

28 AUGUST 2023

## **FLORA OF FORT LARAMIE NATIONAL HISTORIC SITE**

**Goshen County, Wyoming**

*Prepared for the USDI National Park Service, Inventory & Monitoring Program  
And Fort Laramie National Historic Site*

Bonnie Heidel

Wyoming Natural Diversity Database

University of Wyoming



## 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 Rivers, which were Rocky Mountain travel corridors and gateways to natural resources for traders, military personnel, settlers, and Native Americans alike. This report addresses the culmination of work documenting the FOLA flora, and the lessons learned.

Baseline floristic inventory at FOLA was identified as a priority by the NPS under the Inventory and Monitoring initiative. The first step was to compile and interpret existing floristic information from earlier vascular plant collections made in FOLA and in the county (Fertig 2001). From these data, a total of 178 plant species were reported. This represented 26.7% of the Goshen County flora known at that time. Systematic floristic inventory conducted at FOLA (2003 – 2004) more than doubled the documented flora (Heidel 2004). Since that time, the flora has been expanded by short visits in favorable years and in under-sampled periods and with online data searches. It has also been cross-checked with specimen data and redefined in sorting between those specimen records that are from the Historic Site versus those only on nearby BLM tracts. There is a current tally of 355 vascular plant species in FOLA in addition to 57 species only known from nearby BLM tracts (Marriott 2022).

The results are represented for ease of access in NPSpecies. This report chronicles the process for robust floristic documentation as it reflects remnant high plains vegetation, a high proportion of nonnative species (33.7%), two species additions to the Wyoming flora (a native and a nonnative species), and a critical resource base for reference in any restoration planting or cultural plants developments. The baseline floristic information provides a management reference, biogeographic reference, and a natural history reference befitting the rich human history.

### Citation:

2023. Flora of Fort Laramie National Historic Site. Prepared for the Northern Great Plains Inventory Program and Fort Laramie National Historic Site. Wyoming Natural Diversity Database, Laramie, WY.

## 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 led by B. E. Nelson. The floristic information and prior rare species information were compiled by Walter Fertig of the Wyoming Natural Diversity Database (WYNDD), later incorporated into the NPSpecies database. These complementary efforts provided an exceptional framework for this investigation.

The professional contributions to this project that were made by Robert Dorn in the field and by Hollis Marriott are priceless.

The help and support of Kara Paintner, Chris Mather, Michael Evans, Alison Loar, Isabel Ashton, Tammy Benson, Dan Licht, and Ted Benson of the National Park Service; and Amy Symstad of the U.S. Geological Survey, are acknowledged with thanks.

The facility and resources of the Rocky Mountain Herbarium at the University of Wyoming (Laramie, WY) are acknowledged with gratitude.

## TABLE OF CONTENTS

INTRODUCTION .....	1
STUDY AREA .....	1
METHODS .....	4
Additional Floristic Documentation in the Field .....	4
Updating and Adding Records to NPSpecies .....	5
RESULTS .....	6
Floristic Documentation Highlights.....	7
DISCUSSION .....	7
REFERENCES CITED.....	8

## Figures and Tables

Figure 1. Location of Fort Laramie National Historic Site (inset) and nearby BLM tracts (Fort Laramie Quad; 7.5')

Figure 2. Fort Laramie National Historic Site vegetation classes

Figure 3. Fort Laramie National Historic Site flora documentation

## **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. More recently, under congressional mandate, each unit of the NPS started 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, originally envisioned as a 1- or 2-step process has evolved into a more elaborate task reflecting the intrinsic changes in floras, intrinsic changes in plant taxonomy, development of new online databases, and the challenge of pulling information resources together to provide links between 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 as building on all prior work. In 2019, Isabel Ashton and Kara Paintner-Green (Northern Great Plains Inventory and Monitoring Program of NPS), contracted WYNDD to update the FOLA flora as represented in NPSpecies, as representing current taxonomic conventions, and with the distinction added between public lands owned by NPS vs those managed by NPS.

This most recent project was designed to make updates to the flora resulting from ensuing fieldwork of NPS Inventory & Monitoring personnel and others, and through data searches, present it all through editing of NPSpecies as the NPS species information portal, and elucidate the process of documenting floras across study phases.

## **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 two major rivers, the North Platte and the 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). Close to FOLA are approximately 340 acres in three tracts of BLM lands. These BLM Oregon Trail tracts have related historic significance and NPS has management and

law enforcement responsibility. The BLM tracts lie to the north and south of the designated historic site, but only part of one northern BLM tract has public access.

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

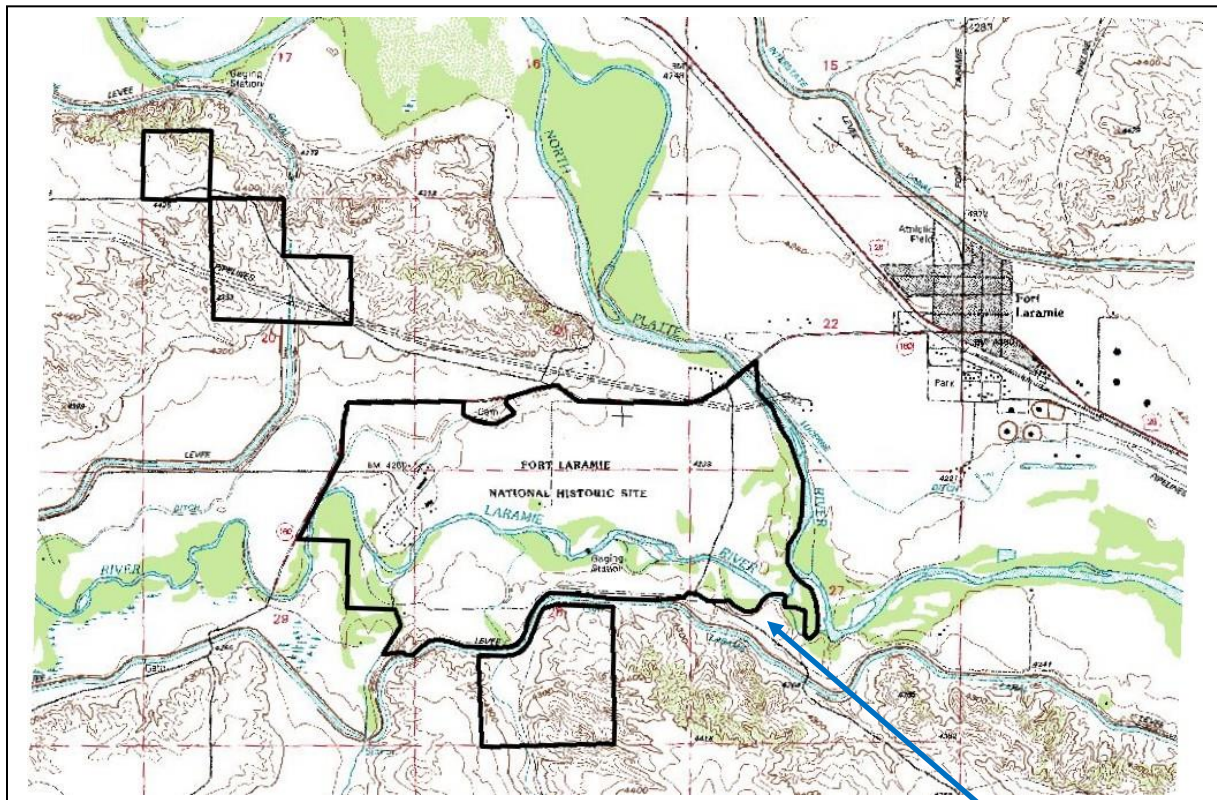
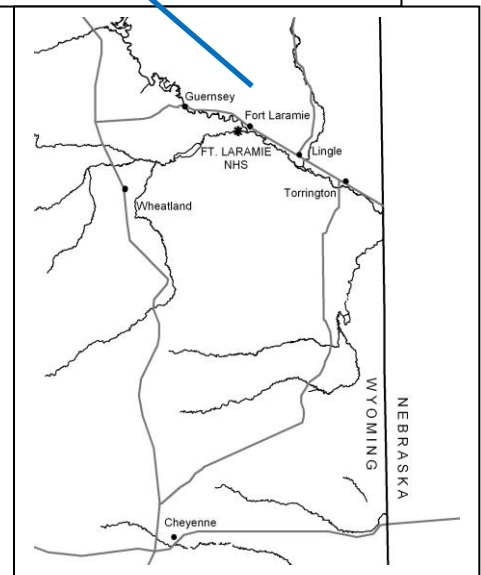


Figure 1. Location of Fort Laramie National Historic Site in southeastern Wyoming (right), and local setting with nearby BLM tracts (Fort Laramie Quad; 7.5')



FOLA lies in a physiographic region of unglaciated high plains, shaped by the forces of wind and water erosion. Local outcrops are Lower Miocene and Upper Oligocene sedimentary rocks comprised of soft, porous sandstone, underlying white tuffaceous claystone, with a mantle of alluvial cobble and outcrops of limestone above the North Platte River as found in the nearby BLM parcels. (Love and Christiansen 1985). Much of FOLA is comprised of unconsolidated Quaternary alluvial deposits in the valley bottom.

The climate at FOLA is documented as continental 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. FOLA vegetation is presented by Marriott et al. (1998) with 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. A GIS vegetation map was produced for FOLA (USDI Geological Survey 1998) in which large areas are in heavy use areas marked by blue patterning that have high degrees of vegetation conversion (Figure 3). Parts of the flats were homesteaded and farmed, and the warm colors (orange, scarlet) represent varying degrees of alteration with or without some natural or manmade restoration. The results of this mapping have been cross-referenced to FOLA management objectives for weed control and wetland management (Jones and Tebben 2002).

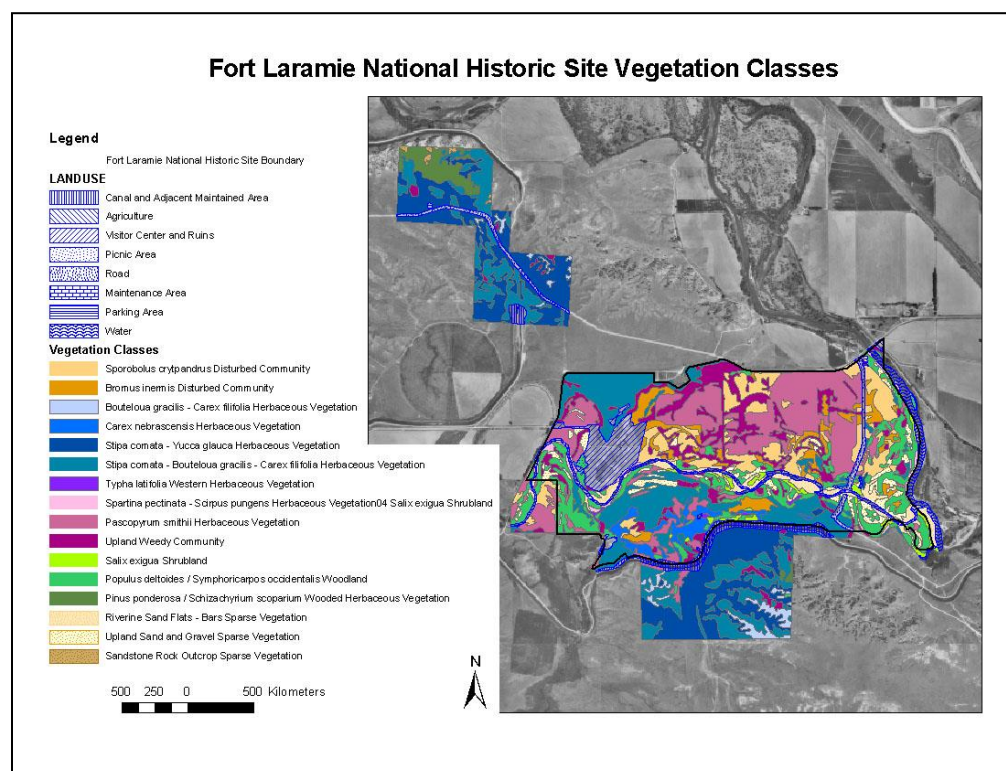


Figure 2. Fort Laramie National Historic Site vegetation classes (USDI Geological Survey 1997, Marriott et al. 1998)



Earlier vegetation studies were conducted on FOLA including that by Davis (1959) in three relict areas within the original 214 acre national monument boundaries Fort Laramie National Monument boundaries, and vegetation mapping conducted by Olmsted and Perez (1986) across the expanded national historic site in its current boundaries to characterize the array of vegetation, consider historical conditions, and develop management zones. The expanded boundary includes areas with a history of homesteading and cultivation, canal constructions, and areas placed in winter grazing use by NPS horses. The nearby BLM tracts are part of much larger grazing allotments with their own history. The original disturbance regime of fire and grazing and their altered states were considered by Olmsted and Perez (1986) but information on idle conditions, old field plantings, horticultural plantings, restoration plantings, vegetation succession and accidental weed introductions and encroachments was sketchy or unavailable. 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. More recently, 2015-2016 witnessed 100-year floods on the Laramie River in which the river course and much of the primary succession habitat had shifted.

## METHODS

### Additional Floristic Documentation in the Field

The first reported flora of Fort Laramie National Historic Site was prepared by Fertig (2000) based primarily on extensive systematic collecting by B.E. Nelson and graduate students (five days in 1993-1994). It was later expanded by Heidel (2004) based exclusively on intensive collecting that she and Robert Dorn conducted (parts or all of 21 days in 2003-2004). Results were further expanded by targeted visits and collecting of Robert Dorn who visited in moist growing seasons and at under-sampled times of growing season. They were also expanded by the NPS Inventory and Monitoring personnel in the course of collecting vegetation plot data over ensuing years. It was also expanded by NPS staff photographs of a new species, most notably Prairie gentian (*Eustoma grandiflorum*) as later collected. Voucher specimens were generally collected in duplicate. The original supporting voucher material is deposited at FOLA, and duplicate material is on loan to RM.

In reporting presence of a plant species in a given place, the most reliable form of evidence is a voucher specimen deposited in an accessible herbarium. On rare occasions, a photograph may suffice. Many journals now reject papers with unvouchered species reports (Culley 2013). The reasons are many. Broadly speaking, specimens ensure the science is repeatable. More specifically, and relevant to NPSpecies, herbarium specimens allow plant species reports to be verified.

FOLA specimens are accessible online for the RM and the park herbarium will become available in the future through RM. Both herbaria are accessible via the SEINet digital herbaria portal (<https://swbiodiversity.org/seinet/index.php>), so SEINet links were used instead.



## Updating and Adding Records to NPSpecies

In 2021, all records for FOLA plants were exported from NPSpecies to start a working spreadsheet by Marriott (2022). First, the species reported for FOLA by Fertig (2000) and Heidel (2004) were sorted between those only known from nearby BLM tracts, or present in FOLA boundaries. This was based on the collection labels of B.E. Nelson, Robert D. Dorn, and B. Heidel as deposited at RM including the additional documentation in the field (above). Additional sources for updating included the following:

- SEINet herbarium data portal (<https://swbiodiversity.org/seinet/index.php>) proved to be the best source for FOLA specimens. It provides access to many herbaria nationwide, including the FOLA herbarium and the RM.
- The Rocky Mountain Herbarium (RM) (<http://rmh.uwyo.edu/data/search.php>) can be more up-to-date than SEINet, depending on when data are uploaded. It contains FOLA specimens, often duplicates of specimens in the park herbarium.
- The FOLA herbarium, digitized in 2013, is accessible online through the Rocky Mountain Region Digital Herbarium (RMRDH; <https://www-lib.uwyo.edu/digitalherbaria/index.php/public>).
- Chris Mather, FOLA Cultural Resources Manager, provided a list of specimens added to the Interior Collections Management System (ICMS) since the park herbarium was digitized. For those of interest (possible additions), he provided high-quality scanned images.

One of the challenges of this work is that scientific (Latin) names of plants continue to change, especially with new molecular methods and an increasingly global plant taxonomy community (Weakley 2005). Names of many FOLA plants were updated in NPSpecies as part of this project. Accepted names are based on ITIS (Integrated Taxonomic Information System; <https://itis.gov>). When an older name was replaced, it was retained in the record as a synonym. In the past, synonyms sometimes were incorrectly added as separate records. In these cases, the extra record was deleted after transferring information.

All FOLA species were assigned to one of three Occurrence categories (NPS 2019):

1. Present – adequately documented, with a voucher specimen in almost all cases
2. Unconfirmed – reported without adequate documentation
3. Not in Park/False Report – report determined to be incorrect; record left in NPSpecies to explain the earlier report

Documentation and other relevant information was summarized briefly in the Occurrence Notes field.

FOLA manages nearby Bureau of Land Management (BLM) tracts with Oregon Trail wagon ruts. These have been included in floristic surveys, adding species from habitat not found within the park proper. For species present only in these tracts, the tag Adjacent was added, i.e., Present/Adjacent. A brief explanation was included in Occurrence Notes.

Vouchered species not already in FOLA NPSpecies were added, with information as described above. These included both recently collected species, and species documented in the past but not added to NPSpecies.

With so many sources, some of which sometimes conflicted or were incomplete, it was best to proceed list by list, editing NPSpecies along the way. A side benefit was repeated quality control. Matching NPSpecies records to online specimens also served as a quality control step. And because there can never be too much QC when dealing with lots of data from multiple sources, a final comparison was made of NPSpecies and the working spreadsheet, specifically for names and occurrence status.

## RESULTS

There are 412 species now documented for FOLA. They are among 426 species entered in NPSpecies records for FOLA, with fourteen that are either Unconfirmed (reported without adequate documentation), or Not in Park/False Report (Marriott 2022). The latter remain in the database to explain earlier reports. Of the 412 species, 355 (86%) are currently known from within FOLA boundaries and the rest are only known from BLM tracts managed by NPS.

In all, 36 vascular plant records were added since the prior report. Most were true additions. However, other kinds of records were created, e.g., for some nomenclatural changes and misidentifications. There was also addition of one nonvascular plant, the alga *Chara* (species not determined nor included in tallies).

The three primary compilation efforts are represented in Figure 3. The most current compilation corresponds with species now stored in NPSpecies. For update-to-date information, visit the NPSpecies website, and query on Fort Laramie National Historic Site, Vascular Plants (see NPS 2019 for specific steps).

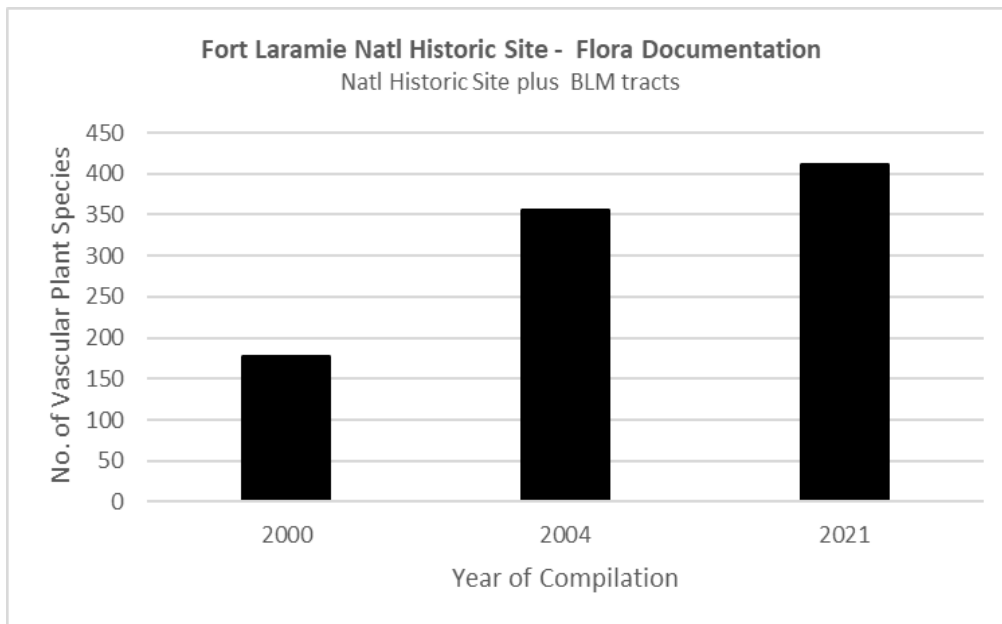


Figure 3. Fort Laramie National Historic Site flora documentation<sup>1</sup>

<sup>1</sup> All three tallies represent the combination of FOLA as historic site and three nearby BLM parcels managed to NPS

## Floristic Documentation Highlights

Of the 426 vascular plant records entered for FOLA in NPSpecies, the vast majority—on the order of 97%—are Present (about 15% of these are Present/Adjacent, currently known only from BLM tracts managed by FOLA). The remainder are either Unconfirmed (reported without adequate documentation), or Not in Park/False Report. The latter remain in the database to explain earlier reports.

The first addition to the Wyoming flora documented in FOLA was based on a collection by Robert Dorn in 2004: Onerow yellowcress (*Nasturtium microphyllum*) grows in a spring-fed area on Deer Creek. It is a non-native species with no other records from the Rocky Mountain states except New Mexico. A second addition to the Wyoming flora was also documented by Robert Dorn in 2019: Slickseed fuzzybean (*Strophostyles leiosperma*) grows along the Laramie River. It is a native species found from North Dakota to Texas, as well as Colorado, Arizona and New Mexico among western states, but not previously documented in Wyoming. FOLA remains the only place where these species are known in Wyoming.

The most recent set of added FOLA collection information includes Andean prairie clover (*Dalea cylindriceps*). It is a species that was only known in FOLA from a collection by A.A. Beetle in 1949, relocated by Robert Dorn in 2019. It is a Great Plains species that is possibly globally vulnerable (GRANK=G3G4), subject to widespread habitat loss in parts of its distribution (Locklear 2013).

## DISCUSSION

The deliberate, extensive collecting in the 1990s, intensive collecting a decade later, and then targeted gap-filling collecting since then represent a thorough floristic documentation. These numbers may change with additional survey and study because floras change and because exhaustiveness is an elusive target. “New” additions to floras may signify serious noxious weed invaders or changes to native species distribution. This places a premium on maintaining NPSpecies (see NPS 2019 for specific steps). For most plants in the park, NPSpecies was edited to include links to online specimens. Now if there's a question about a plant's identity, a high-quality image can be examined.

NPSpecies is now an up-to-date reliable resource for FOLA plants useful to both NPS staff and the public. Nearly all species listed as Present are documented with specimens in curated herbaria—the FOLA herbarium/Museum database and the RM. Inventory and Monitoring crews can check whether a species occurs at FOLA, and if it does, look at a specimen online for help with identification. Visitors can generate a plant checklist for FOLA, and they too can examine specimens online. FOLA interpretive staff may wish to provide a link on the park website to a plant checklist generated from NPSpecies. It is also important that FOLA staff who use NPSpecies can update NPSpecies as new information becomes available in keeping with the excellent documentation provided at the Integrated Resource Management Applications Portal online (<https://irma.nps.gov/content/npspecies/Help/>).

If any native species restoration plantings are pursued in the future, it would be appropriate to have a system of record-keeping that includes the species, the cultivar name, the source, the establishment success and a specimen voucher for each species at FOLA with full collection label data. 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.

The FOLA flora is dynamic, with a high proportion of non-native species; 33.7% of the 355 species are non-native. It also represents a noteworthy diversity associated with the free-flowing Laramie River drainage system supporting rare riparian species. Prairie gentian was reported in FOLA for the first time in 2018, photographed by FOLA personnel at the western end of the Park on Deer Creek. It disappeared from that location in ensuing years and appeared at the eastern end of the Park on the Laramie River. It is an annual that often changes in its local locations, the most recent addition to the six other rare riparian species known from the Laramie River (*Agalinis parvifolia*, *Cyperus bipartitus*, *Cyperus squarrosus*, *Lipocarpa drummondii*, *Lobelia siphilitica*, *Sorghastrum nutans*). The dynamic river system maintains early successional habitat for these species.

This report highlights the values of the BLM Oregon Trail tracts managed by NPS with native habitat and plants that rare or absent in the park proper. The full FOLA flora is a window into the past, including some plants that used to be more common in the region (Marriott et al. 1998). Like the wagon ruts, the vegetation provides a glimpse of pre-settlement times.

## REFERENCES CITED

- Culley, T.M. 2013. Why vouchers matter in botanical research. *Applications in Plant Sciences* 2013 1(11): 1300076.
- Davis, G.V. 1959. A vegetative study of three relic areas located within Fort Laramie National Historic Monument. Master thesis. Submitted to the Sub-department of Range Management and the Graduate School of the University of Wyoming. Laramie, WY.
- Fertig, W. 2000. Rare plants of Fort Laramie National Historic Site. Report prepared for the National Park Service by the Wyoming Natural Diversity Database, University of Wyoming, Laramie, WY.
- Fertig, W. 2001. Known and potential vascular plant flora of Fort Laramie National Historic Site. Report prepared for the National Park Service by the Wyoming Natural Diversity Database, University of Wyoming, Laramie, WY.
- Hartman, R.L. and B.E. Nelson. 1995. Final report on the general floristic inventory of the southern Powder River Basin and Eastern Plains, Wyoming. Report prepared for the Bureau of Land Management Wyoming State Office by the Rocky Mountain Herbarium, University of Wyoming, Laramie, WY.
- Heidel, B. 2004. Floristic inventory of Fort Laramie National Historic Site. Prepared for the Northern Great Plains Inventory Program and Fort Laramie National Historic Site. Wyoming Natural Diversity Database, Laramie, WY. Posted at: (<https://wyndd-reports.s3.us-west-2.amazonaws.com/U04HEI10WYUS.pdf>).

- Jones, G. and B. Tebben. 2002. A vegetation management plan for Fort Laramie National Historic Site. Report prepared for National Park Service. Wyoming Natural Diversity Database, University of Wyoming, Laramie.
- Locklear, J.H. 2013. Taxonomic identity and historical accounts of *Dalea cylindriceps* (Fabaceae), a species of conservation concern in the Great Plains (U.S.A.). *J. Bot. Res. Inst. Texas* 7(2):879-890.
- Love, J.D. and A.C. Christiansen. 1985. Geologic map of Wyoming: U.S. Geological Survey, scale 1:500,000.
- Marriott, HJ, Drake, J, Curtis, A, Grossman, D. 1998. Classification of the Vegetation of Fort Laramie National Historic Site.  
<https://irma.nps.gov/DataStore/DownloadFile/424112> .
- Marriott, M. 2022. NPSpecies Update for Plants of Fort Laramie National Historic Site. Prepared for Wyoming Natural Diversity Database. Laramie, WY.
- Nelson, B.E. and B.S. Legler. 2023. Checklist of the vascular plants of Wyoming. Rocky Mountain Herbarium, University of Wyoming. Laramie, WY. Posted electronically at: <http://www.rmh.uwyo.edu/>
- Nelson, B.E. and R. Hartman. 2001. Final report on the general floristic inventory of Southeastern Wyoming. Prepared for Wyoming Bureau of Land Management, Rocky Mountain Herbarium – University of Wyoming, Laramie.
- Olmsted, C. K. and J.M. Perez. 1986. Vegetation analysis and management for Fort Laramie National Historic Site, Wyoming. Report prepared for National Park Service, University of Northern Colorado, Greeley, CO.
- USDI Geological Survey. 1998. Fort Laramie National Historic Site Spatial Vegetation Data; Cover type / Association level of the National Vegetation Classification System. Posted at: <http://biology.usgs.gov/npsveg/fola/index.html>
- USDI National Oceanic and Atmospheric Association – Western Regional Climate Center. 2004. Mean monthly temperature and precipitation data for Fort Laramie, Wyoming. Posted electronically at: <http://www.wrcc.dri.edu/summary/>
- USDI National Park Service. 2019. NPSpecies user guide. Integrated Resource Management Applications portal. <https://irma.nps.gov/content/npspecies/Help/> or [https://irma.nps.gov/content/npspecies/Help/docs/NPSpecies\\_User\\_Guide.pdf](https://irma.nps.gov/content/npspecies/Help/docs/NPSpecies_User_Guide.pdf)
- Weakley, A.S. 2005. Why are plant names changing so much? *Native Plants Journal*. DOI: 10.2979/NPJ.2005.6.1.53.