A PROGRAM TO MONITOR COMPOSITION AND STRUCTURE OF SELECTED VEGETATION TYPES ON FORT LARAMIE NATIONAL HISTORIC SITE.

OBJECTIVE 2: TREE RECRUITMENT IN THE RIPARIAN WOODLANDS

Final Report for Cooperative Agreement Number H1200040001

between the

National Park Service's Rocky Mountains Cooperative Ecosystem Studies Unit

and the

University of Wyoming, Wyoming Natural Diversity Database

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ABSTRACT

Riparian woodlands dominated by plains cottonwood (*Populus deltoides*) grow along the Laramie River and the North Platte River on Fort Laramie National Historic Site. These woodlands are composed mostly of groves of mature trees growing on relatively high, dry terraces, often at some distance from the active channels. A 2006 survey of the alluvial bars and terraces near the rivers showed that seedling-size cottonwoods grow along the Laramie River but not along the North Platte. Most of the small trees were growing in patches on the insides of meanders; a few patches and individual trees were found on the outsides of meanders; and some grew on banks above the stream. Nearly all of the small trees appeared to be sprouts from root crowns at least two years old. Several stands of larger, sapling-size cottonwoods also were described during the survey, growing on the margins of cobble and sand bars higher above and farther from the Laramie River channel. Additional sapling stands were noted but not described in this study. Conditions along several miscellaneous stream reaches, where no seedlings were noted, also were described.

The long-term survival of riparian woodlands along meandering streams like the Laramie River depends on the creation of bare, moist sediment bars for the establishment of cottonwood seedlings. The presence of seedling-size trees suggests that the woodlands along the Laramie River will persist for some time, although it is still entirely unclear whether or not seedlings are being established often enough to maintain the present extent and structure of the woodland. The dense herbaceous vegetation on even the lowest sediment bars, the presence of tree sprouts on the outsides of meanders, and the rather dense growth of vascular plants and algae on the bottom of the Laramie River channel suggest that the stream has not created suitable habitat for seedling establishment in a number of years. Along the North Platte River, the absence of cottonwood seedlings and of low alluvial bars above the active channel suggests that the woodlands there will disappear as the existing, mature trees on the high, dry terrace die.

Periodic surveys of the type conducted in this study would suffice to show whether new seedling patches appear in the future or, in contrast, these patches are relicts of past periods of habitat generation and are not being augmented by new patches. Periodic surveys also would show whether these existing patches survive and the trees grow taller. Past changes in the extent and structure of the Laramie River woodlands could be determined from examination of aerial photographs taken in different years. This sort of analysis is useful in showing whether or not the woodland has been in a steady state over the period of the photographic record, but it allows for only general prediction of what is likely to happen to the woodland in the future. The most reliable information for predicting the future of a riparian woodland comes from a comparison of the years of establishment of cottonwood groves to the streamflow record.

INTRODUCTION

Fort Laramie National Historic Site, at the confluence of the Laramie River and the North Platte Rivers in southeastern Wyoming (Figure 1), encompasses approximately 870 acres (approximately 350 hectares) of land and 3.5 miles (5.6 kilometers) of the rivers, both of which are perennial streams. Riparian woodlands dominated by plains cottonwood (*Populus deltoides*) grow along both rivers. These woodlands are composed of groves of trees that vary in size and density (U.S. Geological Survey 1998), but many of the groves consist of mature trees and grow on high, dry terraces at some distance from the stream channels.

In 2005, the National Park Service and the University of Wyoming entered into a cooperative agreement for several studies of the vegetation on Fort Laramie, including a study of recruitment of trees in the riparian woodlands. In September of 2006, George Jones of the University's Wyoming Natural Diversity Database collected information in the field on locations of tree seedlings and other features of the riparian zones. This document describes the methods used in that field survey, reports the results, and places those results in the context of knowledge about the ecology of riparian woodlands.

METHODS

FIELD SURVEY

The segments of the Laramie River and the North Platte River on Fort Laramie (Figure 2) are short enough (Laramie River 2.5 miles [4 km], North Platte River 1 mile [1.6 km][1]) that the investigator (George Jones) walked the length of each and recorded the locations of riparian features encountered. On the Laramie River, both banks and most islands in the channel were searched. On the North Platte, only the bank in the park (the western bank) and one island were searched. Field work was conducted from September 18th through 20th, 2006.

The feature of most interest was young trees, especially those that had started growing in the spring of 2005 or the spring of 2006. The assumption was made before field work was started that seedlings of this age would be encountered on bars and low terraces. The first day of field work showed, though, that most small trees actually were at least two years old, and seedlings from 2005 and 2006 were very rare or absent. Consequently, during the field survey, stems were counted as seedlings if they were shorter than ca. 1.5 meter, less than ca. 1.5 cm in diameter at the base, and did not obviously arise in groups from a thick, woody crown. These criteria were adopted in an attempt to exclude sprouts from plants several years old. Limited time and budget precluded the excavation of small trees and the determination of their precise ages, though, so sprouts from root systems several years old undoubtedly were counted as seedlings. Hence the term, as used in this report, simply refers to small trees.

Nearly all seedlings were growing in groups of at least several plants. The location of each such seedling patch encountered was documented with a global positioning system receiver (Garmin eTrex Legend), which was used to record at least one waypoint for each seedling patch. Waypoints were recorded in the UTM projection, 1983 North American Datum, Zone 13 North. The horizontal accuracy of the waypoints ranged from 2 meters to over 8 meters. For each patch, the seedlings of each tree species were counted or their numbers estimated; the modal height of the seedlings was estimated; the horizontal distance to the active stream channel and the height above the channel were estimated; the vegetation was briefly described; and the geomorphic surface on which the seedlings were growing was

[1] Lengths were calculated for line features digitized along the channel of the Laramie River at 1:3,000 scale and along the western bank of the North Platte River at ca. 1:7,000 scale, against the background of a year 2000 digital color infra-red photo.

noted. A handful of single seedlings (< 10) encountered during the survey were not documented in detail.

Several patches of saplings (trees taller than ca. 1.5 meter and up to 13 cm diameter at breast height) growing near the channels also were documented, to show the variety of young tree stands close to the rivers. For most of these sapling patches, the same information was recorded as for the seedling patches. Stands of saplings farther than ca. 20 meters from the channels were ignored, so this project does not provide a thorough documentation of sapling stands at Fort Laramie.

Five reaches of river where no seedlings were noted were nevertheless described as miscellaneous riparian features. The condition of the river banks and the channel in those zones may suggest why recent seedlings apparently are so rare, and those reaches were included in the survey so that those conditions would be documented.

DATA SUMMARY

The coordinates for the waypoints were down-loaded into a shape file[2] and that file was added to an ArcMap project (version 9.1; ESRI, Redlands CA). A shape file representing the riparian features[3] (that is, the seedling and sapling patches and the miscellaneous stream reaches) was created in ArcMap, with each record consisting of a polyline feature digitized on-screen between the waypoints. Notes from the field survey were used for guidance during the digitizing, and the 2000 color infra-red aerial photograph was used as the background.

The information for each riparian feature documented in the field survey was entered into a Microsoft Access database. Each record in the database can be easily related to records in the riparian features shape file.

RESULTS

Patches of seedling-size and sapling-size trees were encountered along much of the length of the Laramie River, but no small trees were noted along the North Platte River (Figure 3). Each of these tree patches, and the miscellaneous stream reaches, are described in Appendix 1.

SEEDLING PATCHES

Thirty-three seedling patches were described, 32 of them between the upstream-most, northward meander on the Laramie River and the bridge on the county road (Figure 3). The 33rd seedling patch was documented on the Laramie River a short distance above its confluence with the North Platte.

In the seedling patches, plains cottonwood (*Populus deltoides*) was the most common tree species, growing in 32 of the patches and constituting the most common seedling in 29 of them. Six patches included only plains cottonwood. Peachleaf willow (*Salix amygdaloides*) was the second most common seedling, growing in 23 of the 33 seedling patches and contributing the most individuals in one patch. Green ash (*Fraxinus pennsylvanica*) grew in 13 of the 33 patches and was the most common seedling in two patches; one patch consisted solely of green ash. Additional trees noted during the survey were narrowleaf cottonwood (*Populus angustifolia*) in at least 3 patches; and lanceleaf cottonwood (*Populus acuminata*)[4], boxelder (*Acer negundo*), and Russian olive (*Elaeagnus angustifolia*), each in at least one patch.

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[2] The file is fola_sept06_points.shp.

[3] This file is Riparian Features.shp.

[4] Lanceleaf cottonwood seedlings may have been under-counted. Trees of this species, a naturally-occuring hybrid between plains cottonwood and narrowleaf cottonwood, are distinguished from plains cottonwood by leaf characteristics. A number of seedlings labelled as plains cottonwood had some leaves characteristic of plains

Most of the seedling patches grew on bars and terraces (and a few on banks) less than 1 meter above the level of the active channel, although several seedlings were documented higher above the channel (one up to 3 meters). Horizontal distances from the channel varied more widely, with many patches up to 15 meters from the channel. The seedling patches were largely associated with meanders in the channel, with most on the insides of meanders and fewer on the outsides (Figures 3 and 4).

Heights of seedlings were estimated for 26 of the 33 patches, and in 24 of those, most of the seedlings were less than 1 meter tall. In virtually all of the seedling patches, the small trees were in at least their second year, and trees in at least their fourth year were common, as shown by the presence of branches and of scars on twigs from over-wintering buds. (Seedlings of the year would have been unbranched and lacked bud-scale scars because they had not yet formed over-wintering buds.) A number of stands included seedling-sized trees that were sprouts from root crowns at or just below the soil surface. In five stands, the sprouts came from root crowns that had produced earlier stems that had been browsed or broken off. Sprouts ca. 1.5 cm in diameter or larger at the base were excluded from the seedling count, but some stems counted as seedlings no doubt were sprouts from root crowns that shallow digging did not reveal.

Seedlings in 25 of the 33 patches grew in herbaceous vegetation described as moderately dense or dense. The dominant herbaceous plant species usually were prairie cordgrass (*Spartina pectinata*), redtop grass (*Agrostis stolonifera*), western goldentop (*Euthamia occidentalis*), and yellow and white sweetclovers (*Melilotus officinalis* and *M. alba*, respectively). Bulrush (*Schoenoplectus* sp.) was common in the wetter soils. Smooth brome (*Bromus inermis* ssp. *inermis*), quackgrass (*Elymus repens*), and switchgrass (*Panicum virgatum*) each were common in at least one patch. Patches of coyote or narrowleaf willow (*Salix exigua*) were common in the tree seedling patches, usually as sparse groups of stems 1 to 1.5 meter tall.

SAPLING PATCHES

Patches of saplings (stems taller than 1.5 meter and up to 13 cm diameter at breast height [4.5 feet above the ground]) were less common than seedling patches in the portion of the riparian zone near the active channel. Eight such patches were described, all from the middle part of the Laramie River (Figures 3 and 5), on bars or banks at least 2 meters higher than the active channel. Five of those patches (numbers 2, 3, 4, 5, and 6) were bands around older cobble bars; two (numbers 101 and 102) consisted of sprouts growing on banks on the outsides of meanders; and one (number 103) consisted of scattered stems growing on an island.

As in the seedling patches, plains cottonwood was the most common species, growing in all eight sapling patches. Peachleaf willow grew in two patches, green ash in one, and narrowleaf cottonwood in one. Only in the sapling patch on the island was the vegetation described as dense. Additional sapling stands were observed farther from the channel, growing as a part of the mosaic of cottonwood groves.

MISCELLANEOUS STREAM REACHES

Features of the vegetation and geomorphology were described along five reaches of river where tree seedlings and saplings were absent or so sparse that they did not merit recording as sapling or seedling patches (Figures 3 and 6). Along the Laramie River in reaches 1, 2, and 5, the bars and terraces were within approximately 1 meter above the channel, were well vegetated, and showed little or no bare sediment. The same plant species were common there as in the seedling patches: bulrush on the lowest, wettest bars; and prairie cordgrass, redtop grass, and sweet clovers on the higher, drier bars and terraces. A handful of individual plains cottonwood seedlings were noted in reaches 1 and 2, but none in reach 5.

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cottonwood and some leaves that resembled those of lanceleaf cottonwood. Some of those seedlings may have been lanceleaf cottonwood.

Groves of saplings and trees of various sizes, dominated by plains cottonwood with some green ash, peachleaf willow, and boxelder, grew on the higher terraces at some distance from the channel.

The two stream reaches along the North Platte River, reaches 3 and 4, were quite different from those on the Laramie River. The channel of the North Platte was bounded by banks 2 to 3 meters high and water flowed in only a portion of the channel, exposing bare or sparsely vegetated sediment bars, many of them composed of cobbles. The appearance was that of a channel that had been flooded for some time at bank-full stage but was then flowing at a much lower stage. The steep banks and the terrace immediately above them were densely vegetated with prairie cordgrass and reed canarygrass (*Phalaris arundinacea*), and groves of plains cottonwood trees (with smaller amounts of green ash, boxelder, and peachleaf willow) were common at some distance from the channel. Stands of cattail (*Typha* sp.) grew in places at the edge of the channel. No tree seedlings or saplings were noted along the North Platte River.

Correspondence to the Existing USGS-NPS Vegetation Map of Fort Laramie

The seedling patches, sapling patches, and features in the miscellaneous stream reaches correspond to vegetation types mapped by the USGS-NPS vegetation mapping project (U.S. Geological Survey 1998). The herbaceous vegetation on bars and terraces belongs to the *Spartina pectinata - Scirpus pungens* Herbaceous Vegetation type, the coyote willow patches to the *Salix exigua* Shrubland Provisional vegetation type, and the cattail stands to the *Typha latifolia* Western Herbaceous Vegetation type. Sparsely vegetated bars, terraces, and channels represent the Riverine Sand Flats - Sparse Bars Vegetation type. The locations of the seedling and sapling patches described in this project match reasonably well the polygons of each of those vegetation types as shown on the USGS-NPS map.

Discussion

Riparian Woodland Ecology and Fort Laramie

The cottonwood woodland along the Laramie River on Fort Laramie NHS appears to be typical of such woodlands along meandering streams on the western Great Plains (Friedman *et al.* 1997). These woodlands are early-successional vegetation types, dominated by a pioneer species (plains cottonwood) that depends on bare, moist sediments for its establishment and cannot become established beneath the canopies of existing woodlands or in dense herbaceous vegetation. The moist sediments must be available in the spring when cottonwoods release their seeds (Johnson 1994).

Each such woodland typically is a mosaic of groves, and the groves each have a crescent or sinuous shape (Figure 2) and are composed of trees of very nearly the same size and age. A series of parallel groves may be found, with tree age and size increasing gradually with increasing distance from the channel. (For example, see the bands of trees shown on Figures 2 and 4a, on the inside of the northward meander of the Laramie River immediately downstream from the park's western boundary.) In contrast, groves on opposite sides of the stream may differ markedly in the sizes and ages of their trees.

This structure is the consequence of the cottonwoods having become established on point bars on the insides of meanders. The crescent shape of a grove preserves the shape of the point bar on which the trees were established, and the even age of the trees in a grove results from their having been established within a year or two of each other on the same sediment bar. Seedling patches are not established every year because the spring high water flows may be too low in some years, and because a patch of seedlings established in one year may be destroyed when a flood scours their sediment bar before they are large enough to survive it. Hence nearby groves do not merge into one another but rather are distinct because several years elapsed between the establishment of one grove and the establishment of the next. In contrast, a grove of saplings on the inside of a meander may be juxtaposed with a grove of old, large trees across the stream on the outside of the meander because the stream is

cutting into the floodplain on the outside, removing the grove that was established years before when the stream had a different shape.

Cottonwood groves that escape destruction by the meandering stream eventually give way to shrub stands or herbaceous meadows, as the trees succumb to disease, windthrow, fire, or old age. As long as the stream creates suitable habitat for the establishment of seedlings, those older groves are replaced by stands of young trees and the woodland persists. A cottonwood woodland along a meandering stream thus may reach a steady state (when viewed over a long enough span of time), with the extent of the woodland and the relative proportions of young and old groves determined by the rates at which the former are established and the latter are removed or die off (Friedman *et al.* 1997).

This structure and steady-state condition are absent from woodlands along confined streams or streams where channel narrowing (instead of flooding) has created the establishment sites (Friedman *et al.* 1997). But in these cases, too, the survival of the woodland depends on the creation of sites where seedlings can become established to replace the older trees. When the stream's hydrology changes, the structure of the woodland (that is, the proportion of groves of different ages and sizes) changes; if bare, moist sediment bars are no longer produced in the spring when cottonwood seeds are abundant, the woodland probably will disappear.

A central question addressed by this project is whether or not enough seedlings occur for the riparian woodlands to persist at Fort Laramie. The absence of seedling-size trees along the North Platte River suggests that the woodland there will disappear when the existing trees die. It is possible that the flood regime along the North Platte in the years preceding this survey was unsuitable for the creation of seedling habitat, and that suitable habitat will be created often enough in the future for new cottonwood seedling stands to replace the groves of old trees. The morphology of the river, though, suggests otherwise: the high and relatively dry, densely vegetated terrace on which the woodland grows is separated from unvegetated bars by a nearly vertical, 2-meter high bank. These bars are flooded at bank full stage and hence are in the active channel. No new point bars or other suitable surfaces were observed above the active channel.

The potential seems to exist for the woodlands of native cottonwoods along the North Platte River to be replaced by a different type of woodland, dominated by shorter and non-native Russian olive trees. National Park Service staff has removed a number of large Russian olives from the woodland along the North Platte in recent years (Tammy Benson, Fort Laramie National Historic Site, personal communication), and a cessation of control efforts might result in the growth of a Russian olive woodland, as has occurred in many places throughout western North America (Katz and Shafroth 2003).

Along the Laramie River, in contrast, the presence of seedling-size trees on bars and terraces near the channel suggests that the riparian woodland will persist for some time. Moreover, the similarity in species composition between these seedling patches and the mature riparian groves in the area, documented in the U.S. Geological Survey - National Park Service vegetation mapping project (U.S. Geological Survey 1998), suggests that the composition of the riparian woodland will remain much as it is now. Even if Russian olive trees were to become common in the Laramie River woodlands in the absence of control efforts, it seems likely that plains cottonwood would continue to dominate most groves.

QUESTIONS PROMPTED BY THIS PROJECT

The conclusion about the persistence of the Laramie River woodland must be qualified for several reasons, which can be expressed as questions about the woodlands.

1. How long do the patches of seedling-size trees survive? How likely are they to grow into larger trees or, alternatively, to be maintained as small trees by repeated browsing?

Simple surveys like the one reported here, repeated periodically, would suffice to show how many of the seedling patches persist, if the numbers of trees in them change substantially, and if the

trees grow taller. Slightly more detailed surveys, involving more careful counts of seedlings and non-destructive excavation of the root crowns, would yield useful information.

2. Is suitable habitat for cottonwood seedlings being created along the Laramie River? Are new seedlings patches appearing?

These questions, too, can be answered by periodic simple surveys to document new seedling patches. Numbers and heights of seedlings could be recorded rather generally, as in this project, or quantified with a bit more effort.

3. Are seedlings established often enough and in sufficient numbers along the Laramie River to replace the groves of older trees as the latter disappear? That is, does the steady-state condition exist in the Laramie River woodland, or is it likely to shrink in area or change substantially in structure?

Although small trees occur along the Laramie River, it is unclear that seedling patches are becoming established often enough to maintain the current extent and structure of the woodland. Two pieces of anecdotal evidence cast doubt on the existence of a steady state. First, virtually none of the seedling-size trees documented in the September 2006 survey are new seedlings, but rather are sprouts from plants of undetermined age. While seedlings need not become established every year, and future surveys might find patches of new seedlings, their absence now is a cause for doubt.

Second, there is little evidence that the Laramie River is producing sediment bars suitable for seedling establishment. The bars documented in 2006 near channel-level were nearly all moderately to densely vegetated, suggesting that they had been present for at least several growing seasons. The channel, too, seemed to be well vegetated with vascular plants and with algae. Cottonwood and peachleaf willow sprouts occurred on the outsides of meanders. (See sapling patches 101 and 102.) These may be signs that the river has not flooded sufficiently in recent years to re-work channel and bar sediments, and is meandering only very slowly. The presence of rip-rap on the outside of the large northward meander near the west end of the park (seedling patch 5) is noteworthy in this regard. While stabilizing the river meanders may be necessary to protect the historic buildings at the Fort, it may have consequences for the channel morphology and the vegetation downstream.

Modifications upstream from Fort Laramie may have been more important in reducing the river's ability to generate new habitat for seedlings. Grayrocks Dam was completed on the Laramie River approximately 7 air miles (11 km) upstream from Fort Laramie in 1980. The major effect of dam construction on stream flow at Fort Laramie appears to be a reduction in the month-to-month variability in flows within a year, due mainly to a reduction in the peak annual flow combined with an increase in the minimum annual flow (Figure 7). Very high flows, though, have not been reduced; rather, they have reached the same magnitude in the 26 years of record since the dam was constructed as they did in the 23 years before its construction, and they have occurred slightly more often.

The question of whether the Laramie River woodland is in a steady state or is likely to change substantially could be addressed in two ways. The simplest way would be comparison of the woodlands on a series of aerial photographs, starting with the earliest photos that can be found and ending with current photos. If enough photographs can be assembled that show the woodlands in sufficient detail, then a straightforward geographic information system analysis can be performed to estimate changes in area of woodland. High-resolution photographs, combined with ground-truthing, can be used to estimate changes in structure of individual groves and, hence, changes in proportions of groves of different types. An analysis of this type for the North Platte River 12 air miles (19 kilometers) downstream from Fort Laramie NHS for the period 1937 to 1990 showed that the area covered by dense stands of young trees declined while the area covered by sparse stands of old trees increased, coincident with a decrease in the wetted area of the river (Miller *et al.* 1995).

Analysis of a time-series of photographs would give a reasonably good estimate of whether the structure and area of the woodland have changed over the period of the photographs. Predicting what is likely to happen to the woodland in the future, though, would require collecting precise data on the ages of tree groves so that the years of their establishment can be compared to the stream flow record. (See,

for example, Akashi 1988.) This is an ambitious undertaking that involves careful collection of a large amount of field data.

CONCLUSION

If maintenance of the riparian woodlands is part of the management of Fort Laramie NHS (which seems to be the case; Jones and Tebben 2002), then the questions posed above have practical applications for Park Service managers. How long the seedling patches found in this study last, and whether new seedling patches are established or not, both can be determined with basic surveys like the one conducted in this project, perhaps with more quantitative information collected on numbers and heights of plants. Such surveys could be done periodically by NPS employees, or by other researchers through short-term cooperative projects.

Estimating past changes in the woodlands from aerial photographs would involve more time. This project would require locating and obtaining the photographs, converting printed photos to digital form, and using a geographic information system to produce and analyze digital files. While much of the work should be straightforward for a person trained in the use of geographic information systems, the time required might well prevent the staff at Fort Laramie from doing it. A project of this sort probably would be well suited for another National Park Service office, or for a cooperative project between the Park Service and another organization. It might be suitable as the subject of an independent project by an advanced-level undergraduate student.

A study of the relationship between woodland structure and stream hydrology would be the most useful of the projects, but also the most difficult and expensive, and the longest. A thorough study might extend upstream beyond the boundary of Fort Laramie. Because of the time required to collect and analyze data, this sort of project may be particularly well suited for a master's thesis.

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FIGURES

Figure 1. Location of Fort Laramie National Historic Site.

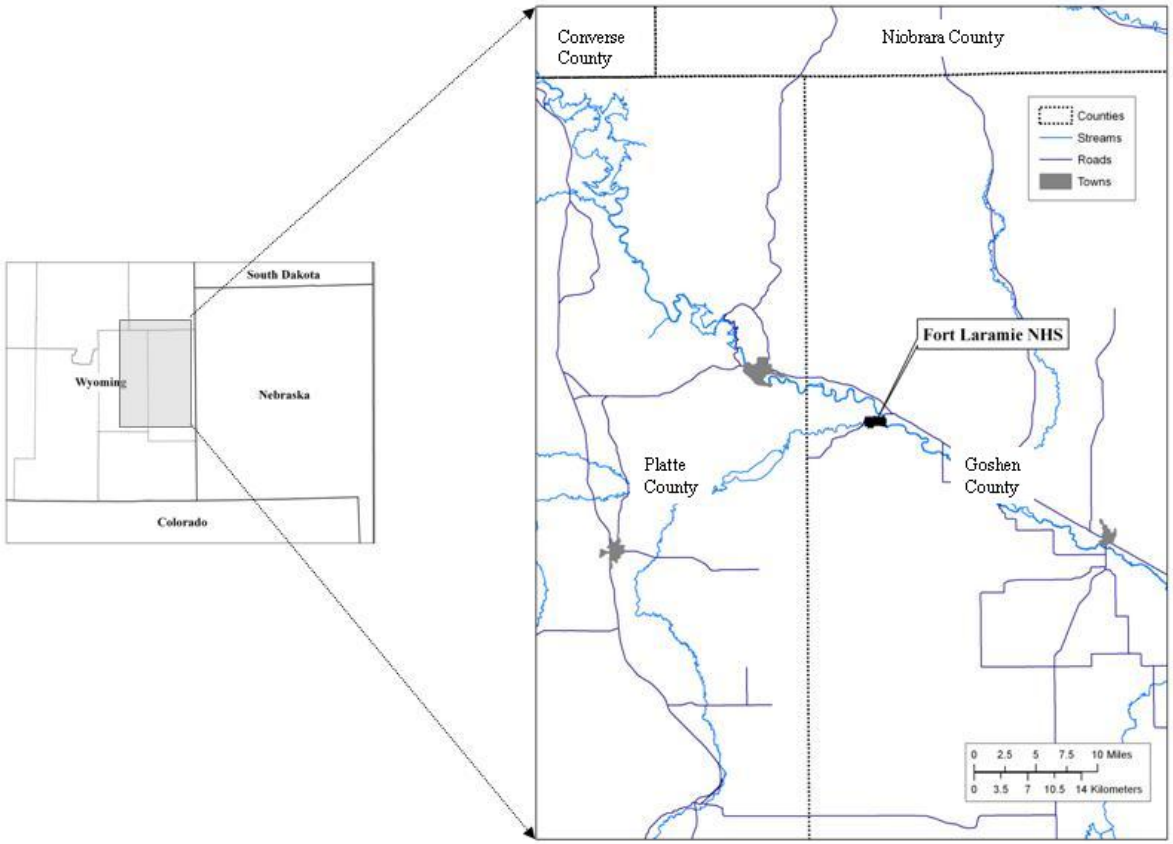

Figure 2. The Laramie and North Platte Rivers on Fort Laramie National Historic Site.
The color infrared aerial photograph is from 200. Arrows indicate direction of water flow.

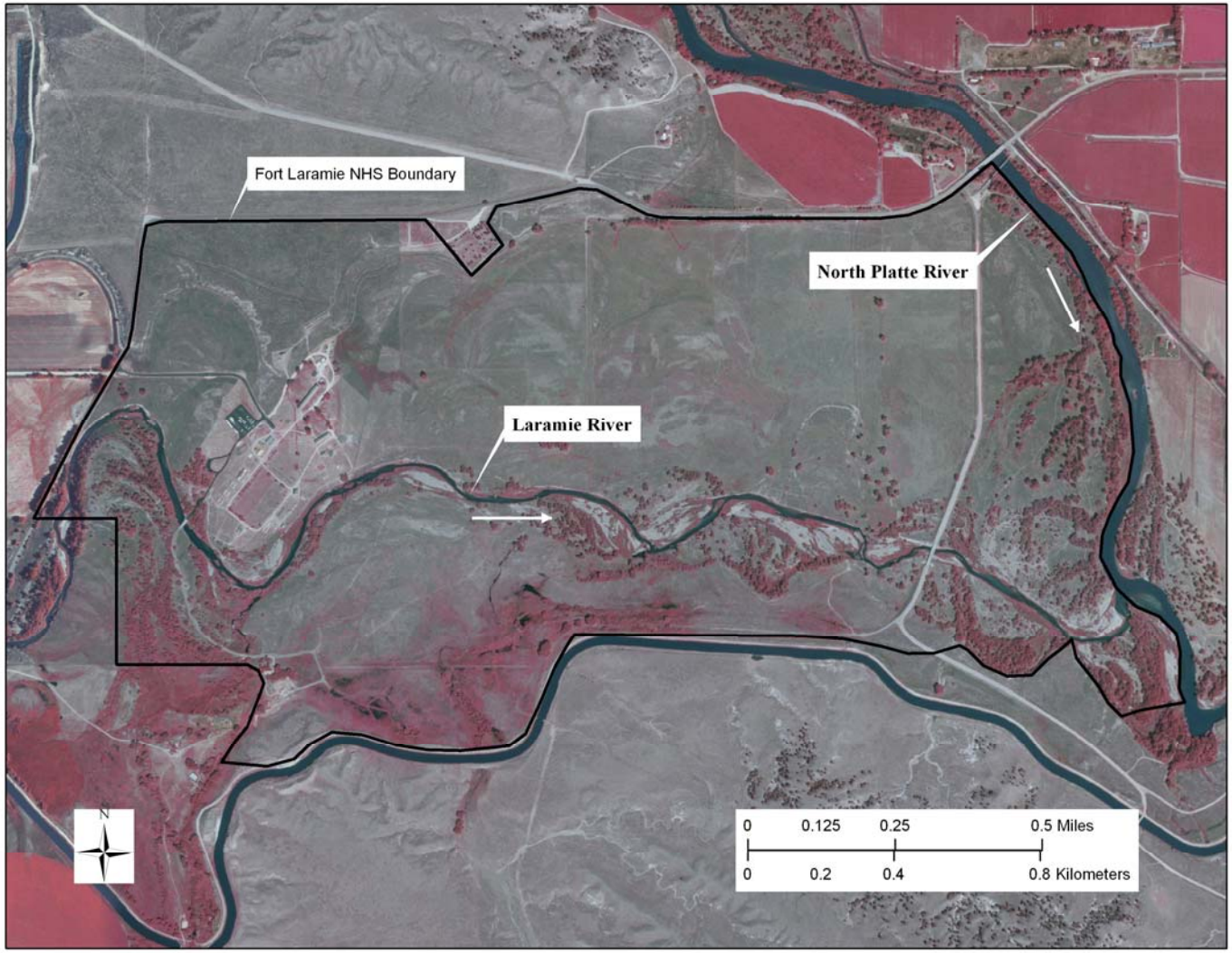

Figure 3. Locations of riparian features described in the 2006 field survey.
Each type of riparian feature is shown in more detail on the following maps.

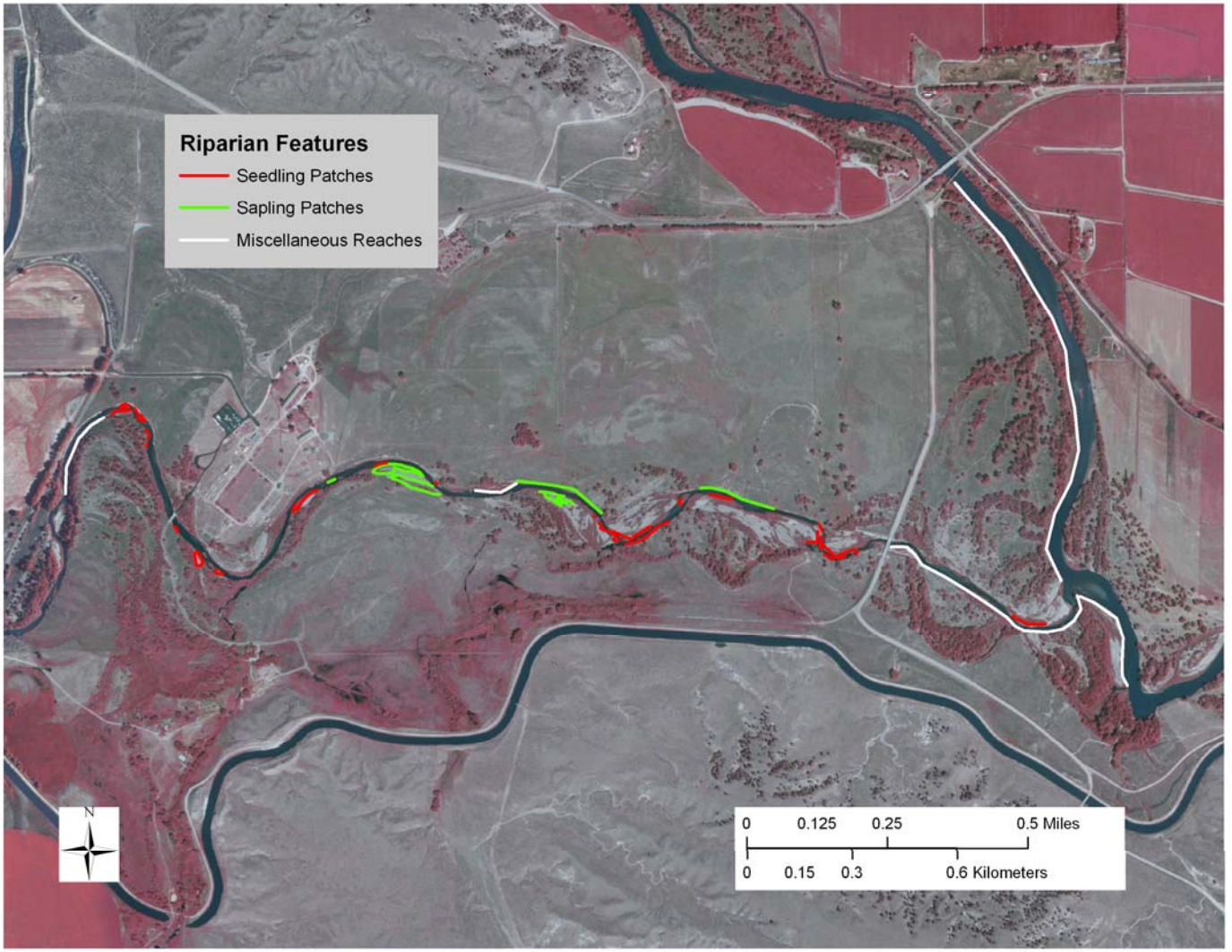

Figure 4. Seedling patches described in the 2006 field survey.

a. Western part of the park

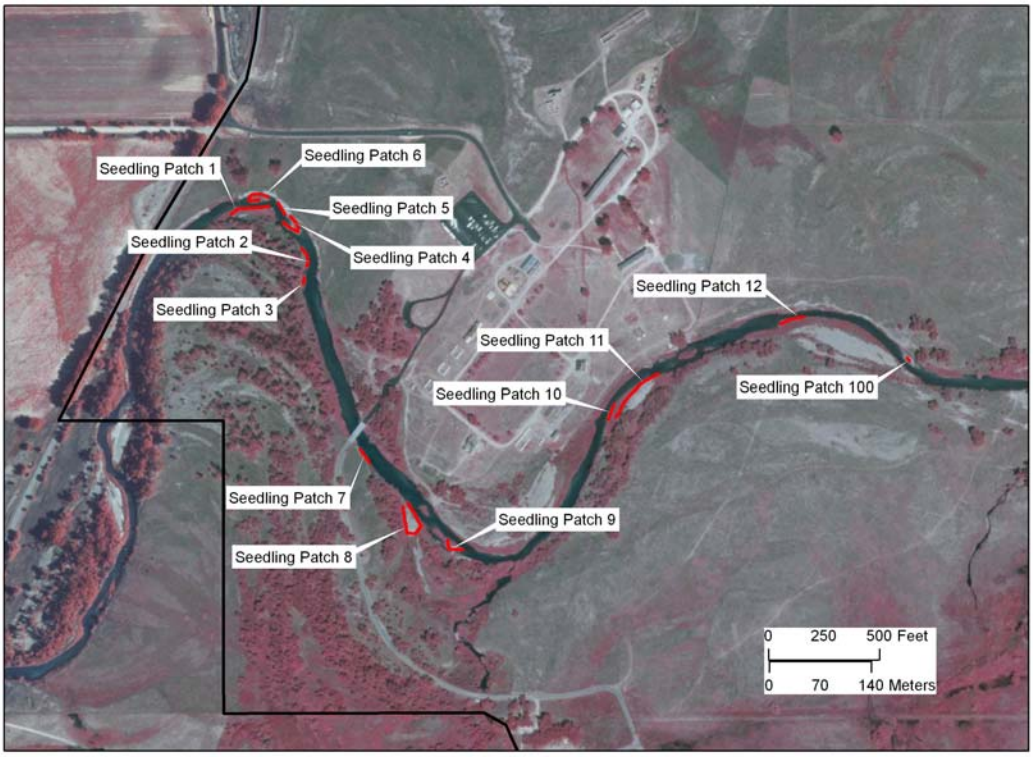

Figure 4. (continued).

b. Central part of the park

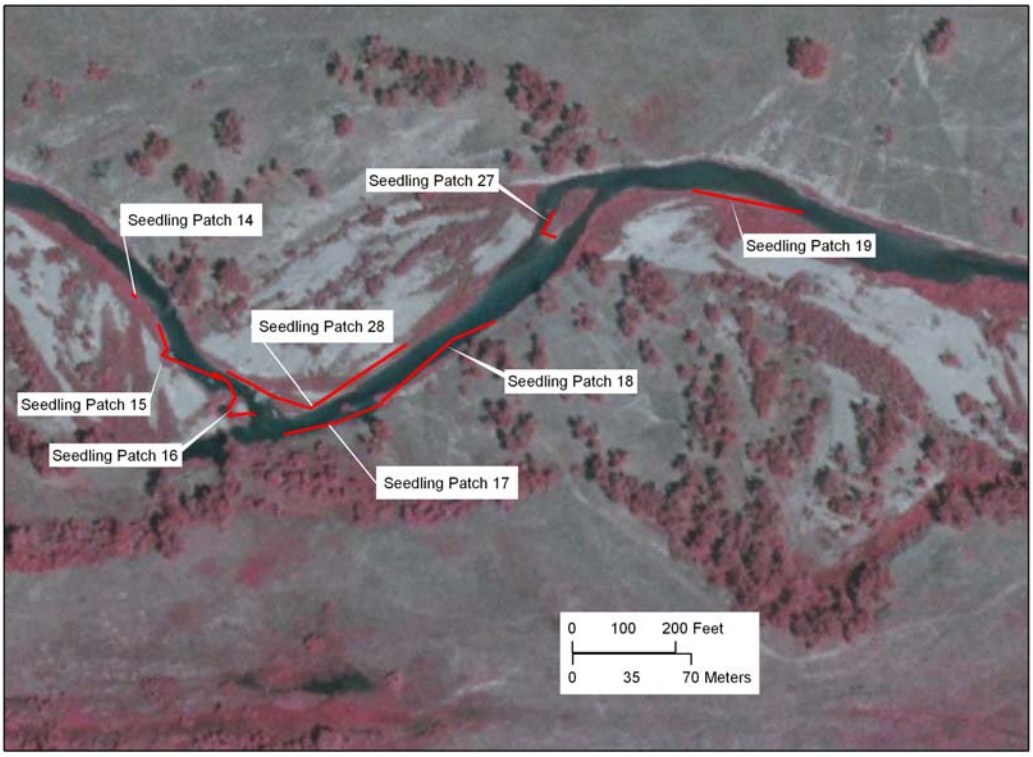

Figure 4 (continued).

c. Eastern part of the park

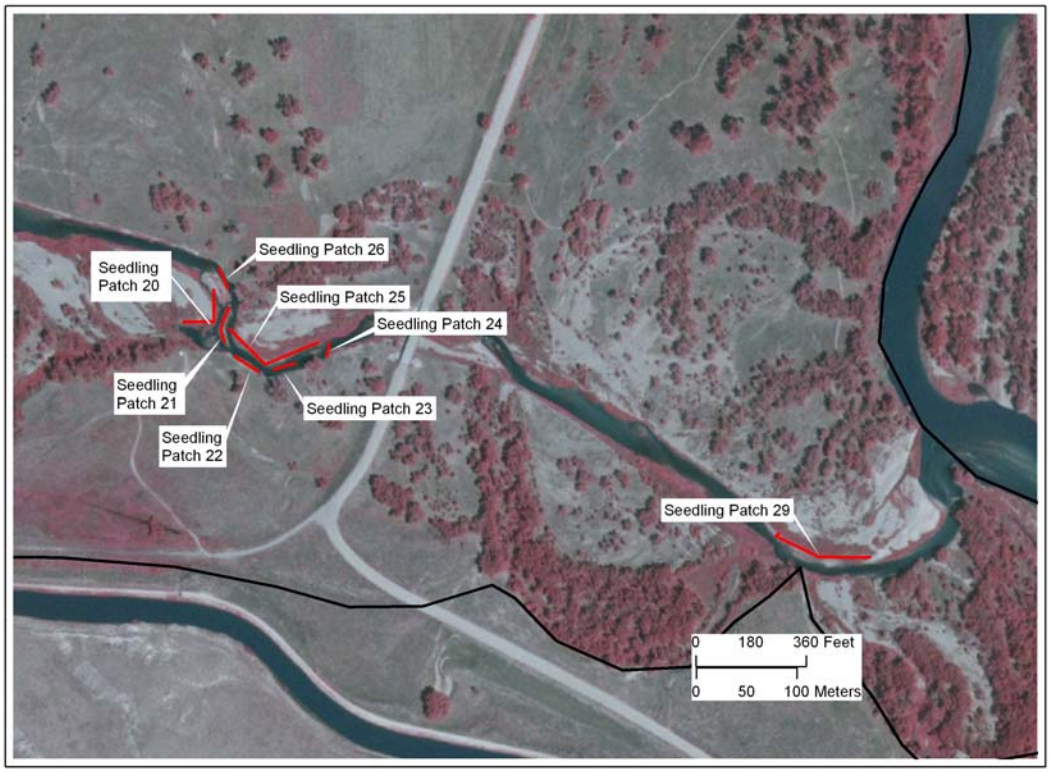

Figure 5. Sapling patches described in the 2006 field survey.

a. Western part of the park

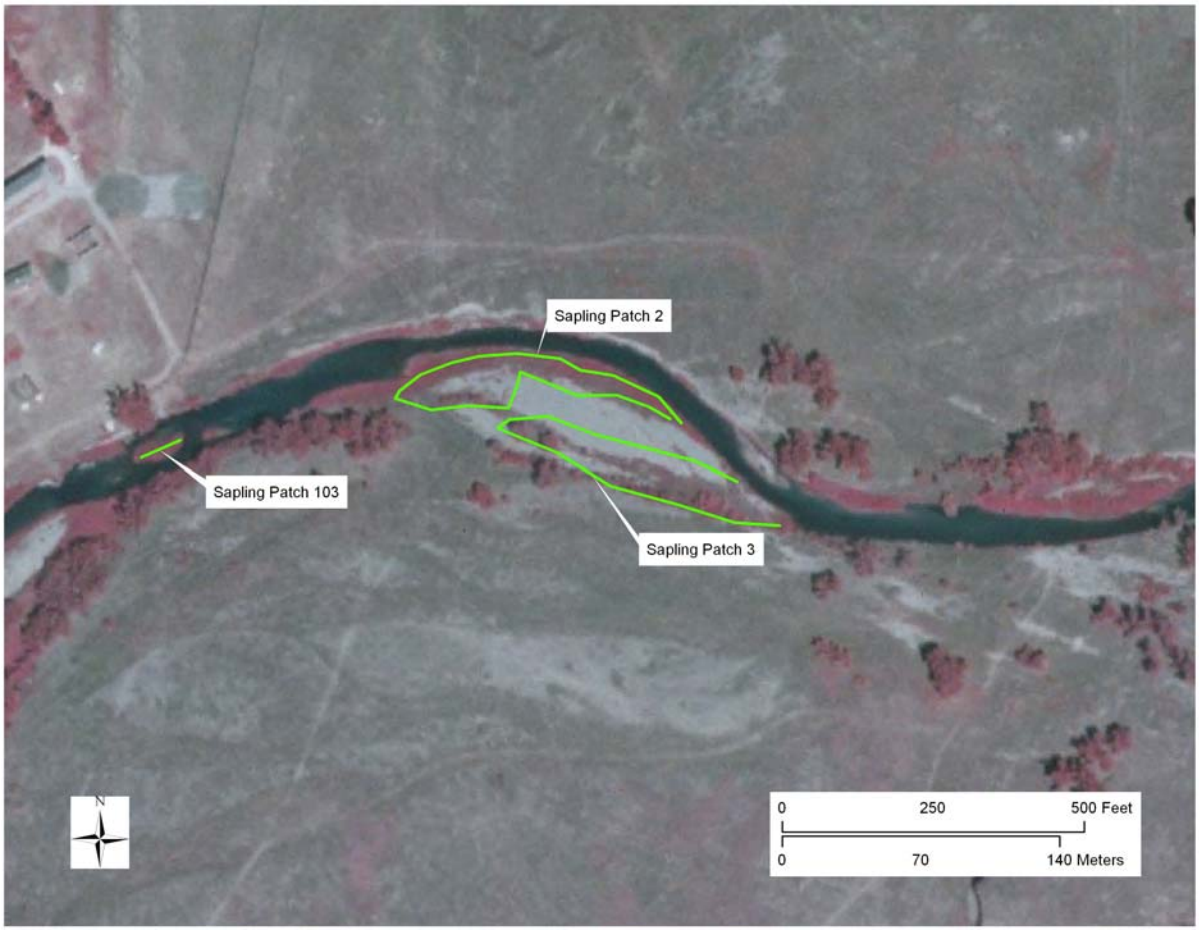

Figure 5 (continued).

b. Central part of the park.

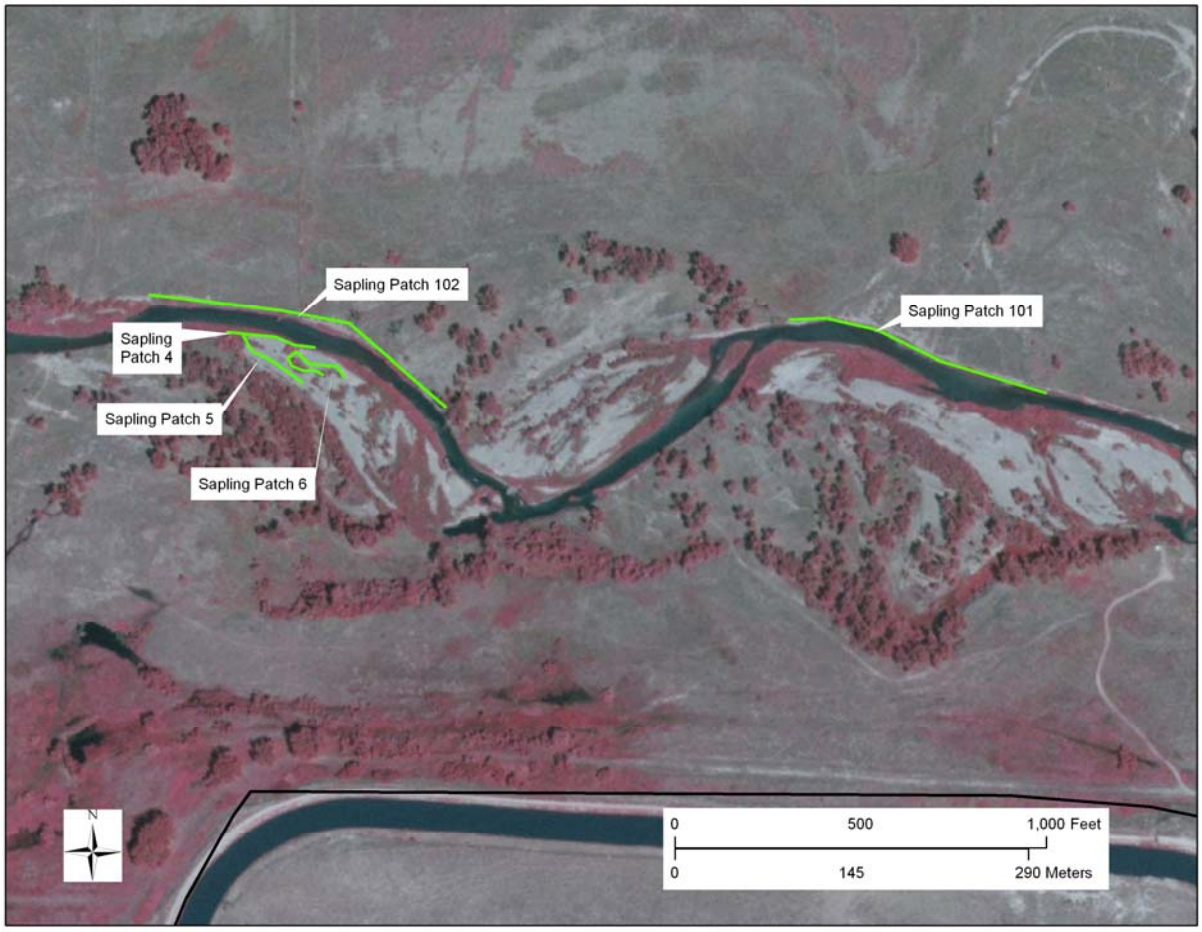

Figure 6. Miscellaneous stream reaches described in the 2006 field survey

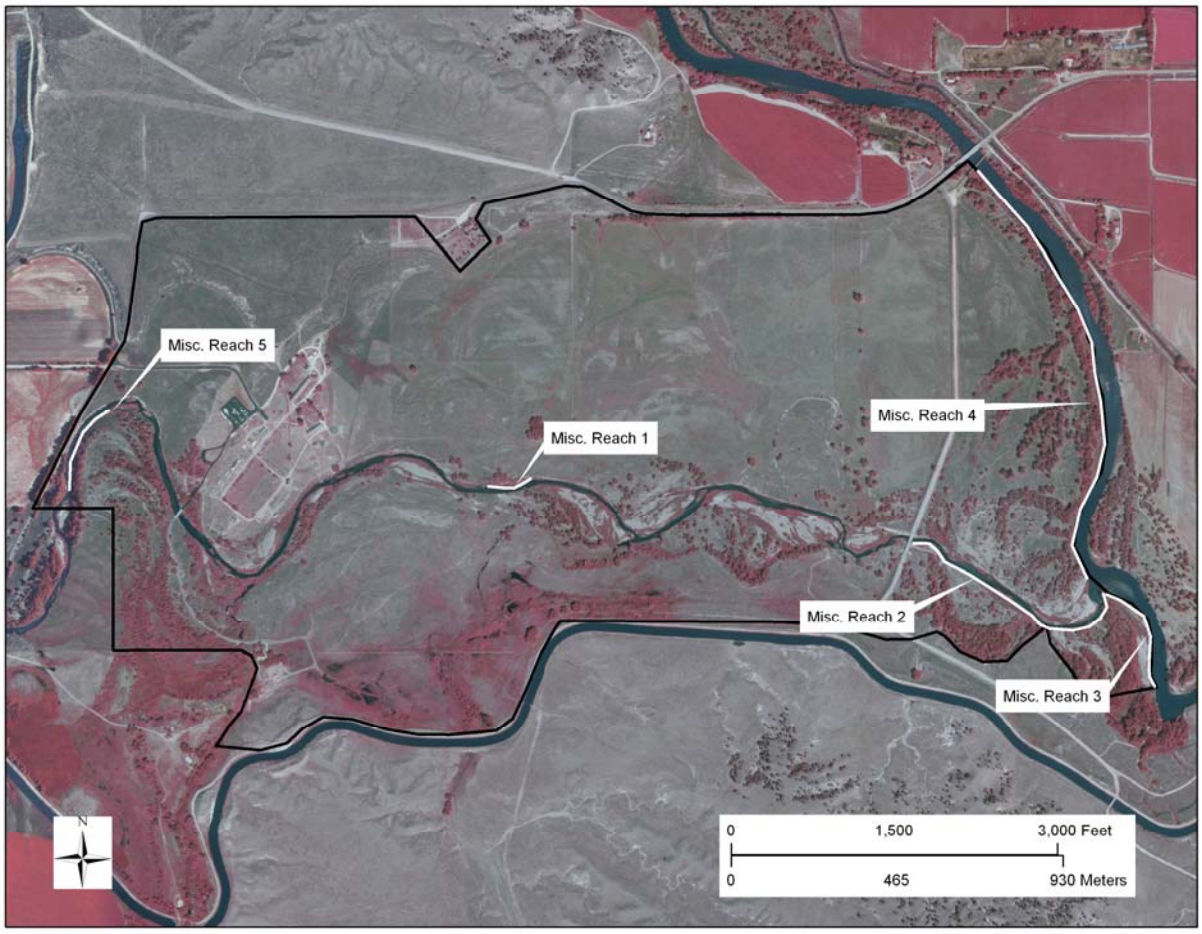

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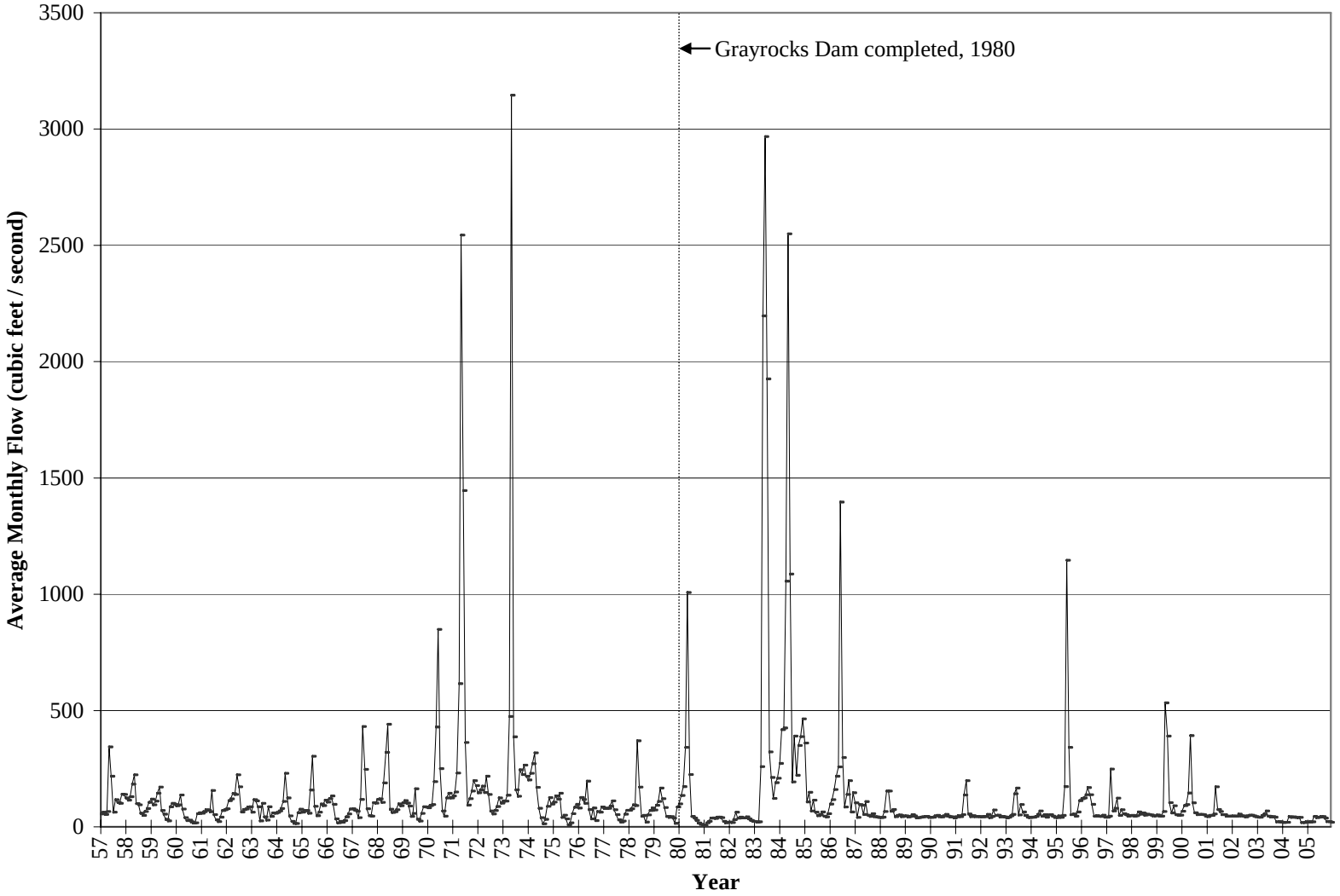
Figure 7. Average monthly stream flow in the Laramie River at the gage on Fort Laramie NHS, for the years 1957 through 2005. Data are from U.S. Geological Survey (2007).



APPENDIX 1. DESCRIPTIONS OF SEEDLING PATCHES, SAPLING PATCHES, AND MISCELLANEOUS STREAM REACHES

This information is contained in the Microsoft Access database, FtLar_Sept06_survey.mdb.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 1a

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 1 **Last waypoint**

Other waypoints

Description

Geomorphic position

On terrace inside meander. Terrace is ca. 8 m wide and is bounded on side away from stream by bank ca. 2 m high up to next terrace.

Height above channel (m) 1.5 **Distance from channel (m)** 15

Composition

Tree Species	Number	Height (cm)
Populus deltoides	16	100
	0	0
	0	0
	0	0

Other species

Notes

Group of 16 Populus deltoides seedlings between dense herbaceous vegetation (Spartina pectinata, Euthamia occidentalis) on channel side and bank up to next terrace on other side; next to cobble patch but in finer sediment.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 1b

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 2 **Last waypoint** 0

Other waypoints

Description

Geomorphic position

Terrace, lower than waypoint 1

Height above channel (m) 1 **Distance from channel (m)** 15

Composition

Tree Species	Number	Height (cm)
Populus deltoides	2	70
	0	0
	0	0
	0	0

Other species

Notes

2 seedlings growing in dense herbaceous Spartina pectinata - Carex spp. vegetation.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 1c

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 3 **Last waypoint** 0

Other waypoints

Description

Geomorphic position

Terrace

Height above channel (m) 1 **Distance from channel (m)** 6

Composition

Tree Species	Number	Height (cm)
Populus deltoides	1	50
	0	0
	0	0
	0	0

Other species

Notes

Single Populus deltoides seedling growing in moderately dense Bromus inermis - Elymus repens vegetation with much litter on ground surface.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 1d

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 4 **Last waypoint** 0

Other waypoints

Description

Geomorphic position

Side and top of bank ca. 1 m high and near channel

Height above channel (m) 0.5-1 **Distance from channel (m)** 0.5

Composition

Tree Species	Number	Height (cm)
Fraxinus pennsylvanica	3	75
	0	0
	0	0
	0	0

Other species

Notes

3 Fraxinus pennsylvanica seedlings along side and top of bank. Waypoint 4 is between them.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 2

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 5 **Last waypoint** 6

Other waypoints

Description

Waypoint 5 at upstream end, 6 at downstream end.

Geomorphic position

Looks like old point bar, now split into upstream and downstream pieces.

Height above channel (m) 0.5 - 1 **Distance from channel (m)** 0.25 - 3

Composition

Tree Species	Number	Height (cm)
Populus deltoides	12	0
Salix amygdaloides	5	0
	0	0
	0	0

Other species

Notes

Scattered seedlings on alluvial surface within 1 m of channel and on lower part of 1.5 m tall bank up to next terrace. Dense herbaceous vegetation of Spartina pectinata, Carex sp., Euthamia occidentalis.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 3

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 7 **Last waypoint** 8

Other waypoints

Description

Waypoint 7 is at upstream end, 8 at downstream.

Geomorphic position

Small bar next to channel

Height above channel (m) 0.9 **Distance from channel (m)** 0.2 - 3

Composition

Tree Species	Number	Height (cm)
Salix amygdaloides	6	60
Populus deltoides	1	60
	0	0
	0	0

Other species

Notes

Seedlings grow in dense herbaceous vegetation of Spartina pectinata, Panicum virgatum, Euthamia occidentalis.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 4

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 10 **Last waypoint** 15

Other waypoints 11, 12, 13, 14

Description

Geomorphic position

Channel bar

Height above channel (m) 0.75 **Distance from channel (m)** 0.5 - 10

Composition

Tree Species	Number	Height (cm)
Populus deltoides	300	30
Salix amygdaloides	40	30
Populus angustifolia	6	30
Elaeagnus angustifolia	1	100

Other species *Populus acuminata*

Notes

Numbers of seedlings are estimates. Surface is dense vegetation with Spartina pectinata, Euthamia occidentalis, Melilotus officinalis, and Melilotus alba. The estimate for P. deltoides includes an unknown number of Populus acuminata.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 5

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 16 **Last waypoint** 17

Other waypoints

Description

Waypoint 16 is at downstream end, 17 at upstream.

Geomorphic position

Bar on outside of meander.

Height above channel (m) 0.75 **Distance from channel (m)** 0.2 - 2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	10	0
Fraxinus pennsylvanica	8	0
Salix amygdaloides	3	0
	0	0

Other species

Notes

Narrow band (3 m wide) at foot of bank 3 m tall up to next surface. Bank has been covered with limestone boulders. Some seedlings grow between boulders; some obviously are several years old (at least) and have been broken or browsed, and re-grown.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 6

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 18 **Last waypoint** 24

Other waypoints 19, 20, 21, 22, 23

Description

Geomorphic position

Bar at foot of bank ca. 3 m high.

Height above channel (m) **Distance from channel (m)** 0

Composition

Tree Species	Number	Height (cm)
Populus deltoides	29	30
Fraxinus pennsylvanica	7	25
Salix amygdaloides	5	30
	0	0

Other species

Notes

Surface mostly densely vegetated with Schoenoplectus (Scirpus) sp., Spartina pectinata, Euthamia occidentalis, Cirsium arvense.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 7

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 25 **Last waypoint** 26

Other waypoints

Description

Waypoint 25 is at upstream end, 26 at downstream

Geomorphic position

At foot of steep, N-facing bank along straight reach.

Height above channel (m) 0.5 - 1 **Distance from channel (m)** 0.5 - 1.5

Composition

Tree Species	Number	Height (cm)
Fraxinus pennsylvanica	9	0
Populus deltoides	4	0
Salix amygdaloides	1	0
	0	0

Other species

Notes

Seedlings grow in dense vegetation of Bromus inermis, Apocynum sp., Spartina pectinata, Euthamia occidentalis, Equisetum sp.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 8

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 27 **Last waypoint** 33

Other waypoints 28, 29, 30, 31, 32

Description

Around cobble bar at upstream end of old meander

Geomorphic position

Abandoned channels

Height above channel (m) 1 - 2 **Distance from channel (m)** 5 - 25

Composition

Tree Species	Number	Height (cm)
Populus deltoides	32	60
Fraxinus pennsylvanica	5	40
Acer negundo	2	40
	0	0

Other species

Notes

Seedlings grow in dense vegetation of Spartina pectinata, Bromus inermis, Euthamia occidentalis. Many browsed & re-grown, probably several years old.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 9

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 34 **Last waypoint** 36

Other waypoints 35

Description

Waypoint 34 along bank at downstream end, 36 along bank at upstream end

Geomorphic position

Bar, between Laramie R and very small channel flowing parallel to river.

Height above channel (m) 1 **Distance from channel (m)** 2 - 10

Composition

Tree Species	Number	Height (cm)
Populus deltoides	103	35
Fraxinus pennsylvanica	24	20
Salix amygdaloides	12	30
	0	0

Other species

Notes

Dense vegetation of Spartina pectinata, Cirsium arvense, Agrostis stolonifera, Elymus repens. Salix exigua 2 m tall are present. Many seedlings are older plants, browsed and re-sprouted.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 10

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 37 **Last waypoint** 38

Other waypoints

Description

Waypoint 37 at upstream end, 38 at downstream

Geomorphic position

Bar inside meander

Height above channel (m) 0.5 **Distance from channel (m)** 1 - 5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	122	35
Salix amygdaloides	11	40
Fraxinus pennsylvanica	3	15
	0	0

Other species

Notes

Seedlings grow mainly in open area with sand & cobble, and vegetation of Spartina pectinata, Agrostis stolonifera, Euthamia occidentalis, and Salix exigua.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 11

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 39 **Last waypoint** 47

Other waypoints 40, 41, 42, 43, 44, 45, 46

Description

Waypoints are on line lying approx. down center of patch.

Geomorphic position

Point bar inside meander. Seedling patch seems to have formed on both channel side and bank side of cobble-gravel-sand bar.

Height above channel (m) 1 **Distance from channel (m)** 10

Composition

Tree Species	Number	Height (cm)
Populus deltoides	300	45
Salix amygdaloides	35	45
Fraxinus pennsylvanica	10	35
	0	0

Other species

Notes

Slightly higher than Seedling Patch 10. Moderately dense vegetation of Bromus inermis, Spartina pectinata, Apocynum sp., Asclepias sp., Ambrosia sp.; Salix exigua clumps.

P. deltoides are shortest (30-50 cm) near channel and tallest back from channel.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 12

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 48 **Last waypoint** 51

Other waypoints 49, 50

Description

Waypoint 48 at upstream end, 51 at downstream

Geomorphic position

Bar inside meander.

Height above channel (m) 0.7 - 1 **Distance from channel (m)** 1 - 12

Composition

Tree Species	Number	Height (cm)
Populus deltoides	66	45
	0	0
	0	0
	0	0

Other species

Notes

Sandy soil. Vegetation is dense in most of patch: Melilotus officinalis, Poa pratensis, Spartina pectinata, Salix exigua (1-1.5 m tall). Adjoining P. deltoides sapling stand grows on margin of this bar, farther from channel and higher.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 13

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 52 **Last waypoint** 0

Other waypoints

Description

Waypoint 52 is in middle of seedling patch

Geomorphic position

Bar inside meander.

Height above channel (m) 0.5 - 1 **Distance from channel (m)** 1.5 - 3.5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	33	50
Salix amygdaloides	2	0
	0	0
	0	0

Other species

Notes

Patch measures 5m long x 2.5 m wide, between the channel on one side and Salix exigua stand on a higher slope. Vegetation is moderately dense, composed of Spartina pectinata, Agrostis stolonifera, Schoenoplectus (Scirpus) sp., Carex sp.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 14

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 104 **Last waypoint** 0

Other waypoints

Description

Waypoint 104 is in small group of P. deltoides seedlings

Geomorphic position

Edge of alluvial terrace

Height above channel (m) 0.7 **Distance from channel (m)** 2.5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	8	70
	0	0
	0	0
	0	0

Other species

Notes

Small group of Populus deltoides seedlings (all woody, at least 4 yrs. old) growing on edge of low terrace in dense herbaceous vegetation of Schoenoplectus (Scirpus) sp. On higher terrace is Spartina pectinata with some Salix exigua.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 15

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 105 **Last waypoint** 108

Other waypoints 106, 107

Description

Waypoint 105 is at upstream end, 106 at bend, 108 at downstream end

Geomorphic position

Terrace

Height above channel (m) 0.5 - 1 **Distance from channel (m)** 1 - 2.5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	14	45
Salix amygdaloides	2	45
Fraxinus pennsylvanica	1	0
	0	0

Other species

Notes

Cottonwoods are woody, at least 4 years old, and grow in dense vegetation of Spartina pectinata and Euthamia occidentalis.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 16

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 109 **Last waypoint** 114

Other waypoints 110, 111, 112, 113

Description

Waypoint 109 is at downstream end, 111 at upstream end.

Geomorphic position

Bar (?) at confluence of main channel with side channel

Height above channel (m) 0.5 - 1 **Distance from channel (m)** 0.5 - 3.5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	67	50
Salix amygdaloides	6	0
Fraxinus pennsylvanica	1	0
	0	0

Other species

Notes

Most P. deltoides are at least 4 years old, some are ca. 2 years old. Vegetation is dense, of Spartina pectinata, Ambrosia sp., Melilotus spp. Agrostis stolonifera.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 17

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 115 **Last waypoint** 117

Other waypoints 116

Description

Waypoint 115 is at upstream end, 117 at downstream

Geomorphic position

Bank ca. 3 m tall.

Height above channel (m) 0.15 - 1.5 **Distance from channel (m)** 0.25 - 2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	117	50
Fraxinus pennsylvanica	1	40
Salix amygdaloides	1	40
	0	0

Other species

Notes

Most of the P. deltoides grow on gentle to steep slope below higher terrace. Age ca. 2 years to at least 4 years; some obviously are sprouts from browsed plants.

Taller P. deltoides (>3.5 m) were not counted as seedlings. Merges with Seedling Patch 18 on terrace below.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 18

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 118 **Last waypoint** 120

Other waypoints 119

Description

Waypoint 118 is at upstream end, 119 at downstream. This patch merges with Seedling Patch 17.

Geomorphic position

Terrace & foot of slope leading to higher terrace

Height above channel (m) 0. 5 - 1 **Distance from channel (m)** 0.2 - 2.5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	62	60
Salix amygdaloides	2	40
Fraxinus pennsylvanica	1	30
	0	0

Other species

Notes

Band of P. deltoides ca. 2.5 m wide. Some of plants counted here are sprouts, re-grown after browsing. Did not count P. deltoides taller than breast height, and some shorter than breast height but with several stems sprouting from thick crowns.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 19

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 121 **Last waypoint** 122

Other waypoints

Description

Waypoint 121 is at upstream end, 122 at downstream

Geomorphic position

Point bar

Height above channel (m) 0.25 - 0.5 **Distance from channel (m)** 0.5 - 2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	100	35
Salix amygdaloides	1	0
	0	0
	0	0

Other species

Notes

P. deltoides grow in dense mesic vegetation of Spartina pectinata, Agrostis stolonifera, Schoenoplectus sp. but not on wetter terrace below. Some are obvious sprouts; smallest are at least 2 yrs old. Excluded from count some > 1/2" diameter at base.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 20

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 123 **Last waypoint** 125

Other waypoints 124

Description

Waypoint 123 is at upstream end, 124 at downstream end, 125 at upstream end of old channel

Geomorphic position

Bar between active channel and abandoned channel

Height above channel (m) 0.25 - 0.75 **Distance from channel (m)** 0.5 - 2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	31	25
	0	0
	0	0
	0	0

Other species

Notes

P. deltoides form narrow band in dense vegetation of Agrostis stolonifera, Spartina pectinata, Melilotus officinalis, Schoenoplectus sp.

Excluded some P. deltoides stems at least 1/2" dia., obviously sprouts from established plants, but probably also counted some like this.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 21a

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 126 **Last waypoint** 0

Other waypoints

Description

Waypoint 126 is on downstream of 2 islands. Upstream island has Seedling Patch 21b

Geomorphic position

Island in channel

Height above channel (m) 0.25 - 0.75 **Distance from channel (m)** 0.1 - 1.5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	25	40
Salix amygdaloides	1	30
	0	0
	0	0

Other species

Notes

Smallest of P. deltoides are at least 2 yrs. old. Most grow in wet vegetation of Schoenoplectus sp. and Agrostis stolonifera; some in drier vegetation of Spartina pectinata.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 21b

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 126 **Last waypoint** 0

Other waypoints

Description

Waypoint 126 is on island imm. downstream from this one. Downstream island has Seedling Patch 21a.

Geomorphic position

Lower edges of island in channel

Height above channel (m) 0.25 - 0.75 **Distance from channel (m)** 0.2 - 2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	300	40
Salix amygdaloides	3	35
	0	0
	0	0

Other species

Notes

Numbers are estimates. Some seedlings are sprouts; shortest are 2-3 years old.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 22

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 127 **Last waypoint** 128

Other waypoints

Description

Waypoint 127 is at upstream end, 128 at downstream

Geomorphic position

Terrace or bar, including foot of slope up to next terrace

Height above channel (m) 0.2 - 3 **Distance from channel (m)** 0.25 - 0.75

Composition

Tree Species	Number	Height (cm)
Populus deltoides	106	0
Salix amygdaloides	14	0
	0	0
	0	0

Other species

Notes

Terrace is cobble in places. Dense vegetation of Agrostis stolonifera, Schoenoplectus sp, Melilotus officinalis, Spartina pectinata. Many P. deltoides are sprouts are at least 2 years old.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 23

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 129 **Last waypoint** 130

Other waypoints

Description

Waypoint 129 is at upstream end, 130 at downstream

Geomorphic position

Terrace, and foot of cobble bank up to next higher terrace

Height above channel (m) 0.3 - 0.75 **Distance from channel (m)** 0.5 - 1.5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	33	0
Salix amygdaloides	3	0
	0	0
	0	0

Other species

Notes

P. deltoides grow in band ca. 1 m wide. Some are sprouts. Excluded several plants taller than breast height, and also some large P. acuminata or P. angustifolia sprouts on bank.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 24

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 131 **Last waypoint** 132

Other waypoints

Description

Waypoint 131 is at upstream end, 132 at downstream

Geomorphic position

Alluvial bar along edge of narrow terrace, below cobble bank.

Height above channel (m) 0.3 - 0.5 **Distance from channel (m)** 1.5 - 3

Composition

Tree Species	Number	Height (cm)
Populus deltoides	17	45
	0	0
	0	0
	0	0

Other species

Notes

P. deltoides grow in band along edge of terrace. Some are sprouts; none look like this year's seedlings. Vegetation is dense -- Spartina pectinata, Agrostis stolonifera, Schoenoplectus sp., Salix exigua (latter to 1.5 m tall).

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 25

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 133 **Last waypoint** 135

Other waypoints 134

Description

Waypoint 133 is at downstream end, 134 at bend in channel, 135 at upstream end.

Geomorphic position

Point bar and low terrace downstream from bar

Height above channel (m) 0.25 - 1 **Distance from channel (m)** 1.5 - 5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	270	0
Salix amygdaloides	13	0
Populus angustifolia	2	0
	0	0

Other species

Notes

Number of P. deltoides is an estimate. Many are sprouts; all appear to be at least 2 yrs old. Vegetation is dense, dominated by Spartina pectinata, Agrostis stolonifera, Melilotus officinalis, some Salix exigua to 1 m tall.

P. deltoides become gradually taller with distance from channel.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 26

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 136 **Last waypoint** 137

Other waypoints

Description

Waypoint 136 is at downstream end, 137 at upstream

Geomorphic position

Alluvial bar on outside of channel between 2 bends

Height above channel (m) 0.2 - 1 **Distance from channel (m)** 0.2 - 1.2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	34	0
Salix amygdaloides	8	0
	0	0
	0	0

Other species

Notes

P. deltoides grow in narrow band, in dense vegetation of Spartina pectinata, Agrostis stolonifera, Schoenoplectus sp. Large sprouts (sapling size) grow higher on bank.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 27

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 140 **Last waypoint** 142

Other waypoints 141

Description

Waypoint 140 is at downstream end on S side, 141 at upstream end, 142 at downstream end on N side

Geomorphic position

Alluvial bar on upstream end of island

Height above channel (m) 0.5 - 0.75 **Distance from channel (m)** 0.25 - 3

Composition

Tree Species	Number	Height (cm)
Populus deltoides	40	50
	0	0
	0	0
	0	0

Other species

Notes

Smallest P. deltoides is at least 2 yrs old. Some are sprouts. P. deltoides grow in moderately dense vegetation of Spartina pectinata and Melilotus officinalis. In higher, center part of island, P. deltoides are sapling size.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 28

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 143 **Last waypoint** 145

Other waypoints 144

Description

Waypoint 143 is at downstream end, 144 at bend, 145 at upstream end

Geomorphic position

Narrow alluvial bar inside broad meander

Height above channel (m) 0.25 - 0.75 **Distance from channel (m)** 1 - 3

Composition

Tree Species	Number	Height (cm)
Populus deltoides	143	20
Salix amygdaloides	5	0
Fraxinus pennsylvanica	2	0
Populus angustifolia	1	0

Other species

Notes

P. deltoides are woody and the smallest is at least 2 yrs old; many are sprouts. They grow in dense vegetation of Spartina pectinata, Euthamia occidentalis, Ambrosia sp., Salix exigua (to 1.5 m tall). Number of P. deltoides is an estimate.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Seedling Patch 29

Date 9/20/2006 **Investigator** George Jones

Location

First Waypoint 151 **Last waypoint** 155

Other waypoints 152, 153, 154

Description

Waypoint 151 & 152 are at upstream end, 153 at bend, 154 at downstream end

Geomorphic position

Alluvial cobble bar

Height above channel (m) 0.5 - 1 **Distance from channel (m)** 3 - 10

Composition

Tree Species	Number	Height (cm)
Populus deltoides	67	0
Salix amygdaloides	1	0
	0	0
	0	0

Other species

Notes

Even small P. deltoides are at least 3 yrs old. They grow in moderately dense vegetation (Spartina pectinata, Melilotus officinalis, Salix exigua), between S. exigua/S. pectinata patches farther from channel and Typha sp. clumps closer to channel.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 2

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 53 **Last waypoint** 72

Other waypoints 54 - 71

Description

South of Laramie R., farther from channel than seedling patch 1

Geomorphic position

Alluvial terrace, on margin of large cobble bar.

Height above channel (m) 2 **Distance from channel (m)**

Composition

Tree Species	Number	Height (cm)
Populus deltoides	0	0
	0	0
	0	0
	0	0

Other species

Notes

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 3

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 73 **Last waypoint** 84

Other waypoints 74-83

Description

South of Laramie R., farther from channel than sapling patch 2

Geomorphic position

Alluvial terrace, on margin of large cobble bar.

Height above channel (m) 2 **Distance from channel (m)**

Composition

Tree Species	Number	Height (cm)
Populus deltoides	0	0
	0	0
	0	0
	0	0

Other species

Notes

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 4

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 85 **Last waypoint** 89

Other waypoints 86,87,88

Description

Geomorphic position

Alluvial terrace

Height above channel (m) 2 **Distance from channel (m)** 6

Composition

Tree Species	Number	Height (cm)
Populus deltoides	10	100
Salix amygdaloides	2	100
Fraxinus pennsylvanica	2	100
	0	0

Other species

Notes

Narrow band of saplings, from 3 m to at least 6 m back from channel, between bank above channel on one side and cobble bar on the other. Scattered, taller P. deltoides grow farther from the bank All plants are woody and > 1/2 " diameter at base.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 5

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 90 **Last waypoint** 94

Other waypoints 91, 92, 93

Description

Geomorphic position

Margin of cobble bar

Height above channel (m) **Distance from channel (m)** 30

Composition

Tree Species	Number	Height (cm)
Populus deltoides	0	200
	0	0
	0	0
	0	0

Other species

Notes

Narrow band, ca. 2 m wide, of cottonwood saplings (1.5 - 3 m tall) growing along edge of cobble bar. Waypoints are in a line approximately down the center of the band.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 6

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 95 **Last waypoint** 104

Other waypoints 96 - 103

Description

Geomorphic position

Edge of cobble bar

Height above channel (m) **Distance from channel (m)**

Composition

Tree Species	Number	Height (cm)
Populus deltoides	0	400
	0	0
	0	0
	0	0

Other species

Notes

P. deltoides to 5 m tall grow in a patch ca. 4 m wide along the edge of a cobble bar and edges of small channels crossing bar.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 101

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 138 **Last waypoint** 139

Other waypoints

Description

N side Laramie R

Geomorphic position

Steep bank 2 m tall from channel to terrace

Height above channel (m) 2 **Distance from channel (m)** 5

Composition

Tree Species	Number	Height (cm)
Populus deltoides	0	0
Salix amygdaloides	0	0
	0	0
	0	0

Other species

Notes

S. amygdaloides sprouts (sapling size) grow on lower part of bank, ca. 0.5 m above channel. P. deltoides suckers (sapling size) are common on bank in reach of river.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 102

Date 9/19/2006 **Investigator** George Jones

Location

First Waypoint 146 **Last waypoint** 149

Other waypoints 147, 148

Description

N side Laramie R

Geomorphic position

Steep bank 2 m tall from channel to terrace

Height above channel (m) 2 **Distance from channel (m)**

Composition

Tree Species	Number	Height (cm)
Populus angustifolia	0	0
Populus deltoides	0	0
	0	0
	0	0

Other species

Notes

Group of P. angustifolia sprouts and P. deltoides sprouts (both sapling size), probably with some P. acuminata, grow on bank and at foot of bank.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Sapling Patch 103

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 0 **Last waypoint** 0

Other waypoints

Description

No waypoints. Island in channel south of visitor center

Geomorphic position

Island

Height above channel (m) 1.5 **Distance from channel (m)** 2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	10	150
	0	0
	0	0
	0	0

Other species

Notes

Viewed island from bank of river to north. Number of cottonwood saplings is an estimate. Island is densely vegetated. Salix exigua 1.5 - 2 m tall are present.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Stream Reach 1

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 0 **Last waypoint** 0

Other waypoints

Description

No waypoints. Laramie R., north bank on broad right-hand bend

Geomorphic position

Bar

Height above channel (m) 1 **Distance from channel (m)** 2

Composition

Tree Species	Number	Height (cm)
Populus deltoides	2	0
	0	0
	0	0
	0	0

Other species

Notes

Only 2 P. deltoides seedlings. Stream morphology (channel bars, low terrace) seems to provide suitable habitat for tree seedlings. But, low surfaces near the channel are wet and densely vegetated (lowest Schoenoplectus sp, higher Spartina pectinata).

This reach may be an example of an area that would support cottonwood seedlings if the river still had very high flows some years. But, high flows may be too similar every year, and base flows sufficient to support dense herbaceous vegetation.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Stream Reach 2

Date 9/20/2006 **Investigator** George Jones

Location

First Waypoint 0 **Last waypoint** 0

Other waypoints

Description

No waypoints. Laramie R., south side, from lower bridge downstream to confluence w/ North Platte R.

Geomorphic position

Alluvial terrace

Height above channel (m) **Distance from channel (m)**

Composition

Tree Species	Number	Height (cm)
Populus deltoides	5	0
	0	0
	0	0
	0	0

Other species

Notes

Only scattered seedlings are present in this reach. No recent alluvial bars are present. Vegetation is Spartina pectinata, Melilotus spp., and other species common upstream on Laramie R.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Stream Reach 3

Date 9/20/2006 **Investigator** George Jones

Location

First Waypoint 0 **Last waypoint** 0

Other waypoints

Description

No waypoints. N. Platte R., west bank from mouth Laramie R. downstream to Ft. Laramie boundary line.

Geomorphic position

Bars, terrace

Height above channel (m) **Distance from channel (m)**

Composition

Tree Species	Number	Height (cm)
None	0	0
	0	0
	0	0
	0	0

Other species

Notes

No seedlings were noted in this reach. Lower surfaces are bare or sparsely vegetated bars, apparently flooded annually. Higher surface is terrace, densely vegetated, with groves of P. deltoides.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Stream Reach 4

Date 9/20/2006 **Investigator** George Jones

Location

First Waypoint 0 **Last waypoint** 0

Other waypoints

Description

No waypoints. N. Platte R., west bank from mouth Laramie R. upstream to historic bridge.

Geomorphic position

Bars

Height above channel (m) 0.5 **Distance from channel (m)** 0.5

Composition

Tree Species	Number	Height (cm)
None	0	0
	0	0
	0	0
	0	0

Other species

Notes

Channel is incised 2 - 3 m below terraces that support groves of large P. deltoides. Cobble bars on alternate sides of current channel suggest that channel meanders within limited width; absence of vegetation suggests frequent and prolonged flooding.

Banks ca. 2 m above bars and channel densely vegetated with Phalaris arundinacea and Spartina pectinata; large Typha sp. patches grow in places along channel.

FORT LARAMIE RIPARIAN FEATURES **September 2006**

Feature Stream Reach 5

Date 9/18/2006 **Investigator** George Jones

Location

First Waypoint 0 **Last waypoint** 0

Other waypoints

Description

No waypoints. Laramie R. imm. below upper Ft. Laramie boundary line, east side.

Geomorphic position

Bars, channel

Height above channel (m) 0.5 **Distance from channel (m)** 0.5

Composition

Tree Species	Number	Height (cm)
None	0	0
	0	0
	0	0
	0	0

Other species

Notes

Noted no seedlings in this reach. The few bars in this reach are well vegetated with Schoenoplectus sp., Spartina pectinata, Melilotus spp. Higher terraces support groves of Populus deltoides trees and saplings.

APPENDIX 2. PLOT DATA FROM THE USGS-NPS VEGETATION MAPPING PROJECT

These plot data were extracted from the full data set collected by the USGS-NPS vegetation mapping project (U.S. Geological Survey 1998), available at http://biology.usgs.gov/npsveg/fola/index.html. Each of the three plots included here measured 20 m x 20 m.

Plot Code **FOLA.1**

Scientific Name	% Canopy Cover	DBH (cm) of Trees in Plot
Stratum	*Emergent*	
Populus deltoides Bartr. ex Marsh.	2.5	26
Stratum	*Canopy*	
Fraxinus pennsylvanica Marsh.	2.5	14.3, 14.7
Populus deltoides Bartr. ex Marsh.	62.5	10, 10.8, 15.3, 10, 11.5, 12, 19.1, 22.9, 10, 14.3, 15.9, 10.8, 18.5, 13, 10, 18.5, 16.9, 11.8, 14.3, 15, 18.5, 15.3, 18.8, 15, 15.9, 13.7
Stratum	*Tall Shrub*	
Fraxinus pennsylvanica Marsh.	2.5	
Populus deltoides Bartr. ex Marsh.	2.5	
Stratum	*Short Shrub*	
Ribes aureum Pursh	0.5	
Ribes L.	0.5	
Symphoricarpos occidentalis Hook.	37.5	
Toxicodendron P. Mill.	0.5	
Stratum	*Herbaceous*	
Ambrosia L.	0.5	
Apocynum cannabinum L.	0.5	
Asclepias L.	0.5	

Plot Code **FOLA.1**

Asclepias speciosa Torr.	0.5
Bromus inermis Leyss.	0.5
Carex L.	0.5
Cirsium arvense (L.) Scop.	2.5
Fraxinus pennsylvanica Marsh.	0.5
Galium aparine L.	0.5
Glycyrrhiza L.	0.5
Pascopyrum smithii (Rydb.) A. Love	0.5
Poa pratensis L.	2.5
Spartina Schreb.	15
Taraxacum G.H. Weber ex Wiggers	0.5

Plot Code **FOLA.4**

Scientific Name	% Canopy Cover	DBH (cm) of Trees in Plot
Stratum	*Canopy*	
Fraxinus pennsylvanica Marsh.	15	21.7, 14.9, 15.9
Populus deltoides Bartr. ex Marsh.	37.5	22.3, 24.8, 22.3, 17.5, 20.7, 26.4, 29.6, 18.2, 24.2, 33.4, 17.2, 18.2, 24.5, 26.1, 16.6, 22.9, 13.4, 14.3, 14.3
Salix amygdaloides Anderss.	2.5	20.4, 12.7, 23.9, 25.5, 19.1, 17.2, 19.7, 15.9, 22.9, 15.9
Stratum	*Sub-canopy*	
Acer negundo L.	2.5	29.6
Stratum	*Tall Shrub*	
Populus deltoides Bartr. ex Marsh.	15	
Salix amygdaloides Anderss.	2.5	
Stratum	*Short Shrub*	
Symphoricarpos occidentalis Hook.	0.5	
Stratum	*Herbaceous*	
Asclepias speciosa Torr.	0.5	
Bromus inermis Leyss.	62.5	
Cirsium arvense (L.) Scop.	0.5	
Elytrigia repens var. repens (L.) Desv.	0.5	
Poa pratensis L.	2.5	

Plot Code **FOLA.6**

Scientific Name	% Canopy Cover	DBH (cm) of Trees in Plot
Stratum	*Canopy*	
Populus deltoides Bartr. ex Marsh.	15	31.8, 63.1, 47.7, 36.9, 68.8
Populus X acuminata Rydb. (pro sp.)	37.5	32.2, 39.8, 22, 22.3, 49.4, 15.9, 81.2
Stratum	*Short Shrub*	
Artemisia frigida Willd.	0.5	
Stratum	*Herbaceous*	
Ambrosia L.	0.5	
Apocynum cannabinum L.	0.5	
Artemisia campestris L.	0.5	
Artemisia ludoviciana Nutt.	0.5	
Asclepias speciosa Torr.	0.5	
Bromus inermis Leyss.	62.5	
Bromus tectorum L.	2.5	
Camelina microcarpa DC.	0.5	
Cirsium arvense (L.) Scop.	0.5	
Elytrigia repens var. repens (L.) Desv.	2.5	
Fraxinus pennsylvanica Marsh.	0.5	
Poa pratensis L.	0.5	
Populus deltoides Bartr. ex Marsh.	0.5	

Plot Code **FOLA.6**

Sisymbrium L.	0.5
Sporobolus airoides (Torr.) Torr.	0.5
Taraxacum G.H. Weber ex Wiggers	0.5
Thlaspi arvense L.	2.5
Tragopogon dubius Scop.	0.5