

WEED MITIGATION KNOWLEDGE AMONG NORTHERN KENTUCKY FARMLAND OWNERS

CENTER FOR APPLIED ANTHROPOLOGY, NORTHERN KENTUCKY UNIVERSITY

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The following students conducted qualitative interviews with farmland owners as part of the spring 2011 Anthropology 325, Applied Anthropology, course at Northern Kentucky University: Kelley Anderson, Brandy Blust, Amanda Branham, Andrew Carter, Caitlin Chandler, Devon Cowherd, Kyle Crabtree, Sarah Domhoff, Andrew Doyle, Patricia Fahrmeier, Vincent Fraley, Christian Glassey, Alex Grimes, Tracy Keel, Tara Kellison, Ashley Lacalameto, Emrys Lynch, Rachel Miller, Samuel Ranney, Tracey Skelton, Caitlin Sparks, Jade Spechthold, Adam Weeden, and Peter Young.

During summer 2012, as part of an independent study on research methods, Northern Kentucky University student Michael Adkins, processed and digitized the data from questionnaires.

We acknowledge the partnerships with the following agencies and individuals that made this field school and research possible:

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In addition, we also thank Sarah Hume for editing drafts of this report, although any errors still contained within are our own.

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Introduction

This research project, in collaboration with the Boone, Campbell, and Kenton County Conservation Districts, evaluates knowledge of weed mitigation among farmland owners in Boone, Campbell, and Kenton Counties, Kentucky. The research involved students enrolled in applied anthropology methods courses at Northern Kentucky University (NKU) who conducted ethnographic interviews as well as digitized the questionnaire responses from Northern Kentucky farmland owners. While the response rate of questionnaire was low, a general picture of the weed mitigation knowledge among farmland owners indicates that a variety of methods are used without consensus about the particular methods for any specific plant species.

Methods

During Spring 2011, 25 students in Anthropology 325 (Applied Anthropology) interviewed 62 farmland owners, collecting data on their folk knowledge of invasive plants and management methods. A letter requesting interview volunteers was mailed to 2,225 farmland owners in Boone, Campbell, and Kenton Counties for which the Conservation Districts had current addresses. The mailing was funded by a University-Community Partnership Grant Service Learning Mini-Award from NKU.

Interviews were held at farms, homes, places of employment, and on the phone with 62 farmland owners using the methods of ethnographic interview¹ (see Appendix B: Informed Consent [Qualitative Interview] and Appendix C: Qualitative Interview Schedule). From these interviews 60 invasive plants and noxious weed types as well as 16 mitigation methods were collected from informants. The plant list was then compiled (common and scientific names added when necessary) with the aid of several state and federal online resources².

A second letter requesting completion of a questionnaire (see Appendix D: Informed Consent [Questionnaire] and Appendix E: Questionnaire) along with a raffle ticket for the opportunity to win one of two \$50.00 gift certificates to Southern States Cooperative was sent to 2,225 farmland owners in Boone, Campbell, and Kenton Counties in spring 2012. The mailing was funded by a University-Community Partnership Grant Service

¹James P Spradley, *The Ethnographic Interview* (New York: Holt, Rinehart and Winston, 1979).

² Local Planning Team for the Wellhead Protection Plan, *Pocket Field Guide to Kentucky's Common Weeds and Other Unwanted Plants* (Louisville, Kentucky: Louisville Water Company, 2009), <http://www.louisvilleky.gov/nr/rdonlyres/3e824c1e-57e3-4eb3-b051-59e2e33f92e3/0/srag300pocketfieldguidetoweeds.pdf>; The University of Georgia Center for Invasive Species and Ecosystem Health, "EDDMapS Southeast Species Distribution Maps," <http://www.eddmaps.org/southeast/distribution/>; Kentucky Exotic Pest Plant Council, "Exotic Invasive Plants of Kentucky," n.d., http://www.se-eppc.org/ky/KYEPPC_2013list.pdf; "Fact Sheets & Plant Guides | USDA PLANTS," <http://plants.usda.gov/java/factSheet>.

Learning Mini-Award and the gift certificates were arranged by Mary Kathryn Dickerson.

By summer 2012, 116 completed questionnaires were returned. A NKU student, Michael Adkins, processed the questionnaire data during summer 2012. Since it was indicated on two of the questionnaires that the respondents initially thought the envelope contained a request for funds, since it was from NKU, a second request and questionnaire was sent in the Boone, Campbell, and Kenton Counties Conservation District's January/March 2013 newsletter, Landscapes, to farmland owners. An additional four questionnaires were returned. A total of 120 questionnaires were returned to form the basis for the findings of this report.

Findings

The majority of the respondents owned land in Boone (45.83%), followed by Campbell (24.17%) and Kenton (17.5%) Counties (see Appendix F: Questionnaire Results [About You] for summary statistical tables). The average age of the respondents was 63.45 years old, with a maximum of 89 and minimum of 39 years old. A majority (73.33%) of the respondents were male, with 20.83% female. The average time that the respondents reported owning and/or working with farmland was 39.38 years, with 81 years being the maximum time and 8 years the minimum.

The results from the weed mitigation portion of the questionnaire are summarized in three tables: Appendix G: Questionnaire Results (Original Set); Appendix H: Questionnaire Results (Additional Methods); and Appendix I: Questionnaire Results (Additional Plants). In Appendix G, the counts indicate the number of times the mitigation method was indicated for each plant. Farmland owners reported multiple mitigation methods for more difficult to manage plant species (i.e., Morning-glory species [*Ipomoea* species] 15, Amur Honeysuckle [*Lonicera maackii*] 14, Cocklebur species [*Xanthium* species] 14, Plantain/Ribwort [*Plantago* species] 14, and Jimsonweed/Stinkweed [*Datura stramonium*] 14, see Appendix J: Number of Mitigation Methods Reported by Plant). In addition, cutting with bush hog or mowing was the most common mitigation method (45.16%), followed by treating with Roundup (12.78%) and cutting back (10.35%) (see Appendix K: Mitigation Method Counts).

Three respondents added additional mitigation methods to the questionnaire, which are listed with their associated plant species in Appendix H: Questionnaire Results (Additional Methods). Thirteen informants added additional plants to the questionnaire, which are listed with the reported mitigation methods in Appendix I: Questionnaire Results (Additional Plants).

Conclusion

The small number of responses (120 responses out of 2,225 landowners, 5.39% response rate) suggests that, while the results of the questionnaire are valid, they do not form a representative sample of the knowledge of weed mitigation among Northern Kentucky farmland owners. The results indicate that farmland owners employ a variety of

methods to control weeds, without any clear consensus or indication that one method is preferred for any particular species. It is recommended that further research, in the form of workgroups/focus groups and on-site workshops be conducted to explore how farmland owners can share their own experiences with various mitigation methods as well as learn new methods from weed mitigation specialists.

Appendix A: Memorandum of Understanding

Applied Environmental Anthropology Research Group
Scripps Howard Center for Civic Engagements
Northern Kentucky University
Highland Heights, KY 41099

MEMORANDUM of UNDERSTANDING
BETWEEN
THE APPLIED ENVIRONMENTAL ANTHROPOLOGY RESEARCH GROUP
AND
THE BOONE, CAMPBELL, AND KENTON COUNTY CONSERVATION DISTRICTS

SUBJECT: The MEMORANDUM OF UNDERSTANDING is hereby entered into by and between the Applied Environmental Anthropology Research Group, hereinafter referred to as AEARG, Boone County Conservation District, hereinafter referred to as BCCD, Campbell County Conservation District, hereinafter referred to as CCCD, and the Kenton County Conservation District, hereinafter referred to as KCCD.

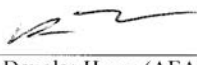


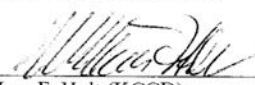
1. PURPOSE. The purpose of this MOU is to continue to develop and expand a framework of cooperation between AEARG and the BCCD, CCCD, and KCCD to develop mutually beneficial programs and projects, which provide needed services and knowledge to conservation in Northern Kentucky.
2. PROBLEM. Programs designed to educate local farmers in conservation techniques are often conducted without prior research on what farmers already know about conservation. The AEARG plans to discover what farmers in Boone, Campbell and Kenton Counties know about conservation and invasive plants so that the BCCD, CCCD, and KCCD may design educational programs for what the farmers do not already know.
3. UNDERSTANDINGS, AGREEMENTS, SUPPORT AND RESOURCE NEEDS. The AEARG, being comprised of students enrolled in courses at Northern Kentucky University, will interview farmers, members of the BCCD, CCCD, and KCCD and other individuals as needed to fulfill the purpose of this MOU. The BCCD, CCCD, and KCCD will comment on and approve any letters or questionnaires mailed to farmers. The AEARG will retain intellectual property rights for the collected data and analyses and reserves the right to publish the results on the Internet, at professional conferences and in scholarly journals. The BCCD, CCCD, and KCCD will retain intellectual property rights for the final report and reserves the right to use the final report for their own purposes. The BCCD, CCCD, and KCCD will act as an initial liaison to the local community and negotiate meeting places for meetings and interviews as necessary. The BCCD, CCCD, and KCCD are not responsible for any AEARG fees associated with any services provided by AEARG. All activities of the AEARG will be funded by small service learning grants from the Scripps Howard Center for Civic Engagements.
At the completion of data collection and analysis, a report in both PDF and bound format (approximately thirty copies) will be distributed by the AEARG to the BCCD, CCCD, and KCCD. The BCCD, CCCD, and KCCD reserve the right to review all draft documents before the final report is disseminated. AEARG, in particular Douglas Hume, will present the results of the research to the BCCD, CCCD, and KCCD at the completion of the project.
4. COMMENCEMENT/EXPIRATION. This instrument is executed as of the date of last signature and is effective through June 30, 2010, but will renew automatically on July 1 of subsequent years unless either party requests termination.

5. **TERMINATION.** Any of the parties, in writing, may terminate the instrument in whole, or in part, at any time before the date of expiration
6. **MODIFICATION.** Modifications within the scope of the instrument shall be made by mutual consent of the parties, by the issuance of a written modification, signed and dated by all parties, prior to any changes being performed.
7. **PARTICIPATION IN SIMILAR ACTIVITIES.** This instrument in no way restricts the AEARG or the BCCD, CCCD, and KCCD from participating in similar activities with other public or private agencies, organizations, and individuals.
8. **NON-FUND OBLIGATING DOCUMENT.** This instrument is neither a fiscal nor a funds obligation document. Any endeavor or transfer of anything of value involving reimbursement or contribution of funds between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This instrument does not provide such authority. Specifically, this instrument does not establish authority for noncompetitive award to the cooperator of any contract or other agreement. Any contract or agreement for training or other services must fully comply with all applicable requirements for competition.
9. **PRINCIPAL CONTACTS.** The principal contacts for this instrument are:

<p>AEARG Douglas Hume, Ph.D., Director Applied Environmental Anthropology Research Group Northern Kentucky University 228 Landrum, Nunn Drive Highland Heights, KY 41099 Phone: (859) 572.5702 Fax: (859) 572.6086</p>	<p>BCCD James B. Walton Boone County Conservation District 6028 Camp Ernst Road Burlington, KY 41005 Phone: (859) 586-7903 Fax: (859) 586-7683</p>
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<p>CCCD Larry Varney Campbell County Conservation District 8351 East Main Street, Suite 104 Alexandria, KY 41001 Phone: (859) 635-9587 Fax: (859) 635-0496</p>	<p>KCCD Marc F. Hult Kenton County Conservation District 6028 Camp Ernst Road Burlington, KY 41005 Phone: (859) 586-7903 Fax: (859) 586-7683</p>
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IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the last written date below.

 _____ Douglas Hume (AEARG)	12/8/09 _____ Date	 _____ James B. Walton (BCCD)	11/24/09 _____ Date
 _____ Larry Varney (CCCD)	11/19/09 _____ Date	 _____ Marc F. Hult (KCCD)	11/24/09 _____ Date

Appendix B: Informed Consent (Qualitative Interview)



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INFORMED CONSENT STATEMENT

Principal Investigator: Dr. Douglas Hume, Northern Kentucky University

Title of Study: Farmer Invasive Plant Folk Knowledge

Introduction

You are invited to participate in research about farmer invasive plant folk knowledge. It is hoped that the results of this research will assist Boone, Campbell, and Kenton County Conservation Districts in providing education programs about invasive plants to farmers.

Your participation in this study is voluntary. You may choose to stop participating (withdraw) at any time without penalty. You will not be paid for being in this study.

The interview is estimated to last approximately one hour.

Confidentiality

The audio recording of the interview will be securely stored and destroyed after it is transcribed. Data collected in this study will then be anonymous, as we are not collecting names or other identifying information.

The results of this research will be published on the Internet, journals and conference proceedings as well as a report available to Boone, Campbell, and Kenton County Conservation Districts.

Contact

If you have any questions or concerns, please feel free to contact the Principal Investigator, Douglas Hume, Ph.D., Assistant Professor of Anthropology, Northern Kentucky University, at humed1@nku.edu or 859-572-5702.

Questions about your rights as a participant of this research may be directed to Philip J. Moberg, Ph.D., IRB Chair, Northern Kentucky University, at either mobergp1@nku.edu or 859-572-1913. The IRB is a group of people that reviews research studies and protects the rights of people involved with research.

Appendix C: Qualitative Interview Schedule

1. Explain Research (Invasive Flora and Fauna Folk Knowledge of Farmers in Boone, Campbell, and Kenton Counties, Kentucky)
2. Informed Consent Statement
3. Demographic Questions
 - a. Note: M/F
 - b. About how old are you?
 - c. About how long have you been farming?
 - d. About how big is your farm (farmed acreage)?
 - e. How did you learn to farm (parents, education)?
 - f. What do you grow or raise?
4. Invasive Plants and Animals
 - a. What types of invasive plants and animals have you dealt with on your farm?
 - i. What is it called (folk term)?
 - ii. Can you describe it to me?
 - iii. How does it impact your farm (economic, etc.)?
 - iv. How would you tell me to eradicate it (step-by-step)?
 - v. Are there any other ways that work?
 - vi. What methods do not work?
 - b. Do you know of other invasive plants and animals that impact tri-county farms?
 - i. If so, repeat i-vi above...
 - c. Have you spoken to other farmers about how to deal with invasive plants and/or animals?
5. Exit
 - a. Leave contact information about Conservation Districts.

Appendix D: Informed Consent (Questionnaire)



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Department of Sociology, Anthropology, &
Philosophy
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March 22, 2012

Dear Boone, Campbell or Kenton County Landowner,

I am inviting you to participate in research about the invasive plants of Boone, Campbell and Kenton County landowners. Students in my spring 2011 applied anthropology course at Northern Kentucky University interviewed landowners about how they managed invasive plants on their land. Now, we have constructed a questionnaire (see enclosure) to collect information on successful techniques for managing invasive plants in northern Kentucky.

If you choose to participate by completing and mailing the questionnaire back to us, you have the option of filling out the raffle ticket for the opportunity to win one of two \$50.00 gift certificates to Southern States Cooperative. Upon receipt of your questionnaire and raffle ticket, the two will be separated so that your answers on the questionnaire cannot be connected to your personal information on the raffle ticket. The raffle drawing will take place and the winners notified by July 1, 2012.

The results of this project will be published on the Internet (<http://aearg.nku.edu>), journals and conference proceedings as well as in a report to the Boone, Campbell and Kenton County Conservation Districts. It is hoped that the results of this research will influence how the Boone, Campbell and Kenton County Conservation Districts provide technical and financial assistance to landowners in each county to manage invasive plants.

Your participation in this study is voluntary. You may choose to stop participating (withdraw) at any time without penalty. You will not be paid for your participation in this study. Data collected in this study is anonymous, as we are not collecting names or other identifying information.

If you would like to participate in this research project, please complete the enclosed questionnaire and return it to us using the enclosed return envelope. The questionnaire should take about fifteen minutes to complete.

If you have any questions or concerns, please feel free to contact the Primary Investigator, Douglas Hume, Ph.D., Assistant Professor of Anthropology, Northern Kentucky University, at humed1@nku.edu or 859-572-5702.

Questions about your rights as a participant of this research may be directed to Philip J. Moberg, Ph.D., IRB Chair, Northern Kentucky University, at either mobergp1@nku.edu or 859-572-1913. The IRB is a group of people that reviews research studies and protects the rights of people involved with research.

If you have questions regarding technical and financial assistance offered by the Boone, Campbell and Kenton County Conservation Districts, please contact Mary Kathryn Dickerson, Conservation District Coordinator, at 859-586-7903, 859-635-9587, or mkdickerson@nkcd.org.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Hume', written over a horizontal line.

Douglas Hume,
Assistant Professor

Appendix E: Questionnaire

Boone, Campbell, and Kenton County Plant Study

About You

1. In which county(ies) do you own farmland property? Boone, Campbell, and/or Kenton
2. How old are you? _____ years old
3. What sex are you? Male Female
4. How long have you owned and/or worked with farmland? _____ years

Plants

Write the letter code for each method that you have successfully used to manage each of the plants below. If there is something not listed, you may create your own plant or management code.

- | | |
|--|---------------------------------|
| A. Animal Forage (Goats and Sheep) | K. Treat with Copper Sulfate |
| B. Burn | L. Treat with Diesel Fuel |
| C. Cut with Bush Hog or Mow | M. Treat with Generic Herbicide |
| D. Cut Back (chainsaw, hatchet, clip) | N. Treat with Glyphosate |
| E. Cut Seed Heads | O. Treat with Roundup |
| F. Cut Tap Root | P. Treat with Weed B Gon |
| G. Remove Roots (bulldoze, shovel, etc.) | Q. _____ |
| H. Treat with 2, 4-D | R. _____ |
| I. Treat with Agricultural Lime | S. _____ |
| J. Treat with Atrazine | T. _____ |

1. Amur Honeysuckle (*Lonicera maackii*) _____
2. Annual Ragweed (*Ambrosia artemisiifolia*) _____
3. Autumn Olive (*Elaeagnus umbellata*) _____
4. Bamboo species (Several species) _____
5. Barnyardgrass (*Echinochloa crus-galli*) _____
6. Black Locust (*Robinia pseudoacacia*) _____
7. Blackberry species (*Rubus* species) _____
8. Bristly (Thorny) Locust (*Robinia hispida*) _____
9. Bull Thistle (*Cirsium vulgare*) _____
10. Canada Goldenrod (*Solidago altissima*) _____
11. Canadian Horseweed (*Conyza canadensis*) _____
12. Canadian Thistle (*Cirsium arvense*) _____
13. Cannabis Thistle (*Cannabis sativa*) _____
14. Cattail (*Typha* species) _____
15. Cherry tree (*Prunus* species) _____
16. Chicory (*Cichorium intybus*) _____
17. Cocklebur species (*Xanthium* species) _____
18. Common Dandelion (*Taraxacum officinale*) _____
19. Crabgrass Species (*Digitaria* species) _____
20. Curly Pondweed (*Potamogeton crispus*) _____
21. Fescue Species (Various species) _____
22. Fox Grape (*Vitis labrusca*) _____
23. Foxtail species (*Alopecurus* species) _____
24. Garden Onion (*Allium cepa*) _____
25. Garlic Mustard (*Alliaria petiolata*) _____
26. Hedge Apple (*Maclura pomifera*) _____

- | | |
|--|---------------------------------|
| A. Animal Forage (Goats and Sheep) | K. Treat with Copper Sulfate |
| B. Burn | L. Treat with Diesel Fuel |
| C. Cut with Bush Hog or Mow | M. Treat with Generic Herbicide |
| D. Cut Back (chainsaw, hatchet, clip) | N. Treat with Glyphosate |
| E. Cut Seed Heads | O. Treat with Roundup |
| F. Cut Tap Root | P. Treat with Weed B Gon |
| G. Remove Roots (bulldoze, shovel, etc.) | Q. _____ |
| H. Treat with 24D | R. _____ |
| I. Treat with Agricultural Lime | S. _____ |
| J. Treat with Atrazine | T. _____ |

27. Henbit Deadnettle (*Lamium amplexicaule*) _____
28. Honeysuckle (not Amur) species (*Lonicera* species) _____
29. Japanese Honeysuckle (*Lonicera japonica*) _____
30. Japanese Wisteria (*Wisteria floribunda*) _____
31. Japanese Yew (*Taxus cuspidata*) _____
32. Jimsonweed (Stinkweed) (*Datura stramonium*) _____
33. Johnsongrass (*Sorghum halepense*) _____
34. Little Duckweed (*Lemna obscura*) _____
35. Milkweed species (*Asclepias* species) _____
36. Morning-glory species (*Ipomoea* species) _____
37. Multiflora Rose (*Rosa multiflora*) _____
38. Nodding Plumeless (Musk) Thistle (*Carduus nutans*) _____
39. Plantain (Ribwort) (*Plantago* species) _____
40. Poison Hemlock (*Conium maculatum*) _____
41. Prostrate (Smooth) Pigweed (*Amaranthus albus*) _____
42. Queen Anne's Lace (*Daucus carota*) _____
43. Red Buckeye (*Aesculus pavia*) _____
44. Red Inkplant (Polk Berry/Pokeweed) (*Phytolacca octandra*) _____
45. Russian Thistle (*Salsola kali*) _____
46. Sage species (*Salvia* species) _____
47. Sago Pondweek (*Stuckenia pectinata*) _____
48. Spiderwart (Wandering Jew) Species (*Tradescantia* species) _____
49. Sticky Chickweed (*Cerastium glomeratum*) _____
50. Sticky Snakeroot (*Ageratina adenophora*) _____
51. Stickywilly (Sticky Weed) (*Galium aparine*) _____
52. Sweetbriar Rose (*Rosa eglanteria*) _____
53. Tiger Lily (*Lilium lancifolium*) _____
54. Tree of Heaven (*Ailanthus altissima*) _____
55. Violet Woodsorrel (*Oxalis violacea*) _____
56. Wild Celery (*Apium graveolens*) _____
57. Wild Garlic (*Allium vineale*) _____
58. Winter Creeper (*Euonymus fortunei*) _____
59. Woodland Strawberry (*Fragaria vesca*) _____
60. Yellow Foxtail (*Setaria pumila*) _____
61. Other: _____
62. Other: _____
63. Other: _____
64. Other: _____
65. Other: _____

Appendix F: Questionnaire Results (About You)

1. In which county(ies) do you own farmland property?

Response	Count	Percentage
Boone County	55	45.83%
Boone and Campbell Counties	1	0.83%
Boone and Kenton Counties	3	2.50%
Campbell County	29	24.17%
Kenton County	21	17.50%
No response	11	9.17%
Total	120	100.00%

2. How old are you?

Average	63.45
Maximum	89.00
Minimum	39.00
Standard Deviation	10.72
Count	112.00
No Response	7.00

3. What sex are you?

Response	Count	Percentage
Female	25	20.83%
Male	88	73.33%
No response	7	5.83%
Total	120	100.00%

4. How long have you owned and/or worked with farmland?

Average	39.38
Maximum	81.00
Minimum	8.00
Standard Deviation	16.86
Count	109.00
No Response	11.00

Appendix G: Questionnaire Results (Original Set)

Plant Variety (Species)	Animal Forage (Goats and Sheep)		Cut with Bush Hog or Mow	Cut Back (chainsaw, hatchet, clip)	Cut Seed Heads	Cut Tap Root	Remove Roots (bulldoze, shovel, etc.)	Treat with 2, 4-D	Treat with Agricultural Lime	Treat with Atrazine	Treat with Copper Sulfate	Treat with Diesel Fuel	Treat with Generic Herbicide	Treat with Glyphosate	Treat with Roundup	Treat with Weed B Gon	Pre-emergent Herbicides	Cultivation/Handpull
	Burn																	
Amur Honeysuckle (<i>Lonicera maackii</i>)	10	6	43	39	1	8	20	12				1	2	8	27	3	3	
Annual Ragweed (<i>Ambrosia artemisiifolia</i>)	2		47	2	1	1	1	6					3	3	10	2	2	
Autumn Olive (<i>Elaeagnus umbellata</i>)	1	1	14	9			5						1	4	4		2	
Bamboo species (Several species)	1	2	11	2		1	3				1				2	1		
Barnyardgrass (<i>Echinochloa crus-galli</i>)	2	1	32					3	1				1	3	7	2	1	2
Black Locust (<i>Robinia pseudoacacia</i>)	2	4	29	28			7	4				1		3	4		3	
Blackberry species (<i>Rubus</i> species)	3		46	10			4	2		1				1	5	1	1	
Bristly (Thorny) Locust (<i>Robinia hispida</i>)	1	1	30	22		1	8	4				1		3	3	1	4	
Bull Thistle (<i>Cirsium vulgare</i>)	1		36	6	2	2	3	7					1	6	17	2	1	1
Canada Goldenrod (<i>Solidago altissima</i>)	1	1	36	1				2						1	5	1	1	
Canadian Horseweed (<i>Conyza canadensis</i>)			31	1		1	1	2					1	1	6	2		
Canadian Thistle (<i>Cirsium arvense</i>)	1		34	3	4	3	3	6					1	6	15	1	2	2
Cannabis Thistle (<i>Cannabis sativa</i>)			24	1	1		3	2			1			4	5	1	1	1
Cattail (<i>Typha</i> species)			11	1	1		5	1			2			5	13	1	5	
Cherry tree (<i>Prunus</i> species)			16	20			5	1				1	1	1	4			
Chicory (<i>Cichorium intybus</i>)	1		27			1	3	2	1					1	6	1	1	
Cocklebur species (<i>Xanthium</i> species)	1	2	40			4	1	5					1	6	10	3	3	1
Common Dandelion (<i>Taraxacum officinale</i>)	4	1	35	2	1	5	5	12					4	2	14	11	3	1
Crabgrass Species (<i>Digitaria</i> species)	2		30	1		2	3	3					3	2	10	7	4	1
Curly Pondweed (<i>Potamogeton crispus</i>)			8	1			1	1			6		2		6	1	2	1
Fescue Species (Various species)	4	1	29			1			1				2	7	9	1	2	2
Fox Grape (<i>Vitis labrusca</i>)		1	15	10			2	2				1	1	3	2	1		

Plant Variety (Species)	Animal Forage (Goats and Sheep)	Burn	Cut with Bush Hog or Mow	Cut Back (chainsaw, hatchet, clip)	Cut Seed Heads	Cut Tap Root	Remove Roots (bulldoze, shovel, etc.)	Treat with 2, 4-D	Treat with Agricultural Lime	Treat with Atrazine	Treat with Copper Sulfate	Treat with Diesel Fuel	Treat with Generic Herbicide	Treat with Glyphosate	Treat with Roundup	Treat with Weed B Gon	Pre-emergent Herbicides	Cultivation/Handpull
Foxtail species (<i>Alopecurus species</i>)	2		31	5			2	2	1				1	3	4	1	2	1
Garden Onion (<i>Allium cepa</i>)	2		23	1		1	5	3					1		5	2	1	1
Garlic Mustard (<i>Alliaria petiolata</i>)	1		23	1		1	5	2					2	2	4	1	3	2
Hedge Apple (<i>Maclura pomifera</i>)	1	3	18	29		1	10	4				2		4	7		1	
Henbit Deadnettle (<i>Lamium amplexicaule</i>)		1	15				1	3						3	4	3	3	2
Honeysuckle (not Amur) species (<i>Lonicera species</i>)	5	5	27	19		2	12	7				1	2	5	18	2	1	
Japanese Honeysuckle (<i>Lonicera japonica</i>)	1	1	23	12	1	2	11	8				1	1	1	9	1		
Japanese Wisteria (<i>Wisteria floribunda</i>)			14	3			1	1							4			
Japanese Yew (<i>Taxus cuspidata</i>)			12	4			5	1					1		4			
Jimsonweed (Stinkweed) (<i>Datura stramonium</i>)	1	1	26					4						1	9	2	2	
Johnsongrass (<i>Sorghum halepense</i>)	1	1	41	4	3	2	4	2			1	1		8	18	2	3	
Little Duckweed (<i>Lemna obscura</i>)			13				1				4		1	1	5	1	3	2
Milkweed species (<i>Asclepias species</i>)			32	4		2	4	3						2	6	1	3	1
Morning-glory species (<i>Ipomoea species</i>)	1	1	25	6	1	3	3	5						6	7	1	2	2
Multiflora Rose (<i>Rosa multiflora</i>)	1	1	39	24	1	2	6	10				1	2	12	19	1	3	1
Nodding Plumeless (Musk) Thistle (<i>Cardus nutans</i>)			21				1	2			1			2	3			
Plantain (Ribwort) (<i>Plantago species</i>)		1	14					9		1	1			2	6	4	3	2
Poison Hemlock (<i>Conium maculatum</i>)	2	3	25	4	1	1	2	5			1		1	5	10	2	1	
Prostrate (Smooth) Pigweed (<i>Amaranthus albus</i>)		2	26	1				2						3	4	1	2	1
Queen Anne's Lace (<i>Daucus carota</i>)	1	1	41	4		1	2	4						3	7	2	1	1
Red Buckeye (<i>Aesculus pavia</i>)			16	7		1	2	3	1			1			1			

Plant Variety (Species)	Animal Forage (Goats and Sheep)	Burn	Cut with Bush Hog or Mow	Cut Back (chainsaw, hatchet, clip)	Cut Seed Heads	Cut Tap Root	Remove Roots (bulldoze, shovel, etc.)	Treat with 2, 4-D	Treat with Agricultural Lime	Treat with Atrazine	Treat with Copper Sulfate	Treat with Diesel Fuel	Treat with Generic Herbicide	Treat with Glyphosate	Treat with Roundup	Treat with Weed B Gon	Pre-emergent Herbicides	Cultivation/Handpull
Red Inkplant (Polk Berry/Pokeweed) (<i>Phytolacca octandra</i>)		1	20	4		1	2	1						4	7	1		
Russian Thistle (<i>Salsola kali</i>)			21	4			4	3				1		1	6	1	1	1
Sage species (<i>Salvia species</i>)		1	17	1			2	1	2						3	1		
Sago Pondweek (<i>Stuckenia pectinata</i>)			7				2				2		2		1		1	1
Spiderwart (Wandering Jew) Species (<i>Tradescantia species</i>)			13	3		1	1						1		4	2		
Sticky Chickweed (<i>Cerastium glomeratum</i>)		1	22	2				5						3	9	1	2	2
Sticky Snakeroot (<i>Ageratina adenophora</i>)		1	15	2			1							1	3	1		
Stickywilly (Sticky Weed) (<i>Galium aparine</i>)		1	18	1			2								4	1		
Sweetbriar Rose (<i>Rosa eglanteria</i>)		1	22	4			3	1	1			1			2		2	
Tiger Lily (<i>Lilium lancifolium</i>)		1	15	1			1						2		2			1
Tree of Heaven (<i>Ailanthus altissima</i>)		1	12	7			2	2			1		1				1	
Violet Woodsorrel (<i>Oxalis violacea</i>)		1	9	1			1						1	1	1			1
Wild Celery (<i>Apium graveolens</i>)		1	17	3			1		1					2	3			
Wild Garlic (<i>Allium vineale</i>)		1	19	1			2	1						3	3		1	1
Winter Creeper (<i>Euonymus fortunei</i>)		2	14	1			2	2							4	1		1
Woodland Strawberry (<i>Fragaria vesca</i>)			18	1			1	1	1					1	3	1	1	2
Yellow Foxtail (<i>Setaria pumila</i>)			22		1				1				1	1	6	1	1	2

Appendix H: Questionnaire Results (Additional Methods)

Plant Variety (Species)	Pre-emergent Herbicides	Cultivation- Hand pull	Cutting	Crossbow
Amur Honeysuckle (<i>Lonicera maackii</i>)	1			
Black Locust (<i>Robinia pseudoacacia</i>)	1			
Blackberry species (<i>Rubus</i> species)	1			
Bristly (Thorny) Locust (<i>Robinia hispida</i>)	1			
Bull Thistle (<i>Cirsium vulgare</i>)	1			
Canada Goldenrod (<i>Solidago altissima</i>)	1			
Canadian Horseweed (<i>Conyza canadensis</i>)	1			
Canadian Thistle (<i>Cirsium arvense</i>)	1			
Cattail (<i>Typha</i> species)		1		
Cherry tree (<i>Prunus</i> species)	1			
Chicory (<i>Cichorium intybus</i>)	1			
Crabgrass Species (<i>Digitaria</i> species)	1			
Curly Pondweed (<i>Potamogeton crispus</i>)			1	
Fox Grape (<i>Vitis labrusca</i>)	1			
Hedge Apple (<i>Maclura pomifera</i>)	1			
Henbit Deadnettle (<i>Lamium amplexicaule</i>)	2			
Honeysuckle (not Amur) species (<i>Lonicera</i> species)	1			
Japanese Honeysuckle (<i>Lonicera japonica</i>)	1			
Japanese Wisteria (<i>Wisteria floribunda</i>)	1			
Japanese Yew (<i>Taxus cuspidata</i>)	1			
Little Duckweed (<i>Lemna obscura</i>)		1	1	
Multiflora Rose (<i>Rosa multiflora</i>)	1			1
Nodding Plumeless (Musk) Thistle (<i>Carduus nutans</i>)		1		
Poison Hemlock (<i>Conium maculatum</i>)	1			
Red Buckeye (<i>Aesculus pavia</i>)	1			
Russian Thistle (<i>Salsola kali</i>)	1			
Sage species (<i>Salvia</i> species)	1			
Sago Pondweed (<i>Stuckenia pectinata</i>)	1			
Spiderwort (Wandering Jew) Species (<i>Tradescantia</i> species)	1			
Sticky Chickweed (<i>Cerastium glomeratum</i>)	2			
Sticky Snakeroot (<i>Ageratina adenophora</i>)	1			
Stickywilly (Sticky Weed) (<i>Galium aparine</i>)	1			
Sweetbriar Rose (<i>Rosa eglantheria</i>)	1			
Tree of Heaven (<i>Ailanthus altissima</i>)	1			
Violet Woodsorrel (<i>Oxalis violacea</i>)	1			

Appendix I: Questionnaire Results (Additional Plants)

Plant Variety	Burn	Cut with Bush Hog or Mow	Cut Back (chainsaw, hatchet, clip)	Cut Seed Heads	Cut Tap Root	Remove Roots (bulldoze, shovel, etc.)	Treat with 2, 4-D	Treat with Agricultural Lime	Treat with Glyphosate	Treat with Roundup	Treat with Weed B Gon	Pre-emergent Herbicides	Cultivation/Handpull	Pre-emergent Herbicides
<i>Pyrus calleriana</i>						1								
<i>Misanthos</i> sp.						1			1					
Annual Bluegrass									1				1	
<i>Rumix Acetosella</i>									1				1	
<i>Polygonum</i> sp.									1				1	
<i>Galinsoga</i> sp.									1				1	
<i>Cyperus esculentus</i>									1				1	
White Clover										1	1		1	
<i>Agropyron repens</i> (Quackgrass)									1				1	
<i>Cynodon dactylon</i> (Common Bermuda)									1					
Curly Dock	1	2		1	1	1	1		1	1	1			
Broomsedge								1						
Vinca										1				
Wild Grape Vine			1							1				
Bradford Pear		2	1							1				
Lake Duckweed												1	1	1
Lake Water Meal												1	1	1
Dock Weed										1				
Tick Clover							1						1	1
Catchweed Bedstraw							1						1	
Iron Weed		2												
Wild Rose Bushes		1								1				

Appendix J: Number of Mitigation Methods Reported by Plant

Plant Variety (species)	Number of Mitigation Methods Reported
Morning-glory species (<i>Ipomoea species</i>)	15
Amur Honeysuckle (<i>Lonicera maackii</i>)	14
Cocklebur species (<i>Xanthium species</i>)	14
Plantain (Ribwort) (<i>Plantago species</i>)	14
Jimsonweed (Stinkweed) (<i>Datura stramonium</i>)	14
Henbit Deadnettle (<i>Lamium amplexicaule</i>)	13
Bristly (Thorny) Locust (<i>Robinia hispida</i>)	13
Canadian Horseweed (<i>Conyza canadensis</i>)	13
Honeysuckle (not Amur) species (<i>Lonicera species</i>)	13
Milkweed species (<i>Asclepias species</i>)	13
Annual Ragweed (<i>Ambrosia artemisiifolia</i>)	12
Common Dandelion (<i>Taraxacum officinale</i>)	12
Fox Grape (<i>Vitis labrusca</i>)	12
Chicory (<i>Cichorium intybus</i>)	12
Garden Onion (<i>Allium cepa</i>)	12
Prostrate (Smooth) Pigweed (<i>Amaranthus albus</i>)	12
Curly Pondweed (<i>Potamogeton crispus</i>)	11
Barnyardgrass (<i>Echinochloa crus-galli</i>)	11
Foxtail species (<i>Alopecurus species</i>)	11
Garlic Mustard (<i>Alliaria petiolata</i>)	11
Canadian Thistle (<i>Cirsium arvense</i>)	11
Blackberry species (<i>Rubus species</i>)	10
Black Locust (<i>Robinia pseudoacacia</i>)	10
Cherry tree (<i>Prunus species</i>)	10
Cannabis Thistle (<i>Cannabis sativa</i>)	10
Crabgrass Species (<i>Digitaria species</i>)	10
Fescue Species (Various species)	10
Little Duckweed (<i>Lemna obscura</i>)	10
Nodding Plumeless (Musk) Thistle (<i>Carduus nutans</i>)	10
Red Inkplant (Polk Berry/Pokeweed) (<i>Phytolacca octandra</i>)	10
Winter Creeper (<i>Euonymus fortunei</i>)	10
Autumn Olive (<i>Elaeagnus umbellata</i>)	9
Bamboo species (Several species)	9
Bull Thistle (<i>Cirsium vulgare</i>)	9
Canada Goldenrod (<i>Solidago altissima</i>)	9
Hedge Apple (<i>Maclura pomifera</i>)	9
Johnsongrass (<i>Sorghum halepense</i>)	9

Plant Variety (species)	Number of Mitigation Methods Reported
Red Buckeye (<i>Aesculus pavia</i>)	9
Spiderwart (Wandering Jew) Species (<i>Tradescantia</i> species)	9
Stickywilly (Sticky Weed) (<i>Galium aparine</i>)	9
Wild Celery (<i>Apium graveolens</i>)	9
Woodland Strawberry (<i>Fragaria vesca</i>)	9
Japanese Yew (<i>Taxus cuspidata</i>)	8
Cattail (<i>Typha</i> species)	8
Queen Anne's Lace (<i>Daucus carota</i>)	8
Russian Thistle (<i>Salsola kali</i>)	8
Tiger Lily (<i>Lilium lancifolium</i>)	8
Tree of Heaven (<i>Ailanthus altissima</i>)	8
Wild Garlic (<i>Allium vineale</i>)	8
Sage species (<i>Salvia</i> species)	7
Sago Pondweek (<i>Stuckenia pectinata</i>)	7
Sticky Chickweed (<i>Cerastium glomeratum</i>)	7
Sweetbriar Rose (<i>Rosa eglantheria</i>)	7
Violet Woodsorrel (<i>Oxalis violacea</i>)	7
Japanese Wisteria (<i>Wisteria floribunda</i>)	6
Multiflora Rose (<i>Rosa multiflora</i>)	6
Sticky Snakeroot (<i>Ageratina adenophora</i>)	6
Japanese Honeysuckle (<i>Lonicera japonica</i>)	5

Appendix K: Mitigation Method Count

Mitigation Method	Count	Percentage
Cut with Bush Hog or Mow	1410	45.16%
Treat with Roundup	399	12.78%
Cut Back (chainsaw, hatchet, clip)	323	10.35%
Remove Roots (bulldoze, shovel, etc.)	187	5.99%
Treat with 2, 4-D	174	5.57%
Treat with Glyphosate	150	4.80%
Pre-emergent Herbicides	85	2.72%
Treat with Weed B Gon	81	2.59%
Animal Forage (Goats and Sheep)	56	1.79%
Burn	55	1.76%
Cut Tap Root	51	1.63%
Treat with Generic Herbicide	44	1.41%
Cultivation/Handpull	40	1.28%
Treat with Copper Sulfate	21	0.67%
Cut Seed Heads	19	0.61%
Treat with Diesel Fuel	14	0.45%
Treat with Agricultural Lime	11	0.35%
Treat with Atrazine	2	0.06%
Total	3122	100.00%