Appendix H. Effects of Glyphosate-Resistant Weeds in Non-agricultural Ecosystems

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APPENDIX H.1. Effects of Glyphosate-Resistant Weeds in Non-agricultural Ecosystems

Executive Summary

This report examines potential weedy problems in non-agricultural ecosystems related to the use of glyphosate-tolerant (GT) alfalfa or glyphosate-resistant weeds.

Medicago sativa (alfalfa) is native to the Middle East and Central Asia and was introduced to North America over 200 years ago (Putnam et al. 2001). *Medicago sativa* subsp. *sativa* (purple-flowered alfalfa) has naturalized populations in the United States and occurs in all 50 states. In a survey of 1040 roadside sites in 57 counties in six major alfalfa production states, Washington had the lowest percentage of sites with feral alfalfa occurring in 10 percent of the pre-selected sites and South Dakota had the highest with feral alfalfa occurring in 63 percent of the pre-selected sites. In sites where feral alfalfa was present, the average cover area ranged from 1.2 to 5.4 percent per state (Rogan and Fitzpatrick., 2004). In an additional biogeographic survey, feral alfalfa populations were located within 2000 meters of cultivated alfalfa at approximately 22 percent of the sites examined (Kendrick et al., 2005).

Medicago sativa subsp. *falcata*, (yellow-flowered or Siberian alfalfa) is naturalized in the more northern and western states. It is being promoted as a rangeland enhancer for grazing. A naturalized population of falcata that was seeded on rangeland in South Dakota in 1915 is still in existence. Hybridization between falcata and cultivated alfalfa would result in hybrids that would be less adapted to northern plains rangeland than the falcata parent, but possibly better hardier than the cultivated alfalfa parent (Bagavathiannan and Van Acker 2009).

Alfalfa is used for a variety of non-agricultural purposes. These uses include: rehabilitation of overgrazed rangelands, erosion-control projects in interior forests, treatment of compacted soils, revegetation of areas damaged by wildfire, and erosion reduction in mined soils (Sullivan 1992).

Fourty weed species are known that either have newly evolved glyphosate-resistant biotypes or have historical natural tolerance to glyphosate. 11 of the 20 newly evolved glyphosate-resistant weeds have documented glyphosate-resistant biotypes in the United States. Glyphosate-resistant Sumatran fleabane has been observed in other parts of the world, but only glyphosate-sensitive plants have been observed in the U.S. The remaining 8 have sensitive biotypes in the United States, but glyphosate-resistant biotypes have not yet been documented in the United States. All 20 of the glyphosate-tolerant weeds have naturalized or native populations in the United States (although one, Chinese foldwig, is found only in Hawaii). Thirteen glyphosate-resistant or glyphosate-tolerant weed species are on at least one state noxious weed list. Liverseedgrass is on the federal noxious weed list, though glyphosate-resistant ecotypes have only been observed elsewhere in the world. Tropical spiderwort, a glyphosate-tolerant weed, is also on the federal noxious weed list and observed within the United States. An increase in the prevalence of these glyphosate-resistant weeds would likely be combated with alternative herbicides, mechanical removal, and spot burning.

There is very little evidence to suggest that alfalfa is considered a weed, other than as a volunteer in agricultural settings. Out of 12 weed lists from the USDA PLANTS Database, *Medicago sativa* is only listed on one, the Southern Weed Science Society, and this listing could be due to volunteer alfalfa in cropland. Thirteen surveyed weed control experts only identified one setting, irrigation ditches in California, where GT alfalfa could not be controlled by alternative herbicides. In this case only glyphosate is approved for irrigation ditches, so mechanical removal or spot burning would be the alternative control measures (Rogan and Fitzpatrick, 2004).

The USDA Forest Service uses glyphosate to manage forests. Their use is 0.275 percent of the quantity used on agricultural lands. The Roundup® herbicide label has 41 other non-crop setting listed. Many of these setting overlap with areas where feral alfalfa is found. There is a possibility that feral GT alfalfa could be found in non-crop areas. In cases where control is desired alternative control methods are available.

1.0 Introduction

This technical report discusses the distribution and possible effects of glyphosate-resistant weeds and escaped glyphosate-tolerant (GT) alfalfa in non-agricultural ecosystems. Alfalfa that is intentionally grown in agricultural fields and volunteer alfalfa in agricultural fields is not discussed in this report.

1.1 Non-agricultural Alfalfa in the United States

Medicago sativa (alfalfa) was introduced to the United States at least 200 years ago (Putnam et al. 2001). It is native to the Middle East and Central Asia, and has adapted to many growing conditions due to wide-spread cultivation (Xu et al. 2004). Since its introduction to the United States, alfalfa has escaped agricultural fields and become naturalized. The term feral is synonomous with the term naturalized, and will be used interchangably throughout this appendix. Different non-agricultural settings where feral alfalfa might be found include air fields, canals, cemeteries, ditch banks, fence rows, highways, irrigation ditches, pipelines, railroads, rangeland, rights-of-way, roadsides, and wasteland (Rogan and Fitzpatrick 2004). Alfalfa in non-agricultural ecosystems might be either intentionally seeded or escaped from agricultural settings. Alfalfa plants outside of cropping systems generally do not have regular external inputs like irrigation, herbicides, insecticides, and fertilizers. Sometimes the definition of feral alfalfa includes volunteer alfalfa in crop land (Bagavathiannan and Van Acker 2008). For this report, volunteer alfalfa growing out of rotation in an agricultural field with another crop (e.g., corn) is not discussed, but escaped volunteers out of the agricultural field are included. Escaped volunteers are alfalfa plants from seed that escaped from an agricultural field, creating the first generation of a possible feral population. Escaped volunteers might not persist past a generation or two, depending on environmental conditions.

There is considerable literature on non-domesticated alfalfa in regions where it is native and wild relatives exist (appendix H-1 to this technical report). In other countries, such as Spain, gene flow between wild and cultivated alfalfa has been more extensively studied than in the United

States (Jenczewski et al. 1999). This report does not review the global body of literature on wild alfalfa; it focuses on only naturalized populations in the United States.

The subject for this report is whether GT-alfalfa or glyphosate-resistant weeds that might increase in prevalence due to use of GT alfalfa are likely to present weedy problems in non-agricultural ecosystems.

1.2 Feral Attributes

Survival without management inputs requires that feral plants have traits that might be different from cultivated plants. Bagavathiannan and Van Acker (2008) list the following traits that are common among most successful feral species:

- Variety of pollinators;
- Continuous seed production;
- Considerable seed output;
- Seeds produced in several habitats;
- Seed dispersal over short and long distances;
- Seed dormancy (ability to form a seedbank);
- Broad germination requirements;
- Discontinuous germination;
- Rapid vegetative growth;
- Can withstand competition;
- Tolerance to unfavorable biotic and abiotic conditions;
- Rapid flowering.

Alfalfa has many of the above attributes and competes well with other native and introduced plants in a variety of settings. Some of the intentional uses of alfalfa on non-agricultural lands, such as habitat rehabilitation, erosion control, and rangeland rehabilitation or enhancement, are discussed in this technical report.

1.3 Methodology

A literature search was undertaken to identify peer-reviewed articles and grey literature (e.g., government reports, State Agricultural Extension Office publications) on feral alfalfa (appendix H-2 of this technical report). Several databases were searched with Dialog. Google, Yahoo, and Scirus search engines supplemented the Dialog search. Calculations for percentages of harvest were done with Microsoft Excel. Alfalfa harvest statistics were obtained from the USDA National Agricultural Statistics Service (NASS).[1] USDA Agricultural Marketing Service also provided information on harvests.[2] The common and scientific names for weeds were found in the USDA PLANTS database (appendix H-4 of this technical report).[3]

[1] http://www.nass.usda.gov/index.asp
[2] http://www.ams.usda.gov
[3] http://plants.usda.gov/java/invasiveOne.

2.0 Alfalfa Populations

2.1 Distribution of Naturalized Alfalfa in the United States

The USDA, Natural Resources Conservation Service (NRCS), National Plant Data Center, PLANTS Database provides habitat ranges and other standardized information for over 43,000 U.S. plant species.[4] *Medicago sativa* subsp. *sativa* (purple-flowered alfalfa used in cultivation) has naturalized populations in all 50 States, while *Medicago sativa* subsp. *falcata* (yellow-flowered or Siberian alfalfa) is naturalized in the northern and western States (USDA NRCS 2010). Appendix H-3 of this technical report includes U.S. distribution maps for *Medicago sativa* subsp. *sativa* and *Medicago sativa* subsp. *falcata*. For some states, county specific data are available. The PLANTS Database indicates that "county data are based primarily on the literature, herbarium specimens, and confirmed observations." Not all populations have been documented, however, and significant gaps in the distribution shown might reflect a lack of data.Agricultural distribution is not included in the PLANTS Database and the size of the naturalized population in a given area is not indicated.

Scientists at Forage Genetics and Monsanto Company conducted a six-state survey of feral alfalfa populations within six major alfalfa-producting states in 2001 and 2002 (Rogan and Fitzpatrick 2004). Data were collected at 1040 total survey sites across Idaho, Pennsylvania, Wisconsin, California, Washington, and South Dakota. Three survey strategies were adopted. "Pre-selected" survey sites without knowledge of terrain or vegetation were selected to avoid sampling bias. "Satellite" sites were selected at or near 3 miles from each pre-selected site and were selected whether feral alfalfa was present or not. The third strategy recorded the frequency of feral alfalfa populations observed along an entire travel route. Rogan and Fitzpatrick (2004) summarized the results. Their narrative summary was converted to table H-1. In a meeting abstract, Kendrick et al. (2005) described that 940 roadside sites were surveyed in 47 counties in five states. In approximately 22 percent of the sites, feral populations were located within 2000 meters of cultivated alfalfa. On average, feral populations occupied less than 3 percent of the area surveyed.

Table H-1 Summary of Six State Feral Survey (adapted from Rogan and Fitzpatrick 2004)

State (# of counties surveyed)	Feral alfalfa occurred within or near X% of pre-selected sites	Feral alfalfa occurred within or near X% of satellite sites	Cultivated alfalfa occurred near X% of pre-selected sites	Cultivated alfalfa occurred near X % of satellite sites	Average mean coverage in sites where feral alfalfa occurred	Travel route – distance between feral populations
Idaho (11)	17%	41%	44%	43%	1.7%	>12 miles
Pennsylvania (10)	ND	57%	Feral and cultivated occurred together in	Feral and cultivated occurred together in	1.2%	6-12 miles (Centre and Franklin Counties 1-3

[4] http://npdc.usda.gov/pdf/0105_npdc_brochure.pdf

Table H-1 Summary of Six State Feral Survey (adapted from Rogan and Fitzpatrick 2004)

State (# of counties surveyed)	Feral alfalfa occurred within or near X% of pre-selected sites	Feral alfalfa occurred within or near X% of satellite sites	Cultivated alfalfa occurred near X% of pre-selected sites	Cultivated alfalfa occurred near X % of satellite sites	Average mean coverage in sites where feral alfalfa occurred	Travel route – distance between feral populations
			10% of sites	21% of sites		miles)
Wisconsin (10)	ND	47% (70-80% in Dane, Grant, Shawno and Vernon counties)	Feral and cultivated occurred together in 9% of sites	Feral and cultivated occurred together in 31% of sites	1.7%	ND
California (10)	27%	67%	38%	52%	4.2%	3-6 miles
South Dakota (6)	63%	82%	ND	Feral and cultivated occurred together in 40% of sites	5.4%	3-6 miles (Hand, Harding, Tripp counties 1-3 miles)
Washington (10)	10%	ND	Feral and cultivated occurred together in 2% of sites	ND	ND	>12 miles

ND = no data provided by Rogan and Fitzpatrick 2004.

2.2 Seeding into Non-agricultural Lands

2.2.1 Rangeland

Medicago sativa subsp. *sativa* (purple-flowered alfalfa used in cultivation) only rarely becomes naturalized in North American rangelands (Xu et al. 2004). However, *Medicago sativa* subsp. *falcata*, (yellow-flowered or Siberian alfalfa) is naturalized in the more northern and western states (appendix H-3 of this technical report). *Medicago sativa* subsp. *falcata* was introduced to North Dakota in the late 1800s by Dr. N.E. Hansen, who was a professor at what is now South Dakota State University at Brookings (Smith 1997). Interest in *Medicago sativa* subsp. *falcata* as a rangeland plant to benefit livestock grazing has increased in the past decade partially because of a notable ranch. *Medicago sativa* subsp. *falcata* was seeded in rangeland (near Lodgepole, SD) in 1915 with a small packet of seeds from Dr. Hansen. In the 1950's, Norman "Bud" Smith, began nurturing seed to harvest and periodically reseeded the rangeland. Those *Medicago sativa* subsp. *falcata* populations reproduced and survived without help (Bliss 2003). USDA Agricultural Research Service (ARS) scientists have determined that on the Smith farm, soil organic carbon was increased by 4 percent in the 1998 seeding, 8 percent in the 1987 seeding, and 17 percent in the 1965 seeding (Schuman and Mortenson 2003). Soil inorganic nitrogen increased from 8 to 51 percent on the interseeded pastures, which corresponded to an

increased plant nitrogen content of 8 to 33percent in the native species (Schuman and Mortenson 2003, Hess et al. 2004). Researchers are recruiting more ranchers to seed *Medicago sativa* subsp. *falcata* on native rangelands (Waggener 2007, High Plains Midwest Ag Journal 2008) and are conducting rangeland seeding projects with different varieties of alfalfa (Manske 2004).

Xu et al. (2004) studied the effects of naturalized *Medicago sativa* subsp. *falcata* in northwestern South Dakota on native species in the Grand River National Grasslands (GRNG). The GRNG is adjacent to the Smith ranch discussed above, and falcata has become naturalized on over 600 acres in the GRNG. The authors concluded that although naturalized falcata increased the total biomass production on semiarid rangeland, it was at the expense of species richness and native species production when *Medicago sativa* subsp. *falcata* cover exceeded 50 percent. At the GRNG, the highest alfalfa seed density was more than 39,000 seeds per square meter (790 kg/ha) in areas with the highest alfalfa cover and 99 percent of the alfalfa seeds collected from the soil seed bank were hard and viable (Xu et al. 2007).

Researchers and rangeland managers have been trying since the 1930s to find or adapt a variety of alfalfa to enhance rangeland (Berdahl et al. 1986, Berdahl et al. 1989, Lorenz 1982, Rumbaugh 1982, Sneva et al. 1964). It is unclear how widely *Medicago sativa* subsp. *falcata* might be adopted as interseed for rangeland because USDA ARS has only begun recruiting test ranches in the last few years. Researchers have also put forth the idea that the practice of interseeding adaptable cultivars of alfalfa into native rangelands might help in the mitigation of elevated atmospheric carbon dioxide and enhance the long-term sustainability of the ecosystem (Mortenson et al. 2004).

The traits that are likely to contribute to falcata's survival on rangeland include (Berdahl et al. 1989):

- Root proliferation – new shoots from horizontal roots (creeping root trait)
- Broad crown development – protection from trampling and winter injury
- Dormancy during midsummer in drought – low forage production in dry years with regrowth and blossom after late rain
- Slow regrowth compared to cultivated alfalfa (slow decumbent regrowth – lying or growing on the ground but with erect or rising tips) – possibly a grazing survival mechanism
- Hard seed that remains viable over extended periods of drought

These traits could enhance alfalfa in semiarid rangeland, but could have no utility in more humid environments where maximum forage yields from multiple harvests are desired (Berdahl et al. 1989). Expression of traits that are important for feral survival in semiarid rangeland can be masked in performance tests, because performance tests are seeded in narrow rows with high plant densities, in monoculture, are often irrigated, and are usually maintained for short periods (2 to 5 years) (Berdahl et al. 1989).

A few examples of alfalfa cultivars that have prevalent *Medicago sativa* subsp. *falcata* germplasm in their parentage include: Drylander, Roamer, Swift Current S3703L, Travois, South Dakota T25SYN2, Spredor 2, Alaska Synthetic A, Mandan MAL34, Alaska Synthetic B, Alaska

Falcata Strain, Colorado C-3, and Mandan MAL 33 (Berdahl et al. 1989). Gimm and Ranger are also known to have *Medicago sativa* subsp. *falcata* in their parentage (Rumbaugh 1982). Alfalfa cultivars and experimental strains with a high proportion of *Medicago sativa* subsp. *falcata* parentage are better adapted to interseeding into rangeland in the Northern Great Plains than traditional hay-type cultivars which have a high proportion of *Medicago sativa* subsp. *sativa* parentage (Berdahl et al. 1989).

Both *Medicago sativa* subsp. *sativa* and *Medicago sativa* subsp. *falcate* freely interbreed. Hybrids can be vigorous and fertile, and can thrive sympatrically with their *falcata* and *sativa* parents. Hybrid populations with *Medicago sativa* subsp. *falcata* parentage inherit winter and drought hardiness, as well as the ability to exist in grass mixtures, making them more adaptable to resource poor environments and increasing the likelihood of feral populations (Bagavathiannan and Van Acker 2009). Unless properly managed, these feral populations could serve as bridges for long-distance gene flow, facilitating the adventitious presence of novel traits, like glyphosate-tolerance, into the environment. As such, feral populations could potentially be a barrier to the co-existence of transgenic and non-transgenic alfalfa fields, and must be accounted for in landscape level gene flow models (Bagavathiannan and Van Acker 2009).

2.2.2 Rehabilitation and Erosion Control

Sullivan (1992) reviewed alfalfa use for rehabilitation and disturbed sites, though no distinction was made between alfalfa subspecies. Some of the uses that lead to feral alfalfa populations include:

- Rehabilitation of overgrazed rangelands for improvement of both wildlife habitat and livestock;
- Erosion-control projects in interior forests;
- Beneficial for compacted soils (alfalfa has deep roots that will grow vigorously in compacted soils);
- Conservation Reserve Program (CRP) lands may be seeded with mixes containing alfalfa (FAPRI 2007);
- Revegetation of areas damaged by wildfire (Oregon DFW 2008); and
- Erosion reduction in mined soils (Sullivan 1992 and Withers 2002).

Alfalfa was found to survive and increase on rangeland in Utah for more than 10 years and can reseed on sites with as little as 11 inches (28 cm) of precipitation a year (Sullivan 1992).

When the Bureau of Land Management (BLM) toured sites in eastern Oregon that had undergone seeding treatment 35 to 40 years prior to the tour, they noted that the Nomad alfalfa cultivar, which had been seeded in 1966 (36 years before 2002), was still scattered sparingly at each site (Kindschy et al. 2002).

As an example of what one state recommends for rehabilitation after wildfires, the Oregon Department of Fish and Wildlife recommends alfalfa as one component of seeding mixtures, which can sometimes contain over 20 different plant species. Recommended alfalfa quantities (only) are as follows (Oregon DFW 2008):

- Southwest Oregon Elk Mix – 7% percent alfalfa

- North Central Oregon Precipitation Zones, 12-20 inches and 18-30 inches – Ranger and Ladak alfalfa, 1 lb/acre each
- Central Oregon, greater than 12 inches precipitation – Ranger or Ladak alfalfa, 2 lbs/acre each (if appropriate)
- Central Oregon, less than 12 inches precipitation – Ranger or Ladak alfalfa, 1-2 lbs/acre each (if appropriate)
- Northeast Oregon, dry south-facing slopes with little soil – Ladak alfalfa, 1 lb/acre
- Northeast Oregon, north slopes or flat areas with soil and some broken shade quality (charred sticks count) – Ladak alfalfa, 2 lb/acre
- Northeast Oregon, north slopes/flat areas with soil, some broken shade quality only with rocks or little soil – Ladak alfalfa, 1 lb/acre
- Wallowa County – If grazed, Rhizoma or Spreader, 2 lbs/acre, if not grazed, Ladak, 2 lbs/acre
- Baker County Range Mix – Nomad Alfalfa, 1-2 lbs. in mix
- South Central and Southeast Oregon seed mixes, for sagebrush steppe and upland environments with 9-12 inches precipitation (Common Mix), seed mixes for saline or alkali soils and areas of poor drainage, seed mixes for rangelands with 9-12 inches precipitation (Common Mix), Seed mixes for rangelands with less than 9" precipitation – alfalfa listed, but unspecified quantity
- South Central and Southeast Oregon Sandy or Loam Soils – alfalfa, 2 lbs/acre

To put the above seeding rates in context, irrigated agricultural alfalfa is seeded at 12 to 15 pounds per acre under ideal conditions, 15 to 20 pounds per acre when drilling, and 20 to 25 pounds per acre when broadcasting. Typically only 60 percent of the seeds germinate and 60 percent of the emerged seedlings could die during the first year. Four pounds per acre equals 20 seeds per square foot (Orloff et al. 1997). Therefore, two pounds per acre equals 10 seeds per square foot, six of which could germinate. Seedling survival would depend on the competing species. Alfalfa is included in almost all of the wildfire rehabilitation mixes. Even though the seeding rate is low, populations from rehabilitated lands could contribute to the feral population of alfalfa.

2.3 Summary of Findings

Medicago sativa subsp. *sativa* has naturalized populations in the United States and occurs in all 50 states. In a survey of 1040 roadside sites in 57 counties in sixmajor alfalfa production states, Washington had the lowest percentage of sites with feral alfalfa occurring in 10 percent of the pre-selected sites and South Dakota had the highest, with feral alfalfa occurring in 63 percent of the pre-selected sites. In sites where alfalfa was present, the ground cover of alfalfa was 1.2 to 5.4 percent in each state. In another survey of five states, Kendrick et al. (2005) observed that feral alfalfa populations were located within 2000 meters of cultivated alfalfa in approximately 22 percent of the sites examined.

Medicago sativa subsp. *falcata*, (yellow-flowered or Siberian alfalfa) is naturalized in the more northern and western states. It is being promoted as a rangeland enhancer for grazing. A naturalized population of *Medicago sativa* subsp. *facalta* that was seeded on rangeland in South Dakota in 1915 is still in existence. Hybridization between *Medicago sativa* subsp. *falcata* and

Medicago sativa subsp. *sativa* would result in hybrids that would be less adapted to northern plains rangeland than the *Medicago sativa* subsp. *falcata* parent, but possibly better adapted than the *Medicago sativa* subsp. *sativa* alfalfa parent.

Alfalfa is used for a variety of non-agricultural purposes. These uses include; rehabilitation of overgrazed rangelands, erosion-control projects in interior forests, treatment of compacted soils, revegetation of areas damaged by wildfire, and erosion reduction in mined soils.

3.0 Glyphosate-Resistant Weeds

3.1 Potential Glyphosate-Resistant Weeds in Non-agricultural Ecosystems

Management practices associated with the use of GT-alfalfa could conceivably increase the occurrence of glyphosate-resistant weeds, which might impact non-agricultural lands. However, as discussed in the technical report *Effects of Glyphosate-Tolerant Weeds in Agricultural Systems* (appendix G), alfalfa farming practices limit the likelihood of weed occurrence because alfalfa grown for hay is mowed, which reduces the likelihood that weeds reach their reproductive stage, and alfalfa is grown in rotation with annual crops (because of the nitrogen benefits it provides and autotoxicity limiting continuous alfalfa), which also limits both perennial and annual weed presence.

Appendix H-4 of this technical report presents 40 glyphosate-resistant and glyphosate-tolerant weeds,their range, and noxious status within the U.S.. Whether or not they are mentioned on the Roundup® herbicide label is also included. The WSSA definition of resitance and tolerance is utilized here and are are as follows (WSSA 1998):

> Herbicide resistance: "Herbicide resistance is the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal to the wild type. In a plant, resistance might be naturally occurring or induced by such techniques as genetic engineering or selection of variants produced by tissue culture or mutagenesis."
>
> Herbicide tolerance: "Herbicide tolerance is the inherent ability of a species to survive and reproduce after herbicide treatment. This implies that there was no selection or genetic manipulation to make the plant tolerant; it is naturally tolerant."

U.S. distribution maps produced by the PLANTS database for all 40 weeds are also presented in appendix H-4. As mentioned for appendix H-3 *Medicago* maps, the PLANTS database indicates that, “not all populations have been documented, however, and significant gaps in the distribution shown may not be real….Remember that only native and naturalized populations are mapped.” Also, the distribution maps in appendix H-3 of this technical report do not represent glyphosate-resistant biotypes. The maps are presented to give a general sense of where the plant species currently grow, which are potentially states to which glyphosate-resistant biotypes could spread if conditions promoted their spread. For example, glyphosate-resistant buckhorn plantain, goosegrass, junglerice, sourgrass, and wild poinsettia, have been reported in other countries, but not in North America. However, since these weeds have susceptible populations in North America, the growing conditions in North America presumably would also support glyphosate-resistant biotypes. It is possible that glyphosate-resistant biotypes could independently evolve from the North American populations, or foreign biotypes could be introduced to North America through human error or other unintentional routes.[5]

The Federal Noxious Weed Act (1975) gave USDA the authority to designate plants as noxious weeds. The movement of noxious weeds in interstate or foreign commerce is prohibited except

[5] Intentional introduction of noxious or herbicide resistant weeds is poss ble, but discussion of intentional environmental and agricultural sabotage is beyond the scope of this report.

under permit. USDA can inspect, seize and destroy products, and quarantine areas, if necessary to prevent the spread of noxious weeds. Liverseedgrass, described on the U.S. federal noxious weed list, also has glyphosate-resistant phenotypes though none have been observed in the United States. Only tropical spiderwort (Benghal dayflower) is both glyphosate-tolerant and on the U.S. federal noxious weed list. Several of the glyphosate-resistant or glyphosate-tolerant weeds are on at least one state's noxious weed list. These include:

- Common ragweed.
- Giant ragweed.
- Johnsongrass.
- Buckhorn plantain.
- Kochia.
- Bermudagrass.
- Field bindweed.
- Filaree.
- Hemp sesbania.
- Morning glory.
- Nutsedge.
- Purslane.
- Velvet leaf.

Because control programs actively seek to eradicate noxious weeds, their susceptibility to herbicides and their distribution is important information for control managers. It is important to note that noxious weeds are not just weeds in agricultural systems. They are considered weeds regardless of their habitat, once they have been declared noxious in that state, county, or area. Alternative herbicides, mechanical removal, and spot burning are possible alternative control strategies for glyphosate-resistant weeds.

3.1.1 Is Alfalfa Considered a Weed?

There is very little evidence to suggest that alfalfa is considered a weed, other than as a volunteer in agricultural settings (see USDA APHIS 2009). Monsanto corresponded with 13 weed control experts in Arizona, California, Idaho, Pennsylvania, Oregon, South Dakota, Washington, and Wisconsin (Rogan and Fitzpatrick 2004). None of the respondents considered alfalfa a weed. In South Dakota and Wisconsin it is encouraged to grow along roadsides. Alfalfa is one of the species that is controlled where bare ground is desired. Glyphosate as well as other herbicides were cited as tools for weed control in non-agricultural settings, with glyphosate considered less effective in controlling alfalfa than other herbicides. Rogan and Fitzpatrick (2004) conclude that GT alfalfa would not present a negative environmental impact in non-agricultural setting. There were also two situations where GT alfalfa would require extra control strategies. One is in irrigation ditches with running water in regions of California where the only labelled herbicide for that location is glyphosate. In these situations mechanical weed removal or spot burning was recommended. Another situation describes the potential presence of volunteer alfalfa on land rotated to fruit trees. In this situation, Rogan and Fitzpatrick (2004) suggest that aggressive alfalfa stand termination practices be adopted for land that is rotated to fruit trees or other crops where herbicide use is limited and GT alfalfa has been grown previously. However, this strategy is prevention-based and does not address mitigation once a problem occurs.

USDA Natural Resources Conservation Service's Plant Fact Sheet on Alfalfa states the following (USDA NRCS 2002):

> Weediness
> This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. Please consult with your local NRCS Field Office, Cooperative Extension Service office, or state natural resource or agriculture department regarding its status and use.

However, out of the 12 weed lists from the USDA PLANTS Database, *Medicago sativa* is only listed on one, the Southern Weed Science Society.

- Plant Protection and Quarantine. 2006. *Federal noxious weed list* (24 May 2006). USDA Animal and Plant Health Inspection Service. Washington, DC. 2pp. (104 entries)
- Assorted authors. S*tate noxious weed lists for 46 states.* State agriculture or natural resource departments. (661 entries)
- California Invasive Plant Council. 2006. *California Invasive Plant Inventory*. Cal-IPC Publication 2006-02 (February 2007). California Invasive Plant Council. Berkeley, California. (107 entries)
- Florida Exotic Pest Plant Council. 1999. *Invasive plant list* (19 October 1999). Florida Exotic Pest Plant Council. Florida. (134 entries)
- USDI, Geological Survey. 1999. *Information index for selected alien plants in Hawaii* (20 October 2003). Hawaiian Ecosystems at Risk Project, Biological Resources Division, Haleakala Field Station. Makawao, Hawaii. (197 entries)
- Haragan, P.D. 1991. *Weeds of Kentucky and adjacent states: a field guide.* The University Press of Kentucky. Lexington, Kentucky. 278pp. (141 entries)
- Uva, R.H., J.C. Neal, & J.M. DiTomaso. 1997. *Weeds of the Northeast*. Cornell University Press. Ithaca, New York. 397pp. (237 entries)
- Stubbendieck, J., G.Y. Friisoe, & M.R. Bolick. 1994. *Weeds of Nebraska and the Great Plains.* Nebraska Department of Agriculture, Bureau of Plant Industry. Lincoln, Nebraska. 589pp. (287 entries)
- Southeast Exotic Pest Plant Council. 1996. *Invasive exotic pest plants in Tennessee* (19 October 1999). Research Committee of the Tennessee Exotic Pest Plant Council. Tennessee. (140 entries)
- Southern Weed Science Society. 1998. *Weeds of the United States and Canada*. CD-ROM. Southern Weed Science Society. Champaign, Illinois. (411 entries)
- Hoffman, R. & K. Kearns (eds.). 1997. *Wisconsin manual of control recommendations for ecologically invasive plants*. Wisconsin Dept. Natural Resources. Madison, Wisconsin. 102pp. (75 entries)
- Whitson, T.D. (ed.) et al. 1996. *Weeds of the West*. Western Society of Weed Science in cooperation with Cooperative Extension Services, University of Wyoming. Laramie, Wyoming. 630pp. (344 entries)

The updated Southern Weed Science Society (SWSS), in collaboration with the North Central Weed Science Society, Interactive Encyclopedia of North American Weeds Version 3.0 (447 entries), includes alfalfa (NCWSS 2005). This is an updated version of the 1998 version cited

above. The documentation provided by this list does not indicate why alfalfa is considered a weed.

The author of the alfalfa segment of the SWSS Weed Identification guide has stated that alfalfa is not "an invasive weed" nor does it "displace native species," but alfalfa does colonize disturbed areas (Brett Serviss, Docket No. 04-085-1 #480).

3.2 Use of Glyphosate in Non-agricultural Settings

3.2.1 USDA Forest Service

The Forest Service uses glyphosate primarily in conifer release (58.2 percent), noxious weed control (15.5 percent), and site preparation (16.4 percent). Other minor uses (10.3 percent) include hardwood release, facilities maintenance, recreation improvement, right-of-way maintenance, seed orchard protection, wildlife habitat improvement, and other weed control (agricultural, aquatic, or nursery). The application rates are approximately 3.31 lb/acre for conifer release, 1.06 lb/acre for noxious weed control, and 3.34 lb/acre for site preparation. Thirty-five commercial formulations of glyphosate are registered for forestry applications. In 2001, the total annual use of glyphosate by the Forest Service was 44,721 pounds applied to 19,021 acres, which corresponds to about 0.275 percent of the agricultural use (USDA FS 2003). The Forest Service tracks use by Region. The use rates for the Regions are shown in table H-2.[6]

Table H-2 USDA Forest Service use of Glyphosate 2001 (Adapted from USDA FS 2003)

Region	Forest Area	Pounds	Pounds per Acre	Percentage of FS Use by Pounds
1	Northern	264	1.99	0.6
2	Rocky Mountain	182	0.69	0.4
3	Southwestern	3	1.00	--
4	Intermountain	261	0.64	0.6
5	Pacific Southwest	34,740	4.14	78
6	Pacific Northwest	1,706	1.70	3.8
8	Southern	3,419	0.88	7.6
9	Eastern	4,146	0.84	9.3
Total		**44,721**	**2.35**	**100%**

Glyphosate can be applied by directed foliar, broadcast foliar, or aerial methods. Backpack-applied directed foliar sprays are the most common method of application in Forest Service programs. In these applications, the sprayer is carried by backpack, and the glyphosate is sprayed on selected plant species. Glyphosate can also be applied by "hack and squirt" operations, in which a hatchet is used to cut open a tree exposing the cambium, and then the herbicide is applied to the tree using a squirt bottle. Hack and squirt applications are used to eliminate large trees during site preparation, rights-of-way maintenance, or conifer release procedures.

[6] FS regions do not correspond to EPA Regions or to the USDA Plant Variety Protection Office alfalfa growing regions. Also there is no Region 7 in the FS system.

A less often used method of glyphosate application is broadcast foliar ground applications. This method involves mounting a two to six nozzle boom to a tractor or heavy-duty vehicle and applying the herbicide while driving through the selected vegetation.

Some additional methods are also occasionally used by the Forest Service. One is a cut stem application that is used to treat some noxious weeds. The weed stem is cut and the herbicide is sprayed onto the cut stem. Another method is an aquatic application, in which the herbicide is applied onto emergent vegetation of aquatic noxious weeds. Aerial applications can be used for brown-and-burn operations.

In situations where bare ground is desired, glyphosate-resistant weeds can persist after glyphosate application. However, since burning follows herbicide treatment, the resistant weeds would likely be controlled.

3.2.2 Other Glyphosate Users

As mentioned previously, 13 weed control experts did not consider glyphosate to be the only herbicide for roadside and other weed management, but it is considered among the tools that could be used. It was also mentioned that glyphosate is not particularly good at controlling non-GT alfalfa (Rogan and Fitzpatrick 2004).

The Roundup® herbicide (glyphosate) label[7] includes numerous non-crop uses such as: airports, apartment complexes, Christmas tree farms, CRP areas, ditch banks, driveways, dry ditches, dry canals, fencerows, golf courses, greenhouses, industrial sites, landscape areas, lumber yards, manufacturing sites, municipal sites, natural areas, office complexes, ornamentals, parks, parking areas, pastures, petroleum tank farms and plumbing stations, plant nurseries, public areas, railroads, rangelands, recreation areas, rights-of-way, roadsides, schools, shadehouses, sod or turf seed farms, sports complexes, storage areas, substations, turfgrass areas, utility sites, warehouse areas, and wildlife management sites.

- Feral alfalfa is known to grow in many of the above settings; therefore, it is possible that feral GT alfalfa could also survive in some of these non-crop locations. Additionally, it is possible that glyphosate applications could result in drift of glyphosate to crop fields and weed management targets if herbicide application practices are not followed. The selective potential of glyphosate drift on GTalfalfa populations has not been studied to date. It is possible that drift of glyphosate could impart weak selection on feral populations and a potential competitive advantage to GT individuals. In these situations, alternative control measures such as mechanical removal or use of herbicides in tank mixtures would need to be adopted.

3.3 Summary of Findings

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7 http://www.monsanto.com/products/Documents/MSDS-Labels/roundup_orig_max_label.pdf

Fourty weed species are known that either have newly evolved glyphosate-resistant biotypes or have historical natural tolerance to glyphosate. 11 of the 20 newly evolved glyphosate-resistant weeds have documented glyphosate-resistant biotypes in the United States. Glyphosate-resistant Sumatran fleabane has been observed in other parts of the world, but only glyphosate-sensitive plants have been observed in the U.S. The remaining 8 have sensitive biotypes in the United States, but glyphosate-resistant biotypes have not yet been documented in the United States. All 20 of the glyphosate-tolerant weeds have naturalized or native populations in the United States (although one, Chinese foldwig, is found only in Hawaii). Thirteen glyphosate-resistant or glyphosate-tolerant weed species are on at least one state noxious weed list. Liverseedgrass is on the federal noxious weed list, though glyphosate-resistant ecotypes have only been observed elsewhere in the world. Tropical spiderwort, a glyphosate-tolerant weed, is also on the federal noxious weed list and observed within the United States
There is very little evidence to suggest that alfalfa is considered a weed, other than as a volunteer in agricultural settings. Out of the 12 weed lists from the USDA PLANTS Database, *Medicago sativa* is only listed on one, the Southern Weed Science Society, and this listing might be due to volunteer alfalfa in cropland. Thirteen surveyed weed control experts only identified one setting, irrigation ditches in California, where GT alfalfa could not be controlled by alternative herbicides. In this case only glyphosate is approved for irrigation ditches, so mechanical removal or spot burning would be the alternative control measures.

The USDA Forest Service uses glyphosate to manage forests. Their use is 0.275 percent of the quantity used on agricultural lands. The Roundup® herbicide label has 41 other non-crop setting listed. Many of these setting overlap with areas where feral alfalfa is found. There is a possibility that feral GT alfalfa could be found in non-crop areas. In cases where control is desired alternative control methods are available.

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Appendix H-2. Literature Search

1.0 Literature Search Strategy

1.1 Purpose

The purpose of this literature search is to locate references about the potential impacts of glyphosate-tolerant weeds in nonagricultural ecosystems.

In addition, the titles retrieved for the literature search for the technical report *Effects of Glyphosate-Tolerant Weeds in Agricultural Systems* were also reviewed for applicability to nonagricultural eco-systems.

1.2 Retrieval criteria

Titles were used to indicate the subject of the paper. If the paper was not in English or indicated a geographic region outside of the United States, it was not retrieved. Titles that seemed to focus on insect pests were not retrieved. Titles that seemed to indicate an agricultural focus were not retrieved. All titles that seemed applicable to the scope of the paper were searched for online by a professional librarian. Titles that were obtained for free and were cited include the URL in the citation. Titles that were not free access were obtained through online purchase or the use of a copy vendor, who regularly visits National Institutes of Health and National Agricultural Library to obtain references.

1.3 Databases

File 10:AGRICOLA 70-2008/Jun
(c) format only 2008 Dialog
File 203:AGRIS 1974-2008/Feb
Dist by NAL, Intl Copr. All rights reserved
File 266:FEDRIP 2008/Apr
Comp & dist by NTIS, Intl Copyright All Rights Res
File 5:Biosis Previews(R) 1926-2008/Jul W1
(c) 2008 The Thomson Corporation
File 6:NTIS 1964-2008/Jul W3
(c) 2008 NTIS, Intl Cpyrght All Rights Res
File 41:Pollution Abstracts 1966-2008/Aug
(c) 2008 CSA.
File 40:Enviroline(R) 1975-2008/Apr
(c) 2008 Congressional Information Service
File 76:Environmental Sciences 1966-2008/Jul
(c) 2008 CSA.
File 24:CSA Life Sciences Abstracts 1966-2008/Mar
(c) 2008 CSA.
File 117:Water Resources Abstracts 1966-2008/Mar
(c) 2008 CSA.

File 144:Pascal 1973-2008/Jul W1
(c) 2008 INIST/CNRS
File 50:CAB Abstracts 1972-2008/Jun W5
(c) 2008 CAB International
File 44:Aquatic Science & Fisheries Abstracts 1966-2008/Mar
(c) 2008 CSA.
File 71:ELSEVIER BIOBASE 1994-2008/Jun W5
(c) 2008 Elsevier B.V.
File 143:Biol. & Agric. Index 1983-2008/Apr
(c) 2008 The HW Wilson Co

Descriptions of these files are available at http://library.dialog.com/bluesheets/.

1.4 Scope of Search

The search focused on any published references between 1980 and the present. A list of titles (below) was screened followed by screening of abstracts for relevant titles. There were no limits on language for titles but only English language publications were retrieved for evaluation. In addition, only papers relevant to the United States were retrieved. All titles are provided below, to demonstrate the wide range of literature available for other countries where Medicago species are naturally occurring.

1.5 Keywords

alfalfa (Medicago and Lucerne are synonyms for alfalfa) combined with the terms below
Feral
Wild
Forest*
Meadow*
Roadside*
Ditch*
Canal*
Railroad*
Wasteland*
Cemeter* (for cemeteries and cemetery)
Highway*
Pipeline*
Fence*

1.6 Results

```
S1  163012  ALFALFA OR MEDICAGO OR LUCERNE OR M()SATIVA
S2  936526  WILD OR FERAL
S3 1819113  FOREST? OR MEADOW? OR ROADSIDE? ? OR WASTELAND? ?
S4  265626  DITCH OR DITCHES OR CANAL OR CANALS
S5  199278  RAILROAD? ? OR CEMETER? OR HIGHWAY? ? OR PIPELINE? ? OR
            FENCE OR FENCES OR NATURAL()(AREA OR AREAS OR HABITAT? ?)
S6  120548  S1 NOT PY=1900:1979
```

S7 2240 S6 (S) (S3 OR S4 OR S5)

10/K,6/3 (Item 3 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007280290 CAB Accession Number: 19960710684
The avifauna of remnant tallgrass prairie near Boulder, Colorado.
Publication Year: 1995
... virgatum and Sorghastrum nutans , and the agricultural grasslands in the Boulder valley include mixtures of *Medicago* sativa , Carex sp. and various non-native pasture grasses such as Bromus inermis , Festuca pratensis...
... grasses and herbs, and Yucca glauca and Opuntia spp. are common. The relative abundances of *wild* birds on tallgrass prairie plots were compared with those of the 2 adjacent grassland habitats...
...the Great Plains, USA. Nesting songbird species were abundant in Boulder tallgrass and included western *meadowlark* (Sturnella neglecta), red-winged blackbird (Agelaius phoeniceus) and grasshopper sparrow (Ammodramus savannarum), with smaller numbers...

10/K,6/9 (Item 9 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005385072 CAB Accession Number: 19840507892
Diet of the adult of Tytthaspis sedecimpunctata (L.) (Coleoptera Coccinellidae) in an environment with primary human influence: a meadow containing multiple plant species.
Original Title: Regime alimentare dell'adulto di Tytthaspis sedecimpunctata (L.) (Coleoptera Coccinellidae) in ambiente a influenza antropica primaria: prato polifita.
Atti XIII Congresso Nazionale Italiano di Entomologia.
Publication Year: 1983
... 1978-79 by examination of the gut contents of insects sampled by aspirator from a *meadow* used for agricultural purposes; it contained a wide variety of plants including *lucerne*, red clover, various grasses and *wild* carrot. The diet of the coccinellids as indicated by the gut contents consisted largely of...diet varied in relation to the time of year and to the mowing of the *meadow* for hay, but in general pollen was the preferred food and fungi were taken in...

10/K,6/11 (Item 11 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
02391566
Ecogeography and distribution of wild legumes in Turkey
1998
Proceedings of International Symposium on In Situ Conversation of Plant Genetic Diversity
Since Turkey is one of the center of diversity for legumes, most of the *wild* relatives of economically important food and forage legume species consisting of Cicer, Lens, Pisum, Vicia, Lathyrus, Trifolium, *Medicago* exist in flora. The ecogeography and distribution of *wild* legumes differ from species to species for each genus, starting from coastal habitats up to the highlands including *forests*. Within the framework of National Plant Genetic Resources Program ecogeography and distribution of *wild* legumes have been determined with systematic annual expeditions.

10/K,6/15 (Item 15 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.

0007088386 CAB Accession Number: 19950710609
Phenological development of different wild flower meadow mixtures during the course of a growing season.
Original Title: Phanologische Entwicklung verschiedener Blumenwiesenmischungen im Verlauf einer Vegetationsperiode.
Publication Year: 1994
The development of *wild* flower *meadows* from 4 seed mixtures was observed between 14 May and 9 Oct. 1992. The plots...
... desirable. A mixture with a high proportion of legumes was dominated by Lotus corniculatus and *Medicago* sativa . Except for Anthoxanthum odoratum and Trisetum flavescens , the flowering grasses were mostly inconspicuous. The...

10/K,6/20 (Item 20 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008321578 CAB Accession Number: 20023088265
Genetic resources of forage-turf grasses and legumes in Lithuania: collecting activity, evaluation/characterization, genetical collection.
Publication Year: 2001
... locations of 16 Lithuanian administrative districts. The work was started by making inventories of natural *meadows* in each district. 624 seed accessions of forage-turf grasses and legumes were collected in...
... programmes. Initial evaluation has shown that there are real grounds to accumulate genetic resources of *wild* ecotypes of perennial grasses and legumes, as the genotypes collected in Silute, Kaisiadoriai, Trakai, Klaipeda...
... morphological traits and agronomic properties within the species. The new varieties "Arka" and "Gaja" of *Medicago* lupulina L. and Poa pratensis L. species created from *wild* ecotypes collected in the Klaipeda district will be tested in the official variety trials over...
... collection of forage-turf grasses and legumes currently consists of 548 seed samples, including 265 *wild* or semi-natural ecotypes, 229 breeder's lines, 54 advanced cultivars.

10/K,6/26 (Item 26 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
06664738 BIOSIS NO.: 198274081161
THE LEGUMES OF VAISHALI DISTRICT BIHAR INDIA
1982
ABSTRACT: A systematic survey of *wild* and naturalized (46 spp.) and cultivated (47 spp.) leguminous plants of the Vaishali district is...
...important synonyms, diagnostic features, local names, economic uses, locality records, ecological amplitude and phenology. The *wild* and naturalized taxa are mostly found in pastures, *wastelands*, orchards, etc. Alysicarpus longifolius Wight et Arn., Astragalus graveolens Buch.-Ham. ex Benth. and *Medicago* laciniata var. brachycantha Bioss. are new records for the state. Astragalus graveolens Buch.-Ham. ex...
...appears to have extended its geographical range from the western hills to the eastern plains. *Medicago* falcata L., Psophocarpus tetragonolobus DC. and Trifolium alexandrinum L. were introduced under cultivation for food...

10/K,6/27 (Item 27 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007913654 CAB Accession Number: 20001612632
The mielgas: wild Spanish populations of alfalfa. Results of ten years of researches.

Lucerne and medics for the XXI Century. Proceedings XIII Eucarpia Medicago spp. Group Meeting, Perugia, Italy, 13-16 September 1999.
Publication Year: 2000
Some 104 natural populations of *Medicago* sativa were collected in Spain, from September 1985 to July 1987. They were mainly from *roadsides* , non-irrigated and often grazed rangelands or even orchards. This germplasm has been evaluated at...
... of the total annual dry matter production for the first cut), a greater persistence than *alfalfa* [*lucerne*] cultivars and a good vegetative spring yield and seed production level for non-selected populations...
...distinguished from the others. The maintenance of original morphological features in most natural populations of *Medicago* sativa in Spain questions the relative extent of crop-to-weed gene flow versus selection ...
... pattern of population differentiation were measured in a subset of populations, within and among the *wild* and cultivated gene pools with respect to both allozymes, RAPD and quantitative traits. Combining these ...
... in some locations is likely to oppose gene flow to establish cultivated traits into the *wild* populations. Third, some other populations were different from all the cultivated landraces with respect to...

10/K,6/28 (Item 28 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007693735 CAB Accession Number: 19991102584
Monitoring for impact of the introduced leafcutting bee, Megachile rotundata (F.) (Hymenoptera: Megachilidae), near release sites in South Australia.
Publication Year: 1996
Native plants from remnant strip vegetation at *roadside* sites near Keith, South Australia, were monitored during the period when M. rotundata were managed on nearby *lucerne* crops. The predominant native plants flowering at sampling sites during the November to March period...
... 12 microdomiciles placed in a nearby Conservation Park. The results of the monitoring programme suggested *feral* leafcutting bee populations were unlikely to have established in significant numbers and the impact on ...

10/K,6/29 (Item 29 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
19070960 BIOSIS NO.: 200600416355
Morphologic and agronomic diversity of wild genetic resources of Medicago sativa L. collected in Spain
2006
ABSTRACT: One hundred and three natural populations of *Medicago* L. were collected in Spain, mainly from *roadsides*, non-irrigated or grazed lands. This germplasm was evaluated at Montpellier (France) with control cultivars...
...Differences between natural populations and cultivated controls are highly significant, but gene flow occurs between *wild* and cultivated compartment and hybrid populations were identified. On the basis of multivariable analysis, the...
...their disappearance even when they disappeared from the other regions of the western Mediterranean. Spanish *wild* pool of *alfalfa*, also called 'Mielga', appears of great interest for the breeding of *alfalfa* because it contains a large diversity of characteristics (prostrate habit, rhizomes) linked to tolerance to...

...of natural habitats and the necessity for rehabilitation of degraded ecosystems, the importance of this *wild* pool is really inestimable.

10/K,6/30 (Item 30 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
14952858 BIOSIS NO.: 199900212518
Morphometric analysis of main wild food plants of South Ural region
1998
ABSTRACT: The morphometric and phenotypic analysis of variability of 16 natural populations of eight *wild* food species have been carried out in the central mountain-*forest* part of the South Urals and in north-eastern *forest*-steppe Bashkir Cis-Urals. As a result, 11 populations with high plant morphometric values and...
...are selected within the following species: Alopecurus pratensis L., Dactylis glomerata L., Phleum pratense L., *Medicago* falcata L., Trifolium medium L., T. hybridum L. Populations with morphometric parameters of plants are...

10/K,6/43 (Item 43 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0009355551 CAB Accession Number: 20073193255
Steppe field shelterbelts: a new factor in ecological stabilization and sustainable development of agrolandscapes.
Publication Year: 2007
... erosion, which pertains to phytoamelioration, was examined. The steppe shelterbelts were laid out between existing *forest* belts across slopes, along horizontals, with a width of 7-10 m, and on a...
...7%; and the dominant association is fescue and grass (Festuca valesiana + Koeleria cristata [K. macrantha] + *Medicago* romanica). The most important characteristics of the steppe shelterbelts, these quasi-natural plant communities, are unlimited longevity, self-reproduction of rich flora, annual regeneration after a fire, optimum environment for *wild* fauna and 95-97% reduction of runoff processes.

10/K,6/44 (Item 44 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007473718 CAB Accession Number: 19980200036
Structure and density of lucerne pollinating wild bee populations as affected by changing agriculture.
Proceedings of the 7th International Symposium on Pollination, Lethbridge, Alberta, Canada, 23-28 June 1996.
Publication Year: 1997
Intensive surveys on populations of *wild* bees (Apoidea) which pollinate *lucerne* were made in Hungary in the mid-fifties, late sixties and early seventies. Comparing these surveys, a dramatic change in the structure of *wild* bee populations occurred between the fifties and the sixties. The populations of some bee species have fallen, other species have remained unchanged, while the population of *Medicago* oligoleges has increased. The changes may be explained by changes in agricultural land usage since...increase in field size as well as an increased use of mechanical weed
control along *roadsides*, and by an increased use of herbicides on arable land. The effects are discussed in terms of seasonal occurrence for different groups of *wild* bees. It is concluded that the changes in agriculture have been favourable for some bee...

10/K,6/45 (Item 45 from file: 50)

DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008974830 CAB Accession Number: 20053170218
Strip undersowing of perennial fodders in natural degraded pastures of the forest steppe of the River Ob region.
Publication Year: 2005
... work carried out in 1999-2004, the botanical composition of degraded pastures in the northern *forest* steppe of Novosibirsk province in Siberia around the River Ob (Priob'e region) was determined...
... yielding perennial fodder species was investigated. The pastures were mainly mixed grass and narrow-leaved *meadow* grass [Poa angustifolia] grasslands on *meadow* chernozem soil, in which the dominant plant species were dandelion [Taraxacum officinale], dropwort [Filipendula vulgaris], *wild* strawberry [Fragaria vesca] and tufted vetch [Vicia cracca]. Pasture plots were undersown with either cocksfoot [Dactylis glomerata] or yellow *lucerne* [*Medicago* falcata]. Best results in terms of dry matter (DM) yield (3-4 t/ha) were...
... 340 to 480 g/m SUP 2 . One drawback was poor seedling drought resistance. For *lucerne* , which was also relatively competitive, after 3-6 years it occupied 60-70% of the...

16/K,6/3 (Item 3 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007903234 CAB Accession Number: 20001911501
The influence of sewage water on the growth of wild plants, north of Sana'a, Republic of Yemen.
Publication Year: 2000
...to 70% in areas fed by sewage and rain water, and 5 to 10% in *natural* *areas* , fed by rainfall only. On the basis of their life form plants were classified as short-lived annual, long-lived annuals, long-lived annuals or biennials, and perennials. Barley, *alfalfa* (*Medicago* sativa) and maize were successfully planted for animal and human consumption along the banks of...

21/K,6/1 (Item 1 from file: 71)
DIALOG(R)File 71:(c) 2008 Elsevier B.V. All rts. reserv.
03691993 2007114099
Acacia nilotica and *Medicago* sativa, suitable plants for agro-*forestry* in southern coasts of Iran
PUBLICATION DATE: May 15, 2007
...leaf and fruit of Acacia were determined and compared with those of in foliage of *Medicago* sativa being managed under an agro-*forestry* system.

By analyzing data it was revealed that the biggest trees were found in Dashteyari...
...the Oman Sea coast). Values in most of nutritional elements were higher in foliage of *Medicago* than in leaf and fruit of Acacia, respectively. From this investigation it is concluded that in south of Iran where the site is favorable for Acacia plantation, cultivation of *Medicago* or other adaptable crops together with Acacia can be developed as agroforestry systems (such as...

21/K,6/2 (Item 2 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
2135393 83040751 Holding Library: AGL
Aggregation patterns of *meadow* spittlebugs, Philaenus spumarius L. (Homoptera: Cercopidae), on old-field *alfalfa* plants
1983

21/K,6/5 (Item 5 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
2455244 85032562 Holding Library: AGL
Alfalfa in the *forest*-steppe zone of the Ukrainian SSR
1984 Nov

21/K,6/6 (Item 6 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
1871930 81061129 Holding Library: AGL
Alfalfa pests and measures of their control in the central *foreststeppe* of the Ukranian SSR.
1980

21/K,6/8 (Item 8 from file: 76)
DIALOG(R)File 76:(c) 2008 CSA. All rts. reserv.
0002018019 IP ACCESSION NO: 7669446
Alternative methods for sustainably managing coastal *forests* as silvo-pastoral systems
PUBLICATION DATE: 2006
ABSTRACT: Integration of shelter *forest* and herbage into a silvo-pastoral system
with sustainable management can improve the ecological and economic sustainability of shelter *forest* in coastal China. Sustainable management of tree density and forage grasses planting was studied by establishing five experimental treatments through selective logging of the *forest*. The tree density at the five treatments was 5.00, 2.50, 1.67, 1...
...100m2 (Treatment 4) is the best for introduced forage plants (Sorghum sudanense, Lolium multiflorum, and *Medicago* sativa) and mature Populus to integrate into a silvo-pastoral system, while the density of...

21/K,6/10 (Item 10 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0009070567 CAB Accession Number: 20063118697
Applications of bioengineering for *highway* development in southwestern China.
Book Title: Ground and water bioengineering for erosion control and slope stabilization
Publication Year: 2004
A surge of high-grade *highway* infrastructure construction is expected in China (includes Yunnan, Guizhou and Sichuan) by 2020 within the framework of the National Trunk *Highway* Networks. The southwestern part of China, where over 170 million people live, is characterized by...
... rainfalls and high seismic activity. Due to the complex nature of this environment, construction of *highways* is a highly challenging task. Bioengineering techniques have been utilized since 1992 in an attempt to reduce the ecological impacts of *highway* construction and improve the aesthetics of *highway* environment. Plants are used to reduce the flow of water, provide protection against raindrop impact...
... subtropical montane areas and include: Agropyron cristatum, Cynodon dactylon, Eragrostis ferruginea, Festuca arundinacea, Lolium perenne, *Medicago* sativa, Paspalurn notatum, Poa pratensis, Trifolium pratense, T. repens , and Zoysia japonica . Grasses and shrubs...
... Evidence clearly shows that bioengineering techniques are part of the sustainable development of high-grade *highway* construction projects by creating beautiful scenery, ensuring the security of transportation, and improving environmental protection.

21/K,6/12 (Item 12 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006615591 CAB Accession Number: 19920758889
Applying chemical treatments to hay *meadows*.
Publication Year: 1992
A weed-infected natural hay *meadow* on a S.-facing 15(deg) slope in the Krasnodarsk district was sprayed with 2...
... was sown with a mixture of Bromus inermis, Festuca pratensis, Dactylis glomerata, Trifolium pratense and *Medicago* falcata after preliminary

loosening to 6-8 cm depth. The herbicide and fertilizer treatments were...

21/K,6/13 (Item 13 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0009056221 CAB Accession Number: 20063096543
Application of thick substrate spraying technique to high edge slopes in Chengdu-Nanchong *highway*.
Publication Year: 2004
... tested during 2001-02 for controlling the collapse of high edge slopes of Chengdu-Nanchong *Highway* in Sichuan, China. It was developed by the Sichuan Sihai Brilliant Ecological Environment Engineering Co...
...to sow plant seeds to the substrates. The sown plants were Festuca elata , Cynodon dactylon , *lucerne* [*Medicago* sativa], Lespedeza bicolor and Ficus tikoua . Observations on their growth showed that C. dactylon , F. elata and *lucerne* had a plant height and density 29 and 2089, 15 and 209, and 8 cm...

21/K,6/16 (Item 16 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006490254 CAB Accession Number: 19920750531
Studies of the biology and its application in the cropping system of upland red soil in southeastern China. II. A study of the microflora and crop yield potential of sloping *wasteland* planted with grass.
Publication Year: 1990
... in southeastern China. II. A study of the microflora and crop yield potential of sloping *wasteland* planted with grass.
... autumn 1986 and 1987 mixtures of Festuca arundinacea or Lolium perenne with Trifolium repens and *Medicago* sativa were sown on sloping *wasteland* at Nanchang and Qingjiang in Jiangxi. The total number of microorganisms in soil increased each...

21/K,6/17 (Item 17 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
01046132
1984
Bromus willdenowii, Dactylis glomerata, Festuca arundinacea, *Medicago* sativa: 4 species for the rotating *meadows* of the plain (Bromus willdenowii, Dactylis glomerata, Festuca arundinacea, Medicago sativa: 4 specie per i prati avvicendati di pianura)

21/K,6/19 (Item 19 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008548930 CAB Accession Number: 20033206628
Botanical and chemical composition of *meadow* hay from different grassland regions of Macedonia.
Original Title: Botanicki i kemijski sastav livadnog sijena s

razlicitih pasnjackih podrucja r. Makedonije.
Publication Year: 2003
In order to determine the botanical and chemical composition of *meadow* hay, share of grasses, legumes and other plants as well as the basic nutrients, 10...
... and Dactylis glomerata , from the family of legumes Fabaceae are Trifolium repens , Trifolium pratense and *Medicago* lupulina and representatives of other plant families are Plantago lanceolata , Achillea millefolium and Siliene vulgaris...low or medium quality and those from the Males region as good and medium quality *meadow* hay.

21/K,6/27 (Item 27 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005653396 CAB Accession Number: 19851645170
The concept of *meadow* structure and its importance in the definition of the *lucerne* ideotype.
Development, construction and multiplication of fodder crop varieties. Meeting of the Fodder Crops Section of Eucarpia, 17-20 September 1984, Freising-Weihenstephan, German Federal Republic.
Publication Year: 1985

21/K,6/33 (Item 33 from file: 6)
DIALOG(R)File 6:(c) 2008 NTIS, Intl Cpyrght All Rights Res. All rts. reserv.
1946278 NTIS Accession Number: MIC-96-02326
Cover crops for *forest* vegetation management: A literature review
(Technical report no. no. 93, and VMAP technical report no. 95-01)
c1995
With increasing social pressures to reduce the amount of herbicides used in *forestry*, cover crops are being evaluated for their use as a *forest* management tool. This publication summarizes current available information on the use of cover crops to control competing vegetation in *forest* management. The publication begins with a review of research on cover crops for weed suppression...species and describes some cover crop plants suitable for use in northern Ontario. These include *alfalfa* , timothy grass, clover,
bird's-foot trefoil, and orchard grass.

21/K,6/38 (Item 38 from file: 144)
DIALOG(R)File 144:(c) 2008 INIST/CNRS. All rts. reserv.
10958470 PASCAL No.: 93-0467834
Dynamics of mown *meadows* in the hinterland of the Province of Macerata (Central Italy)
1993
A study has been made of the dynamics of the Pian di Pieca mown *meadows* in the Sarnano area (Province of Macerata). These are subjected to rotation and alternate every five years with wheat and oat crops. The *meadow* regrowth prevalently occurs through the seed bank in the soil and through the dispersion of seed from the more mature plots of the surrounding *meadowlands*, with the addition by man of *Medicago* sativa and Lolium multiflorum seed in the first year. The floristic, phytosociological and ecological analyses of the *meadowlands* belonging to five different age classes, each of which corresponds to a vegetative period, has...
... in the presence of Molinio-Arrhenatheretea class species concurrently with the age of the individual *meadow* plots (...)

21/K,6/40 (Item 40 from file: 5)

DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
16997589 BIOSIS NO.: 200200591100
[Dissertationes Botanicae. The plant communities on way- and *roadsides* in the area of Hannover and the relations of these communities to rock and soil.]
ORIGINAL LANGUAGE TITLE: Dissertationes Botanicae. Die Pflanzengesellschaften der Weg- und der Strassenraender in der Region Hannover und die Beiziehungen dieser Gesellschaften zu Gestein und Boden
2002
...ABSTRACT: page book is part of the Dissertationes Botanicae series. This band describes vegetation composition along *roadsides* in Hannover, Germany and their relation to rock and soil type. Seventy-six vegetation units are grouped into five fundamental communities that include Agrostis capillaris, *Medicago* lupulina, Chaerophyllum bulbosum, Lolium perenne, and one community free of differential species. In addition to...

21/K,6/49 (Item 49 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
1858511 81049724 Holding Library: AGL
The influence of formalin addition on the quality of silages made of *meadow* grass, *alfalfa* or red clover
1980

21/K,6/50 (Item 50 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005562142 CAB Accession Number: 19850772947
The effect of fertilizer application and duration of exploitation on the composition of the vegetative cover of temporary *meadows*.
Original Title: Dinamica structurii covorului vegetal al pajistilor temporare sub influenta fertilizarii si a duratei de exploatare.
Publication Year: 1982
... fertilizer application and duration of exploitation on the composition of the vegetative cover of temporary *meadows*.
A temporary *meadow* composed initially of a 1:1 mixture of *lucerne* and cocksfoot studied during 1979-83 was treated with 0, 100, 140 or 180 kg...
... doses of sheep dung had little effect on pasture composition, but favoured the maintenance of *lucerne* cover when applied with P. Increasing the length of pasture production increased the proportion of...

21/K,6/51 (Item 51 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005164770 CAB Accession Number: 19810729014
Effect of potassium and molybdenum on *lucerne* yield on dark grey *forest* soils.
Publication Year: 1980
Application of 100-200 kg K2O/ha to *lucerne* grown on dark grey *forest* soil increased plant resistance to cold, drought and lodging, but had no effect on DM...

21/K,6/57 (Item 57 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006419738 CAB Accession Number: 19910746119
Effect of nitrogen and lime application at sowing on soil properties, weed development, dry matter yield and nutritive value in *alfalfa* *meadow*.
Publication Year: 1990

... lime/ha on soil properties, weed growth and DM yield and nutritive value in a *Medicago* sativa *meadow* were studied. Soil pH, P, K and Ca contents increased 6 months after lime application...

21/K,6/60 (Item 60 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
1893847 81079873 Holding Library: AGL
Effect of application of potassium and molybdenum fertilizer on *alfalfa* yield on dark Gray *forest* soils.
1980

21/K,6/65 (Item 65 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
10100547 BIOSIS NO.: 199089018438
EFFECT OF RIPE BRACKEN LEAF WATER EXTRACT ON THE GROWTH OF SOME PERENNIAL CEREAL AND LEGUMINOUS GRASSES SOWN ON *MEADOW* SOIL
1989
...ABSTRACT: of ripe bracken leaf water extract on the seeds of some grass species sown on *meadow* soil. Watering soil with this extract inhibited seed emergence and plant stem and root growth...
...more toxic for burr reedd, red clover, trefoil and agopyrum and less toxic for pasture *alfalfa*, cane like foescue, red fescue and timothy.

21/K,6/68 (Item 68 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008583702 CAB Accession Number: 20043020622
The environmental weed risk of revegetation and *forestry* plants.
Publication Year: 2003
... and grasses which have been planted for use in broad scale rural revegetation and farm *forestry* in South Australia. The result of a weed risk assessment of 20 plant species in...
... also the minimal weed risk of others (including Eucalyptus globulus, E. grandis, E. platypus and *lucerne*). Suggestions are given on how the weed risk of various species can be managed more...

21/K,6/73 (Item 73 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008821638 CAB Accession Number: 20053069255
Evaluation on the synthetic benefits of the agro-*forest* compound ecosystem in the loess hilly-ravine region in the central part of Gansu Province.
Publication Year: 2004
... in the study area includes the management modes of Hippophae rhamnoides-Armeniaca vulgaris [Prunus armeniaca]- *Medicago* sativa, Platycladus orientalis [Thuja orientalis]- Tamarix austromongolica-*M*. *sativa* , Tamarix austromongolica -crops, courtyard industrial crops irrigated with converged rainwater, enclosure-grazing animal husbandry, etc...
... project of withdrawing from farming to afforesting and grass planting, achieving the sustainable development of *forestry* and agriculture, and promoting the rural social and economic development in the loess hilly-ravine...

21/K,6/74 (Item 74 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
3429849 20448256 Holding Library: AGL
Evaluation of sulfur mineralization potential of *meadow* soils and

availability to *alfalfa*
1994 Aug

21/K,6/75 (Item 75 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008914574 CAB Accession Number: 20053149967
The evolution of the *forestry* vegetation on degraded areas in Ariesul Valley basin.
Publication Year: 2004
Results are presented of a study, conducted in Campeni *forest* districts in Romania, which aimed to: provide a better information referring to the degraded areas stational conditions; specify the ecological features of the *forestry* species used for afforestation of degraded areas in Ariesul Valley basin, following the evolution of different species and types of *forestry* cultures in various conditions of degraded areas for cultures and for recently installed experimental areas...
... the degraded lands for previously installed experimental areas. Four experimental blocks were set up where *forestry* species and working technologies were tested for the rehabilitation of degraded areas: Turda experimental block...excelsior, E. angustifolia and F. ornus); Turda experimental block (R. typhina + Lolium sp., R. typhina + *Medicago* sativa , R. typhina + Lolium
sp. and control area (bare ground)); and Baia de Aries experimental...

21/K,6/77 (Item 77 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005693401 CAB Accession Number: 19860786105
Establishment of forage species in *forests* on calcareous soils with a cold semiarid climate.
Original Title: Implantacion de especies pascicolas en montes calizos con clima semiarido frio.
Publication Year: 1984
... 1982, plants of (a) Astragalus cicer cv. Lutana, (b) Colutea arborescens, (c) Coronilla minima, (d) *Medicago* arborea, (e) *M*. *sativa* ecotype Ayna and (f) Dactylis glomerata ecotype Barriopedro were transplanted into a calcareous soil in the Carralejo *forest* (Guadalajara) with a NW aspect. Establishment became stabilized by the 2nd summer and, despite the...

21/K,6/80 (Item 80 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007408350 CAB Accession Number: 19970707563

Fodder and landscape aspects of herbaceous *meadows*.
Original Title: aki zioowe w aspekcie paszowym i krajobrazowym.
Publication Year: 1996
Forb *meadows* in the valleys of the Obrzan and Wyskoc *canals* were studied in 1992-94. Among the dominant species, Trifolium repens, Plantago lanceolata and Ranunculus acer [R. acris] were rich in chlorophyll, carotenoids and beta-carotene. *Medicago* lupulina, T. repens, Achillea millefolium, Cirsium oleraceum and P. lanceolata contained >12% total protein. The...

21/K,6/83 (Item 83 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.

01102937
Function of *alfalfa* *meadow*-grass *Medicago* sativus in the soils (La funzione del medicaio Medicagus sativus nei terreni in pendio)
1984

21/K,6/84 (Item 84 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
01925087
(Phenological development of different wildflower-*meadows* during the period of vegetation) (Phaenologische Entwicklung verschiedener Blumenwiesenmischungen im Verlauf einer Vegetationsperiode)
1994
... show an unharmonious picture and the appearance of individually dominating species (e.g. Lotus corniculatus, *Medicago* sativa) prevents the development of a many coloured aspect when blossoming. The flowering aspect of...coloured plot, blooming till autumn, which is very close to the
conceptions of a flower *meadow*.

21/K,6/90 (Item 90 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007550654 CAB Accession Number: 19981607057
Genetic diversity in *wild* accessions of Medicago sativa in Spain.
Book Title: Seed production of lucerne. Proceedings of the 12th Eucarpia Meeting of the Group Medicago, Brno, Czech Republic, 2-5 July 1996.
Publication Year: 1997
During 1985-87, 104 natural populations of *M*. *sativa* were collected from *roadsides* , unirrigated and grazed rangelands, and orchards in Spain. These populations have been evaluated under grazing...
...plants had prostrate habit and good soil colonizing ability. Populations had greater perenniality than cultivated *lucerne*, and good vegetative spring yield and seed production. Populations from the northeastern Spain could be...

21/K,6/96 (Item 96 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
4028311 23300107 Holding Library: AGL
Gas *pipelines*: are they a detriment or an enhancement for crops?
2000
DESCRIPTORS: *medicago* sativa.....*pipelines*; ;

21/K,6/97 (Item 97 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
02428297
[The health of *lucerne* *meadows*-grass [*Medicago* sativa L.]] (La salute del medicaio [Medicago sativa L.]])
1999

21/K,6/98 (Item 98 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006930520 CAB Accession Number: 19941909014
The humus in eroded Gray *Forest* soils in the region west of the Urals and changes effected by planting mixed grasses.
Publication Year: 1993

...of growing perennial grass and legumes on the quantity and quality of humus in Grey *Forest* soils in the northern *forest* steppe zone of Bashkiria was investigated. Legumes (blue hybrid *lucerne*), grass (tall fescue) and a legume-grass mix (red clover, blue hybrid *lucerne* and tall fescue) were grown for 5 years on soils at different stages of erosion...
... humus accumulation depended on the kind of grass, accumulation being faster under legume-grass. For *lucerne* and grass, accumulation was more rapid in the early years and later years, respectively. Humus...
... The content of humic acid increased by 12%, 8% and 6% in legume-grass mix, *lucerne* and grass, resp. in slightly eroded soil. The humus of all soils had a higher...
... acid under pure grass were lower than for those under legume-grass mix and pure *lucerne* and this is attributed to faster accumulation of HA-1, which has a low optical...

21/K,6/99 (Item 99 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
10291848 BIOSIS NO.: 199090076327
HEMIPTERA OF *ALFALFA* AGROCENOSIS IN NEWLY DEVELOPED LANDS IN THE KARA KUM *CANAL* AREA TURKMEN SSR USSR
1989

21/K,6/100 (Item 100 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
0020009629 BIOSIS NO.: 200800056568
Herbaceous plant cover establishment on *highway* road sides
BOOK TITLE: Developments in Plant and Soil Sciences
2007
...ABSTRACT: types of plants to become established was studied on the road sides of the Egnatia *highway*, Thessaloniki, Greece. A mixture of perennial plants (grasses, legumes and forbs) was sown at equal...
...Agropyrum cristatum L., Bromus inermis Leyss., Dactylis glomerata L. and Festuca valesiaca Schleich, the legume *Medicago* sativa L. and the forb Sanguisorba minor Scop.

21/K,6/102 (Item 102 from file: 266)
DIALOG(R)File 266:Comp & dist by NTIS, Intl Copyright All Rights Res. All rts. reserv.
00561691
IDENTIFYING NO.: 0191385 AGENCY CODE: AGRIC
Impacts of Interactions among Generalist Arthropod Predators in Two Complex Food Webs: Vegetable-Crop Gardens and *Forest*-Floor Leaf Litter
...SUMMARY: of rainfall in field experiments.PR publication from the experiment on linyphiid dispersion patterns in *alfalfa*, and the impact on the *forest* -floor food web and rates of decomposition of changes in rainfall induced by global climate change; (2) further analysis of data from the *forest*-floor experiment using multivariate techniques; and (3) initiation of field experiments in the forest system...

21/K,6/109 (Item 109 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
02551719
Investigations into the causes of poor *alfalfa* development and early weed infestation on calcareous *meadow* soils (A lucerna gyenge fejlodese es korai gyomosodasa okainak vizsgalata meszes reti talajokon)
The reasons for the poor development of *alfalfa* on calcareous *meadow*

soils at many sites, leading to the thinning of the stands within 2-3 years...

21/K,6/113 (Item 113 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
01578449
Lucerne *meadow* structure. Analysis of aerial part and roots, 1: Dry weight
1986
New methods, techniques and applications in fodder crop breeding. Report. EUCARPIA meeting of the Fodder Crops Section, Svaloev, Sweden, 16-19 September 1985

21/K,6/114 (Item 114 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
01578537
Lucerne *meadow* structure. Analysis of aerial part and roots, 2: Sugar content
1986
New methods, techniques and applications in fodder crop breeding. Report. EUCARPIA meeting of the Fodder Crops Section, Svaloev, Sweden, 16-19 September 1985

21/K,6/115 (Item 115 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006492791 CAB Accession Number: 19920750695
Lucerne/maize crop rotations on grey *forest* soils.
Publication Year: 1990

21/K,6/116 (Item 116 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
1952148 82006452 Holding Library: AGL
Possibility of increasing *lucerne* yield on *meadow* clay soil.
A lucernatermes novelesenek lehetosegei reti agyagtalajon
1981

21/K,6/118 (Item 118 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005755772 CAB Accession Number: 19861907137
Legumes for improving irrigated *meadows*.
Proceedings of the Second Intermountain *Meadow* Symposium
Publication Year: 1984
... a number of species and varieties of forage legumes have been evaluated in the mountain *meadows* of Colorado and Wyoming. Of these, alsike clover is particularly well adapted to the wet...
... either naturally or artificially. Red clover is widely adapted and yields as much forage as *alfalfa* during the first two or three years following establishment. Thereafter, red clover begins to lose stand. *Alfalfa* is one of the most persistent and productive legumes on better drained sites. Cicer milkvetch....adapted as the above four species.
ADDITIONAL ABSTRACT: The use of Trifolium hybridum, T. pratense, *Medicago* sativa, Lotus corniculatus, Onobrychis viciifolia, Coronilla varia and Astragalus cicer
alone and in mixtures with grasses in the mountain *meadows* of Colorado and Wyoming is reviewed. T. pratense was well adapted but did not persist

beyond 2-3 years. *M*. *sativa* was the most persistent and productive legume on well drained sites and A. cicer showed...

21/K,6/119 (Item 119 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
3518991 20520706 Holding Library: AGL
Legume seeding trials in a *forested* area of north-central Washington
1995
...are site specific. Alsike closer (Trifolium hybridum L.), white clover (T. repens L.), black medic (*Medicago* lupulina L.), cicer milkvetch (Astragalus cicer L.), two varieties of birdsfoot trefoil (Lotus corniculatus L... Hederma pine lupine (Lupinus albicaulis Dougl.) were planted at several
elevations on the Wenatchee National *Forest* in Washington state. After 2 years, alsike clover and Hederma pine lupine were the most...

21/K,6/121 (Item 121 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006136895 CAB Accession Number: 19890727849
Lime requirements of *lucerne* on *forest* land in Galicia.
Original Title: Necesidades de cal en el establecimiento de alfalfa en terrenos a monte en Galicia.
Publication Year: 1986
...or 16 t lime/ha, resp. It was concluded that it is possible to grow *lucerne* as a 1st crop in *forest* land, provided that its acidity is corrected with an amount of 4-8 t lime...

21/K,6/122 (Item 122 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005971393 CAB Accession Number: 19881923212
Long-term effects of an oil *pipeline* installation on soil productivity.
Publication Year: 1988
Crop yields and heights and soil chemical properties on and immediately adjacent to an oil *pipeline* right-of-way (ROW) were monitored over a 10-yr period. Effects of soil mixing on chemical properties were still apparent despite good crop management. With the exception of *alfalfa*, field crop yields on the ROW were reduced by an average of 28% 10 yr...

21/K,6/124 (Item 124 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005986376 CAB Accession Number: 19880714407
Meadows of central Pyrenees: floristical composition and quality.
Publication Year: 1987
In 1985, 45 plots in *meadows* of San Juan de Plan were sampled for DM production, botanical composition and chemical composition...
... proportion of Agrostis capillaris and Festuca rubra + Trisetum flavescens and those in which legumes including *Medicago* sativa and Trifolium spp. were more abundant. Cultivation was least in the 1st type and...

21/K,6/126 (Item 126 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006733963 CAB Accession Number: 19930765682
Monitoring, modelling and management of semi-natural *meadow* ecosystems in Pieniny National Park (West Carpathians).
Original Title: Monitoring, Modellierung und Management von

halbnaturlichen Wiesenokosystemen im Pieniny-Nationalpark (West-Karpaten).
Publication Year: 1991
... a current project (planned for 1986-98) on vegetation and growth characteristics of semi-natural *meadow* ecosystems in Pieniny National Park in the W. Carpathian mountains (800 m alt), Poland. In...
... Nardus stricta, Danthonia decumbens and Luzula nemorosa ; Anthyllis vulneraria, Trifolium medium, Trifolium montanum, Ononis arvensis, *Medicago* falcata, Sanguisorba minor, Carlina acaulis, Centaurea scabiosa, Campanula glomerata, Gymnadenia conopsea, Traunssteinera globosa, and Plantanthera...

21/K,6/127 (Item 127 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
07186020 BIOSIS NO.: 198477017931
MORPHOLOGICAL FEATURES OF UNDERGROUND PARTS AND THE BIOLOGICAL PRODUCTIVITY OF NATURAL *MEADOW* COMMUNITIES IN THE VALLEY OF THE SVENTOJI RIVER AND ITS TRIBUTARIES THE MUSIA RIVER AND THE SETEKSNA RIVER LITHUANIAN-SSR USSR
1982
ABSTRACT: The total phytomass weight or the biological productivity of natural *meadow* communities growing in the floodplain *meadows* and on the slopes of the Sventoji, Musia and Seteksna Rivers was determined by the...
...soil horizons and on the environment. Dominant taxa included Koeleria grandis, Phleum phleoides, Poa angustifolia, *Medicago* spp., Festuca rubra, Helictotrichon pubescens, Dactylis glomerata and Fragaria viridis.

21/K,6/129 (Item 129 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
1842481 81037110 Holding Library: AGL
Methods of *alfalfa* sowing on floodplain *meadows* (Kirov Region).
1980

21/K,6/130 (Item 130 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005621767 CAB Accession Number: 19850775094
Methods for improving mountain *meadow* communities.
Managing intermountain rangelands - improvement of range and wildlife habitats [Monsen, S.B.; Shaw, N. (Compilers)].
Publication Year: 1983
Research on mountain *meadow* improvement for livestock, wildlife and site stability is reviewed with reference to work in Nevada...
... E. hispidus subsp. barbulatus], A. trachycaulum [E. trachycaulus], Bromus biebersteinii, Festuca arundinacea, Onobrychis viciifolia and *Medicago* sativa. Excellent control of Iris missouriensis was given by 2.2-4.5 kg 2...dams with trees and shrubs are also discussed. Further research on
grazing management of riparian *meadow* communities in Oregon, Wyoming, Idaho and N. California is briefly reviewed.

21/K,6/131 (Item 131 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005834189 CAB Accession Number: 19870798784
Methods of increasing yield of *meadows* in Dagestan.
Publication Year: 1985
DM yields of low-yielding *meadows* in Dagestan, N. Caucasus, were increased by applying fertilizers, cutting Celtis caucasica trees, burning of old vegetation, cutting Cirsium arvense and undersowing *Medicago*

sativa. Yields of swards harvested at the tillering, shoot elongation, heading, flowering and seed ripening...

21/K,6/134 (Item 134 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008656840 CAB Accession Number: 20043071878
Nitrogen balance in *alfalfa* and orchard grass *meadows*.
Original Title: Bilancio dell'azoto in prati monofiti di erba medica e di erba mazzolina.
Publication Year: 2003
... the key processes in the evaluation of the advantages derived from legume forage crops. A *lucerne* *meadow*, receiving nitrogen fertilizer application only at sowing, and an orchard grass (Dactylis glomerata) *meadow* regularly fertilized with nitrogen, were compared in two trials carried out in the Northern Italy...
...pools of soil and plant. Dry matter production and nitrogen content were significantly higher in *lucerne* than in D. glomerata . Nitrogen uptake in the legume ranged from 430 to 750 kg...
... roots. Net mineralization fluxes showed a decreasing trend throughout the 3-year period in both *meadows*. In *lucerne*, nitrogen in soil organic matter pool decreased during the first year. The reduction ranged between...
...the 3-year period ranged from 226 to 306 kg N/ha. In D. glomerata *meadow* the final accumulation of nitrogen in the soil organic matter was positive but insignificant, ranging...

21/K,6/138 (Item 138 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
02382937
1998
[Interspecific hybridization in creating the new *lucerne* varieties for conditions of the Ukraine's Polissya (*Forest* Zone)] (Mezhvidovaya gibridizatsiya v sozdanii novykh sortov lutserny dlya usloviy Poles'ya Ukrainy)

21/K,6/140 (Item 140 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008922958 CAB Accession Number: 20053180510
The occurrence of legumes in *meadow* communities of the Por River valley.
Book Title: Optimal forage systems for animal production and the environment. Proceedings of the 12th Symposium of the European Grassland Federation, Pleven, Bulgaria, 26-28 May 2003
Publication Year: 2003
On the basis of 560 releves taken on the semi-natural *meadows* in the Por River valley (in the south-east of Poland) 30 plant communities were ...
...found. The most frequently occurring were Trifolium pratense , T. repens , T. hybridum , T. dubium and *Medicago* lupulina , found in 10-13 communities, while the poorest were Trifolium arvense and T. aureum...

21/K,6/143 (Item 143 from file: 76)
DIALOG(R)File 76:(c) 2008 CSA. All rts. reserv.
0000933284 IP ACCESSION NO: 3600610

Study on use of alien versus native plants by nectarivorous *forest* birds on Maui, Hawaii
PUBLICATION DATE: 1993
ABSTRACT:... sources for the Hawaiian honeycreepers, there are other locally significant sources including "the introduced tree *alfalfa* Cytisus proliferus [C. palmensis] growing in certain upland pastures on Maui and to which Vestiaria....come in large numbers to feed." Several trees occurring near the upper
limit of rain *forest* in Waikamoi Preserve have attracted management attention because of visitation by native *forest* birds. This study was undertaken to assess the nectar-foraging pattern of native and alien *forest* birds on Cytisus and selected native plants in the Waikamoi Preserve. The study site was...

21/K,6/144 (Item 144 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005165459 CAB Accession Number: 19810730071
On optimum rates of fertilizers for some perennial herbage species and their mixtures grown on grey *forest* soils.
Publication Year: 1980
In trials in 1972-5 on grey *forest* soil with several herbage spp. given combinations of various rates of N, P and K, the opt. fertilizer (N + P2O5 + K2O) rates were 80 + 63 + 130 kg/ha for *lucerne* grown with lime application to soil, 108 + 94 + 145 kg/ha for Lotus corniculatus, 170...

21/K,6/146 (Item 146 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
2003766 82048671 Holding Library: AGL
Correlation between the yield of *lucerne* and moisture-content of soil layer of 0-100 cm on *meadow* Solonetz.
Osszefugges a lucerna termese es a 0-100 cm talajreteg nedvessegtartalma kozott reti szolonyecen
1980

21/K,6/147 (Item 147 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
00879846
Problems involved in modelling tree growth [TEEM, Terrestrial Ecosystem Energy Model, SIMED, Simulation of *Medicago* Growth, SDF, Simulating a Deciduous *Forest*, PT, Production Tree, CERES]
1981
Understanding and predicting tree growth

21/K,6/149 (Item 149 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
2575158 86048642 Holding Library: AGL
Productivity of *alfalfa* , red clover and their mixtures with Bromus inermis on drained lands of the central *forest* steppe
1985

21/K,6/152 (Item 152 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0009206656 CAB Accession Number: 20073021900
Performance of *fences* on the protection of *alfalfa* grown at Siwa aeolian sand.
Publication Year: 2006

... Farm in western desert of Egypt during 2004 to 2005 to study the performance of *fences* and to determine the best distance for the optimum protection of *lucerne*. *Fences* of single and double rows of palm leaves were investigated as well as their distance from the *lucerne* fields (10, 20, 30 and 40 m). Sand collectors were used for monitoring the quantity and shifting sand in front and behind the *fences*. The combination of double rows *fence* and distances of 10 and 20 m recorded superior growth characters and yield of *lucerne* (i.e., plant height, number of branches per plant, total, fresh and dry weight per...
... percentage, and green and dry forage yield), while the best protection was observed with the *fence* of double rows and a distance of 20 m. This treatment decreased wind speed and trapped most of sand drift. The efficiency of *fences* on sand accumulation was 43.8 and 54.2% for single and double *fences*, respectively. The efficiency of distances was 43.8, 43.7, 28.1 and 22.7...
... 40 m, respectively. Regarding the interaction efficiency, it was revealed that the treatments of double *fence* with 10 or 20 m distance gave the highest records of sand accumulation efficiency being...

21/K,6/153 (Item 153 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006545759 CAB Accession Number: 19920754154
The performance of several legume species on mine tailings in the Naseby *Forest*.
Publication Year: 1989
Lotus pedunculatus [L. uliginosus] cv. Maku, L. corniculatus cv. Tana and *Medicago* sativa cv. WL318 were inoculated with the recommended Rhizobium strain and oversown on mine tailings on an open site in the Naseby *Forest*, New Zealand between 1983 and 1987, and 0, 10, 20 or 40 kg P/ha...

21/K,6/155 (Item 155 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005027575 CAB Accession Number: 19800712421
Perennial herbage species for *meadows* on solonetz soils.
Publication Year: 1980
In trials with several herbage spp. sown on chernozem *meadow* solenetz chalk soils at 3 locations in Poltava region of the Ukraine, Melitolus alba, brome grass, *meadow* fescue and Arrhenatherum elatius gave the highest fresh fodder yields; *lucerne*, red clover, sainfoin hybrid, Lotus corniculatus, Agropyron trachycaulum and A. imbricatum gave lower yields.

21/K,6/160 (Item 160 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0008671405 CAB Accession Number: 20043052195
Recultivation of natural *meadows*.
Publication Year: 2001
North-East Siberia and the territory of Baykal-Amur *Railroad*, Russia suffer ever-increasing adverse impact on natural and cultivated landscapes from mining, gold mining...Such lands represent a reserve for expanding agricultural fields. Recultivation of floodland damaged (drag dikes) *meadows* was studied in 1991-94 in Tynda district, Amur region, Russia. Plots were set up on
meadow -swamp permafrost soil. Drag dikes were flattened using a C-100 bulldozer, a fertile layer... SibNIIZKhoz 189 (20 kg seeds/ha), Elymus sibiricus Guran 25, Festuca pratensis cv. Priangarskaya 10, *Medicago*

sativa cv. Onkhoiskaya 10 and Melilotus alba Sayanskii (all 12 kg seeds/ha) were sown...
... on productivity in fresh and dry weight are tabulated. The best results were obtained using *Medicago* sativa both in control and fertilizer input treatments (2.11 t/ha of dry weight...
...fertile soil layer was introduced. The species tested were the same with the exception of *M*. *sativa* which was not used. The best results were obtained using B. inermis (0.56 t...

21/K,6/161 (Item 161 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005435949 CAB Accession Number: 19841396723
Reaction of *lucerne* varieties to Fusarium wilt under grey *forest* soil conditions.
Publication Year: 1983

21/K,6/162 (Item 162 from file: 41)
DIALOG(R)File 41:(c) 2008 CSA. All rts. reserv.
0000022687 IP ACCESSION NO: 335832
Recovery of productivity of Ontario soils disturbed by an oil *pipeline* installation.
PUBLICATION DATE: 1982
ABSTRACT:... of soil properties and field-crop yields on cropland traversed by the
Sarnia-Montreal oil *pipeline* indicated that *pipeline* installation detrimentally affected both crop yields and soil physical-chemical properties in the first year...
...5 yr, relative yields improved although reductions still persisted at most row-cropped sites. However, *alfalfa* yields at two sites appeared to be unaffected by *pipeline* construction. Soil mixing and compaction on the right-of-way were most prevalent on medium...

21/K,6/169 (Item 169 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006216064 CAB Accession Number: 19900640302
Restoring productivity on degraded *forest* soils: two case studies.
Publication Year: 1987
...in 1981 at 40 kg/ha with a legume mixture of 3 spp. of Trifolium, *Medicago* sativa and L. corniculatus, and received NPK (19:19:19) at 300 kg/ha. Nutrient...enhancement of site nutrient capital is considered to be a gain likely to benefit commercial *forestry* production.

21/K,6/170 (Item 170 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
01314351
Successful *alfalfa* grass production with *meadow* fescue (Erfolgreicher Luzernegrasbau mit Wiesenschweidel)
1988

21/K,6/173 (Item 173 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
3018170 90044268 Holding Library: AGL
Seeding techniques for *alfalfa* to improve subirrigated *meadows*
1984

21/K,6/174 (Item 174 from file: 50)

DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005312115 CAB Accession Number: 19830747729
Sodseeding of Wyoming hay *meadows*.
Publication Year: 1981
Improvement of hay *meadows* was examined in relation to the determination of suitable spp. for intersowing, opt. sowing date...

...Melroe grass seeder. The most suitable spp. were Alopecurus arundinaceus cv. Garrison, tallfescue cv. Fawn, *lucerne* cv. Phytor and alsike clover. Late May was the opt. sowing date with glyphosate applied...

21/K,6/175 (Item 175 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007429696 CAB Accession Number: 19971910980
Safe nitrogen in sowing grass in fields and *meadows*.
Publication Year: 1996
... effectiveness of twelve different rates and mixtures of legumes, legumes/grasses, and grasses (clover [Trifolium], *lucerne* [*Medicago* sativa], timothy [Phleum pratense]) used in a 9-year cropping rotation system, and also on the effectiveness of 8 different N fertilizer regimes on perennial grasses in an irrigated floodplain *meadow* . Data are tabulated on yields of oven-dry matter and digestible protein, exchangeable energy, energy...

21/K,6/176 (Item 176 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0009566157 CAB Accession Number: 20083138319
Selection of suitable *wild* species for *highway* side slopes in Heilongjiang Province.
Publication Year: 2008
... indexes were selected by the analytic hierarchy process aiming at getting the suitable plants for *highway* side slopes. Some important indexes, including root density, growth rate, barren resistance, drought-resistance, root...
... utilization, were used to evaluate 21 herbaceous plants grown on the side slopes of seven *highways* in Heilongjiang Province. Result shows that Poa pratensis , Agropyron cristatum , *Medicago* falcate , Bromus inermis , Silene jenisseensis , Oenothera biennis , Iris lactea var. chinensis , Viola alisoviana , Elytrigia repens...
... Plantago depressa are excellent species, which can be used as the suitable pioneer plants for *highway* side slopes in cold regions.

21/K,6/179 (Item 179 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
4498642 43832835 Holding Library: AGL
A survey of Lygus spp. occurring in cotton, *alfalfa*, and *roadside* weeds in the northern Texas Rolling Plains
2006
DESCRIPTORS: ...*alfalfa*; .....*Medicago* sativa.....*roadside* plants;

21/K,6/180 (Item 180 from file: 203)
DIALOG(R)File 203:Dist by NAL, Intl Copr. All rights reserved. All rts. reserv.
01330714
The use of stable N isotope for the determination of the effectiveness of nitrogenous fertilizers for *alfalfa* Experiments on *meadow* chernozem soils (Ispol'zovanie stabil'nogo izotopa N pri opredelenii ehffektivnosti

dejstviya azotnykh udobrenij pod lyutsernu)
1987
Increased soil fertility in West Siberia (Povyshenie plodorodiya pochv Zapadnoj Sibiri)
...use of s`N isotope for the determination of the effectiveness of nitrogenous fertilizers for *alfalfa* Experiments on *meadow* chernozem soils

21/K,6/181 (Item 181 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007525860 CAB Accession Number: 19980704548
Structural specificities of *Medicago* sativa L. agrophytocoenosis on open cut spoil banks in the *forest*-steppe zone of Kusbas.
Publication Year: 1997

21/K,6/184 (Item 184 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006131901 CAB Accession Number: 19890727254
Seasonal dynamics of vegetation in natural *meadows* in the Fausola mountains (Latium Appenines).
Original Title: Dinamismo stagionale della vegetazione nei prato-pascoli naturali del monte fausola (Appennino Laziale).
Publication Year: 1986 publ. 1988
Changes in botanical composition of native *meadows* which had developed on formerly arable land, were studied at 4 sites in the Fausola...
... Poa pratensis, Festuca centro-appenninica, Lotus corniculatus, T. campestre, Poa alpina, Astragalus depressus, T. nigrescens, *Medicago* lupulina, T. striatum, Luzula campestris, Bromus erectus and T. arvense. It was concluded that 20...

21/K,6/185 (Item 185 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007963790 CAB Accession Number: 20000712641
Techniques for afforesting side slopes of Taiyuan-Jiuguan Express *Highway* in Shanxi.
Publication Year: 1999
... 1996-97 on the techniques for revegetating the side slopes of the Taiyuan-Jiuguan Express *Highway* in Shanxi, China, 7 species of plants were tested alone or in combinations. The species were Astragalus adsurgens, *Medicago* sativa , Onobrychis viciaefolia [O. viciifolia], Bromus inermis , Festuca arundinacea , Lespedeza bicolor and Lotus corniculatus . The first 5 species in combinations of 3-4 species were most suitable, such as *M*. *sativa* (30%) + A. adsurgens (30%) + B. inermis (40%), *M*. *sativa* (30%) + O. viciae (30%) + B. inermis (40%), A. adsurgens (25%) + *M*. *sativa* (25%) + Lespedeza bicolor (10%) + F. arundinacea (40%), and *M*. *sativa* (20%) + O. viciaefolia (20%) + A. adsurgens (20%) + L. corniculatus (10%) + B. inermis (30%). The optimum...

21/K,6/189 (Item 189 from file: 6)
DIALOG(R)File 6:(c) 2008 NTIS, Intl Cpyrght All Rights Res. All rts. reserv.
0854505 NTIS Accession Number: PB81-104036/XAB
Time Responses and the Susceptibility of *Roadside* Plants to Growth Regulation (Final rept. 1975-79)
1980
... Euphorbia esula L., leafy spurge; and Taraxacum officiale Weber,

common dandelion. Two were desirable as *roadside* ground cover: *Medicago* sativa L., *alfalfa*, and Triofolium pratense L., red clover. Methods were developed for germinating weed seeds, a process...

21/K,6/192 (Item 192 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006612042 CAB Accession Number: 19920662634
Utilization of natural vegetation by red deer in deer *forests* from the view-point of damage to *forest* stands.
Original Title: Moznosti vyuzitia prirodzenych vegetacnych zdrojov jelenov zverou v jelenich chovatel'skych oblastiach z hl'adiska skod nou sposobenych.
Publication Year: 1989
A study was made of red deer [Cervus elaphus] browsing and damage in *forests* in Slovakia, Czechoslovakia. Protection of *forest* trees in Slovakia from 1985 to 1986 cost Kcs 33 129 298. Direct damage is...
... by red deer in fir/beech (Abies / Fagus) and spruce/beech/fir (Picea / Fagus / Abies) *forests* were studied. Red deer fed on about 50 herbaceous species and 16 species of trees...
... content, minerals and beta-carotene. The results were compared with analyses of agricultural forage crops (*meadow* grassland, pasture, red clover [Trifolium pratense] and *lucerne* [*Medicago* sativa]). Many of the *forest* species contained more nutrients than the crops. [With English captions.].

21/K,6/193 (Item 193 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
4894825 44029773 Holding Library: AGL
Vole-feeding damage and *forest* plantation protection: Large-scale application of diversionary food to reduce damage to newly planted trees
2008
URL: http://dx.doi.org/10.1016/j.cropro.2007.11.003
Forest and agricultural crops periodically experience feeding damage from herbivorous rodents such as voles of the...
...B, C, and D) were conducted with long-tailed vole (Microtus longicaudus) populations in new *forest* plantations of lodgepole pine (Pinus contorta), Douglas-fir (Pseudotsuga menziesii), and interior spruce (Picea glaucaxPicea...2003 to 2007. Diversionary food Ta pucksTa were composed of Douglas-fir
bark mulch and *alfalfa* (*Medicago* sylvatica) pellets/meal mixed with canola (Brassica rapa) oil and wax. Mean percentage (+-SE) survival...

21/K,6/203 (Item 203 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0005740182 CAB Accession Number: 19860701721
Yield increase in temporary *meadows* under the effect of fertilization and structure of the species mixture.
Original Title: Sporirea productiei pajistilor temporare sub influenta fertilizarii si structurii amestecurilor de specii.
Publication Year: 1983
... grasses and perennial legumes and the most efficient dose of N fertilizer to create temporary *meadows* on leached chernozem soil in the *forested* steppes of Moldova. The best results were obtained with seed mixtures of 20 kg Bromus inermis + 15 kg *Medicago* sativa /ha and with 10 kg Dactylis glomerata + 15 kg B. inermis + 2 kg Agropyron...

26/K,6/3 (Item 3 from file: 50)

DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0006294760 CAB Accession Number: 19900398877
Influence of high salt levels on the germination and growth of five potentially utilizable plants for median turfing in northern climates.
Publication Year: 1988
... levels. The effects of salinity on the germination and growth of Coronilla varia, Lotus corniculatus, *Medicago* lupulina, Kochia scoparia and Polygonum aviculare were studied. Seed germination was not affected within the...
...DESCRIPTORS: *roadsides*; ...ORGANISM DESCRIPTORS: *Medicago* lupulina
...BROADER TERMS: *Medicago*;

26/K,6/4 (Item 4 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
17952282 BIOSIS NO.: 200400323042
Factors controlling vegetation establishment and water erosion on motorway slopes in Valencia, Spain
2004
...ABSTRACT: semiarid Mediterranean areas, the widespread environmental impact caused by the construction of motorways, railways, and *pipelines* has created an increasing need for effective restoration. We examined the influence of slope characteristics...
...dominant species associated with each slope type and aspect should improve considerably the success of *roadside* revegetation.

...ORGANISMS: *Medicago* sativa (Leguminosae

26/K,6/7 (Item 7 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0007814573 CAB Accession Number: 19990710798
Leguminous plants in swards on steep road cuttings.
Original Title: Rosliny motylkowate w runi poboczy drog.
Publication Year: 1999
... 30.34% other dicots. The most suitable plants for sward formation on road shoulders were *Medicago* falcata , M. lupulina , Trifolium repens , Melilotus albus , Arrhenatherum elatius , Agropyron repens [Elymus repens], Festuca rubra...
...DESCRIPTORS: *roadside* plants.....*roadsides*IDENTIFIERS: *highways*;
...
...*Medicago* sativa subsp. falcata...*Medicago* falcata.....*Medicago* lupulina

26/K,6/8 (Item 8 from file: 10)
DIALOG(R)File 10:(c) format only 2008 Dialog. All rts. reserv.
2769987 87106544 Holding Library: AGL
Long-term effects of an oil *pipeline* installation on soil productivity
1988 Feb
DESCRIPTORS: zea mays; glycine max; *medicago* sativa; soil fertility ; soil chemistry; crop yield; *pipelines*; soil degradation; soil chemistry;

26/K,6/9 (Item 9 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.

12678881 BIOSIS NO.: 199598146714

Manganese accumulation in *roadside* soil and plants
1994
...ORGANISMS: *Medicago* sativa (Leguminosae

26/K,6/10 (Item 10 from file: 41)
DIALOG(R)File 41:(c) 2008 CSA. All rts. reserv.
0000287078 IP ACCESSION NO: 7174168
Metabolic and cometabolic degradation of herbicides in the fine material of railway ballast
PUBLICATION DATE: 2007
ABSTRACT:... these were only detectably degraded in the sample with the highest
SIR. Addition of ground *lucerne* straw to the ballast samples stimulated microbial activity and led to increased formation of metabolites...
DESCRIPTORS: Biochemistry; Biodegradation; Biomass; Herbicides; Kinetics; Metabolites; Microbial activity; Mineralization; Nitrogen; Organic matter; *Railroads*; Respiration; Soil; diuron; weed control ; ISE, Pacific, New Zealand Island Terr., Niue I., Alofi, Sir

26/K,6/12 (Item 12 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0009511400 CAB Accession Number: 20083023741
Study on techniques for comprehensive improvement of degraded grasslands in Xilamuren, Nei Menggu.
Publication Year: 2007
... degraded grasslands in Xilamuren, Nei Menggu, China. The main measures adopted were fencing, resowing of *lucerne* + Astragalus + Melilotus at a ratio of 1:1:1, harrowing, planting of Caragana korshinskii, Hippophae...
...DESCRIPTORS: *fences*; .....*lucerne*; IDENTIFIERS: *alfalfa*;
...ORGANISM DESCRIPTORS: *Medicago*; .....*Medicago* sativa

26/K,6/18 (Item 18 from file: 50)
DIALOG(R)File 50:(c) 2008 CAB International. All rts. reserv.
0009050850 CAB Accession Number: 20063098828
Is seed availability enough to ensure colonization success? An experimental study in road embankments.
Publication Year: 2006

...IDENTIFIERS: *highways*;
...ORGANISM DESCRIPTORS: *Medicago* minima.....*Medicago* orbicularis
...BROADER TERMS: *Medicago*;

26/K,6/19 (Item 19 from file: 143)
DIALOG(R)File 143:(c) 2008 The HW Wilson Co. All rts. reserv.
1929257 H.W. WILSON RECORD NUMBER: BBAI06118011
Soil water and *alfalfa* yields as affected by alternating ridges and furrows in rainfall harvest in a semiarid environment
20060601
DESCRIPTORS: *Alfalfa*--.....Irrigation canals and *ditches*;

26/K,6/21 (Item 21 from file: 5)
DIALOG(R)File 5:(c) 2008 The Thomson Corporation. All rts. reserv.
18177930 BIOSIS NO.: 200500084995

Site description and ecological characteristics of higher plants on the abandoned goods railway station Wien Nord (Vienna, Austria).
ORIGINAL LANGUAGE TITLE: Der stillgelegte Frachtenbahnhof Wien-Nord Standortbedingungen und oekologische Charakteristik der Gefaesspflanzen einer Bahnbrache.
2002
...ABSTRACT: Ailanthus altissima dominating in the railtrack ballast. Erysimum diffusum, Gypsophila scorzonerifolia, Hieracium echioides, Holosteum umbellatum, *Medicago* minima, Petrorhagia prolifera, Rosa corymbifera and the mosses Tortula canescens, Ceratodon conicus and Didymodon rigidulus...
MISCELLANEOUS TERMS: ...urban *wasteland*

ADDITIONAL MORE GENERAL TITLES

40/6/2 (Item 2 from file: 50)
0007856926 CAB Accession Number: 20000504012
About species abundances approximation. 1. *Wild* bees (Hymenoptera, Apoidea) on *alfalfa*.
Proceedings of the International Colloquia on Social Insects: Volume 3-4.
Publication Year: 1997

40/6/9 (Item 9 from file: 50)
0005260619 CAB Accession Number: 19830747136
Adaptation and utilization of three legumes in China.
Proceedings of the XIV International Grassland Congress, held at Lexington, Kentucky, USA, June 15-24, 1981 [Smith, J.A.; Hays, V.W. (Editors)].
Publication Year: 1983

40/6/12 (Item 12 from file: 50)
0008642355 CAB Accession Number: 20043084998
Alfalfa black aphid, Aphis craccivora Koch (Hom.: Aphididae) stage preferences by Lysiphlebus fabarum Marshall (Hym.: Aphidiidae).
Publication Year: 2004

40/6/13 (Item 13 from file: 10)
3080193 91020637 Holding Library: AGL
Alfalfa controls nodulation during the onset of Rhizobium-induced cortical cell division
1991 Feb

40/6/16 (Item 16 from file: 10)
3073805 91017771 Holding Library: AGL
Alfalfa mosaic virus RNA3 mutants do not replicate in transgenic plants expressing RNA3-specific genes
1991 Feb

40/6/17 (Item 17 from file: 5)
08760677 BIOSIS NO.: 198784114826
ALFALFA MOSAIC VIRUS TEMPERATURE-SENSITIVE MUTANTS IV. TBTS 7 A COAT PROTEIN MUTANT DEFECTIVE IN AN EARLY FUNCTION
1987

40/6/18 (Item 18 from file: 5)
06652720 BIOSIS NO.: 198274069143
ALFALFA POLLINATING BEES HYMENOPTERA APOIDEA IN THE REGION OF PLEVEN
BULGARIA 1. SPECIES COMPOSITION AND NUMBERS
1981

40/6/22 (Item 22 from file: 5)
16545468 BIOSIS NO.: 200200138979
Analysis of gene expression during flowering in apomeiotic mutants of
Medicago spp.: Cloning of ESTs and candidate genes for 2n eggs
2001

40/6/37 (Item 37 from file: 266)
00570924
IDENTIFYING NO.: 0203095 AGENCY CODE: AGRIC
Assessing RNAi as a Reverse Genetic Tool for Global Analysis of NBS-LRR
Gene Function in *Medicago* Truncatula

40/6/59 (Item 59 from file: 24)
0001646391 IP ACCESSION NO: 3951739
A cDNA encoding a PR-1-like protein in the model legume *Medicago* truncatula
PUBLICATION DATE: 1995

40/6/60 (Item 60 from file: 10)
4545566 43858228 Holding Library: AGL
A CDPK isoform participates in the regulation of nodule number in
Medicago truncatula
2006
URL: http://dx.doi.org/10.1111/j.1365-313X.2006.02910.x

40/6/63 (Item 63 from file: 76)
0000557399 IP ACCESSION NO: 1892518
Characterization and culture of Agrobacterium rhizogenes transformed roots
of forage legumes.
PUBLICATION DATE: 1988

40/6/65 (Item 65 from file: 266)
00577069
IDENTIFYING NO.: 0210647 AGENCY CODE: AGRIC
Characterization of the effect of light signaling on the formation of
nitrogen-fixing nodules in *Medicago* truncatula and Pisum sativum.

40/6/71 (Item 71 from file: 5)
18033457 BIOSIS NO.: 200400404246
Characterisation of *wild* legume nodulating bacteria (LNB) in the
infra-arid zone of Tunisia
2003

40/6/72 (Item 72 from file: 5)
17185621 BIOSIS NO.: 200300144340
Characterization of zinc inefficient mutants in *Medicago* truncatula.
1999

40/6/74 (Item 74 from file: 10)
3986824 23267410 Holding Library: AGL
Chronic intracellular infection of *alfalfa* nodules by Sinorhizobium
meliloti requires correct lipopolysaccharide core

2002

40/6/78 (Item 78 from file: 5)
12074172 BIOSIS NO.: 199497095457
Complementation and disruption of viral processes in transgenic plants
1993

40/6/79 (Item 79 from file: 5)
10836589 BIOSIS NO.: 199192082360
COMPLEX SYMBIOTIC PHENOTYPES RESULT FROM GLUCONEOGENIC MUTATIONS IN RHIZOBIUM-MELILOTI
1991

40/6/82 (Item 82 from file: 5)
08160980 BIOSIS NO.: 198682007367
COMPARATIVE ANALYSIS OF THE NITROGEN-FIXING ACTIVITY AND PLASMID COMPOSITION OF RHIZOBIUM TRANSCONJUGANTS IN THE INTRODUCTION OF THE PRD-1 PLASMID
1985

40/6/85 (Item 85 from file: 10)
2724383 87074478 Holding Library: AGL
Competitive effects of *wild* barley in seedling *alfalfa*
1986

40/6/88 (Item 88 from file: 50)
0007255631 CAB Accession Number: 19960708746
The capability of *wild* species of *Medicago* L. and Melilotus officinalis (L.) Pall., widespread in Dagestan, for symbiosis with Rhizobium meliloti .
Publication Year: 1995

40/6/89 (Item 89 from file: 5)
17601722 BIOSIS NO.: 200300558153
Coordinate replication of *alfalfa* mosaic virus RNAs 1 and 2 involves cis- and trans-acting functions of the encoded helicase-like and polymerase-like domains.
2003

40/6/90 (Item 90 from file: 10)
3022094 90039237 Holding Library: AGL
Correlation between ultrastructural differentiation of bacterioids and nitrogen fixation in *alfalfa* nodules
1990 Aug

40/6/91 (Item 91 from file: 5)
11898444 BIOSIS NO.: 199396062860
Creation of Rhizobium meliloti
1992

40/6/95 (Item 95 from file: 10)
4072174 23333763 Holding Library: AGL
Calcium oxalate crystal morphology mutants from *Medicago* truncatula
2002

40/6/109 (Item 109 from file: 10)
2936192 89051975 Holding Library: AGL

Differential histone acetylation in *alfalfa* (*Medicago* sativa) due to growth in NaCl: responses in salt stressed and salt tolerant callus cultures
1989 May

40/6/112 (Item 112 from file: 5)
17253793 BIOSIS NO.: 200300212512
Dual genetic pathways controlling nodule number in *Medicago* truncatula.
2003

40/6/117 (Item 117 from file: 5)
19050976 BIOSIS NO.: 200600396371
Domestication history in the *Medicago* sativa species complex: inferences from nuclear sequence polymorphism
2006

40/6/121 (Item 121 from file: 5)
08622370 BIOSIS NO.: 198783101261
DETECTION OF NODULE-SPECIFIC POLYPEPTIDES FROM EFFECTIVE AND INEFFECTIVE ROOT NODULES OF *MEDICAGO*-SATIVA L
1986

40/6/126 (Item 126 from file: 50)
0005794366 CAB Accession Number: 19870795877
Distribution of triterpene glycosides in legumes of the flora of the Crimea.
Publication Year: 1985

40/6/128 (Item 128 from file: 10)
2804345 88906026 Holding Library: AGL
Ecology and geography of certain *wild* *alfalfa* species in Central Asia = K ekologii i geografii nekotorykh dikorastushchikh vidov liutsern v Srednei Azii / O.Kh. Khasanov and E. Abdullazhanov
K ekologii i geografii nekotorykh dikorastushchikh vidov liutsern v Srednei Azii
1987

40/6/129 (Item 129 from file: 5)
17320385 BIOSIS NO.: 200300274918
Influence of the calcium oxalate defective 4 (cod4) mutation on the growth, oxalate content, and calcium content of *Medicago* truncatula.
2003

40/6/136 (Item 136 from file: 76)
0001414612 IP ACCESSION NO: 4773871
The Effect of a Genetically Modified Rhizobium meliloti Inoculant on Fungal Alkaline Phosphatase and Succinate Dehydrogenase Activities in Mycorrhizal *Alfalfa* Plants as Affected by the Water Status in Soil
PUBLICATION DATE: 2000

40/6/144 (Item 144 from file: 50)
0006533940 CAB Accession Number: 19920231619
Effect of the population density of *wild* bees (Apoidea) on the percentage of pollination of *lucerne* flowers.
Publication Year: 1990

40/6/146 (Item 146 from file: 10)
4058412 23321154 Holding Library: AGL
Influence of arbuscular mycorrhizae and a genetically modified strain of Sinorhizobium on growth, nitrate reductase activity and protein content in shoots and roots of *Medicago* sativa as affected by nitrogen concentrations
2002

40/6/147 (Item 147 from file: 50)
0006828534 CAB Accession Number: 19940200392
Effect of relative air humidity on the flight of *wild* bees (Apoidea), pollinators of *lucerne*.
Publication Year: 1992

40/6/150 (Item 150 from file: 50)
0006828533 CAB Accession Number: 19940200391
Effect of air temperature on the flight dynamics of *wild* bees (Apoidea), pollinators of *lucerne*.
Publication Year: 1992

40/6/153 (Item 153 from file: 10)
4242730 43677704 Holding Library: AGL
Effect of zinc and manganese supply on the activities of superoxide dismutase and carbonic anhydrase in *Medicago* truncatula *wild* type and raz mutant plants
2005

40/6/159 (Item 159 from file: 5)
09223391 BIOSIS NO.: 198886063312
ENHANCED NODULE INITIATION ON *ALFALFA* BY *WILD*-TYPE RHIZOBIUM-MELILOTI CO-INOCULATED WITH NOD GENE MUTANTS AND OTHER BACTERIA
1988

40/6/163 (Item 163 from file: 5)
15921514 BIOSIS NO.: 200100093353
Early symbiotic responses induced by Sinorhizobium meliloti ilvC mutants in *alfalfa*
2001

40/6/171 (Item 171 from file: 5)
18919523 BIOSIS NO.: 200600264918
Evolutionary responses of native plants to novel community members
2006

40/6/172 (Item 172 from file: 10)
3193417 92042870 Holding Library: AGL
Exogenous suppression of the symbiotic deficiencies of Rhizobium meliloti exo mutants
1992 May

40/6/173 (Item 173 from file: 5)
08053274 BIOSIS NO.: 198681017165
EXOPOLYSACCHARIDE-DEFICIENT MUTANTS OF RHIZOBIUM-MELILOTI THAT FORM INEFFECTIVE NODULES
1985

40/6/176 (Item 176 from file: 10)

3548594 20543500 Holding Library: AGL
  An experimental test of the rhizopine concept in Rhizobium meliloti
  1996 Nov

 40/6/177   (Item 177 from file: 24)
0002746357   IP ACCESSION NO: 6474024
Expression of the *Medicago* truncatula DMI2 Gene Suggests Roles of the Symbiotic Nodulation Receptor Kinase in Nodules and During Early Nodule Development
PUBLICATION DATE: 2005

40/6/179   (Item 179 from file: 144)
  16929646   PASCAL No.: 04-0594176
  Expression profiling in *Medicago* truncatula identifies more than 750 genes differentially expressed during modulation, including many potential regulators of the symbiotic program
  2004

40/6/184   (Item 184 from file: 50)
0006743209   CAB Accession Number: 19931981291
   Expression of Serratia marcescens chitinase gene in Rhizobium meliloti during symbiosis on *alfalfa* roots.
   Publication Year: 1993

40/6/188   (Item 188 from file: 5)
0020193387   BIOSIS NO.: 200800240326
Factors affecting pesticides hazard to different kinds of pollinators
2007

 40/6/189   (Item 189 from file: 76)
0000556691   IP ACCESSION NO: 1885342
Feedback regulation of nodule formation in *alfalfa*.
PUBLICATION DATE: 1988

 40/6/190   (Item 190 from file: 5)
16581405   BIOSIS NO.: 200200174916
A fadD mutant of Sinorhizobium meliloti shows multicellular swarming
  migration and is impaired in nodulation efficiency on *alfalfa* roots
2002

40/6/194   (Item 194 from file: 144)
  16009899   PASCAL No.: 03-0155418
  Floral development of the model legume *Medicago* truncatula: ontogeny studies as a tool to better characterize homeotic mutations
  2003

40/6/197   (Item 197 from file: 203)
 02573726
   Flow cytometric analysis in diploid *Medicago* species from Algeria: Relationship between genome size and competence for direct somatic embryo formation
   2003

 40/6/201   (Item 201 from file: 50)
0008932988   CAB Accession Number: 20053185225
   Does fundamental host range match ecological host range? A retrospective case study of a Lygus plant bug parasitoid.

Publication Year: 2005

40/6/202 (Item 202 from file: 5)
16606354 BIOSIS NO.: 200200199865
Phenotypic selection and phase variation occur during *alfalfa* root colonization by Pseudomonas fluorescens F113
2002

40/6/206 (Item 206 from file: 5)
17786673 BIOSIS NO.: 200400153334
Phytohormonal responses in enod40-overexpressing plants of *Medicago* truncatula and rice.
2004

40/6/210 (Item 210 from file: 10)
4718088 43963102 Holding Library: AGL
Glucosylceramide synthase is essential for *alfalfa* defensin-mediated growth inhibition but not for pathogenicity of Fusarium graminearum
2007
URL: http://dx.doi.org/10.1111/j.1365-2958.2007.05955.x

40/6/213 (Item 213 from file: 5)
06289904 BIOSIS NO.: 198172023855
A GENERAL METHOD FOR SITE DIRECTED MUTAGENESIS IN PROKARYOTES
1981

40/6/228 (Item 228 from file: 10)
3190252 92039234 Holding Library: AGL
Growth and movement of spot inoculated Rhizobium meliloti on the root surface of *alfalfa*
1992 Mar

40/6/231 (Item 231 from file: 76)
0001197404 IP ACCESSION NO: 4207650
Growth and nodulation competitiveness of Sinorhizobium meliloti L1 (RecA super(-)) is less than that of its isogenic strain L33 (RecA super(+)) but comparable to that of two S. meliloti *wild*-type isolates
PUBLICATION DATE: 1997

40/6/232 (Item 232 from file: 203)
02169992
Guizhou natural legume herbage-Introduction and domestication of *Medicago* lupulina
1996

40/6/239 (Item 239 from file: 144)
05198276 PASCAL No.: 83-0464519
Herbicides applied to Dodder (Cuscuta spp.) after attachment to *alfalfa*

(*Medicago* sativa)
1983

40/6/242 (Item 242 from file: 50)
0005078868 CAB Accession Number: 19801958815
Histological comparisons of plant and Rhizobium induced ineffective nodules in *alfalfa*.
Publication Year: 1980

40/6/243 (Item 243 from file: 76)
0000637523 IP ACCESSION NO: 2263066
Host-specificity mutants of Rhizobium meliloti have additive effects in situ on initiation of *alfalfa* nodules.
PUBLICATION DATE: 1990

40/6/254 (Item 254 from file: 50)
0008808723 CAB Accession Number: 20053057348
Impact of agrochemicals on non- Apis bees.
Book Title: Honey bees: estimating the environmental impact of chemicals
Publication Year: 2002

40/6/255 (Item 255 from file: 50)
0009424353 CAB Accession Number: 20073294185
Impacts of initial species richness and deer browsing on the quality of restored prairie in central Illinois.
Publication Year: 2007

40/6/261 (Item 261 from file: 76)
0000756971 IP ACCESSION NO: 2734177
Interactions between three *alfalfa* nodulation genotypes and two Glomus species.
PUBLICATION DATE: 1991

40/6/264 (Item 264 from file: 5)
18755048 BIOSIS NO.: 200600100443
The introduction of grapes and *alfalfa* into China: A reflection on the role of Zhang Qian
2005

40/6/266 (Item 266 from file: 5)
11627364 BIOSIS NO.: 199345058345
Introduction of plants with special regard to cultigens running *wild*
BOOK TITLE: Advances in Life Sciences; Transgenic organisms: Risk assessment of deliberate release
1993

40/6/273 (Item 273 from file: 5)
08236340 BIOSIS NO.: 198682082727
IN-VITRO TRANSLATION OF NODULE SPECIFIC MESSENGER RNA FROM *ALFALFA* *MEDICAGO*-SATIVA ROOT NODULES
1986

40/6/275 (Item 275 from file: 50)
0009167912 CAB Accession Number: 20063219405
An investigation on *alfalfa* aphids and their parasitoids in different parts of iran, with a key to the parasitoids (Hemiptera: Aphididae; Hymenoptera: Braconidae: Aphidiinae).
Publication Year: 2006

40/6/276 (Item 276 from file: 76)
0001884426 IP ACCESSION NO: 6910690
Investigation of the potential of two *wild* *Medicago* species - *Medicago* orbicularis and *Medicago* arabica for in vitro callusogenesis and direct organogenesis
PUBLICATION DATE: 2005

40/6/288 (Item 288 from file: 50)
0005032756 CAB Accession Number: 19810722899
Isolation of a mutant of Rhizobium meliloti adapted to *lucerne* cultured on acid soil.
Publication Year: 1981

40/6/291 (Item 291 from file: 5)
17232434 BIOSIS NO.: 200300191153
Kinetics and strain specificity of rhizosphere and endophytic colonization by enteric bacteria on seedlings of *Medicago* sativa and *Medicago* truncatula.
2003

40/6/294 (Item 294 from file: 5)
12661502 BIOSIS NO.: 199598129335
Localization of poly(A)+-containing RNA during female gametophyte development in *Medicago* sativa and the diploid mutant *Medicago* sativa ssp. falcata using digoxigenin-labelled oligo-dT probes
1995

40/6/295 (Item 295 from file: 50)
0006360673 CAB Accession Number: 19910229851
Local *wild* bee species are the main *lucerne* pollinators in the steppe zone of the northwestern Transcaucasus [USSR].
Publication Year: 1987

40/6/304 (Item 304 from file: 50)
0006147102 CAB Accession Number: 19891937040
Microscopic structure of ineffective *alfalfa* nodules formed by auxotrophic mutants of Rhizobium meliloti.
Publication Year: 1988

40/6/306 (Item 306 from file: 50)
0006637058 CAB Accession Number: 19930760077
Microsite differentiation in a Mediterranean oak savanna.
Publication Year: 1992

40/6/307 (Item 307 from file: 5)
08559098 BIOSIS NO.: 198783037989
MEDICAGO CELL VARIANTS SHOWING ALTERED NITROGEN UTILIZATION
1986

40/6/308 (Item 308 from file: 5)
17253806 BIOSIS NO.: 200300212525
The *Medicago* species A2-type cyclin is auxin regulated and involved in meristem formation but dispensable for endoreduplication-associated developmental programs.
2003

40/6/318 (Item 318 from file: 50)
0007149869 CAB Accession Number: 19960200034
Methods of domiciling and beekeeping with *alfalfa* pollinating sub-tropical megachilid bees.
Publication Year: 1991

40/6/321 (Item 321 from file: 6)
1080708 NTIS Accession Number: DE83703485

Mutants of *Alfalfa* Mosaic Virus
1983

40/6/323 (Item 323 from file: 5)
10265836 BIOSIS NO.: 199090050315
MUTANTS OF RHIZOBIUM-MELILOTI AFFECTED IN NODULATION ABILITY
1989

40/6/325 (Item 325 from file: 5)
09248464 BIOSIS NO.: 198886088385
MATERIALS FOR THE NATURALIZED FLORA OF JAPAN 2
1988

40/6/329 (Item 329 from file: 50)
0006407914 CAB Accession Number: 19910745048
Moose and deer habitat use and diet on a reclaimed mine in west-central Alberta.
Proceedings of the conference: Reclamation, a global perspective, Aug. 27-31, 1989, Calgary, Alberta, Canada.
Publication Year: 1989

40/6/332 (Item 332 from file: 10)
3068208 91015685 Holding Library: AGL
Measurement of the ovipositional potential of potato leafhopper, Empoasca fabae (Homoptera: Cicadellidae): a comparison of *feral* and culture populations
1990 Jul

40/6/354 (Item 354 from file: 203)
01879677
The naturalised flora of South Australia 2. Its development through time
1987

40/6/361 (Item 361 from file: 50)
0006032693 CAB Accession Number: 19880226305
Observations on the insect pollinators of some Leguminosae (Onobrychis viciifolia, Lotus corniculatus, *Medicago* arborea, *Medicago* sativa) in a specialized area.
Original Title: Osservazioni sugli insetti pronubi di alcune Leguminosae (Onobrychis viciifolia Scop., Lotus corniculatus L., *Medicago* arborea L., *Medicago* sativa L.) in un areale specializzato.
Publication Year: 1984

40/6/365 (Item 365 from file: 50)
0006127721 CAB Accession Number: 19890227662
Studies on the diurnal flight activity of *wild* bees (Apoidea), pollinators of *lucerne*.
S'vremenni postizheniya na bulgarskata zoologiya.
Publication Year: 1987

40/6/367 (Item 367 from file: 203)
00973985
1982
Studies on the *wild* bees of Family: Andrenidae (Hymenoptera) in Egypt [A study for utilizing the *wild* bees for inoculation of *Medicago* sativa, Trifolium alexandrium, Vicia faba]

40/6/370 (Item 370 from file: 10)
4554382 43835773 Holding Library: AGL
Overexpression of BetS, a Sinorhizobium meliloti High-Affinity Betaine Transporter, in Bacteroids from *Medicago* sativa Nodules Sustains Nitrogen Fixation During Early Salt Stress Adaptation
2006

40/6/376 (Item 376 from file: 203)
01623240
[Apoidea are the pollinators of *lucerne* in the Republic of Moldova] (Apoidea - opyliteli lyutserny v respublike Moldovy)
1991

40/6/377 (Item 377 from file: 10)
2017388 82060896 Holding Library: AGL
Pollination of *alfalfa* (by honeybees and *wild* bees).
1981

40/6/382 (Item 382 from file: 5)
12432938 BIOSIS NO.: 199497454223
Plants transformed with a mutant *alfalfa* mosaic virus coat protein gene are resistant to the mutant but not to *wild*-type virus
1994

40/6/383 (Item 383 from file: 10)
3526779 20527324 Holding Library: AGL
Plant signals to soil microbes: regulators of rhizosphere colonization
1995

40/6/388 (Item 388 from file: 5)
15165426 BIOSIS NO.: 199900425086
Population dynamics of Lygus hesperus (Heteroptera: Miridae) on selected weeds in comparison with *alfalfa*
1999

40/6/396 (Item 396 from file: 10)
2320809 84059420 Holding Library: AGL
Propagation of *wild* pollinators (Leafcutting solitary bees as pollinators of *alfalfa*, Ukrainian SSR).
1983

40/6/397 (Item 397 from file: 203)
01490241
Properties of the neutral foliar phosphatases in the *wild* *lucerne*, *Medicago* minima. 1. Kinetic parameters and natural variability (Proprietes des phosphatases foliaires neutres de la luzerne sauvage, *Medicago* minima. 1. Parametres cinetiques et leur variabilite naturelle)
1989

40/6/399 (Item 399 from file: 203)
01490242
Properties of the neutral foliar phosphatases of the *wild* *lucerne*, *Medicago* minima. 2. Comparison between Hill coefficients of five natural phosphorylated esters (Proprietes des phosphatases foliaires neutres de la luzerne sauvage, *Medicago* minima. 2. Comparaison des coefficients de Hill de cinq esters phosphoriques naturels)
1989

40/6/402 (Item 402 from file: 203)
01490243
Properties of the neutral foliar phosphatases of the *wild* *lucerne*, *Medicago* minima. 3. Determination of Ks in five phosphorylated esters from glycolysis by substrate competition (Proprietes des phosphatases foliaires neutres de la luzerne, *Medicago* minima. 3. Determination du Ks de cinq esters phosphoriques de la glycolyse par competition de substrats)
1989

40/6/404 (Item 404 from file: 5)
17132549 BIOSIS NO.: 200300091268
Proteome analysis of nodulation-related proteins in the *wild* type and a supernodulation mutant (sunn) of the model legume, *Medicago* truncatula.
BOOK TITLE: Nitrogen fixation: Global perspectives
2002

40/6/409 (Item 409 from file: 10)
1890885 81069664 Holding Library: AGL
Parasites (Chalcidoidea) and pests (Coleoptera, Lepidoptera) in the nests of the *wild* (*alfalfa* -pollinating) bee Megachile rotundata Fabr. (Romania).
Paraziti si daunatori in cuiburile albinei salbatice Megachile rotundata Fabr
1980

40/6/412 (Item 412 from file: 10)
4772733 44002414 Holding Library: AGL
The potential role of waterbirds in dispersing invertebrates and plants in arid Australia
2008
URL: http://dx.doi.org/10.1111/j.1365-2427.2007.01901.x

40/6/413 (Item 413 from file: 50)
0006884996 CAB Accession Number: 19941905955
Patterns of nodule development and nodulin gene expression in *alfalfa* and afghanistan pea.
Advances in molecular genetics of plant-microbe interactions.
Publication Year: 1991

40/6/415 (Item 415 from file: 5)
07226343 BIOSIS NO.: 198477058254
PESTICIDES AND BEES
1983

40/6/418 (Item 418 from file: 5)
15674737 BIOSIS NO.: 200000393050
Qualitative and quantitative analysis of carbohydrates in green juices (*wild* mix grass and *alfalfa*) from a green biorefinery by gas chromatography/mass spectrometry
2000

40/6/422 (Item 422 from file: 5)
0019714281 BIOSIS NO.: 200700374022
Recent advances in biological control of pest insects by using viruses in China
2007

40/6/424 (Item 424 from file: 143)
2113128 H.W. WILSON RECORD NUMBER: BBAI07141525
Reaction Tissue Formation and Stem Tensile Modulus Properties in *Wild* -type and p-Coumarate-3-hydroxylase Downregulated Lines of *Alfalfa*, *Medicago* sativa (Fabaceae)

20070600

40/6/428 (Item 428 from file: 76)
0000370881 IP ACCESSION NO: 1037440
Regulation of nodulation by Rhizobium meliloti 102F15 on its mutant which forms an unusually high number of nodules on *alfalfa*.
PUBLICATION DATE: 1985

40/6/433 (Item 433 from file: 10)
2868852 89001631 Holding Library: AGL
Rhizobium meliloti host range nodH gene determines production of an *alfalfa*-specific extracellular signal
1988 Dec

40/6/435 (Item 435 from file: 10)
3230175 92066729 Holding Library: AGL
A Rhizobium meliloti lipopolysaccharide mutant altered in competitiveness for nodulation of *alfalfa*
1992 Sep

40/6/437 (Item 437 from file: 10)
3319933 20337597 Holding Library: AGL
Rhizobium meliloti mutants defective in symbiotic nitrogen fixation affect the oxygen gradient in *alfalfa* (*Medicago* sativa) root nodules
1993 Feb

40/6/440 (Item 440 from file: 5)
08611437 BIOSIS NO.: 198783090328
A RHIZOBIUM-MELILOTI MUTANT THAT FORMS INEFFECTIVE PSEUDONODULES IN *ALFALFA* PRODUCES EXOPOLYSACCHARIDE BUT FAILS TO FORM BETA-1-2 GLUCAN
1987

40/6/448 (Item 448 from file: 76)
0000471147 IP ACCESSION NO: 1572328
Requirement of succinate dehydrogenase activity for symbiotic bacteroid differentiation of Rhizobium meliloti in *alfalfa* nodules.
PUBLICATION DATE: 1987

40/6/452 (Item 452 from file: 5)
13882005 BIOSIS NO.: 199799516065
Role of the K-antigen subgroup of capsular polysaccharides in the early recognition process between Rhizobium meliloti and *alfalfa* leaves
1997

40/6/464 (Item 464 from file: 5)
18473211 BIOSIS NO.: 200510167711
Role of trehalose transport and utilization in Sinorhizobium meliloti - *Alfalfa* interactions
2005

40/6/465 (Item 465 from file: 10)
4802578 43731174 Holding Library: AGL
Role of trehalose transport and utilization in Sinorhizobium meliloti-*alfalfa* interactions. [Erratum: 2005 Nov., v. 18, no. 11, p. 1243.]
2005

40/6/468 (Item 468 from file: 50)
0007291607 CAB Accession Number: 19961909908
Role of surface factors in plant-microbe interactions: involvement of Rhizobium meliloti exopolysaccharide during early infection events in *alfalfa* [*Medicago* sativa].
Advances in molecular genetics of plant-microbe interactions: volume 3. Proceedings 7th International Symposium, Edinburgh, UK, June 1994.
Publication Year: 1994

40/6/472 (Item 472 from file: 10)
2382459 84107907 Holding Library: AGL
Reproduction of *wild* *alfalfa* pollinators (*Wild* bees, Krasnodar Territory, RSFSR-in-Europe).
1984

40/6/479 (Item 479 from file: 50)
0008751060 CAB Accession Number: 20043206871
Revegetation and reclamation of soils using *wild* leguminous shrubs in cold semiarid Mediterranean conditions: litterfall and carbon and nitrogen returns under two aridity regimes.
Publication Year: 2004

40/6/480 (Item 480 from file: 50)
0009452547 CAB Accession Number: 20083007482
A review of weeds in Australia resistant to herbicides.
Book Title: Proceedings of the Eighth Australian Weeds Conference, Sydney, New South Wales, Australia, 21-25 September, 1987
Publication Year: 1987

40/6/484 (Item 484 from file: 5)
09645078 BIOSIS NO.: 198987092969
SCREENING OF *MEDICAGO* *WILD* SPECIES FOR CALLUS FORMATION AND THE GENETICS OF SOMATIC EMBRYOGENESIS
1988

40/6/488 (Item 488 from file: 5)
14386231 BIOSIS NO.: 199800180478
Selection of methionine-resistant variant of *Medicago* sativa
1997

40/6/489 (Item 489 from file: 144)

08290577 PASCAL No.: 88-0291128
Solanum nigrum L. and *wild* *alfalfa* plants as natural hosts for *alfalfa* mosaic virus, in Portugal
1987

40/6/490 (Item 490 from file: 144)
08229871 PASCAL No.: 88-0230332
(Resistance au sel et teneur en composes ammonium quaternaire d'especes sauvages de luzerne)

(Salt resistance and the level of quaternary ammonium compounds in *wild* *lucerne* species)
1987

40/6/491 (Item 491 from file: 144)
08246688 PASCAL No.: 88-0247151
Salt tolerance and content of quaternary ammonium compounds in *wild* species of *Medicago*
1988 publ. 1977

40/6/492 (Item 492 from file: 50)
0005895664 CAB Accession Number: 19870706104
Salt tolerance of *wild* *lucerne* species and contents of quaternary ammonium compounds.
Publication Year: 1987

40/6/521 (Item 521 from file: 144)
17983911 PASCAL No.: 07-0044856
Strategies to obtain stable transgenic plants from non-embryogenic lines : complementation of the nn SUB 1 mutation of the NORK gene in *Medicago* sativa MN1008
2006

40/6/527 (Item 527 from file: 76)
0001843030 IP ACCESSION NO: 6725879
Symbiosis between the Root-Nodule Bacterium Sinorhizobium meliloti and *Alfalfa* (*Medicago* sativa) under Salinization Conditions
PUBLICATION DATE: 2006

40/6/545 (Item 545 from file: 144)
16565718 PASCAL No.: 04-0214103
Transgenic tobacco plants overproducing *alfalfa* aldose/aldehyde reductase show higher tolerance to low temperature and cadmium stress
2004

40/6/546 (Item 546 from file: 5)
09201813 BIOSIS NO.: 198886041734
TRANSGENIC TOBACCO EXPRESSING TOBACCO STREAK VIRUS OR MUTATED *ALFALFA* MOSAIC VIRUS COAT PROTEIN DOES NOT CROSS-PROTECT AGAINST *ALFALFA* MOSAIC VIRUS INFECTION
1988

40/6/552 (Item 552 from file: 10)
2625876 87002794 Holding Library: AGL
Taxonomy of glandular *wild* *alfalfa* (*Medicago* sativa)
1986 Sep

40/6/553 (Item 553 from file: 5)
11766054 BIOSIS NO.: 199395068320
Ultrastructure of infection mode of Rhizobium meliloti exopolysaccharide mutant in *alfalfa*
1992

40/6/556 (Item 556 from file: 203)
01006295
1982
[Evaluation of production curves for *wild* medic (*Medicago* sp.)] (

Evaluacion de curvas de produccion de hualputras silvestres (*Medicago* sp.))

40/6/563 (Item 563 from file: 10)
2434416 85015838
Visiting rate of *wild* *alfalfa* species by bees
1983

40/6/564 (Item 564 from file: 50)
0005756425 CAB Accession Number: 19860218557
Visits to *wild* *lucerne* species by bees.
Publication Year: 1983

40/6/567 (Item 567 from file: 50)
0006121778 CAB Accession Number: 19890227558
Wild bees (Apoidea) as pollinators of *lucerne* in the Krasnodar region.
Zashchita semenovodcheskikh posevov lyutserny ot kompleksa vrednykh organizmov v stepnoi zone severnogo kavkaza.
Publication Year: 1988

40/6/568 (Item 568 from file: 10)
1801065 81002531 Holding Library: AGL
Wild bees as pollinators of plants (including *alfalfa*, USSR).
1980

40/6/569 (Item 569 from file: 10)
2741698 87087359 Holding Library: AGL
Wild barley (foxtail) control in *alfalfa*
1987

40/6/570 (Item 570 from file: 10)
1801087 81002553 Holding Library: AGL
Wild insect pollinators of *alfalfa* (Poltava Region, Ukrainian SSR).
1980

40/6/572 (Item 572 from file: 203)
00725212
[Wild pollinators of *alfalfa* [bees (general), Ukrainian SSR]] (Dikie opyliteli posevnoj lyutserny)
1980

40/6/573 (Item 573 from file: 10)
2837593 88047958 Holding Library: AGL
Wild proso millet and broadleaf weed control in seedling *alfalfa*
1988

40/6/577 (Item 577 from file: 203)
01624072
[The stability of collected strain samples of *alfalfa* to fusarial wilt root rot in Western Siberia] (Ustojchivost' kollektsionnykh sortoobraztsov lyutserny k fuzarioznoj kornevoj gnili v Zapadnoj Sibiri)
1991

H-3 Supplemental Searches

Engine	Term	# Titles Reviewed
Yahoo	Nomad alfalfa	20
Google	feral alfalfa	100
Goggle	yellow-blossomed alfalfa on rangeland	20
Google	rangeland alfalfa	30
Google	fire damage alfalfa	20
Google	fire recovery alfalfa	10
Google	erosion control alfalfa	10
Google	roadside alfalfa	20
Google	alfalfa seedbank	20
Scirus	feral alfalfa	30

Appendix H-3. Alfalfa Naturalized Status in the United States

Figure H-1. *Medicago sativa* Naturalized Status (USDA Plants Database)[8]

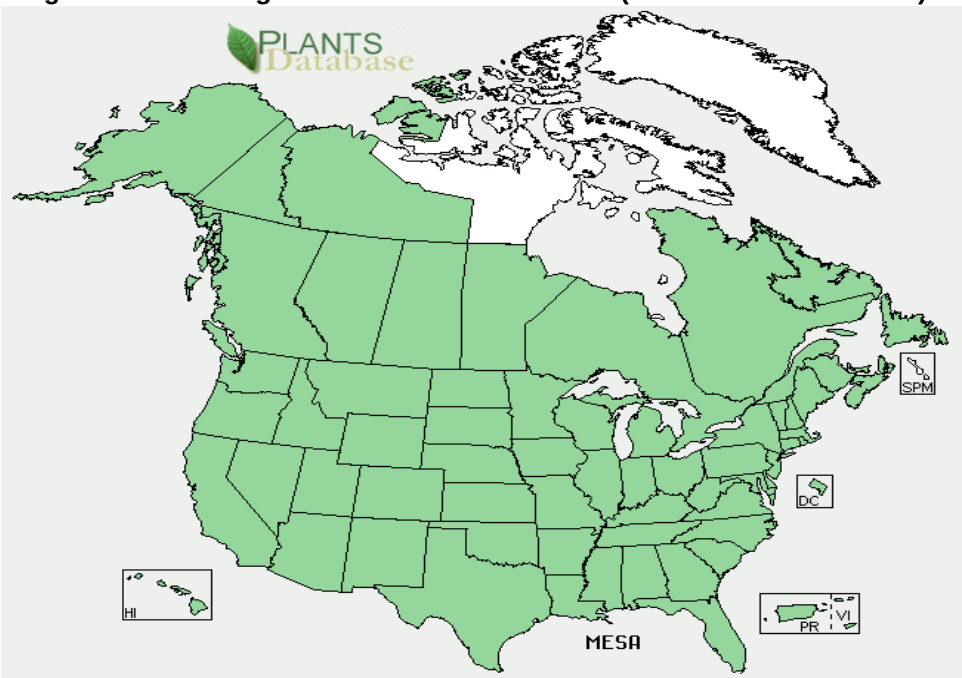
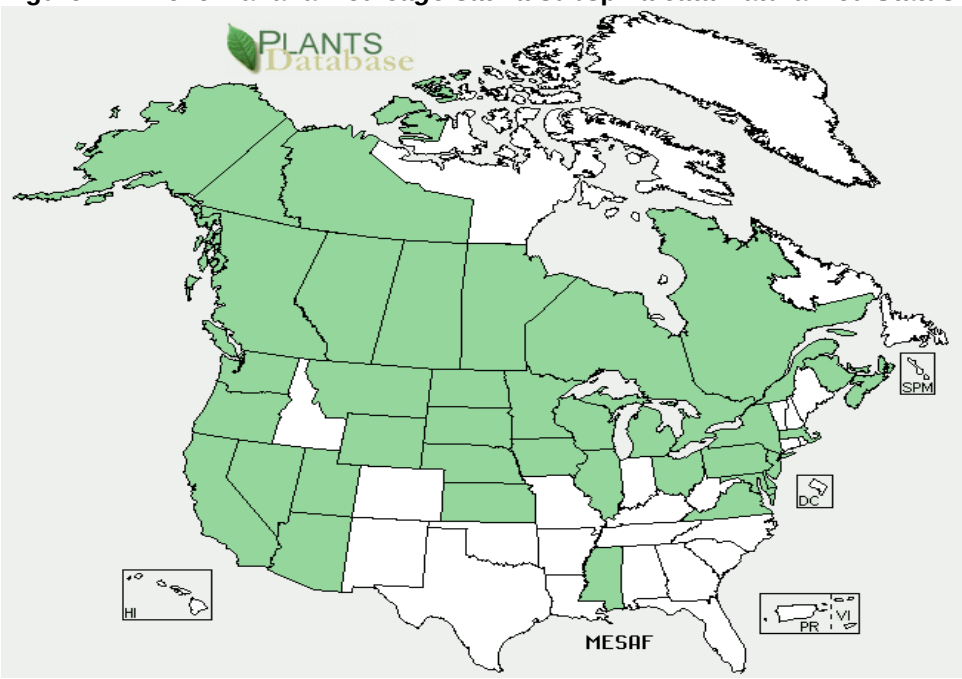


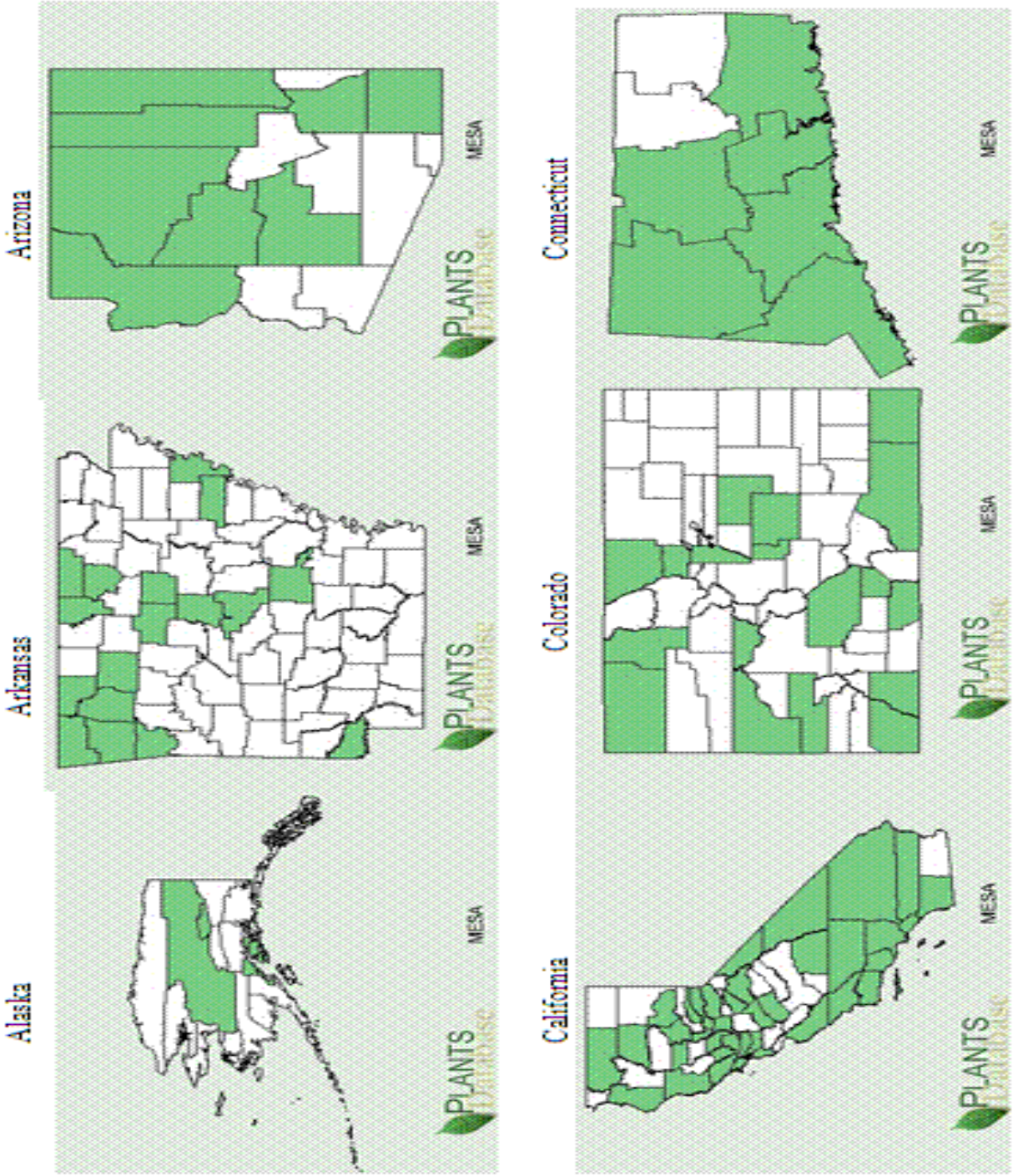
Figure H-2..Yellow alfalfa *Medicago sativa* subsp. *falcata* Naturalized Status



[8] http://plants.usda.gov/index.html

Figure H-3. *Medicago sativa* Naturalized Status by State (USDA Plants Database)[9]

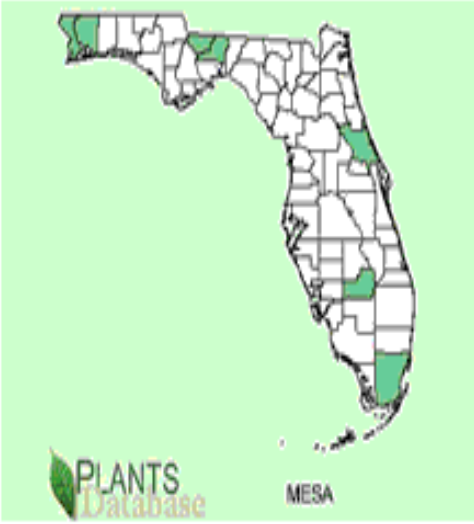
The USDA Plants Database "county data are based primarily on the literature, herbarium specimens, and confirmed observations. Not all populations have been documented, however, and significant gaps in the distribution shown [below] may not be real…. Remember that only native and naturalized populations are mapped"



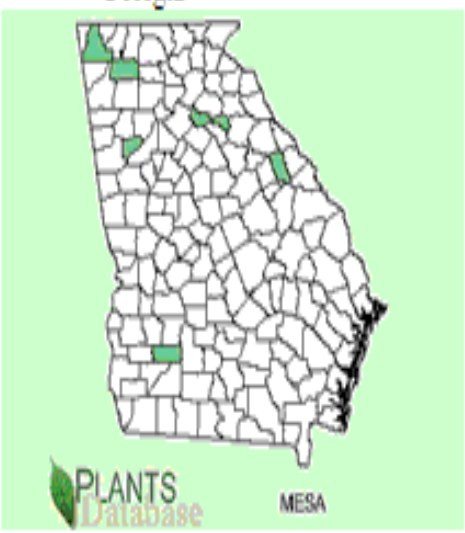
[9] http://plants.usda.gov/index.html

District of Columbia

Florida

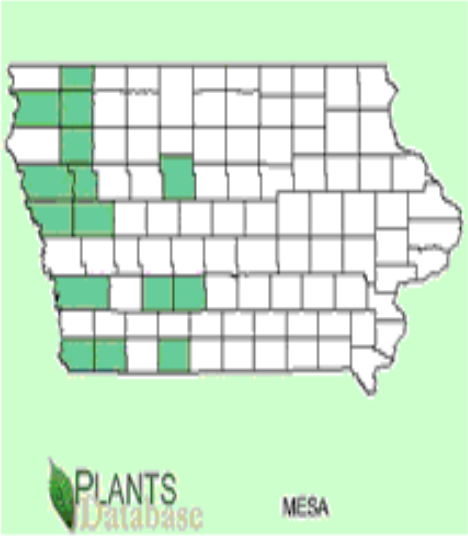


Georgia

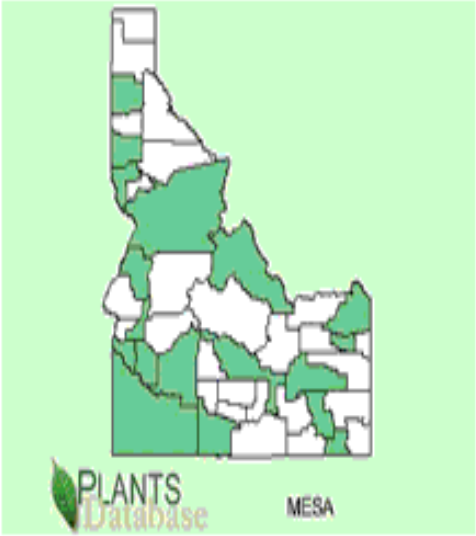


Hawaii

Iowa



Idaho

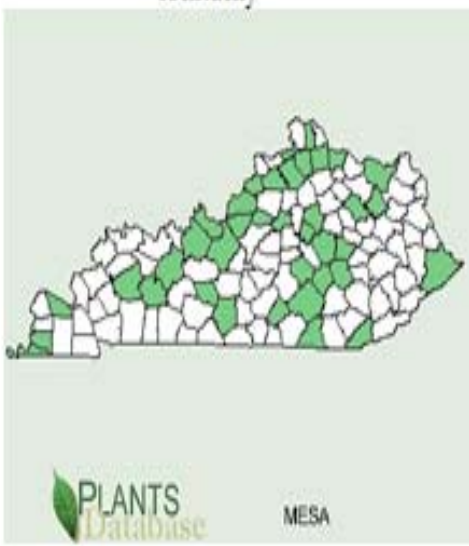


Illinois

Indiana

Kansas

Kentucky



Louisiana

Massachusetts

Maine

Michigan

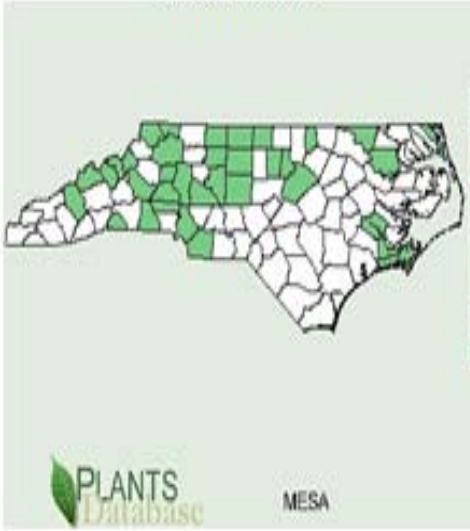
Minnesota

Missouri

Mississippi

Montana

North Carolina



North Dakota

Nebraska

New Hampshire

New Jersey

New Mexico

Nevada

New York

Ohio

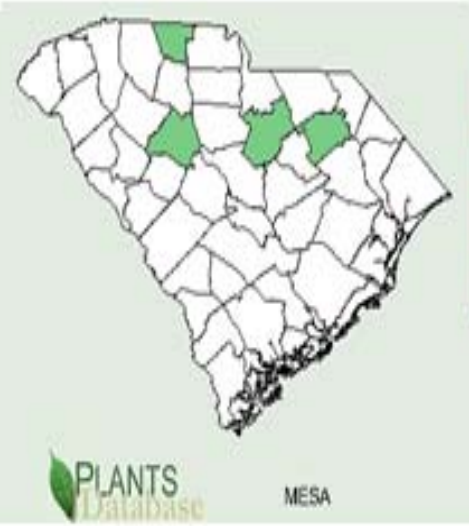
Oklahoma

Oregon

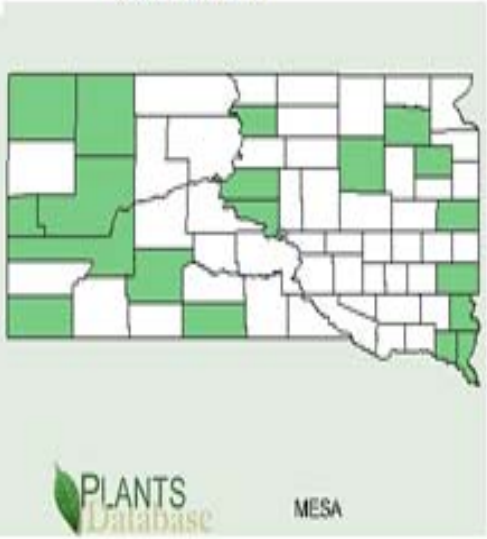
Pennsylvania

Rhode Island

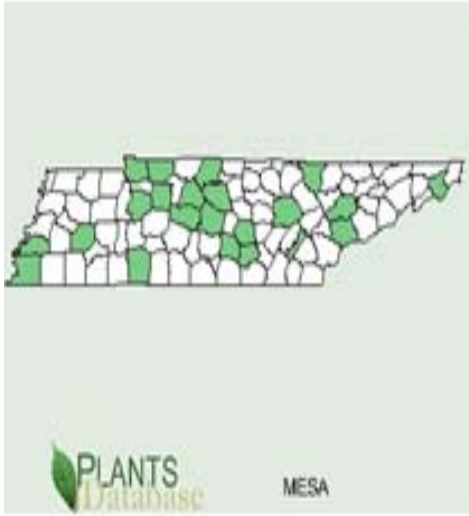
South Carolina



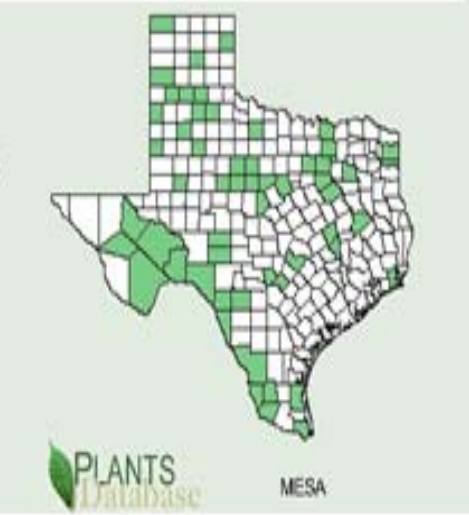
South Dakota



Tennessee



Texas



Utah

Virginia

Vermont

Washington

Wisconsin

West Virginia

Wyoming

Appendix H-4. Glyphosate-Resistant and –Tolerant Weeds

Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
Recently Evolved or Selected Resistant Biotypes						
Common Ragweed	*Ambrosia artemisiifolia*	All states except AL	2004 - Arkansas 2004 - Missouri 2006 – Ohio* 2007 - Kansas	Yes (with resistant biotype note)	IL: Noxious weed (within the corporate limits of cities, villages, and incorporated towns) MI: *Ambrosia elatior*, Noxious weed OR: "B" designated weed, Quarantine	Heap et al. 2010
Common Waterhemp	*Amaranthus rudis* and *Amaranthus tuberculatus*	All except, AK, AZ, DC, FL, HI, MD, MT, NV, OR, UT, VA, WY	2005 - Missouri – (3 MOA's) 2006 - Illinois - (2 MOA's) 2006 - Kansas 2007 - Minnesota	Yes (with resistant biotype note)	No	Heap et al. 2010, Nandula et al. 2005 , Cerdeira and Duke 2006
Giant Ragweed	*Ambrosia trifida*	All except AK, HI, NV	2004 - Ohio 2005 - Arkansas 2005 - Indiana 2006 - Kansas 2006 – Minnesota 2006 – Ohio* 2007 – Tennessee 2009 – Iowa 2009 - Missouri	Yes (with resistant biotype note)	CA: B list (noxious weeds) DE: Noxious weed IL: Noxious weed (within the corporate limits of cities, villages, and incorporated towns)	Heap et al. 2010
Hairy Fleabane	*Conyza bonariensis*	AL, AR, AZ, CA, FL, GA, LA, MS, NC, NM,	2007 – California 2009 - California	Yes	No	Heap et al. 2010,

[10] http://plants.usda.gov/index.html
[11] http://www.monsanto.com/products/Documents/MSDS-Labels/roundup_orig_max_label.pdf
*Multiple herbice resistance

Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
		NV, OR, SC, TX, UT, VA				Nandula et al. 2005
Horseweed	*Conyza canadensis*	All States	2000 - Delaware 2001 - Kentucky 2001 - Tennessee 2002 - Indiana 2002 - Maryland 2002 - Missouri 2002 - New Jersey 2002 - Ohio 2003 - Arkansas 2003 - Mississippi 2003 - North Carolina 2003 – Ohio* 2003 - Pennsylvania 2005 - California 2005 - Illinois 2005 - Kansas 2007 – Michigan 2007 – Mississippi*	Yes (with resistant biotype note)	No	Heap et al. 2010, Nandula et al. 2005
Italian Ryegrass	*Lolium multiflorum*	All States	2004 - Oregon 2005 – Mississippi 2008 - Arkansas	Yes (with resistant biotype note)	No	Heap et al. 2010, Nandula et al. 2005
Johnsongrass	*Sorghum halepense*	All except AK, ME, MN	2007 - Arkansas	Yes (mixture also recommended)	AR, DE, ID, IL,IN, KS, KY, MD, MO, NV, PA, WV, UT: noxious weed CA, CO: class C noxious weed	Heap et al. 2010

Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
					OH: Prohibited noxious weed OR:"B" designated weed, Quarantine SD: Regulated nonnative plant species WA: Class A noxious weed, Noxious weed seed and plant quarantine	
Palmer Amaranth	*Amaranthus palmeri*	AR, AZ, CA, CO, FL, GA, IL, KS, KY, LA, MA, MD, MO, MS, NC, NE, NJ, NM, NV, NY, OH, OK, PA, SC, TN, TX, UT, VA, WI, WV	2005 – Georgia 2005 North Carolina 2006 - Arkansas 2006 – Tennessee 2007 – New Mexico 2008 – Alabama 2008 – Georgia* 2008 – Mississippi* 2008 – Missouri 2010 - Louisiana	Yes (with resistant biotype note)	No	Heap et al. 2010
Rigid Ryegrass	*Lolium rigidum*	AZ, CA, LA, MS, MO, OR, TX	1998 - California	Yes (with resistant biotype note)	No	Heap et al. 2010, Nandula et al. 2005
Buckhorn Plantain	*Plantago lanceolata*	All States	Not reported in U.S. yet	No	AR: Noxious weed IA: Secondary noxious weed	Heap et al. 2010
Goosegrass	*Eleusine indica*	All except AK, ID, MT, WA, WY	Not reported in U.S. yet	Yes	No	Heap et al. 2010, Nandula et

Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
						al. 2005
Junglerice	*Echinochloa colona*	AL, AR, AZ, CA, FL, GA, HI, IL, KS, KY, LA, MA, MD, MO, MS, MT, NC, NJ, NM, OK, OR, PA, SC, TN, TX, VA, VT	Not reported in U.S. yet	Yes (mixture also recommended)	No	Heap et al. 2010
Sourgrass	*Digitaria insularis*	AL, AZ, FL, HI, IL, MS, TX	Not reported in U.S. yet	No	No	Heap et al. 2010
Wild Poinsettia	*Euphorbia heterophylla*	AL, AZ, CA, FL, GA, HI, LA, MS, NM, TX	Not reported in U.S. yet	No	No	Heap et al. 2010
Perennial Ryegrass	*Lolium perenne*	All States	Not reported in U.S. yet	Yes	No	Heap et al. 2010
Kochia	*Kochia scoparia*	All except AK, AL, AR, DC, GA, FL, HI, MD,	2007 – Kansas (corn, soybean, and cotton)	Yes	CT: Potentially invasive, banned. OR: "B" designated weed, quarantine. WA: Class "B" noxious weed. Noxious weed seed and plant quarantine.	Heap et al. 2010
Sumatran Fleabane	*Conyza sumatrensis*	Not reported in U.S. yet.	Not reported in U.S. yet.	No	No	Heap et al. 2010
Ragweed Parthenium	*Parthenium hysterophorus*	AL, AR, CT, DC, DE, FL, HI, IL, KS, MA, MD, MI, MO, MS, NJ, NY, OH, OK, PA, SC, TX, VA	Not reported in U.S. yet.	No	No	Heap et al. 2010
Annual Bluegrass	*Poa annua*	All States	2010 - Missouri	Yes	No	Heap et al. 2010
Liverseedgrass	***Urochloa panicoides***	AZ, MD, NM, TX	Not reported in U.S. yet.	No	US: Noxious weed. AL: Class A noxious weed. CA: Quarantine.	Heap et al. 2010

Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
					FL: Noxious weed. MA: Prohibited. MN: Prohibited noxious weed. NC: Class A noxious weed. OR: Quarantine. SC: Plant Pest. VT: Class A noxious weed.	
Historically Naturally Tolerant						
Asiatic dayflower	*Commelina communis*	AL, AR, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, VA, VT, WA, WI, WV		No	No	Nandula et al. 2005
Birdsfoot trefoil	*Lotus corniculatus*	All except AK, FL, HI, LA, MS, NV, SC		No	No	Nandula et al. 2005
Bermudagrass	*Cynodon dactylon*	All except AK, MN, ND, SD, VT, WI, WY		Yes (partial control notes)	AR: Noxious weed CA: C list (noxious weeds) UT: Noxious weed (Bermudagrass shall not be a noxious weed in Washington County and shall not be subject to provisions of the Utah noxious Weed Act within the boundaries of the county)	Cerdeira and Duke 2006
Burning nettle	*Urtica uren*	AK, AL, AZ, CA, CT, FL, GA, HI, IA, IL, MA,		No (mixture recommended)	No	Van Deynze et al. 2004,

Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
		MD, ME, MI, MO, NH, NJ, NM, NV, NY, OK, OR, PA, SC, TX, VA, VT, WA, WI				Canevari et al. 2004
Cheeseweed	*Malva parviflora*	AZ, CA, CO, FL, GA, HI, IA, ID, KS, LA, MA, MD, MO, MT, ND, NE, NJ,NM, NV, NY, OR, SC, TX, WA, WY		No (mixture recommended)	No	Van Deynze et al. 2004
Chinese foldwig	*Dicliptera chinensis*	HI		No	No	Nandula et al. 2005
Common lambsquarters	*Chenopodium album*	All States		Yes (mixture also recommended)	No	Nandula et al. 2005
Field bindweed	*Convolvulus arvensis*	All States except AK		No (mixture recommended)	AK, AR, HI, ID, KS, MI, MO, ND, UT, WI, WY: Noxious weed AZ: Prohibited noxious, Regulated noxious weeds weed CA, CO: C list (noxious weeds) IA: Primary noxious weed MN: Prohibited noxious weed MT: Category 1 noxious weed NM: Class C noxious weed OR: "B" designated weed Quarantine SD: Regulated nonnative plant species TX: Noxious plant	Nandula et al. 2005

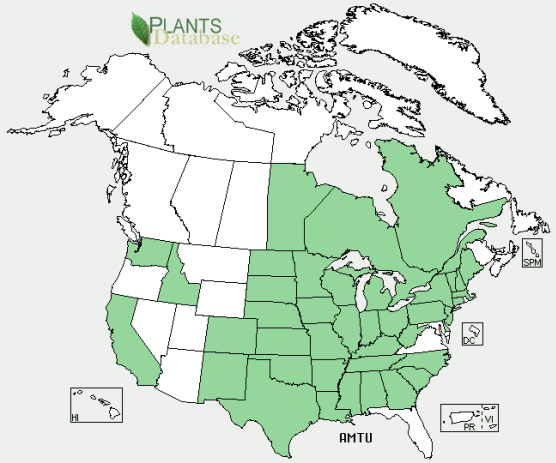
Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
					WA: Class C noxious weed	
Filaree	*Erodium* spp. *(e.g., Erodium cicutarium)*	All except FL and MS (Redstem filaree)		Yes (mixture also recommended)	CO: B list (noxious weeds)	Van Deynze et al. 2004
Florida pellitory	*Parietaria debilis (aka Parietaria floridana)*	AL, FL, GA, KY, LA, MD, MS, NC, NH, SC, TX		No	No	Cerdeira and Duke 2006
Hemp sesbania	*Sesbania exalta*	AL, AR, AZ, CA, FL, GA, IL, KS, KY, LA, MA, MD, MO, MS, NC, NY, OK, PA, SC, TN, TX, VA		Yes	AR: Noxious weed	Cerdeira and Duke 2006
Large crabgrass	*Digitaria sanguinalis*	All except AK, HI, FL		Yes (mixture also recommended)	No	Cerdeira and Duke 2006
Morning glory	*Ipomoea purpurea*	All except AK, ID, WY		Yes (mixture also recommended)	AZ: Prohibited noxious weed (all species except Ipomoea carnea, Mexican bush morning glory, I. triloba, three-lobed morning glory, and I. arborescens, morning glory tree) AR: Noxious weed	Hilgenfeld et al. 2004, Cerdeira and Duke 2006
Nutsedge	*Cyperus* spp. *(Cyperus esculentus)*	All except MT, WY		Yes	CA, CO: B list (noxious weeds) HI: Noxious weed OR: "B" designated weed Quarantine WA: Class B noxious weed Quarantine	Cerdeira and Duke 2006

Common Name	Scientific Name	U.S. Range[10] for Resistant and Susceptible Biotypes	U.S. Reports of Resistant Biotypes	Listed on Roundup® Label[11]	Noxious Status[5]	Source
Oval-leaf false buttonweed	*Spermacoce latifolia*	HI		No	No	Cerdeira and Duke 2006
pillpod sandmat	*Chamaesyce hirta*	AL, AZ, CA, FL, GA, HI, LA, MD, MI, MS, NC, NM, NY, SC, TX		No	No	Cerdeira and Duke 2006
Purslane	*Portulaca oleracea*	All except AK		Yes (mixture also recommended)	AZ: Prohibited noxious weed, Regulated noxious weeds	Van Deynze et al. 2004
Tropical Mexican clover	*Richardia brasiliensis*	AL, FL, GA, HI, LA, MS, NC, NJ, PA, SC, TN, TX, VA		No	No	Cerdeira and Duke 2006
Tropical spiderwort (Benghal dayflower)	*Commelina benghalensis*	CA, FL, GA, HI, LA, NC		No	United States: - Noxious weed AL: Class A noxious weed CA: Quarantine FL: Noxious weed MA: Prohibited MN: Prohibited noxious weed NC: Class A noxious weed OR: Quarantine SC: Plant pest VT: Class A noxious weed	Nandula et al. 2005
Velvet leaf	*Abutilon theophrasti*	All except AK, HI		Yes (mixture also recommended)	CO: C list (noxious weeds) IA: Secondary noxious weed OR: "B" designated weed Quarantine WA: Class A noxious weed, Noxious weed seed and plant, quarantine	Nandula et al. 2005

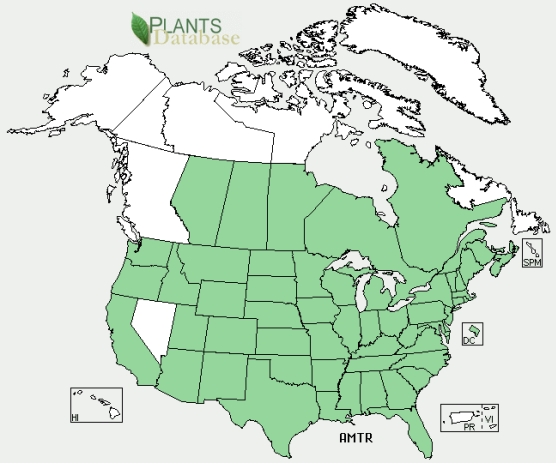
Cline 2004 reports that fleabane and henbit are also difficult to control with glyphosate. *These 3 weeds are not fully controlled by any of the 16 herbicides listed in the University of California Pest Management Guidelines (Rogan and Fitzpatrick 2004).

Common Ragweed (*Ambrosia artemisiifolia*)

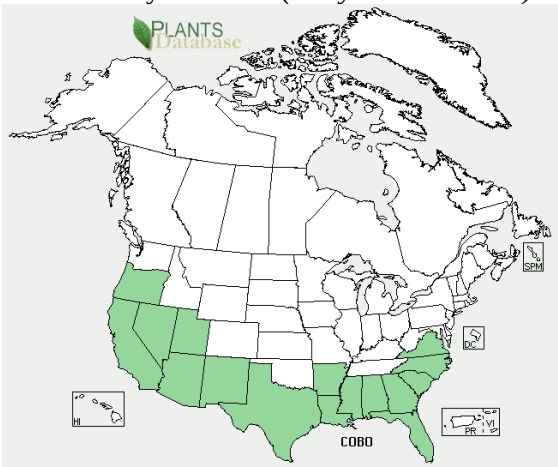
Common waterhemp *(Amaranthus tuberculatus)*



Giant ragweed (*Ambrosia trifida)*



Hairy Fleabane *(Conyza bonariensis)*

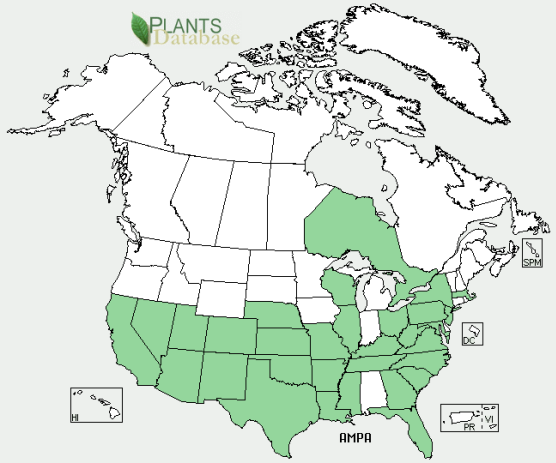


Horseweed *(Conyza canadensis)*

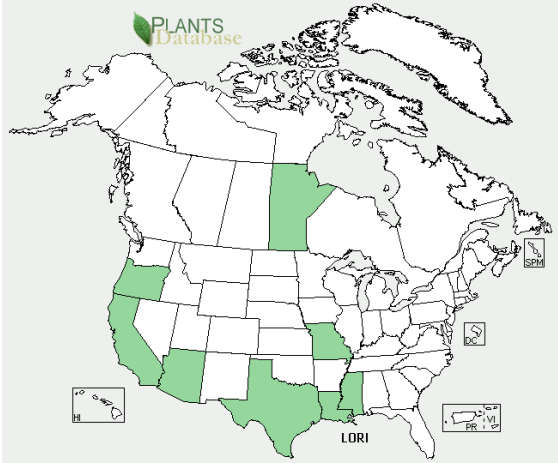
Italian ryegrass *(Lolium multiflorum)*

Johnsongrass *(Sorghum halapense)*

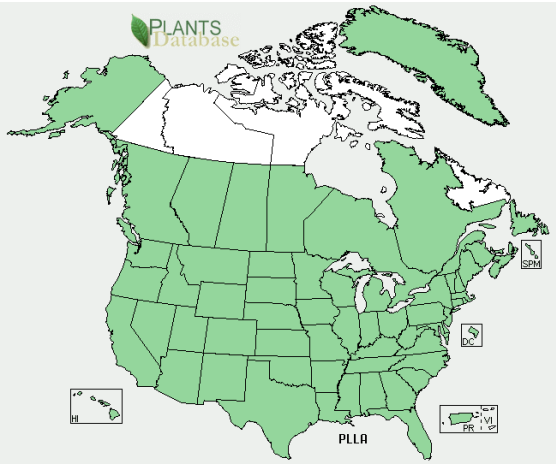
Palmer amaranth *(Amaranthus palmeri)*



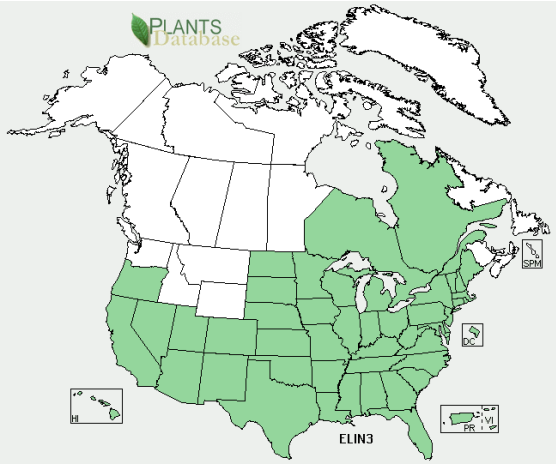
Rigid ryegrass *(Lolium rigidum)*



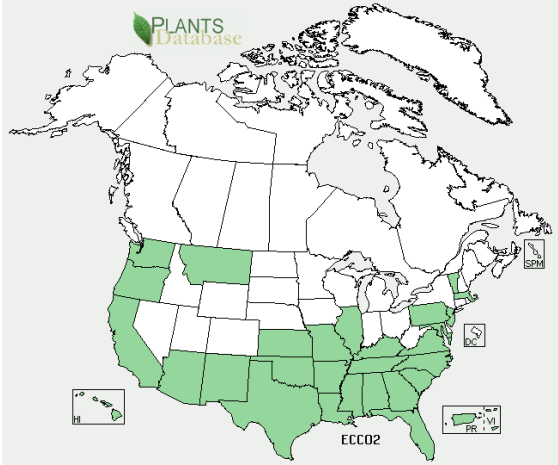
Buckhorn plantain *(Plantago lanceolata)*



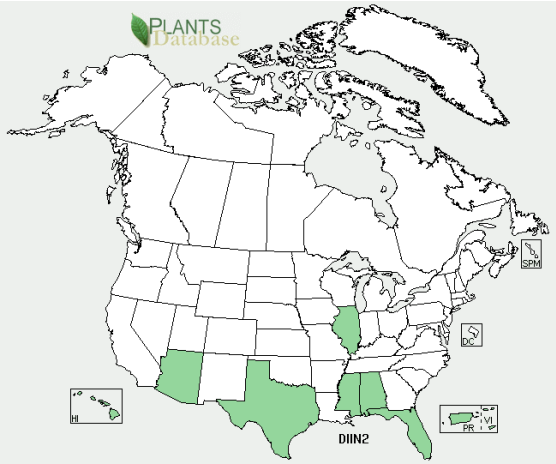
Goosegrass *(Eleusine indica)*



Junglerice *(Echinochloa colona)*

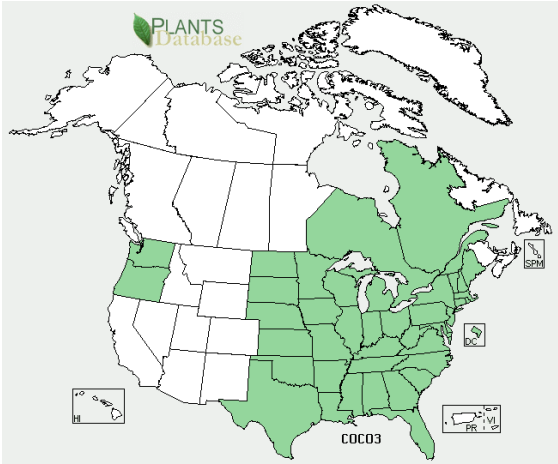


Sourgrass *(Digitaria insularis)*

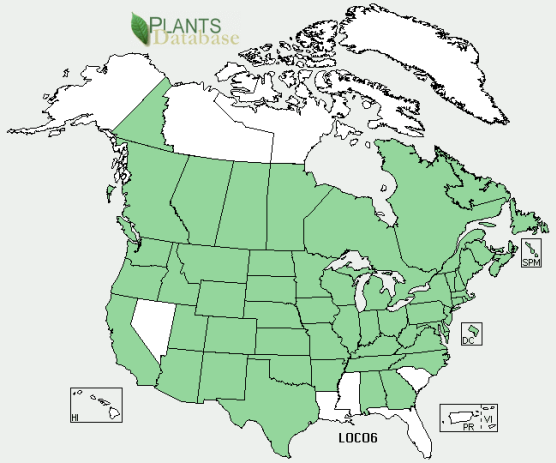


Wild Poinsettia *(Euphorbia heterophylla)*

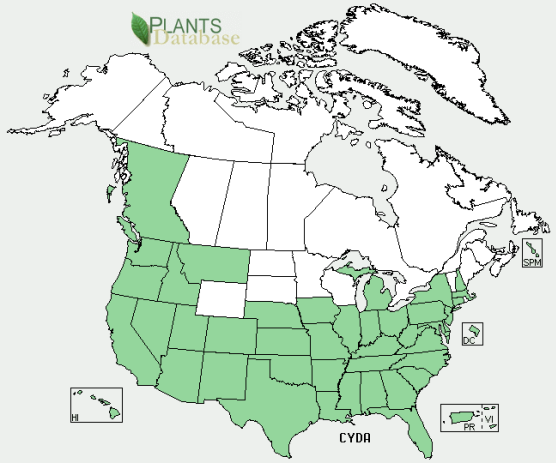
Asiatic dayflower *(Commelina communis)*



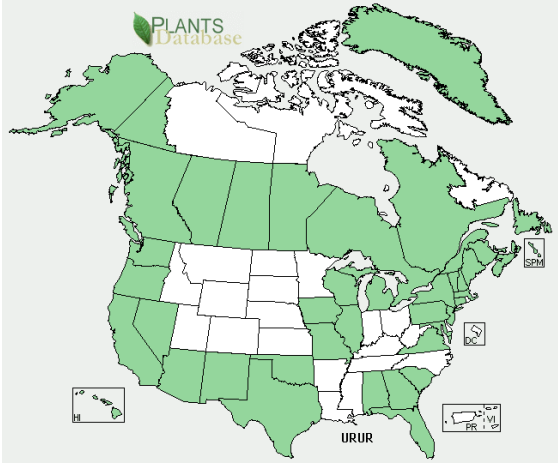
Birdsfoot trefoil *(Lotus corniculatus)*



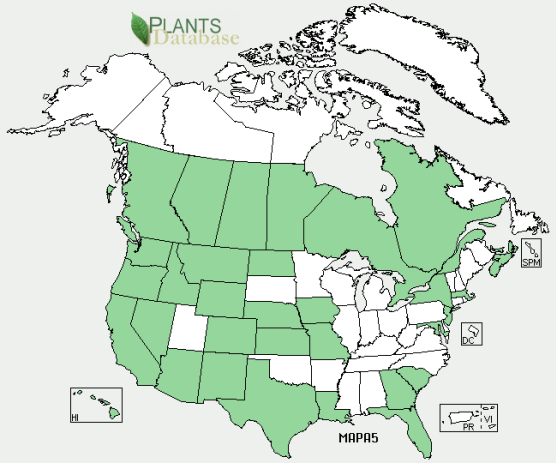
Bermudagrass *(Cynodon dactylon)*



Burning nettle *(Urtica uren)*

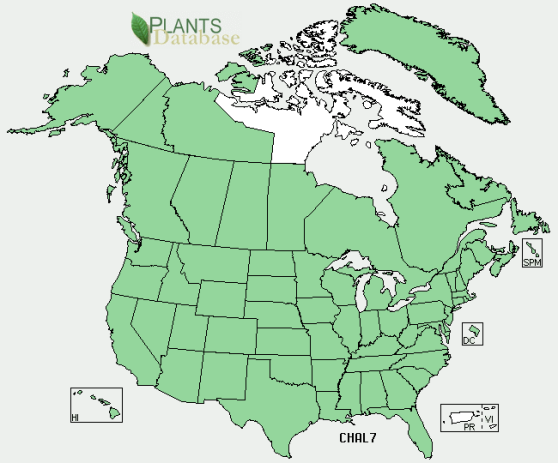


Cheeseweed *(Malva parviflora)*



Chinese foldwig *(Dicliptera chinensis)*

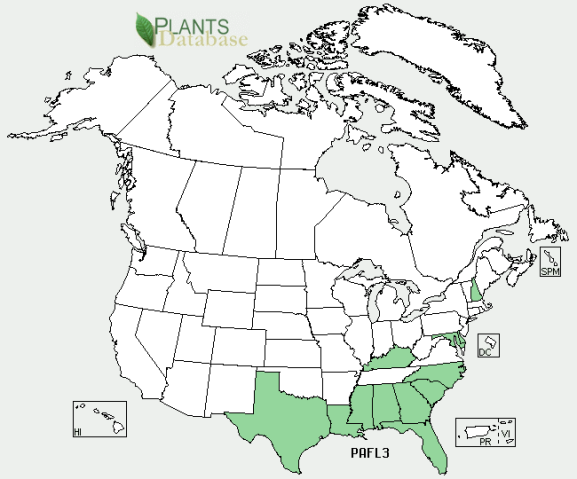
Common lambsquarters *(Chenopodium album)*



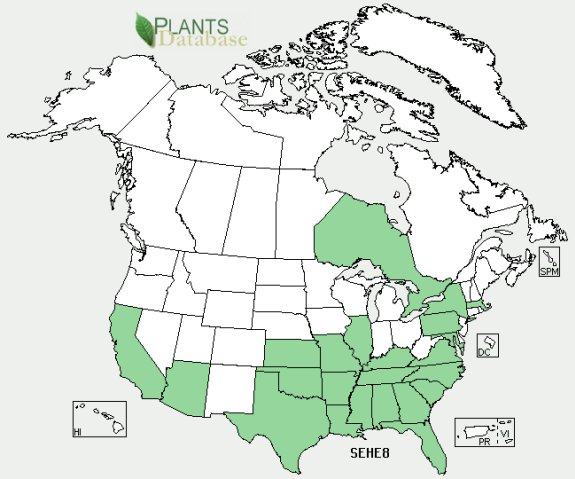
Field bindweed *(Convolvulus arvensis)*

Redstem filaree *(Erodium cicutarium)*

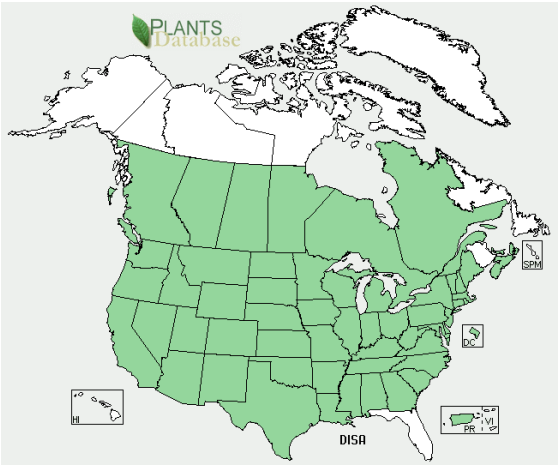
Florida pellitory *(Parietaria floridana)*



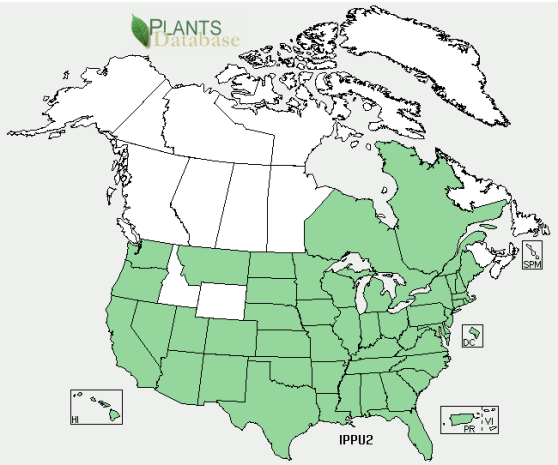
Hemp sesbania *(Sesbania exalta)*



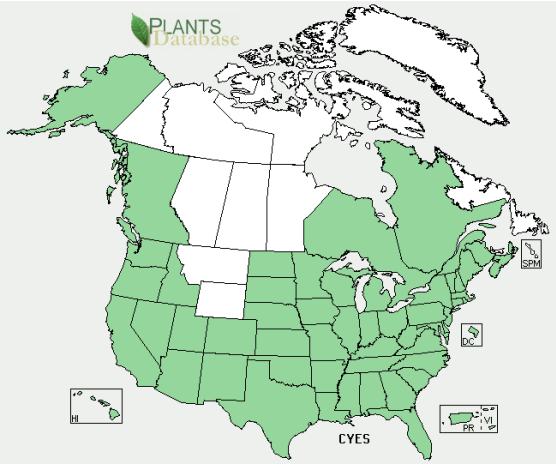
Large crabgrass *(Digitaria sanguinalis)*



Morning glory *(Ipomoea purpurea)*



Yellow nutsedge *(Cyperus esculentus)*



Oval-leaf false buttonweed *(Spermacoce latifolia)*

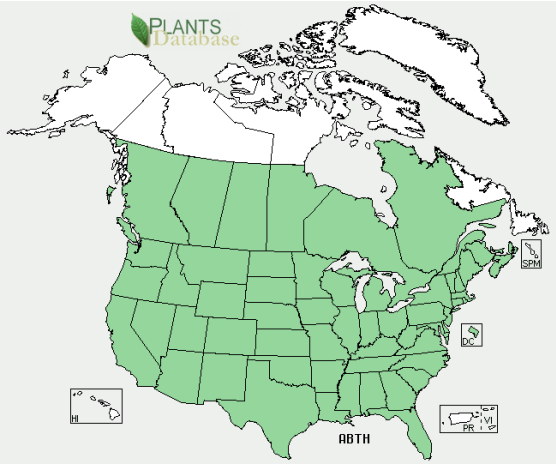
Pillpod sandmat *(Chamaesyce hirta)*

Purslane *(Portulaca oleracea)*

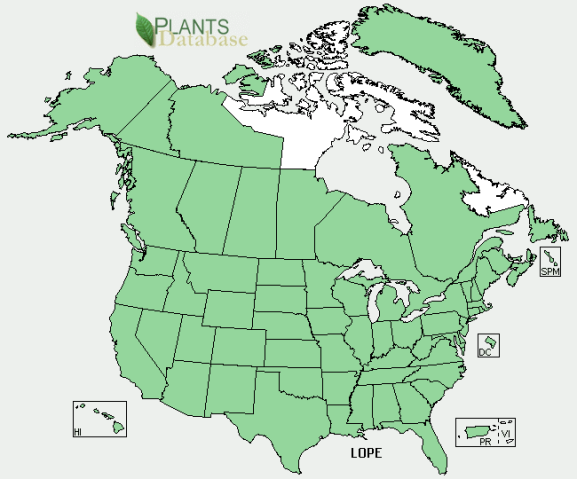
Tropical Mexican clover *(Richardia brasiliensis)*

Tropical spiderwort *(Commelina benghalensis)*

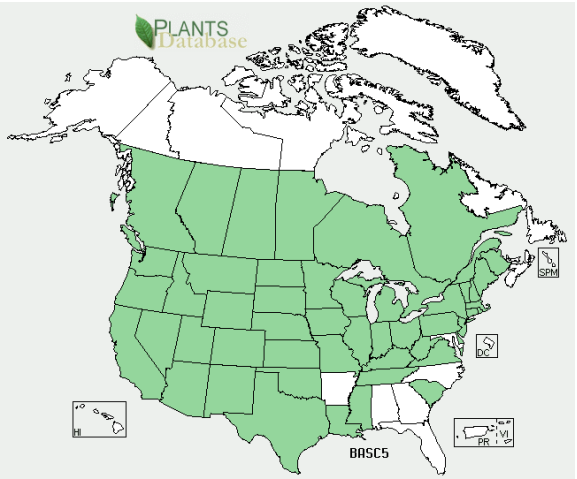
Velvet leaf *(Abutilon theophrasti)*



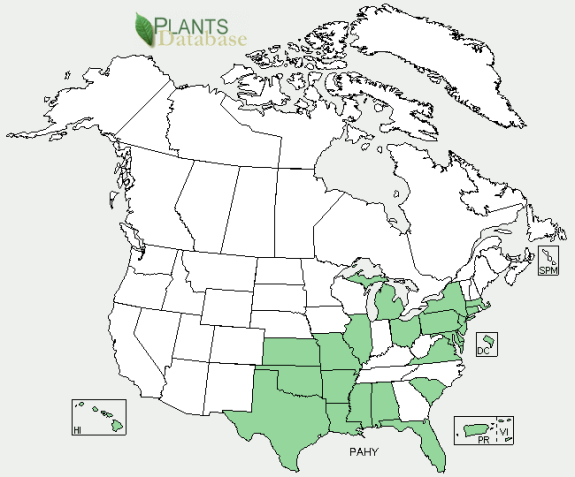
Perennial Ryegrass (*Lolium perenne)*



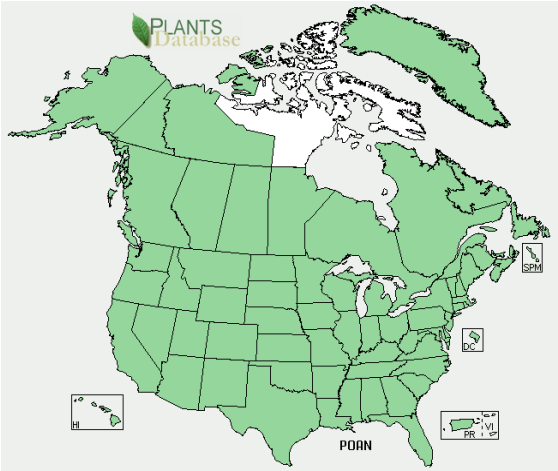
Kochia (*Kochia scoparia)*



Ragweed Parthenium *(Parthenium hysterophorus)*



Annual bluegrass *Poa annua)*



Liverseedgrass (*Urochloa panicoides)*

Sumatran Fleabane (*Conyza sumatrensis*)