4. **D.B.H. Size Classes (inches)**

<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
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</thead>
<tbody>
<tr>
<td>C. Willow</td>
<td>32%</td>
<td>64%</td>
<td>4%</td>
<td>31%</td>
<td>38%</td>
<td>8%</td>
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<tr>
<td>P. Cotton</td>
<td>8%</td>
<td>15%</td>
<td>3%</td>
<td>38%</td>
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<td>3%</td>
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<tr>
<td>TOTAL</td>
<td>22%</td>
<td>46%</td>
<td>7%</td>
<td>10%</td>
<td>12%</td>
<td>3%</td>
</tr>
</tbody>
</table>

5. **Number of Cottonwood Saplings/100m²**
   - .36
   - Height: >2m 0% 1-2m 50% <1m 50%

6. **Number of Willows/100m²**
   - 1.06
   - Height: >2m 100% 1-2m 0% <1m 0%

7. **Number of Shrubs/100m²**
   - 334.62
   - Height: >2m 8% 1-2m 9% <1m 83%

8. **Relative Frequency of Shrubs**
   - Snowberry - 66%
   - Hawthorn - 9%
   - Rose - 9%
   - Locust - 8%
   - W. Plum - 5%
   - W. Cherry - 3%
   - Currant - 1%
Rock Creek #4

1. Width of Riparian Area
   Average - 6 m Range - 1-20 m

2. Absolute Density of Trees
   Mean Distance - 7.33 m
   Trees/100m² - 1.86 59% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 87%
   G. Willow - 13%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Cotton</td>
<td>71%</td>
<td>10%</td>
<td>5%</td>
<td>9%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>G. Willow</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>75%</td>
<td>8%</td>
<td>4%</td>
<td>8%</td>
<td>4%</td>
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</tr>
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</table>

5. Number of Cottonwood Saplings/100m² 1.46
   Height: >2m 0% 1-2m 40% <1m 60%

6. Number of Willows/100m² 41.23
   Height: >2m 11% 1-2m 44% <1m 45%

7. Number of Shrubs/100m² 142.40
   Height: >2m 3% 1-2m 8% <1m 89%

8. Relative Frequency of Shrubs
   Snowberry - 78% Rose - 1%
   Locust - 21% Other - 1%
1. **Width of Riparian Area**
   - Average: 19 m
   - Range: 5-50 m

2. **Absolute Density of Trees**
   - Mean Distance: 5.01 m
   - Trees/100m²: 3.98
   - 29% without trees

3. **Relative Frequency of Tree Species**
   - N. Cotton: 50%
   - Boxelder: 24%
   - P. Cotton: 12%
   - Honeylocust: 9%
   - Elm: 6%

4. **D.B.H. Size Classes (inches)**
   - **Species**: 4-10" 11-20" 21-30" 31-40" 41-50" 50+
   - **N. Cotton**: 47% 41% 6% 6% 6% 6%
   - **Boxelder**: 50% 50% 75% 25%
   - **P. Cotton**: 100%
   - **Honeylocust**: 75%
   - **Elm**: 50% 50%
   - **TOTAL**: 44% 29% 15% 3% 3%

5. **Number of Cottonwood Saplings/100m²**
   - Height: >2m: 15% 1-2m: 25% <1m: 60%
   - Total: 5.32

6. **Number of Willows/100m²**
   - Height: >2m: 18% 1-2m: 82% <1m: 0%
   - Total: 2.92

7. **Number of Shrubs/100m²**
   - Height: >2m: 26% 1-2m: 60% <1m: 14%
   - Total: 25.80

8. **Relative Frequency of Shrubs**
   - Chokecherry: 41% Plum: 9%
   - Snowberry: 15% Honeylocust: 3%
   - Other: 15% Locust: 2%
   - Boxelder: 12% Currant: 1%

*St. Vrain #1*

**A Survey of Plains Riparian Vegetation**
1. Width of Riparian Area
   Average - 27 m    Range - 5-55 m
2. Absolute Density of Trees
   Mean Distance - 4.95 m
   Trees/100m² - 4.08
   14% without trees
3. Relative Frequency of Tree Species
   N. Cotton - 47%    Elm - 5%
   P. Cotton - 21%   Birch - 4%
   Boxelder - 8%     Hybrid Cotton - 3%
   Locust - 6%       Crack Willow - 6%
4. D.B.H. Size Classes (inches)
   Species       4-10"  11-20"  21-30"  31-40"  41-50"  50+
   N. Cotton     57%    32%     11%   
   P. Cotton     69%    25%     
   Boxelder      83%    17%     
   Locust        60%    40%     
   C. Willow     60%    40%     
   Elm           50%    50%     
   Birch         33%    67%     
   Hy. Cotton    50%    50%     
   TOTAL         60%    32%     6%    1%
5. Number of Cottonwood Saplings/100m²
   Height: >2m 42%  1-2m 35%  <1m 23%
6. Number of Willows/100m²
   Height: >2m 35%  1-2m 48%  <1m 16%
7. Number of Shrubs/100m²
   Height: >2m 51%  1-2m 7%   <1m 42%
8. Relative Frequency of Shrubs
   Chokecherry - 32%   Elm - 11%
   Locust - 29%   Snowberry - 4%
   Boxelder - 25%
St. Vrain #3

1. **Width of Riparian Area**
   - Average: 23 m
   - Range: 0-62 m

2. **Absolute Density of Trees**
   - Mean Distance: 5.56 m
   - Trees/100m²: 3.23
   - 13% without trees

3. **Relative Frequency of Tree Species**
   - N. Cotton: 46%
   - P. Cotton: 19%
   - Honeylocust: 12%
   - Elm: 7%
   - R. Olive: 6%
   - P. Willow: 4%
   - C. Willow: 2%
   - Alder: 2%
   - B. Locust: 1%

4. **D.B.H. Size Classes (inches)**
   - Species | 4-10" | 11-20" | 21-30" | 31-40" | 41-50" | 50+
   - N. Cotton | 71% | 24% | 5%
   - P. Cotton | 87% | 13%
   - Honeylocust | 100%
   - Elm | 100%
   - R. Olive | 100%
   - P. Willow | 33% | 67%
   - C. Willow | 100%
   - Alder | 100%
   - B. Locust | 100%
   - TOTAL | 82% | 16% | 2%

5. **Number of Cottonwood Saplings/100m²**
   - Height: >2m: 71%, 1-2m: 21%, <1m: 7%
   - 6.29

6. **Number of Willows/100m²**
   - Height: >2m: 25%, 1-2m: 30%, <1m: 44%
   - 28.77

7. **Number of Shrubs/100m²**
   - Height: >2m: 75%, 1-2m: 10%, <1m: 15%
   - 2.96

8. **Relative Frequency of Shrubs**
   - Alder: 30%
   - Snowberry: 22%
   - R. Olive: 17%
   - B. Locust: 10%
   - Honey Locust: 10%
   - Elm: 8%
   - Hawthorn: 3%
South Boulder Creek #2

1. Width of Riparian Area
   Average - 22 m  Range - 2-120m

2. Absolute Density of Trees
   Mean Distance - 4.90 m
   Trees/100m² - 5.25  25% without trees

3. Relative Frequency of Tree Species
   P. Cottonwood - 45%  Hybrid Cottonwood - 6%
   N. Cottonwood - 20%  Alder - 6%
   C. Willow - 18%  Boxelder - 4%

4. D.B.H. Size Classes (inches)
   Species  4-10"  11-20"  21-30"  31-40"  41-50"  50+
   P. Cotton  14%  45%  18%  14%  9%
   N. Cotton  100%
   C. Willow  18%  22%  22%  11%  11%
   Hyb. Cotton  67%  33%
   Alder  100%
   TOTAL  47%  27%  12%  8%  6%

5. Number of Cottonwood Saplings/100m²  8.24
   Height: >2m  37%  1-2m  26%  <1m  37%

6. Number of Willows/100m²  23.16
   Height: >2m  5%  1-2m  56%  <1m  39%

7. Number of Shrubs/100m²  74.43
   Height: >2m  9%  1-2m  31%  <1m  60%

8. Relative Frequency of Shrubs
   Chokecherry - 27%  Sumac - 5%
   Lead Plant - 17%  Raspberry - 1%
   Hawthorn - 14%  Alder - 1%
   Rose - 13%  Boxelder - 1%
   Plum - 11%  Skunkbrush - 1%
   Snowberry - 10%
South Boulder Creek #3

1. Width of Riparian Area
   Average - 25 m  Range - 5-50m

2. Absolute Density of Trees
   Mean Distance - 8.71m
   Trees/100m² - 1.32  22% without trees

3. Relative Frequency of Tree Species
   - P. Cottonwood - 60%
   - C. Willow - 4%
   - N. Cottonwood - 16%
   - Elm - 2%
   - P. Willow - 12%
   - Apple - 2%
   - Hyb. Cottonwood - 4%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Cotton.</td>
<td>3%</td>
<td>43%</td>
<td>33%</td>
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<td>10%</td>
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</tr>
<tr>
<td>N. Cotton</td>
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<td>37%</td>
<td>13%</td>
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</tr>
<tr>
<td>P. Willow</td>
<td>17%</td>
<td>83%</td>
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<tr>
<td>Hyb. Cotton</td>
<td>100%</td>
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<td></td>
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</tr>
<tr>
<td>C. Willow</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Elm</td>
<td>100%</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple</td>
<td>100%</td>
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<td></td>
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</tr>
<tr>
<td>TOTAL</td>
<td>24%</td>
<td>42%</td>
<td>22%</td>
<td>6%</td>
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</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m²  2.38
   Height: >2m 12%  1-2m 41%  <1m 47%

6. Number of Willows/100m²  15.13
   Height: >2m 0%  1-2m 52%  <1m 48%

7. Number of Shrubs/100m²  35.43
   Height: >2m 2%  1-2m 19%  <1m 79%

8. Relative Frequency of Shrubs
   - Rose - 51%  Snowberry - 5%
   - Lead Plant - 25%  Hawthorn - 4%
   - Plum - 10%  Birch - 1%
   - Chokecherry - 5%  Skunkbrush - 1%
South Boulder Creek #4

1. Width of Riparian Area
   Average - 46 m  Range - 13-113m

2. Absolute Density of Trees
   Mean Distance - 7.13m
   Trees/100m² - 1.97  13% without trees

3. Relative Frequency of Tree Species
   N. Cottonwood - 44%  P. Willow - 11%  Boxelder - 1%
   P. Cottonwood - 20%  H. Cottonwood - 10%  Apple - 1%
   Alder - 11%  R. Olive - 2%

4. D.B.H. Size Classes (inches)
<table>
<thead>
<tr>
<th>Species</th>
<th>4-10&quot;</th>
<th>11-20&quot;</th>
<th>21-30&quot;</th>
<th>31-40&quot;</th>
<th>41-50&quot;</th>
<th>50+</th>
</tr>
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<tbody>
<tr>
<td>N. Cotton</td>
<td>82%</td>
<td>13%</td>
<td>4%</td>
<td>3%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>P. Cotton</td>
<td>58%</td>
<td>26%</td>
<td>3%</td>
<td>3%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>Alder</td>
<td>94%</td>
<td>6%</td>
<td>3%</td>
<td>3%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>P. Willow</td>
<td>62%</td>
<td>38%</td>
<td>7%</td>
<td>7%</td>
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<td></td>
</tr>
<tr>
<td>H. Cotton</td>
<td>53%</td>
<td>33%</td>
<td>7%</td>
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<td></td>
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<tr>
<td>R. Olive</td>
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</tr>
<tr>
<td>Apple</td>
<td>100%</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>TOTAL</td>
<td>73%</td>
<td>20%</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

5. Number of Cottonwood Saplings/100m²  9.66
   Height: >2m 57% 1-2m 13% <1m 30%

6. Number of Willows/100m²  5.54
   Height: >2m 16% 1-2m 30% <1m 54%

7. Number of Shrubs/100m²  90.72
   Height: >2m 2% 1-2m 2% <1m 96%

8. Relative Frequency of Shrubs
   Snowberry - 71%  Chokecherry - 1%  Hawthorn - 1%
   Rose - 24%  Currant - 1%  Plum - 1%
   Amarpha - 2%  Elm - 1%  R. Olive - 1%
   Apple - 1%  G. Ash - 1%  R. Birch - 1%
   Alder - 1%  Honeysuckle - 1%
Appendix II

Common and Scientific Names of Plants Found in Text*

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plains Cottonwood</td>
<td>Populus sargentii</td>
</tr>
<tr>
<td>Narrowleaf Cottonwood</td>
<td>Populus angustifolia</td>
</tr>
<tr>
<td>Crack Willow</td>
<td>Salix fragilis</td>
</tr>
<tr>
<td>Golden Willow</td>
<td>Salix alba</td>
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<td>Peachleaved Willow</td>
<td>Salix amygdaloides</td>
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<tr>
<td>Locust</td>
<td>Robinia neomexicana</td>
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<tr>
<td>Rose</td>
<td>Rosa spp.</td>
</tr>
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<td>Snowberry</td>
<td>Symphoricarpus occidentalis</td>
</tr>
<tr>
<td>Box-elder</td>
<td>Acer negundo</td>
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<td>Hawthorn</td>
<td>Crataegus succulenta</td>
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<tr>
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<td>Prunus virginiana</td>
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<tr>
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<td>Celtis reticulata</td>
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<tr>
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<td>Alnus tenuifolia</td>
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<td>Lead Plant</td>
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<td>River Birch</td>
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<td>Rubus idaeus</td>
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<td>Sumac</td>
<td>Rhus glabra</td>
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<td>Cherry</td>
<td>Prunus besseyi</td>
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<tr>
<td>Juniper</td>
<td>Juniperus communis</td>
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</tbody>
</table>

* Names follow Weber 1976
The BCNA is a non-profit, public charity organization dedicated to fostering an awareness, understanding and appreciation for the natural history and heritage of Boulder County. Associated with the County Parks & Open Space Department, BCNA will help collect, interpret and disseminate natural and cultural resource information about features which contribute to the desirable environment and life-style in the Boulder County region.

Activities

Three functions have been identified as the basis of activity for the BCNA:

- Natural and Cultural History Data Base -
  
  One of our continuing tasks is gathering current knowledge about Boulder County's natural and cultural history. This includes a bibliography of such materials as natural area studies, flora and fauna studies, historical research, wildlife inventories, weather phenomena and geology research. Copies are available to members.

- Environmental and Cultural Research -
  
  By piecing together what is known comes the ability to discover what is not known. BCNA identifies informational needs, encourages and supports new scientific investigation and research. Studies are conducted by BCNA members, other individuals, or non-profit groups such as universities.

- Environmental Education -
  
  A major function is dissemination of natural and cultural history information to the public through such avenues as nature hikes, slide programs, publications, seminars, and support for interpretive facilities in the County. Many of the educational activities support the existing County Parks & Open Space "Discover Nature" program.

Your role in BCNA

The strength of BCNA lies in active member support. All members have a vote in the Association and can become involved in the various committees - from data collection, to research, to interpretive services. The membership also elects a Board of Directors which provides guidance for the Association and sets priorities. Members can take advantage of publications, nature classes, and seminars at discount rates.

Financial Support

BCNA funds come entirely from member dues, donations and publication sales. As a non-profit corporation, BCNA also has the ability to acquire and hold real and personal property as appropriate toward furthering the objectives of the Association.

MEMBERSHIP APPLICATION

Boulder County Nature Association

Name

Address

City State Zip

Telephone #

___ Student and Senior Citizen (65+) _______ $5
___ General Member _______ $10
___ Family _______ $15
___ Subscribing Member _______ $30
___ Life Member _______ $300
___ Corporate Member _______ $500

Members receive a quarterly newsletter and discounts on BCNA publications. Additionally, there are quarterly seminars and outings. Subscribing members receive publications free of charge.

The membership year is January 1 through December 31. Make check or money order payable to Boulder County Nature Association and mail to: BCNA, 3893 North 75th Street, Boulder, CO 80301
BCNA Publications Available


No. 4 Ecology, Status and Avifauna of Willow Carrs in Boulder County. By Dave Hallock, Nancy Lederer and Mike Figgs. 1986. Discusses one of the most productive and threatened habitat types for breeding birds. 38 pp. incl. maps and photos. $2.50 memb., $3.00 non-memb.

No. 5 The Diets and Breeding Biology of Red-tailed Hawks in Boulder County: 1985 Nesting Season. By Daniel T. Blumstein. 1986. Includes literature review and extensive bibliography. 78 pp. $3.50 memb., $4.00 non-memb.

No. 6 Habitat Use by Breeding Birds on City of Boulder Open Space, 1985. By Richard W. Thompson and Joseph G. Strauch. 1986. Study contracted by Open Space Dept. Includes discussions of species found, use of various habitat types, management recommendations, maps. 131 pp. $5.00 memb., $5.50 non-memb.

No. 7 Indian Peaks Four Season Bird Counts: a Five Year Retrospective 1982-1986. By Dave Hallock. 1987. What has been learned from our mountain bird counts. Includes discussions on cavity nesters, forest structure and management, photos. 69 pp. $3.50 memb., $4.00 non-memb.

No. 8 Hawks, Eagles, and Prairie Dogs: Wintering Raptors in Boulder County, Colorado. By Stephen R. Jones. 1987. Seven years' worth of information from an ongoing study of populations, habitat use and prey of our wintering buteos and eagles. 30 pp., incl. photos and maps. $2.50 memb., $3.00 non-memb.

Special Publication. The Notebooks of Denis Gale. Edited by Junius Henderson. Field notes of one of Boulder County's earliest ornithologists; valuable historical information from the late 1800's. Photocopy of microfilm. 310 pp. $15.00 memb., $17.50 non-memb.

Also Available

A Field Guide to Mammal Tracking in Western America. By James Halfpenny. How to understand tracks, interpret clues, and read trails of wildlife. Includes numerous illustrations, a section on scatology, and graphic exercises in reading tracks. $10.95 memb., $11.95 non-memb.

From Grassland to Glacier; the Natural History of Colorado. By Cornelia F. Mutel and John C. Emerick. The basic text of Colorado natural history with descriptions of the state's major ecosystems; chapter on self-guided tours. $9.95.

Common Edible and Medicinal Plants of Colorado, with Recipes and Prescriptions. By Kathryn G. Marsh and Andrew L. Marsh. Practical uses for many of our common plants. $5.95.


Publications may by purchased at meetings, or ordered from Nan Lederer, 2635 Mapleton #77, Boulder, CO 80302. Orders must be pre-paid. Include $1.00 postage and handling for each book.