

FLORISTIC INVENTORY OF FORT LARAMIE NATIONAL HISTORIC SITE



Prepared for
Northern Great Plains Inventory Program
National Park Service
and
Fort Laramie National Historic Site
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ABSTRACT

Fort Laramie National Historic Site (FOLA) is a landmark of western history. It lies at the confluence of two major rivers, the North Platte and the Laramie, which were Rocky Mountain travel corridors and gateways to natural resources for traders, military personnel, settlers, and Native Americans alike. For all of the research on the local and regional human history and vast natural resources of the Rocky Mountains there had not been systematic documentation of natural resources as represented by the flora and fauna at many of the parks and historic sites administered by the National Park Service (NPS), such as FOLA.

Baseline floristic inventory at FOLA was identified as a priority by the NPS under the Inventory and Monitoring initiative. Existing floristic information was earlier compiled and interpreted from vascular plant collections made in FOLA (Fertig 2001). From these data, a total of 177 plant species were reported. This represented 26.7% of the Goshen County flora known at that time. An additional 182 plant species were inferred as likely to be present because they were known from elsewhere in the county and occupied habitats similar to those found at the FOLA.

Systematic floristic surveys conducted at FOLA from June 2003 – September 2004 more than doubled the documented flora to 376 species with the addition of 201 species (114% increase). The majority of the additions were among those that had been inferred as likely to be present. However, these included one new addition to the state flora, a watercress (*Nasturtium microphyllum*), and 23 additions to the county flora. The FOLA flora represents 53.6% of the revised Goshen County flora

At the start of the project, there were five Wyoming plant species of concern reported from FOLA (Fertig 2000). Three of these proved to be invalid because they were later determined or interpreted to be collected outside FOLA boundaries. However, four additional Wyoming species of concern and one of the rare species collected outside FOLA boundaries were documented inside the FOLA study area during systematic floristic surveys, signifying a total of seven verified state species of concern. Riparian habitat harbors six of the seven Wyoming species of concern at FOLA, as well as the species addition to the state flora. In addition, thorough surveys were conducted for two federally Threatened species of riparian habitats, which were not found.

The previous evaluation of floristic completeness is revisited, information is presented on all documented species, with special emphasis on Wyoming plant species of concern, and a select set of remaining floristic tasks are recommended for consideration. The baseline floristic information provides a management reference, biogeographic reference, and a natural history reference befitting the rich human history.

Front cover photos:

A landscape of sand sage, sand dropseed and prickly pear cactus surrounds the infirmary at Fort Laramie NHS, a familiar flora to the original Fort residents.

White prickly poppy (*Argemone polyacanthos*; upper right) was not on the previous floristic checklist and is the only poppy species found. Previous reports of *A. hispida* at Fort Laramie NHS proved false.

Great blue lobelia (*Lobelia siphilitica*; lower right) is among the showiest of the seven Wyoming species of concern that were documented and mapped in detail at Fort Laramie NHS. *Photos by B. Heidel.*

ACKNOWLEDGEMENTS

The floristic work in this report has a strong foundation in prior work at Fort Laramie National Historic Site (FOLA) conducted by the Rocky Mountain Herbarium and lead by B. E. Nelson. The floristic information and prior rare species information was compiled by Walter Fertig of the Wyoming Natural Diversity Database (WYNDD), including the documented flora, the rare flora components, and a preliminary evaluation of floristic completeness. These complementary efforts provided a sterling framework for this investigation.

The professional contributions to this project that were made by Robert Dorn in the field and in the herbarium are priceless. He also provided critical reviews of this report in draft form.

The help and support of Tammy Benson, Dan Licht, and Ted Benson of the National Park Service; and Amy Symstad of the U.S. Geological Survey, are acknowledged with special gratitude. The interest and helpfulness of all FOLA staff are greatly appreciated.

Technical expertise with maps and digitizing was provided by Joy Handley and Tessa Dutcher (WYNDD), George Jones (WYNDD) provided background FOLA information, and Luanne Lum assisted and persisted on the first collecting trip.

Access to the plant collection repository in the University of Wyoming (UW) - Department of Renewable Resources (Laramie, WY) was provided by Quentin Skinner and Dan Rodgers. Neil Snow provided a preliminary review to determine if there are FOLA specimens collected by Olmsted and Perez (1986) on hand in the Department of Biological Sciences at the University of Northern Colorado (Greeley, CO). The facility and resources of the Rocky Mountain Herbarium at the University of Wyoming (Laramie, WY) are acknowledged with gratitude, along with the help in procuring herbarium supplies, and the help of B.E. Nelson in providing his 1994 collection label information. This work represents the contributions of many while any shortcomings rest with the author.

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INTRODUCTION

Fort Laramie was at the crossroads of a nation moving westward, and was operated as a trading post and military fort from 1834-1890. The National Park Service (NPS) established Fort Laramie National Monument in 1938 to preserve the fort grounds and vicinity. The National Park Service established Fort Laramie National Historic Site (FOLA) in 1960 to preserve this landmark of western history and its immediately-surrounding landscape. Now, under congressional mandate, each unit of the NPS is developing documentation of its total flora and fauna at or exceeding the 90% level of completeness (USDI National Park Service 2001). Such an effort to systematically document the flora, as addressed in this report, offers a stepping stone in linking the rich human history of Fort Laramie with its rich natural history.

In 2003, Dan Licht (Northern Great Plains Inventory and Monitoring Program of NPS), in coordination with FOLA natural resources staff, contracted the Wyoming Natural Diversity Database (WYNDD) to conduct a floristic inventory of the vascular plant flora on FOLA. The primary goal was to document at least 90% of the vascular plant species occurring at the Historic Site. The four-pronged floristic inventory approach was to address species of possibly overlooked habitats such as riparian habitats or disturbed habitats, species that are most readily identified in spring and fall months outside phenological periods of past floristic work, all sectors of land comprising FOLA, and taxonomic groups that were possibly under-represented as identified in Fertig (2001); including some of the largest families in the state flora: Asteraceae, Brassicaceae, Fabaceae, Poaceae, and Cyperaceae. Voucher specimens were to be collected for each species addition. There were also secondary objectives of recording the location and distribution of species listed as Endangered or Threatened by the federal government and species of concern tracked by the WYNDD. There were additional objectives of characterizing the abundance and habitat of all species in the flora.

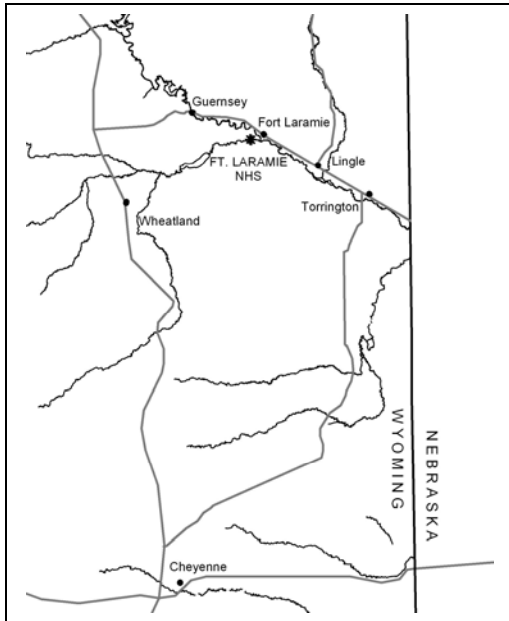
This inventory project and study was designed to provide thorough floristic documentation, including overviews of the flora, the rare species components, and the noxious species. Specifically, it has produced an annotated checklist of the known flora of FOLA, a list of falsely reported species, a list of the predicted species that have not been found to occur, a current occurrence record for each rare plant species documented on FOLA, and Wyoming plant species abstracts produced as an aid in the identification and status review reference for each of the rare plant species documented on FOLA.

STUDY AREA

Fort Laramie was a military post with a history of exploration, trading, Indian wars, pioneer trails, and settlement. The 35,000 acre military reservation was turned over to the Department of Interior and opened to homesteading in 1890. The fort grounds and vicinity were acquired by the National Park Service (NPS) and designated as a National Monument on July 16, 1938, totaling 214 acres. Fort Laramie was later designated as a National Historic Site on April 29, 1960 and expanded to 832.85 acres.

Fort Laramie National Historic Site (FOLA) lies at the confluence of the North Platte and Laramie rivers. It is centered on the historic fort site and encompasses approximately 1.5 miles of the Laramie River valley. It is located less than one mile west of the town of Fort Laramie, between Guernsey and Lingle, in Goshen County of southeastern Wyoming (Figure 1).

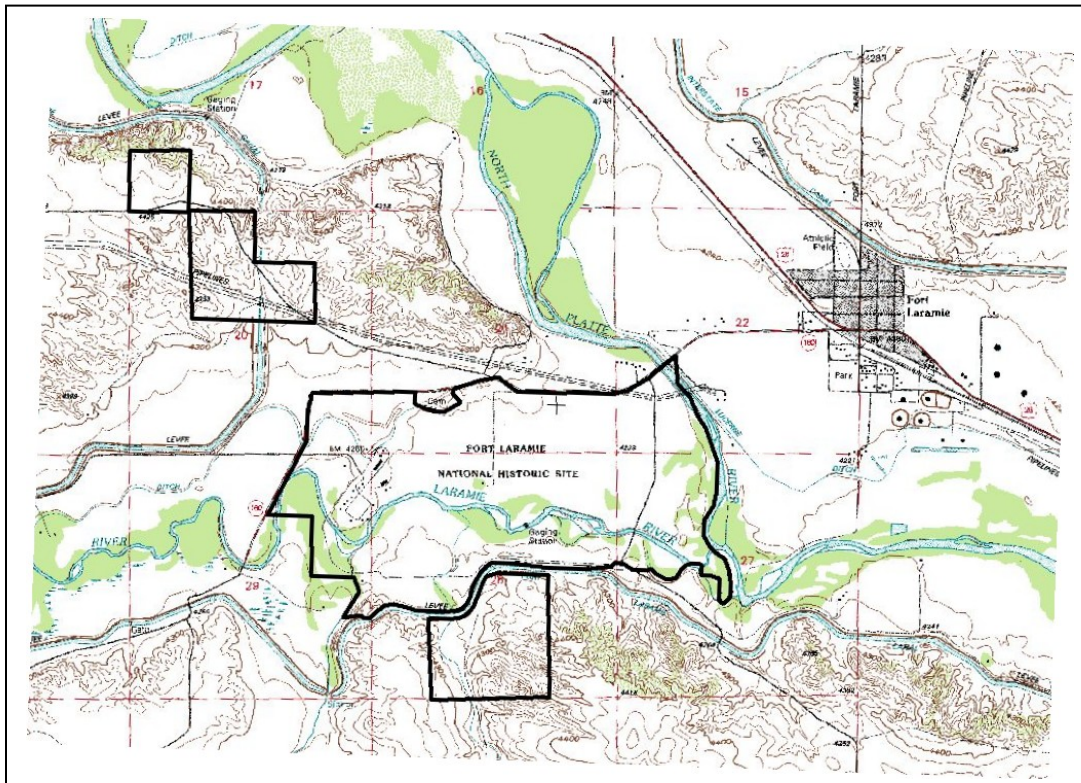
Figure 1. Location of Fort Laramie National Historic Site



The study area also includes approximately 340 acres in two nearby tracts of BLM lands having related historic significance where the National Park Service has law enforcement responsibility. The BLM tracts lie to the north and south of the designated historic site, and only the northern BLM tract has public access. In this report, the Fort Laramie NHS study area implicitly includes these BLM tracts unless otherwise stated (Figure 2).

The designated National Historic Site is comprised of valleybottom terrain and low terraces on the Laramie River. The river gradient drops less than 20 feet over its meandered course along the lower Laramie River valley. The two BLM tracts are located higher on opposite sides of the valley from one another. Topographic relief in the study area, spans 230 feet (4210-4440 ft).

Figure 2. Fort Laramie National Historic Site study areas (Fort Laramie Quad; 7.5')

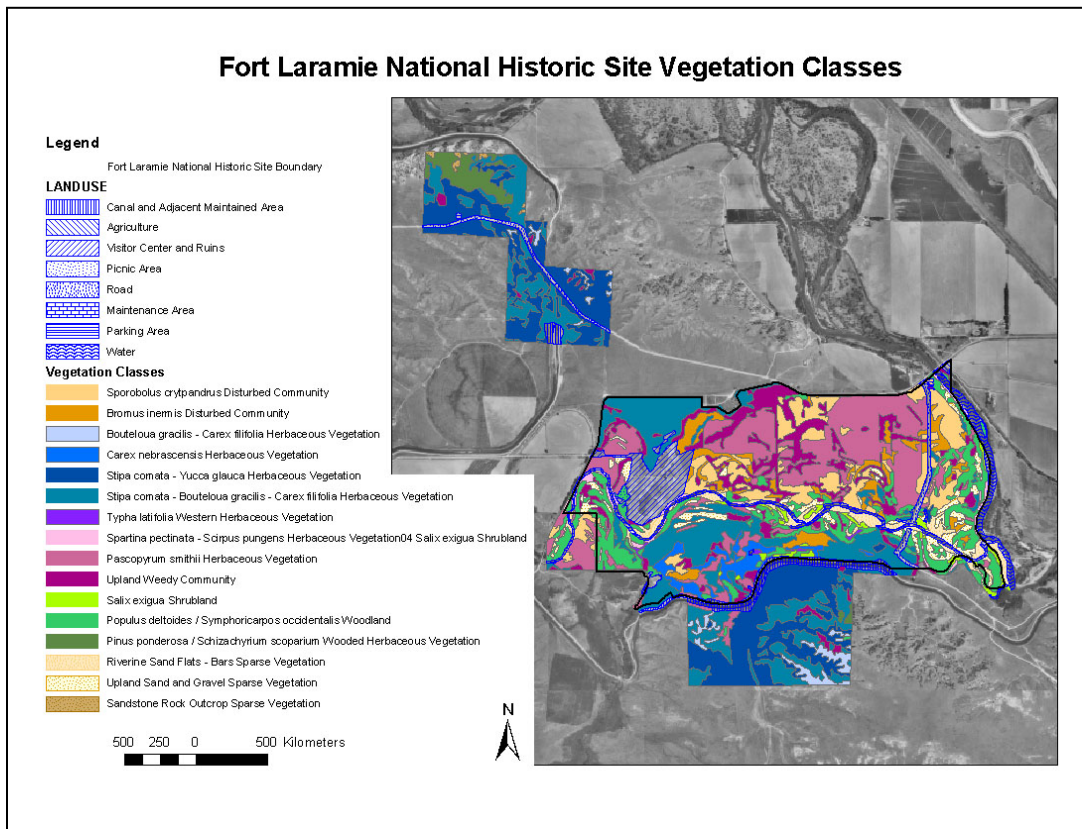


FOLA lies in a physiographic region of unglaciated high plains, shaped by the forces of wind and water erosion. The sedimentary parent material includes unconsolidated Quaternary alluvial deposits in the valley bottom and overlying Lower Miocene and Upper Oligocene sedimentary rocks comprised of soft porous sandstone, underlying white tuffaceous claystone, and siltstone (Love and Christiansen 1985). A mantle of alluvial cobble and outcrops of limestone above the North Platte River add to the upland array.

The climate at FOLA is documented as a continental climate in National Oceanic and Atmospheric records, with accompanying variability and extremes in temperature, precipitation, and growing season duration. The mean annual precipitation is 15.48 inches with highs in May and early summer months (USDI NOAA 2004). While the 2003 and 2004 growing seasons appear to be within the range of typical precipitation conditions, the 2002 growing season had 7.65 inches of precipitation (less than 50% of average annual precipitation), which may have affected conditions the following year.

FOLA lies in the shortgrass prairie zone of the high plains, dissected by gallery forests along river ways. Current FOLA vegetation is presented by The Nature Conservancy (1997) that produced a GIS map (Figure 3) and vegetation description of 16 vegetation types. Of the 16 vegetation types, six are grass-dominated types of prairie or steppe, four are graminoid-dominated wetland types, three are grass-dominated disturbed types, two are woodland types and one is a shrubland type. The results of this mapping have been cross-referenced to FOLA management objectives for weed control and wetland management (Jones and Tebben 2002).

Figure 3. Fort Laramie National Historic Site vegetation classes (The Nature Conservancy 1997)



Two earlier vegetation studies were conducted on FOLA that helped set the stage for more recent work. Vegetation sampling was conducted by Olmsted and Perez (1986) to characterize the array of vegetation, consider historical conditions, and develop management zones. Vegetation sampling was also conducted earlier by Davis (1959) in three relict areas within the original Fort Laramie National Monument boundaries.

One cannot consider the vegetation of FOLA apart from its human history and vegetation dynamics. The history of the trading post and military fort are highlighted from a natural history perspective by Davis (1959) within the original 214 acre national monument boundaries, and by Olmsted and Perez (1986) for the expanded national historic site in its current boundaries. The later, expanded boundary includes areas with a history of homesteading and cultivation, canal constructions, and areas placed in winter grazing use by NPS horses. Two of the three NPS areas regarded as relict areas (Davis 1959) were apparently disked or plowed since they were studied. The BLM tracts are part of much larger grazing allotments with their own history. In general, information on idle conditions, old field plantings, horticultural plantings, restoration plantings, vegetation succession and accidental weed introductions and encroachments are sketchy or wanting. The original disturbance regime of fire and grazing and their altered states were considered by Olmsted and Perez (1986). In addition, riparian succession is evident on the Laramie River within FOLA boundaries. The mouth shifted since the 1950 USGS topographic map was printed, promoting upstream channel shifts and new river bar deposits along approximately 0.75 miles of river.

METHODS

Prior Floristic Documentation

The previously-reported flora of Fort Laramie National Historic Site (FOLA; Fertig 2000, 2001) reflected concerted work in the 1990's to document the flora of southeastern Wyoming. In 1993 and 1994, B. E. Nelson of the University of Wyoming's Rocky Mountain Herbarium (RM) visited FOLA over the field season while conducting general floristic surveys of public lands in southeastern Wyoming (Hartman and Nelson 1995, Nelson and Hartman 2001). Most collections were made in the company of graduate students and recent graduates. Nelson's voucher specimens were deposited at the RM and at the FOLA herbarium. Jim Drake of The Nature Conservancy also compiled a brief list of plant species during a vegetation mapping project in 1997 (The Nature Conservancy 1997), and determinations were made by Hollis Marriott.

A rigorous compilation of the known and likely vascular plant flora of FOLA provided the framework to build on previous work. The above-mentioned studies and other historical records were synthesized into a single checklist by Fertig (2000) with minor updates (Fertig 2001); following the taxonomic conventions in Dorn (1992). The 2001 list contained 177 plant taxa, including 5 plants considered "species of special concern" by Wyoming Natural Diversity Database (WYNDD) and 35 non-native species.

Information on the vascular plant species that potentially occur in FOLA but which had not been previously documented was subsequently prepared by Fertig (2001) in a three-step process. First he compared the known FOLA flora with that documented in surrounding Goshen County and eliminated those species that are not typically found in the vegetation types represented at Fort Laramie (The Nature Conservancy 1997). Then, he used the digital range maps available from the RM “Atlas of the Vascular Plants of Wyoming” (www.esb.utexas.edu/tchumley/wyomap/atlas.htm) to eliminate those plant species that were not known from the vicinity of the Park. Finally, using statewide abundance and habitat requirements, as well as his fieldwork familiarity elsewhere in the county, he judged the likelihood of species not known from FOLA occurring in FOLA habitats (Fertig 2001).

The master list of the documented flora (Fertig 2001) was further expanded by NPS staff by incorporating species listed in a vegetation study at FOLA (Olmsted and Perez 1986). However, this report and the species listed in it were not cited in the checklist of known species by Fertig (2001). The report by Olmsted and Perez (1986) was reviewed for purposes of this project and determined that these investigators did not report collecting vouchers, did not use Wyoming floristic references, and did not compare results against Wyoming references. The curator of the herbarium at the University of Northern Colorado was consulted, and there are no vouchers deposited by these investigators from FOLA (Neil Snow, personal communication 2004). By the guidelines that were provided in this study project, species listed in this report were excluded from the list of confirmed species, and were instead treated as potentially occurring there in addition to those judged likely by Fertig (2001) for consideration during fieldwork.

The NPSpecies dataset for FOLA that was provided at the onset of this project also included synonyms of species already in the database for FOLA, an artifact of differences in taxonomic nomenclature and incomplete taxonomic review of the list. There were 193 taxa in the NPSpecies dataset for FOLA that we were conveyed as reference, of which 15 were unvouchered or synonyms with species already included. Therefore, review of the list was needed before fieldwork to eliminate synonymy and critique which species were actually vouchered. The master list used at the start of this project contained 178 plant taxa. It included one species, *Verbesina encelioides*, that was collected by Nelson but had not been included in the checklist compilation (Fertig 2000, 2001) for a total of 178 plant taxa that were considered vouchered prior to the start of this project. It also included one hybrid in the barley genus, *Hordeum x caespitosum*.

The family name was added for each species in the conventions of Weber (1982) for quick cross-reference. Family nomenclature used in this report is slightly revised from that in the NPSpecies database, following the family nomenclature presented in Dorn (2001) as revised from the previous edition (Dorn 1992).

The previously-documented floristic information was not reviewed prior to fieldwork, but in select cases the label data for FOLA vouchers on file at RM were reviewed after fieldwork. For example, the collection of *Argemone hispida* was checked because only *A. polyanthemus* could be found in the field. In this case, the original specimen was determined as *A. polyanthemus* but a small error in data entry for the specimen resulted in an incorrect species entry. So the collection of *A. polyanthemus* that was made in this study did not represent a new addition but an edit to the

original list. Three other corrections to the original list were made. In the case of *Sambucus canadensis*, it was determined in a consultation with B.E. Nelson that he collected it immediately outside FOLA boundaries. In the case of *Eustoma grandiflorum*, the extensive surveys and collecting in intact riparian study area habitats gave reason to expect that the species had also originally been collected outside FOLA boundaries. In addition, Robert Dorn provided information from conversation with Steve Kettler, who originally collected *Sorghastrum nutans* in the vicinity, that his collection station was outside FOLA boundaries (Robert Dorn, personal communication 2004). Thus, the master list of previously-documented species was edited for these latter three cases and reduced to 175 species as representing the actual prior floristic documentation. This sum of 175 species is the number used for comparison with the 2003-04 inventory results, even though we originally assumed there were 178 vouchered species known from FOLA.

The floristic data presented in Fertig (2000, 2001) was assumed to represent the previously documented flora. As part of this project, the 1994 collection data from records of B.E. Nelson were incorporated so that there are voucher specimens on record for reference and any future examinations. However, there are seven species reported by Fertig (2000, 2001) that were not on the 1993-94 collection records of Nelson or otherwise stored at RM. All seven were reported in recent vegetation sampling (The Nature Conservancy 1997), they were assumed to be part of the documented flora during 2003-04 inventory, and they were observed to be widespread. There are not voucher specimens of the seven species at RM but it is possible that they are stored at FOLA. The sum of 175 species was retained as the number used for comparison with the 2003-04 inventory results despite the question on seven of these species.

After the completion of fieldwork, the author learned of 140 plant species reported at FOLA in 1958 said to be collected as part of a vegetation study of three relic areas for a thesis (Davis 1959) within the original 214 acre national monument. Specimens were said to be deposited at what had been the UW Sub-department of Range Management. The species list in Davis (1959) was compared with the results from this study and 13 species were on it that are not on the current checklist. Those 14 species were sought in the plant collections repository at what is now the UW Department of Renewable Resources (UW-DRR). Only two of the additions to the FOLA flora were found. There is not a catalogue of specimens at this facility so it is not possible to know whether the other 13 species were actually vouchered or if the collections were transferred out of the repository. Most of the species in the thesis checklist are common prairie species, but two of the plant species, many-flowered gromwell (*Lithospermum multiflorum*) and Andean prairie clover (*Dalea cylindriceps*) are Wyoming species of concern and the latter is vouchered by a specimen collected at FOLA in 1949. It appears that the two primary relict areas were disked or plowed, so all 13 of the species reported by Davis (1959) are placed on a list of species of undetermined status because even the two vouchered species may no longer be extant. In addition, one of the 13 species, a blazing star (*Mentzelia chrysantha*), is not in the state flora and other specimens in the UW-DRR plant collections repository identified to *M. chrysantha* from Wyoming were misidentified.

The species listed in Olmsted and Perez (1986) were not placed on a list of species of undetermined status because there was no indication that voucher documentation was part of methods, or that the resulting list produced using a Colorado floristic reference was double-

checked for reasonableness with what was known for the Wyoming flora at the time. All species reported by Davis (1959) or by Olmsted and Perez (1986) that have not subsequently been documented with voucher specimens are placed on a separate list of species that were inferred or that may be falsely reported in FOLA (Appendix C).

Survey Methods

Surveys were planned around four sets of criteria, seeking to collect plants that are identifiable especially early and late in the growing season, to collect plants within the 16 vegetation types, to seek out plants from under-represented taxonomic groups, and to collect plants from each sector of land within the study area. In addition, plant surveys and collecting were conducted in potential habitat for the five species of concern as identified in Fertig (2000). Concerted surveys were conducted by Robert Dorn (consultant), on 14 partial or full days, focusing on species-rich areas and under-represented taxonomic groups, while six full days and other partial days of WYNDD surveys were conducted by Bonnie Heidel (WYNDD) to survey rare species targets, conduct stratified sampling in the array of vegetation types, and conduct survey in all sectors of land.

Table 1. Dates of Floristic Inventory at Fort Laramie National Historic Site

Month, Day(s) and Year	Investigator(s)
June 5, 2003	Robert Dorn
July 17-19, 2003	Bonnie Heidel and Luanne Lum
Aug. 28, 2003	Robert Dorn
Sept. 4-5, 2003	Bonnie Heidel and Amy Symstad
Oct. 1, 2003	Robert Dorn
May 27, 2004	Robert Dorn
May 27-28, 2004	Bonnie Heidel and Ted Benson
July 8, 10-11, and 29, 2004	Robert Dorn
August 4, 2004	Bonnie Heidel
August 12, 17, 24 and 27, 2004	Robert Dorn
20 September, 2004	Robert Dorn

All floristic results were cross-referenced noting whether species are native or non-native (Fertig 1999), planted (includes both native and non-native species), noxious weeds (Wyoming Department of Agriculture 2003), or Wyoming species of concern (Keinath et al. 2003). For surveys of species of concern, sensitive plant survey forms were filled out and GPS reference points were taken, marked on maps, and photographed.

The floristic reference routinely used in the field was Dorn (2001), with use of the Great Plains Flora Association (1986) for more detailed information, other select floras for the sedges (Johnston 2001, Hurd et al. 1998) and limited use of other references (e.g., Hitchcock and Cronquist 1973). Plant identifications were generally made in the field to the finest level (species level for most taxa, but recognizing varieties and subspecies when more than one is present in Wyoming), and field identifications were cross-checked after the field season.

Finally, the species were cross-referenced as to which of the 16 vegetation classes they occur in, and at what frequency (abundant, common, uncommon, rare). This cross-referencing was based on the local pattern of distribution at the collection site, on notes taken during surveys, and in limited cases, on the vegetation sampling data presented in USDI Geological Survey (1998) and in the original vegetation sampling information (The Nature Conservancy 1997).

Voucher specimens were generally collected in duplicate. About 275 collections were made, including about 100 by Robert Dorn. Effort was made to minimize overlap with the previous checklist and between investigators. The original material is deposited at FOLA, and duplicate material is on loan to RM.

Labels for specimens collected by the author were prepared in “plabel” software used at RM, following the taxonomic conventions currently used at RM (Nelson and Hartman 1994). These taxonomic treatments differ in some cases with the current flora (Dorn 2001) and with NPSpecies as represented by the Integrated Taxonomic Information System (IT IS) Database. Labels for specimens collected by Dorn were prepared on word processor using the most current taxonomic treatment in the state (Dorn 2001). Therefore, the nomenclature represented on labels differs between investigators, so all scientific names are cross-referenced in an electronic file that accompanies this report following all three treatments for ease of reference and maximum utility and the taxonomic conventions used in this report are written in by hand on specimens submitted to FOLA in cases where treatments differ.

Documentation of the planted flora was not among the original objectives, but the paucity of planted species in this historic site is part of its historic authenticity, and planted species were documented as encountered. We did not inventory a grassland planting tract with restoration underway that is immediately east of the fort grounds, but were provided a list of the native species in the seed mix by Ted Benson (NPS). Species on the plant materials list for this planting are cross-referenced as species of uncertain status in Appendix C, and were not sought.

The thesis by George Davis (1959) was reviewed after all fieldwork was completed, and it indicated that the very first collections at FOLA were made by Davis or A.A. Beetle, his advisor. Preliminary investigation of the plant collection repository in the US-DNRR (Laramie, WY) was made for all species reported in this thesis but not found during the survey. The results are incorporated in results, but this review was not done systematically for all 140 species reported by Davis (1959) as such a review was not possible to initiate in the last month of the project.

RESULTS

Floristic Documentation

Systematic floristic surveys conducted at Fort Laramie National Historic Site (FOLA) in this project doubled the documented flora from 175 to 376 species, an addition of 201 species (114% increase). This represents an increase from 50 families to 64 families (or 68 families, following the revised family treatment in Dorn 2001 that splits up the Lily Family). More than one variety is present of two species, so that there are actually 374 taxa at the species level and two additional varieties. The caveat “or variety” is omitted in most places of this report for brevity.

The records for each documented species or variety in this project and in the 1994 work are presented in Appendix A and include family, scientific name, collector initials, collection number and year. This is followed by a cross-reference indicating which species are rare, planted, noxious, or non-native in general. The documented or observed presence of each species on NPS-administered and on BLM lands during the 2003-04 inventory is noted, and additions to the Goshen County flora are indicated. Finally, there is a cross-reference of information on species frequency by habitat. Appendix A is organized by species, and Appendix B, listing only the scientific name, is cross-referenced by family for direct comparison with Table 1 in Fertig (2001). Electronic copies of this information are provided that cross-reference scientific names as used in the NPSpecies database, Dorn (2001), and RM; along with a common name. This synonymy reference is needed to incorporate the results in the NPSpecies database, and to relate the herbarium labels of the author's collections (produced following RM conventions) and the labels of Dorn collections (produced following Dorn 2001 conventions) with the NPSpecies database. Mounted voucher specimens with collection labels, and the primary fieldbook used for note-taking are also submitted as products.

There are 26 additional species identified for documentation follow-up at FOLA, with varying degrees of certainty or uncertainty that they are present (Appendix C). The tally of results as presented in Appendix A does not include at least two species that were observed but not collected. It also omits thirteen of the species reported by Davis (1959) that were not found in the course of this inventory. Among them are two species that were collected by Davis and by Beetle from FOLA that are stored in the plant collection repository at the UW-DNRR. They are not included in the checklist because the two species may or may not be extant. The collecting at FOLA by Beetle and Davis was done over 40 years ago in an area adjoining the historic fort site that has subsequently been plowed or disked. The list of species for follow-up also includes three preliminary determinations with inadequate material for positive determination, including a planted shrub or small tree that appears to be a cherry (*Prunus* spp.). The 26 species of uncertain status represent less than 10% of the total number of species reported in this study (376 species). However, there are seven species reported in the previous checklist (Fertig 2000, 2001) that are not vouchered at RM. Either they are at FOLA or they are not vouchered at all. They are treated as vouchered species based on interpretations and assumptions in place at the start of this project, and observations during the project. If they are included among the status uncertain set, instead, then they further contribute to the case for small-scale fieldwork follow-up as warranted in order to state with confidence that 90% of the flora is documented.

In final steps of specimen review and determination, specimens of closely-related species and varieties were checked. Corrections or annotations were made in specimen determinations. In a few cases, specimens collected at FOLA in 1994 were checked and one data entry edit and a specimen annotation resulted for the original floristic collections. The variety of a ragwort, *Senecio spartioides* was annotated from *S. spartioides* var. *spartioides* as reported in Fertig (2000, 2001) to *S. s.* var. *fremontii*. The entry for rough prickly-poppy (*Argemone hispida*), as reported in Fertig (2001), was determined to represent a data entry error for a record of white prickly-poppy (*A. polyanthemos*). These changes do not affect the original number of species reported from FOLA (Fertig 2000). They just modify the contents slightly and reduce the number of species claimed as additions to the flora in this project accordingly.

Rare Species Documentation

Two Wyoming species of concern were known at the start of this project, slender false-foxglove (*Agalinis tenuifolia* var. *parviflora*) and Great blue lobelia (*Lobelia siphilitica*). Five more were added (Table 2). In addition, a regional endemic, alpine feverfew (*Parthenium alpinum*) was documented at the eastern limits of its range. This species has its center of distribution in Wyoming and has long been tracked as a species of concern by WYNDD. However, it is now known from 47 extant occurrences in Wyoming, and is no longer tracked as rare in Wyoming (Heidel and Handley 2004). Only one of the seven Wyoming species of concern and the alpine feverfew are located on BLM tracts. The other species of concern are on NPS-administered land along the Laramie River and Deer Creek tributary.

The distribution of each rare species has been mapped onto digital orthophotographs. A composite distribution map showing the general distribution patterns of the riparian rare species is represented in Figure 4. The shapefiles are conveyed with electronic copies of this report. The collection and survey information available for each species is presented in Appendix D. New FOLA information updates or expands the understanding of these species' distribution and conservation status in Wyoming. State plant species abstracts are being created or updated as a result, to be posted on the WYNDD homepage (<http://www.uwyo.edu/wyndd>). Photographs taken in FOLA will be incorporated into the state plant species abstracts. The example of a state species abstract for slender false-foxglove (*Agalinus tenuifolia* var. *parvifolia*) is presented in Appendix E.

Table 2. Wyoming species of concern at Fort Laramie National Historic Site

Name	Common Name	Global rank/ State rank ¹
<i>Agalinus tenuifolia</i> var. <i>parviflora</i>	slender false-foxglove	G5T4/S1
<i>Cyperus acuminatus</i>	short-point flatsedge	G5/S1
<i>Cyperus bipartitus</i>	shining flatsedge	G5/S1
<i>Euphorbia hexagona</i>	six-angle spurge	G5/S1
<i>Lipocarpa drummondii</i>	dwarf bulrush	G5/S1
<i>Lobelia siphilitica</i>	great blue lobelia	G5/S1
<i>Sorghastrum nutans</i>	Indian grass	G5/S1

¹ **Heritage Ranks:** WYNDD uses a standardized ranking system originally developed by the Nature Conservancy and its network of natural heritage programs (now called NatureServe) to assess the global and statewide abundance and the probability of extinction of each plant and animal species, subspecies, and variety. The global and state-rank codes are as follows:

- G Global rank: rank refers to the rangewide status of a species.
- T Trinomial rank: rank refers to the rangewide status of a subspecies or variety.
- S State rank: rank refers to the status of the taxon in Wyoming. State ranks differ from state to state.

Each taxon is ranked on a scale of 1-5 from most vulnerable to extirpation to least.

- 1 Critically imperiled because of extreme rarity (often known from 5 or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.
- 2 Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.
- 3 Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).
- 4 Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
- 5 Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.

Three Wyoming species of concern reported from the original FOLA checklist (Fertig 2000) are now re-interpreted to have originally been collected outside FOLA boundaries:

- Common elderberry (*Sambucus canadensis*) had been collected outside FOLA boundaries according to the collector (B.E. Nelson, personal communication 2004). Note: It was subsequently dropped from the Wyoming plant species of concern list because it is generally an accidental escape from horticultural material in Wyoming.
- The location of the showy prairie-gentian (*Eustoma grandiflorum*) collection made in 1959 was not known to the nearest section, and the surveys conducted during this study in intact riparian habitat lead to the interpretation that it was probably collected outside of current FOLA boundaries.
- The location of the Indiangrass (*Sorghastrum nutans*) collection was not recorded on the collection label to the nearest section, but the collector later relayed precise location information through Robert Dorn indicating it was outside FOLA boundaries (Robert Dorn, personal communication 2004). The absence of this species on FOLA was noted by Davis (1959) and Olmsted and Perez (1986) because it was among the species collected in the Fort Laramie vicinity by Captain John C. Fremont in 1842. This is the only one of the three species that was subsequently found inside FOLA boundaries in this project. It is present on riverbanks, and in low numbers.

Three additional Wyoming species of concern were inadequately addressed. Golden prairie-clover (*Dalea aurea*) was collected in 2003 on or near a border of the BLM tract after fruit had ripened and fallen. The specimen is submitted to FOLA for reference, but is not included in the flora until a voucher in fruit or flower is collected for verification purposes and the public land boundary is clarified. This species is known from seven other occurrences in Wyoming and is ranked S2 (imperiled in the state). The validity of this record is unresolved.

Many-flowered gromwell (*Lithospermum multiflorum*) was reported and possibly collected by Davis (1959) in an area of FOLA that has changed since the time of the collection. A voucher specimen could not be found in searching the plant collection repository in the UW-DNRR and the validity of this report is unresolved. This species is known only from one vouchered historic collection in Wyoming and is ranked SH (known only from historical records in the state).

Andean prairie clover (*Dalea cylindriceps*) was collected at FOLA by Beetle (syn. *Petalostemum compacta*) in 1949, likely to have been collected in an area of FOLA that has changed since the time of the collection. This species is known from four other occurrences in Wyoming and is ranked S1 (critically imperiled in the state). The voucher is confirmed, the record has been entered in the WYNDD database, but the question of whether the species is extant is unresolved.

In addition, thorough surveys were conducted for two federally Threatened plant species of riparian habitats, Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*) and Ute ladies-tresses (*Spiranthes diluvialis*). These species were not found despite thorough searching during their flowering periods. The survey information has been added to a running compendium of survey data for these species where they have been sought but not found. This information

was also highlighted in a memo to the National Park Service characterizing the unlikelihood of their presence in FOLA (Bonnie Heidel, personal communication 2004).

Noxious Species Documentation

Only two of the additions to the FOLA flora are noxious weeds. There are eleven noxious weed species documented in total on FOLA, including ten designated by the state of Wyoming (Wyoming Department of Agriculture 2003), and one designated by Goshen County (Table 3).

Table 3. Noxious Species at Fort Laramie National Historic Site

Species	Common name	Report	WY/Goshen Lists
<i>Arctium minus</i>	common burdock	New	WY
<i>Carduus acanthoides</i>	spiny plumeless thistle	New	WY
<i>Carduus nutans</i>	musk thistle	Previous	WY
<i>Cirsium arvense</i>	Canada thistle	Previous	WY
<i>Convolvulus arvensis</i>	field bindweed	Previous	WY
<i>Cynoglossum officinale</i>	common hound's-tongue	Previous	WY
<i>Elymus repens</i>	common quackgrass	Previous	WY
<i>Onopodum acanthium</i>	Scotch thistle	Previous	WY
<i>Sonchus arvensis ssp. uliginosus</i>	marsh sowthistle	Previous	WY
<i>Tamarix chinensis</i>	tamarisk	Previous	WY
<i>Tribulus terrestris</i>	puncture-vine	Previous	Goshen

There are two additional noxious weeds on the list of species for followup (Appendix C). Yellow toadflax (*Linaria vulgaris*; also called “butter-and-eggs”) is a state noxious weed that was reported in FOLA by Olmsted and Perez (1986) but was not found during this survey. Absinth wormwood (*Artemisia absinthium*) is a state noxious weed that may be in the pasture south of the machinery shed but was not collected.

The floristic survey is not an exhaustive weed survey, but indicates that none of the eleven were found to be common or abundant in any of the collection stations or habitats that were surveyed (Appendix A). The array of thistles may be an artifact of grazing history, and the quackgrass (*Elymus repens*) may have been planted or may be an artifact of agricultural land conversions. The areas with high numbers and densities of weeds include the pasture immediately south of the machinery shed and the woodland in the southwest corner of FOLA. There is the potential for increase among the noxious species and at least two of the noxious weed species, tamarisk (*Tamarix chinensis*) and Canada thistle (*Cirsium arvense*), have the potential to invade and dominate river shore habitat occupied by species of concern. These two noxious weeds are provisionally identified as the most serious management concerns consistent with the criteria identified in the invasive species assessment protocol (Morse et al. 2004) because of their ecological impact and management difficulty, particularly as they could dramatically alter the habitat conditions and appearance of the lower Laramie River. Tamarisk is relatively uncommon on the North Platte River and the Laramie River mouth. Dead stumps of tamarisk were noted on the North Platte shore south of the Laramie River mouth, but no signs of control were noted among smaller Tamarisk plants growing at the mouth and among large Tamarisk plants in backwater channels south of the mouth. Canada thistle is uncommon along the wet areas

artificially caused by seepage from the canal, the setting where it could increase greatly and expand into natural riparian habitats.

DISCUSSION

Floristic documentation at Fort Laramie National Historic Site (FOLA) proved to be much more challenging than originally envisioned. There was no single gap in floristic documentation among phenology targets, habitat targets, taxonomic targets, and segments of the landscape. The preparation tasks were also underestimated and the project would have been improved by doing all literature reviews at the onset and consulting with RM personnel and records first. Finally, the history of FOLA land use is incomplete for interpreting the disparities between species reported by Davis (1959) which have not otherwise been vouchered. Despite these challenges, the floristic documentation is robust, the outstanding questions are succinct, and there is a sound management framework for noxious weeds and for rare species.

Floristic Overview

The FOLA study area has a rich flora that complements its designation. FOLA harbors 376 species, representing over 50% of the Goshen County flora of 679 species (Fertig 2004; not including the 20 county flora additions documented in this project). The core of the flora is a Great Plains component but there are significant additions of wetland species on the Laramie and North Platte rivers. There are also significant non-native components that reflect the long history of human occupation, land uses and habitat conversion at FOLA. There are minor contributions among Rocky Mountain and Eastern Deciduous Forest species.

A rich flora does not necessarily equate with a natural landscape because the species diversity is not evenly distributed throughout. Large portions of grass-dominated landscapes in the valley bottom are old fields that were planted into single-species monocultures of introduced grasses. The management objective of maintaining the historical authenticity of the landscape may be met if the countenance of the landscape is a much higher priority than the flora comprising it.

If any native species restoration plantings are pursued in the future, it is recommended that a system of record-keeping be established for any plantings including the species, their source, and the establishment success of each species. It would be appropriate to check the 2003 restoration planting to determine which native species have become established.

The associated BLM tracts provide the largest expanses of unbroken grassland habitat with basically intact landscapes. Less than half of the additions to the FOLA flora collected in this study came from the BLM tracts, but many of the added species are present on the BLM tracts and not within designated NPS boundaries. Even though only four of the 16 vegetation types are restricted to the BLM tracts; these tracts also have differences in substrate, topographic relief, and aspect from the lands within the designated national historic site.

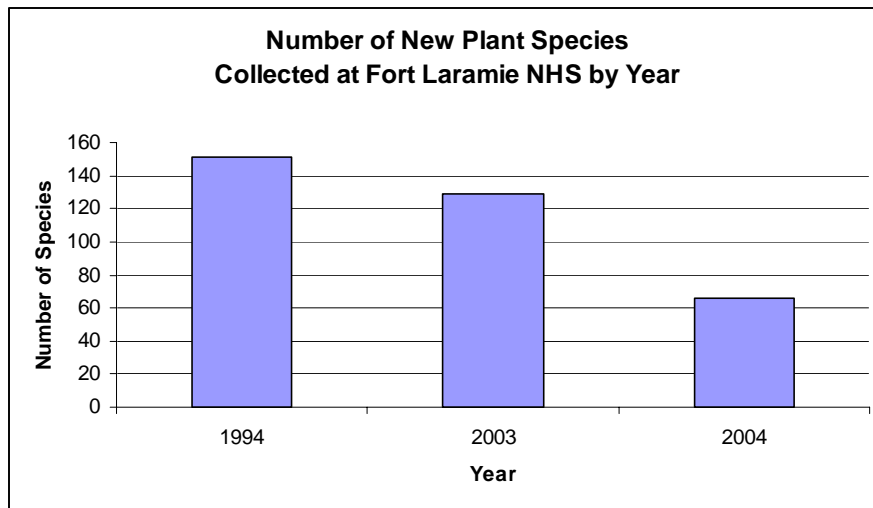
FOLA is ringed on all sides by roads, even though the canal road on the south is not open to the public. Some of the most conspicuous native plants grow in road corridor habitat, including white prickly poppy (*Argemone polyanthemus*) and bush morning glory (*Ipomoea leptophylla*). They contribute to the visitor's initial impressions of the landscape. Thus, road maintenance and

weed control in road corridors is a consideration in maintaining the appearance of the landscape and the visitors' impressions. Only two of the species, purple lovegrass (*Eragrostis spectabilis*) and false salsify (*Scorzonera laciniata*) were found in the Wyoming Highway 160 right-of-way adjoining FOLA and not elsewhere on FOLA (the latter is non-native). In addition, six-angle spurge (*Euphorbia hexagona*) was found to be extensive in the roadside right-of-way along Goshen County Road 236, though it is also in adjoining native rangeland.

Completeness of Floristic Documentation

A graph of the FOLA collection tallies made with each concerted floristic inventory effort is presented in Figure 4. It suggests that the number of new collection records has tapered over time in the years of concerted collecting. The ability to interpret such collection data is limited by the fact that the timing and duration of sampling efforts differed between years. The likelihood of documenting 40 new species in the FOLA flora, signifying a 10% increase, is judged to be low by the author and by Robert Dorn (personal communication 2004). The documented flora includes the seven species cited in Fertig (2000) that do not have vouchers at RM. It does not include the thirteen species reported in Davis (1959) that were not found in this inventory, or thirteen other species that have not been vouchered (including a couple species observed in 2003-04).

Figure 4. Floristic documentation pattern at Fort Laramie National Historic Site



Floristic additions in 2003 were numerous even though the project began in June and missed some early-season species. Results in 2003 may have also been affected by 2002 drought conditions. Under the circumstances, a two-year period for floristic inventory was essential.

The largest families in the previous Fort Laramie flora got larger, led by the Sunflower Family (Asteraceae; 68 species) and Grass Family (Poaceae; 61 species; Table 4). These families had the largest net increases in species per family. The highest proportionate increases in species per family were in families like the Mustard Family (Brassicaceae) and Sedge Family (Cyperaceae) which were poorly-represented in the initial flora.

Table 4. Plant Families at Fort Laramie National Historic Site

Family Scientific Name	Family Common Name	No. of Species in Previous Flora (Fertig 2000)	No. of Species in Current Flora	% Increase
Asteraceae	Sunflower	41	68	66
Brassicaceae	Mustard	3	15	400
Cyperaceae	Sedge	4	17	325
Fabaceae	Bean	9	22	144
Poaceae	Grass	35	61	74

Other important components that bolstered the current flora include the species that are characteristic of phenological extremes (early and late flowering in the growing season), and the species that are obligate or facultative wetland species.

The majority of the additions made to the flora in 2003-04 were among those that had been identified as likely. However, these included one new addition to the state flora, a watercress (*Nasturtium microphyllum*), and 23 additions to the county flora (not including planted species). The current FOLA flora represents 53.6% of the revised Goshen County flora

The method of interpolation as presented by Fertig (2000) might be more aptly referred to as “best professional judgement” or inference, rather than as a prediction or an analysis of the probability of occurrence. He used the relatively well-documented Goshen flora and the FOLA habitat mapping as well as his other field experience in Goshen County to infer which species may be present. The convention of using expert judgement to evaluate floristic completeness based on well-developed county floras is a reasonable tool for making ballpark approximations. The strength of the original inference was supported by this study. The magnitude of additions (201 additions) was close to the predicted magnitude of high-probability species (185) even though at least 70 of the predicted species are not present and some of the species that were documented were not identified as probable.

Rare Species Overview

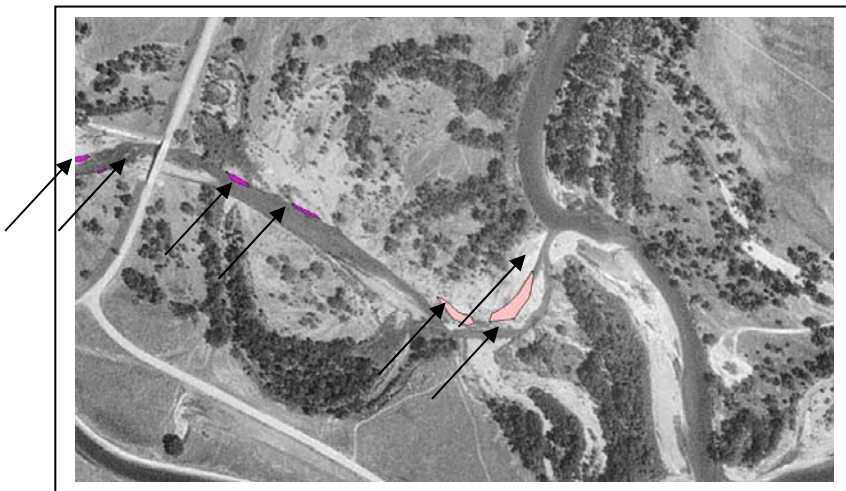
The new information derived from rare species survey at FOLA increased proportionately more than noxious weed documentation or floristic documentation as a result of this inventory, with the addition of five Wyoming species of concern to the two previously-documented species. The seven Wyoming plant species of concern are all Great Plains species or more widespread species of eastern North America at their western limits. Five of the seven occur on no other federal lands in Wyoming.

Six of the seven Wyoming plant species of concern confirmed in the study area occur on the Laramie River, in addition to small outliers on Deer Creek (Figure 5). This signifies a high concentration of rare plant species for the state, especially on riparian habitat and on federal land in high plains of eastern Wyoming. These species span the lowest 1-mile reach of river between its mouth on the North Platte River and the historic fort site. Therefore, there should be a premium placed on maintaining shoreline conditions, water quality, groundwater, and runoff patterns within FOLA boundaries.

Figure 5. Riparian habitat for rare species in Fort Laramie National Historic Site on the Laramie River and Deer Creek (upper river reach; highlighted in color)



Figure 6. Riparian habitat for rare species in Fort Laramie National Historic Site on the Laramie River (lower river reach at its confluence with the North Platte River; highlighted in color)



The viability of these riparian species' populations appears high under current management. However, we did not evaluate the affects of current grazing practices. Moreover, we did not evaluate long-term succession associated with river flows. The quality of habitat on the lower Laramie River may have been fostered by the recent shift in the channel course and accompanying successional changes. The river mouth has moved upstream rather than downstream, as is the norm in unimpeded river systems. Of the six rare riparian species, four are annuals; and species of short life span are all the more strongly affected by riparian succession. Two of the annuals in particular, short-point flatsedge (*Cyperus acuminatus*) and dwarf bulrush (*Lipocarpa drummondii*) are highly restricted to small areas, and are mapped as points.

The seventh species, six-angle spurge (*Euphorbia hexagona*), is restricted to sandy uplands in the northern BLM tract. It occurs in both roadside settings and in native range. It may also require successional conditions. The FOLA survey of six-angle spurge (*Euphorbia hexagona*) was not sufficient to determine whether it might be favored by natural disturbance (e.g., burrowing) or current land management practices (e.g., trampling and trailing along the roadside, and road maintenance practices like blading). If it is locally favored by land use disturbances, and there is reason to expect this pertains to its distribution and status elsewhere in the state, then the species may no longer be tracked on the Wyoming plant species of concern list.

In addition, there are three Wyoming species of concern that are reported from the study area that are included on the list of species for follow-up survey. Golden prairie clover (*Dalea aurea*) probably warrants further survey in June-July, particularly if the BLM study area boundary extends east of the canal road that connects to the North Platte river valley. Survey is warranted for Andean prairie clover (*Dalea cylindriceps*) once land-use history in relict areas I and II is available and aerial photointerpretation is conducted. It was collected in FOLA by Beetle in 1960 and reported by Davis (1959), with a specimen in the plant collection repository at the UW-DNRR. Survey may also be warranted for many-flowered puccoon (*Lithospermum multiflorum*) which was reported FOLA by Davis (1959); though a voucher could not be located. The absence of sand dunes or rolling sand plains in the northwest corner of FOLA, as reported by Davis (1959), and presence of plowed or disked landscape at present, may be the reason the latter two were not relocated in 2003-04 inventory. Background information is needed on NPS management of this area, accompanied by photointerpretation to look for vestiges.

The presence of two other Wyoming species of concern, James nailwort (*Paronychia jamesii*) and annual skeletonweed (*Shinnersoseris rostrata*), is noted in the same township as FOLA or adjoining townships. The information on their habitat requirements is sketchy, so they may warrant consideration if additional botanical surveys are considered in FOLA.

Alpine feverfew (*Parthenium alpinum*) is among the few species in the documented flora that may be globally rare or vulnerable based on the number of occurrences throughout its range (54 populations worldwide; Heidel and Handley 2004). The distribution and extent of some of these in Wyoming has been the basis for removing it from tracking. There are two other species that were once tracked as Wyoming species of concern that are present in FOLA, including rice cutgrass (*Leersia oryzoides*) and American germander (*Teucrium canadense*). They are widespread eastern species at their western limits, and were found to be more common than previously known.

Non-native Species Overview

The number of native species added to the FOLA flora in 2003-04 greatly exceeded the net increase in non-native species (Table 5), although the relative proportion of the non-native species in the net flora increased slightly from 19.7% to 23.1%. This suggests that the non-native flora was previously under-documented. The high proportion of non-native species is entirely consistent with the FOLA history of land use and habitat conversion. For purposes of this tally, the species that are native in Wyoming but present in FOLA only as planted species are included in the non-native tally (e.g.: Colorado blue spruce, *Picea pungens*; and wild plum, *Prunus americana*). Some of the most conspicuous tree plantings are native within FOLA boundaries and are also planted at the historic fort site or along Wyoming Highway 160 within FOLA boundaries (including green ash, *Fraxinus pennsylvanica*., narrow-leaved cottonwood, *Populus acuminata*; and plains cottonwood, *P. deltoides*). These species are recorded as native species in Appendix A.

Table 5. Native and Non-native Species at Fort Laramie National Historic Site (includes planted species)

	No. of Species in Previous Flora (Fertig 2000)	No. of Species in Current Flora	% Increase
Nonnative	35	87	148
Native	140	289	106

The eleven noxious species documented at FOLA include species that are artifacts of habitat conversion (quackgrass, *Elymus repens*) and grazing history (thistles, including *Carduus acanthoides*, *Carduus nutans*, *Cirsium arvense*, *Onopodum acanthium*, and *Sonchus arvensis* ssp. *uliginosus*). Two species are identified as having the potential for serious invasion of native riparian habitat using the standards of the NPS Invasive Species Evaluation (Morse et al. 2004), tamarisk (*Tamarix chinensis*) and Canada thistle (*Cirsium arvense*). Vigilance in surveying for new invaders (e.g.: leafy spurge, *Euphorbia esula*; Dalmatian toadflax, *Linaria dalmatica*; and common toadflax, *Linaria vulgaris*) is needed over the long-term. The paved road system and constraints on driving over the FOLA grounds impedes the introduction of noxious species by most human vectors into the middle of FOLA grounds, but invasion from the perimeter or from non-human vectors are still possible.

Recommendations

The floristic data in this report provides a reference and framework for management planning, research, and interpretive activities that are outside the scope of this project. The new floristic data, preliminary observations, and accompanying remarks that pertain to management are consolidated in this section and in some cases expanded. They are strictly for discussion purposes and further consideration. In addition, there are a couple steps needed to ensure floristic documentation completeness that are included as recommendations.

Six of the seven confirmed Wyoming species of concern within FOLA boundaries are restricted to the Laramie River and mouth of Deer Creek. This places a premium on maintaining water quality, groundwater movements, runoff patterns and shoreline conditions within FOLA boundaries. Any shoreline developments and recreation use in occupied habitat may pose threats.

An established foot trail at the mouth of the Laramie River runs parallel to the shoreline with limited foot traffic to the river or features that funnel foot traffic to the river at present. FOLA riparian habitat may be affected by upstream uses and flow regulation. The small amount of shoreline habitat at the mouth of Deer Creek is affected by a drop-structure at the bridge and by beaver dams and related management, such as recent dam removal efforts.

Is monitoring of rare plant populations warranted? Four of the six rare riparian species are annuals, and it is a challenge to differentiate inherent oscillations from overall trends, particularly when there is no information on the presence or absence of a seedbank. Two of the rare riparian species (short-point flatsedge, *Cyperus acuminatus*; and dwarf bulrush, *Lipocarpa drummondii*) are located at the mouth of the Laramie River in a single patch, and periodic presence/absence monitoring is recommended, perhaps with photopoint documentation. At the other extreme, slender false foxglove (*Agalinis parvifolia* var. *tenuiflora*) occurs in at least thirteen polygons spanning approximately a one-mile reach of shoreline as well as occurring in Deer Creek. The mapping and census of it was done using arbitrarily-placed GPS reference points and a series of estimates throughout occupied habitat. More detailed GPS information that delimits its endpoints and width of occupied habitat is recommended for this successional species to determine if it moves around and occupies the same extent of habitat annually. A 2-year mapping of slender false foxglove (*Agalinis parvifolia* var. *tenuiflora*) is probably more important and practical than getting a thorough census of it in any given year. Shining flatsedge (*Cyperus bipartitus*) is the fourth annual, and is widespread and inconspicuous, hence difficult to monitor effectively. If there is any scouring activity along the Laramie River shoreline, whether from dam releases or ice jams, this is the species that would be most directly affected and in need of monitoring.

There are unanswered questions regarding the two rare perennial riparian species (great blue lobelia, *Lobelia siphilitica*; and Indiangrass, *Sorghastrum nutans*) as to whether they are affected by livestock utilization. Horses graze FOLA late in the season when these plant species are at their peak activity, but horses had been brought in to FOLA only one day before rare riparian species survey was conducted in 2003, so no signs of use were noticed. A preliminary check for grazing of these species (particularly of their seed heads) or trampling is needed to decide whether this warrants any closer look.

Submerged vegetation is an indication of water quality, and the ombrotrophic conditions of the Laramie River were in striking contrast to the eutrophic conditions of the North Platte River as evidenced by water clarity, color, and lack of green algae washed up on shore. Much of the Laramie River is dominated by a pondweed (*Stuckenia filiformis*). This may be an important food source for waterfowl. In addition, *Chara* spp., a nonvascular plant that is particularly robust, is abundant in places and may indicate spring-fed conditions or seeps within the Laramie River. A specimen of *Chara* spp. is included among the specimens of vascular plants submitted to FOLA for reference. In addition, a watercress (*Nasturium microphyllum*) was collected in this project that represents an addition to the flora. It is non-native but restricted to spring-fed waters. It was locally abundant at the mouth of Deer Creek, and may have been affected by efforts to remove a beaver dam on the creek. Quantitative evaluation is needed to set benchmarks for water quality as part of riparian habitat maintenance. It would be of value to document water clarity, water chemistry conditions, and possibly submerged vegetation composition as a baseline.

One of the critical steps for pursuing basic floristic documentation is to reconstruct the management history of the land units identified as relict areas I and II by Davis (1959) in the northwestern corner of FOLA grounds. Davis (1959) described small dunes in the relict areas. These areas were visited on the first day of fieldwork in 2003 by the author and characterized as heavily disturbed. The furrow pattern indicates that they have been plowed or disked since the time of Davis' work. These areas had flat surfaces, without dunes or rolling sand plains. Information on whether they were plowed or disked and review of aerial photographs may indicate whether there are any vestiges or less-disturbed pockets for concerted survey, especially as potential habitat for two Wyoming plant species of special concern that were likely to have been collected in the relicts.

The two BLM tracts included in this inventory contribute significantly to the flora and to the image of the presettlement landscape for visitors. The flora of these BLM tracts included one of the Wyoming species of concern, six-angle spurge (*Euphorbia hexagona*), and one of the noxious weeds, puncture-vine (*Tribulus terrestris*). The distinction between NPS and BLM lands is more than a footnote, but a key criterion for considering what proportion of the Wyoming flora is present on lands with the highest levels of biodiversity conservation protection as found on NPS-administered lands (Gap status 1 or 2; Fertig et al. 2002). Therefore, records of which species were collected on the NPS-administered FOLA unit versus nearby BLM tracts in the 2003-04 inventory were added to Appendix A. The majority of 2003-04 collections were made on the NPS-administered FOLA unit, and there were 301 species collected or observed on this unit. Recording this distinction is identified as an information need for all previous collections.

Roads run along most of the FOLA perimeter and cross the northern BLM tract. The right-of-way along State Highway 160 contains conspicuous wildflowers that contribute to visitor impressions as they approach the FOLA entrance, such as white prickly-poppy (cover photo; *Argemone polyanthemus*) and bush morning glory (*Ipomaea leptophylla*). The right-of-way along Goshen County Road 236 contains a significant part of the six-angle spurge (*Euphorbia hexagona*) population. This species persists under heavy trampling and right-of-way blading, but it is not known whether these practices are favorable or detrimental overall. The only noxious weed collected in right-of-ways was puncture-vine (*Tribulus terrestris*); collected along Goshen County Road 236, where it is confined to the right-of-way. Surveys for noxious weeds in the right-of-ways warrant systematic work and repeated checking.

If any native species restoration plantings are pursued in the future, it is recommended that a system of record-keeping be established for any plantings including the species, their source, and the establishment success of each species. It would be appropriate to check the 2003 restoration planting to determine which native species have become established.

The floristic information collected in this project might be compared with other NPS units in the Great Plains to characterize regional patterns and contributions of the NPS to the regional flora.

Three additional tasks are recommended to double-check the floristic documentation and ensure 90% completeness in meeting the core objectives.

First, each of the seven species listed in Fertig (2000, 2001) for which a FOLA voucher has not been found need to be sought among FOLA specimens and records. These species lacking vouchers at RM have “Fertig 2001” entered under the year of collection in Appendix A. They include: buffalograss (*Buchloe dactyloides*), threadleaved sedge (*Carex filifolia*), needle-and-thread (*Heterostipa comata* var. *comata*; syn. *Stipa comata*), prickly pear cactus (*Opuntia polyacantha*), Kentucky bluegrass (*Poa pratensis*), golden currant (*Ribes aureum* var. *villosum*), and yucca (*Yucca glauca*). All of these species were observed during the 2003-04 inventory. It is possible that there are specimens of these species stored at FOLA. They were reported in vegetation sampling (The Nature Conservancy 1997) by Wyoming botanists. If there are not specimens on hand in FOLA, then they warrant documentation.

Second, the entire FOLA collections of Davis that he made in 1958 need to be sought and verified in the plant collection repository at the UW-DNRR, so that they may be verified and cited. The collections should correspond with the 140 species listed in the Appendix VII list of plants that occurred in his study areas (Davis 1959). Among them were thirteen species in the flora that have not otherwise been documented, and this set was already sought by the author, but only two of the species had supporting vouchers. There may also be additional FOLA collections made by Beetle in the same collection set but not listed by Davis (1959). Unless there are Beetle collections from FOLA that were not reported by Davis, this review would not expand the documented flora; but just provide new data on the earliest collection dates.

The first two tasks will dictate the need for pursuing a third task of additional fieldwork, particularly if all 20 of the species above do not have voucher specimens. This is still less than 10% of the documented flora (37 species). However, when added to the list of 26 species of uncertain status identified in Appendix C, there is a compelling case to conduct a final phase of fieldwork.

Results are submitted by WYNDD to NPS for incorporation in the NPSpecies database, with willingness to consider checklist maintenance support and specimen review to keep it current, in addition to the above-mentioned tasks. The need for and value in collecting voucher specimens and depositing them in a maintained, public repository is evident by the comparative ease of building on fieldwork of B.E. Nelson and on the previous checklist compilations (Fertig 2000, 2001), and the spin-off contributions that this study makes in contributing to an understanding of the state and county floras.

What is the use of a floristic checklist? It provides a framework for restoration planning, for consolidating floristic information from each of the NPS units on the Great Plains to develop an overview of biodiversity conservation by the NPS, and for GAP analysis across states and regions. It provides a time-sensitive representation of landscape conditions and changes, a baseline reference rather than an end in itself. The floristic checklist might be directly used in educating the public; developing coordinated weed control with surrounding landowners; assessing ecosystem health; or developing interpretive materials on the presettlement landscape, rare species, and Native American uses of plants. Finally, it provides a springboard for many other forms of research on the natural history of FOLA and its associated human history.

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APPENDIX

Appendix A. Annotated checklist of the known flora of Fort Laramie National Historic Site

Appendix B. Species that remain to be documented at Fort Laramie National Historic Site

Appendix C. Species of uncertain status at Fort Laramie National Historic Site

Appendix D. Species identified as likely or reported but unconfirmed at Fort Laramie National Historic Site

Appendix E. Wyoming species of concern at Fort Laramie NHS – occurrence records

Appendix F. Wyoming species of concern at Fort Laramie NHS – state abstract example –
Agalinis tenuifolia var. *parviflora*