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ANNOTATED CHECKLIST OF EXOTIC VASCULAR PLANTS IN YELLOWSTONE NATIONAL PARK

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ABSTRACT.—Documentation of the arrival of exotic vascular plants in Yellowstone National Park has been sporadic. An annotated checklist of exotic vascular plants is presented, with information about the approximate arrival time in the park of each species and the current extent of the infestation. Yellowstone's flora includes 187 exotic vascular plant species (14.8% of the flora), and the park has an extrapolated mean number of exotic species per 10 km^2 of 47.3. The situation in Yellowstone is compared with other areas in North America. The increase in exotics mirrors a corresponding increase in visitation.

Key words: Yellowstone National Park, exotic plants, flora, vascular plants, annotated checklist.

The intense interest generated by the expeditions of Folsom and Cook in 1869 and Langford, Washburn, and Doane in 1870 led to the establishment of Yellowstone as the 1st national park in the world in 1872. The 1st botanical collection was by Robert Adams, Jr., who was a member of the 1871 Hayden expedition. The earliest known record of an exotic species in Yellowstone is *Oxalis violacea* Jacq., which was collected by Forwood in 1881 (Denton 1973). The 1st Yellowstone flora was published by Frank Tweedy (1886), who incorporated the work of several collectors and listed 657 species, including 6 species that, if correctly identified, are exotic. Thus, a relatively early baseline of information exists that predates most major disturbance by visitors. In 1900, Per Axel Rydberg completed a catalogue of the vascular plants of Montana and Yellowstone National Park and reported 8 species that appear to be exotic, including 4 that were reported by Tweedy. These early floras did not include all collections that had been made within Yellowstone, omitting, for example, the Forwood collection of *Oxalis violacea.* Intense interest in the park resulted in many other collectors visiting and making extensive collections that are now scattered among many different institutions. Examination of material at Yellowstone National Park (YELLO), Montana State University (MONT), and Rocky Mountain Herbarium (RM) resulted in the location of specimens documenting the presence of at least 12 exotic species in the park by 1900. Other collections, such as many of those cited by Tweedy and Rydberg, are at East Coast herbariums such as the New York Botanical Gardens (NY) and the Smithsonian Institution (US) and therefore were not easily available for examination.

A significant interval has passed since the last flora was published for Yellowstone National Park (Despain 1975). In the intervening time exotics have continued to arrive and spread in Yellowstone. The purpose of this paper is to provide an updated annotated checklist of exotics known to occur within the park.

Precise demarcation of exotic species can be difficult. A species is considered exotic by the National Park Service if it occurs in a given place as a result of direct or indirect, deliberate, or accidental actions by humans (NPS 1988). Species that are native to North America, but would not be found within the confines of the park without human intervention, are therefore considered exotic.

During the early years of the park, several species including *Syringa vulgaris* L., *Picea pungens* Engelm., and *Populus* spp. were intentionally planted in Mammoth and at other locations in the park. The annotated checklist of exotic plants does not include any species that was intentionally planted if the original plant has not reproduced or spread from the historical planting. Because one goal of the National Park Service is to prevent the establishment of exotic species, any new arrival is

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eradicated if possible. Therefore, some species that might not persist and reproduce within the confines of the park are included in this list.

The origins of several cosmopolitan weeds that occur in Yellowstone, such as *Amaranthus retroflexus* L., *Poa pratensis* L., *Polygonum aviculare* L., and *Rorippa nasturtium-aquaticum* (L.) Hayek, have spawned intense debate in the literature and may never be satisfactorily resolved (Cronquist et al. 1977, Stuckey and Barkley 1993, Rejmánek and Randall 1994). The decision to include *Amaranthus retroflexus, Poa pratensis, Polygonum aviculare,* and *Rorippa nasturtium-aquaticum* as exotic species to Yellowstone is somewhat arbitrary, yet generally consistent with records of the earliest collections in the park.

Documentation of the arrival of exotics has been somewhat sporadic through the years. The first 50 years after the park's establishment was a time of intense collecting, but interest in and documentation of exotics varied from collector to collector. P.H. Hawkins and H.S. Conard in the 1920s collected extensively in the park and documented many exotics for the 1st time. Interest in documenting exotic species presence in the park then dwindled until the early 1950s, when Ray Davis documented the presence of an additional 28 species. The arrival of plant ecologist Don Despain in Yellowstone in 1972 renewed interest in the flora of the park and resulted in publication of a flora reporting 86 exotics (Despain 1975). Additional new records of exotics were documented during habitat mapping of the entire park during the late 1970s. Yellowstone's Exotic Vegetation Management Plan (NPS 1986) listed 89 species of exotics but failed to mention several species reported in Despain (1975). The intensification of interest and alarm about the spread of exotics has resulted in a determined effort by the National Park Service to document all exotics present in the park and eradicate new arrivals, if possible, before they become established (Olliff et al. 2001). Currently, 187 species of exotics (188 taxa) are known to occur or have occurred in the past within the confines of the park, and new taxa are located almost every year.

Even though visitors come from all over the world to visit Yellowstone, origins of the exotic species do not reflect this wide diversity. The primary source of exotics is Eurasia, representing 93.6% of the exotic flora, as is typical in many parts of the United States (Rejmánek and Randall 1994, Sheley et al. 1999). The remainder are from North America (5.3%) and Central and South America (1.1%).

Because the incidence and spread of exotics is escalating, more interest is focused on the magnitude of the problem. Several methods have been used to present information about the presence of exotics in a flora. The total number of exotic taxa, of interest in itself, provides no way to compare diverse areas, especially when the areas to be contrasted are of significantly different size. Another commonly used comparison is the percentage of the flora that is exotic. This method has some of the same problems as the number of exotic species. In addition, the percentage can be highly influenced by the relative diversity of the flora, allowing comparable-sized areas with the same number of exotics to have very different percentages. Rejmánek and Randall (1994) used the number of species $\cdot$ $\log(\text{area})^{-1}$ as a standardized expression of exotic species richness. When used with log to the base 10, this index corresponds to the extrapolated mean number of exotic species $\cdot$ 10 km^{-2}. The high number of exotics centered near developed areas, roads, and trails in Yellowstone skews this result. The likelihood of finding a particular 10-km^2 plot with this exact number of exotics is low. Even with these difficulties, this method allows comparison among areas of greatly different sizes and native flora richness (Table 1). The infestation of exotics is greater than might be expected in Yellowstone, given that most of the park is de facto wilderness and has not been logged, farmed, or grazed by domestic stock.

Most exotic vascular plants currently known from within Yellowstone National Park are also widespread in adjacent states. Yellowstone, though, is a destination for visitors from throughout the United States and the world. The 1st report of an exotic for the state of Wyoming has not infrequently been from Yellowstone National Park. The annotated checklist includes 11 species not reported by the most recent flora of Wyoming (Dorn 1992): *Centaurea* × *pratensis, Cerastium glomeratum, Hieracium caespitosum, H. flagellare, H. floribundum, Holosteum umbellatum, Prunus avium, Senecio jacobaea, Trifolium aureum, T. campestre, Vicia cracca.*

The escalating number of exotics mirrors the steadily increasing visitation to the park

TABLE 1. Species richness of exotic vascular plant floras at selected locations in the United States.

Region	Number of native species	Number of exotic species	Percentage of exotic species	Number of exotic species per log(area)
Alaska[1]	1229	144	10.5	23.3
California[1]	4844	1025	17.5	182.6
Glacier N. P.[2]	1131	126	11.1	34.9
Great Plains[1]	2495	394	13.6	63.5
Great Smoky Mountains N. P.[3]	1573	341	21.7	102.6
New York[1]	1940	1082	35.8	210.5
Utah[1]	2572	444	14.7	83.1
Western Montana[1]	1251	250	16.7	64.2
Wyoming[4]	2761*	348*	12.6	64.4
Yellowstone N. P.	1265	187	14.8	47.3
Yosemite N. P.[5]	1352	126	9.3	36.2

[1]Modified from Rejmánek and Randall 1994
[2]Peter Lesica personal communication
[3]Janet Rock personal communication
[4]Fertig 1999
[5]Jan VanWagtendonk personal communication
* = total number of taxa (not species)

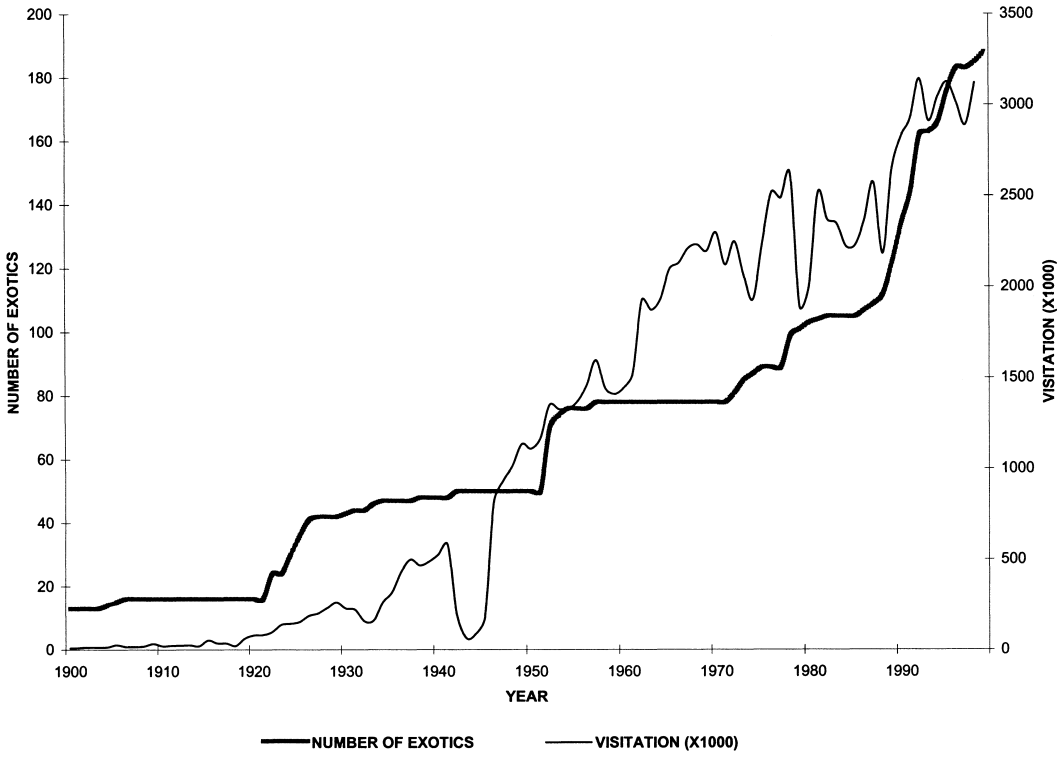

Fig. 1. Number of exotic plant taxa occurring in Yellowstone National Park based on herbarium records compared with visitation to the park based on official records since 1900.

(Fig. 1). The correlation between increasing visitation and increasing numbers of exotics has been noted previously in other national park units (Lesica et al. 1993). The arrival of new exotic plants into Yellowstone associated with vehicles, muddy shoes, equipment, and stock is likely to persist unabated. Continued vigilance is needed to eradicate new exotic species to the park prior to their becoming established.

The annotated checklist represents the current state of knowledge about the exotic flora

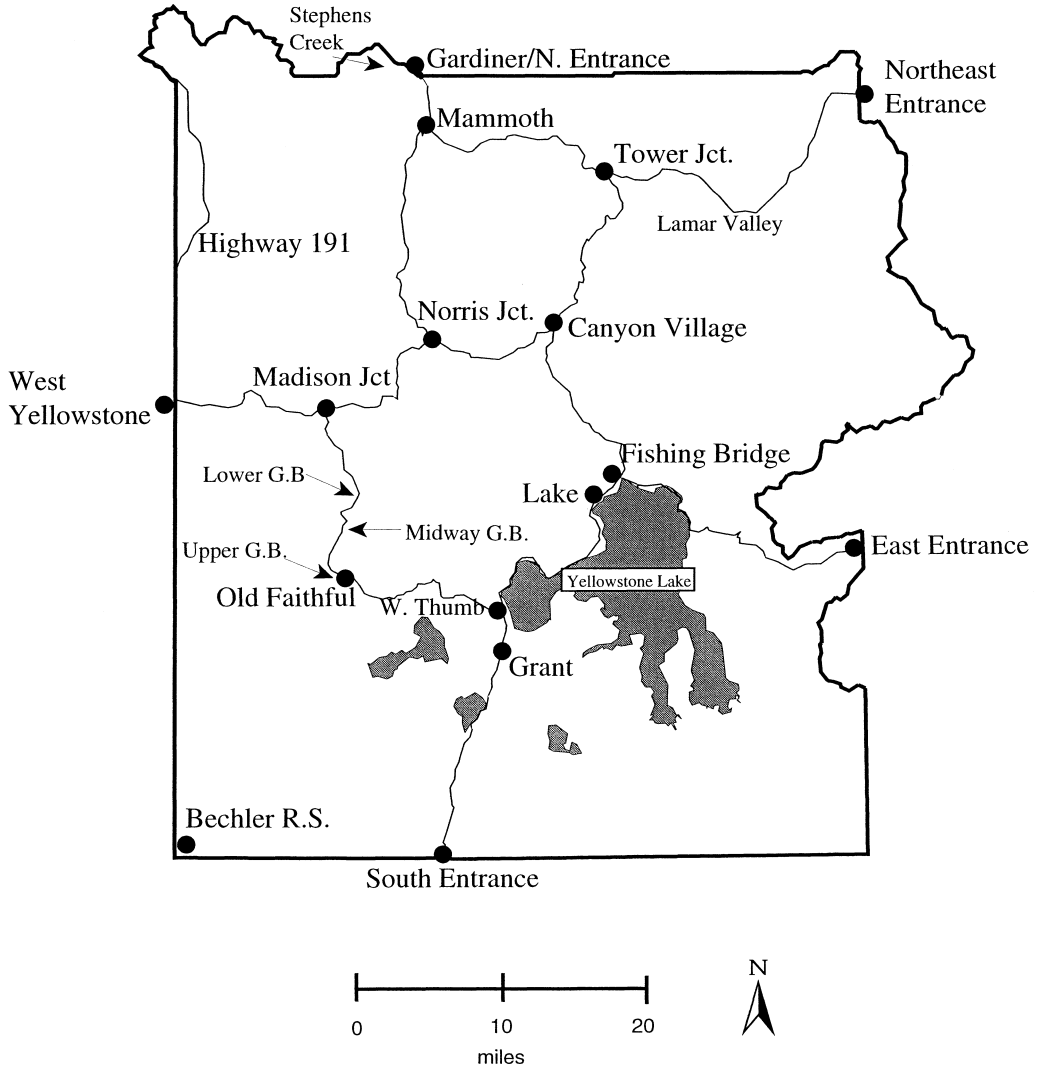

Fig.2. Map of Yellowstone National Park.

of Yellowstone and is based primarily on a review of specimens at the Yellowstone National Park herbarium. The Montana State University herbarium and Rocky Mountain Herbarium were also consulted, resulting in documentation of a minimum of 12 exotic species in the park by the turn of the 20th century. The review of specimens was not exhaustive; additional material that was not examined may be present at these facilities. The extensive early and continual interest in Yellowstone National Park has resulted in collections of Yellowstone material now housed throughout the country. As these collections are examined and additional literature citations located, the time of establishment of many exotic species will be further refined. Regretfully, the timing of arrival of many species will never be known exactly, due to the sporadic collecting efforts that focused on exotic species.

The annotated list is arranged alphabetically by family, genus, and species. Nomenclature follows Dorn (1992) except that traditional names for families were used as in Hitchcock and Cronquist (1973). Following the scientific name, common names are provided as used in Yellowstone or adjacent states (Hitchcock and Cronquist 1973, Whitson et al. 1992, Welsh et

al. 1993, Stubbendieck et al. 1995). The earliest herbarium record that could be located is cited by herbarium code and year of collection. In some cases information exists in records that suggests an earlier arrival time; due to an inability to verify these reports, this information was not included in the graph of arrival times (Fig. 1). Noxious species as listed by the states of Idaho, Montana, and Wyoming are noted. A brief summation of the current status of the species in the park completes the information provided. Information about the location and extent of various species was augmented by the author's personal observations. A map of Yellowstone, including reference to areas commonly mentioned in the annotated list, is also provided (Fig. 2). Exotic species that had been reported previously, but which were based on misidentified material or for which no specimens could be located, include the following: *Artemisia vulgaris* L., *Callitriche anceps* Fern., *Chenopodium album* L., *Foeniculum vulgare* Mill., *Silene noctiflora* L., and *Spergularia marina* (L.) Griseb.

Annotated List of Exotic Plants of Yellowstone National Park

Aceraceae

Acer negundo L.; box-elder; YELLO (1979); 2 roadside shrubs in the Mammoth area (highly browsed, not able to discern variety)

Agavaceae

Yucca glauca Nutt.; Great Plains yucca, soapwell; YELLO (1996); a few plants at 1 campsite at Mammoth campground, not persisting

Amaranthaceae

Amaranthus retroflexus L.; redroot pigweed, rough pigweed; YELLO, 1952; disturbed areas around Mammoth, Gardiner, and Stephens Creek

Boraginaceae

Amsinckia menziesii (Lehm.) Nels. & Macbr.; Menzies' fiddleneck; YELLO (1991); disturbed ground at the South Entrance

Asperugo procumbens L.; catchweed, madwort; YELLO (1979); around Mammoth, Stephens Creek, and Gardiner

Cynoglossum officinale L.; houndstongue; YELLO (1953); listed noxious by MT, WY; infestation around Mammoth and near the East Entrance

Lappula squarrosa (Retz.) Dum. var. *squarrosa*; European stickseed, European sticktight; YELLO (1989); scattered occasionally along roadsides

Lithospermum arvense L.; corn gromwell; YELLO (1989); Mammoth and Gardiner

Myosotis micrantha Pallas ex Lehm.; blue scorpion-grass, small-flower forget-me-not; YELLO (1990); Upper Geyser Basin and West Thumb Geyser Basin

Campanulaceae

Campanula rapunculoides L.; creeping bellflower, rover bellflower; YELLO (1992); apparently planted historically around residences on Officer's Row in Mammoth and persisting in lawns and along building edges

Cannabaceae

Cannabis sativa L.; marijuana, hemp; YELLO (1995); located and eradicated at least twice along roadside of Highway 191

Humulus lupulus L. var. *neomexicanus* Nels. & Cock.; hops; YELLO (1978); perhaps planted historically, a few plants persisting around Mammoth and Grant Village near buildings

Caprifoliaceae

Lonicera tatarica L.; Tatarian honeysuckle; YELLO (1988); planted historically around Mammoth and occasionally spreading into adjacent sinkholes

Caryophyllaceae

Arenaria serpyllifolia L.; thyme-leaf sandwort; YELLO (1989); a few locations in Upper and Lower geyser basins

Cerastium glomeratum Thuill.; sticky chickweed; YELLO (1995); spreading in Midway and Lower geyser basins

Cerastium fontanum Baumg.; mouse-ear chickweed; YELLO (1926); Upper and Lower geyser basins, Mammoth, and other scattered sites around park

Dianthus armeria L.; grass pink; RM (1981), YELLO; near Old Faithful, Midway Geyser Basin, and on the West Entrance road

Dianthus barbatus L.; sweet william; YELLO (1992); roadside near Blacktail Drive possibly intentionally spread from seed packet, eradicated

Gypsophila paniculata L.; baby's breath; YELLO (1978); perhaps planted historically, occasional plants along roadsides near Mammoth

Holosteum umbellatum L.; jagged chickweed, holosteum; YELLO (1992); Mammoth Terraces

Saponaria officinalis L.; bouncing-bet, soapwort; YELLO (1952); perhaps planted historically, occasional near houses around Mammoth

Silene latifolia Poir.; white campion, white cockle; YELLO (1924); disturbed ground along roadsides and in developed areas

Silene vulgaris (Moench) Garcke; bladder campion; YELLO (1990); roadsides and spreading, especially along the Northeast Entrance road

Spergularia rubra (L.) J. & K. Presl; red sandspurry; MONT (1922), YELLO; widespread and naturalized

Stellaria media (L.) Vill.; common chickweed; YELLO (1992); scattered locations including Mammoth

Vaccaria hispanica (Miller) Rauschert; cowcockle, cowherb; RM (1899); disturbed areas historically by Gardner River, not located recently in park

CHENOPODIACEAE

Atriplex heterosperma Bunge; two-seed orache; YELLO (1996); 1 site near Rattlesnake Butte

Atriplex hortensis L.; garden orache, sea purslane; YELLO (1952); label states Gardiner dumps, not recently located within park

Atriplex rosea L.; red orache, tumbling orache; YELLO (1952); on disturbed ground near Stephens Creek

Bassia hyssopifolia (Pallas) Kuntze; bassia, five-hook bassia; YELLO (1995); Yellowstone River Trail near Gardiner

Kochia scoparia (L.) Schrad.; summer cypress, kochia; YELLO (1957); widespread on disturbed soil near Gardiner

Salsola australis R. Br.; Russian thistle, tumbleweed; YELLO (1926); widespread on disturbed ground near Gardiner and Mammoth

Salsola collina Pallas; Pallas' tumbleweed; YELLO (1990); along roadsides near Gardiner and Mammoth

COMPOSITAE

Anthemis tinctoria L.; yellow chamomile; YELLO (1992); 1 plant eradicated in parking lot of Administration Building at Mammoth

Arctium sp. (Hill) Bernh.; burdock; YELLO (1999); *Arctium minus* Bernh. listed noxious by WY; 1 vegetative plant eradicated in lawn at Mammoth, probably *Arctium minus*

Artemisia absinthium L.; wormwood, absinthium; YELLO (1992); isolated plants along roads, apparently not reproducing

Carduus acanthoides L.; plumeless thistle, acanthus thistle; YELLO (1992); listed noxious by WY; 1 infestation near Tuff Cliff north of Madison Junction

Carduus nutans L.; musk thistle, nodding thistle; YELLO (1973); listed noxious by ID, WY; a few small infestations scattered throughout park

Centaurea diffusa Lam.; diffuse knapweed; YELLO (1989); listed noxious by ID, MT, WY; occasional plants along roadsides

Centaurea maculosa Lam.; spotted knapweed; YELLO (1973); listed noxious by ID, MT. WY; established in scattered areas such as around Mammoth, Fountain Paint Pots, and along the West Entrance Road

Centaurea × *pratensis* Thuill.; meadow knapweed; YELLO (1990); listed noxious by ID; discovered as only 1 plant and eradicated

Centaurea repens L.; Russian knapweed; YELLO (1989); listed noxious by ID, MT, WY; a few small infestations near North Entrance and Reese Creek

Chrysanthemum leucanthemum L.; oxeye daisy; YELLO (1927); listed noxious by MT, WY (as *Leucanthemum vulgare* Lam.); infestations at Mammoth and Madison Junction

Cichorium intybus L.; chicory, wild succory, bluesailors; YELLO (1990); occasional single plants found along road edge and eradicated

Cirsium arvense (L.) Scop. var. *horridum* Wimm. & Grab.; Canada thistle, creeping thistle; YELLO (1934); listed noxious by ID, MT, WY; widespread throughout park including backcountry

Cirsium vulgare (Savi) Tenore; bull thistle, common thistle; YELLO (1952); several infestations along roads, in developed areas, and in backcountry

Crepis tectorum L.; annual hawksbeard; YELLO (1953); established in southern portion of park and at several other locations

Filago arvensis (L.) L.; field filago; YELLO (1992); spreading at several locations

Hieracium aurantiacum L.; orange hawkweed, orange king devil; YELLO (1978); listed noxious by ID, MT; roadside infestations at several locations

Hieracium caespitosum Dumort.; yellow hawkweed, yellow king devil; MONT (1992), YELLO; listed noxious by ID, MT; roadside infestations at several locations

Hieracium flagellare Willd.; whiplash hawkweed; YELLO (1996); established along roadside near Sand Point

Hieracium floribundum Wimmer & Grab.; glaucous king devil; YELLO (1994); listed noxious by MT; established along roadside near Tuff Cliff

Lactuca serriola L.; prickly lettuce; YELLO (1952); widespread on disturbed soil near roads

Matricaria maritima L.; scentless may weed, scentless chamomile; YELLO (1987); occasional along roadsides

Onopordum acanthium L.; scotch thistle, cotton thistle, winged thistle; YELLO (1991); listed noxious by ID, WY; at least 2 separate establishments of single plants that were eradicated

Ratibida columnifera (Nutt.) Wooton & Standley; prairie coneflower; MONT (1900), YELLO; occasional plant along roadside, not persisting

Sececio jacobaea L.; tansy ragwort; YELLO (1990); listed noxious by ID, MT; 1 plant eradicated from roadside in Lower Geyser Basin

Senecio vulgaris L.; common groundsel; YELLO (1992); Fern Cascades trail at Old Faithful

Solidago rigida L. var. *humilis* Porter; stiff goldenrod; YELLO (1998); 1 roadside plant eradicated near Antelope Creek

Sonchus arvensis L.; perennial sow-thistle, field sow-thistle; YELLO (1989); listed noxious by WY, ID; spreading from several infestations

Sonchus asper (L.) Hill; prickly sow-thistle, spiny sow-thistle; YELLO (1933); occasionally scattered around park

Sonchus uliginosus Bieb.; marsh sow-thistle, meadow sow-thistle; YELLO (1978); spreading from several infestations

Tanacetum vulgare L.; common tansy; YELLO (1973); listed noxious by MT; a few scattered plants along roadsides

Taraxacum laevigatum (Willd.) DC.; red-seeded dandelion; YELLO (1926); naturalized parkwide

Taraxacum officinale Weber; common dandelion; YELLO (1924); naturalized parkwide

Tragopogon dubius Scop.; yellow salsify, western salsify; MONT (1922), YELLO; widespread

Tragopogon porrifolius L.; salsify, vegetable oyster, oyster plant; YELLO (1925); Stephens Creek, not recently relocated

Tragopogon pratensis L.; meadow salsify, Jack-go-to-bed-at-noon; YELLO (1925); scattered along roadsides, especially on northern range

CONVOLVULACEAE

Convolvulus arvensis L.; field bindweed, field morning-glory; YELLO (1952); listed noxious by ID, MT, WY; established along roads primarily near Mammoth, Gardiner, and along Highway 191

CRUCIFERAE

Alyssum alyssoides (L.) L.; pale alyssum, yellow alyssum; YELLO (1952); scattered locations in park including all over Mammoth Terraces

Alyssum desertorum Stapf; desert alyssum, dwarf alyssum; YELLO (1972); abundant in undisturbed vegetation near Gardiner and Stephens Creek

Barbarea vulgaris R. Br.; bitter wintercress, yellow rocket; YELLO (1924); occasional plants along roadsides and developed areas

Berteroa incana (L.) DC.; berteroa, hoary allysum; YELLO (1986); dense along roadside near West Entrance and at other scattered locations

Brassica kaber (DC.) Wheeler; wild mustard, charlock; YELLO (1954); disturbed area near Mammoth, not located recently in park

Brassica rapa L.; field mustard, rape, birdsrape mustard; RM (1899), YELLO; disturbed areas historically, not located recently in park

Camelina microcarpa Andrz. ex DC.; smallseed falseflax, littlepod falseflax; MONT (1922), YELLO; occasional, especially on northern range

Camelina sativa (L.) Crantz; false flax, gold-of-pleasure; RM (1899); near Undine Falls, not located recently in park although reported as "[v]ery abundant in some places on the roadside" (Nelson 1899)

Capsella bursa-pastoris (L.) Medic.; shepherd's purse; RM (1899), YELLO; widespread in thermal areas and disturbed places

Cardaria chalepensis (L.) Hand.-Mazz.; chalapa hoarycress, orbicular whitetop; YELLO (1995); listed noxious by MT (as *Cardaria* spp.), WY (as *Cardaria* spp.); near Gardiner

Cardaria draba (L.) Desv.; hoary cress, whitetop; YELLO (1995); listed noxious by ID, MT, WY; 1 infestation along northeast entrance road

Cardaria pubescens (Meyer) Jarmol.; hairy whitetop, globepodded hoarycress; YELLO (1931); listed noxious by MT (as *Cardaria* spp.), WY; established near Gardiner and Mammoth

Chorispora tenella (Pallas) DC.; blue mustard, musk mustard; YELLO (1996); small population along Coyote Creek trail near northern boundary

Descurainia sophia (L.) Webb ex Prantl; flixweed, bed-ground-weed; YELLO (1952); occasional sites, especially on northern range

Draba verna L.; whitlow-grass, spring draba; RM (1980), YELLO; spreading throughout Upper Geyser Basin

Hesperis matronalis L;. dame's rocket, damask violet, sweet rocket; YELLO (1978); perhaps planted historically, occasional plants persisting in vicinity of Mammoth

Isatis tinctoria L.; dyer's woad; YELLO (1992); listed noxious by ID, MT, WY; 4 separate establishments of single plants, eradicated

Lepidium campestre (L.) R. Br.; fieldcress, field pepperweed; YELLO (1992); occasional plants along roadsides

Lepidium perfoliatum L.; clasping peppergrass, clasping pepperweed; YELLO (1978); on disturbed ground at several locations in park

Lepidium sativum L.; garden cress; YELLO (1990); Mammoth along Officer's Row

Rorippa nasturtium-aquaticum (L.) Hayek; watercress; YELLO (1922); widespread especially in thermal areas

Sisymbrium altissimum L.; tumblemustard, Jim Hill mustard; MONT (1922), YELLO; common in disturbed areas along roads and near developed areas

Sisymbrium loeselii L.; Loesel tumblemustard, tall-hedge mustard; YELLO (1975); occasional along roads and in developed areas

Thlaspi arvense L.; fanweed, field pennycress; RM (1906), YELLO; widespread on disturbed ground

CYPERACEAE

Scirpus atrocinctus Fern.; wool-grass; YELLO (1996); a few plants persisting in roadside ditch near Yellowstone Lake

DIPSACACEAE

Dipsacus fullonum L.; teasel; YELLO (1992); several plants eradicated from roadside

EUPHORBIACEAE

Euphorbia esula L. var. *uralensis* (Fisch. ex Link) Dorn; leafy spurge; YELLO (1991); listed noxious by ID, MT, WY; 1st written report in park in 1983, several small infestations scattered around park

Euphorbia maculata L.; spotted spurge; RM (1980), YELLO; West Thumb Geyser Basin

GERANIACEAE

Erodium cicutarium (L.) L'Her. ex Aiton; filaree, stork's-bill; YELLO (1974); established in several thermal areas including Mammoth Hot Springs and the Upper Geyser Basin

GRAMINEAE

Agropyron cristatum (L.) Gaertn. var. *desertorum* (Fisch. ex Link) Dorn; crested wheatgrass; YELLO (1942); deliberately planted in the Stephens Creek area in the northern portion of the park in the 1950s and occasionally spreading

Agropyron triticeum Gaertn.; annual wheatgrass; YELLO (1952); widespread in undisturbed areas near Gardiner

Agrostis stolonifera L.; red top, creeping bentgrass; YELLO (1924); widespread along roads

Aira caryophyllea L.; silver hairgrass; RM (1982), YELLO; known only from vicinity of Firehole Lake in Lower Geyser Basin

Alopecurus arundinaceus Poiret; creeping foxtail; YELLO (1990); a few scattered locations, especially along roads

Alopecurus pratensis L.; meadow foxtail; YELLO (1978); scattered locations including the backcountry

Apera interrupta (L.) Beauv.; Italian sandgrass, interrupted apera; YELLO (1991); Mammoth Terraces

Arrhenatherum elatius (L.) J. & K. Presl; tall oatgrass, tuber oatgrass; YELLO (1989); eradicated 3 times from roadside

Avena fatua L.; wild oats; YELLO (1990); roadside near Mammoth Terraces

Avena sativa L.; common oats; YELLO (1989); rarely present and not persisting along roadsides in the Gallatin and Stephens Creek area

Bromus briziformis Fisch. & Meyer; rattlesnake chess; YELLO (1925); historically in Mammoth area, currently along 1 area of Old Gardiner Road

Bromus inermis Leyss. var. *inermis*; smooth brome; YELLO (1925); widespread in northern range of park, especially in Lamar Valley and near roadsides

Bromus japonicus Thunb. ex Murray; Japanese brome; YELLO (1986); along roads in northern portion of park, especially near Gardiner and Stephens Creek

Bromus tectorum L.; cheatgrass, downy brome, downy chess; YELLO (1930); present and widely distributed in park, especially in thermal areas and northern range

Dactylis glomerata L.; orchard-grass; YELLO (1978); occasional along roadsides

Elymus hispidus (Opiz) Melderis var. *hispidus*; intermediate wheatgrass; YELLO (1999); a few patches scattered along roads

Elymus hispidus (Opiz) Melderis var. *ruthenicus* (Griseb.) Dorn; intermediate wheatgrass; YELLO (1990); a few patches scattered along roads and in developed areas

Elymus junceus Fisch.; Russian wild rye; YELLO (1988); apparently planted during 1960s and/or 1970s for revegetation and persisting

Elymus repens (L.) Gould; quackgrass, couchgrass; YELLO (1952); listed noxious by WY [as *Elytrigia repens* (L.) Nevski]; well established near Gardiner and at scattered locations along roads

Festuca arundinacea Schreb.; tall fescue; YELLO (1995); 1 site near Old Gardiner Road

Festuca pratensis Huds.; meadow fescue; YELLO (1995); scattered along roadsides, especially along Northeast Entrance road

Lolium perenne L.; perennial ryegrass, English ryegrass; YELLO (1925); Mammoth and a few scattered locations

Phleum pratense L.; timothy, common timothy; MONT (1897), YELLO; widespread on northern range and spreading from many additional locations

Poa annua L.; annual bluegrass; MONT (1922), YELLO; disturbed areas, thermal areas, and along many backcountry trails

Poa bulbosa L.; bulbous bluegrass; YELLO (1972); Mammoth and Bechler Ranger Station

Poa compressa L.; Canada bluegrass; YELLO (1938); widespread

Poa palustris L.; fowl bluegrass; MONT (1922), YELLO; widespread

Poa pratensis L.; Kentucky bluegrass; MONT (1897), YELLO; widespread

Polypogon monspeliensis (L.) Desf.; rabbitfoot grass; MONT (1922); Mammoth area in wetlands

Puccinellia distans (L.) Parl.; weeping alkaligrass, European alkaligrass; YELLO (1926); occasional

Secale cereale L.; cultivated rye; YELLO (1989); planted in adjacent national forests after 1988 fires leading to some casual seeding in park, not persisting

Setaria viridis (L.) Beauv.; green bristlegrass; YELLO (1952); rarely appearing along roadside near Gardiner, not persisting

Triticum aestivum L.; cultivated wheat; YELLO (1991); rare along roadsides and not persisting

HYPERICACEAE

Hypericum perforatum L.; common St. Johnswort, Klamath weed; YELLO (1973); listed noxious by MT; a few infestations, especially in Lower Geyser Basin

LABIATAE

Dracocephalum thymiflorum L.; thyme-leaved dragonhead; YELLO (1990); established at several sites along roadsides

Galeopsis ladanum L.; hemp nettle; YELLO (1954); a few scattered sites

Glecoma hederacea L.; ground-ivy, gill-over-the-ground; YELLO (1974); persisting in Mammoth lawns

Lamium amplexicaule L.; common dead-nettle, henbit; YELLO (1952); a few areas near Gardiner and Stephens Creek

Nepeta cataria L.; catnip, catmint; YELLO (1952); perhaps planted historically in the Mammoth area, persisting along building edges

Salvia nemorosa L.; sage, violet sage; YELLO (1978); 1 plant eradicated near the North Entrance

LEGUMINOSAE

Medicago lupulina L.; black medic, hop clover; YELLO (1952); widespread along roadsides, thermal areas, and other locations

Medicago sativa L. var. *falcata* (L.) Doell; yellow alfalfa; YELLO (1994); plant eradicated along roadside

Medicago sativa L. var. *sativa*; alfalfa; YELLO (1952); occasional roadside plants, spreading only at lowest elevations

Melilotus albus Medikus; white sweet-clover; YELLO (1952); roadsides, especially on northern range

Melilotus officinalis (L.) Pallas; yellow sweet-clover; YELLO (1952); widespread on northern range and at other scattered locations around park

Onobrychis viciifolia Scop.; saintfoin, sandfain; YELLO (1990); isolated plants along roadside

Trifolium aureum Pollich; yellow clover, large hop clover; YELLO (1992); a few small sites scattered along roadsides

Trifolium campestre Schreber in Sturm; hop clover; YELLO (1995); Midway Geyser Basin and Potts Hot Springs

Trifolium hybridum L.; alsike clover; RM (1899), YELLO; widespread and spreading

Trifolium pratense L.; red clover, rose clover; RM (1899), YELLO; scattered locations

Trifolium repens L.; white clover, Dutch clover; RM (1899), YELLO; widespread and spreading

Vicia cracca L.; bird vetch; YELLO (1996); at least 2 roadside plants eradicated

MALVACEAE

Alcea rosea L.; hollyhock; YELLO (1993); perhaps planted historically, appeared and eradicated in parking area in Mammoth

Malva neglecta Wallr.; common mallow; YELLO (1992); 1 plant eradicated at Old Faithful

Malva rotundifolia L.; roundleaved mallow; YELLO (1989); 1 plant eradicated at Stephens Creek

OLEACEAE

Fraxinus pennsylvanica Marsh.; green ash; YELLO (1995); planted in Gardiner and escaping, 1 tree eradicated

OXALIDACEAE

Oxalis dillenii Jacq.; Dillen's wood-sorrel, gray-green wood-sorrel; YELLO (1991); a few scattered locations

Oxalis violacea L.; violet wood sorrel; US (1881); only known report, Denton (1973) states probably introduced

PLANTAGINACEAE

Plantago lanceolata L.; buckhorn plantain, ribwort; YELLO (1953); occasional in disturbed areas

Plantago major L.; broadleaf plantain, nippleseed; YELLO (1926); occasional in disturbed areas

POLYGONACEAE

Polygonum aviculare L.; prostrate knotweed, doorweed; US? (1885), YELLO; widespread, first collected by Frank Tweedy (Tweedy 1886, Rydberg 1900)

Polygonum convolvulus L.; wild buckwheat, dullseed, cornbind; RM (1899), YELLO; disturbed areas at Stephens Creek, Old Faithful, and rarely along roadsides

Polygonum lapathifolium L.; willow weed, pale smartweed; YELLO (1991); a few scattered small sites

Rumex acetosella L.; sheep sorrel, red sorrel; RM (1904), YELLO; widespread and naturalized

Rumex crispus L.; curly dock, sour dock; YELLO (1924); occasional near roads and developed areas

Rumex patientia L.; patience dock; YELLO (1924); Madison Junction

PORTULACACEAE

Portulaca oleracea L.; common purslane, mother-of-millions; YELLO (1991); spreading in Upper, Lower, and Midway geyser basins and other thermal areas

RANUNCULACEAE

Ranunculus acris L.; tall buttercup; YELLO (1998); listed noxious by MT; small infestations at Bechler Ranger Station and on northern range

Ranunculus repens L. var. *repens*; creeping buttercup; YELLO (1991); established in lawn at Mammoth

Ranunculus testiculatus Crantz; bur buttercup, hornseed buttercup; YELLO (1988); spreading around Mammoth Hot Springs and the North Entrance

ROSACEAE

Potentilla argentea L.; silvery cinquefoil; YELLO (1972); Madison Junction

Potentilla norvegica L.; rough cinquefoil, Norwegian cinquefoil; YELLO (1925); widespread in disturbed areas

Potentilla recta L.; sulphur cinquefoil; YELLO (1992); listed noxious by MT; a few scattered infestations

Prunus avium L.; sweet cherry; YELLO (1992); 1 plant on roadside thermal ground, eradicated

Pyrus malus L.; cultivated apple; YELLO (1992); a few shrubs along roadside

RUBIACEAE

Galium mollugo L.; wild madder, great hedge bedstraw; YELLO (1996); 2 sites along roadside in Lamar Valley

Galium verum L.; yellow bedstraw, lady's bedstraw; YELLO (1978); 1 site in Mammoth

SALICACEAE

Salix fragilis L.; crack willow; YELLO (1995); planted in Gardiner and escaping, 1 shrub eradicated in Yellowstone

SCROPHULARIACEAE

Linaria dalmatica (L.) Miller; Dalmatian toadflax; YELLO (1957); listed noxious by ID, MT, WY; major infestation in the Mammoth and Gardiner area (unconfirmed report that it may have been planted historically at Mammoth) and small infestations in several other areas

Linaria vulgaris Miller; yellow toadflax, butter and eggs; YELLO (1933); listed noxious by ID, WY; scattered infestations especially in the southern portion of the park

Verbascum thapsus L.; common mullein, wooly mullein, flannel mullein; YELLO (1953); well established on Mammoth Terraces and at other scattered locations

Veronica arvensis L.; corn speedwell, common speedwell; YELLO (1974); well established throughout the Upper, Lower, and Midway geyser basins

Veronica biloba L.; bilobed speedwell; YELLO (1994); Bechler Ranger Station, Mammoth, and Heart Lake

SOLANACEAE

Hyoscyamus niger L.; henbane, hog's bean; YELLO (1942); listed noxious by ID; Mammoth

Lycium barbarum L.; matrimony vine, teavine; YELLO (1987); probably originally planted around Mammoth and occasionally spreading

Solanum physalifolium Rusby var. *nitidibaccatum* (Bitter) Edmonds; hairy nightshade; YELLO (1952); Stephens Creek

UMBELLIFERAE

Carum carvi L.; caraway; RM (1905), YELLO; occasional along Northeast Entrance road

Conium maculatum L.; poison-hemlock; YELLO (1989); listed noxious by ID; established in Mammoth along Officer's Row

Daucus carota L.; wild carrot, Queen Anne's lace; YELLO (1999); one roadside plant eradicated near Midway Geyser Basin

Pastinaca sativa L.; common parsnip; YELLO (1952); Stephens Creek, not recently relocated

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