

Bryce Canyon National Park



2006 Invasive Non-Native Plant Inventory

Northern Colorado Plateau Inventory and Monitoring Network

Addendum Report

November 2006

Prepared by
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Cover photo:

Inventoried area along the northern Park boundary. Photo by K. A. Andersen.

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ADDENDUM REPORT

**Inventory of Invasive Non-native Plants
Conducted during 2006 in Portions of Bryce Canyon National Park,
Northern Colorado Plateau Network of the National Park Service.**

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INTRODUCTION

Utah State University conducted an invasive plant inventory project for twelve Parks and Monuments associated with the National Park Service, Northern Colorado Plateau Network, including Bryce Canyon National Park, (BRCA). Funding became available to continue the work on a limited basis during the 2006 field season. This report documents the results of the 2006 invasive non-native plant inventory at Bryce Canyon National Park. The document serves as an addendum to the Final Report for the Bryce Canyon National Park 2004 Invasive Non-native Plant Inventory (Dewey and Andersen 2005) and its addendum in 2005 (Dewey and Andersen 2006). Methods are documented fully in the original report and only summarized in the current report.

OBJECTIVES

The primary objective of this project was to document distribution and abundance of targeted invasive non-native plant species across the range of habitats and areas of management concern in Bryce Canyon National Park. It was anticipated that information from this inventory will be useful in the Park's ongoing efforts to improve strategic planning and to increase the effectiveness and efficiency of field operations associated with invasive plant management.

METHODS

SELECTION OF TARGET SPECIES AND INVENTORY AREAS

Two members of the Utah State University weed mapping crew participated in an inventory of targeted invasive plants in portions of Bryce Canyon National Park in August of 2006. Crew qualifications are documented in Appendix A. All field and office methods used in 2006 were identical to those described in the 2004 Final Report and 2005 Addendum Report. The same twelve species were identified as high-priority targets in the BRCA inventory (Table 1), and searched for systematically by all inventory crew members. Any other non-native species recognized as relatively new to BRCA and potentially invasive on wildlands in the West were documented if found. Forty-seven species were listed in the GPS data dictionary, representing all species targeted for inventory by the 12 Parks included in this project, plus some additional species of regional or national concern.

Areas inventoried were selected in consultation with Kristin Legg, Chief of Resources for Bryce Canyon National Park. The location and size of the areas inventoried in 2004, 2005, and 2006 are represented in Figure 1. Lands inventoried in 2004 are shown in yellow, lands inventoried in 2005 are shown in orange, and those inventoried in 2006 are shown in red. The acreage of each year's inventoried area is listed in the legend. Figure 2 shows just the individual area inventoried in 2006. The areas included were those most likely to have invasive plant habitat, with priority given to areas of present or anticipated Park development and high visitor use and were designated a management priority. Areas of likely weed seed introduction as well as sites

identified as significant known or potential weed seed sources or "vector areas" were also given priority during the selection process.

As in 2004 and 2005, the primary focus of the 2006 inventory project was NPS lands. However, in some cases a limited number of additional lands near or immediately adjacent to the BRCA border were inventoried. Non-NPS lands inventoried included portions outside of the northeast Park boundary. This area was inventoried as a matter of convenience and efficiency, as crew members were already in the area.

Table 1. List of invasive plant species targeted in Bryce Canyon National Park in the 2006 Non-native Plant Inventory.

Invasive species	Common Name
<i>Acroptilon repens</i>	Russian knapweed
<i>Bromus inermis</i>	Smooth brome
<i>Bromus tectorum</i>	Downy brome
<i>Carduus nutans</i>	Musk thistle
<i>Centaurea diffusa</i>	Diffuse knapweed
<i>Centaurea maculosa</i>	Spotted knapweed
<i>Centaurea virgata v. squarrosa</i>	Squarrose knapweed
<i>Cirsium arvense</i>	Canada thistle
<i>Cirsium vulgare</i>	Bull thistle
<i>Elaeagnus angustifolia</i>	Russian olive
<i>Onopordum acanthium</i>	Scotch thistle
<i>Tamarix ramosissima</i>	Saltcedar

DATA CATEGORIES

The data categories included in this inventory were discussed at length and agreed upon by NCPN and USU project leaders prior to initiation of the project. A complete description of the data categories and value options appears in Table 2. Data collection categories and definitions comply with the minimum mapping data standards established by North American Weed Management Association (NAWMA 2003) and include most of the core elements contained in the NPS Intermountain Region Weed Mapping Guidelines (Benjamin 2001, USDI-NPS 1995).

Data elements were collected by one of several methods: automatically recorded or manually entered into GPS units in the field (GPS-entered); transcribed from field notes; obtained from previously existing GIS data sets during post-processing (GIS-derived), or added manually in the office during post-processing (office). GIS-entered data included the location and size of each infestation, percent canopy cover, phenology of the weedy species, woody growth stage (if a woody species), presence of site disturbance, hydrology, dominant native species present, date, time, and any additional pertinent notes about the site. Data entered in the office during post-processing included ecological status, Park code, record numbers, detection confidence for inventory area polygons, scientific name, ITIS code, lifeform of species, county, state, and country. Additional data elements (e.g. datum, UTM zone, source of data) that pertain to the spatial data set as a whole are provided as metadata files (e.g., datum, UTM zone).

Figure 1. Total area inventoried for non-native invasive plant species in Bryce Canyon National Park in 2004, 2005, and 2006.

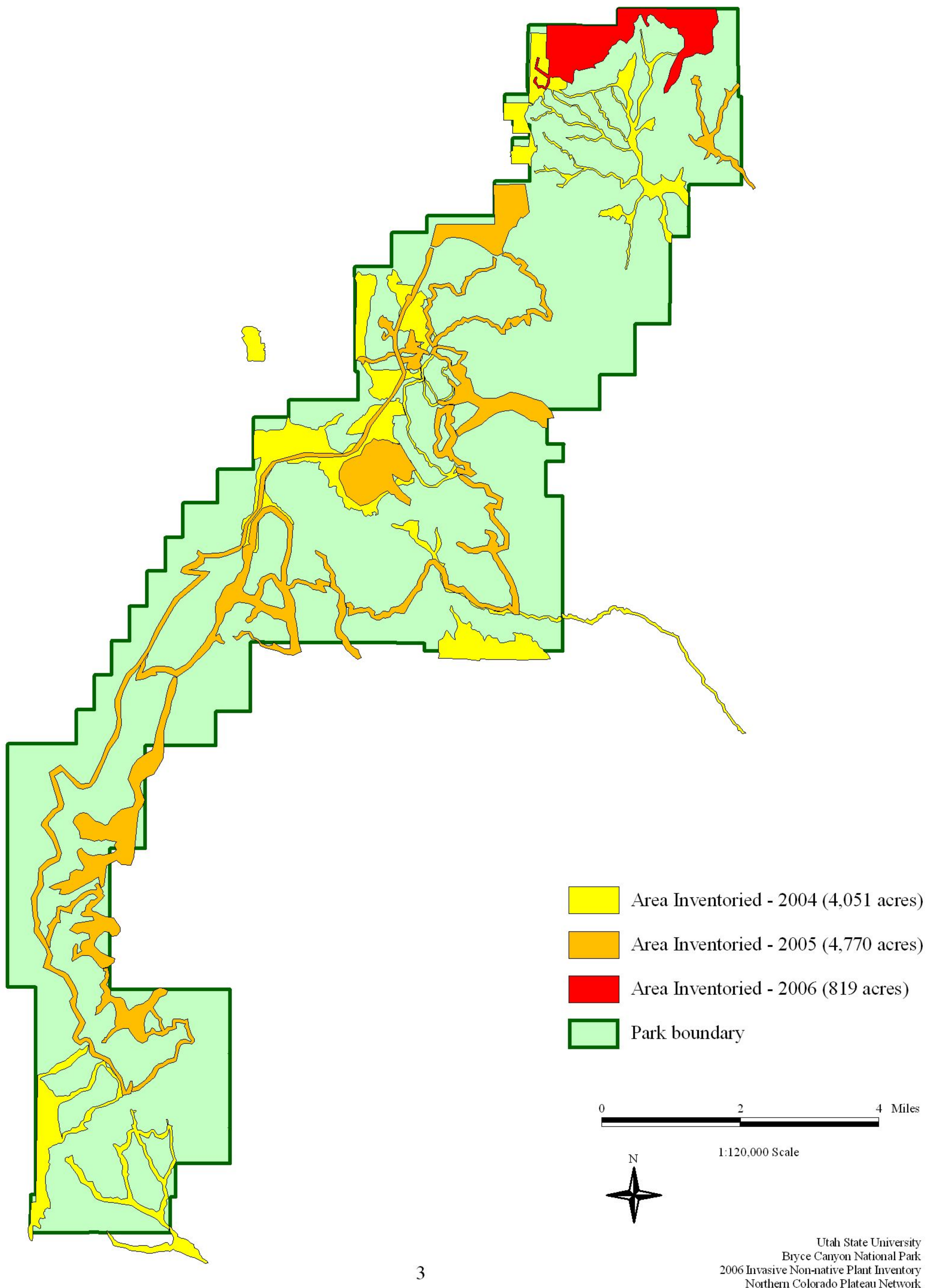
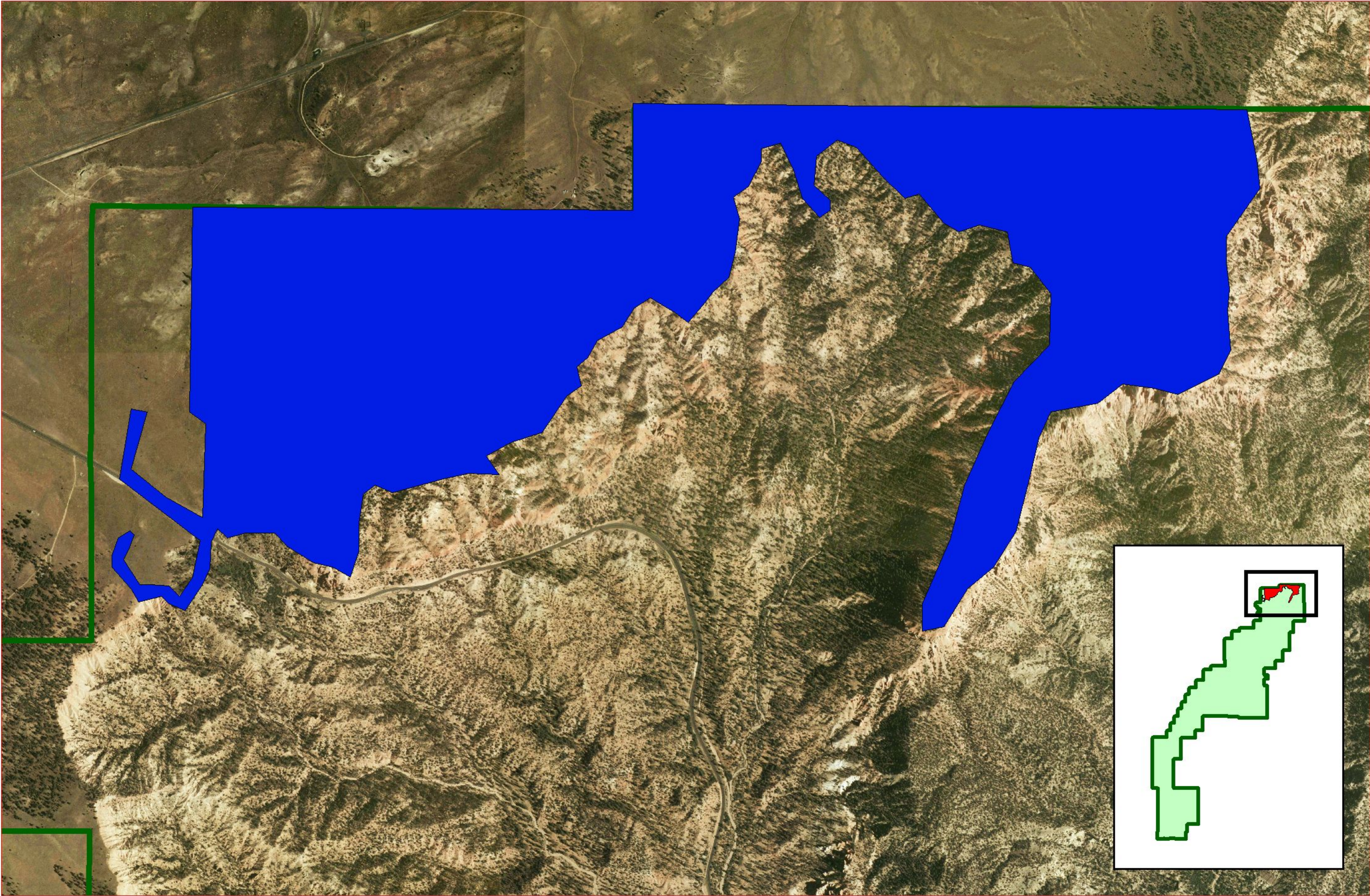


Figure 2. Identification number and acreage of the area inventoried for non-native invasive plant species in Bryce Canyon National Park during 2006.



Area Inventoried - 2006 (819 acres)
■ Area 29 - Northern Park boundary and fields
□ Park boundary

0 1000 2000 3000 4000 Feet



1:20,000 Scale

2006 Invasive Non-native Plant Inventory
Utah State University
Bryce Canyon National Park
Northern Colorado Plateau Network

Table 2. Description of data fields used in 2006 Inventory of Invasive Non-Native Plants in Bryce Canyon National Park.

Data Field	Description	Options / Values	Priority	Entry
Species Name	Latin name of species	Pick-list to be provided by Park staff	Required	GPS
Species Code	IT IS		Required	Office
Additional Names	Common name of the species			Office
Date	Date species observed		Required	GPS
Observer	Name of person observing population	First initial of person's last name used in data file name	Required	GPS
Location ID	Unique identifier for species population ("Record #")		Required	GPS
Park Code	Four-letter abbreviation of Park	BRCA	Required	Office
Country	Name of country (e.g. USA)		Required	Office
State	Two-letter state abbreviation		Required	Office
County	County name		Required	Office
UTMN	UTM northing coordinate for population		Required	GPS
UTME	UTM easting coordinate for population		Required	GPS
Elevation	Elevation in meters (and feet)	Meters (or feet)	Required	GPS
Size of Infested Area	Size of population (if a point feature). Based on average diameter of weed infestation.	- 1 to few plants - 0.1 acre - 0.25 acre - 1 acre - 2.5 acres - 5 acres	Required only for points.	GPS
Gross Area		Gross estimate of land area occupied by a weed species	Required in specific situations.	GPS
Cover of infested area	Estimated percent of area infested with weed	trace (<1%) low (1 to 5%) moderate (6 to 25%) high (26 to 50%) majority (51-100%)	Required.	GPS
Distribution	Characterization of density	To be determined by PI		GPS
Phenology	Life stage of majority of population. Use most progressive life stage if population appears evenly split.	- vegetative - bud - flower - immature fruit - mature fruit - seed dispersing - dormant	Required	GPS

Table 2 continued.

Data Field	Description	Options / Values	Priority	Entry
Woody Growth	Predominant growth stage of species. Use for woody weed species only (elm, tamarisk, Russian olive, etc.) If stages are mixed, use most advanced stage. (valuable for planning control efforts)	- seedling - sapling - mature - old-growth	Optional	GPS
Lifeform	Lifeform of species.	-tree -shrub -graminoid -forb	Required	office
Ecological Status	Qualitative description of the level of infestation that identifies ability of site to recover to natural state once the weeds have been removed.	<ol style="list-style-type: none"> 1. No weeds -The management emphasis is preventing weed encroachment. 2. New and/or small infestations - These infestations have good potential for eradication because they are small and there is a good understory of desirable plants. 3. Large scale infestation with 30% or greater understory of residual grasses and good potential productivity – Management of these sites in a way that selects for the recovery of the residual native grasses and shrubs has good potential for control but not eradication of the weeds. May be more than one noxious weed species, but the underlying biologic integrity of the unit is good. 4. Large-scale infestations with few or no (less than 30% cover) desirable grasses in the understory. Infestation often dense and/or multiple weed species. Control will require intense treatment and probably revegetation. Control may be possible but not eradication. In some areas, the infestation may have changed the character of the land so much that attempts for rehabilitation are cost prohibitive. 	Required	Field and Office
Dominant Species	Species Latin name for dominant species at site (up to four species can be recorded)	Two to three dominant species need to be provided at each point (list of dominant species provided by Park). If single or few plants, use dominant species in 1/10 acre area.	Required	GPS
Buffer	Buffer needed to encompass population if GPS'ed as a line or polygon feature	Enter number in feet	Required for lines, optional for polygons	GPS

Table 2 continued.

Data Field	Description	Options / Values	Priority	Entry
Hydrology	General hydrologic setting of site. If further specificity is needed in Park, add items as subcategories to existing terms (e.g., wetland - seep).	- upland (above and away from floodplains) - riparian (along rivers or stream channels) - perennial: stream flows continuously in time. - intermittent: stream flows only at certain times of the year (typically on seasonal basis) when it receives water from springs or from melting snow. - ephemeral: stream flows only in direct response to precipitation. Ephemeral streams generally lack obligate riparian vegetation. - wetland (saturated soil for majority of growing season) - playa lakebed (poorly drained depressions)	Required	GPS
Disturbance	Evaluate disturbance at population site	1 - no disturbance apparent 2 - light to moderate disturbance 3 - site heavily disturbed	Required	GPS
Treatment	Comment on obvious control treatments at the field collection site	-Yes (additional notes then to be placed under the "Notes" section identifying treatment type) -No	Optional	GPS
Data Dictionary	Data dictionary utilized during the project.		Optional	office
Receiver Type	GPS unit used to collect data	Identifies the type of GPS unit used for the data collection process in the field.	Optional	office
Notes	Additional comments	Can include compass bearing for photos, description of non-weed features, etc.	Optional	GPS and field notes
Area ID	Unique identifier for inventory area		Required	GPS
Disturbance Comments	Comments on type and extent of disturbance noted in inventory area. If area is undisturbed, note as such.	-Agriculture/Livestock Grazing -Construction/Development -Fire -Fire Suppression -Flooding -Wind -Geothermal -Animal Disturbance (e.g. gopher mound, buffalo wallow) -Irrigation/Ditches -Mining and Quarries -Oil and Gas Exploration/Production -Habitat Improvement Project -Recreation/Visitor Use -Right-of-Way -Construction/Maintenance -Utility -Construction/Maintenance -Trail/Outfitter/ORV use	Required	Field notes

FIELD PROCEDURES

The 2006 invasive non-native plants inventory in Bryce Canyon National Park was conducted on August 22 and August 23 and involved a two-person crew (Table 3). The area inventoried included the northern park boundary and plateaus above Tropic Canyon. For purposes of planning and data analysis the inventoried land is shown as one area. The order in which the area was inventoried over the two days in 2006 was determined by the USU crew leader. Potential invasive plant habitat within the targeted inventory area was considered prior to planning each day's travel route.

Table 3: Invasive plant inventory areas, inventory dates, crew members, and acres inventoried during 2006 in Bryce Canyon National Park.

Area Number	Area Description	Dates Inventoried	Crew Members*	Acres Inventoried**
29	Northern Park boundary above Tropic Canyon	August 22-23	KA, AS	819

* Crew abbreviations: KA = Kim Andersen, AS = Anna Schmidt.

** An average of 264 acres inventoried per person per 10-hr day in 2006.

Field searches were conducted at as fine of a scale as required to be confident that 90 to 100 percent of all invasive plant infestations 0.01 acre or larger within each inventory area were detected. Search swath widths were adjusted as needed based on variations in terrain, walking speed, associated vegetation, and target species. Areas searched underneath ponderosa pine were generally open and visibility was good, allowing relatively broad EDSW's (typically 75 to 100 yards). In areas where vegetation cover was heavy such as along the eastern boundary along the canyon rim, EDSW's were usually narrower, sometimes less than 50 yards. Whenever inventorying areas wider than a single swath width, multiple parallel passes of a lone crew member (or multiple crew members walking parallel transects or contours) were searched as contiguous or slightly overlapping strips to avoid coverage gaps. In situations of extremely steep or otherwise inaccessible terrain where vegetation could be identified clearly from a distance, crew members sometimes used binoculars to visually scan the area for suspected target species. Daily inventory routes of each crew member were recorded and mapped using the BFP tracking function of the GeoExplorer GPS units. BFP tracking distance settings were adjusted as needed to correspond closely to the EDSW distance for each area.

The inventoried area within Bryce Canyon National Park was assigned a detection confidence value based on the crew's estimated ability to see infestations of 0.01 acre in size of the least visible target species, taking into account terrain, vegetation cover, and the size and growth stage of the targeted plant species. Detection confidence was broken into three categories: Low (1 to 50 %), Medium (51 to 89 %), and High (90 to 100%).

The locations of all target species were documented by the USU crew using Trimble GeoExplorer 3 global positioning system (GPS) units with 2- to 5-meter accuracy. Crews also recorded the location and documented the identity of any other non-target species they encountered if that species has a known history of invasiveness in other regions in the West. Field locations were recorded by GPS as UTM coordinates, and were later differentially corrected in the production of final digital products.

At the end of each day, field crews marked and dated all inventoried areas on USGS 7.5' topographic maps to assist in determining project progress and thoroughness of coverage. Data were downloaded from GPS units onto a laptop computer each day using Pathfinder Office GIS software. Edits (such as eliminating any duplicate features) were made to the data, and any additional information (such as infestations drawn by hand on field maps or other data not recorded with a GPS unit) was added at this time. The data was then processed and managed following the protocols described in the original report (Dewey and Andersen 2005).

GENERAL PHOTOGRAPHS

Representative photos are included in this report showing some of the species and habitats inventoried. Photographs were taken of each new weed species found in the Park in previous years' inventories. No new species were found this year. Photographs taken in previous years' inventories were provided in the report to serve as vouchers for those species mapped in 2006. Close-up photographs were intended to serve as a type of voucher specimen for weed species encountered, and landscape photos of weeds are expected to assist in relocating small isolated infestations for future control. The location of each weed infestation documentation photo was recorded as a GPS "photo point". In the case of landscape photographs, the UTM coordinates represent the location of the photographer, and the direction that the camera was facing is noted as a compass bearing (magnetic north reference). The locations of photos taken to show general types of terrain and habitat, or crew activities usually were not documented with GPS points. Photographs were taken with 35-mm digital camera. Pertinent photographs are included with this report (see Appendix B). Digital copies of all photographs were submitted to NCPN as part of the final deliverables.

RESULTS and DISCUSSION

Field crews inventoried 819 acres in Bryce Canyon National Park during August of 2006 (Table 3), an amount representing approximately 2.3 percent of the entire 35,835-acre Park. An average of 264.2 acres was inventoried per person per 10-hr day in 2006.

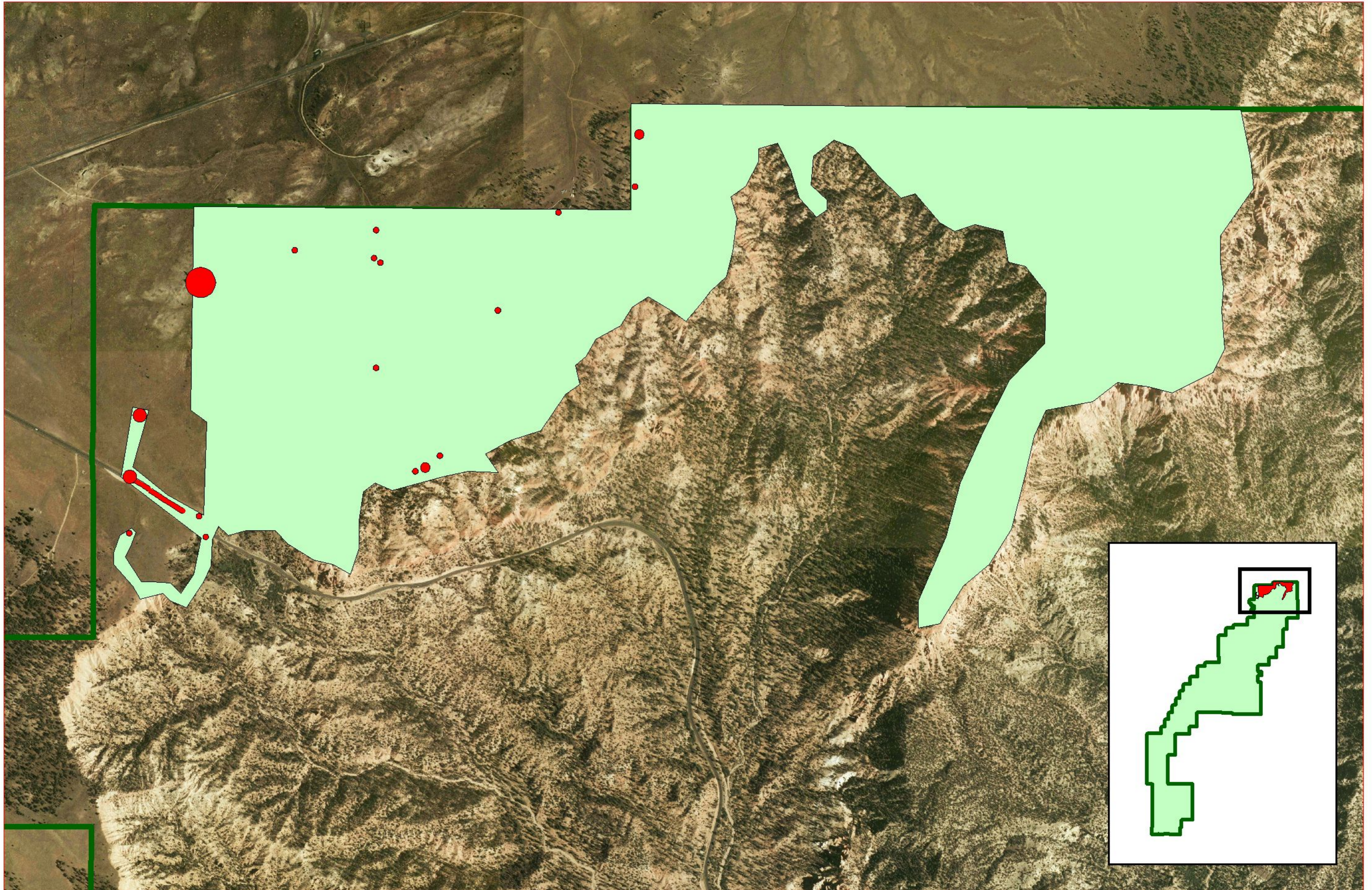
Figure 3 displays the overall weed distribution and weed-free areas found within the inventoried area during 2006. Appendix C displays smaller 1:11,000 scale individual weed species-distribution “Inset” maps. Inset maps are distinguished by individual species and represent the four species mapped by the crew. The individual points displayed represent true-to-scale infestation size classes recorded by surveyors during the field season. The extremely small size classes between 0.001-acre and 0.10-acre were impossible to see on maps upon initial creation and it was decided to make all points recorded as 0.10-acre or smaller the size of 0.10-acre for ease of visualization.

Invasive plants infested a total of 4.825 acres within the mapped areas (Table 4), an amount equal to 0.59 percent of the land inventoried. Of the 12 initial targeted species, crews found only *Bromus inermis* and *Bromus tectorum*. No infestations of *Acroptilon repens*, *Carduus nutans*, *Centaurea diffusa*, *Centaurea maculosa*, *Centaurea virgata* v. *squarrosa*, *Cirsium arvense*, *Cirsium vulgare*, *Elaeagnus angustifolia*, *Onopordum acanthium*, or *Tamarix ramosissima* were discovered within the inventoried area. Non-target species found and mapped were *Melilotus officinalis* and *Salsola iberica*.

The most abundant target species found in the Park in 2006 was *Bromus tectorum*. The crew recorded 3.423 acres of this species during the project. *Bromus tectorum* comprised 70.9 percent of the total infested acreage inventoried. Infestations of *Bromus tectorum* were generally less than 0.1 acres in size, often consisting of dense patches found scattered in open meadows. *Bromus inermis* was the second most abundant target species found in the Park and comprised approximately 26.4 percent of the total infested acreage. *Salsola iberica* was the third most common target species, making up 2.7 percent of the total infested acreage. The remaining infested acreage (0.02 percent of the total infested acreage) consisted of a single patch of *Melilotus officinalis* found and mapped.

Not all non-native species that were found were mapped. For example, species such as *Chenopodium album* and *Lactuca serriola* were noted in a few areas but were ignored due to their previously recognized presence in the Park. *Agropyron cristatum* was also present along the park boundary in several places but was ignored.

Figure 3. Overall distribution of invasive non-native plant species in the inventoried area in Bryce Canyon National Park during 2006.



- Invasive Non-native Plant Species
- Invasive Non-native Plant Species
- Inventoried Area
- Park boundary

0 1000 2000 3000 4000 Feet



1:20,000 Scale

2006 Invasive Non-native Plant Inventory
Utah State University
Bryce Canyon National Park
Northern Colorado Plateau Network

Table 4: Acres infested by invasive plant species within inventoried areas of Bryce Canyon National Park and adjacent lands in 2006.

Species	Infested Acres (Points)	Infested Acres (Lines)	Total
<i>Bromus inermis</i>	1.004	0.268	1.272
<i>Bromus tectorum</i>	3.330	0.093	3.423
<i>Melilotus officinalis</i>	0.001	0	0.001
<i>Salsola iberica</i>	0.101	0.028	0.129
Totals	4.436	0.389	4.825

Appendix C contains maps of individual species occurrences and weed-free areas within that portion of Bryce Canyon National Park inventoried in 2006. The following is a narrative summary of the weed situation within that inventory area:

This inventory unit consisted of the northern Park boundary from the fenceline to the canyon rim above Tropic Canyon and the eastern Park boundary. The crew inventoried the area by walking 50-m and 75-m transects through the site. Terrain and vegetation within the unit varied greatly. The eastern portion of the unit consisted of heavy bitterbrush and sagebrush while the western portion consisted of open Ponderosa Pine forest. The area along the canyon rim was more open and consisted of manzanita and bristlecone pine. Low-lying meadows found on the western edge of the unit were found containing rabbitbrush and native grasses. Native thistles and snakeweeds were found throughout the entire inventory unit as well as several native grasses including *Stipa hymenoides*, *Hesperostipa comata*, and *Bouteloua* species.

The inventory unit contained relatively few weed species as compared to the numerous native grasses and shrubs present. *Bromus tectorum* was the most commonly found species in this area. The largest infestation of *Bromus tectorum* was found on a small hill in the western portion of the unit. Other smaller infestations were found bordering the fenceline in an area that displayed evidence of having burned recently. Additional infestations were found in a low-lying meadow and an open slope above the canyon. *Bromus tectorum* was also found along the road shoulder of the main highway passing through Tropic Canyon.

The majority of the infested acres of *Bromus inermis* were also found along Highway 12 through Tropic Canyon. *Bromus inermis* was the second most commonly seen target invasive species recorded. The remaining patches were found in a low-lying meadow containing small water catch-basins. These wetter meadows contained several small 0.10-acre patches of *B. inermis* although the four patches were found in the lowest portion of the meadow and near the park boundary fenceline.

Additional non-target species were found along Highway 12 in Tropic Canyon and mapped by the crew. Two small patches of *Salsola iberica* were found directly on the north side of the road shoulder in the same vicinity as previously mapped *Bromus inermis* and *Bromus tectorum*. A 0.10-acre patch of *Salsola iberica* was also found in the meadow south of the highway. A single 0.001-acre patch of *Melilotus officinalis* was also found on the south shoulder of Highway 12. Although only a small portion of Highway 12 was inventoried during 2006, a previous

inventory of the highway in 2004 (Dewey and Andersen 2005) found it to be extremely weedy. Species found during that survey include *Bromus inermis*, *Bromus tectorum*, *Cirsium vulgare*, *Convolvulus arvensis*, *Dactylis glomerata*, *Halogeton glomeratus*, *Marrubium vulgare*, *Melilotus officinalis*, *Salsola iberica*, and *Tragopogon dubius*.

Overall the inventoried area was relatively weed-free and demonstrated few signs of disturbance. Signs of previous fire could be seen in only a handful of places and occasional evidence of livestock trespass along the park boundary was evident. The majority of weed infestations were found along Highway 12 or near the park boundary, implicating people and livestock are likely to blame for their introduction. However, the majority of the inventory unit received little to no disturbance and the native plant populations appeared to be intact and healthy. Visibility was generally good throughout the inventoried area and the crew was confident of finding 90 percent or more of all 0.01-acre and larger patches of the targeted species. Due to presence of small invasive plant infestations the area was assigned an ecological status rating of two, although the majority of the unit could be assigned a rating of one for its many weed-free areas.

CONCLUSIONS / RECOMMENDATIONS

The primary objective of this project was to document the distribution and relative abundance of targeted non-native invasive plant species across the range of habitats and areas of management concern within Bryce Canyon National Park. As with the information contained in the 2004 and 2005 reports, it is anticipated that this 2006 inventory will continue to be useful in the Park's ongoing efforts to improve strategic planning and to increase the efficiency and effectiveness of all field operations associated with invasive plant management.

USU continues to urge the Park to develop a comprehensive written management plan for invasive plant species in BRCA, and to review and improve it on a regular basis. Regularly scheduled weed inventories of all managed lands should be a part of the plan. Permanent monitoring sites should be established to evaluate the impact and spread of weeds, and to evaluate the effectiveness of its weed management approaches. Bryce Canyon National Park is encouraged to become an active member of a local Cooperative Weed Management Area.

As in other NCPN Parks that were inventoried between 2003 and 2006, Bryce Canyon National Park is in the enviable situation of still having the majority of its lands free of targeted invasive weeds. In Bryce Canyon National Park 99.4 percent of the inventoried acres in 2006 were free of all targeted species. Furthermore, 99.3 percent of the inventoried acres in the three years combined (2004-2006) were free of all targeted species. And, because areas selected for this inventory were generally considered the sites most likely to be infested, it can be assumed that those BRCA lands not inventoried have an even higher proportion of weed-free acres. Furthermore, 100 percent of all inventoried lands in 2006 were completely free of at least 37 species of great concern to the region (Appendix D).

ACKNOWLEDGEMENTS:

We express appreciation to the Northern Colorado Plateau Network in Moab, UT, for their vision and efforts in initiating this inventory project. We are grateful to Kristen Legg for her help in logistical planning and coordination. Above all, we thank the dedicated USU crew members who frequently encountered potentially dangerous situations and considerable physical hardship in the summer heat and rugged backcountry of southern Utah to collect this information.

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Appendix Tables and Figures

Appendix A. Crew Qualifications and Project Quality Assurance for the 2006 Invasive Non-native Plant Inventory in Bryce Canyon National Park.

The Utah State University wildland weed mapping team has considerable experience conducting the type of survey required in this NPS project. Previous weed surveys conducted by USU include:

- 1997 Mt. Naomi Wilderness Area, Cache County, UT
- 1998 Wellsville Mountains Wilderness Area, Cache and Box Elder Counties, UT
- 1999 Franklin Basin Recreation Area, USFS Logan Ranger District, Cache County UT
- 2000 Rich County Public Lands (BLM, USFS), UT
- 2001 Hardware Ranch WMA, UDWR, Cache County, UT
- 2001 Bud Phelps WMA, UDWR, Cache County, UT
- 2002 Hawkins Fire, USFS, Bannock County, ID
- 2002 Canyon Fire, USFS, Franklin County, ID
- 2002 Cherry Creek Fire, USFS, Bannock County, ID
- 2002 West Fork Fire, BLM, Bannock County, ID
- 2002 Dinosaur National Monument, Green River District, UT
- 2003 Invasive Non-native Plant Inventories conducted in portions of ARCH, BLCA, CANY, CARE, COLM, HOVE, NABR, MEVE, ZION; Northern Colorado Plateau Network, National Park Service
- 2004 Invasive Non-native Plant Inventories conducted in portions of ARCH, BLCA, BRCA, CANY, CARE, CEBR, and DINO; Northern Colorado Plateau Network, National Park Service
- 2005 Invasive Non-native Plant Inventories conducted in portions of BRCA, CANY, CARE, and DINO; Northern Colorado Plateau Network, National Park Service
- 2005 Yampa River corridor, Moffat and Routt Counties, CO

Kim Andersen (crew leader) has considerable experience working on the USU crew in past years. Kim has a Bachelor of Science degree in Fisheries and Wildlife from the College of Natural Resources and is currently working towards a Master's Degree in Weed Science. Kim began work on the USU crew in 1999, and has been crew leader since 2000. She has additional experience with invasive weed GPS mapping projects in Grand Teton National Park. Anna Schmidt has a Bachelor of Science degree in Nutrition. She has considerable outdoor skills and participated in numerous outdoor survival courses. She also participated in the annual training course taught at Utah State University.

All USU weed survey crew members were required to pass a written exam in weed identification and mapping skills before being hired. Each also had passed an upper-

division university course in weed identification, biology, and management, and/or has extensive practical experience in wildland plant identification. Once hired, USU and NPS crew members also attended a 3-week classroom and outdoor training course in early May in wildland weed mapping techniques taught by Dr. Dewey at Logan during 2006. Crew members were provided with weed identification field guide book, taxonomic keys, and pressed reference specimens of all targeted weeds. During the course of the summers USU crew members were quizzed periodically with fresh plant specimens provided by the crew leader and/or Dr. Dewey. Dr. Dewey also spent several days working with individual crew members under field conditions. To further authenticate findings, Dr. Dewey and/or the crew leader re-visited representative areas in each park that had been previously mapped by the USU crew, using the most recent crew-generated weed infestation maps to compare them against their own field observations.

Weeds Detected



Figure 1. *Bromus inermis* flower heads.*



Figure 2. *Bromus tectorum*.*



Figure 3. *Melilotus officinalis*.



Figure 4. *Salsola iberica*.*

Bryce Canyon Landscapes



Figure 5. Inventoried fields along the northern Park boundary, above Tropic Canyon, BRCA PR-83.



Figure 6. Looking southwest across the mesa inventoried in 2006 by USU, BRCA PR-84.

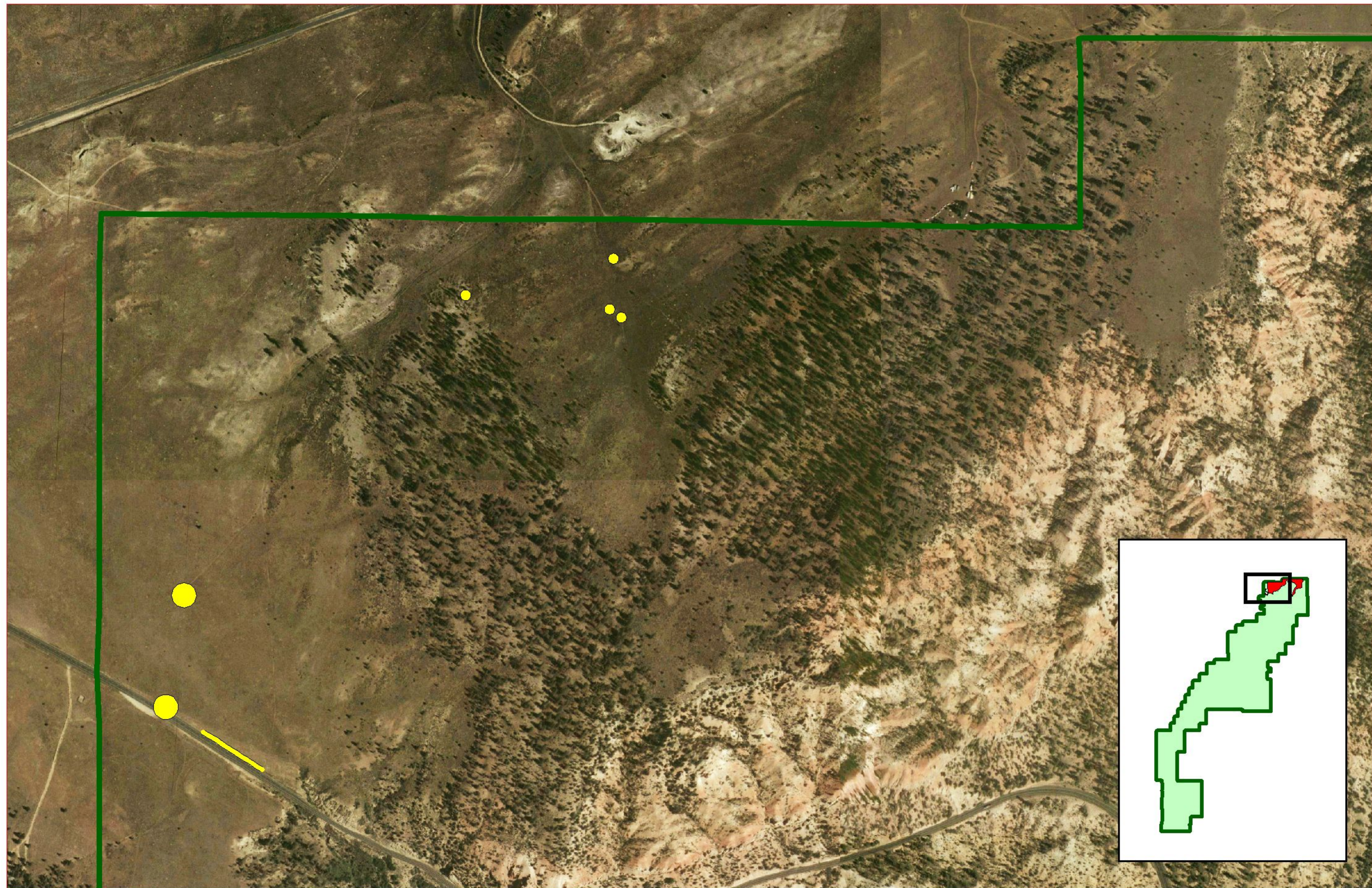


Figure 7. Looking into Tropic Canyon (south) from the inventoried site along the northern Park boundary.







Figure 8. Looking down into Little Henderson Canyon and Tropic Canyon from the inventoried area along the Park boundary.

Appendix C1. Location and size of *Bromus inermis* infestations found in the portion of Bryce Canyon National Park inventoried in 2006.



C-1

Bromus inermis

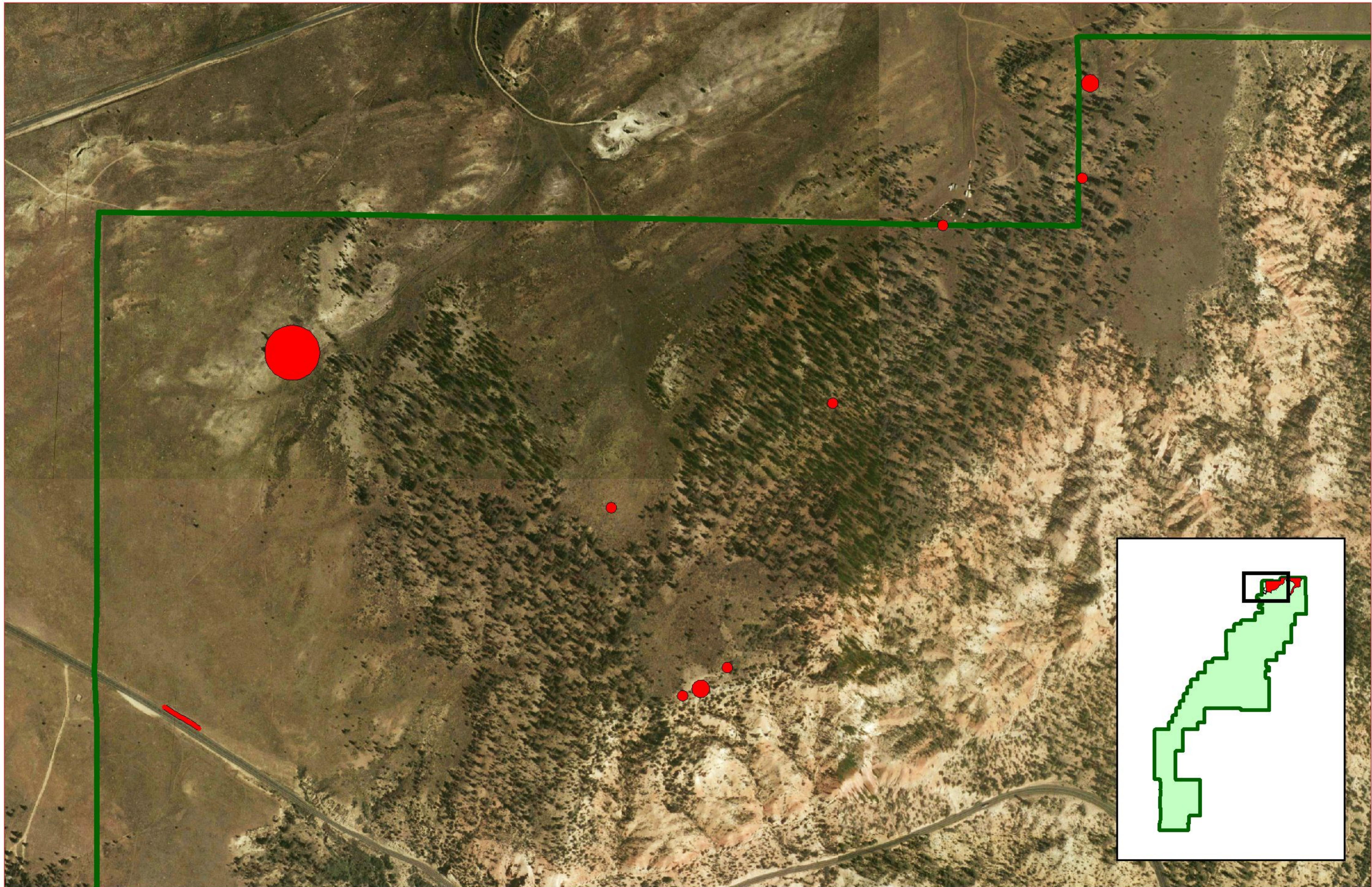
-  0.10 or less acres infested
-  0.25 acres infested
-  Linear infestation
-  Park boundary

0 500 1000 1500 2000 Feet

1:11,000 Scale



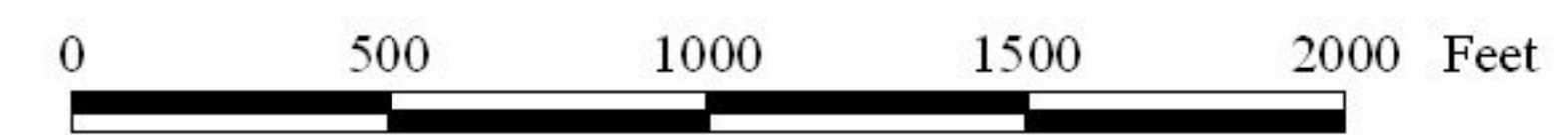
2006 Invasive Non-native Plant Inventory
Utah State University
Bryce Canyon National Park
Northern Colorado Plateau Network



C-2

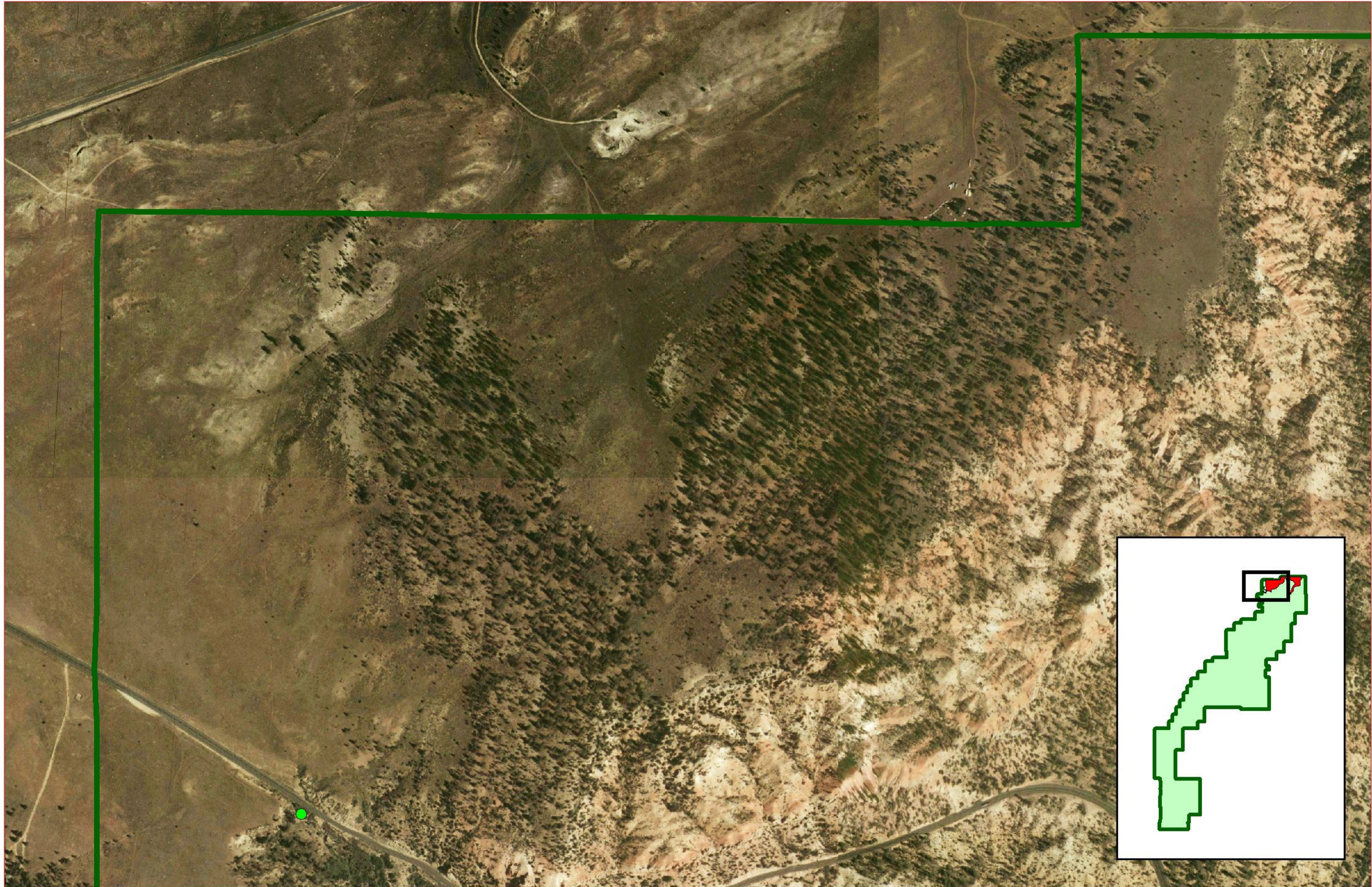
Bromus tectorum

- 0.10 or less acres infested
- 0.25 acres infested
- 2.5 acres infested
- Linear infestation
- ▭ Park boundary



1:11,000 Scale

C-3



Melilotus officinalis

● 0.10 or less acres infested

▭ Park boundary

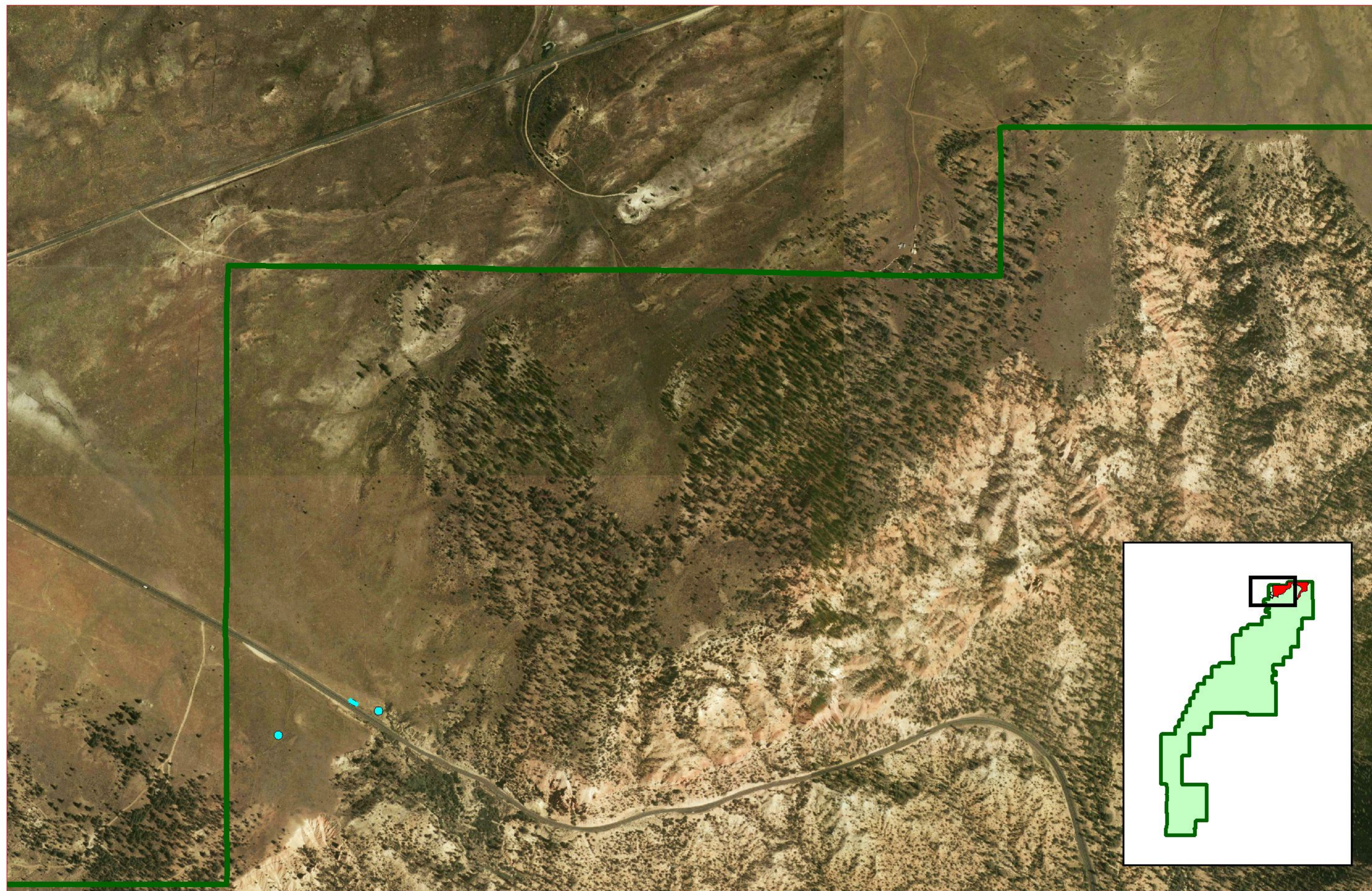
0 500 1000 1500 2000 Feet



1:11,000 Scale




2006 Invasive Non-native Plant Inventory
Utah State University
Bryce Canyon National Park
Northern Colorado Plateau Network

Appendix C4. Location and size of *Salsola iberica* infestations found in the portion of Bryce Canyon National Park inventoried in 2006.



C-4

Salsola iberica

-  0.10 or less acres infested
-  Linear infestation
-  Park boundary

0 600 1200 1800 2400 Feet



1:11,000 Scale

2006 Invasive Non-native Plant Inventory
Utah State University
Bryce Canyon National Park
Northern Colorado Plateau Network

Appendix D. Summary of occurrence and inventory status of the 47 non-native species listed in the GPS data dictionary, plus any additional species noted in the 2006 inventory of invasive plants in Bryce Canyon National Park.

GPS Species	A	B	C	D	E	GPS Species	A	B	C	D	E
<i>Agropyron cristatum</i>			X			<i>Lepidium latifolium</i>				X	
<i>Ailanthus altissima</i>				X		<i>Linaria dalmatica</i>				X	
<i>Alhagi pseudalhagi</i>				X		<i>Linaria vulgare</i>				X	
<i>Anthemis L.</i>				X		<i>Lythrum salicaria</i>				X	
<i>Arctium minus</i>				X		<i>Marrubium vulgare</i>				X	
<i>Arundo donax</i>				X		<i>Moluccella laevis</i>				X	
<i>Asparagus sp.</i>					X	<i>Onopordum acanthium</i>				X	
<i>Brassica tournefortii</i>				X		<i>Phleum pratense</i>					X
<i>Bromus inermis</i>	X					<i>Rubus discolor</i>				X	
<i>Bromus tectorum</i>	X					<i>Rumex crispus</i>					X
<i>Cardaria draba</i>				X		<i>Salsola iberica</i>	X				
<i>Carduus nutans</i>				X		<i>Sorghum halepense</i>				X	
<i>Centaurea diffusa</i>				X		<i>Tamarix ramosissima</i>				X	
<i>Centaurea maculosa</i>				X		<i>Tragopogon dubius</i>					X
<i>Centaurea repens</i>				X		<i>Tribulus terrestris</i>				X	
<i>Centaurea solstitialis</i>				X		<i>Verbascum thapsus</i>				X	
<i>Centaurea virgata</i>				X		<i>Ulmus pumila</i>				X	
<i>Chenopodium album</i>					X						
<i>Cirsium arvense</i>				X		Other:					
<i>Cirsium vulgare</i>				X		<i>Lactuca serriola</i>			X		
<i>Conium maculatum</i>				X		<i>Melilotus officinalis</i>	X				
<i>Convolvulus arvensis</i>				X							
<i>Cynoglossum officinale</i>				X							
<i>Dactylis glomerata</i>					X						
<i>Elaeagnus angustifolia</i>				X							
<i>Euphorbia esula</i>				X							
<i>Halogeton glomeratus</i>				X							
<i>Hyoscyamus niger</i>				X							
<i>Isatis tinctoria</i>				X							
<i>Iva xanthifolia</i>				X							

A = Present - Full inventory
 B = Present – Partial inventory
 C = Present – Not Mapped
 D = Searched For - Absent
 E = No Information