An Inventory and Analysis of the Alien Plant Flora of New Mexico

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Abstract

I summarized published information on non-native vascular plants recorded as established in the wild in New Mexico. Alien plants numbered 390 species and one additional hybrid form, with 13 species being represented by two or three alien subspecies. Alien plant species comprised 1 family and species of fern, 50 families and 270 species of Dicotyledons, and 5 families and 119 species of Monocotyledons. The families with most alien species were Poaceae, with 112, Asteraceae, with 43, Brassicaceae, with 42, Fabaceae, with 22, and Chenopodiaceae, with 18. About 77.2 percent of alien species were of Eurasian origin, with 11.3 percent being from other parts of North America. Annual forbs, vines and grasses constituted 44.9 percent of the aliens, whereas trees and shrubs constituted 8.5 percent of alien species. Since publication of the first state flora, the number of alien plants has increased from 136 in 1915 to 390 in 2000. The pattern of increase has been exponential, with about 6.75 new aliens appearing per year since 1980. Many other alien plants are present in neighboring states, and the potential for additional invasions is great.

Introduction

New Mexico, with a vascular plant flora of about 3542 species in AD 2000, is experiencing invasions of alien plant species from several phytogeographic regions: the Chihuahuan and Sonoran desert regions to the south and west, the Colorado Plateau and Great Basin to the northwest, the Rocky Mountain region to the north, and the Great Plains to the east. Although New Mexico is somewhat remote from the points of introduction of alien plants from outside North America, many such species are now appearing. This review examines the known flora of alien plants in New Mexico, and traces the history of invasion from 1915, the data of publication of the first state flora, to 2000.

Methods

Information on the current presence of alien species was taken from Allred (2000), Carter (1997), and recent issues of The New Mexico Botanist. Data on the presence of alien plants at earlier dates were taken from Wooton and Standley (1915), Tidestrom and Kittell (1941), and Martin and Hutchins (1980/1981). Data on growth form, life history pattern, and native region were obtained from Martin and Hutchins (1980/1981), other regional floras, and the National Resource Conservations Service’s Plants Database (USDA-NRCS 2000). Plant nomenclature was based on Allred (2000) and Carter (1997), the latter for woody plants not included in the former. The current species total for New Mexico was obtained from the statistical summary given by Roalson and Allred (1995) plus species new to the state reported since then in The New Mexico Botanist.

Results

A total of 390 species plus one hybrid taxon were recognized as established aliens (Appendix I). Three additional species were characterized as cryptogenic species (Carlton 1996), that is, species of uncertain status because natural pre-European invasion might have occurred or because European settlers might have introduced these species before the first studies of the flora of North America. Three species of dicots and 10 of grasses were represented by 2 or 3 subspecies. Alien flora included 1 family and species of fern, 50 families and 270 species of Dicotyledons, and 5 families and 119 species of Monocotyledons. Seven families were represented by more than 10 species: Poaceae (112), Asteraceae (43), Brassicaceae (42), Fabaceae (22), Chenopodiaceae (18), Caryophyllaceae (12), and Polygonaceae (12).

(Continued on page 2, Aliens)
Since the total number of species known in New Mexico is now about 3,542, alien species make up about 11.0 percent of the state’s flora.

Species classified ascryptogenic include *Amaranthus hybridus* L., Slim Amaranth; *Limosella aquatica* L., Mudwort; and *Xanthium strumarium* var. *canadense* (Mill.) Torr., Cocksfootbur. These species, all widespread in Europe, were well established in eastern North America in the early 18th Century, and might have reached North America by natural or human-assisted dispersal.

Several species occasionally considered alien are omitted from the list because of recent analyses that establish them as native. These include several taxa of *Corispermum*, which Martin and Hutchins (1980/81) characterize as alien. Mosyakin (1996) has revised this group and determined our species to be native to North America.

New Mexican varieties of *Oxalis corniculata*, some North American forms of which are European exotics, are natives (Turner 1994). The New Mexican subspecies of *Calyptostegia sepium*, listed in some floras as a European import, is likewise native to western North America (Austin 1990).

The number of species of alien plants has increased by a factor of 2.88-fold since publication of the state’s first flora (Wooton and Standley 1915). In 1915, only 136 species of 32 families had been recorded, corresponding to 4.6 percent of the flora then known (2,975 species), or 4.1 percent of the flora known today. By 1942, no additional families of aliens had appeared, but the total number of alien species had increased to 181, a rate of increase of 1.67 species per year. Between 1942 and 1980, aliens belonging to 14 additional families had appeared, with total species increasing to 255, a rate of increase of 1.95 per year. Since 1980, 10 new families of aliens have appeared and 135 additional species have been recognized, a rate of increase of 6.75 per year. The number of alien species established in New Mexico has thus been increasing exponentially.

Most of the 24 families of aliens appearing since 1942 are now represented by only 1-2 species. Altogether, these families have contributed only 43 species to the current alien list. Two families however, have contributed more substantially: 5 species of the Rosaceae, all native to Europe or Eurasia, and 4 species of the Ranunculaceae, all from the Old World, have appeared in New Mexico’s alien flora since 1942.

Since 1915, the major families increasing most in relative number of species were the Brassicaceae (3.82-fold increase), Poaceae (3.61-fold increase), and Asteraceae (2.87-fold increase). These three families have contributed 55.1 percent (140 species) of the increase in number of alien species since 1915.

Annual forbs were the most frequent life form group among aliens, followed by perennial forbs, annual grasses and perennial grasses (Table 2). Annuals of all groups make up 44.9 percent of the present alien flora. Graminoids constitute 29.2 percent of the total alien flora.

From 1915 to 2000, the groups increasing most in relative species number were trees, which increased 6.67-fold, and shrubs, which increased 4.33-fold. Graminoids as a whole increased 3.56-fold, with annual grasses increasing 4.20-fold and perennial grasses 3.00-fold. Forbs increased only 2.44-fold.

Forbs and vines with variable life history patterns (i.e., annual/biennial, annual/perennial, or biennial/perennial) almost doubled in numbers between 1980 and 2000. The total number of vines and woody plants more than doubled during this same period.

About 77.2 percent of present alien plants are native to temperate Eurasia (Table 3). An additional 11.3 percent are native to the United States, Canada, and Mexico. The representation of temperate Eurasian species has declined somewhat since 1915, when it was about 83.8 percent. Species native to Africa and the Old World tropics have increased 6.33-fold; 13 of the 19 species from these areas are grasses. Since 1980, the numbers of alien species from other parts of North America have increased 2.44-fold.

**Discussion**

The alien component of the New Mexico flora, 11.0 percent, is only slightly greater than that estimated for the coterminous United States, 10.8 percent (Vitousek et al. 1997). The number of established alien plants in the coterminous United States, however, is estimated to be about 2,100 species. This number, together with the fact that northern Mexico and states adjacent to New Mexico possess many alien species that have not yet invaded New Mexico indicates that many additional invasions are certain to occur. In 1990, for example, Texas was estimated to possess 492 established alien plants, which equaled 9.9 percent of that state’s flora (Vitousek et al. 1997). Colorado, with a total flora of 3,088 taxa (species, subspecies, and varieties), has 492 alien taxa, which equal 15.9 percent of the flora (Weber and Wittman 1992). In both states, the absolute number of alien species is more than 100 greater than the number established in New Mexico. No statewide analysis is available for Arizona, but California has about 1,045 established alien plants, which make up 17.7 percent of the state flora (Randall et al. 1998). Many of California’s alien plants reach Arizona, so that Arizona probably has a substantially larger number of alien plant species than New Mexico.

The native regions of alien plants in New Mexico differ somewhat from those of eastern North America. In the central and northeastern United States and adjacent Canada, 87.9 percent of alien plants are of Eurasian origin, with only 4.3 percent coming from other parts of North America (Foy et al. 1983). In New Mexico, the representation of Eurasian species is 10.4 percent less, but the importance of exotics from elsewhere in North America is greater. This reflects the fact that New Mexico is located central to several diverse native floras, and to the fact that urban and agricultural development of the state have created environments favorable for invasion of many species from the more humid eastern part of the continent.

New Mexico also differs somewhat from areas of the Pacific Coast in the representation of alien plants from different regions. In California, roughly 65 percent of alien plants come from Eurasia (Randall et al. 1998). For New Mexico, the percentage of aliens from Eurasia is thus about 12.2 percent greater, with the bulk of these being of European origin. The greater isolation of California, compared to New Mexico, from the European source area of exotic plants probably accounts for this difference. About 5 percent of California’s exotics come from Australia and New Zealand, whereas less than 1 percent of New Mexico’s exotics come from this region. An additional 7 percent of California’s aliens come from southern Africa, compared to about 3.1 percent for New Mexico.

The large increase in alien woody plant species in New Mexico over the last 20 years of the 20th Century may be somewhat more apparent than real. Field botanists have often overlooked the early stages of establishment of many of these species in the wild, documenting them only when they appear far from areas of obvious planting (Jack L. Carter, Pers. Comm.). Nevertheless, these species represent one of our most serious ecological threats because of their tendency to invade native riparian ecosystems.

The abundance of alien plant species in bordering states means that New Mexico is poised to receive many new invaders in coming years. Indeed, the current rate of increase in alien species suggests that at least 6 to 7 species are likely to appear per year in the immediate future. This likelihood argues for establishment of an early detection and eradication program for alien invaders in New Mexico.

(Continued on page 3, Aliens)
### Acknowledgements

I thank Kelly Allred, Jack Carter, Joe Duft, Roger Peterson, and Robert Sivinski for comments on drafts of the species list. I also thank Ellen Bauder and Joe DiTomasso for information on certain plants. William Weber provided information on the representation of alien plants in Colorado.

### Literature Cited


### Table 1. The number of families and species of alien plants in the New Mexico flora from 1915 through 2000.

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<td>32</td>
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|                |      |      |      |      |
| **Species**    | 136  | 181  | 255  | 390  |

### Acknowledgements

I thank Kelly Allred, Jack Carter, Joe Duft, Roger Peterson, and Robert Sivinski for comments on drafts of the species list. I also thank Ellen Bauder and Joe DiTomasso for information on certain plants. William Weber provided information on the representation of alien plants in Colorado.

### Literature Cited


### Table 2. The number of alien species of different life forms in the New Mexico flora from 1915 through 2000.

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<td>181</td>
<td>255</td>
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### Table 3. The number of alien species of different geographical origins in the New Mexico flora from 1915 through 2000.

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<td>181</td>
<td>255</td>
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(Continued on page 4, Aliens)
Appendix I. Alien plants known to be established in New Mexico (December 2000).

Ferns and Allies
Salviniaceae  
Salvinia minima Baker, Water Spangles

Angiosperms: Dicotyledoneae
Aceraceae  
Acer saccharinum L., silver maple
Amaranthaceae  
Amaranthus abus L., prostrate pigweed
Amaranthus caudatus L., love-lies-bleeding
Amaranthus cruentus L., red amaranth
Amaranthus hypochondriacus L., Prince-of-Wales feather
Amaranthus retroflexus L., redroot amaranth
Amaranthus viridis L., slender amaranth

Apiaceae  
Apium graveolens L., wild celery
Apium leptophyllum (Pers.) Sprague ex Britt. & Wilson, marsh parsley
Carum carvi L., caraway
Conium maculatum L., poison hemlock
Coriandrum sativum L., coriander
Daucus carota L., Queen Anne’s lace
Foeniculum vulgare Mill., fennel
Levisticum L., wild celery
Pastinaca sativa L., wild parsnip

Asteraceae  
Acroptilon repens(L.) DC., Russian knapweed
Anthemis cotula L., camomile
Arctium minus (Hill) Bernh., burdock
Artemisia biennis Willd. var. biennis, biennial wormwood
Calycopsis vialis Less., straggler daisy
Carduus acanthoides L., spiny plumeless thistle
Carduus nutans L., mug thistle
Carduus tinctorius L., safflower
Centauraea calcitrapa L., purple starthistle
Centaurea diffusa Lam., diffuse knapweed
Centaurea maculosa Lam., spotted knapweed
Centaurea melitensis L., Malta starthistle
Centaurea solstitialis L., yellow starthistle
Chrysanthemum leucanthemum L., oxeye daisy
Chichorium intybus L., chicory
Cirsium arvense (L.) Scop., Canada thistle
Cirsium vulgare (Savi) T. ten., bull thistle
Conyza bonariensis (L.) Cronq., asthmaweed
Conyza ramosissima Cronq., dwarf horseweed
Cosmos bipinnatus Cav., garden cosmos
Cotula australis (Sieber) Hook. f., Australian waterbuttons
Eclipta prostrata (L.) L., false daisy
Erigeron annuus (L.) Pers., annual daisy
Galinsoga parviflora Cav., gallant-soldier
Hedyphnos cretica (L.) Willd., crenate weed
Hyoscyamus radicata Cav., hairy catsear
Lactuca serriola L. var. integriifolia Boeghen., prickly lettuce
Lactuca serriola L var. serriola, prickly lettuce
Onopordum acanthum L., Scotch thistle
Pentzia incana (Thunb.) O. Kuntze, African sheepbush
Scorzoner a lucinata L., cutleaf vipergrass
Senecio vulgaris L., common groundsel
Silybum marianum L., blessed milkthistle
Sonchus arvensis L., field sowthistle
Sonchus asper (L.) Hill, spiny-leaved sowthistle
Sonchus oleraceus L., common sowthistle
Tanacetum vulgare L., common tansy
Taraxacum laevigatum (Willd.) DC., red-seeded dandelion
Taraxacum officinale Weber, common dandelion
Tragopogon dubius Scop., yellow salsify
Tragopogon porrifolius L., salsify
Tragopogon pratenus L., meadow goatsbeard
Vernonia noveboracensis (L.) Michx., New York ironweed
Xanthium spinosum L., cocklebur

Bignoniaceae  
Catalpa speciosa Warder, northern catalpa

Brassicaceae  
Alyssum desertorum Stapf., desert mouse-ear
Alyssum fulgens (L.) Rothm., alpine mouse-ear
Berteroa incana (L.) DC., hoary false mustard
Barbarea vulgaris R. Br., common wintercress
Brassica juncea (L.) Cosso n., India mustard
Brassica napus L., turnip
Brassica rapa L., field mustard
Brassica tournefortii Gouan, Asian mustard
Camelina microcarpa Andr., littlepod false flax
Camelina sativa (L.) Crantz, gold-of-pleasure
Capsella bursa-pastoris (L.) Medic., shepherd’s purse
Cardamine hirsuta L., hairy bittercress
Cardaria draba (L.) Desv., hoary cress
Cardaria chalupensis (L.) Handel-Mazzetti, lenspod whitetop
Chorispora tenella (Pall.) DC., crossflower
Corydinaea orientalis (L.) Dumort., hare’s ear mustard
Coronopus didymus (L.) I. E. Smith, lesser swinecress
Descurainia sophia (L.) Webb, chickweed
Diplotaxis muralis (L.) DC., wall wallflower
Diplotaxis tenuifolia (L.) DC., perennial wallflower
Eruca vesicaria (L.) Cav., rocketsalad
Erysimum repandum L., spreading wallflower
Euphorbia palustris Cav., garden cosmos
Hesperis matronalis L., dame’s rocket
Iberis umbellata L., globe candytuft
Isatis tinctoria L., dyer’s woad
Lobularia maritima (L.) Desv., sweet alpine
Lepidium campestre (L.) DC., field pepperweed
Lepidium latifolium L., perennial pepperweed
Lepidium perfoliatum L., clamping pepperweed
Malcolmi a africana (L.) R. Br., African mustard
Matthioli bicornis DC., night scented stock
Nasturtium officinale R. Br., watercress
Raphanus sativar L., radish
Rapistrum rugosum (L.) Allioni, annual bastardcabbage
Rorippa microphylla (Boech. ex Reichenb.) Hyland ex Löve & Löve, erow yellowcress
Sinapis alba L., white mustard
Sinapis arvensis L., charlock mustard
Sisymbrium althaeos (L.) tall timothy mustard
Sisymbrium irio (L.) London rocket
Sisymbrium loeselli L., small timothy weed mustard
Sisymbrium officinale (L.) Scop. L., hemlock mustard
Thlaspi arvense L., pennygrass

Botany is the natural science that transmits the knowledge of plants.
— L. innes
Coronilla varia
Caragana arborescens
Fabaceae

Elaeagnus angustifolia
Dipsacus fullonum L.
Civitulaceae

Citrullus vulgaris
Cucurbitaceae

Chenopodiaceae

Silene latifolia
Caryophyllaceae

Lathyrus latifolius

Euphorbia peplus
Elaeagnus angustifolia
Dipsacus fullonum

Mormordica balsamina
Citrullus vulgaris
Ipomoea purpurea
Ipomoea hederacea
Convolvulus arvensis
Hypericum perforatum
Teloxys botrys
Teloxys ambrosioides
Salsola tragus
Salsola paulsenii
Salsola collina
Kochia scoparia
Halogeton glomeratus
Chenopodium paganum
Chenopodium hircinum
Bassia hyssopifolia
Atriplex semibaccata
Atriplex rosea
Atriplex hortensis
Vaccaria
Spergularia media
Silene noctiflora
Saponaria officinalis
Dianthus armeria
Cerastium vulgatum
Arenaria serpylliifolia
Agrostemma githago
Lonicera tatarica
Lonicera morrowii
Lonicera japonica
Campanula rapunculoides
L., rampion bellflower

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Angiosperms: Monocotyledoneae

Cyperaceae

Cyperus esculentus L., cluffa flateadge
Cyperus rotundus L., nutgrass

Hydrocharitaceae

Egeria densa Planch, Brazilian waterweed

Liliaceae

Asparagus officinalis L., garden asparagus
Asphodelus fistulosus L., onionweed
Muscaria neglectum Guss. ex Ten., starch grape hyacinth

Poaceae

Aegilops cylindrica Host, jointed goatchgrass
Agropyron cristatum (L.) Gaertn. ssp. cristatum, crested wheatgrass
Agropyron cristatum (L.) Gaertn. ssp. desertorum (Fisch. ex Link) Löve, crested wheatgrass
Agropyron cristatum (L.) Gaertn. ssp. fragile (Roth) Löve, crested wheatgrass

Agrostis gigantea Roth, redtop
Agrostis stolonifera L., creeping bentgrass
Aira elegans Willd. ex Guad., annual silver hairgrass
Alopecurus geniculatus L., water foxtail
Alopecurus myosuroides Huds., foxtail
Alopecurus pratensis L., meadow foxtail
Anthoxanthum odoratum L., little vernalgrass
Apera iiportu L. Beauv., apéra
Aristida setacea Michx., oldfield theaceawn
Arrhenatherum elatius (L.) J. & C. Presl, tall oatgrass
Arundo donax L., giant reed
Avena barbata Pott ex Link, slender oat
Avena fatua L. var. fatua, wild oat
Avena fatua L. var. sativus (L.) Hausskn., wild oat
Bothriochloa bladhii (Retz.) S. T. Blake, Australian bluestem
Bothriochloa ischaemum (L.) Keng var. ischaemum, yellow bluestem
Bothriochloa ischaemum (L.) Keng var. songarica (Rupr.) Celerier & Harlan, King Ranch bluestem
Briza minor L., little quakinggrass
Bromus brizaeformis Fisch. & Mey., rattlesnake chess
Bromus catharticus Vahl, rescuegrass
Bromus diandrus Roth, ripgut brome
Bromus hordeaceus L., soft brome
Bromus inermis Leyss., smooth brome
Bromus japonicus Thunb. ex Murray, Japanese brome
Bromus rubens L., foxtail brome
Bromus secalinus L., rye chess
Bromus sterilis L., poverty brome
Bromus tectorum L., cheatgrass

Catanopodium rigidum (L.) C. E. Hubb., fergnass
Cenchrus echinatus L., southern sandbur
Chloris submucosa Kunth, Mexican windmillgrass

Chloris virgata Sw., showy windmillgrass
Cydonon dactylon L., Bermuda grass
Dactylis glomerata L., orchardgrass
Dactylolentum aegypticum (L.) Wild., crowfootgrass
Deschampsia cespitosa (Trin.) Munro, annual hairgrass

Digitaria ciliata (Retz.) Koel., southern crabgrass
Digitaria eriantha Steudel, pangola grass
Digitaria ischaemum (Schreb.) Schult., hairy crabgrass
Digitaria sanguinalis (L.) Scop., hairy crabgrass

Echinochloa colona (L.) Link, junglerice
Echinochloa crus-galli (L.) Beauv., barnyardgrass
Echinochloa crus-pavonis (Kunth) Schult. barnyardgrass

Eleusine indica (L.) Gaertn., goosegrass
Elymus elongatus (Host) R. Runem. ssp. elongatus, tall wheatgrass
Elymus elongatus (Host) R. Runem. ssp. pungicus (Podp.) Melderis, tall wheatgrass
Elymus hirsutus (Opiz) Melderis ssp. hirsutus, intermediate wheatgrass
Elymus hirsutus (Opiz) Melderis ssp. barbata (Schur), pubescent wheatgrass
Elymus repens (L.) Gould, quackgrass

Eragrostis barbieri D. C. Beauv., Mediterranean lovegrass

(Continued on page 7, Aliens)
What's In A Name?

It’s helpful and even satisfying for us to know the meaning of the scientific names of New Mexico plants. We delight in knowing that Iris means rainbow (Greek), commemorate the great Sweedish naturalist with Linnaea (Latin), nod knowingly with Dracoccephalum (dragon’s head, Greek), scratch our heads a bit over Gaura, meaning superb (Greek), and take comfort that Alyssum (without madness, Greek) was recommended as a cure for rabies. But not all generic names are so meaningful. It is perfectly acceptable and within the rules to rearrange the letters of a closely related genus to arrive at a new name. Thus we have Sibara from Arabis (Cruciferae), Sartidia from Aristida (Gramineae), Litrisia from Liatris (Compositae), Milula from Allium (Liliaceae), and Leymus from Elymus (Gramineae). Some untapped anagrams for future botanists are Spoilage from Aegilops, Precis from Crepis, Acid-rio from Dicoria, Septic from Pectis, Altercate from Tetraclea, and Ada-sue from Suaeda.
Alien plants more closely related to the native community could attract more herbivores, but on the other hand, they could also draw more predators and mutualists. The success of the alien plant in the new range would thus depend on the strength of each interaction. Another aspect related to phylogenetic distance is heterospecific pollination: the fruit and seed set of a plant can be negatively influenced by the presence of heterospecific pollen depending on the relatedness of the other species. Thus, an alien plant could both be affected negatively by the native community or be hampered by it.