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Assessing Installation Ethnobotanical Resources Using Land Condition Trend Analysis (LCTA) Data: A Fort Riley, Kansas, Case Study

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The Land Condition Trend Analysis (LCTA) program is the Army's standard for land inventory and monitoring, employing standardized methods of natural resources data collection, analyses, and reporting designed to meet multiple goals and objectives. LCTA data has been used to characterize installation natural resources, evaluate the effects of Army multiple use demands on training lands, ground-truth remote sensed imagery, and as a source of data for carrying capacity modeling efforts. This report examines the potential to use LCTA data to assess installation ethnobotanical resources.

This report briefly reviews the relevant laws and regulations relating to an installation's ethnobotanical resources and the degree to which LCTA data can be used to characterize the resource and assess the impact of land use activities on the resource. Data collected as part of the LCTA program was used to identify potential ethnobotanical resources found on an installation and to assess potential susceptibility to mission activities. Examples of analyses pertinent to ethnobotanical characterization and impact assessment are provided for Fort Riley, Kansas.

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This report briefly reviews the relevant laws and regulations relating to an installation's ethnobotanical resources and the degree to which LCTA data can be used to characterize the resource and assess the impact of land use activities on the resource. Data collected as part of the LCTA program was used to identify potential ethnobotanical resources found on an installation and to assess potential susceptibility to mission activities. Examples of analyses pertinent to ethnobotanical characterization and impact assessment are provided for Fort Riley, Kansas.

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Foreword

This research was conducted for the Office of the Directorate of Environmental Programs under Project 4A162720A896, Environmental Quality Technology; Work Unit EN-TL6, "Integrated Natural and Cultural Resources Data Analysis." The technical monitor was Dr. Victor E. Diersing, DAIM-ED-N.

The work was performed by the Natural Resources Assessment and Management Division (LL-N), of the Land Management Laboratory (LL), U.S. Army Construction Engineering Research Laboratories (USACERL). The USACERL co-principal investigators were Mr. Alan B. Anderson and Dr. James A. Zeidler. Mr. John H. Dendy is an Archeologist, Cultural Resources Program, Directorate of Environment and Safety at Fort Riley, KS, under contract from Dynamac Corporation. Dr. Daniel E. Moerman is the William E. Stirton Professor of Anthropology, University of Michigan-Dearborn. Dr. John T. Bandy is Acting Laboratory Operations Chief, CECER-LL-N. The USACERL technical editor was Gloria J. Wienke, Technical Information Team.

We wish to thank the Natural Resources and Cultural Resources staff at Fort Riley, KS, for access to installation data and their review of this report.

COL James A. Walter is the Commander and Dr. Michael J. O'Connor is Director of USACERL.

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1 Introduction

Background

The U.S. Army must comply with the intent and directives of the following cultural resources related statutes, regulations, and policy memoranda in a manner that supports accomplishment of the mission:

- National Historic Preservation Act of 1966 (NHPA), Public Law [P.L.] 96-515, as amended by P.L. 102-575,
- National Environmental Policy Act of 1969 (NEPA), P.L. 91-190,
- American Indian Religions Freedom Act of 1978 (AIRFA), P.L. 95-341, as amended by P.L. 103-344,
- Executive Order [EO] 13007—Indian Sacred Sites, Archeological Resources Protection Act of 1979 (ARPA), P.L. 96-95,
- Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), P.L. 103-141, and
- 36 Code of Federal Regulations (CFR) 800 Protection of Historic and Cultural Properties, Department of Defense (DoD) Memorandum 1995.

In addition, specific Army policy on the management of cultural resources is set forth in Army Regulation (AR) 200-4 *Cultural Resources Management* (DRAFT); detailed guidance for implementation of this policy is found in DA Pamphlet 200-4 *Cultural Resources Management* (DRAFT). These statutes, regulations, and policy memoranda apply to Active Army, Army National Guard, and U.S. Army Reserve installations. Because of these statutes, regulations, and policy memoranda, the potential impacts of development and land use proposals on elements of a people's culture have become part of the social impact assessment studies that regulatory agencies use to evaluate the social soundness of proposed projects.

When an undertaking as defined in NHPA Section 301 is found to affect properties having historic value to Indian tribes on non-Indian lands, the Army shall afford such tribes the opportunity to participate as interested persons pursuant to 36 CFR 800.1. In carrying out NHPA Section 106 responsibilities and in accordance with NHPA Section 101, the Army shall also consult with Indian tribes and Native Hawaiian organizations that attach importance to traditional religious or cultural properties that are eligible for the National Register of Historic Places (DoD Memorandum 1995). Traditional cultural properties (TCPs) are properties that have traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and by virtue of that importance, are eligible for or listed in the National Register of Historic Places. According to National Register Bulletin 38, TCPs are eligible for the National Register if they are associated with cultural practices that are rooted in history and are important in maintaining cultural identity (DoD Memorandum 1995). Traditional cultural properties potentially include the botanical resources of an installation. For example, while developing the Warm Springs Dam — Lake Sonoma project Environmental Impact Statement it was discovered that Pomoan Indians had historically inhabited and continued to use plants from the proposed project area. These botanical resources were subsequently determined to be eligible for inclusion in the National Register of Historic Places, and in compliance with the NHPA, a program was developed to mitigate project-caused losses of these plant resources (Peri, Patterson, and Goodrich 1982).

AIRFA requires that installation commanders protect and preserve for Native Americans their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and freedom to worship through ceremonials and traditional rights. AIRFA specifically reaffirms the First Amendment rights of American Indian people to have access to lands and natural resources essential in the conduct of their traditional religion. They have these rights even though the lands and natural resources are located beyond the boundaries of a tribal reservation. These rights are also endorsed by EO 13007 — Indian Sacred Sites. Effective 24 May 1996, EO 13007 provides direction to Federal agencies on managing sacred Indian sites. Under AR 200-4, this EO instructs the installation to ensure access and ceremonial use of Native American sacred sites, to avoid adversely impacting those sites, and to maintain confidentiality of sacred site locations. A "sacred site" is defined in EO13007 as:

> any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as

> sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site. Sacred sites can include but may not be limited to burial areas and graves, purification sites, healing sites, special floral and faunal and mineral areas that contain resources used in religious ceremonies, vision quest sites such as caves or mountain tops, myth and legendary sites associated with certain geographical landforms, and historic sites associated with specific historic events (DA Pamphlet 200-4 *Cultural Resources Management*, Section 3-5).

In accordance with this definition, installation commanders must identify through use of existing materials and consultations with local Native American groups, sites that are necessary to the exercise of traditional religions and shall provide access to military installations for the practice of traditional religious rights and ceremonies. Installation commanders may impose reasonable restrictions upon access to such sites on installations when deemed necessary to avoid interference with the military mission (DoD Memorandum 1995). Sites of religious or cultural importance to Native Americans include native plant gathering areas and sources for materials that Native Americans use to conduct religious ceremonies or to manufacture sacred objects and traditional implements. Installations must help facilitate Native American visits to these sacred sites or to important resource areas for gathering plants or collecting mineral resources (DA Pamphlet 200-4; Air Force Instruction [AFI] 32-7065).

The National Environmental Policy Act of 1969 states "it is the continuing responsibility of the Federal Government to ... preserve important historic, cultural, and natural aspects of our national heritage." Installation commanders are required to seek the participation of interested Indian tribes or Native Hawaiian organizations in the NEPA decisionmaking process for actions that may affect traditional cultural and historic resources, cultural properties as defined by NHPA Section 101, sites containing cultural items as defined by NAGPRA Section 2, and archaeological sites of religious or cultural significance in accordance with ARPA. Impacts to treaty rights and resources important in sustaining Native American cultural activities such as plant harvesting, hunting, fishing, and water rights should, as appropriate, also be considered in the NEPA process (DoD Memorandum 1995).

Major commands (MACOMs) are required to maintain a current and approved Integrated Cultural Resources Management Plan (ICRMP) that contains an inventory and evaluation of all known cultural resources, identifies the likely presence of other significant cultural resources, and clearly identifies mission impacts on cultural resources (AR 200-4).

Significance of plants as reflected by U.S. Federal law is primarily a function of the availability of the plant. Federal laws protect rare and endangered plants (Endangered Species Act of 1973, PL 93-205). However, Native American peoples evaluate the cultural significance of a plant without emphasizing its availability. Plants with cultural significance are often fairly common plants that are widely distributed. Consequently, the potential co-occurrence with the military mission is likely to be high. During a Native American cultural assessment of potential resource impacts of a planned U.S. Air Force electronic combat range at the Utah Test and Training Range, the vast majority of tribal representatives recommended that plants of cultural significance should be avoided by ground-disturbing activities despite the wide availability of the plants (Stoffle, Halmo, and Olmsted 1989). Indian peoples generally wanted to protect all individual plants when confronted with the prospect of development projects destroying plants on traditional lands (Stoffle and Evans 1990). When Indian peoples expressed the desire to protect and maintain access to plants that are commonly available elsewhere, Halmo, Stoffle, and Evans (1993) concluded the Indian people were responding to a combination of the plants' cultural significance and the people's desire to maintain or reestablish control over traditional land.

The importance of an area may not be restricted to just local Indian populations. A succession of groups and multiple tribes may identify with the same sites in a region. For example, Shoshones and Paiutes gathered plants in nearby areas, traded and exchanged with distant Indian communities, and traveled long distances to gather species not growing near their homes (Train, Henrichs, and Archer n.d.). Stoffle et al. (1990) also documented collection and exchange of plant materials by Native American groups over large distances. An installation's ethnobotanical resources may be of interest to Native American groups that are located both near and far from an installation.

Native American groups continue to use many of the plants that have historically been used. Recent studies showed Southern Paiute peoples currently use 43 of the 60 plants they traditionally used (Stoffle et al. 1990). The studies also showed Western Shoshone currently use 22 of the 35 plants traditionally used, and Owens Valley peoples currently use 24 of the 32 plants in their traditional repertoire. While the number of plants currently used is lower than the number traditionally used, the decrease was partially attributed to a restricted land base and reduced access to certain species. Some Native

American groups are attempting to relearn historic cultural practices; demands may actually be increasing for plant materials.

The statutes, regulations, and policy memoranda requiring consultation with Native American groups and preservation of traditional cultural properties also requires comprehensive surveys that may include ethnobotanical surveys. The facts that culturally significant species are often commonly occurring, that Native American groups often desire to protect all significant resources, and that the Army is a large land holder of territories previously used and inhabited by Native Americans, indicate that the military mission may potentially be affected by culturally significant plant materials present on an installation. Currently, installations have minimal information on the ethnobotanical resources of military lands.

Objectives

The overall objective of this report is to demonstrate how existing Integrated Training Area Management (ITAM) natural resources data can be used in assessing the ethnobotanical resources of an installation; including documenting the presence, abundance, and distribution of the resources; assessing the potential impact of these resources on the military mission; and assessing the potential impact of military training activities on culturally significant plants. The analyses contained in this report are intended to assist project managers, and others who establish and implement policy, to identify and quantify potential ethnobotanical resources and assess and monitor installation mission impacts to these resources.

Approach

Researchers conducted consultations with selected installation cultural resources personnel to identify data needs and problem constraints. A literature survey was conducted to identify culturally significant plants for the continental United States. Information obtained from the survey was then used to analyze a test installation (Fort Riley, KS) Land Condition Trend Analysis (LCTA) database. Initially, an assessment was made of potentially significant ethnobotanical resources for all Native American groups for which literature data was available. A similar but more detailed analysis was then conducted for Native American groups selected by Fort Riley cultural resource personnel.

Scope

This report provides a preliminary assessment of an installation's ethnobotanical resources that does not include consultation with outside organizations. However, analyses presented in this report do not diminish the need for consultations with Native American groups and should not be viewed as a replacement for such consultations. Analyses contained in this report make use of existing installation data to limit the cost of preliminary assessments and to provide background research to enhance the quality of data obtained during consultation procedures.

Mode of Technology Transfer

Installation LCTA coordinators can incorporate these data summary methods and procedures into LCTA annual installation reports and other reporting mechanisms. Data summaries can be used in consultations with Native American groups.

2 Land Condition Trend Analysis Program Data

The DoD is responsible for administering more than 25 million acres of Federally owned land in the United States (Public Land Law Review Commission 1970), making it the fifth largest Federal land managing agency. In addition, DoD military branches have agreements with states and other Federal land-managing agencies to allow training use of 15 million acres of land (Council of Environmental Quality 1989). The LCTA program was developed at the U.S. Army Construction Engineering Research Laboratories (USACERL) under the sponsorship of the U.S. Army Engineering and Housing Support Center (USAEHSC) as a means to inventory and monitor natural resources on military installations. LCTA uses standard methods to collect, analyze, and report natural resources data (Diersing et al. 1992), and is the Army's standard for land inventory and monitoring (Technical Note 420-74-3 1990). Over 50 military installations and training areas in the United States and Germany have begun or plan to implement LCTA. LCTA data is available for over three-quarters of the Army's 12 million acre land base (Shaw and Kowalski 1996). This land base includes Army Materiel Command (AMC), Forces Command (FORSCOM), Training and Doctrine Command (TRADOC), U.S. Army Europe (USAEUR), U.S. Army Pacific (USAPAC) and National Guard Bureau (NGB) installations.

The LCTA program was designed to meet the needs of natural resources management and land stewardship on military installations (Tazik et al. 1992, U.S. Army 1995). A detailed description of the LCTA data collection methods can be found in Tazik et al. 1992. LCTA uses information on topographic features, soil characteristics, climatic variables, vegetation, and wildlife resources to characterize an installation's natural resources. The information helps installation managers make decisions on: the best use of land, scheduling of military activities, protection of threatened and endangered species, and long-term environmental planning. The information also provides officials at all levels with standardized natural resources inventory information for installations across the continental United States and overseas. Specific objectives of LCTA are to: (1) characterize installation natural resources, (2) implement standards for collection, analysis, and reporting of acquired data that enable compilation and reporting of these data Army-wide, (3) monitor changes in land resource condition and evaluate changes in terms of current land uses, (4) evaluate the capability of land to meet the multiple-use demands of the Army on a sustained basis, (5) delineate the biophysical and regulatory constraints on uses of the land, and (6) develop and refine land management plans to ensure long-term resource availability.

Considerable effort has gone into analyzing, interpreting, and using LCTA data for natural resources concerns (Price et al. 1995, Bouman and Shapiro 1994, Warren and Bagley 1992, Wu and Westervelt 1994, Shaw and Diersing 1990, Trumbull et al. 1994, U.S. Army CAA 1996a, U.S. Army CAA 1996b, Shaw and Kowalski 1996, Diersing et al. 1992, Shaw and Schultze 1996, Senseman et al. 1996, Anderson et al. 1996, Whitworth and Hill 1997, Schreiber et al. DRAFT). However, little effort to date has been made to use LCTA data for issues related to cultural resources.

3 Study Site

Fort Riley was selected for the case study because of the interest expressed by Fort Riley cultural resources personnel to assess the potential ethnobotanical resources of their installation.

Fort Riley is a FORSCOM installation with the primary mission to provide training, facilities, housing, and support for the 1st Infantry Division (Mechanized). Fort Riley also supports several other nondivisional units, the principal ones being the 937th Engineering Group and the U.S. Army Correctional Brigade (USACB). Other nondivisional units include the U.S. Army Reserve and National Guard units.

Fort Riley is located in north-central Kansas within the Osage Plains section of the Central Lowlands physiographic province. Elevations on Fort Riley vary from 312 to 416 meters above mean sea level. Terrain varies from alluvial bottom lands along the Republican and Kansas Rivers on the southern portion of the installation, through the hilly to steep lands in the central and eastern portions, to the high uplands on the north and west portions. The climate is temperate. Maximum daily average temperatures range from a low of 4 °C in January, to a high of 33 °C in July. Precipitation averages 85 cm per year, with 75 percent of that falling in the 6-month period from April through September (U.S. Department of Agriculture [USDA] 1975).

Fort Riley is located in the Bluestem Prairie section of the Tall Grass Prairie biotic province (Bailey 1976). This area is characterized by rolling plains dissected by stream valleys. These plains are dominated by grasses such as *Andopogon gerardii, Sorghastrum nutans, Panicum virgatum, Schizachyrium scoparius*, and *Boutaloua curtipendula*. This system evolved and is maintained by wildfires and herbivore grazing. Forest lands, which occur mainly in the stream valleys, are characterized by *Quercus macrocarpa, Quercus muehlenbergii, Ulmus americana,* and *Morus rubra* on the upper slopes, and *Juglans nigra, Fraxinus pennsylvania*, and *Gleditsia triacomthos* on the lower slopes. Flood plains along the Kansas and Republican Rivers are dominated by *Populus deltoides, Platanus occidentalis, Acer negundo*, and *Celtis occedentalis*. Much of the bottom lands and uplands in this region, including Fort Riley, have been cultivated for crop production. Areas once cultivated have largely reverted back to tall grasses since acquisition by the Army.

More than 20 tribes were allotted lands in eastern Kansas (O'Brien 1984). The Ottawa, Peoria, Wea, Kaskaskia, Piankeshaw, Kickapoo, Quapaw, Arkansas, Cherokee, Chippewa, Iowa, Sac, Fox, Pottawatomie, Miami, Munsee, Wyandot, Delaware, Shawnee, Oto, and Missouri all had reservations in this region at some time since the early 1800s. Currently, the Pottawatomie, Sac and Fox, Iowa, and Kickapoo have reservations in northeastern Kansas. The Kansa, Pawnee, Wichita, and Apache have historically inhabited parts of Kansas.

4 Identification of Ethnobotanically Significant Plant Species

Plant Species Known To Occur at Fort Riley

Data from several field surveys were used to identify plant species that are known to occur on Fort Riley. Species data from the Fort Riley floral inventory were combined with species data collected as part of the LCTA core and special use plot surveys (Johnson et al. 1992, Tazik et al. 1992). The following briefly summarizes the Fort Riley floral inventory and LCTA field methodologies.

Aerial photographs, maps, and soil surveys were used to identify and select a number of potential floral inventory collection sites. The principal criteria for selecting sites were that each major soil type and each major habitat type on the installation were represented by at least one site and that variable habitat types be represented by more than one site. Each potential site was visited; 11 were selected for intensive plant collection. These 11 sites represented 8 habitat types (floodplain forest, old field, riparian, prairie, upland forest, disturbed areas, walnut grove, grassland). Each intensive collection site was visited in the 1991 growing season on four different dates. On each visit, two persons observed the vegetation as they walked separate paths of at least 1000 m through the site. Collections were not limited to the 11 designated intensive collection sites. When uncollected species were seen elsewhere on the installation, they were collected. The floral inventory identified 417 taxa (184 new taxa and 233 previously identified taxa).

As part of the LCTA program, field data for Fort Riley are collected from permanently established plots (Tazik et al. 1992). These plots are monitored annually to determine trends in resource condition over time. The standard size of the LCTA permanent plot is 100 x 6 m with a 100-m line transect forming the longitudinal axis. A modified point intercept method is used to document ground cover, surface disturbance, species composition, and vertical distribution of the plant canopy along the line transect. The density and size distribution of woody species is characterized by noting the location, size, and species of all trees and shrubs within the 600 m^2 plot. To ensure objectivity and representativeness in the placement of plots, a procedure was developed to automate the site selection process. The procedure incorporates satellite imagery, digital soil surveys, and a geographic information system (GIS) (Warren et al. 1990). An unsupervised classification was performed on the satellite image, allowing the selection of distinct spectral categories based on reflectance values in the spectral bands. These spectral categories are referred to as landcover categories. Within a GIS, the landcover and soils data layers were superimposed. Each unique soil/landcover combination was recognized as a unique category. Soil/landcover polygons smaller than 2 hectares (5 acres) were removed from the sample pool of potential sites due to the difficulty in locating and sampling these small areas in the field. The number of sites assigned to each soil/landcover category was proportional to the percent of the land area that it covered. Plots located as part of this automated site selection process are referred to as core plots. Plots located by any other means are referred to as special use plots. Special use plots address installation-specific issues that are not addressed by core plots. Species data from all plot types (core and special use), measurement years (1989 through 1994), and measurement types (line transect and belt transect) were used to identify plant species that occurred on the installation. The LCTA program at Fort Riley consists of 155 core plots and 21 special use plots. On these 176 plots, 321 species were identified.

Of the 545 species identified at Fort Riley and used in this report, 148 (27.2 percent) were identified only on LCTA plots, 224 (41.1 percent) were identified only by the floral inventory, and 173 (31.7 percent) were identified by both surveys. These percentages are consistent with data from other ITAM installations (Whitworth and Hill 1997, Schreiber et al. DRAFT). Unique habitats, species identification difficulties, level of effort, seasonality, number of years, and chance occurrence may explain differences in the species lists developed from each survey.

The completeness of the installation species list is important when characterizing the ethnobotanical resource of an installation. An ethnobotanical inventory can only be as complete as the floristic inventory on which it is based. LCTA floral inventories have previously been reported as being 92 percent complete (Phelps 1995). An area the size of Fort Riley would be expected to have between 500 and 1000 taxa, depending on climate and diversity of soils, topography, and rock types (Johnson et al. 1992). Since Fort Riley has relatively low topographic-soil-geologic diversity, the number of taxa would be expected to be toward the lower end of this range (Johnson et al. 1992). Johnson et al. (1992) estimated that as many as 100 or more additional species may be found on the installation with additional effort. Thus, they estimated the Fort Riley floristic inventory to be less than 80 percent complete. Combining LCTA and floristic survey data indicates the floral inventory alone may be less than 73 percent complete. LCTA plot and floristic survey data for Fort Riley demonstrates the importance of using all available data sources to establish a species list for an installation. It also highlights the need to realize that the species lists identify only know occurrences of species and that these lists may not include many species present on an installation.

Culturally Significant Plant Species

Culturally significant plants can be identified by searches of the relevant literature or by consultation with representatives of native American groups. While it is easier and less costly in terms of time and money to assess the significance of plants in an area by reviewing the literature and inventorying the plants, Halmo, Stoffle, and Evans (1993) suggest that social impact assessment cannot accurately represent the contemporary concerns of Indian peoples unless they are actively involved in the study. Evaluations of the cultural significance of specific plants or areas based only on literature information should be considered a preliminary assessment in the absence of consultations. Since the one task of this research was to conduct a preliminary ethnobotanical survey of Fort Riley, the cultural significance of plant species was based on a literature review conducted by Dr. D.E. Moerman of the University of Michigan. The ethnobotanical literature survey contained information on approximately 45,000 uses of 3,894 species of plants by more than 200 Native American groups.

A preliminary ethnobotanical inventory of an installation based on literature is only as complete as the documented studies contained in the literature. The completeness of this information is always suspect for several reasons. Native American groups often do not use the same classification systems as the scientific literature. In the Great Plains, there are two distinct varieties of Beebalm (*Monarda fistulosa*) recognized in the scientific literature. However, the Pawnee recognize and use four distinct varieties (Kindscher 1992). Classification of plants in the scientific literature also changes over time. Differences in taxonomy systems can lead to misidentification and improper assessment of cultural significance. Also, there is no single ethnobotany for every tribe. The importance of plants and knowledge about plants varies with gender, social position, and the creativity of the people studied (Stoffle et al. 1990). People from different tribal backgrounds use plants for different purposes. Plant usages also change over time, some uses are lost while other uses are added. Halmo, Stoffle, and Evans (1993) found consultations with Goshiute tribal members resulted in six new plants being added to the historical ethnobotanical list developed from an ethnobotany literature survey. However, in similar consultations with Paiute and Ute tribal members, no new plants were added to the literature-derived ethnobotanical lists as a result of the consultations (Halmo, Stoffle, and Evans 1993). Thus, while literature review lists are always suspect, there is evidence that the ethnobotanical literature can provide an adequate preliminary assessment.

Information in the ethnobotanical literature survey identified plant usage to the species or genus level, depending on the publication. In this report both levels of detail were used and are noted in the subsequent summaries.

Culturally Significant Plant Species Known To Occur at Fort Riley

A list of culturally significant plant species for Fort Riley was developed by combining all species of vascular plants known to occur on Fort Riley with the species list from the ethnobotanical literature survey (Appendix A). Of the 418 species identified as potentially significant, 278 (66.5 percent) were identified at the species level. Usage of the remaining 140 (33.5 percent) species was only identified in the literature to the genus level. The 418 plant species identified at the genus level represents 76.7 percent of all species known to occur on the installation. The 278 plant species identified at the species level represent 51.0 percent of the plant species known to occur on the installation. These high percentages reflect the fact that information on approximately 200 Native American groups was used to identify potentially significant species without regard to historic land use.

Of the 418 species identified as potentially having cultural significance, 109 (26.1 percent) were identified only on LCTA plots, 161 (38.5 percent) were identified only by the floral inventory, and 148 (35.4 percent) were identified by both surveys. These percentages closely reflect the percentages for total number of species identified by each survey method and demonstrate the need to use all available data.

Table 1 shows the number of species and occurrences by use group for each life form and growth form. The drug, dye, food, fiber, and other use type categories used in this analysis are similar to categories commonly reported in the literature. The "Occurrences" section shows the number of line transect intercepts with culturally significant species summed for all plots. This is a general measure of abundance.

Approximately 79 percent of the culturally significant species were perennials compared to 75 percent for all species known to occur at Fort Riley. Approximately 66 percent of the culturally significant species were forbs, compared to 62 percent for all species known to occur at Fort Riley. While most of the culturally significant species for all use types were forbs, they were most often listed for medicinal uses. More species of plants were identified as having medicinal uses than any other category. This may be an artifact of the types of uses documented in the literature. Trends in the number of occurrences were similar to number of species trends.

The list of 418 species represents all plants that were documented in the literature as being historically used by Native American groups. However, when consultations or environmental impact statements are conducted, specific Indian groups are involved and tribal-specific information may be desirable. In conjunction with Fort Riley cultural resources personnel, five Native American groups were identified for tribal-specific ethnobotanical surveys. These Native American groups are the Kansa, Meskwaki, Pawnee, Delaware, and Pottawatomie. A list of potentially significant plant species for each tribe was developed by combining all species of vascular plants known to occur on Fort Riley with data from the ethnobotanical literature survey for each Indian group (Appendix B). The amount of information in the literature on each Indian group varied considerably. Only one species and use reference was found for the Kansa Indians, whereas 216 species references with 534 use references were found for the Meskwaki Indians. As a consequence of the limited literature documenting the Kansa Indians' use of plant species, a preliminary ethnobotanical survey would be of marginal value.

Table 1. Ethnobotanical significance information by use type, growth form, and life form for Fort Riley, KS.

Measure	Use	Total	Life Form		Growth Form				
	Type		Annual	Perennial	Forb	Grass	Shrub	Tree	Vine
Species*									
	Drug	247	50	197	171	17	17	33	9
	Dye	26	5	21	12	0	2	10	2
	Fiber	52	3	49	16	1		20	1
	Food	140	22	118	80	15	13	26	6
	Other	115	20	95	59	11	14	27	4
	Total	278	57	221	184	28	21	34	11
Occurrences									
	Drug	3711	503	3208	2631	44	374	539	123
	Dye	85	8	77	20	0	18	43	4
	Fiber	446	3	443	220	25	40	159	2
	Food	1275	216	1059	792	49	164	241	29
	Other	674	56	618	292	31	100	232	19
	Total	6191	786	5405	3955	149	696	1214	177

* Species is the number of unique species having cultural significance for all plots. Occurrences is the number of LCTA line transect intercepts with culturally significant species summed for all plots.

5 Identification of Ethnobotanically Significant Plant Habitats

Native American peoples evaluate the cultural significance of a plant without emphasizing its availability. Plants with cultural significance are often fairly common plants that are widely distributed. Consequently, the potential co-occurrence with the military mission is likely to be high. During the American Indian cultural assessment of potential impacts of the U.S. Air Force plans for an electronic combat range at the Utah Test and Training Range, the vast majority of tribal representatives recommended that plants of cultural significance should be avoided by ground-disturbing activities despite the wide availability of the plants (Stoffle, Halmo, and Olmsted 1989). Indian people generally wanted to protect all individual plants when confronted with the prospect of development projects destroying plants on traditional lands (Stoffle and Evans 1990). Halmo, Stoffle, and Evans (1993) concluded that availability is not a component of cultural significance.

Protection of individual culturally significant plants would rarely be feasible because many of the plants are commonly found in plant communities and are often densely found in particular habitats. Also, a large proportion of the known plants at an installation may have some significance to some Native American group. It may be more feasible to protect areas where significant combinations of plants grow than to protect individual plants. Comparisons of usefulness of vegetative communities have been conducted by Phillips et al. (1994), Stoffle et al. (1990), Stoffle et al. (1989), Grenand (1992), and Salick (1992). These studies have shown preferential use of specific areas and habitat types. Results of these studies have yielded specific land use recommendations. The objective of this chapter is to evaluate Fort Riley's plant community types to determine which are most ethnobotanically important.

Methodological problems have plagued attempts to apply quantitative analysis to ethnobotany (Trotter and Logan 1986; Johns, Kokwaro, and Kimanani 1990; Phillips et al. 1994). Most studies simply total plant uses reported by variable numbers of informants, or assign importance values by subjective means. Totaling useful species (percent useful species) in an area is only a crude guide to the cultural significance of an area and can be misleading (Phillips et al. 1994). Misinterpretations of percent useful species can result from the fact that many cultures have at least occasional uses for many species. Therefore, a plant with only one minor use counts as much as a plant with many important uses. These values are as much a function of the level of ethnobotanical research effort as they are an objective measure of importance. The more effort expended in gathering information, the more likely species with minor importance will be documented.

Several techniques for estimating use values that are explicit, replicable, and relatively objective have been proposed and demonstrated (Phillips and Gentry 1993a; Phillips and Gentry 1993b; Phillips et al. 1994; Halmo, Stoffle, and Evans 1993; Turner 1988; Stoffle et al. 1990; Stoffle et al. 1989). However, the data required to use these methods was often not available from the literature review and/or the Fort Riley vegetation surveys. For the purposes of this report, cultural significance of an area or habitat was characterized with several measures: number of species, percent of species, percent cover, percent hits, and utility value of the area. Number of species is the average number of culturally significant species found on a measurement plot. Percent of species is the average number of culturally significant species found on a plot divided by the total number of species found on the plot. Percent cover is the average percent area covered by species with cultural significance. Percent hits is the average percent of total intercepts measured that are species with cultural significance. Utility value is the average plot value of the sum for all species of the percent cover for a species times the number of uses reported for the species. Use values reflect both amount of use, number of different uses, and relative abundance of the plant. While most studies have used numbers of plants when calculating utility values, cover was used since individual numbers of plants was not available from the field surveys. The method used in this report weights each use equally. However, some uses (religious) are much more significant than others, but this type of information was not readily available from the literature review.

Vegetation data from 144 LCTA plots were used to assess cultural significance of Fort Riley's major plant communities. Three major plant communities were identified: forestlands, shrublands, and grasslands. Because grasslands accounted for the largest portion of the installation, these plots were divided into three subgroups: native grasslands, plowed grasslands, and broomweed grasslands. Native grasslands had no prior agricultural land use. Plowed grasslands were abandoned cultivated agricultural fields. Broomweed grasslands were abandoned cultivated agricultural fields that were dominated by broomweed. Plots were classified into plant communities based on a visual inspection of the site by the LCTA field crews. Plots were not classified using the LCTA data.

Table 2 shows plant community cultural significance values for all Native American groups combined. Tables 3 through 6 show plant community cultural significance values for 4 of the 5 selected Indian groups. To gain more insight into potential differences between the vegetation types, the average use value by component use categories was calculated for each vegetation type. Generally, for the combined and individual Indian groups, forestlands and shrublands had greater cultural significance ratings than grasslands. Native grasslands had greater cultural significance ratings than either plowed grasslands or broomweed grasslands. However there were culturally significant species unique to each vegetation type that may be related to the sampling intensity of each vegetation type or to actual differences between species found in each vegetation type.

While the percent significant species did not differ considerably between grassland types, native grasslands had more culturally significant species present; approximately 50 percent more than either of the other two grassland types. This maybe explained by the fact that there were three times as many native grassland plots. The percentage of plots having any significant species was higher for native grasslands than the other two types. On the plowed grassland types, no significant species was found on more than 30 percent of the plots. On native grasslands, approximately 10 percent of culturally significant species were found on more than 30 percent of the plots. While plowed and unplowed plots had many of the same species, the relative cover of species differed. No clear trends were evident.

The assessment of culturally significant plants used in this report represents an assessment of the existing vegetation rather than the potential vegetation that might exist given a different land use history. The rating process evaluates the existing resources rather than the potential ethnobotanical significance. Depending on management objectives and the alternatives being considered, evaluating existing or potential significance could be an important consideration (Halmo, Stoffle, and Evans 1993).

Table 2. Ethnobotanical significance ratings by vegetation type for Fort Riley, KS.

Measure	Forestlands*		Shrublands		Grasslands					
					Native		Plowed		Plowed-broomweed	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pct. Sig. Species	69.4	10.0	60.7	11.6	49.1	7.9	45.1	10.9	39.9	12.3
Pct. Sig. Hits	75.8	13.2	72.8	27.0	53.1	16.3	30.8	18.0	20.0	13.1
Pct. Sig. Cover	72.4	12.5	70.7	24.5	51.3	16.0	31.1	17.1	18.3	11.3
Utility Value - All	6606.2	5404.8	3553.6	2370.7	850.9	530.1	440.9	481.3	331.9	371.9
Utility Value - Drug	3159.2	2584.7	1830.8	1187.6	384.1	323.5	225.7	253.4	169.2	204.5
Utility Value - Dye	215.3	187.6	106.6	124.7	4.8	14.2	2.6	10.0	13.0	35.5
Utility Value - Food	1067.5	639.1	482.4	491.5	50.4	53.3	48.1	90.9	40.1	54.6
Utility Value - Fiber	735.1	936.6	219.7	173.4	91.5	45.2	36.7	45.4	26.4	52.2
Utility Value - Other	1429.0	1376.8	914.0	589.9	319.8	185.8	127.5	178.6	83.0	101.0

* 20 forestland, 11 shrubland, 70 native grassland, 23 plowed grassland, and 20 broomweed grassland plots.

Table 3. Meskwaki Indian potential ethnobotanical significance ratings by vegetation type for Fort Riley, KS.

Measure	Forestlands		Shrublands		Grasslands					
					Native		Plowed		Plowed-broomweed	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pct. Sig. Species	32.7	10.7	28.7	7.6	12.8	8.0	14.1	7.1	10.6	8.3
Pct. Sig. Hits	53.4	17.1	33.9	26.9	5.5	4.7	6.8	4.6	4.8	6.1
Pct. Sig. Cover	48.1	13.5	31.1	23.1	5.1	4.5	7.2	4.9	4.3	4.4
Utility Value - All	201.1	86.1	116.9	96.8	14.2	14.4	14.3	10.6	10.0	13.2
Utility Value - Drug	139.8	66.6	86.5	64.6	12.2	12.0	12.7	8.4	7.0	7.8
Utility Value - Dye	12.4	15.7	6.0	9.0	0.2	0.8	0.1	0.6	0.6	2.0
Utility Value - Food	35.3	24.7	23.3	26.4	0.5	1.5	0.3	1.0	1.5	3.7
Utility Value - Fiber	13.5	21.0	0.2	0.4	0.3	1.1	0.4	1.1	0.8	2.5
Utility Value - Other	0.0	0.0	0.7	1.7	0.7	2.0	0.6	1.2	0.0	0.0

Table 4. Pawnee Indian potential ethnobotanical significance ratings by vegetation type for Fort Riley, KS.

Measure	Forestlands		Shrublands		Grasslands					
					Native		Plowed		Plowed-broomweed	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pct. Sig. Species	28.8	10.5	20.0	6.6	6.1	6.1	5.6	7.2	5.9	8.0
Pct. Sig. Hits	53.9	21.7	34.2	26.3	2.4	3.6	2.3	3.7	4.0	6.9
Pct. Sig. Cover	47.1	18.4	27.3	21.8	2.3	3.2	2.2	3.5	2.7	4.5
Utility Value - All	343.5	226.2	189.2	174.7	7.2	14.6	3.5	7.6	12.0	23.7
Utility Value - Drug	27.4	38.4	13.8	17.1	2.0	4.1	1.1	2.5	2.8	6.4
Utility Value - Dye	12.3	16.0	3.7	7.2	0.0	0.0	0.0	0.0	0.5	2.2
Utility Value - Food	58.8	34.0	29.7	36.1	0.7	2.3	0.3	1.0	0.9	1.7
Utility Value - Fiber	56.6	65.0	21.9	21.26	1.3	2.7	0.7	1.3	1.2	4.9
Utility Value - Other	188.3	150.1	120.0	109.4	3.2	8.5	1.3	3.9	6.6	14.1

Table 5. Delaware Indian potential ethnobotanical significance ratings by vegetation type for Fort Riley, KS.

Measure	Forestlands		Shrublands		Grasslands					
					Native		Plowed		Plowed-broomweed	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pct. Sig. Species	15.8	6.9	12.9	7.0	1.3	2.8	0.9	2.5	2.1	3.8
Pct. Sig. Hits	34.3	24.4	32.0	25.9	0.5	1.7	0.4	1.6	1.5	5.3
Pct. Sig. Cover	30.4	20.8	27.9	22.1	0.5	1.5	0.3	0.7	1.0	2.5
Utility Value - All	230.7	209.0	172.0	167.1	1.5	4.1	0.6	1.6	1.8	3.8
Utility Value - Drug	206.5	181.8	164.6	155.1	1.5	4.1	0.6	1.6	1.8	3.8
Utility Value - Dye	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utility Value - Food	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utility Value - Fiber	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utility Value - Other	24.2	31.9	7.4	14.4	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Pottawatomie Indian potential ethnobotanical significance ratings by vegetation type for Fort Riley, KS.

Measure	Forestlands		Shrublands		Grasslands					
					Native		Plowed		Plowed-broomweed	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pct. Sig. Species	12.2	6.5	6.6	3.3	1.2	3.0	1.1	3.3	3.0	5.1
Pct. Sig. Hits	19.2	17.1	15.7	15.3	0.5	1.9	0.4	1.8	1.8	5.2
Pct. Sig. Cover	18.6	16.7	12.5	11.4	0.4	1.2	0.3	1.3	1.2	2.8
Utility Value - All	135.3	156.8	47.6	43.9	1.8	6.1	1.0	3.1	5.1	15.0
Utility Value - Drug	86.5	85.0	42.6	43.7	1.0	3.3	0.6	2.1	2.6	7.4
Utility Value - Dye	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utility Value - Food	0.6	0.9	4.4	9.9	0.0	0.2	0.1	0.8	0.3	1.0
Utility Value - Fiber	47.6	76.2	0.5	0.9	0.6	2.7	0.1	0.6	2.0	7.4
Utility Value - Other	0.6	2.0	0.0	0.0	0.1	0.4	0.0	0.2	0.1	0.3

6 Impact of Military Land Use Activities on Culturally Significant Plants

Military regulations and policies require that an Integrated Cultural Resources Management Plan (ICRMP) contain an inventory and evaluation of all known cultural resources, identify the likely presence of other significant cultural resources, and clearly identify mission impacts on cultural resources (AR 200-4, Air Force Instruction [AFI] 32-7065). To assess the potential impact of training activities on culturally significant plant species, correlation coefficients were calculated for measures of military land use and cultural significance (Table 7, column 3). LCTA military disturbance data was used to quantify military land use. Cultural significance measures were calculated from LCTA line transect vegetation data and included number of species, percent of species, number of intercept hits, percent of intercept hits, percent cover, and total use value. These measures were calculated as described earlier in this report. Correlation coefficients of military land use with vegetation measures are also provided in Table 7 for comparison. Military land use was correlated with total number of species, number of hits, percent cover, and range condition.

Disturbance was negatively correlated with each potential ethnobotanical value index. While many correlation coefficients are statistically significant, only 14 percent to 35 percent of the total variation was accounted for by military land use measures. Correlation coefficients of cultural significance measures were only marginally larger than equivalent measures of total vegetation. Correlations were generally stronger for all Indian groups combined than for any of the individual tribes. Total vegetation and cultural significance measures were also correlated with LCTA-derived estimates of range condition (Table 7, column 5). Cultural significance measures were positively correlated with range condition. Trends in range condition correlations were similar to trends in disturbance correlations and range condition is negatively correlated with military disturbance.

Correlation coefficients do not indicate cause and effect, but only measure the relationship between variables. The negative relationship between cultural significance variables and disturbance when all plots are used may reflect adverse impacts on these plants by training activities or that training activities occur where these plants are not located. In general, the most damaging training is maneuver training. Much of the heavy impact training occurs in grasslands while the most culturally significant plant communities are forestlands and shrublands. Correlation coefficients for military land use and cultural significance measures were calculated for subset of the LCTA data that only contained grassland plots (Table 7, column 4). Disturbance was negatively correlated with each potential ethnobotanical value index. However, grassland only correlations accounted for much less of the variation than when all plots were used. Correlations for individual Indian groups were generally not significant.

Care must be taken when interpreting these results. First, correlations do not indicate cause and effect relationships. Second, individual plant species of particular interest may behave differently than the cultural significance variables based on all species of cultural significance. However, the negative correlation between disturbance and cultural significance appears to result from two processes. First, the most ethnobotanically significant vegetation types (forestland and shrubland) receive less military use than grasslands. Second, on areas where military disturbance does occur, disturbance reduces the amount of significant vegetation.

A second approach used to assess the potential impact of training activities on culturally significant plant species involved a literature review of impact data on individual species to determine the relative susceptibility of each species to damage (Yorks et al. 1997). Of the 418 potentially culturally significant plant species found at Fort Riley, data for 82 (20 percent) species were found in the literature. Species-level data existed for 43 species (10 percent) while genus level data was available for 39 (9 percent) species. Table 8 shows relative resistance and resilience values for each species found in the literature.

Yorks et al. (1997) reported average resilience and resistance ranking by plant growth form and life span. The ranking of resistance to impacts was grasses>tree>trees>forbs>shrubs. Average life form resistance was greater for annuals than perennials. Average resilience ranking by growth form was grass>forbs>tree>shrub. Average life form resilience was greater for annuals than perennials. While there was an average ranking by life and growth form, there was wide variation within each form.

Table 7. Correlation coefficients of selected variables for Fort Riley, KS.

Group	Measure	Disturbance all plots	Disturbance grass only plots	Range condition grass only plots
All	Range Condition	-0.64	-0.64	1.00
	Num. Species	-0.28	-0.04	0.12
	Num. Sig. Species	-0.41	-0.15	0.24
	Pct. Sig. Species	-0.44	-0.24	0.33
	Num Hits	-0.45	-0.23	0.24
	Num Sig. Hits	-0.48	-0.49	0.61
	Pct. Sig. Hts	-0.59	-0.47	0.65
	Cover	-0.50	-0.33	0.41
	Sig. Cover	-0.56	-0.50	0.68
	Pct. Sig. Cover	-0.57	-0.44	0.64
	Use Value - total	-0.37	-0.40	0.41
Meskwaki	Num. Sig. Species	-0.39	-0.09	0.08
	Pct. Sig. Species	-0.34	-0.04	0.01
	Num Sig. Hits	-0.39	-0.06	-0.05
	Pct. Sig. Hts	-0.38	0.10	-0.18
	Sig. Cover	-0.40	0.02	-0.07
	Pct. Sig. Cover	-0.36	0.19	-0.23
	Use Value - total	-0.40	-0.11	0.02
Pawnee	Num. Sig. Species	-0.37	-0.02	-0.12
	Pct. Sig. Species	-0.37	-0.06	-0.13
	Num Sig. Hits	-0.38	-0.10	-0.12
	Pct. Sig. Hts	-0.40	-0.04	-0.17
	Sig. Cover	-0.39	-0.05	-0.09
	Pct. Sig. Cover	-0.39	0.01	-0.15
	Use Value - total	-0.36	-0.12	-0.03
Delaware	Num. Sig. Species	-0.43	-0.17	-0.03
	Pct. Sig. Species	-0.44	-0.17	-0.01
	Num Sig. Hits	-0.35	-0.10	-0.11
	Pct. Sig. Hts	-0.38	-0.10	-0.13
	Sig. Cover	-0.36	-0.16	-0.01
	Pct. Sig. Cover	-0.39	-0.16	-0.03
	Use Value - total	-0.33	-0.17	0.00
Pottawatomie	Num. Sig. Species	-0.32	0.03	-0.25
	Pct. Sig. Species	-0.29	0.00	-0.24
	Num Sig. Hits	-0.32	-0.09	-0.18
	Pct. Sig. Hts	-0.33	-0.06	-0.20
	Sig. Cover	-0.32	-0.05	-0.21
	Pct. Sig. Cover	-0.32	-0.03	-0.24
	Use Value - total	-0.27	-0.09	-0.12

Table 8. Resistance and resilience of culturally significant plant species found at Fort Riley, KS.

Genus	Species	Resistance[1]	Resilience[2]	Match[3]
Achillea	millefolium	3.5	3.5	S
Agoseris	glauca	4.0		S
Agropyron	smithii		4.0	S
Aster	drummondii	4.0		G
Aster	ericoides	4.0		G
Aster	oblongifolius	4.0		G
Aster	sericeus	4.0		G
Aster	subulatus	1.0		S
Bouteloua	gracilis	4.5		S
Buchloe	dactyloides		5.0	S
Carex	annectens	4.4	3.8	G
Carex	brevior	4.4	3.8	G
Carex	bushii	4.4	3.8	G
Carex	capillaris	4.4	3.8	G
Carex	cephalophora	4.4	3.8	G
Carex	gravida	4.4	3.8	G
Carex	illota	4.4	3.8	G
Carex	laeviconica	4.4	3.8	G
Carex	microdonta	4.4	3.8	G
Carex	oreocharis	4.4	3.8	G
Carex	retroflexa	4.4	3.8	G
Carex	vulpinoidea	4.4	3.8	G
Chenopodium	album	4.5		S
Commelina	erecta	5.0		S
Cynodon	dactylon	3.0	4.7	S
Descurainia	pinnata		4.0	G
Descurainia	sophia		4.0	G
Dyssodia	papposa		4.0	S
Epilobium	angustifolium	1.0	4.0	S
Festuca	arundinacea	3.3	4.0	S
Fragaria	virginiana	3.0	3.0	S
Grindelia	squarrosa		4.0	S
Helianthus	annuus	4.0		S
Hieracium	longipilum	4.0		G
Hordeum	pusillum	4.0		S
Juglans	nigra	3.0		S
Juncus	balticus	2.5		G
Juncus	brachyphyllus	2.5		G
Juncus	interior	2.5		G
Juncus	tenuis	4.0		S
Juncus	torreyi	2.5		G
Juncus	vaseyi	2.5		G
Kochia	scoparia	4.0		S
Lathyrus	latifolius	4.0		G
Melilotus	alba	5.0		S
Oxytropis	lambertii	2.0	2.0	G
Plagiobothrys	arizonicus	3.0		S
Plantago	rugelii	5.0		S
Poa	compressa		4.0	S
Poa	pratensis	4.1	3.3	S
Polygonum	amphibium		1.0	G
Polygonum	arenastrum		1.0	G
Polygonum	aviculare	3.5	5.0	S
Polygonum	densiflorum		1.0	G
Polygonum	hydropiperoides		1.0	G
Polygonum	lapathifolium		1.0	G
Polygonum	pensylvanicum		1.0	G
Polygonum	punctatum		1.0	G

Polygonum	tenue		1.0	G
Polygonum	virginianum		1.0	G
Populus	deltoides	4.0		S
Potentilla	simplex		4.5	S
Prunella	vulgaris	2.0		S
Rosa	arkansana	1.0		S
Rosa	multiflora	4.0		G
Rubus	flagellaris		4.0	S
Rudbeckia	hirta	1.0		S
Salix	amygdaloides	3.0	4.0	G
Salix	exigua	3.0	4.0	G
Salix	nigra	3.0	4.0	G
Sanicula	marilandica	4.0		S
Schedonnardus	paniculatus		5.0	S
Schizachyrium	scoparium	3.0	4.0	S
Sitanion	hystrix	4.0	4.0	S
Solidago	missouriensis	3.7	3.0	S
Solidago	rugosa	2.0	2.0	S
Taraxacum	laevigatum	4.0		S
Taraxacum	officinale	4.4		S
Trifolium	pratense	2.3	4.0	S
Trifolium	repens	3.5	4.3	S
Verbena	bracteata		5.0	S
Vulpia	octoflora	4.0	4.0	S

1. Resistance is the ability of the plant species to withstand traffic before injury. 1: disappearance of species, 2: greater than 50 percent decrease in cover or biomass, 3: less than 50 percent decrease in cover or biomass, 4: little change in cover or biomass, 5 increase in cover or biomass.
2. Resilience is the capacity of a species to survive or regenerate following disturbance. 1: disappearance of species, 2: greater than 50 percent decrease in cover or biomass, 3: less than 50 percent decrease in cover or biomass, 4: little change in cover or biomass, 5 increase in cover or biomass.
3. S indicates disturbance data exists at the species level. G indicates disturbance data exists only at the genus level.

7 Conclusions

LCTA floristic data and literature data as combined and demonstrated in this study can be useful for a preliminary assessment of the ethnobotanical resources of an installation. As demonstrated in this study, the assessment makes use of existing data, is relatively inexpensive, and can be completed fairly quickly. LCTA vegetation data combined with disturbance data can assist in assessing the potential impacts to ethnobotanical resources.

The methods demonstrated in this report are not sufficient for a complete assessment of the ethnobotanical resources of an installation because they exclude the Native American peoples' opinions that are specifically intended to be included. A complete assessment can only be accomplished through consultations with the affected peoples. However, the analyses presented in this report can be effectively used in the consultation process itself. The literature review also revealed that laminated specimens similar to those of the LCTA floristic inventory can be especially helpful in consultations with Indian groups. Stoffle et al. (1990), for example, found voucher specimens useful during consultations. Native American consultants seemed to have little difficulty in recognizing pressed plant material if they were familiar with the plant at all (Train, Henrichs, and Archer n.d.).

The analyses demonstrated in this report made use of LCTA data collected by methods described in Tazik et al. (1992). However, any installation data collection methodology that provides species-level data are applicable. The LCTA program is currently evolving to more adequately meet the requirements of installation managers (U.S. Army Environmental Center 1996). Potential modifications to the LCTA program may include changes in data collection methodologies, data sources, and sampling intensity. These changes are likely to improve any assessment of an installation's ethnobotanical resources and their potential impact on the military mission.

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Appendix A: Plant Species at Fort Riley, KS, With Potential Ethnobotanical Significance

Scientific Name	Match[2]	Survey[3]	Scientific Name	Match	Survey
Acalypha virginica	S	F	Brickellia eupatorioides	S	F
Acer negundo	S	B	Bromus inermis	G	B
Acer saccharinum	S	F	Bromus japonicus	G	B
Achillea millefolium	S	B	Bromus pubescens	G	F
Aesculus glabra	S	B	Bromus tectorum	S	L
Ageratina altissima	S	B	Buchloe dactyloides	S	L
Agoseris glauca	S	F	Callirhoe involucrata	S	B
Agrimonia pubescens	G	F	Calochortus catalinae	S	L
Agropyron smithii	G	L	Calochortus splendens	G	L
Alisma subcordatum	S	F	Calycanthus occidentalis	S	L
Allium drummondii	S	B	Camassia scilloides	S	F
Amaranthus arenicola	S	F	Cannabis sativa	S	F
Amaranthus californicus	G	L	Cardamine concatenata	S	F
Amaranthus retroflexus	S	B	Carduus nutans	G	F
Ambrosia artemisiifolia	S	B	Carex annectens	G	F
Ambrosia psilostachya	S	B	Carex brevior	S	F
Ambrosia trifida	S	B	Carex bushii	G	F
Amorpha canescens	S	B	Carex capillaris	G	L
Amorpha fruticosa	S	B	Carex cephalophora	G	L
Ampelopsis cordata	S	L	Carex gravida	G	F
Amphiachyris dracunculoides	S	F	Carex illota	G	L
Andropogon gerardii	S	B	Carex laeviconica	G	F
Anemone virginiana	S	F	Carex microdonta	G	F
Antennaria neglecta	G	L	Carex oreocharis	G	L
Apocynum cannabinum	S	B	Carex retroflexa	G	F
Argemone polyanthemos	S	F	Carex vulpinoidea	S	F
Artemisia ludoviciana	S	B	Carya cordiformis	S	B
Asclepias incarnata	S	F	Carya illinoensis	G	L
Asclepias stenophylla	S	B	Ceanothus herbaceus	S	B
Asclepias syriaca	S	B	Ceanothus oliganthus	S	L
Asclepias tuberosa	S	B	Ceanothus serrulatus	G	L
Asclepias verticillata	S	B	Celastrus scandens	S	B
Asclepias viridiflora	S	B	Celtis occidentalis	S	B
Asclepias viridis	G	B	Centaurea cyanus	G	F
Asparagus officinalis	S	L	Cephalanthus occidentalis	S	F
Aster drummondii	G	B	Cercis canadensis	S	B
Aster ericoides	S	L	Chaerophyllum procumbens	S	B
Aster oblongifolius	S	L	Chamaecyparis thyoides	S	F
Aster sericeus	G	L	Chenopodium album	S	B
Aster subulatus	S	F	Chenopodium disiccatum	G	F
Astragalus canadensis	S	B	Chenopodium gigantospermum	G	B
Baptisia bracteata	S	B	Chenopodium pallascens	G	F
Baptisia minor	G	B	Chenopodium pallescens	G	L
Bidens connata	G	L	Cicuta maculata	S	F
Briochloa saccharoides	S	F	Cinna arundinacea	S	F
Bouteloua curtipendula	S	B	Cirsium altissimum	S	L
Bouteloua gracilis	S	B	Cirsium undulatum	S	B
Bouteloua hirsuta	S	B	Comandra umbellata	S	B
Commelina erecta	S	B	Fraxinus americana	S	F

Conium maculatum	S	F	Fraxinus pennsylvanica	S	B
Convolvulus arvensis	S	B	Fritillaria pinetorum	G	L
Conyza canadensis	S	L	Gaillardia pulchella	S	F
Coreopsis grandiflora	G	F	Galium aparine	S	B
Coreopsis lanceolata	G	F	Galium circaezans	S	B
Coreopsis tinctoria	S	F	Galium pilosum	G	L
Cornus amomum	S	F	Gaura parviflora	S	B
Cornus drummondii	S	B	Geranium maculatum	S	F
Coronilla varia	S	F	Geum canadense	S	L
Coryphantha missouriensis	G	F	Gleditsia triacanthos	S	B
Crataegus phaenopyrum	G	F	Glycyrrhiza lepidota	S	F
Croton monanthogynus	S	F	Grindelia squarrosa	S	B
Cucurbita foetidissima	S	B	Gymnocladus dioicus	S	B
Cuscuta glomerata	G	B	Hedeoma drummondii	S	L
Cuscuta gronvii	G	F	Hedeoma hispidum	G	B
Cynodon dactylon	S	L	Helianthus annuus	S	B
Cyperus esculentus	S	F	Helianthus grosseserratus	S	L
Cyperus filiculmis	G	F	Helianthus hirsutus	G	B
Dalea aurea	S	B	Helianthus laetiflorus	G	L
Dalea candida	S	B	Helianthus maximiliani	S	L
Dalea purpurea	S	B	Helianthus petiolaris	S	F
Daucus carota	S	L	Helianthus rigidus	G	F
Delphinium alabamicum	G	L	Helianthus tuberosus	S	B
Delphinium californicum	G	L	Hibiscus trionum	G	B
Delphinium virescens	G	F	Hieracium longipilum	G	B
Descurainia pinnata	S	F	Hordeum pusillum	G	F
Descurainia sophia	S	F	Hymenopappus scabiosaeus	G	B
Desmanthus illinoensis	S	B	Hypericum perforatum	S	B
Desmodium canadense	S	L	Hypericum punctatum	S	F
Desmodium glutinosum	S	B	Ipomoea leptophylla	S	F
Desmodium illinoense	S	B	Juglans nigra	S	B
Desmodium paniculatum	S	B	Juncus balticus	S	L
Desmodium pauciflorum	G	L	Juncus brachyphyllus	G	F
Dichanthelium oligosanthes	S	B	Juncus interior	G	F
Diospyros virginiana	S	L	Juncus tenuis	S	F
Dyssodia papposa	S	F	Juncus torreyi	S	F
Echinacea angustifolia	S	B	Juncus vaseyi	G	L
Eleocharis xyridiformis	G	F	Juniperus virginiana	S	B
Elymus canadensis	S	B	Kochia scoparia	S	L
Elymus virginicus	G	B	Lactuca canadensis	S	B
Epilobium angustifolium	S	L	Lactuca ludoviciana	S	F
Equisetum hymale	G	F	Lactuca serriola	S	F
Erigeron annuus	G	F	Laportea canadensis	S	L
Erigeron strigosus	S	B	Lathyrus latifolius	G	F
Erysimum repandum	G	F	Lepidium densiflorum	S	B
Euonymus atropurpureus	G	B	Lespedeza capitata	S	B
Euphorbia corollata	S	B	Lespedeza cuneata	G	L
Euphorbia cyathophora	G	F	Lespedeza stipulacea	G	B
Euphorbia dentata	S	B	Lespedeza violacea	G	L
Euphorbia hexagona	G	F	Leucanthemum vulgare	S	F
Euphorbia maculata	G	B	Liatris punctata	S	B
Euphorbia marginata	S	B	Linum lewisii	S	F
Euphorbia missurica	G	F	Linum puberulum	S	L
Euphorbia nutans	G	F	Lithospermum incisum	S	F
Euphorbia obtusata	G	F	Lobelia cardinalis	S	F
Euphorbia spathulata	G	B	Lomatium foeniculaceum	S	B
Euphorbia strictospora	G	F	Lonicera tatarica	G	B
Festuca arundinacea	G	L	Lycopus americanus	S	F
Festuca obtusa	G	B	Lygodesmia juncea	S	F
Festuca paradoxa	G	F	Lythrum alatum	S	F
Fragaria virginiana	S	B	Lythrum californicum	S	L
Maclura pomifera	S	B	Polygonum aviculare	S	B
Madia yosemitana	G	L	Polygonum densiflorum	S	L
Malus prunifolia	G	F	Polygonum hydropiperoides	G	F
Malva rotundifolia	G	L	Polygonum lapathifolium	S	F
Melilotus alba	G	B	Polygonum pensylvanicum	S	B

Melilotus officinalis	S	B	Polygonum punctatum	S	F
Menispermum canadense	S	L	Polygonum tenue	G	L
Mentha arvensis	S	F	Polygonum virginianum	S	F
Mentha cardiaca	G	L	Polytaenia nuttallii	S	F
Mentzelia oligosperma	G	F	Populus deltoides	S	B
Mimulus ringens	S	F	Potentilla rivalis	G	F
Mirabilis linearis	S	F	Potentilla simplex	S	L
Mirabilis nyctaginea	S	B	Prunella vulgaris	S	F
Monarda citriodora	S	L	Prunus americana	S	B
Monarda fistulosa	S	F	Prunus angustifolia	S	L
Monarda russeliana	G	L	Prunus mexicana	G	F
Morus alba	S	F	Prunus persica	S	F
Morus rubra	S	B	Prunus pumila	S	L
Muhlenbergia cuspidata	S	B	Pyrus communis	S	L
Muhlenbergia racemosa	G	F	Quercus macnabiana	G	L
Muhlenbergia schreberi	G	B	Quercus macrocarpa	S	B
Oenothera biennis	S	L	Quercus marilandica	S	L
Oenothera laciniata	G	B	Quercus muhlenbergii	G	B
Oenothera macrocarpa	G	B	Quercus mutabilis	G	L
Oenothera speciosa	G	B	Quercus velutina	S	F
Oenothera villosa	S	F	Ranunculus abortivus	S	F
Onosmodium molle	S	F	Ranunculus glaberrimus	S	L
Opuntia macrorhiza	S	L	Ranunculus hispidus	S	F
Ostrya virginiana	S	F	Ranunculus longirostris	G	F
Oxalis stricta	S	B	Ranunculus orthorhynchus	G	L
Oxalis violacea	S	B	Ratibida columnifera	S	F
Oxytropis lambertii	S	F	Rhus aromatica	S	B
Panicum anceps	G	L	Rhus glabra	S	B
Panicum capillare	S	B	Ribes missouriense	S	B
Panicum virgatum	G	B	Ribes odoratum	G	L
Parthenocissus quinquefolia	S	L	Robinia pseudoacacia	S	L
Paspalum setaceum	S	F	Rorippa palustris	S	F
Penstemon arenicola	G	L	Rosa arkansana	S	B
Penstemon cobaea	G	F	Rosa multiflora	G	F
Penstemon tubiflorus	G	F	Rubus allegheniensis	S	L
Penthorum sedoides	S	F	Rubus flagellaris	S	L
Phryma leptostachya	S	F	Rubus glaucifolius	G	L
Phyla cuneifolia	S	F	Rubus idaeus	S	F
Physalis angulata	G	F	Rubus occidentalis	S	L
Physalis heterophylla	S	F	Rubus ostryifolius	G	B
Physalis longifolia	S	F	Rubus pensylvanicus	G	F
Physalis virginiana	S	L	Rudbeckia hirta	S	F
Phytolacca americana	S	B	Rudbeckia laciniata	S	F
PlagioBrys arizonicus	S	L	Rumex altissimus	S	F
Plantago aristata	S	L	Rumex crispus	S	L
Plantago patagonica	S	B	Rumex maritimus	S	L
Plantago rhodosperma	G	F	Sagittaria graminea	G	L
Plantago rugelii	S	F	Sagittaria latifolia	S	F
Plantago virginica	S	B	Salix amygdaloides	S	F
Platanus occidentalis	S	F	Salix exigua	S	B
Poa compressa	G	B	Salix nigra	S	F
Poa pratensis	G	B	Salvia pitcheri	G	B
Polygala verticillata	S	L	Sambucus canadensis	S	B
Polygonatum biflorum	S	B	Sanicula canadensis	S	L
Polygonum amphibium	S	L	Sanicula gregaria	G	L
Polygonum arenastrum	S	L	Sanicula marilandica	S	F
Schedonnardus paniculatus	S	B	Tradescantia occidentalis	S	L
Schizachyrium scoparium	S	B	Tradescantia ohiensis	G	F
Scirpus atrovirens	G	F	Tragia ramosa	S	F
Scirpus pendulus	G	F	Tragopogon dubius	G	B
Scirpus validus	G	F	Tribulus terrestris	S	F
Scrophularia lanceolata	S	F	Trifolium pratense	S	F
Scutellaria lateriflora	S	F	Trifolium repens	S	F
Senecio plattensis	G	F	Triodanis perfoliata	S	B
Sicyos angulatus	S	F	Triosteum perfoliatum	S	L
Silphium integrifolium	S	F	Typha angustifolia	S	F

Silphium laciniatum	S	B	Typha latifolia	S	L
Sisyrinchium campestre	S	B	Ulmus americana	S	B
Sitanion hystrix	G	F	Ulmus pumila	G	B
Smilax hispida	G	B	Ulmus rubra	S	B
Solanum carolinense	S	B	Urtica dioica	S	B
Solanum ptycanthum	G	F	Verbascum thapsus	S	B
Solanum rostratum	S	B	Verbena ambrosiifolia	G	L
Solidago altissima	G	B	Verbena bipinnatifida	G	F
Solidago missouriensis	G	B	Verbena bracteata	S	F
Solidago riddellii	G	L	Verbena racemosa	G	L
Solidago rigida	S	B	Verbena simplex	G	F
Solidago rugosa	S	L	Verbena stricta	S	B
Solidago spathulata	S	L	Verbena urticifolia	S	B
Solidago speciosa	S	L	Vernonia baldwinii	G	B
Sophora nuttalliana	S	L	Veronica peregrina	S	L
Sorghum bicolor	S	F	Viburnum prunifolium	S	L
Sorghum halepense	S	L	Viburnum rafinesquianum	G	L
Spartina pectinata	S	L	Viola bicolor	S	F
Sporobolus cryptandrus	S	L	Viola pedatifida	G	B
Sporobolus heterolepis	S	B	Viola praemorsa	G	L
Symphoricarpos orbiculatus	S	L	Viola pratincola	G	L
Taraxacum laevigatum	G	L	Vitis acerifolia	G	F
Taraxacum officinale	S	F	Vitis aestivalis	S	F
Thlaspi arvense	S	B	Vitis riparia	S	B
Tilia americana	S	F	Vulpia octoflora	S	F
Toxicodendron radicans	S	B	Yucca glauca	S	F
Tradescantia bracteata	S	F	Zanthoxylum americanum	S	L
Tradescantia fluminensis	G	L	Zigadenus nuttallii	S	F

1 S indicates disturbance data exists at the species level. G indicates disturbance data exists only at the genus level.

2 F, L, B indicates species found floral inventory, LCTA surveys, or both respectively.

3 Taxonomy used in this report are based on the National List of Scientific Plant Names (USDA 1992).

Appendix B: Plant Species at Fort Riley, KS, With Potential Ethnobotanical Significance, by Indian Tribe

Tribe	Species[1]	Match[2]	Drug	Dye	Fiber	Food	Other
Pottawatomi	Achillea millefolium	S	X				X
	Asclepias syriaca	S	X		X	X	
	Celastrus scandens	S				X	
	Chenopodium album	S	X			X	
	Conyza canadensis	S	X				
	Epilobium angustifolium	S	X				
	Fraxinus pennsylvanica	S			X		X
	Helianthus tuberosus	S				X	
	Oenothera biennis	S	X				
	Ostrya virginiana	S	X				
	Polygonum amphibium	S	X				
	Polygonum lapathifolium	S	X				
	Prunus pumila	S				X	
	Rubus allegheniensis	S	X			X	
	Rubus idaeus	S	X			X	
	Rudbeckia hirta	S	X	X			
	Sagittaria latifolia	S	X			X	X
	Taraxacum officinale	S	X			X	
	Tilia americana	S			X		
	Typha latifolia	S	X		X		X
	Ulmus americana	S	X				
	Ulmus rubra	S	X		X		
	Urtica dioica	S	X		X		
	Verbascum thapsus	S	X				
	Zanthoxylum americanum	S	X				
Delaware	Achillea millefolium	S	X				
	Aesculus glabra	S	X				
	Ambrosia artemisiifolia	S	X				
	Asclepias incarnata	G	X				
	Asclepias stenophylla	G	X				
	Asclepias syriaca	G	X				
	Asclepias tuberosa	S	X				
	Asclepias verticillata	G	X				

	Asclepias viridiflora	G	X				
	Asclepias viridis	G	X				
	Celastrus scandens	S	X				
	Cercis canadensis	S	X				
	Daucus carota	S	X				
	Fraxinus americana	S	X				
	Gleditsia triacanthos	S	X				
	Juglans nigra	S	X				X
	Juniperus virginiana	S	X				
	Lobelia cardinalis	S	X				
	Menispermum canadense	S	X				
	Ostrya virginiana	S	X				
	Phytolacca americana	S	X				
	Platanus occidentalis	S	X				
	Populus deltoides	S	X				
	Prunella vulgaris	S	X				
	Prunus persica	S	X				
	Quercus velutina	S	X				
	Rubus allegheniensis	S	X				
	Rumex crispus	S	X				
	Sambucus canadensis	S	X				
	Taraxacum officinale	S	X				
	Typha latifolia	S	X				
	Ulmus americana	S	X				
	Verbascum thapsus	S	X				
	Viburnum prunifolium	S	X				
	Zanthoxylum americanum	S	X				
Pawnee	Acer negundo	S				X	
	Amorpha fruticosa	S					X
	Artemisia ludoviciana	S			X		
	Asclepias syriaca	S				X	X
	Baptisia bracteata	S	X				
	Celtis occidentalis	S				X	
	Chenopodium album	S				X	X
	Cornus amomum	S					X
	Cucurbita foetidissima	S	X				
	Dalea candida	S	X				
	Dalea purpurea	S	X		X		
	Desmanthus illinoensis	S	X				X
	Echinacea angustifolia	S	X				
	Euphorbia marginata	S	X				
	Fragaria virginiana	S				X	
	Fraxinus pennsylvanica	S					X
	Glycyrrhiza lepidota	S	X				
	Grindelia squarrosa	S	X				
	Gymnocladus dioicus	S	X			X	
	Helianthus annuus	S	X				
	Helianthus tuberosus	S				X	
	Ipomoea leptophylla	S	X				
	Juglans nigra	S		X		X	
	Juniperus virginiana	S	X				X
	Linum lewisii	S				X	
	Lobelia cardinalis	S	X				
	Lomatium foeniculaceum	S	X				
	Maclura pomifera	S					X
	Mirabilis nyctaginea	S	X				

	Oxalis stricta	S				X	
	Oxalis violacea	S	X			X	
	Physalis heterophylla	S				X	
	Phytolacca americana	S					X
	Populus deltoides	S		X		X	X
	Prunus americana	S			X	X	
	Prunus pumila	S				X	
	Quercus macrocarpa	S				X	X
	Rhus glabra	S	X				X
	Rosa arkansana	S	X			X	X
	Rubus idaeus	S				X	
	Rubus occidentalis	S				X	
	Sagittaria latifolia	S				X	
	Sambucus canadensis	S				X	X
	Silphium laciniatum	S	X			X	
	Tilia americana	S			X		
	Typha latifolia	S	X				
	Ulmus americana	S			X		X
	Ulmus rubra	S	X		X		X
	Urtica dioica	S			X		X
	Yucca glauca	S	X		X		X
	Zanthoxylum americanum	S	X				
	Aster drummondii	G	X				
	Aster ericoides	G	X				
	Aster oblongifolius	G	X				
	Aster sericeus	G	X				
	Aster subulatus	G	X				
	Equisetum hymale	G			X		
	Quercus macrocarpa	G	X				
	Quercus marilandica	G	X				
	Quercus muhlenbergii	G	X				
	Quercus mutabilis	G	X				
	Quercus velutina	G	X				
	Salix amygdaloides	G			X		
	Salix exigua	G			X		
	Salix nigra	G			X		
Meskwaki	Acer negundo	S	X				
	Achillea millefolium	S	X				
	Ageratina altissima	S	X				
	Ambrosia trifida	S	X				
	Amorpha canescens	S	X				
	Anemone virginiana	S	X				
	Apocynum cannabinum	S	X		X		
	Artemisia ludoviciana	S	X				X
	Asclepias incarnata	S	X				
	Asclepias syriaca	S			X	X	
	Aster ericoides	S	X				
	Carya cordiformis	S	X				
	Celastrus scandens	S	X				
	Celtis occidentalis	S	X			X	
	Cephalanthus occidentalis	S	X				
	Chenopodium album	S	X				
	Comandra umbellata	S	X				
	Conyza canadensis	S	X				
	Dalea purpurea	S	X				

	Desmodium illinoense	S	X				
	Echinacea angustifolia	S	X				
	Euphorbia corollata	S	X				
	Fragaria virginiana	S				X	
	Fraxinus americana	S	X		X		
	Galium aparine	S	X				
	Geranium maculatum	S	X				
	Gleditsia triacanthos	S	X				
	Gymnocladus dioicus	S	X			X	
	Helianthus grosseserratus	S	X				
	Hypericum punctatum	S	X				
	Juglans nigra	S	X	X		X	
	Juniperus virginiana	S	X				
	Laportea canadensis	S	X		X		
	Lespedeza capitata	S	X				
	Liatris punctata	S	X				
	Lobelia cardinalis	S	X				X
	Lycopus americanus	S	X				
	Mirabilis nyctaginea	S	X				
	Monarda fistulosa	S	X				
	Morus rubra	S	X				
	Oxalis stricta	S		X		X	
	Parthenocissus quinquefolia	S	X				
	Penthorum sedoides	S	X				
	Physalis heterophylla	S	X			X	
	Physalis virginiana	S	X			X	
	Platanus occidentalis	S	X				
	Polygonatum biflorum	S	X				
	Polygonum amphibium	S	X				
	Polygonum pensylvanicum	S	X				
	Polytaenia nuttallii	S	X				
	Prunus americana	S	X			X	
	Quercus macrocarpa	S	X				
	Quercus velutina	S	X				
	Ranunculus abortivus	S	X				
	Rhus glabra	S	X	X		X	
	Rubus allegheniensis	S	X			X	
	Rubus idaeus	S	X				
	Rubus occidentalis	S				X	
	Sagittaria latifolia	S				X	
	Sambucus canadensis	S	X			X	X
	Silphium integrifolium	S	X				
	Silphium laciniatum	S	X				
	Sisyrinchium campestre	S	X				
	Solidago rigida	S	X				
	Solidago speciosa	S	X				
	Taraxacum officinale	S	X			X	
	Tilia americana	S	X		X		X
	Tradescantia occidentalis	S	X				
	Triodanis perfoliata	S	X				X
	Triosteum perfoliatum	S	X				
	Typha latifolia	S	X		X		
	Ulmus americana	S	X				
	Ulmus rubra	S	X		X		
	Verbena urticifolia	S	X				

	Viburnum prunifolium	S				X	
	Zanthoxylum americanum	S	X				

1. Taxonomy used in this report are based on the National List of Scientific Plant Names (USDA 1992).
2. G indicates that plant use only documented a the Genu level in the literature review. S indicates that plant use documented at the Species level in the literature review.

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