

Montana Wetland Index of Alien Impact (IAI)

Prepared for:

U.S. Environmental Protection Agency

Prepared by:

Camie Westfall and Linda Vance

Montana Natural Heritage Program

a cooperative program of the
Montana State Library and the University of Montana

June 2017



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Agreement Number:

CD-95815401

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This document should be cited as follows:

Westfall, C. and L. Vance. 2017. Montana Wetland Index of Alien Impact (IAI). Report to the U.S. Environmental Protection Agency. Montana Natural Heritage Program, Helena, MT. 93 pp.

Executive Summary

This report summarizes the results of an effort to numerically assess and rank 61 invasive species that occur in Montana and provide a way to calculate their current and future potential threat to wetlands. In the majority of wetland assessment protocols currently used, the presence and percent cover of exotic invasive species is considered an indicator of wetland ecological integrity. However, potential impacts of individual invasives are not usually evaluated, even though particular species, alone or in combination, may have a greater potential impact on ecosystem integrity.

We began by developing Invasibility scores (I_i). We selected 61 plant species that are exotic to Montana, based on: 1) common exotic species that we find during wetland assessments, 2) the 2016 USDA Montana Noxious Weed List, and 3) exotic species that were ranked in a study by Magee et al. (2010). Individual species assessments were based on presence or absence of 24 traits spread among three categories: 1) life history traits, 2) establishment and tolerance traits, and 3) ecosystem alteration traits; the latter are weighted values. Presence or absence rankings were based on findings from primary literature, technical reports and databases, and verified observations by a botanist familiar with Montana wetlands. These assessments were the basis for Invasibility scores (I_i), which provide a numeric value for exotic species, where a score of 0 represents a low threat or non-invader and 100 indicates a high threat and extremely aggressive invader. Of the 61 species assessed, scores ranged from 6 to 97. Plants that score between 0-15 are considered weak invaders, 16-25 are moderate invaders, 26-35 are strong invaders, 36-50 are aggressive invaders, and 51-100 are extremely aggressive invaders. For quality assurance, we compared scores to California Invasive Plant Council (IPC) ranks and Nature Serve ranks. We also had trait attributes reviewed by a botanist who is familiar with the species. The equation to calculate the Invasibility (I_i) scores can be easily adjusted as new information becomes available about individual exotic species.

At the site or assessment area level, individual Invasibility scores may be combined into an Index of Alien Impact (IAI) to provide insight into the collective potential impact of the alien species that are present. To evaluate the utility of the IAI, we used the equation developed by Magee et al. (2010) to calculate index scores for 16 wetland sites from the Blackfoot-Swan sub-basin in western Montana. We compared several elements of their Ecological Integrity Assessment (EIA) scores to the Index of Alien Impact (IAI) scores. In particular, we compared 1) mean coefficient of conservatism (mean C), 2) Floristic Quality Integrity (FQI) scores, and 3) assessment area overall stressor scores. IAI scores below 3.0 resulted in what we found to be low risk wetlands, scores between 3.0 and 3.5 were considered moderately disturbed wetlands, and scores above 3.6 were heavily degraded or at-risk wetlands. Of the 16 sites assessed, the IAI scores ranged from 2.7-3.88, with four sites falling into the low risk category, seven sites in the moderately disturbed category, and five sites in the heavily degraded category.

In general, we found a good correlation between IAI and Ecological Integrity Assessment metric scores for poor and degraded sites. There was some correlation between IAI and Floristic Quality Integrity (FQI) scores for degraded sites. There was no correlation for IAI and FQAI scores for the less degraded, more pristine sites, suggesting that the IAI is not redundant when compared to the FQA. We found no significant correlation between IAI and combined stressor scores for the assessment areas. Overall, we believe a larger sample size is needed to successfully assess the merit of correlations between IAI and EIA metric scores.

We conclude that the IAI is useful because it shows how exotic species are currently affecting a wetland site and how they will continue to affect it in the future, and can be used to alert land managers to sites where vegetation treatment may be advisable. The simple calculations are easy to use and can be utilized soon after species are identified in the assessment area and percent cover calculations are made. The Index of Alien Impact (IAI) is a valuable addition to the Ecological Integrity Assessment (EIA) framework, offering additional information about future trends for sites where exotic invasion has occurred.

Acknowledgments

This project was funded by a U.S. Environmental Protection Agency Region 8 Wetland Program Development Grant. We would like to thank Cynthia Gonzales and Jim Berkley for continued support and commitment to wetland assessment and monitoring in Region 8. Gratitude and thanks to Dr. Teresa Magee for creating a model index for assessing the impact of alien species during her work in the John Day River Basin in eastern Oregon. Teresa Magee was very helpful and supportive in answering our many questions on how to recreate this undertaking for Montana wetlands. Thanks to Dr. Jane Horton who provided support for this project as well as insightful botanical comments on the invasive species we ranked. Appreciation is given to all those who spend long days sampling wetlands in the previous field seasons to provide the data used for this project. Special thanks to Melissa Hart who provided expert suggestions as well as formatting and editing revisions on this report.

Any errors or omissions are entirely the responsibility of the authors.

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Introduction

Human land use activities often promote the establishment and spread of non-native species, both directly (e.g., the planting of non-native species for windbreaks, erosion control, or as forage crops) and indirectly (e.g., by creating bare soil surfaces that favor pioneer species). Nevertheless, not all non-native species are equal. Some early successional species will eventually be crowded out by natives, while other, more tenacious species alter ecosystems to the degree that natives cannot compete. In most vegetation-based wetland assessment protocols, the presence and cover of non-native species is considered as an indicator of wetland ecological integrity. However, individual non-natives are not generally ranked or evaluated based on their potential to degrade the system's integrity.

Magee and others (2010) addressed this omission by creating an Invasiveness-Impact (I_i) score to gauge the threat posed by individual non-native species at a given assessment site. Scores were based on a suite of factors including life history traits, establishment and tolerance characteristics, and the tendency to alter ecosystems (Table 1). Although many of the species ranked by Magee et al. in Oregon also occur in Montana, there are some underlying differences in environmental variables that make those species more or less invasive here. At the same time, there are non-native species in Montana that were not found in the Magee et al. study area. Therefore, we decided to adapt the Magee et al. approach to better reflect conditions in Montana, and to include rankings for the species typically encountered here, thus creating a *Montana Index of Alien Impact* that can be used as part of a broader assessment of wetland ecological integrity.

Methods

Calculating Invasiveness Scores

We evaluated a total of 61 species. These species include those that are 1) most commonly recorded in our wetland assessments; 2) found on the USDA Montana noxious weed list, or 3) ranked as aggressive or extremely aggressive in the Magee et al. study *and* present in Montana. Our focus was on alien species that can affect Montana wetlands, and all evaluations of invasiveness were based on a given species' behavior in wetlands and riparian areas. ¹

¹ We did not evaluate obligate upland or obligate aquatic plants that have not been found in our wetland assessments. While we think that this would be a worthwhile effort, it was beyond the scope of this study.

The species included in the Montana noxious weed list are defined as “plants of foreign origin that can directly or indirectly injure agriculture, navigation, fish or wildlife, or public health” (Carpenedo and Saul 2012). These fall into five categories. Priority 1A are weeds that are not present in Montana, but

Table 1. I_j score trait descriptions as developed by Magee et al. (2010). In Magee’s paper, the “Establishment and tolerance” traits are called “Ecological amplitude”. We selected “Establishment and tolerance” as a more user-friendly title for the traits within this category. We did not alter the individual trait titles or their descriptions in any of the trait categories.

Life History (n = 9)	Establishment and tolerance (n = 8)	Ecosystem alteration (n =7)
Strongly clonal —perennials able to spread aggressively via features such as rhizomes, tillers, or stolons	Drought tolerant —described as drought or xeric adapted, growing in dry soil or in rangeland habitat; or growing where annual precipitation > 50 cm	Alters hydrology —changes flooding patterns; raises or lowers water table or surface water levels; changes seasonal availability of water in rooting zone
Large propagule crop —1,000 seeds/plant or 1,000 seeds/m ² , classified as prolific or high seed producers	Wide moisture regime —described as growing in conditions that range from xeric to saturated, xeric to mesic, or mesic to saturated	Alters nutrient cycling —depletes or adds nutrients, alters nutrient cycling patterns
Small seeds/fruits — ≤ 5 mm in longest Dimension	Flooding/saturation tolerant —described as growing in wet conditions, or adapted to intermittent flooding	Alters fire regime —increases or decreases fire frequency, intensity, or fire type; changes fuel-loading patterns
Wind dispersal —presence of specialized structures or traits that facilitate movement in wind, and observation of movement in wind	Wide nutrient or soil texture ranges —described as growing on a wide range of soil types, or across low to high nutrient ranges	Alters soil stability —either facilitates erosion or enhances stability
Animal dispersal —presence of specialized structures or traits that facilitate attachment, survives consumption and excretion by animals	Wide light regime —described as shade tolerant or able to grow under multiple light conditions, e.g., from bright sun to partial or deep shade	Excretes salts or toxins —produces salts or toxins that are known or suspected to alter soil chemistry or act as allelopathic compounds
Water dispersal —observation of floating or long distance water dispersal or seed or plant fragments	Alkaline or saline tolerant —documented as salt tolerant, or growing in alkaline soils, saline soils, or coastal habitats	Forms monocultures or near-monocultures — forms dense patches, excludes other species
Specialized dispersal —unique dispersal traits such as explosive dehiscence, tumbling of seed laden dead plants	Grazing tolerant or increaser —documented as resilient to direct grazing impacts; increases with grazing due to low palatability, to toxicity, or release from competition	Invades in absence of human disturbance — able to establish and spread into relatively intact natural vegetation
Dispersal over time —Persistent seed bank, long seed life, staggered germination, staggered dispersal from inflorescence	Grazing tolerant or increaser —documented as resilient to direct grazing impacts; increases with grazing due to low palatability, to toxicity, or release from competition	Invades in absence of human disturbance — able to establish and spread into relatively intact natural vegetation
Plasticity —high morphological, phenological, or genetic variability	Increases post-fire —able to expand aerial coverage and biomass following fire events	

if detected, immediate eradication, education and prevention of spread will be necessary. Priority 1B are weeds that have limited presence in Montana and require eradication or containment and education. Priority 2A are weeds that are common in isolated areas of Montana, and require eradication and containment where less abundant. Priority 2B are weeds that are abundant or widespread in many counties, with a management prescription for eradication or containment where less abundant. Finally, Priority 3 are regulated plants that are not officially on the designated Montana noxious weed list, but have the potential to have significant negative impacts. For Priority 3 weeds, research, education, and prevention are necessary to minimize spread (Carpenedo and Saul 2012).

We calculated the I_i scores for each plant using the equation developed by Magee et al. This equation is easy to use and allows for simple, clear scoring output that may be altered when new information (from field studies or the literature) becomes available. Traits receive a score of one (1) if they are present and a score of zero (0) if they are absent. The total maximum number of traits is 66. The end I_i score is calculated as a percentage of the possible total and ranges from 0 to 100. A higher I_i score for a species implies its greater potential impact compared to a species with a lower I_i score. All presence and absence scores are based on findings from peer reviewed published literature and from documented and verified observations of the species by botanists and ecologists familiar with Montana wetlands.

Ecosystem alteration traits are weighted (squared) because there is substantial evidence that “alien species that alter ecosystem processes are likely to have greater ecological impact” overall (Magee et al. 2010, p. 763). By squaring the ecosystem alteration traits, there was a stronger separation and distinction of alien species in their rankings at all levels.

$$I_i = \frac{\sum_{i=1}^{a=9} \text{life history} + \sum_{j=1}^{b=8} \text{eco amplitude} + \left(\sum_{k=1}^{c=7} \text{eco alteration} \right)^2}{\text{trait max}} \times 100$$

As part of our quality assurance checks, we compared the calculated I_i scores to two similar invasibility metrics from California Invasive Plant Council (CIPC) scores² and NatureServe Impact Ranks (Morse et al. 2004). We saw adequate correlation between our I_i scores and the rankings used by larger national and state organizations. Trait attributions and calculated I_i scores were also reviewed by a botanist familiar with invasive plants who had not been involved in earlier stages of the project. Finally, numeric scores were translated to categorical scores as follows: Weak = 0-15, Moderate = 16-25, Strong = 26-35, Aggressive = 36-50, Extreme = 51-100.

² Citations for the CIPC scores accompany individual plant species descriptions.

The Index of Alien Impact

Invasiveness scores operate at the species level. At the site or assessment area level, these may be combined into an Index of Alien Impact (IAI) to provide insight into the collective potential impact of the alien species that are present. We used the equation developed by Magee et al. (2010) to calculate IAI for a selection of wetlands that have had full Level 3 assessments performed in recent years.

IAI is calculated as:

$$IAI = \log_{10} \left(\sum_{i=1}^p (I_i^2 * F_i) \right)$$

where I = Invasiveness Impact Score (0-100), F = Frequency of an alien species or occurrence/sample units (0-1), i = *i*th alien species, and p = number of alien species. The sum of the products ($I_i^2 * F_i$) for each alien species estimates the combined potential impact of all aliens present in the area of interest.

By combining individual alien I_i scores for all alien species present at each site, along with frequency of occurrence, the Index of Alien Impact creates a holistic impact score. It also has the advantage of being transferable across states. Although it was designed for assessing riparian systems in the John Day River basin, it can be used in any other basin or state, so long as the individual species ratings have been recalculated as necessary to reflect local conditions, and local species have been added.

Comparison with the Floristic Quality Assessment Index

The Floristic Quality Assessment Index (FQI) captures current condition at a given wetland site based on intensive sampling of vegetation. It typically accounts for the presence of both native and exotic species, as well as individual plant species' tolerance of disturbance (Cronk and Fennessy 2001, Miller and Wardrop 2006). To calculate the FQI, coefficients of conservatism (C-values) are assigned to taxa identified to species based on published data, expert opinion, and local records. These C-values represent the relative tolerance of a species to disturbance, ranging from 0 to 10 (after Andreas et al. 2004). Native species that exhibit high degrees of ecological specificity and sensitivity to disturbance have C-values of 9-10. Native species that are typical of well-established communities that have undergone minimal disturbance have C-values of 6-8. Native species that have some degree of habitat specificity but can tolerate moderate disturbance have C-values of 3-5. Widespread native species that occur in a variety of communities and are common in disturbed sites have values of 1-2. Finally, exotic species were assigned C-values of 0. C-values were recently assigned to most Montana wetland species by the Montana Natural Heritage Program (Pipp 2016).

The IAI is intended to predict trends, and to alert land managers to wetlands where vegetation treatment may be advisable. In disturbed wetlands, the FQI serves a similar function. Because the two indices have a similar function, and because the presence and frequency of exotic species contributes to FQI scores, we wanted to evaluate whether there is correlation between the two, and if so, if that correlation makes the IAI redundant.

To achieve this, we compared IAI and FQI scores for a suite of wetlands that were sampled during a probabilistic assessment of wetland condition in the Blackfoot-Swan subbasin of western Montana (Hart et al. 2015).

Results

Of the 61 species we evaluated for invasiveness, 18 were ranked as extremely aggressive, 19 as aggressive, 11 as strong, 9 as moderate and 4 as weak. Table 2 shows the scores and ranks of individual species. Detailed ranking information for all 61 species can be found in the Species Descriptions section.

Of the extremely aggressive and aggressive invaders, one has not been reported in Montana (Yellow starthistle, *Centaurea solstitialis*) and six are considered to be isolated occurrences. However, some of the most aggressive species, notably leafy spurge (*Euphorbia esula*) spotted knapweed (*Centaurea stoebe*), cheatgrass (*Bromus tectorum*), Canada thistle (*Cirsium arvense*), yellow sweetclover (*Melilotus officinalis*) and common hound's-tongue (*Cynoglossum officinale*) are widespread throughout the state, while others are locally common in specific geographic regions (e.g., Russian olive, *Elaeagnus angustifolia*, along large rivers in the eastern part of the state).

We calculated an Index of Alien Impact for 16 sites that were assessed as part of the Blackfoot-Swan project (Hart et al. 2015), and compared these with the FQI scores for the same sites using graphical correlations.³ We assumed that IAI scores of 3.6 and above indicate degraded/at risk wetlands, scores between 3.0-3.5 indicate moderate disturbance and risk wetlands, and scores 3.0 and below indicate high quality/low risk wetlands. For these purposes, we considered FQI scores below 20 to reflect poor quality wetlands; scores between 21-27, moderate quality wetlands; and scores above 28, high quality or natural sites. We also looked at disturbance metrics collected during the assessment. The following figures display how Index of Alien Impact (IAI) scores are related to EIA Floristic Quality Assessment Index (FQI) scores and EIA disturbance metrics for wetlands sampled in the Blackfoot-Swan River systems in 2013-2014.

³ Although there were Level 3 assessments for 24 sites in that study, only 16 of the sites had invasive species present in a quantity sufficient to calculate the IAI. Because of the low statistical power associated with such a small sample, we opted for graphical rather than numeric association. In future analyses, we intend to use robust statistical approaches.

Table 2. The 61 invasive species assessed in order of I_i score.

	Scientific Name	Common Name	MT Noxious Weed List 2017	I_i Score	Rating
1	<i>Euphorbia esula</i>	leafy spurge	Priority 2B	97	Extreme
2	<i>Tamarix ramosissima</i>	salt-cedar	Priority 2B	95	Extreme
3	<i>Cytisus scoparius</i>	Scotch broom	Priority 1B	94	Extreme
4	<i>Centaurea stoebe</i>	spotted knapweed	Priority 2B	92	Extreme
5	<i>Lythrum salicaria</i>	purple loosestrife	Priority 1B	77	Extreme
6	<i>Polygonum sachalinense</i>	giant knotweed	Priority 1B	77	Extreme
7	<i>Polygonum x bohemicum</i>	Bohemian knotweed	Priority 1B	77	Extreme
8	<i>Tanacetum vulgare</i>	common tansy	Priority 2B	76	Extreme
9	<i>Lepidium latifolium</i>	perennial pepperweed	Priority 2A	73	Extreme
10	<i>Centaurea diffusa</i>	diffuse knapweed	Priority 2B	71	Extreme
11	<i>Elaeagnus angustifolia</i>	Russian olive	MT Regulated	71	Extreme
12	<i>Bromus tectorum</i>	cheatgrass	MT Regulated	68	Extreme
13	<i>Centaurea solstitialis</i>	yellow starthistle	Priority 1A	68	Extreme
14	<i>Cirsium arvense</i>	Canada thistle	Priority 2B	61	Extreme
15	<i>Melilotus officinalis</i>	yellow sweetclover		61	Extreme
16	<i>Lepidium draba</i>	whitetop	Priority 2B	56	Extreme
17	<i>Lepidium chalepense</i>	lenspod whitetop	Priority 2B	55	Extreme
18	<i>Cynoglossum officinale</i>	common hound's tongue	Priority 2B	52	Extreme
19	<i>Iris pseudacorus</i>	yellowflag iris	Priority 2A	50	Aggressive
20	<i>Linaria dalmatica</i>	Dalmatian toadflax	Priority 2B	48	Aggressive
21	<i>Linaria vulgaris</i>	butter and eggs (yellow toadflax)	Priority 2B	48	Aggressive
22	<i>Hieracium aurantiacum</i>	orange hawkweed	Priority 2A	47	Aggressive
23	<i>Hieracium caespitosum</i>	meadow hawkweed complex	Priority 2A	47	Aggressive
24	<i>Hieracium praealtum</i>	kingdevil hawkweed	Priority 2A	47	Aggressive
25	<i>Phalaris arundinacea</i>	reed canarygrass		47	Aggressive
26	<i>Phragmites australis</i>	phragmites	Priority 1A	47	Aggressive
27	<i>Leucanthemum vulgare</i>	oxeye daisy	Priority 2B	45	Aggressive
28	<i>Senecio jacobaea</i>	tansy ragwort	Priority 2A	45	Aggressive
29	<i>Isatis tinctoria</i>	Dyer's woad	Priority 1A	44	Aggressive
30	<i>Lotus corniculatus</i>	garden bird's-foot-trefoil		44	Aggressive
31	<i>Cirsium vulgare</i>	bull thistle		42	Aggressive
32	<i>Phleum pratense</i>	meadow timothy		42	Aggressive
33	<i>Ranunculus acris</i>	tall buttercup	Priority 2A	42	Aggressive
34	<i>Butomus umbellatus</i>	flowering rush	Priority 2A	39	Aggressive
35	<i>Convolvulus arvensis</i>	field bindweed	Priority 2B	39	Aggressive
36	<i>Poa pratensis</i>	Kentucky bluegrass		36	Aggressive
37	<i>Polygonum aviculare</i>	knotweed		36	Aggressive
38	<i>Potentilla recta</i>	sulphur cinquefoil	Priority 2B	35	Strong
39	<i>Rumex crispus</i>	curly dock		35	Strong
40	<i>Agrostis gigantea</i>	redtop		32	Strong
41	<i>Verbascum thapsus</i>	common mullein		32	Strong
42	<i>Elymus repens</i>	quackgrass		29	Strong
43	<i>Taraxacum officinale</i>	common dandelion		29	Strong
44	<i>Acroptilon repens</i>	Russian knapweed	Priority 2B	27	Strong
45	<i>Agrostis stolonifera</i>	creeping bentgrass		27	Strong
46	<i>Tragopogon dubius</i>	meadow goat's-beard		27	Strong
47	<i>Dactylis glomerata</i>	orchard grass		26	Strong

Table 2 (continued). The 61 invasive species assessed in order of I_i score.

	Scientific Name	Common Name	MT Noxious Weed List 2017	I_i Score	Rating
48	<i>Rumex acetosella</i>	sheep sorrel		26	Strong
49	<i>Trifolium repens</i>	white clover		24	Moderate
50	<i>Hypericum perforatum</i>	common St. John's-wort	Priority 2B	23	Moderate
51	<i>Bromus inermis</i>	smooth brome		21	Moderate
52	<i>Cerastium fontanum</i>	common mouse-ear chickweed		21	Moderate
53	<i>Medicago lupulina</i>	black medic		21	Moderate
54	<i>Alopecurus pratensis</i>	meadow foxtail		20	Moderate
55	<i>Chondrilla juncea</i>	rush skeletonweed	Priority 1B	18	Moderate
56	<i>Plantago major</i>	common plantain		18	Moderate
57	<i>Bromus japonicus</i>	Japanese brome		17	Moderate
58	<i>Berteroa incana</i>	hoary false-alyssum	Priority 2B	15	Weak
59	<i>Echium vulgare</i>	common viper's-bugloss (blueweed)	Priority 1B	14	Weak
60	<i>Lactuca serriola</i>	prickly lettuce		12	Weak
61	<i>Alyssum alyssoides</i>	pale alyssum		6	Weak

We calculated an Index of Alien Impact for 16 sites that were assessed as part of the Blackfoot-Swan project (Hart et al. 2015), and compared these with the FQI scores for the same sites using graphical correlations.⁴ We assumed that IAI scores of 3.6 and above indicate degraded/at risk wetlands, scores between 3.0-3.5 indicate moderate disturbance and risk wetlands, and scores 3.0 and below indicate high quality/low risk wetlands. For these purposes, we considered FQI scores below 20 to reflect poor quality wetlands; scores between 21-27, moderate quality wetlands; and scores above 28, high quality or natural sites. We also looked at disturbance metrics collected during the assessment. The following figures display how Index of Alien Impact (IAI) scores are related to EIA Floristic Quality Assessment Index (FQI) scores and EIA disturbance metrics for wetlands sampled in the Blackfoot-Swan River systems in 2013-2014.

In Figure 1, we multiplied the IAI scores by a factor of 10 with the incentive to make the graphic more comparable to the FQI scores. The colors in Figure 1 highlight correlations and similarities between the IAI scores and the FQI scores. For example, sites that had scores that correlated well across both indices have both IAI and FQI score bars of the same color hue (BFJuly_047 and BFJuly_049), whereas sites with scores that correlated fairly well have either red-blue bars (Swan_048s) or green-blue bars (BFJuly_058) where one metric ranked the site as moderate quality and the other metric ranked it as either high or low quality. Poor correlation between scoring metrics is shown by bars of opposite color

⁴ Although there were Level 3 assessments for 24 sites in that study, only 16 of the sites had invasive species present in a quantity sufficient to calculate the IAI. Because of the low statistical power associated with such a small sample, we opted for graphical rather than numeric association. In future analyses, we intend to use robust statistical approaches.

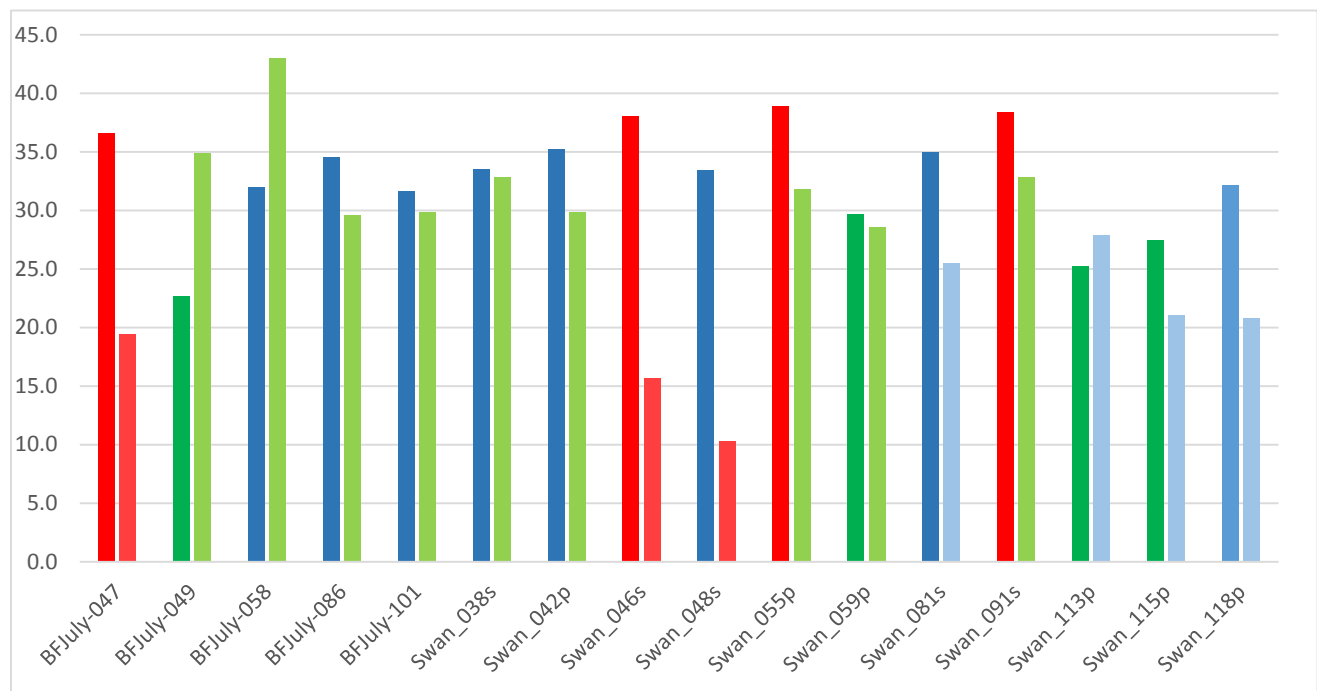


Figure 1. IAI versus FQI scores for Blackfoot-Swan surveys. IAI scores are displayed on the left bar and FQI scores are on the right bar for each site. For both IAI and FQI, similar colored bars were used to determine ranges of poor (red hues), moderate (blue hues), and high (green hues) quality wetlands.

hues (red-green) as seen for Swan_055p and Swan_091s. This method of visualizing the correlations makes it easier to see a relationship between IAI and FQI. This comparison helps show how exotic species, from the IAI, are affecting a site currently and will continue to affect the site in the future, where the FQI takes into account both native and exotic species to help better understand the current quality of the site.

We also examined the relationship between mean C-values and the IAI (Figure 2). As noted earlier, C-values are based on a species' tolerance for changing environmental condition. Non-native species and species with a high tolerance for disturbance receive the lowest scores. We posited that sites with high IAI scores might have low mean C-values, and vice versa. In general, this was true of sites in our sample: we saw the best correlations between IAI scores and mean C-values at sites that were either species poor or very degraded. In the first case, mean C-values were more responsive to the presence of exotics than sites with numerous species having higher C-values, while at degraded sites, both exotics and natives were characteristic of disturbance.

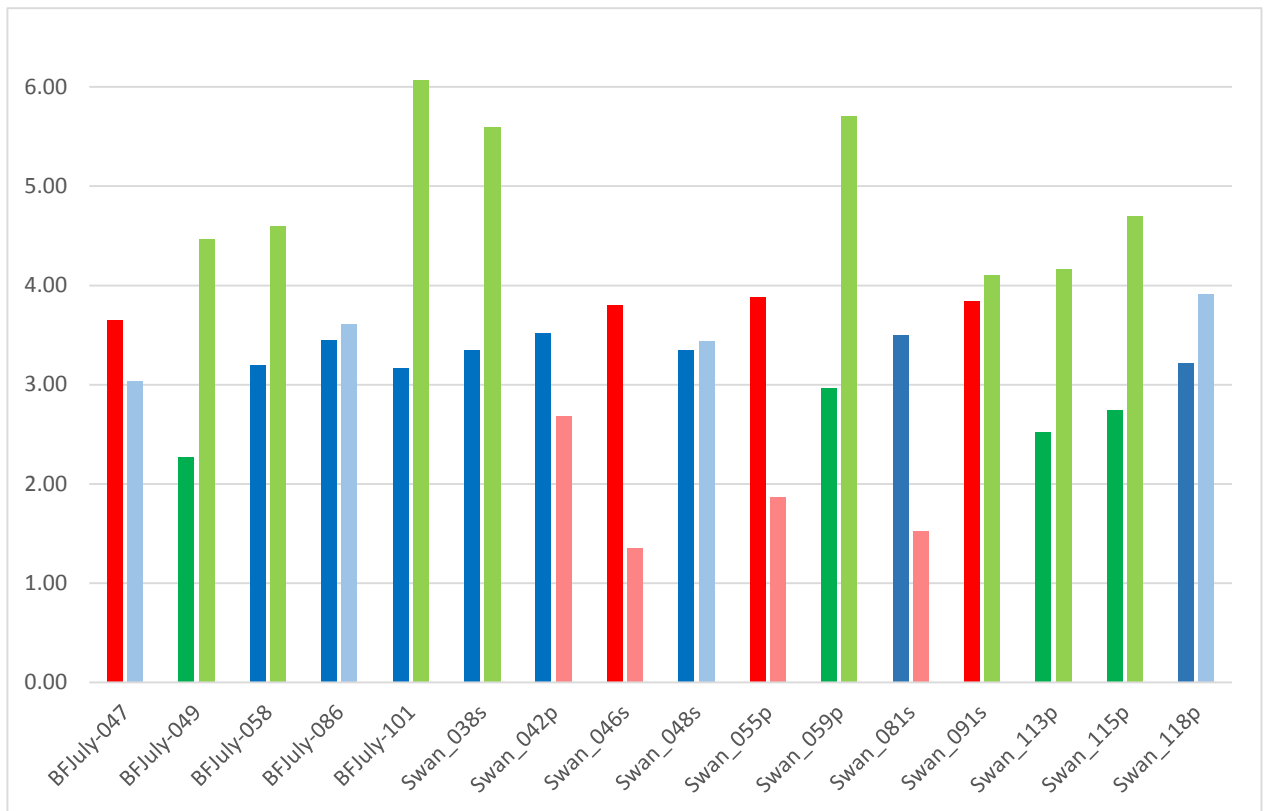


Figure 2. IAI (left bar) versus mean coefficient of conservatism (mean C, right bar) for Blackfoot-Swan surveys. Very similar to FQI score because FQI is based on mean C-values. Similar colored bars were used to determine ranges of poor (red hues), moderate (blue hues), and high (green hues) quality wetlands.

Finally, we examined the relationship between IAI scores and stressor scores calculated as part of the EIA assessments (Figure 3). Assessment area (AA) scores are calculated based on disturbances within the .5 hectare AA. Buffer stressor scores are based on observed disturbances within a 200-meter envelope surrounding the AA. Evaluated disturbances include transportation, recreation, resource extraction, development, agricultural land use, natural disturbances (e.g., fire or beetle kill) and hydrologic alterations such as damming, ditching or dredging. During the assessment, both the scope and impact of the disturbance are scored using the metrics in Table 3.

Again, we saw agreement between scores for wetland sites with poor IAI scores (Swan 046s, Swan 055p and 091s). However, some of the sites (e.g., Swan 059p and Swan 115p) had good scores on the IAI, but showed considerable evidence of disturbance in both the AA and the buffer.

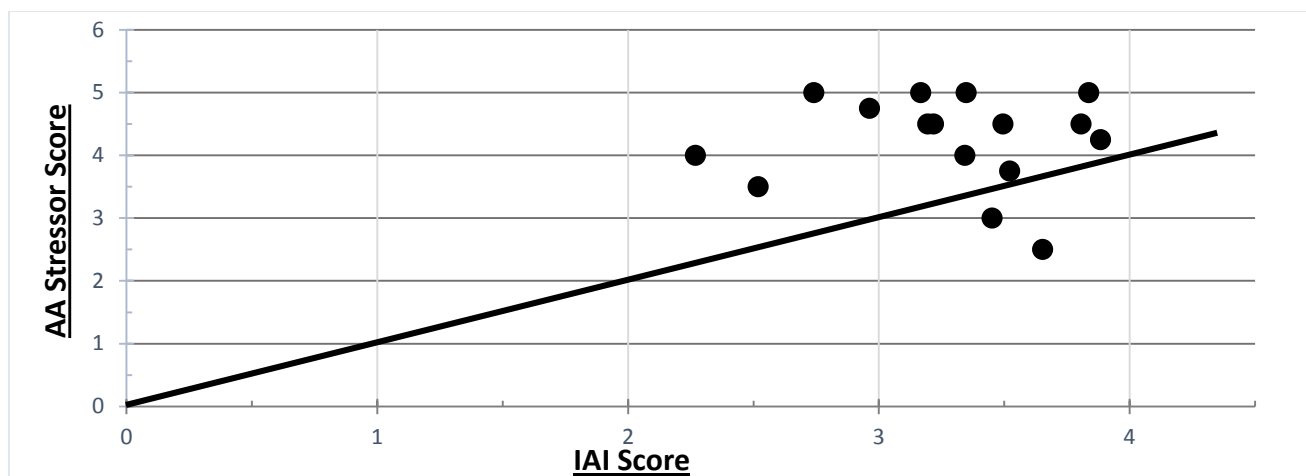


Figure 3. IAI Score compared to Assessment Area Combined Stressor Scores for 16 Blackfoot-Swan wetland sites set against line $y = x$. Pearson's correlation coefficient = - 0.04108. There is no relationship between stressor scores and IAI scores.

Buffer stressor scores are based on Ecological Integrity Assessment (EIA) Scope and Impact Ratings for Disturbance. See Table 3 for metric scores for scope and impact ratings. Disturbances are classified as transportation, recreational, resource extraction, developmental, and agricultural land use, natural and environmental, and hydrological.

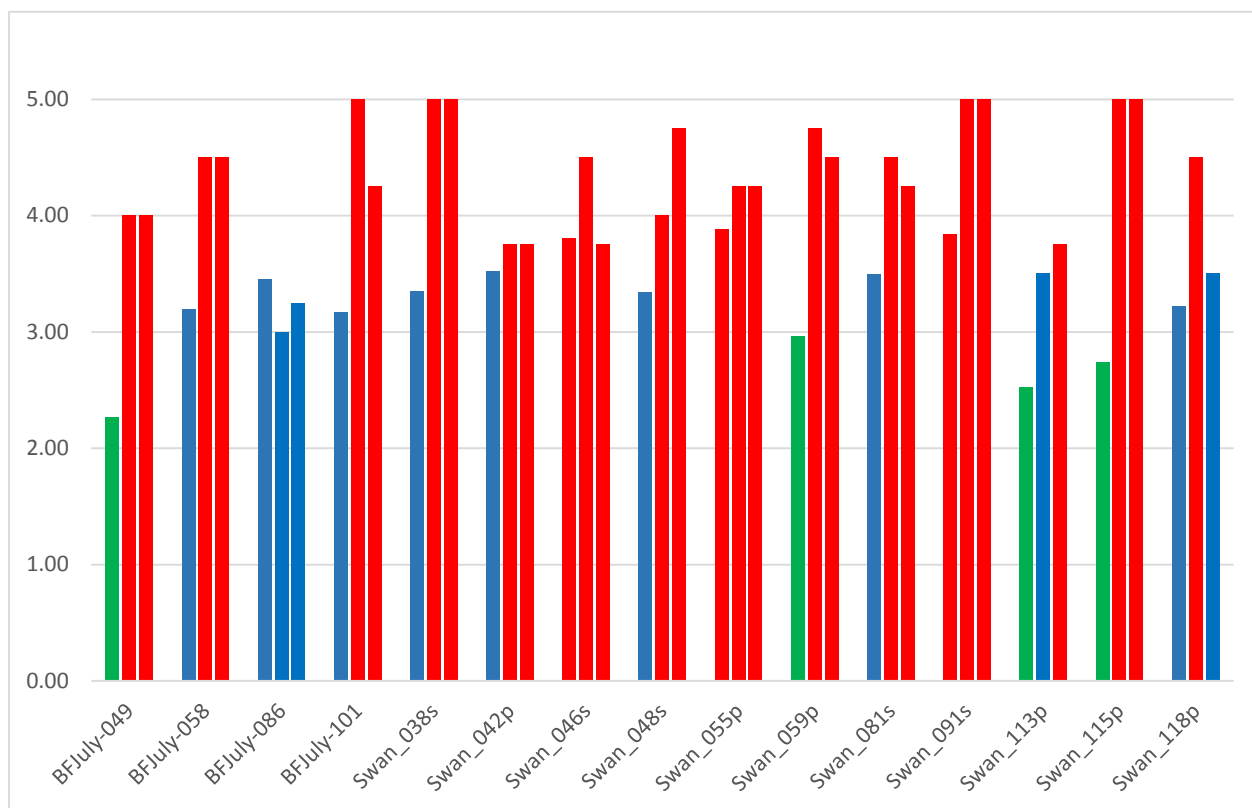


Figure 4. IAI scores compared to assessment area (AA) stressor scores and buffer stressor scores. Left bar is IAI score, middle bar is AA stressor score, and right bar is buffer stressor bar. Similar colored bars were used to determine ranges of poor (red hues), moderate (blue hues), and high (green hues) quality wetlands.

Table 3. Metrics used to score disturbance in the AA or buffer.

Scope of Disturbance	
5	Pervasive – Affects >75% of the AA/buffer
4	Large – Affects >50-75% of the AA/ buffer
3	Moderate – Affects >25-50% of the AA/buffer
2	Restricted – Affects >10-25% of the AA/buffer
1	Small – Affects 1-10% of the AA/buffer
0	Nil – Affects <1% of the AA/buffer
Impact of Disturbance	
4	Extreme – likely to extremely modify, degrade, destroy, or eliminate the wetland
3	Serious – likely to seriously modify, degrade, or reduce wetland function and condition
2	Moderate – likely to moderately modify, degrade, or reduce wetland function and condition
1	Slight – likely to only slightly modify, degrade, or reduce wetland function and condition

Discussion

Our experience with the IAI suggests to us that this is a worthwhile addition to the Ecological Integrity Assessment framework. Now that we have assigned Invasiveness scores to most of the exotic species encountered in Montana wetlands, calculation of the IAI is a rapid process. The relative absence of correlation between the IAI and the FQI, and between the IAI and stressor scores indicates an absence of redundancy in this metric; instead, it appears to offer additional information about future trends for sites where some degree of exotic invasion has occurred. As we revisit assessment sites over the next few years, we will be able to further test whether or not the IAI has predictive value.

Our next steps for the IAI include further testing of correlations between the IAI and individual FQI and stressor metrics using a much larger sample of assessment sites.⁵ Similarly, we hope to devise a quick method for evaluating the threat posed by invasive species within the buffer area. Currently, the IAI only evaluates the assessment area. Some of the upland obligate species found in buffers are not likely to be invasive in wetter wetlands, while other, more facultative species, may find temporarily flooded wetlands to be suitable habitats. We will need to develop invasiveness ratings for both categories of exotics. Finally, we are interested in identifying any apparent causal factors that may explain IAI scores, such as the percentage of bare ground in the AA, flood frequency and duration, and soil characteristics. Some of these factors can be identified from current data, but others will require additional environmental data collections. We expect that this will be the focus of future project development.⁶

⁵ At the time of this writing, we are consolidating our assessment databases and recalculating FQI scores for pre-2015 assessments based on new C-value assignments. Once this is complete, we will have several hundred sites available to carry out the analysis.

⁶ For brevity, within the Species Descriptions in the following section, we list all references by first author and year only.

SPECIES DESCRIPTIONS: Wetland Alien Species Ranked for Invasiveness

1. *Acroptilon repens* (Russian knapweed) | Montana Noxious Weed-Priority 2B | **27-Strong**

Summary of Ranking: Strong invasive that is tolerant of grazing and fire. *A. repens* creates small seeds in a large propagule, although it mainly reproduces via an extensive root system. It is tolerant of many abiotic conditions, can form monocultures, produce allelopathic compounds, and invade without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Primarily spreads via extensive root system	Beck 2002a, Carpenter 1998a, Ralph 2014, CWMA 2017, Hickman 1993, Parker 1972, Prather 2002, Taylor 1990, UNR 2002, Watson 1980, Whitson 1999, Zouhar 2001a
Large Propagule	Present	>1000 seeds/plant	Carpenter 1998a, Watson 1980, Zouhar 2001a
Small Seeds/Fruits	Present	Smaller than 5 mm	Carpenter 1998a, Hickman 1993, Parker 1972, Watson 1980, Zouhar 2001a
Wind Dispersal	No Info Found		
Animal Dispersal	No Info Found		
Water Dispersal	No Info Found		
Specialized Dispersal	No Info Found		
Dispersal Over Time	No Info Found		
Plasticity	No Info Found		
Drought Tolerant	Present		Beck 2002a, Carpenter 1998a, Taylor 1990, Watson 1980
Wide Moisture Regime	Present	Xeric to mesic	Beck 2002a, Carpenter 1998a, CWMA 2017, Parker 1972, Taylor 1990, UNR 2002, Zouhar 2001a
Flooding/Saturation Tolerant	Present	Saturation tolerant	Beck 2002a, Carpenter 1998a, CWMA 2017, Parker 1972, UNR 2002, Zouhar 2001a
Wide Nutrient/Soil Texture Tolerant	No Info Found		
Wide Light Regime	No Info Found		
Alkaline/Saline Tolerant	Present	Alkaline tolerant	Beck 2002a, Zouhar 2001a
Grazing Tolerant	Present	Toxic to horses	Carpenter 1998a, Parker 1972, Zouhar 2001a
Increases Post Fire	Present		Carpenter 1998a, Zouhar 2001a
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	No Info Found		
Excretes Salts/Toxins	Present	Allelopathy	Goslee 2001, Zouhar 2001a
Forms Monocultures	Present		Beck 2002a, Carpenter 1998a, Ralph 2014, UNR 2002, Watson 1980, Whitson 1999, Zouhar 2001a
Invades Without Human Disturbance	Present		Carpenter 1998a

2. *Agrostis gigantea* (Redtop)

32-Strong

Summary of Ranking: Strong invasive, produces clonally, as well as with small seeds in a large propagule. It creates a viable seed bank that produces over time and can tolerate wide abiotic conditions, grazing, and fire. It forms dense monocultures and can invade without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present		Carey 1995, Casler 2003, Hickman 1993, Peat (no date), Taylor 1990, USDA-NRCS 2002b, USDA-NRCS 2004
Large Propagule	Present	Produces more than 1,000 seeds per plant	Peat (no date), USDA-NRCS 2004
Small Seeds/Fruits	Present	Smaller than 5mm	Grime 1981, Hickman 1993, USDA-NRCS 2002b
Wind Dispersal	No Info Found		
Animal Dispersal	No Info Found		
Water Dispersal	No Info Found		
Specialized Dispersal	No Info Found		
Dispersal Over Time	Present	Seed bank	Carey 1995, Oosting 1940, Peat (no date)
Plasticity	Present		Casler 2003, USDA-NRCS 2004
Drought Tolerant	No Info Found		
Wide Moisture Regime	Present	Xeric to mesic	Carey 1995, USDA-NRCS 2002b, USDA-NRCS 2004
Flooding/Saturation Tolerant	Present	Saturation	Carey 1995, Frenkel 1978, Leege 1981, USDA-NRCS 2004
Wide Nutrient/Soil Texture Tolerant	Present		Carey 1995, USDA-NRCS 2002b, USDA-NRCS 2004
Wide Light Regime	Present		Carey 1995
Alkaline/Saline Tolerant	Present	Alkaline tolerant	Casler 2003, Frenkel 1978
Grazing Tolerant	Present		Carey 1995, Clary 1995, Leege 1981
Increases Post Fire	Present		Carey 1995, Swan 1970, USDA-NRCS 2004
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	Present		Carey 1995, Casler 2003, USDA-NRCS 2002b
Excretes Salts/Toxins	No Info Found		
Forms Monocultures	Present		Carey 1995
Invades Without Human Disturbance	Present		Frenkel 1978

3. *Agrostis stolonifera* (Creeping Bentgrass)

27-Strong

Summary of Ranking: Strong invasive with strong clonal reproductive traits and exhibits multiple modes of dispersal. *Agrostis stolonifera* is tolerant of diverse abiotic stressors such as light, water, and soil regimes. Fire and grazing are beneficial disturbances for spread and it can form monocultures and alter soil stability when used in stream bank stabilization projects.

For Ranking Comparison: Nature Serve ranking - Medium/low Cal IPC ranking - Limited Information

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Dense network of stolons and rhizomes	Esser 1994, Lesica 2012
Large Propagule	Present	Produces more than 1,000 seeds per plant	Esser 1994
Small Seeds/Fruits	Present	Smaller than 5mm	MacBryde 2005
Wind Dispersal	Present		MacBryde 2005
Animal Dispersal	Present		MacBryde 2005
Water Dispersal	Present	Floating plants and seeds	Esser 1994
Specialized Dispersal	No Info Found		
Dispersal Over Time	Absent	No seed bank	Esser 1994
Plasticity	Present	Can hybridize and have morphological variation	Esser 1994, Zapiola 2007
Drought Tolerant	No Info Found		
Wide Moisture Regime	Present	Xeric to mesic tolerance	Esser 1994
Flooding/Saturation Tolerant	Present	Moderate flooding tolerance	Esser 1994, Lesica 2012
Wide Nutrient/Soil Texture Tolerant	Present	Poor drained to good quality soil, tolerates heavy metals and minerals	Esser 1994
Wide Light Regime	Present	Shade and sun tolerant	Esser 1994
Alkaline/Saline Tolerant	Present	Tolerates saline	Esser 1994
Grazing Tolerant	Present	Grazing increaser	Esser 1994
Increases Post Fire	Present	Fire is favorable disturbance	Esser 1994
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	Present	Stream bank restoration	Esser 1994
Excretes Salts/Toxins	No Info Found		Esser 1994, Lesica 2012
Forms Monocultures	Present	Rhizomatous monoculture	
Invades Without Human Disturbance	No Info Found		

4. *Alopecurus pratensis* (Meadow Foxtail)

20-Moderate

Summary of Ranking: A moderate invasive that has strong reproductive traits and can be dispersed via wind. The species is tolerant of diverse abiotic stressors such as drought and saturation, soil nutrients, light, and alkaline conditions. It is also tolerant of grazing and can form dense monocultures.

For Ranking Comparison: Nature Serve ranking - Low Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present		Crowe 1997, Hitchcock 1969, PU 2002, USDA-NRCS 2004
Large Propagule	Present	Produces more than 1,000 seeds per plant	Boedeltje 2003, USDA-NRCS 2004
Small Seeds/Fruits	Present	Smaller than 5mm	Hitchcock 1969, PU 2002
Wind Dispersal	Present		CABI 2015a
Animal Dispersal	No Info Found		
Water Dispersal	No Info Found		
Specialized Dispersal	No Info Found		
Dispersal Over Time	No Info Found		
Plasticity	Present		PU 2002, CABI 2015a
Drought Tolerant	Present		Morisawa 1999, PU 2002, USDA-NRCS 2004, CABI 2015a
Wide Moisture Regime	Present	Xeric to mesic tolerance	Morisawa 1999, PU 2002, USDA-NRCS 2004, CABI 2015a
Flooding/Saturation Tolerant	Present	Saturation	Clary 1995, Hitchcock 1969, Morisawa 1999, PU 2002
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil nutrients	Morisawa 1999, PU 2002, CABI 2015a
Wide Light Regime	Present		Morisawa 1999, PU 2002
Alkaline/Saline Tolerant	Present		Morisawa 1999, PU 2002, CABI 2015a
Grazing Tolerant	Present		Clary 1995, Morisawa 1999
Increases Post Fire	No Info Found		
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	No Info Found		
Excretes Salts/Toxins	No Info Found		
Forms Monocultures	Present	Dense monocultures	PU 2002, CABI 2015a
Invades Without Human Disturbance	No Info Found		

Summary of Ranking: Weak invasive that does not have strong reproductive traits except for having small seeds that are still viable if eaten by wildlife. It is tolerant of xeric conditions and wide soil textures from sand to loam/clay.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Annual	Lesica 2012
Large Propagule	Absent	Less than 1,000 seeds per plant	Lesica 2012
Small Seeds/Fruits	Present	Seeds 3mm long	Hickman 1993, Hitchcock 1969, Peat (no date)
Wind Dispersal	No Info Found		
Animal Dispersal	Present	Animal droppings	Peat (no date)
Water Dispersal	No Info Found		
Specialized Dispersal	No Info Found		
Dispersal Over Time	No Info Found		
Plasticity	No Info Found		
Drought Tolerant	Present	Tolerant of xeric conditions	Hitchcock 1969, Whitson 1999
Wide Moisture Regime	No Info Found		
Flooding/Saturation Tolerant	Absent		Hickman 1993
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil texture tolerance	Peat (no date)
Wide Light Regime	No Info Found		
Alkaline/Saline Tolerant	No Info Found		
Grazing Tolerant	Absent		Hickman 1993, Peat (no date)
Increases Post Fire	No Info Found		
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	Absent		Hickman 1993
Alters Fire Regime	No Info Found		
Alters Soil Stability	No Info Found		
Excretes Salts/Toxins	Absent		Peat (no date)
Forms Monocultures	Absent		Peat (no date)
Invades Without Human Disturbance	Absent		Peat (no date)

Summary of Ranking: Weak invasive with potential for strong reproduction, having a large propagule and winged small seeds that can be carried by wind, wildlife, and water. Due to these dispersal methods, it can be found in natural areas and does not need human disturbance to spread. It can create a long viable seed bank and is tolerant of drought conditions. Fire and grazing are beneficial disturbances.

For Ranking Comparison: Nature Serve ranking - Low/Insignificant Cal IPC ranking - Not available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Annual	Lesica 2012
Large Propagule	Present	1000/m ²	Lesica 2012, McGregor 1986, Parkinson 2017a
Small Seeds/Fruits	Present	1-2mm long	McGregor 1986, Parkinson 2017a, Jacobs 2008a
Wind Dispersal	Present	Winged seed margin	Parkinson 2017a, Jacobs 2008a
Animal Dispersal	Present	Viable in animal droppings	Jacobs 2008a, Jacobs 2008a
Water Dispersal	Present	Winged seed margin	Parkinson 2017a, Jacobs 2008a
Specialized Dispersal	No Info Found		
Dispersal Over Time	Present	Seed bank, viable for 9+ years	Parkinson 2017a
Plasticity	No Info Found		
Drought Tolerant	Present	Xeric conditions and drought tolerance	McGregor 1986, Parkinson 2017a
Wide Moisture Regime	Absent		Parkinson 2017a
Flooding/Saturation Tolerant	Absent	Not tolerant of increased water	Parkinson 2017a
Wide Nutrient/Soil Texture Tolerant	Absent	Thrives in poor soil, not tolerant of rich soil	Parkinson 2017a, Jacobs 2008a
Wide Light Regime	Absent	Not tolerant of shade	Parkinson 2017a, Jacobs 2008a
Alkaline/Saline Tolerant	No Info Found		
Grazing Tolerant	Present	Grazing is a beneficial disturbance	Parkinson 2017a
Increases Post Fire	Present	Fire is a beneficial disturbance	Parkinson 2017a, Jacobs 2008a
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	No Info Found		
Excretes Salts/Toxins	No Info Found		
Forms Monocultures	Absent		Parkinson 2017a, Jacobs 2008a
Invades Without Human Disturbance	Present	Many dispersal methods, found in natural areas	Parkinson 2017a, Jacobs 2008a

Summary of Ranking: Moderate invasive with clonal reproduction. It has a large propagule which can be dispersed via animals. It can tolerate drought to saturation and an alkaline/saline environment. It is a fire and grazing increaser and can alter soil stability by forming dense mat monocultures.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present		Bush 2002b, Hickman 1993, Howard 1996, Sather 1987, USDA-NRCS 2004, Weber 2003
Large Propagule	Present		Sather 1987, USDA-NRCS 2004
Small Seeds/Fruits	Absent	Seeds larger than 5mm	Hickman 1993
Wind Dispersal	No Info Found		
Animal Dispersal	Present		Sather 1987
Water Dispersal	No Info Found		
Specialized Dispersal	No Info Found		
Dispersal Over Time	No Info Found		
Plasticity	Present		Howard 1996, Sather 1987, USDA-NRCS 2004, Weber 2003
Drought Tolerant	Present		Bush 2002a, Howard 1996, Sather 1987, USDA-NRCS 2004
Wide Moisture Regime	Present	Xeric to mesic	Howard 1996, Sather 1987, USDA-NRCS 2004
Flooding/Saturation Tolerant	Present	Saturation	Howard 1996, Sather 1987
Wide Nutrient/Soil Texture Tolerant	No Info Found		
Wide Light Regime	No Info Found		
Alkaline/Saline Tolerant	Present		Howard 1996, Sather 1987, Weber 2003
Grazing Tolerant	Present	Increaser	Howard 1996
Increases Post Fire	Present		Howard 1996, Sather 1987, USDA-NRCS 2004
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	Present		Bush 2002b, Hickman 1993, Howard 1996
Excretes Salts/Toxins	No Info Found		
Forms Monocultures	Present	Dense mats	Bush 2002b, Howard 1996, Sather 1987, USDA-NRCS 2004, Weber 2003
Invades Without Human Disturbance	No Info Found		

Summary of Ranking: Moderate invasive with a large propagule and small seeds that are viable after consumption by wildlife. It can form a long viable seed bank and has high morphological plasticity. It can tolerate a diversity of abiotic stressors from drought, saturation, soil nutrients, soil textures, and alkaline conditions. It is tolerant of grazing and can colonize natural areas without human disturbance, but decreases post fire.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Limited Information

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Annual	Howard 1994
Large Propagule	Present		Howard 1994
Small Seeds/Fruits	Present	Smaller than 5mm	Howard 1994
Wind Dispersal	No Info Found		
Animal Dispersal	Present	Viable in animal droppings	Howard 1994
Water Dispersal	No Info Found		
Specialized Dispersal	No Info Found		
Dispersal Over Time	Present	Seed bank, viable for many years	Howard 1994
Plasticity	Present	Morphological variation	Howard 1994
Drought Tolerant	Present	Dry soil, grows <50cm annual precipitation	Howard 1994, Lesica 2012, Skinner 2010, McGregor 1986,
Wide Moisture Regime	Present	Tolerant of fluctuating water levels, xeric to mesic	Howard 1994, Lesica 2012, Skinner 2010, McGregor 1986,
Flooding/Saturation Tolerant	Present	Saturation tolerant	Lesica 2012
Wide Nutrient/Soil Texture Tolerant	Present	Tolerant of high nutrients to poor soil, wide texture regime	Howard 1994
Wide Light Regime	No Info Found		
Alkaline/Saline Tolerant	Absent	Intolerant of alkaline conditions	Howard 1994
Grazing Tolerant	Present		Howard 1994
Increases Post Fire	Absent	Decreases post fire	Howard 1994
Alters Hydrology	No Info Found		
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	No Info Found		
Excretes Salts/Toxins	No Info Found		
Forms Monocultures	No Info Found		
Invades Without Human Disturbance	Present	Can occur in undisturbed locations	Howard 1994

Summary of Ranking: Extreme invasive that produces a large propagule and seed bank and has multiple modes of dispersal. It can tolerate drought to mesic conditions and can increase after grazing and fire. It can alter multiple ecosystem processes such as hydrology, nutrient cycling, soil stability, and fire regime. It can form monocultures and invade without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking – High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Annual	Carpenter 1999
Large Propagule	Present		Carpenter 1999, Evans 2001, Pellant 1996, Upadhyaya 1986, Weber 2003, Young 2000, Zouhar 2003a
Small Seeds/Fruits	Absent	Larger than 5mm	Carpenter 1999
Wind Dispersal	Present		APRS 2000, Carpenter 1999, Upadhyaya 1986, Young 2000
Animal Dispersal	Present		APRS 2000, Carpenter 1999, Neese 2000, Upadhyaya 1986, Young 2000
Water Dispersal	No Info Found		
Specialized Dispersal	No Info Found		
Dispersal Over Time	Present	Seed bank	Pellant 1996
Plasticity	Present		Carpenter 1999, Evans 2001, Pellant 1996, Upadhyaya 1986, Weber 2003
Drought Tolerant	Present		APRS 2000, Carpenter 1999, Evans 2001, Neese 2000, Pellant 1996, Upadhyaya 1986, Weber 2003, Young 2000
Wide Moisture Regime	Present	Xeric to semi mesic	APRS 2000, Carpenter 1999, Upadhyaya 1986, Zouhar 2003a
Flooding/Saturation Tolerant	No Info Found		
Wide Nutrient/Soil Texture Tolerant	No Info Found		
Wide Light Regime	No Info Found		
Alkaline/Saline Tolerant	No Info Found		
Grazing Tolerant	Present	Increaser	Carpenter 1999, Neese 2000, Taylor 1990, Upadhyaya 1986, Zouhar 2003a
Increases Post Fire	Present		APRS 2000, Carpenter 1999, Neese 2000, Pellant 1996, Upadhyaya 1986, Young 2000, Zouhar 2003a
Alters Hydrology	Present		APRS 2000, Carpenter 1999, Evans 2001, Neese 2000, Pellant 1996, Upadhyaya 1986, Weber 2003, Whitson 1999, Young 2000, Zouhar 2003a
Alters Nutrient Cycling	Present		Carpenter 1999, Evans 2001, Pellant 1996
Alters Fire Regime	Present		Carpenter 1999, Evans 2001, Neese 2000, Pellant 1996, Upadhyaya 1986, Weber 2003, Whitson 1999, Young 2000, Zouhar 2003a
Alters Soil Stability	Present		Carpenter 1999, Pellant 1996, Upadhyaya 1986
Excretes Salts/Toxins	No Info Found		
Forms Monocultures	Present	Dense mats	Carpenter 1999, Evans 2001, Neese 2000, Pellant 1996, Upadhyaya 1986, Young 2000, Zouhar 2003a
Invades Without Human Disturbance	Present	Observed in natural areas	Carpenter 1999, Evans 2001, Pellant 1996, Upadhyaya 1986, Weber 2003

Summary of Ranking: Aggressive invasive with prolific rhizomatous reproduction as well as a large propagule of small seeds that can be dispersed via water, wildlife, and fragmentation. The species can remain viable after prolonged drying out of rhizomes and spread in changing water tables such as on Flathead Lake. It can alter hydrology and soil stability by changing water flows with dense monocultures and causing bank sedimentation. On Flathead Lake, the species has spread without human disturbance due to its unique dispersal methods as well as with altered seasonal water table, this dispersal ability may not apply to all habitats.

For Ranking Comparison: Nature Serve ranking - Medium/Low Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Prolific rhizomes	Jensen (no date), Lesica 2012, Parkinson 2010
Large Propagule	Present	1200 seeds/1 flower and 20-50 flowers/plant	Jensen (no date), Lesica 2012, Parkinson 2010
Small Seeds/Fruits	Present	4mm long	Parkinson 2010
Wind Dispersal	No Info Found		
Animal Dispersal	Present	Muskrat can transport fragments for nest building	Jensen (no date)
Water Dispersal	Present	Obligate/Aquatic	Jensen (no date), Lesica 2012, Parkinson 2010
Specialized Dispersal	Present	4 modes of dispersal: seed, bulbils on flowers, bulbils on rhizomes, rhizome fragments	Parkinson 2010
Dispersal Over Time	No Info Found		Jensen (no date), Parkinson 2010
Plasticity	Present	Can grow at various water depths by changing morphology	Jensen (no date), Parkinson 2010
Drought Tolerant	Present	Dry shore lines, tolerates altered water table	Jensen (no date)
Wide Moisture Regime	Present	Dry, shallow, and flooded sites	Jensen (no date)
Flooding/Saturation Tolerant	Present	Flooding/saturation tolerant	Parkinson 2010, Lesica 2012
Wide Nutrient/Soil Texture Tolerant	Absent		Parkinson 2010
Wide Light Regime	No Info Found		
Alkaline/Saline Tolerant	No Info Found		
Grazing Tolerant	No Info Found		
Increases Post Fire	No Info Found		
Alters Hydrology	Present	Thick growth alters water flow	Parkinson 2010
Alters Nutrient Cycling	No Info Found		
Alters Fire Regime	No Info Found		
Alters Soil Stability	Present	Builds sediments on banks	Jensen D. (no date)
Excretes Salts/Toxins	No Info Found		
Forms Monocultures	Present	Dense mats	Jensen D. (no date), Parkinson 2010
Invades Without Human Disturbance	Present	Can disperse without humans by muskrats and water and ice movement	Jensen D. (no date), Vance 2017

11. *Centaurea diffusa* (Diffuse knapweed) | Montana Noxious Weed – Priority 2B | **71-Extreme**

Summary of Ranking: Extreme invasive, reproduces by small seeds in a large propagule. Seeds can disperse by transportation by wind and water and are viable in wildlife droppings. Develops a seed bank and can hybridize with *Centaurea stoebe*. Tolerant of drought to mesic conditions as well as grazing. *C. diffusa* can alter ecosystem function by altering nutrient cycling, fire regime, and soil stability; using allelopathic excretions; forming monocultures; and invading without human-caused disturbance.

For Ranking Comparison: Nature Serve ranking - High/Medium Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Reproduces by seed	Lesica 2012, Duncan 2011, Zouhar 2001b
Large Propagule	Present	>1000 seeds/plant	Lesica 2012, Duncan 2011, Zouhar 2001b
Small Seeds/Fruits	Present	Achenes 2-3 mm long	Lesica 2012, Zouhar 2001b
Wind Dispersal	Present	Blowing seeds and dry seed heads	Duncan 2011, Zouhar 2001b
Animal Dispersal	Present	Droppings	Duncan 2011
Water Dispersal	Present	Floating plants downstream	Duncan 2011, Zouhar 2001b
Specialized Dispersal	Present	Tumbling of plants with seed heads	Duncan 2011, Zouhar 2001b
Dispersal Over Time	Present	Seed bank	Duncan 2011, Zouhar 2001b
Plasticity	Present	Hybridizes with <i>C. stoebe</i>	Zouhar 2001b
Drought Tolerant	Present		Duncan 2011
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2001b
Flooding/Saturation Tolerant	Absent		Zouhar 2001b
Wide Nutrient/Soil Texture Tolerant	Absent	Prefers well drained, fertile soils	Zouhar 2001b
Wide Light Regime	Absent	Prefers full sun	Zouhar 2001b
Alkaline/Saline Tolerant	Absent	Saline sensitive	
Grazing Tolerant	Present		
Increases Post Fire	Absent	Some individuals may survive, does not increase	Duncan 2011, Zouhar 2001b
Alters Hydrology	Info Not Available		
Alters Nutrient Cycling	Present	Depletes soil and water resources	Zouhar 2001b
Alters Fire Regime	Present	Replaces grassland with woody fuel	Zouhar 2001b
Alters Soil Stability	Present	Depletes moisture	Zouhar 2001b
Excretes Salts/Toxins	Present	Allelopathic, phytotoxic	Duncan 2011, Zouhar 2001b
Forms Monocultures	Present		Duncan 2011, Zouhar 2001b
Invades Without Human Disturbance	Present	Can invade natural areas	Duncan 2011, Zouhar 2001b

12. *Centaurea solstitialis* (Yellow starthistle) | Montana Noxious Weed Priority 1A | 68-Extreme

Summary of Ranking: Extreme invasive that reproduces by a large propagule of small seeds that can be dispersed by wind and wildlife. *C. solstitialis* creates a seed bank as well as tolerate drought, grazing, and fire. It can alter hydrology by altering the water table, alter fire regimes, alter soil stability by depleting soil moisture, excrete allelopathic compounds, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	No evidence of asexual reproduction	Zouhar 2002a
Large Propagule	Present	>1000 seeds/plant	DiTomaso 2000, DiTomaso 2001, Gerlach 2000, Sheley 1999, Weber 2003, Zouhar 2002a
Small Seeds/Fruits	Present	Smaller than 5mm	DiTomaso 2000, DiTomaso 2001, Gerlach 2000, Hickman 1993, Prather 2002, Weber 2003, Zouhar 2002a
Wind Dispersal	Present	Blowing seeds and dry seed heads, pappus present	DiTomaso 2000, DiTomaso 2001, Sheley 1999, Weber 2003, Zouhar 2002 ^a
Animal Dispersal	Present	Bird droppings, fur	DiTomaso 2000, DiTomaso 2001, Gerlach 2000, Sheley 1999, Zouhar 2002a
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	DiTomaso 2000, DiTomaso 2001, Gerlach 2000, Zouhar 2002 ^a
Plasticity	Present		Weber 2003, Zouhar 2002a
Drought Tolerant	Present		DiTomaso 1999, DiTomaso 2000, DiTomaso 2001, Gerlach 2000, Prather 2002, Sheley 1999, Weber 2003, Zouhar 2002a
Wide Moisture Regime	No Info Available		
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	No Info Available		
Wide Light Regime	Absent	Not shade tolerant	Zouhar 2002a
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	DiTomaso 2000, DiTomaso 2001, Gerlach 2000
Increases Post Fire	Present	Fire is a favorable disturbance	DiTomaso 1999, DiTomaso 2001, Zouhar 2002a
Alters Hydrology	Present	Alter water cycle, water table depth	DiTomaso 2000, DiTomaso 2001, Gerlach 2000, Weber 2003, Zouhar 2002 ^a
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	Present		Zouhar 2002a
Alters Soil Stability	Present	Deplete soil moisture	Zouhar 2002a
Excretes Salts/Toxins	Present	Allelopathic	Zouhar 2002a
Forms Monocultures	Present		DiTomaso 2001, Gerlach 2000, Sheley 1999, Weber 2003, Zouhar 2002a
Invades Without Human Disturbance	Present	Present in natural areas	DiTomaso 1999, DiTomaso 2001, Weber 2003, Zouhar 2002a

Summary of Ranking: Extreme invasive that reproduces by a large propagule of small seeds that can be dispersed by wind, ungulates, and water. *C. stoebe* creates a seed bank and can hybridize with *C. diffusa* as well as tolerate drought, semi-mesic conditions, grazing, and fire. It can alter the water table depth, alter nitrogen cycles, increase fire intensity, alter soil stability by depleting soil moisture, excrete allelopathic compounds, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High/Medium Cal IPC ranking - High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	not aggressive perennial with tap root	Zouhar 2001c, Jacobs 2012, Lesica 2012, Duncan 2011
Large Propagule	Present	>1000/m ²	Duncan 2011, Jacobs 2012
Small Seeds/Fruits	Present	Achenes and seeds smaller than 5mm	Zouhar 2001c, Skurka 2005, Lesica 2012, Duncan 2011, Jacobs 2012
Wind Dispersal	Present	Blowing of seeds and seed heads	Zouhar 2001c, Skurka 2005, Duncan 2011
Animal Dispersal	Present	Droppings	Zouhar 2001c, Duncan 2011
Water Dispersal	Present	Floating down streams	Zouhar 2001c, Duncan 2011
Specialized Dispersal	Present	Tumbling of plants with seed heads	Zouhar 2001c, Duncan 2011
Dispersal Over Time	Present	Seed bank, long seed viability	Zouhar 2001c, Duncan 2011
Plasticity	Present	Hybridizes with <i>C. diffusa</i>	Zouhar 2001c, Duncan 2011
Drought Tolerant	Present	<50 cm annual precipitation	Zouhar 2001c, Duncan 2011
Wide Moisture Regime	Present	20.3-203 cm of annual precip., xeric to mesic habitats	Zouhar 2001c, Skurka 2005, Duncan 2011
Flooding/Saturation Tolerant	Absent	Does not tolerate irrigation	Duncan 2011
Wide Nutrient/Soil Texture Tolerant	Absent		Duncan 2011
Wide Light Regime	Absent	Prefers full sun	Skurka 2005
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing tolerant	Zouhar 2001c, Skurka 2005, Duncan 2011, Jacobs 2012
Increases Post Fire	Present	Fire is a favorable disturbance	Zouhar 2001c, Duncan 2011
Alters Hydrology	Present	Taproot causes moisture loss, increases soil surface run off and sedimentation	Zouhar 2001c, Skurka 2005
Alters Nutrient Cycling	Present	Alter nitrogen cycle	Zouhar 2001c, Skurka 2005,
Alters Fire Regime	Present	Evidence of increased intensity of fires	Zouhar 2001c, Skurka 2005, Duncan 2011
Alters Soil Stability	Present	Decrease soil moisture, facilitate erosion, sedimentation	Zouhar 2001c, Skurka 2005, Duncan 2011
Excretes Salts/Toxins	Present	Allelopathy	Zouhar 2001c, Duncan 2011
Forms Monocultures	Present	High densities	Zouhar 2001c, Skurka 2005
Invades Without Human Disturbance	Present	Found at pristine sites	Zouhar 2001c, Skurka 2005, Duncan 2011

14. *Cerastium fontanum* (Common mouse-ear chickweed)

21-Moderate

Summary of Ranking: Moderate invasive that reproduces by a large propagule of small seeds that create a persistent seed bank. *C. fontanum* can tolerate drought, mesic conditions, saturation, a wide range of soil textures, and grazing. It forms monocultures and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present		Hickman 1993, Hitchcock 1969, Peat (no date), Taylor 1990
Large Propagule	Present	>1000 seeds/m ²	Boedeltje 2003, Peat (no date)
Small Seeds/Fruits	Present	Smaller than 5mm	Hickman 1993, Hitchcock 1969, Peat (no date)
Wind Dispersal	No Info Available		
Animal Dispersal	No Info Available		
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Peat (no date)
Plasticity	Present		Hitchcock 1969
Drought Tolerant	Present	Xeric conditions	Peat (no date)
Wide Moisture Regime	Present	Xeric to mesic conditions	Peat (no date)
Flooding/Saturation Tolerant	Present	Saturation tolerant	Hickman 1993
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil texture	Peat (no date)
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	Hellström 2003, Pakeman 2004
Increases Post Fire	No Info Available		
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Forms Mats	Horton 2017
Invades Without Human Disturbance	Present	Found at pristine sites	Ryan 2003

15. *Chondrilla juncea* (Rush skeletonweed) | Montana Noxious Weed – Priority 1B | 18-Moderate

Summary of Ranking: Moderate invasive that reproduces by a large propagule of small seeds that can be dispersed by wind and wildlife. *C. juncea* does not have a persistent seed bank and can tolerate drought, xeric to mesic conditions, and grazing. It can alter nitrogen cycling, most likely alters fire regimes, and forms highly dense monocultures.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not rhizomatous	Zouhar 2003b, Brusati 2005
Large Propagule	Present	>2000 seeds/m ²	Zouhar 2003b, Brusati 2005, Jacobs 2009a, USDA-APHIS 2016
Small Seeds/Fruits	Present	Achenes 3-4mm long	Lesica 2012, Zouhar 2003b, Jacobs 2009a, USDA-APHIS 2016
Wind Dispersal	Present	Pappus present	Zouhar 2003a, Brusati 2005, Jacobs 2009b, USDA-APHIS 2016
Animal Dispersal	Present	Seeds have small teeth that stick to fur	Zouhar 2003b, Brusati 2005
Water Dispersal	No Info Available		
Specialized Dispersal	Absent	No specialized features	Zouhar 2003b
Dispersal Over Time	Absent	Seeds are short lived	Zouhar 2003b
Plasticity	Present	Morphological variation	Zouhar 2003b
Drought Tolerant	Present	Large root system aids in water efficiency	Zouhar 2003b, Brusati 2005, USDA-APHIS 2016
Wide Moisture Regime	Present	Locations with 10 inches-50 inches of rainfall/year	Zouhar 2003b, Brusati 2005, USDA-APHIS 2016
Flooding/Saturation Tolerant	Absent	Not tolerant of flooding	Zouhar 2003b
Wide Nutrient/Soil Texture Tolerant	Absent	Needs nitrogen, calcium, and phosphorus, best in sandy soil types	Zouhar 2003b
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing creates a favorable disturbance	Zouhar 2003b, Jacobs 2009a
Increases Post Fire	Absent	Fire may be an optimal soil disturbance if roots survive, no documented evidence	Zouhar 2003b
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Strong nitrogen competitor	Brusati 2005, Jacobs 2009a, USDA-APHIS 2016
Alters Fire Regime	Absent	Most likely alters, but no documented evidence	Zouhar 2003b
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Can form extremely high densities	Zouhar 2003b, Brusati 2005, USDA-APHIS 2016
Invades Without Human Disturbance	No Info Available		

16. *Cirsium arvense* (Canada thistle) | Montana Noxious Weed – Priority 2B | 61-Extreme

Summary of Ranking: Extreme invasive that reproduces asexually by creeping rhizomes and by a large propagule of small seeds that can be dispersed by wind and wildlife. *C. arvense* creates a seed bank and can tolerate drought, saturation, wide soil textures and nutrients, alkaline and saline conditions, grazing, and fire. It can alter hydrology with large taproot, compete for nutrients, alter soil stability by depleting soil moisture, excrete allelopathic compounds, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Creeping horizontal rhizomes	APRS 2000, Crowe 1997, Moore 1975, Zouhar 2001d
Large Propagule	Present	~1530 seeds/plant	APRS 2000, Bayer 2000, Nuzzo 1997, Weber 2003, Zouhar 2001d
Small Seeds/Fruits	Present	4-5mm long	APRS 2000, Hickman 1993, Nuzzo 1997, Prather 2002, Whitson 1999
Wind Dispersal	Present	Blowing seeds and dried plants	Andersen 1995, Moore 1975, Nuzzo 1997, Prather 2002, Zouhar 2001d
Animal Dispersal	Present	Caught in fur	Andersen 1995
Water Dispersal	Present	Floating plants	APRS 2000, Boedeltje 2003, Moore 1975, Nuzzo 1997, Zouhar 2001d
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Bayer 2000, Moore 1975, Nuzzo 1997
Plasticity	Present		Bayer 2000, Moore 1975, Nuzzo 1997, Weber 2003
Drought Tolerant	Present	Drought tolerant	APRS 2000, Bayer 2000, Moore 1975, Prather 2002
Wide Moisture Regime	Present	Xeric to mesic	APRS 2000, Bayer 2000, Moore 1975, Nuzzo 1997, Prather 2002, Zouhar 2001b
Flooding/Saturation Tolerant	Present	Saturation tolerant	APRS 2000, Bayer 2000, Nuzzo 1997, Prather 2002, Weber 2003, Zouhar 2001d
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil texture and nutrient tolerance	APRS 2000, Nuzzo 1997, Zouhar 2001d
Wide Light Regime	Absent	Shade intolerant	APRS 2000
Alkaline/Saline Tolerant	Present	Alkaline and saline	APRS 2000, Moore 1975, Nuzzo 1997
Grazing Tolerant	Present	Grazing creates a favorable disturbance	Bayer 2000, Crowe 1997, Nuzzo 1997, Zouhar 2001d
Increases Post Fire	Present	Fire creates a favorable disturbance	Zouhar 2001d
Alters Hydrology	Present	Taproot alters water table	Bayer 2000, Moore 1975
Alters Nutrient Cycling	Present	Competitive for nutrient resources	Bayer 2000, Moore 1975
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathic	APRS 2000, Bayer 2000, Moore 1975, Nuzzo 1997
Forms Monocultures	Present	Monoculture networks	Bayer 2000, Moore 1975, Nuzzo 1997, Prather 2002, Weber 2003
Invades Without Human Disturbance	Present	Found at pristine sites due to dispersal methods	APRS 2000, Bayer 2000, Nuzzo 1997, Weber 2003, Zouhar 2001d

Summary of Ranking: Aggressive invasive that reproduces by a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *C. vulgare* tolerates drought, xeric to mesic conditions, diverse nutrients and soil textures, alkaline and saline conditions, grazing, and fire disturbance. It can alter the water table, compete for nutrients, alter fire regimes, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent		APRS 2000
Large Propagule	Present	>1000 seeds/plant	APRS 2000, Beck 1999, Randall 2000, Zouhar 2002b
Small Seeds/Fruits	Present	Smaller than 5mm	Beck 1999, Hickman 1993, Randall 2000, Weber 2003, Zouhar 2002b
Wind Dispersal	Present	Easily spread by wind	APRS 2000, Beck 1999, Hickman 1993, Randall 2000, Taylor 1990, Weber 2003, Zouhar 2002b
Animal Dispersal	Present	Caught in fur	Beck 1999
Water Dispersal	Present	Floating plants	Beck 1999, Weber 2003
Specialized Dispersal	No Info Available		
Dispersal Over Time	Absent	Short lived seed bank	Zouhar 2002b
Plasticity	No Info Available		
Drought Tolerant	Present	Drought conditions	Beck 1999, Weber 2003, Zouhar 2002b
Wide Moisture Regime	Present	Xeric to mesic	Beck 1999, Zouhar 2002b
Flooding/Saturation Tolerant	Present	Saturation tolerant	Beck 1999
Wide Nutrient/Soil Texture Tolerant	Present	Wide nutrient and texture tolerance	Beck 1999, Zouhar 2002b
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	Present	Alkaline and saline tolerant	Randall 2000, Zouhar 2002b
Grazing Tolerant	Present	Grazing creates a favorable disturbance	Beck 1999, Bullock 1994, Randall 2000, Medlin (no date), Zouhar 2002b
Increases Post Fire	Present	Fire creates a favorable disturbance	Zouhar 2002b, Zouhar 2002c
Alters Hydrology	Present	Alters water table	Randall 2000
Alters Nutrient Cycling	Present	Competitive for nutrient resources	Randall 2000, Zouhar 2002b
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Absent	No know toxins	Randall 2000
Forms Monocultures	Present	Dense stands	Randall 2000, Weber 2003
Invades Without Human Disturbance	Present	Found at pristine sites due to dispersal methods	Randall 2000, Weber 2003, Zouhar 2002b

18. *Convolvulus arvensis* (Field Bindweed) | Montana Noxious Weed – Priority 2B | 39-Aggressive

Summary of Ranking: Aggressive invasive that reproduces asexually and by a large propagule of small seeds that can be dispersed by wildlife and water. *C. arvensis* creates a seed bank and can tolerate drought, xeric and mesic conditions, and diverse soil textures. It can alter hydrology and the water table, alter nutrient cycles, excrete allelopathic compounds, and form monoculture mats.

For Ranking Comparison: Nature Serve ranking - Medium/Low Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomatous perennial	Zouhar 2004b, Lesica 2012, McGregor 1986
Large Propagule	Present	>1000 seeds/m ²	Zouhar 2004b
Small Seeds/Fruits	Present	Capsule 3-5mm long	Zouhar 2004b, Lesica 2012, McGregor 1986
Wind Dispersal	No Info Available		
Animal Dispersal	Present	Wildlife droppings	Zouhar 2004b
Water Dispersal	Present	Floats and remains viable in water	Zouhar 2004b
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed banking, seeds viable for 20+ years	Zouhar 2004b
Plasticity	Present	High phenotypic diversity	Zouhar 2004b
Drought Tolerant	Present	Extensive root system	Zouhar 2004b
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2004b
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Tolerates serpentine and nonserpentine soils, fertile to poor, gravelly soils	Zouhar 2004b
Wide Light Regime	Absent	Needs full sun	Zouhar 2004b
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Absent	Sheep and pigs are used as control	Zouhar 2004b
Increases Post Fire	Absent	May increase, but not enough evidence	Zouhar 2004b
Alters Hydrology	Present	Reduces soil moisture in the top 24 inches	Zouhar 2004b
Alters Nutrient Cycling	Present	Taproot draws down nutrients, making them less available	Prevey 2014
Alters Fire Regime	No Info Available	No evidence at this time	Zouhar 2004b
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathic chemicals	Balicevic 2014
Forms Monocultures	Present	Forms mats	Zouhar 2004b
Invades Without Human Disturbance	No Info Available		

19. *Cynoglossum officinale* (Common hound's-tongue) | Montana Noxious Weed – Priority 2B | 52-Extreme

Summary of Ranking: Extreme invasive that reproduces by a large propagule of fairly large seeds that can be dispersed by wind and wildlife. *C. officinale* tolerates drought, xeric to mesic conditions, wide soil textures and nutrients, wide light regimes, grazing, and fire. It can alter hydrology, excrete allelopathic compounds, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not clonal	Zouhar 2002c
Large Propagule	Present	>1000 seeds/m ²	APRS 2000, Upadhyaya 1988, Zouhar 2002c
Small Seeds/Fruits	Absent	Larger than 5mm	Zouhar 2002c
Wind Dispersal	Present	Primary mechanism	APRS 2000, Taylor 1990, Upadhyaya 1988, Whitson 1999, Zouhar 2002c
Animal Dispersal	Present	Caught in fur	Zouhar 2002c
Water Dispersal	Absent	Unlikely	Zouhar 2002c
Specialized Dispersal	Present	Spiny husk aids in long distance dispersal	Upadhyaya 1988, Zouhar 2002c
Dispersal Over Time	Absent	No seed bank	Zouhar 2002c
Plasticity	No Info Available		
Drought Tolerant	Present	Xeric conditions	APRS 2000, Upadhyaya 1988, Zouhar 2002c
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2002c
Flooding/Saturation Tolerant	Absent	Not saturation tolerant	Zouhar 2002c
Wide Nutrient/Soil Texture Tolerant	Present	Tolerates wide textures and nutrients	Upadhyaya 1988, Zouhar 2002c
Wide Light Regime	Present	Shade and sun	Zouhar 2002c
Alkaline/Saline Tolerant	Absent		Zouhar 2002c
Grazing Tolerant	Present	Grazing is a favorable disturbance	APRS 2000, Upadhyaya 1988, Zouhar 2002c
Increases Post Fire	Present	Increases post-fire if present before fire	Zouhar 2002c
Alters Hydrology	Present		APRS 2000, Upadhyaya 1988
Alters Nutrient Cycling	Present		APRS 2000, Upadhyaya 1988
Alters Fire Regime	No Info Available	Need more evidence	Zouhar 2002c
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathic	Zouhar 2002c
Forms Monocultures	Present		APRS 2000, Upadhyaya 1988, Zouhar 2002c
Invades Without Human Disturbance	Present	Can colonize natural areas	Zouhar 2002c

Summary of Ranking: Extreme invasive that reproduces by a large propagule of small seeds that can be dispersed by wind, animals, water, and ballistic, catapulting seeds. *C. scoparius* creates a seed bank viable for over 5 years as well as tolerates drought, xeric to mesic conditions, wide soil nutrients and textures acidic and saline conditions, grazing, and fire. It can alter hydrology by altering channel width, alter nitrogen cycle, alter fire regimes and fuels, stabilize soil, acidify soil, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	No form of clonal growth	Parker 2000
Large Propagule	Present	Can produce over 1 millions seeds/year	Zouhar 2005a, Graves 2010a
Small Seeds/Fruits	Present		Zouhar 2005a, Graves 2010a, Bossard 2005
Wind Dispersal	Present		Zouhar 2005a, Graves 2010a
Animal Dispersal	Present	Seed has elaiosome for ant attraction, viable in droppings of ungulates	Zouhar 2005a, Bossard 2005
Water Dispersal	Present	Spreads on riverbanks, hard seed coat can survive water	Zouhar 2005a, Bossard 2005
Specialized Dispersal	Present	Ballistic, catapulting of seeds	Zouhar 2005a, Bossard 2005
Dispersal Over Time	Present	Seed bank, viable at least 5 years	Zouhar 2005a, Bossard 2005
Plasticity	Absent		Zouhar 2005a, Graves 2010a
Drought Tolerant	Present	Establishes in dry areas	Zouhar 2005a
Wide Moisture Regime	Present	Xeric to mesic	Bossard 2005, Lesica 2012,
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Wide nutrient and texture regime	Zouhar 2005a
Wide Light Regime	Absent	Needs full sun	Zouhar 2005a, Graves 2010a
Alkaline/Saline Tolerant	Present	Tolerates acidic, saline environments	Zouhar 2005a, Bossard 2005
Grazing Tolerant	Present	Grazing tolerant	Zouhar 2005a, Bossard 2005
Increases Post Fire	Present	Fire is a beneficial disturbance	Zouhar 2005a
Alters Hydrology	Present	Alters channel width and flood patterns	Graves 2010a
Alters Nutrient Cycling	Present	Alters nitrogen cycle	Zouhar 2005a, Bossard 2005
Alters Fire Regime	Present	Can change regime and fuels	Zouhar 2005a
Alters Soil Stability	Present	Used in dune stabilization, and to stabilize roadsides	Zouhar 2005a, Graves 2010a
Excretes Salts/Toxins	Present	Can acidify the soil	Graves 2010, Bossard 2005
Forms Monocultures	Present		Zouhar 2005a, Graves 2010a
Invades Without Human Disturbance	Present	Can colonizes undisturbed sites	Zouhar 2005a

21. *Dactylis glomerata* (Orchard grass)

26-Strong

Summary of Ranking: Strong invasive that reproduces by creeping rhizomes and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *D. glomerata* can tolerate xeric to mesic conditions, saturation, shade and full sun, grazing, and fire. It can act as a soil stabilizer and can form monocultures, but needs human disturbance to invade.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking – Low

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Creeping rhizomes	Hickman 1993, Sullivan 1992a
Large Propagule	Present	>1000 seeds/m ²	Boedeltje 2003, USDA-NRCS 2004, Weber 2003
Small Seeds/Fruits	Present	Smaller than 5mm	Bush 2000, Bush 2003, Weber 2003
Wind Dispersal	Present	Blowing seeds	Weber 2003
Animal Dispersal	Present	Viable in droppings	Weber 2003
Water Dispersal	Present	Floating plants	Boedeltje 2003, Weber 2003
Specialized Dispersal	No Info Available		
Dispersal Over Time	Absent	No seed bank	Bush 2000
Plasticity	Present		Bush 2000, Bush 2003, Grime 1979, Sullivan 1992a, USDA-NRCS 2004, Weber 2003
Drought Tolerant	No Info Available		
Wide Moisture Regime	Present	Xeric to mesic	Bush 2000, Bush 2003, USDA-NRCS 2004
Flooding/Saturation Tolerant	Present	Saturation	Weber 2003
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil texture	Vance 2017
Wide Light Regime	Present	Shade and sun	Sullivan 1992a, USDA-NRCS 2004
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a beneficial disturbance	Grime 1979, Sullivan 1992a
Increases Post Fire	Present	Fire is a beneficial disturbance	Sullivan 1992a, USDA-NRCS 2004
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Stabilizer	Bush 2000, Bush 2003, Sullivan 1992a
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense mats	Bush 2000, Bush 2003, Weber 2003
Invades Without Human Disturbance	Absent	Needs human disturbance	Bush 2000

22. *Echium vulgare* (Common viper's-bugloss) | Montana Noxious Weed – Priority 2B | **14-Weak**

Summary of Ranking: Weak invasive that reproduces by a large propagule of over 1,800 small seeds that can be easily carried by wind, wildlife, water, and ballistic dispersal. *E. vulgare* creates a seed bank that is viable for over 3 years. This species does not tolerate a wide range of moisture or light regimes or wide soil characteristics with the exception of alkaline and acidic soil. It can excrete allelopathic compounds such as pyrrolizidine alkaloids to deter grazing by ungulates.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Taproot-no vegetative reproduction reported	Graves 2010b
Large Propagule	Present	Average 1800 seeds	Graves 2010b, Klemow 2001
Small Seeds/Fruits	Present	Nutlets 2-3mm long	Klemow 2001, Lesica 2012
Wind Dispersal	Present	Carries seeds up to 16 ft away from parent plant, tumbleweed rolling can occur also	Graves 2010b, Klemow 2001
Animal Dispersal	Present	Sticky, hairy flower containing seeds can attached to animal fur	Graves 2010b, Klemow 2001
Water Dispersal	Present	Seeds can float and be carried in water and be viable	Graves 2010b, Klemow 2001
Specialized Dispersal	Present	Ballistic dispersal	Klemow 2001
Dispersal Over Time	Present	Seeds viable for 3+ years	Graves 2010b, Klemow 2001
Plasticity	Absent	No evidence of hybrids	Graves 2010b
Drought Tolerant	Absent	Does not tolerate arid climates	Graves 2010b, Klemow 2001
Wide Moisture Regime	Absent	Mesic climates, not xeric	Graves 2010b
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Absent	Does not tolerate high soil fertility	Graves 2010b, Klemow 2001
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	Present	Found in alkaline and acidic soil	Graves 2010b, Klemow 2001
Grazing Tolerant	Absent		Graves 2010b
Increases Post Fire	Absent	Not enough evidence	Graves 2010b
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	Absent	Not enough evidence	Graves 2010b
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Pyrrolizidine alkaloids	Graves 2010b, Klemow 2001
Forms Monocultures	No Info Available		
Invades Without Human Disturbance	No Info Available		

Summary of Ranking: Extreme invasive that reproduces primarily by large seeds that can be dispersed by wildlife and water. *Elaeagnus angustifolia* creates a seed bank and also tolerates drought, xeric to mesic conditions, flooding, wide soil types, shade and sun, saline and alkaline conditions, browsing, and fire. It can alter hydrology by increasing floodplain roughness, alter nitrogen cycle, alter vertical fuel density, increase bank stability, form monoculture networks, and can invade natural areas without human disturbance due to its dispersal methods.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking – Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Reproduces by seed primarily	Zouhar 2005b, Katz 2003, CABI 2014a
Large Propagule	Absent	Most likely large, but no data about quantity	Zouhar 2005b, Katz 2003, CABI 2014a, Nature Serve 2015
Small Seeds/Fruits	Absent	Large seed (1 per fruit)	Zouhar 2005b, Katz 2003, CABI 2014a, Nature Serve 2015
Wind Dispersal	No Info Available		
Animal Dispersal	Present	Animals transport the fruits and seeds are viable in droppings	Zouhar 2005b, CABI 2014a
Water Dispersal	Present	Fruits float, travel along streams	Zouhar 2005b
Specialized Dispersal	Absent	No evidence found of specialized traits	
Dispersal Over Time	Present	Seed bank viable for 3+ years	Zouhar 2005b
Plasticity	Absent	No evidence of hybrids	
Drought Tolerant	Present	Tolerates locations where annual precipitation is <15 inches	Zouhar 2005b, Katz 2003, CABI 2014 ^a
Wide Moisture Regime	Present	Xeric to mesic habitats	Zouhar 2005b, Katz 2003, Lesica 2012, CABI 2014a
Flooding/Saturation Tolerant	Present	Streams with over bank flooding	Zouhar 2005b, Katz 2003, Lesica 2012, CABI 2014a
Wide Nutrient/Soil Texture Tolerant	Present	Wide range of soil types	Zouhar 2005b, Katz 2003, CABI 2014 ^a
Wide Light Regime	Present	Full shade and sun	Zouhar 2005b, Katz 2003
Alkaline/Saline Tolerant	Present	Saline and alkaline tolerant	Zouhar 2005b, Katz 2003, Lesica 2012, CABI 2014a
Grazing Tolerant	Present	Commonly invades grazed pastures, browsing tolerant	Katz 2003
Increases Post Fire	Present	Can resprout after fire	Zouhar 2005b
Alters Hydrology	Present	Affects flood plain roughness where previously no woody habitat would occur	Zouhar 2005b, Katz 2003, Lesica 2012, CABI 2014a
Alters Nutrient Cycling	Present	Increased nitrogen in invaded ecosystems	Zouhar 2005b, Katz 2003, Lesica 2012, CABI 2014a, Nature Serve 2015
Alters Fire Regime	Present	Affects fuels, increases vertical canopy density	Zouhar 2005b
Alters Soil Stability	Present	Introduced to stabilize streambanks and roadsides	Zouhar 2005b, Katz 2003
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Monoculture-like networks	Zouhar 2005b, Katz 2003,
Invades Without Human Disturbance	Present	Invades natural areas due to dispersal methods	Katz 2003

Summary of Ranking: Strong invasive that is strongly rhizomatous and reproduces by a large propagule in dense stands. *Elymus repens* tolerates xeric to mesic conditions, saturation, dry sand to wet alluvium soil, sun and shade, alkaline and saline soil, grazing, and seasonal fire. It is highly competitive for nutrients, acts as a soil binder, and forms extensive monoculture stands after a human caused disturbance.

For Ranking Comparison: Nature Serve ranking - High/Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Strongly rhizomatous	Lesica 2012, McGregor 1986, Snyder 1992a, Werner 1977, CABI 2017a
Large Propagule	Present	>1000 seeds/m ² , dense stands	Werner 1977, CABI 2017a
Small Seeds/Fruits	Absent	Seeds are larger than 5mm	Lesica 2012, McGregor 1986, Werner 1977, CABI 2017
Wind Dispersal	Absent	Seeds fall passively from parent plant, rhizomes are main propagation	Werner 1977
Animal Dispersal	Absent		Werner 1977
Water Dispersal	Absent		Werner 1977
Specialized Dispersal	Absent		Werner 1977
Dispersal Over Time	Absent	No long term seed viability	Snyder 1992a, Werner 1977
Plasticity	Present	Morphological variation, hybrids possible in lab setting	Snyder 1992a, Szczepaniak 2002
Drought Tolerant	Absent	Not drought tolerant	Snyder 1992a, Werner 1977
Wide Moisture Regime	Present	Xeric to mesic	Snyder 1992a, Werner 1977, CABI 2017a
Flooding/Saturation Tolerant	Present	Saturated sites	Lesica 2012, McGregor 1986, Snyder 1992a, Werner 1977
Wide Nutrient/Soil Texture Tolerant	Present	Dry sand to wet alluvium	McGregor 1986, Werner 1977, CABI 2017a
Wide Light Regime	Present	Full sun and shade tolerant	Werner 1977
Alkaline/Saline Tolerant	Present	Alkaline and saline tolerant	Werner 1977, CABI 2017a
Grazing Tolerant	Present	Grazing is a beneficial disturbance	Snyder 1992a, Werner 1977
Increases Post Fire	Present	Adapted to seasonal fire, can increase post fire	Snyder 1992a, Smith 2010
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Highly competitive for resources, especially nitrogen and potassium and phosphorus	Werner 1977
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Efficient soil binder on slopes and banks	Werner 1977
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Extensive stands	Werner 1977
Invades Without Human Disturbance	Absent	Invades disturbed cultivated sites	Werner 1977

Summary of Ranking: Extreme invasive that reproduces by persistent, deep taproot and a large propagule of small seeds that can be dispersed by animals, water, and ballistic dispersal. *Euphorbia esula* creates a seed bank and can tolerate drought, xeric to mesic conditions, wide soil nutrients and textures, shade and sun, grazing, and fire. It can alter hydrology by altering the water table, decrease soil nutrient availability, alter fire regimes, stabilize soil, excrete an allelopathic compound, form dense monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking – High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Persistent, deep taproot	ISSG 2005, APRS 2000, Best 1980, Biesboer 1996, Kreps 2000, Prather 2002, Simonin 2000, Weber 2003, Whitson 1999
Large Propagule	Present	>1000/m ²	ISSG 2005, APRS 2000, Best 1980, Biesboer 1996, Taylor 1990
Small Seeds/Fruits	Present	Smaller than 5mm	APRS 2000, Best 1980, Hickman 1993, Hitchcock 1969, Kreps 2000, Simonin 2000,
Wind Dispersal	No Info Available		
Animal Dispersal	Present	Viable in droppings, ant dispersal-elaiosomes	ISSG 2005, APRS 2000, Biesboer 1996, Kreps 2000, Simonin 2000
Water Dispersal	Present		Biesboer 1996, Simonin 2000
Specialized Dispersal	Present	Ballistic dispersal	ISSG 2005, Biesboer 1996, Prather 2002, Simonin 2000, Whitson 1999
Dispersal Over Time	Present	Seed bank	Kreps 2000, Simonin 2000
Plasticity	Present		APRS 2000, Weber 2003
Drought Tolerant	Present		ISSG 2005, APRS 2000, Biesboer 1996, Prather 2002, Taylor 1990
Wide Moisture Regime	Present	Xeric to mesic	ISSG 2005, APRS 2000, Best 1980, Biesboer 1996, Kreps 2000, Prather 2002
Flooding/Saturation Tolerant	Present	Saturation tolerant	APRS 2000, Best 1980, Biesboer 1996, Kreps 2000, Prather 2002
Wide Nutrient/Soil Texture Tolerant	Present		APRS 2000, Biesboer 1996
Wide Light Regime	Present	Shade and full sun	ISSG 2005, APRS 2000, Kreps 2000
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	ISSG 2005, Best 1980, Hirsch 1998, Kreps 2000, Prather 2002
Increases Post Fire	Present	Fire is a favorable disturbance	APRS 2000, Simonin 2000
Alters Hydrology	Present	Changes water availability	ISSG 2005, Kreps 2000
Alters Nutrient Cycling	Present	Decreases soil nutrients	ISSG 2005
Alters Fire Regime	Present	Changes fuel regimes	Simonin 2000
Alters Soil Stability	Present	Can enhance stability	Hirsch 1998
Excretes Salts/Toxins	Present	Allelopathy	ISSG 2005, Best 1980, Biesboer 1996, Kreps 2000
Forms Monocultures	Present	Dense monocultures	ISSG 2005, APRS 2000, Biesboer 1996, Hirsch 1998, Kreps 2000, Weber 2003
Invades Without Human Disturbance	Present	Can invade pristine locations	ISSG 2005, Best 1980, Hirsch 1998, Kreps 2000, Simonin 2000, Weber 2003

26. *Hieracium aurantiacum* (Orange hawkweed) | Montana Noxious Weed – Priority 2A | 47-Aggressive

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and stolons and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *H. aurantiacum* creates a seed bank that is viable for 7 years; and tolerates xeric to mesic conditions, a wide range of soil properties, shade and sun, grazing, and fire. It can alter nutrient cycles, creates allelopathic pollen, forms monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium/Low Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes and stolons	Stone 2010a, Rinella 2009, Lesica 2012
Large Propagule	Present	>1000/m ²	Stone 2010a, Rinella 2009, Jacobs 2007
Small Seeds/Fruits	Present	1.5-2 mm	Stone 2010a, Rinella 2009, Jacobs 2007
Wind Dispersal	Present	Pappus	Lesica 2012, Jacobs 2007
Animal Dispersal	Present	Minute barbs for sticking in fur, viable in droppings	Stone 2010a, Rinella 2009, Lesica 2012, Jacobs 2007
Water Dispersal	Present	Carried downstream, spreads on stream banks	Stone 2010a, Rinella 2009, Jacobs 2007
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank, viable for 7 years	Stone 2010a, Rinella 2009
Plasticity	Present	Morphological variations	Stone 2010a, Rinella 2009, Jacobs 2007
Drought Tolerant	Absent	Not drought tolerant	Laube 2015
Wide Moisture Regime	Present	Wide moisture regime	Stone 2010a, Lesica 2012
Flooding/Saturation Tolerant	Present	Saturation tolerant	Lesica 2012, Jacobs 2007
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil textures and nutrients	Stone 2010a, Jacobs 2007
Wide Light Regime	Present	Shade tolerant, prefers full sun	Stone 2010a
Alkaline/Saline Tolerant	Present	Alkaline to acidic soil tolerant	Stone 2010a
Grazing Tolerant	Present	Grazing tolerant	Stone 2010a, Rinella 2009
Increases Post Fire	Present	Fire is a favorable disturbance	Stone 2010a
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present		Stone 2010a
Alters Fire Regime	No Info Available	Need more evidence	Stone 2010a
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathic pollen	Stone 2010a
Forms Monocultures	Present		Stone 2010a, Rinella 2009, Jacobs 2007
Invades Without Human Disturbance	Present	Can be found at undisturbed sites	Stone 2010a

27. *Hieracium caespitosum* (Meadow hawkweed complex) | Montana Noxious Weed – Priority 2A | **47-Aggressive**

Summary of Ranking: Aggressive invasiv, that reproduces by rhizomes and stolons and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *H. caespitosum* creates a seed bank that is viable for 7 years, tolerates xeric to mesic conditions, a wide range of soil properties, shade and sun, grazing, and fire. It can alter nutrient cycles, creates allelopathic pollen, forms monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium/Insignificant Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes and stolons	Stone 2011, Rinella 2009, Lesica 2012
Large Propagule	Present	>1000/m ²	Rinella 2009, Jacobs 2007
Small Seeds/Fruits	Present	1.5-2 mm	Stone 2011, Rinella 2009, Jacobs 2007
Wind Dispersal	Present	Pappus	Lesica 2012, Jacobs 2007
Animal Dispersal	Present	Minute barbs for sticking in fur, manure	Stone 2011, Rinella 2009, Jacobs 2007
Water Dispersal	Present	Carried downstream, spreads on stream banks	Jacobs 2007
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present		Stone 2011, Rinella 2009
Plasticity	Present	Morphological variations	Stone 2011, Rinella 2009, Jacobs 2007
Drought Tolerant	Absent	Not drought tolerant	Laube 2015
Wide Moisture Regime	Present	Wide moisture regime	Stone 2011, Lesica 2012
Flooding/Saturation Tolerant	Present	Saturation tolerant	Stone 2011, Rinella 2009, Jacobs 2007
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil textures and nutrients	Stone 2011, Jacobs 2007
Wide Light Regime	Present	Shade tolerant, prefers full sun	Stone 2011, Jacobs 2007
Alkaline/Saline Tolerant	Present	Alkaline-acidic soil	Stone 2011
Grazing Tolerant	Present	Grazing tolerant	Stone 2011, Rinella 2009, Jacobs 2007
Increases Post Fire	Present	Fire is a favorable disturbance	Stone 2011
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present		Stone 2011
Alters Fire Regime	No Info Available	More evidence needed	Stone 2011
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathic pollen	Stone 2011
Forms Monocultures	Present	Monoculture, dense patches, thick mats	Stone 2011, Rinella 2009, Jacobs 2007
Invades Without Human Disturbance	Present	Can be found at undisturbed sites	Stone 2011

28. *Hieracium praealtum* (Kingdevil hawkweed) | Montana Noxious Weed – Priority 2A | 47-Aggressive

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and stolons and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *H. praealtum* creates a seed bank that is viable for 7 years; can hybridize with other *Hieracium* species; and tolerates xeric to mesic conditions, a wide range of soil properties, shade and sun, grazing, and fire. It can alter nutrient cycles, creates allelopathic pollen, forms monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes and stolons	Rinella 2009, Lesica 2012, Jacobs 2007, Jacobs 2007
Large Propagule	Present	>1000/m ²	Rinella 2009, Jacobs 2007
Small Seeds/Fruits	Present	1.5-2 mm	Rinella 2009
Wind Dispersal	Present	Pappus	Lesica 2012, Jacobs 2007
Animal Dispersal	Present	Minute barbs for sticking in fur, manure	Rinella 2009, Jacobs 2007
Water Dispersal	Present	Carried downstream, spreads on stream banks	Jacobs 2007
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present		Rinella 2009
Plasticity	Present	Morphological variations	Jacobs 2007, Rinella 2009
Drought Tolerant	Absent	Not drought tolerant	Laube 2015
Wide Moisture Regime	Present	Wide moisture regime	Lesica 2012
Flooding/Saturation Tolerant	Present	Saturation tolerant	Lesica 2012, Jacobs 2007
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil textures and nutrients	Jacobs 2007
Wide Light Regime	Present	Shade tolerant, prefers full sun	Jacobs 2007
Alkaline/Saline Tolerant	Present	Alkaline-acidic soil	Jacobs 2007
Grazing Tolerant	Present	Grazing tolerant	Rinella 2009, Jacobs 2007
Increases Post Fire	Present	Fire is a favorable disturbance	Jacobs 2007
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present		Jacobs 2007
Alters Fire Regime	No Info Available	More evidence needed	
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathic pollen	Jacobs 2007
Forms Monocultures	Present	Monoculture, dense patches, thick mats	Rinella 2009, Jacobs 2007
Invades Without Human Disturbance	Present	Can be found at undisturbed sites	Jacobs 2007

29. *Hypericum perforatum* (Common St. John's-wort) | Montana Noxious Weed – Priority 2B | 23-Moderate

Summary of Ranking: Extreme invasive that reproduces by extensive lateral roots and a large propagule of over 26,000 small seeds that can be dispersed by wind, wildlife, and water. *Hypericum perforatum* creates a persistent seed bank and tolerates drought, saturation, wide nutrient conditions, grazing, and fire. It can also form dense monoculture mats.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Extensive lateral roots	APRS 2000, Maron 2004, Taylor 1990, Weber 2003, Whitson 1999, Zouhar 2004c, Mangold 2017b
Large Propagule	Present	>26,000 seeds/plant	APRS 2000, Weber 2003, Whitson 1999, Zouhar 2004c, Mangold 2017b
Small Seeds/Fruits	Present	Smaller than 5mm	Hickman 1993, Weber 2003, Zouhar 2004c
Wind Dispersal	Present		Zouhar 2004c
Animal Dispersal	Present	Caught in fur of wildlife	Zouhar 2004c
Water Dispersal	Present	Floating seeds and plants	APRS 2000, Weber 2003, Zouhar 2004c
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank, viable for more than 50 years	APRS 2000, Grime 1979, Zouhar 2004c
Plasticity	Present		Zouhar 2004c
Drought Tolerant	Present	Xeric conditions	APRS 2000, Zouhar 2004c
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2004c
Flooding/Saturation Tolerant	Present	Saturation tolerance	Zouhar 2004c
Wide Nutrient/Soil Texture Tolerant	Present	Wide nutrient tolerance	Zouhar 2004c, Mangold 2017b
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	APRS 2000, Taylor 1990, Zouhar 2004c
Increases Post Fire	Present	Fire is a favorable disturbance	APRS 2000, Weber 2003, Wilson 1999, Zouhar 2004c, Mangold 2017b
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense mats	Weber 2003, Zouhar 2004c
Invades Without Human Disturbance	No Info Available		

Summary of Ranking: Extreme invasive that reproduces by rhizomes and fragmentation and a large propagule of seeds that can be dispersed by floating and spreading in water. *Iris pseudacorus* tolerates xeric to mesic conditions, flooding, wide soil textures, shade and sun, and saline and alkaline conditions. It can alter hydrology by narrowing stream channels, alter soil stability by trapping soil sediments, excrete allelopathic glycosides, form dense stands, and can invade natural areas without human disturbance due to fragmentation and dispersal methods.

For Ranking Comparison: Nature Serve ranking - High/Medium Cal IPC ranking - Limited

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Reproduces by rhizomes and fragmentation	Stone 2009, Jacobs 2011, Newhouser 2004
Large Propagule	Present	500 seeds per plant, >1000 seeds/m ² -dense populations	Stone 2009, Jacobs 2011, Newhouser 2004
Small Seeds/Fruits	Absent	Larger than 5mm long	Jacobs 2011
Wind Dispersal	No Info Available		
Animal Dispersal	No Info Available		
Water Dispersal	Present	Seeds float in water	Stone 2009, Jacobs 2011, Newhouser 2004
Specialized Dispersal	No Info Available		
Dispersal Over Time	Absent	Mixed information, need concrete evidence	Stone 2009, Newhouser 2004
Plasticity	No Info Available	More evidence needed	Newhouser 2004
Drought Tolerant	Absent	Needs at least 1 inch of water, but dry rhizome can be viable for 3+ months	Stone 2009, Jacobs 2011
Wide Moisture Regime	Present	Xeric to mesic	Lesica 2012, Jacobs. 2011
Flooding/Saturation Tolerant	Present	Moist/saturated sites, inundated with high water	Lesica 2012, Stone 2009, Jacobs 2011, Newhouser 2004
Wide Nutrient/Soil Texture Tolerant	Present	Cobblestone, gravel, sand, silt	Stone 2009, Jacobs 2011
Wide Light Regime	Present	Tolerates shaded and open, sunny habitats	Stone 2009, Jacobs 2011
Alkaline/Saline Tolerant	Present	Salt marshes, alkaline peat fens	Stone 2009, Jacobs 2011
Grazing Tolerant	Absent	Need more evidence	Stone 2009, Jacobs 2011
Increases Post Fire	No Info Available	Need more evidence	Stone 2009
Alters Hydrology	Present	Narrows stream width, clog streams, and trap sediments	Stone 2009, Jacobs 2011
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available	Need more evidence	Stone 2009
Alters Soil Stability	Present	Used as erosion control, traps sediments	Stone 2009, Jacobs 2011
Excretes Salts/Toxins	Present	Glycosides	Jacobs 2011
Forms Monocultures	Present	Dense stands	Stone 2009, Newhouser 2004
Invades Without Human Disturbance	Present	Rhizome fragments may break off during flooding and float to new location	Stone 2009, Jacobs 2011

Summary of Ranking: Aggressive invasive that reproduces by a large propagule of fairly large seeds that can be dispersed by wind, wildlife, and water. *Isatis tinctoria* can have morphological alterations between individuals, and tolerates drought, xeric to mesic conditions, saturation, wide soil textures, sun and shade, alkaline conditions, grazing, and fire. It can alter hydrology by altering the water table, excretes allelopathic compound, forms monocultures, and can invade pristine forest and rangeland locations without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking – Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Can resprout from taproots, but not an aggressive form of reproduction	Zouhar 2009
Large Propagule	Present	350-500 seeds/plant, >1000 seeds/m ² –dense mats	Zouhar 2009, DiTomaso 2003
Small Seeds/Fruits	Absent	Larger than 5mm	Zouhar 2009, DiTomaso 2003
Wind Dispersal	Present		Zouhar 2009
Animal Dispersal	Present	Carried by ants	Zouhar 2009
Water Dispersal	Present	Carried in water-flattened wings for floatation	Zouhar 2009, DiTomaso 2003
Specialized Dispersal	No Info Available		
Dispersal Over Time	Absent	Not a viable seed bank	Zouhar 2009
Plasticity	Present	Morphological alterations	Zouhar 2009
Drought Tolerant	Present	Dry locations, taproot	Zouhar 2009
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2009, DiTomaso 2003
Flooding/Saturation Tolerant	Present	Tolerates irrigated fields	DiTomaso 2003
Wide Nutrient/Soil Texture Tolerant	Present	Fine to course soils	Zouhar 2009
Wide Light Regime	Present	Sun and shade	Zouhar 2009
Alkaline/Saline Tolerant	Present	Alkaline tolerant	Zouhar 2009
Grazing Tolerant	Present	Grazing tolerant	Zouhar 2009
Increases Post Fire	Present	Persists in soil post-fire	Zouhar 2009, DiTomaso 2003
Alters Hydrology	Present	Can reduce water for natives	DiTomaso 2003
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available	Unknown effect on regime	Zouhar 2009
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathy	Zouhar 2009
Forms Monocultures	Present	Invades and excludes natives	DiTomaso 2003
Invades Without Human Disturbance	Present	Can spread to pristine forest and rangeland	DiTomaso 2003

32. *Lactuca serriola* (Prickly lettuce)

12-Weak

Summary of Ranking: Extreme invasive that reproduces by a large propagule of small seeds that can be dispersed by wind. *Lactuca serriola* tolerates drought, xeric to mesic conditions, grazing, and fire. It does not form monocultures and does not invade natural locations without a human caused disturbance.

For Ranking Comparison: Nature Serve ranking - Low Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not aggressive clonal reproduction	Weaver 2003
Large Propagule	Present	>1000 seeds/m ²	Weaver 2003, Whitson 1999
Small Seeds/Fruits	Present	Smaller than 5mm	Hickman 1993, Weaver 2003
Wind Dispersal	Present		Hickman 1993, Taylor 1990, Weaver 2003
Animal Dispersal	No Info Available		
Water Dispersal	No Info Available		
Specialized Dispersal	Absent	No specialized traits	Weaver 2003
Dispersal Over Time	Absent	No seed bank	Weaver 2003
Plasticity	Present		Weaver 2003, Whitson 1999
Drought Tolerant	Present		Weaver 2003
Wide Moisture Regime	Present	Xeric to mesic	Weaver 2003
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Absent	Specific soil requirements	Weaver 2003
Wide Light Regime	Absent		Weaver 2003
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is favorable	Weaver 2003
Increases Post Fire	No Info Available		
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Absent		Weaver 2003
Invades Without Human Disturbance	Absent	Needs human disturbance	Weaver 2003

33. *Lepidium chalepense* (Lenspod whitetop) | Montana Noxious Weed – Priority 2B | 55-Extreme

Summary of Ranking: Extreme invasive that reproduces by rhizomes and a large propagule of 1200-4800 small seeds that can be dispersed by wind and water. *Lepidium chalepense* tolerates xeric to mesic conditions, irrigation, a wide range of soil types, saline conditions, grazing, and fire. It can alter hydrology by slowing water drainage and increasing flooding; alter carbon and nitrogen cycles; alter soil stability; excrete salts; and form monocultures. It does not invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking – Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomatous perennials	Lesica 2012, McGregor 1986, Goodwin 2011, Richardson 2004a, Zouhar 2004a
Large Propagule	Present	1200-4800 seeds/plant	Goodwin 2011, Richardson 2004a
Small Seeds/Fruits	Present	2-3 mm	McGregor 1986
Wind Dispersal	Present		Goodwin 2011, Richardson 2004a
Animal Dispersal	Absent		Richardson 2004a
Water Dispersal	Present		Goodwin 2011, Richardson 2004a
Specialized Dispersal	Absent	No special mechanism	Richardson 2004a, Zouhar 2004a
Dispersal Over Time	Absent	Not long term viable	Richardson 2004a, Zouhar 2004a
Plasticity	No Info Available		
Drought Tolerant	Absent	Does not do well in arid regions	Goodwin 2011
Wide Moisture Regime	Present	Xeric to mesic	Lesica 2012, Zouhar 2004a
Flooding/Saturation Tolerant	Present	Irrigated, streamsides	Lesica 2012, Goodwin 2011, Richardson 2004a, Zouhar 2004a
Wide Nutrient/Soil Texture Tolerant	Present	Variety of soil types	Goodwin 2011, Zouhar 2004a
Wide Light Regime	Absent	Open, unshaded areas	Goodwin 2011
Alkaline/Saline Tolerant	Present	Saline tolerant	Lesica 2012, Goodwin 2011, Richardson 2004a, Zouhar 2004a
Grazing Tolerant	Present	Grazing tolerant/increaser	Goodwin 2011
Increases Post Fire	Present	Increases post fire	Zouhar 2004a
Alters Hydrology	Present	Slows water drainage, increases flooding	Richardson 2004a
Alters Nutrient Cycling	Present	Alters carbon and nitrogen contents	Richardson 2004a, Zouhar 2004a
Alters Fire Regime	Absent	No evidence of altered fire regimes	Zouhar 2004a
Alters Soil Stability	Present	Soil erosion	Richardson 2004a, Zouhar 2004a
Excretes Salts/Toxins	Present	increased soil salinity	Zouhar 2004a
Forms Monocultures	Present	Dense monocultures	Richardson 2004a, Zouhar 2004a
Invades Without Human Disturbance	Absent	Needs human disturbance	Goodwin 2011, Richardson 2004a, Zouhar 2004a

Summary of Ranking: Extreme invasive that reproduces by rhizomes and a large propagule of 1200-4800 small seeds that can be dispersed by wind, animals, and water. *Lepidium draba* tolerates xeric to mesic conditions, irrigation, a wide range of soil types, saline conditions, grazing, and fire. It can alter hydrology by slowing water drainage and increasing flooding; alter nutrient cycles; alter soil stability; excrete salts; and form monocultures. It does not invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking – Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomatous perennials	Lesica 2012, McGregor 1986, Goodwin 2011, Sarkis 2004, Zouhar 2004a
Large Propagule	Present	1200-4800 seeds/plant	Goodwin 2011, Sarkis 2004
Small Seeds/Fruits	Present	2-3 mm	McGregor 1986, Zouhar 2004a
Wind Dispersal	Present		Goodwin 2011, Sarkis 2004
Animal Dispersal	Present		Sarkis 2004, Zouhar 2004a
Water Dispersal	Present		Goodwin 2011, Sarkis 2004
Specialized Dispersal	Absent	No special mechanism for dispersal	
Dispersal Over Time	Absent	Not long term viable	Sarkis 2004, Zouhar 2004a
Plasticity	No Info Available		
Drought Tolerant	Absent	Does not do well in arid regions	Goodwin 2011
Wide Moisture Regime	Present	Xeric to mesic	Lesica 2012, Goodwin 2011, Zouhar 2004a
Flooding/Saturation Tolerant	Present	Irrigated, streamsides	Lesica 2012, Goodwin 2011, Sarkis 2004, Zouhar 2004a
Wide Nutrient/Soil Texture Tolerant	Present	Variety of soil types	Goodwin 2011, Zouhar 2004a
Wide Light Regime	Absent	Favors open, unshaded areas	Lesica 2012, McGregor 1986, Goodwin 2011, Sarkis 2004
Alkaline/Saline Tolerant	Present	Saline tolerant	Goodwin 2011
Grazing Tolerant	Present	Grazing tolerant/increaser	Lesica 2012, Goodwin 2011, Sarkis 2004, Zouhar 2004a
Increases Post Fire	Present	Increases post fire	Zouhar 2004a
Alters Hydrology	Present	Slows water drainage, increases flooding	Sarkis 2004
Alters Nutrient Cycling	Present		Sarkis 2004, Zouhar 2004a
Alters Fire Regime	Absent	No evidence of altered fire regimes	Zouhar 2004a
Alters Soil Stability	Present	Soil erosion	Sarkis 2004, Zouhar 2004a
Excretes Salts/Toxins	Present	Increased soil salinity	Zouhar 2004a
Forms Monocultures	Present	Dense monocultures	Sarkis 2004, Zouhar 2004a
Invades Without Human Disturbance	Absent	Needs human disturbance	Goodwin 2011, Sarkis 2004, Zouhar 2004a

35. *Lepidium latifolium* (Perennial pepperweed) | Montana Noxious Weed – Priority 2A | **73-Extreme**

Summary of Ranking: Extreme invasive that reproduces by rhizomes and a large propagule of 1200-4800 small seeds that can be dispersed by wind, animals, and water. *Lepidium latifolium* tolerates xeric to mesic conditions, irrigation, a wide range of soil types, saline conditions, grazing, and fire. It can alter hydrology by slowing water drainage and increasing flooding; alter nutrient cycles; alter soil stability; excrete salts; form monocultures; and unlike the other *Lepidiums*, *L. latifolium* can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking – High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomatous perennials	Zouhar 2004d, Roye 2003, McGregor. 1986, Lesica 2012, Goodwin 2011, CABI 2017b
Large Propagule	Present	1200-4800 seeds/plant	Roye 2003, Goodwin 2011, CABI 2017b
Small Seeds/Fruits	Present	2-3 mm	Zouhar 2004d, McGregor 1986, CABI 2017b
Wind Dispersal	Present	Blowing seeds and plants	Roye 2003, Goodwin 2011, CABI 2017b
Animal Dispersal	Present	Viable in droppings	Zouhar 2004d, Roye 2003, McGregor 1986, CABI 2017
Water Dispersal	Present		Roye 2003, Goodwin 2011, CABI 2017b
Specialized Dispersal	Absent	No special mechanism for dispersal	Roye 2003
Dispersal Over Time	Absent	No seed bank	Zouhar 2004d
Plasticity	No Info Available		
Drought Tolerant	Absent	Does not do well in arid regions	Goodwin 2011
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2004d, Lesica 2012, Goodwin 2011, CABI 2017b
Flooding/Saturation Tolerant	Present	Irrigated, streamsides	Zouhar 2004d, Roye 2003, Lesica 2012, Goodwin 2011, CABI 2017b
Wide Nutrient/Soil Texture Tolerant	Present	Variety of soil types	Zouhar 2004d, Goodwin 2011, CABI 2017b
Wide Light Regime	Absent	Open, unshaded areas	Goodwin 2011
Alkaline/Saline Tolerant	Present	Saline tolerant	Zouhar 2004d, Roye 2003, Lesica 2012, Goodwin 2011
Grazing Tolerant	Present	Grazing tolerant/increaser	Roye 2003, Goodwin 2011, CABI 2017b
Increases Post Fire	Present	Increases post fire	Zouhar 2004d
Alters Hydrology	Present	Slows water drainage, increases flooding	Roye 2003
Alters Nutrient Cycling	Present	Alters carbon and nitrogen contents	Zouhar 2004d, Roye 2003
Alters Fire Regime	Absent		Zouhar 2004d
Alters Soil Stability	Present	Soil erosion	Zouhar 2004d
Excretes Salts/Toxins	Present	Increased soil salinity	Zouhar 2004d, Roye 2003
Forms Monocultures	Present	Dense monocultures	Zouhar 2004d, Roye 2003
Invades Without Human Disturbance	Present	Evidence of invading pristine sites	Zouhar 2004d, Roye 2003, Goodwin 2011

36. *Leucanthemum vulgare* (Oxeye daisy) | Montana Noxious Weed – Priority 2B | 45-Aggressive

Summary of Ranking: Aggressive invasive that reproduces by aggressive rhizomes and a large propagule of small seeds that can be dispersed by wind and wildlife. *Leucanthemum vulgare* creates a seed bank and tolerates drought, xeric to mesic conditions, wide soil texture and nutrients, shade and sun, alkaline conditions, grazing, and fire. It competes for nutrient resources, alters soil stability, forms dense monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking – Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Aggressive rhizomatous growth	Alvarez 2000, Ralph 2014, Olson 1997, OMAF 2002, Taylor 1990, Whitson 1999, WSNWCB 2002, Mangold 2017a
Large Propagule	Present	>1000 seeds/m ²	Mitch 2000, Olson 1997, Olson 1999, WSNWCB 2002, Mangold 2017a
Small Seeds/Fruits	Present	Achenes <5mm	Alvarez 2000, Clements 2004, Hickman 1993
Wind Dispersal	Present	Blowing seeds	Olson 1999, WSNWCB 2002
Animal Dispersal	Present	Carried by insects, viable in droppings	Alvarez 2000, Andersen 1995, Mitch 2000, Olson 1999, WSNWCB 2002
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Alvarez 2000, Mitch 2000, Mangold 2017a
Plasticity	Present		Clements 2004
Drought Tolerant	Present		Clements 2004, Mitch 2000, Olson 1999
Wide Moisture Regime	Present	Xeric to mesic conditions	Alvarez 2000, Clements 2004, Mitch 2000, Olson 1999, WSNWCB 2002
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil textures and nutrient tolerances	Clements 2004, Mitch 2000, Olson 1999, USDA-NRCS 2004, WSNWCB 2002
Wide Light Regime	Present	Shade and sun	Alvarez 2000, Clements 2004, USDA-NRCS 2004
Alkaline/Saline Tolerant	Present	Alkaline tolerant	Clements 2004
Grazing Tolerant	Present	Grazing is a favorable disturbance	Alvarez 2000, Clements 2004, Ralph 2014, Olson 1997, Taylor 1990, USDA-NRCS 2004, WSNWCB 2002, Mangold 2017a
Increases Post Fire	No Info Available		
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Competitive for resources	Olson 1999
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Stabilize soils	Clements 2004, WSNWCB 2002
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense stands	Alvarez 2000, CWMA 2017, Olson 1999, OMAF 2002, WSNWCB 2002, Mangold 2017a
Invades Without Human Disturbance	Present	Can invade pristine sites	Alvarez 2000

37. *Linaria dalmatica* (Dalmatian toadflax) | Montana Noxious Weed – Priority 2B | 48-Aggressive

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Linaria dalmatica* creates a seed bank; can have variable flower phenology; and tolerates drought, xeric to mesic conditions, saturation, a wide variety of soils, shade and sun, grazing, and fire. It can alter hydrology by increasing sediments and altering stream flow patterns; alter fire regimes; alter soil stability by increasing soil surface run-off; form dense monocultures; and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking – Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes	Carpenter 1998b, Prather 2002, Whitson 1999, WSNWCB 2002
Large Propagule	Present	>1000/m ²	Carpenter 1998b, Gates 1960, Prather 2002, WSNWCB 2002, Zouhar 2003c
Small Seeds/Fruits	Present	1.2-2 mm	Carpenter 1998b, Hickman 1993, Lajeunesse 1999, Zouhar 2003c
Wind Dispersal	Present	Seeds are winged	Butler 1994, WSNWCB 2002
Animal Dispersal	Present	Ants/birds disperse, viable in droppings	Butler 1994, Lajeunesse 1999, Zouhar 2003c, CABI 2017c
Water Dispersal	Present	Seeds can float	Lajeunesse 1999, Zouhar 2003c
Specialized Dispersal	Present		Lajeunesse 1999
Dispersal Over Time	Present	Seed bank	Butler 1994, Lajeunesse 1999, WSNWCB 2002, Zouhar 2003c
Plasticity	Present	Variable flowering phenology	Carpenter 1998b, Lajeunesse 1999, Zouhar 2003c
Drought Tolerant	Present		Carpenter 1998b, Gates 1960, Whitson 1999, WSNWCB 2002,
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2003c
Flooding/Saturation Tolerant	Present	Saturation tolerant	Carpenter 1998b, Zouhar 2003c
Wide Nutrient/Soil Texture Tolerant	Present	Coarse, sandy loams, gravel	Gates 1960, Lajeunesse 1999, CABI 2017c
Wide Light Regime	Present	Shade to full sun	Zouhar 2003c, CABI 2017c
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	Beck 2002b, Carpenter 1998b, Lajeunesse 1999, Zouhar 2003c
Increases Post Fire	Present	Can survive fire and increase	Carpenter 1998b, Lajeunesse 1999, Zouhar 2003c
Alters Hydrology	Present	Sediment yielding, alters flows	Carpenter 1998b, Lajeunesse 1999, CABI 2017c
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available	Need more evidence	
Alters Soil Stability	Present	Soil erosion, increase soil surface run off	Lajeunesse 1999, Zouhar 2003c
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense monocultures	Carpenter 1998b, Whitson 1999, WSNWCB 2002, Zouhar 2003c
Invades Without Human Disturbance	Present	Invades after naturally occurring disturbances	Beck 2002b, Lajeunesse 1999, Zouhar 2003c, CABI 2017c

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Linaria vulgaris* creates a seed bank; can have variable flower phenology; and tolerates drought, xeric to mesic conditions, saturation, a wide variety of soils, shade and sun, grazing, and fire. It can alter hydrology by increasing sediments and altering stream flow patterns; alter fire regimes; alter soil stability by increasing soil surface run-off; form dense monocultures; and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes	Zouhar 2003b, Vujnovic 1997, McGregor 1986, Lesica 2012, Lajeunesse 1993, CABI 2017d
Large Propagule	Present	>1000/m ²	Zouhar 2003b, Vujnovic 1997, Lajeunesse 1993, CABI 2017d, Brusati 2007
Small Seeds/Fruits	Present	1.2-2 mm	Zouhar 2003b, Vujnovic 1997, McGregor 1986, CABI 2017d
Wind Dispersal	Present	Seeds are winged	Zouhar 2003b, Vujnovic 1997, CABI 2017d
Animal Dispersal	Present	Ants and birds disperse, viable in wildlife droppings	Zouhar 2003b, Vujnovic 1997, Lajeunesse 1993, CABI 2017d
Water Dispersal	Present	Seeds can float	Zouhar 2003b, Vujnovic 1997, Lajeunesse 1993, CABI 2017d,
Specialized Dispersal	Present		Lajeunesse 1993
Dispersal Over Time	Present	Seed bank	Zouhar 2003b, Lajeunesse 1993
Plasticity	Present	Variable flowering phenology	Vujnovic 1997, Brusati 2007
Drought Tolerant	Present		Zouhar 2003b, CABI 2017d
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2003b, Lajeunesse 1993, CABI 2017d
Flooding/Saturation Tolerant	Present	Saturation tolerant	Zouhar 2003b, Lesica 2012, CABI 2017d, Brusati 2007
Wide Nutrient/Soil Texture Tolerant	Present	Course, sandy loams, gravel	Zouhar 2003b
Wide Light Regime	Present	Shade to full sun	Zouhar 2003b
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present		Zouhar 2003b, Vujnovic 1997, Lajeunesse 1993, Brusati 2007
Increases Post Fire	Present	Can survive fire and increase	Zouhar 2003b, Vujnovic 1997, Lajeunesse 1993, Dodge 2008
Alters Hydrology	Present	Sediment yielding, alters flows	Zouhar 2003b, Lajeunesse 1993
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	Absent	Need more evidence	Zouhar 2003b
Alters Soil Stability	Present	Soil erosion, soil surface run off increase	Zouhar 2003b, Lajeunesse 1993
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense monocultures	Zouhar 2003b, Lajeunesse 1993
Invades Without Human Disturbance	Present	Invades after naturally occurring disturbances	Zouhar 2003b, Lajeunesse 1993

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and small seeds that can be dispersed by wildlife droppings and a form of ballistic dispersal from seed pods. *Lotus corniculatus* creates a seed bank and tolerates xeric to mesic conditions, saturation, wide soil textures, shade and sun, alkaline conditions, grazing, and fire. It can alter nitrogen and phosphorus cycles, increase soil stability, excrete allelopathic cyanogenic glycosides, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes	Taylor 1990, Turkington 1980
Large Propagule	Absent		USDA-NRCS 2004
Small Seeds/Fruits	Present	Smaller than 5mm	Turkington 1980, Weber 2003
Wind Dispersal	Absent	Not a common dispersal	USDA-NRCS 2004
Animal Dispersal	Present	Viable in droppings	Turkington 1980
Water Dispersal	No Info Available		
Specialized Dispersal	Present	Pods eject seeds	Turkington 1980
Dispersal Over Time	Present	Seed bank	Turkington 1980
Plasticity	Present		Turkington 1980, USDA-NRCS 2004, Weber 2003
Drought Tolerant	Absent	Needs moisture	USDA NRCS
Wide Moisture Regime	Present	Xeric to mesic	Turkington 1980
Flooding/Saturation Tolerant	Present	Saturation/waterlogging tolerant	Taylor 1983, Turkington 1980, Weber 2003
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil texture tolerant, needs phosphorus	Turkington 1980
Wide Light Regime	Present	Shade and full sun	Taylor 1983, Turkington 1980
Alkaline/Saline Tolerant	Present	Alkaline tolerant	Turkington 1980
Grazing Tolerant	Present	Grazing is favorable	Turkington 1980
Increases Post Fire	Present	Fire is favorable	Weber 2003
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Competitive for phosphorus and nitrogen	Turkington 1980, USDA-NRCS 2004, Weber 2003
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Erosion control	Weber 2003
Excretes Salts/Toxins	Present	Allelopathic, Cyanogenic glycosides	Weber 2003
Forms Monocultures	Present	Dense mats	Turkington 1980, Weber 2003
Invades Without Human Disturbance	Absent	Needs human disturbance	Turkington 1980

Summary of Ranking: Extreme invasive that reproduces by aggressive rhizomes and a very large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Lythrum salicaria* creates a seed bank and tolerates xeric to mesic conditions, saturation, a wide variety of soil types, shade and sun, calcareous and acidic soils, grazing, and fire. It can alter hydrology by altering water flows; alter fire regimes; alter soil stability; form monocultures; and can invade natural areas without human disturbance due to dispersal methods.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes, aggressively spreads	Munger 2002, McGregor 1986, Jacobs 2008b, CABI 2016a
Large Propagule	Present	1,000-1 million/plant	Munger 2002, CABI 2016a,
Small Seeds/Fruits	Present	Smaller than 5mm	Munger 2002, Jacobs 2008b, CABI 2016a,
Wind Dispersal	Present	Blowing seeds	Munger 2002, Jacobs 2008b, CABI 2016a, Pirosko 2004
Animal Dispersal	Present	Can get caught in fur	Munger 2002, CABI 2016a
Water Dispersal	Present	Floating plants	Munger 2002, Jacobs 2008b, CABI 2016a, Pirosko 2004
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Munger 2002, Pirosko 2004
Plasticity	Present	Morphological variation, hybrids are possible in lab setting	Munger 2002, Jacobs 2008b, Pirosko 2004, Montague 2007
Drought Tolerant	No Info Available		
Wide Moisture Regime	Present	Mesic to saturated	Munger 2002
Flooding/Saturation Tolerant	Present	Marshes, ponds, saturation tolerant	Munger 2002, McGregor 1986, Pirosko 2004, Lesica 2012
Wide Nutrient/Soil Texture Tolerant	Present	Variety of soil types	Munger 2002, Jacobs 2008
Wide Light Regime	Present	Tolerates up to 50 % shade and full sun	Munger 2002, Jacobs 2008
Alkaline/Saline Tolerant	Present	Calcareous to acid soils	Munger 2002, Jacobs 2008b
Grazing Tolerant	Present	Resprouts readily	Munger 2002, Jacobs 2008b
Increases Post Fire	Present	Resprouts readily	Jacobs 2008b
Alters Hydrology	Present	Alters aquatic habitat, sedimentation	Munger 2002, Jacobs 2008b, Pirosko 2004
Alters Nutrient Cycling	Present		Pirosko 2004
Alters Fire Regime	Present	Difficult to burn, alters regime	Munger 2002
Alters Soil Stability	Present	Erosion, sedimentation	Pirosko 2004
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense monocultures	Munger 2002, Jacobs 2008b, Pirosko 2004
Invades Without Human Disturbance	Present	Can invade intact communities	Pirosko 2004

Summary of Ranking: Moderate invasive that reproduces by a large propagule of small seeds that can be dispersed by wildlife and water. *Medicago lupulina* creates a seed bank and tolerates drought, xeric to mesic conditions, wide nutrients and soil textures, and grazing. It can alter nitrogen cycles and form dense monoculture mats.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not aggressively clonal	USDA-NRCS 2004
Large Propagule	Present	>1000 seeds/m ²	Turkington 1979, USDA-NRCS 2004
Small Seeds/Fruits	Present	Smaller than 5mm	Hickman 1993, Turkington 1979
Wind Dispersal	No Info Available		
Animal Dispersal	Present	Viable in droppings	Turkington 1979, USDA-NRCS 2002a
Water Dispersal	Present		Turkington 1979
Specialized Dispersal	Absent	No specialized traits	Turkington 1979
Dispersal Over Time	Present	Seed bank	Turkington 1979
Plasticity	Present		Turkington 1979
Drought Tolerant	Present	Drought conditions	Gebhart 1993, Turkington 1979, USDA-NRCS 2004
Wide Moisture Regime	Present	Xeric to mesic	Turkington 1979, USDA-NRCS 2004
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Wide nutrient and soil texture	Turkington 1979, USDA-NRCS 2002a
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is favorable	Grime 1979, USDA-NRCS 2002a
Increases Post Fire	No Info Available		
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Highly competitive for nitrogen	Gebhart 1993, USDA-NRCS 2004
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense mats	USDA-NRCS 2004
Invades Without Human Disturbance	No Info Available		

Summary of Ranking: Extreme invasive that reproduces by a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Melilotus officinalis* creates a seed bank and tolerates drought, xeric to mesic conditions, saturation, wide soil nutrients and textures, alkaline conditions, grazing, and fire. It can alter nitrogen cycles, increase soil stability, excrete an allelopathic compound, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not aggressively clonal	Turkington 1978, Gucker 2009a
Large Propagule	Present	>1000 seeds/m ²	Turkington 1978, USDA-NRCS 2004
Small Seeds/Fruits	Present	Smaller than 5mm	Eckardt 1987, Hickman 1993
Wind Dispersal	Present	Blowing seeds	Eckardt 1987, Turkington 1978, Gucker 2009a
Animal Dispersal	Present	Viable in droppings	Turkington 1978
Water Dispersal	Present	Floating plants	Eckardt 1987, Turkington 1978, Weber 2003
Specialized Dispersal	Present		Turkington 1978
Dispersal Over Time	Present	Seed bank	Eckardt 1987, Turkington 1978, Weber 2003, Gucker 2009a
Plasticity	Present		Turkington 1978
Drought Tolerant	Present	Drought conditions	Eckardt 1987, Gebhart 1993, Turkington 1978, USDA-NRCS 2004
Wide Moisture Regime	Present	Xeric to mesic	Eckardt 1987, USDA-NRCS 2004, Gucker 2009a
Flooding/Saturation Tolerant	Present	Saturation tolerant	Eckardt 1987
Wide Nutrient/Soil Texture Tolerant	Present	Wide nutrient and soil texture	Turkington 1978, Weber 2003
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	Present	Alkaline tolerant	Eckardt 1987, Turkington 1978, Weber 2003
Grazing Tolerant	Present	Grazing is favorable	Gucker 2009a
Increases Post Fire	Present	Fire is favorable	Eckardt 1987, USDA-NRCS 2004, Weber 2003
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Highly competitive for nitrogen	Eckardt 1987, Gebhart 1993, Taylor 1990, Weber 2003, Horton 2017
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Stabilizer	Turkington 1978, Whitson 1999, Horton 2017
Excretes Salts/Toxins	Present	Allelopathic	Gucker 2009a
Forms Monocultures	Present	Dense mats	Eckardt 1987, Turkington 1978, Weber 2003
Invades Without Human Disturbance	Present		Eckardt 1987

43. *Phalaris arundinacea* (Reed Canarygrass) 47-Aggressive

Summary of Ranking: Aggressive invasive that reproduces by aggressive clones and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Phalaris arundinacea* creates a seed bank and can have genetic variation as well as tolerate drought, xeric to mesic conditions, flooding, partial shade to full sun, saline conditions, grazing, and fire. It can alter hydrology by narrowing water flow, stabilize soil, form extremely dense monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Aggressively clonal	APRS 2000, Hickman 1993, Lyons 1998, Naglich 1994, Snyder 1992b, Stannard 2002, Taylor 1990, USDA-NRCS 2002c, USDA-NRCS 2004, Weber 2003, Whitson 1999
Large Propagule	Present	>1000 seeds/m ²	Boedeltje 2003, USDA-NRCS 2004
Small Seeds/Fruits	Present	3-5mm	Hickman 1993, Lyons 1998, Stannard 2002, USDA-NRCS 2004
Wind Dispersal	Present		Moffat 2004
Animal Dispersal	Present	Carried by wildlife	Stannard 2002
Water Dispersal	Present	Buoyant seeds	APRS 2000, Boedeltje 2003, Naglich 1994
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Large seed bank	Stannard 2002
Plasticity	Present	Genetic variation	Lyons 1998, Stannard 2002, USDA-NRCS 2002c, USDA-NRCS 2004, Weber 2003
Drought Tolerant	Present		Lyons 1998, Naglich 1994
Wide Moisture Regime	Present	Xeric to mesic	APRS 2000, Lyons 1998, Naglich 1994, Snyder 1992b, USDA-NRCS 2004
Flooding/Saturation Tolerant	Present	Flooding tolerant	APRS 2000, Hickman 1993, Lyons 1998, Naglich 1994, Snyder 1992b, Stannard 2002, Taylor 1990, USDA-NRCS 2002c, USDA-NRCS 2004, Weber 2003, Whitson 1999,
Wide Nutrient/Soil Texture Tolerant	No Info Available		
Wide Light Regime	Present	Partial shade to full sun	Lyons 1998, Naglich 1994
Alkaline/Saline Tolerant	Present	Saline tolerant	Lyons 1998, Snyder 1992b, USDA-NRCS 2002c, USDA-NRCS 2004
Grazing Tolerant	Present	Grazing is favorable	Lyons 1998, Snyder 1992b, Stannard 2002, USDA-NRCS 2002c
Increases Post Fire	Present	Fire is a favorable disturbance	APRS 2000, Snyder 1992b, Stannard 2002, USDA-NRCS 2004, Wilson 1999
Alters Hydrology	Present	Narrows water flow	APRS 2000, Lyons 1998
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Stabilizer	APRS 2000, Lyons 1998, Naglich 1994, Snyder 1992b, USDA-NRCS 2002c, Weber 2003
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Extremely dense monocultures	APRS 2000, Lyons 1998, Naglich 1994, Snyder 1992b, Stannard 2002, Taylor 1990, USDA-NRCS 2004, Weber 2003
Invades Without Human Disturbance	Present	Does not need human disturbance	APRS 2000, Lyons 1998, Stannard 2002

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and a large propagule of small seeds that can be dispersed by wind and wildlife. *Phleum pratense* can tolerate drought, xeric to mesic conditions, saturation, grazing, and fire. It can alter soil stability, create allelopathic pollen, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes	Esser 1993a
Large Propagule	Present	>2000 seeds/m ²	Esser 1993a, USDA-NRCS 2004
Small Seeds/Fruits	Present	1-2mm	Bush 2002c, Esser 1993a, Hickman 1993, USDA-NRCS 2004
Wind Dispersal	Present	Primary dispersal	Esser 1993a
Animal Dispersal	Present	Transported by insects and rodents	Esser 1993a
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	Absent	No persistent seed bank	NRCS 2004
Plasticity	Present		Bush 2002c, Esser 1993a, USDA-NRCS 2004
Drought Tolerant	No Info Available		
Wide Moisture Regime	Present	Xeric to mesic	APRS 2000, Esser 1993a, Leege 1981
Flooding/Saturation Tolerant	Present	Saturation tolerant	APRS 2000, Esser 1993a, Leege 1981
Wide Nutrient/Soil Texture Tolerant	Present		Bush 2002c, Esser 1993a, USDA-NRCS 2004
Wide Light Regime	Present	Partial shade to sun	APRS 2000, Esser 1993a
Alkaline/Saline Tolerant	Absent	Not alkaline tolerant	USDA-NRCS 2004
Grazing Tolerant	Present	Grazing is favorable	Crowe 1997, Esser 1993a, Green 1995, Leege 1981
Increases Post Fire	Present	Fire is favorable	Esser 1993a, USDA-NRCS 2004
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Stabilizer	Esser 1993a, Weber 2003
Excretes Salts/Toxins	Present	Allelopathic pollen	Esser 1993a
Forms Monocultures	Present	Dense monocultures	Weber 2003
Invades Without Human Disturbance	Present	Does not need human disturbance	Esser 1993a, Weber 2003

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and a large propagule of small seeds that can be dispersed by wind and water. Phragmites creates a seed bank and tolerates drought stress, xeric to mesic conditions, flooding, wide soil textures, partial to full sun, grazing, and fire. It can alter hydrology by altering water flows, alter soil nutrients and cycles, alter soil stability, form monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes	Lesica 2012, McGregor 1986, Orloff 2016, Gucker 2008a, CABI 2015b
Large Propagule	Present	>1000 seeds/m ²	Gucker 2008a, CABI 2015b
Small Seeds/Fruits	Present	1.2mm	Gucker 2008a, CABI 2015b
Wind Dispersal	Present	Blowing seeds	Gucker 2008a
Animal Dispersal	No Info Available		
Water Dispersal	Present	Floating plants	Gucker 2008a
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Gucker 2008a
Plasticity	Present	High phenotypic variation, possible to have hybrids in lab setting	Meyerson 2010, Saltonstall 2007
Drought Tolerant	Present	Tolerates drought stress	Pagter 2005, CABI 2015b
Wide Moisture Regime	Present	Xeric to mesic	Gucker 2008a, CABI 2015b
Flooding/Saturation Tolerant	Present	Ponds, marshes, river floodplains	Lesica 2012, McGregor 1986, Orloff 2016, Gucker 2008a,
Wide Nutrient/Soil Texture Tolerant	Present	Clay, silt, sand, sandy loams	Gucker 2008a
Wide Light Regime	Present	Partial shade to full sun	Gucker 2008a
Alkaline/Saline Tolerant	Present	Saline and basic soil tolerant	Orloff 2016, Gucker 2008a, CABI 2015b
Grazing Tolerant	Present	Resprouts readily after grazing	Gucker 2008a
Increases Post Fire	Present	Post fire succession	Gucker 2008a
Alters Hydrology	Present	Sedimentation, alters water regimes	Orloff 2016, Gucker 2008a, CABI 2015b
Alters Nutrient Cycling	Present	Alters soil properties and cycles	Gucker 2008a
Alters Fire Regime	Absent	Need more evidence	Gucker 2008a
Alters Soil Stability	Present	Erosion	Gucker 2008a, CABI 2015b
Excretes Salts/Toxins	Absent	No allelopathic properties	Lesica 2012, Orloff 2016, Gucker 2008a, CABI 2015b
Forms Monocultures	Present		Gucker 2008a
Invades Without Human Disturbance	Absent	Needs human disturbance	Orloff 2016

Summary of Ranking: Moderate invasive that reproduces by rhizomes and small seeds that can be dispersed by wind and wildlife. *Plantago major* creates a seed bank and tolerates drought stress, xeric to mesic conditions, diverse nutrient and soil textures, shade and sun, grazing, and fire. It does not form monoculture mats and needs human disturbance to invade new locations.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Aggressive clonal	APRS 2000, Hawthorn 1974
Large Propagule	Absent	<1000/plant	APRS 2000
Small Seeds/Fruits	Present	Smaller than 5mm	Hawthorn 1974, Hickman 1993, USDA-NRCS 2004, van der Toorn 1988
Wind Dispersal	Present	Blowing seeds	USDA-NRCS 2004
Animal Dispersal	Present		APRS 2000, Hawthorn 1974
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Hawthorn 1974
Plasticity	Present		Hawthorn 1974, Hickman 1993
Drought Tolerant	Present	Xeric conditions	Hawthorn 1974, USDA-NRCS 2004
Wide Moisture Regime	Present	Xeric to mesic	Hawthorn 1974, USDA-NRCS 2004
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Diverse nutrient and soil texture	APRS 2000, Hawthorn 1974, USDA-NRCS 2004
Wide Light Regime	Present	Shade to full sun	APRS 2000, Hawthorn 1974, USDA-NRCS 2004, van der Toorn 1988
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is favorable	Hawthorn 1974, USDA-NRCS 2004
Increases Post Fire	Present	Fire is favorable	USDA-NRCS 2004
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Absent	Does not form mats	USDA-NRCS 2004
Invades Without Human Disturbance	No Info Available		

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and a large propagule of small seeds that can be dispersed by wind and wildlife. *Poa pratensis* creates a seed bank and tolerates drought, xeric to mesic conditions, saturation, wide soil texture and nutrients, shade and sun, alkaline conditions, grazing, and fire. It can stabilize soil, form monocultures, and invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Low

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomatous	APRS 2000, Crowe 1997, Green 1995, Hickman 1993, Sather 1996, Taylor 1990, Uchytel 1993, Weber 2003,
Large Propagule	Present	>1000 seeds/m ²	APRS 2000, Bush 2002a, Sather 1996, Uchytel 1993, USDA-NRCS 2004
Small Seeds/Fruits	Present	Smaller than 5mm	APRS 2000, Bush 2002a, Hickman 1993, USDA-NRCS 2004
Wind Dispersal	Present	Seeds blown by wind	APRS 2000
Animal Dispersal	Present	Viable in droppings	APRS 2000
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Sather 1996
Plasticity	Present		Bush 2002a, Green 1995, Taylor 1990, USA-NRCS 2004
Drought Tolerant	Present	Drought conditions	Bush 2002c , Uchytel 1993
Wide Moisture Regime	Present	Xeric to mesic	APRS 2000, Bush 2002a, Sather 1996, Uchytel 1993
Flooding/Saturation Tolerant	Present	Saturation	APRS 2000, Sather 1996, Uchytel 1993, Weber 2003
Wide Nutrient/Soil Texture Tolerant	Present	Wide soil textures, specific nutrient needs	USDA-NRCS 2004
Wide Light Regime	Present	Shade to full sun	APRS 2000, Bush 2002a, Sather 1996, Uchytel 1993, USDA-NRCS 2004
Alkaline/Saline Tolerant	Present	Alkaline tolerant	Hickman 1993
Grazing Tolerant	Present	Grazing is a favorable disturbance, increaser	APRS 2000, Clary 1995, Crowe 1997, Green 1995, Hellström 2003, Sather 1996, Uchytel 1993
Increases Post Fire	Present	Fire is favorable	Uchytel 1993, USDA-NRCS 2004
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Soil stabilizer	APRS 2000, Bush 2002a, Uchytel 1993, Weber 2003
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense mats	Bush 2002a, Sather 1996, USDA-NRCS 2004, Weber 2003
Invades Without Human Disturbance	Present	Can invade natural sites	Sather 1996, Uchytel 1993

Summary of Ranking: Aggressive invasive that reproduces by a large propagule of 4,600 small seeds that can be dispersed by wind, wildlife, and water. *Polygonum aviculare* creates a seed bank and tolerates drought, xeric to mesic conditions, saturation, wide soil textures and nutrients, shade and sun, saline conditions, grazing, and fire. It is a soil binder, excretes allelopathic compounds, forms monotypic stands, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Low Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent		Stone 2010b, Parkinson 2017
Large Propagule	Present	4,600 seeds/plant	Stone 2010b
Small Seeds/Fruits	Present	1.7-4mm long nutlets	Stone 2010b, Lesica 2012
Wind Dispersal	Present		Stone 2010b
Animal Dispersal	Present	Birds can disperse, viable in manure	Stone 2010b
Water Dispersal	Present	Plants carried downstream	Stone 2010b, Parkinson 2017
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Stone 2010b
Plasticity	Present	High phenotypic plasticity	Stone 2010b, Parkinson 2017, Lesica 2012
Drought Tolerant	Present		Stone 2010b
Wide Moisture Regime	Present	Xeric and saturated soil	Parkinson 2017
Flooding/Saturation Tolerant	Present	Streamsides, riparian	Stone 2010b, Parkinson 2017, Lesica 2012
Wide Nutrient/Soil Texture Tolerant	Present	Not limited by soil type, wide nutrient tolerant	Stone 2010b, Parkinson 2017, Siemens 2007
Wide Light Regime	Present	Shade and sun tolerant	Parkinson 2017, Siemens 2007
Alkaline/Saline Tolerant	Present	Establishes in salt marshes	Stone 2010b
Grazing Tolerant	Present	Grazing tolerant	Stone 2010b
Increases Post Fire	Present	Can resprout after fire	Stone 2010b
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	Absent	Need more info	Stone 2010b
Alters Soil Stability	Present	Used as a soil binder, facilitates development	Stone 2010b, Parkinson 2017
Excretes Salts/Toxins	Present	Allelopathic properties inhibit germination of other seeds	Stone 2010b
Forms Monocultures	Present	Monotypic stands	Stone 2010b, Parkinson 2017
Invades Without Human Disturbance	Absent	Needs human disturbance	Stone 2010b, Parkinson 2017

49. *Polygonum sachalinense* (Giant Knotweed) | Montana Noxious Weed – Priority 1B | 77-Extreme

Summary of Ranking: Extreme invasive that reproduces by rhizomes and a large propagule of over 50,000 small seeds that can be dispersed by wind, wildlife, and water. *Polygonum sachalinense* creates a seed bank; can hybridize with other *Polygonum* species; and tolerates xeric to mesic conditions, saturation, wide soil textures and nutrients, shade and sun, saline conditions, grazing, and fire. It can alter hydrology, alter nitrogen cycles, act as a soil binder, excrete allelopathic compounds, form monotypic stands, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High/Medium Cal IPC ranking – Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Stout rhizomes	Stone 2010c, Parkinson 2010a
Large Propagule	Present	50,000-150,000 seeds/plant	Stone 2010c
Small Seeds/Fruits	Present	3mm long nutlets	Stone 2010c
Wind Dispersal	Present		Stone 2010c
Animal Dispersal	Present	Birds can disperse, manure	Stone 2010c
Water Dispersal	Present	Plants carried downstream	Stone 2010c, Parkinson 2010a
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Stone 2010c
Plasticity	Present	Hybridize with other <i>Polygonums</i>	Stone 2010c, Parkinson 2010a
Drought Tolerant	Absent		Stone 2010c
Wide Moisture Regime	Present	Xeric and saturated soil	Stone 2010c, Parkinson 2010a
Flooding/Saturation Tolerant	Present	Streamsides, riparian	Stone 2010c, Parkinson 2010a
Wide Nutrient/Soil Texture Tolerant	Present	Not limited by soil type, wide nutrients	Stone 2010c, Parkinson 2010a, Siemens 2007
Wide Light Regime	Present	Shade and sun tolerant	Stone 2010c, Parkinson 2010a, Siemens 2007
Alkaline/Saline Tolerant	Present	Establishes in salt marshes	Stone 2010c
Grazing Tolerant	Present	Grazing tolerant	Stone 2010c
Increases Post Fire	Present	Can resprout after fire	Stone 2010c
Alters Hydrology	Present	Increases streamside woody stems, alters flows	Stone 2010c, Parkinson 2010a
Alters Nutrient Cycling	Present	Uses nitrogen in soil for natives	Stone 2010c
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Used as a soil binder, facilitates soil development	Stone 2010c, Parkinson 2010a
Excretes Salts/Toxins	Present	Allelopathic properties inhibit germination of seeds	Siemens 2007, Vrchotova 2008
Forms Monocultures	Present	Monotypic stands	Parkinson 2010a
Invades Without Human Disturbance	Present	Can be found on natural habitat	Parkinson 2010a

50. *Polygonum x bohemicum* (Bohemian Knotweed) | Montana Noxious Weed – Priority 1B | **77-Extreme**

Summary of Ranking: Extreme invasive that reproduces by rhizomes and a large propagule of over 50,000 small seeds that can be dispersed by wind, wildlife, and water. *Polygonum x bohemicum* creates a seed bank; can hybridize with other *Polygonum* species; and tolerates xeric to mesic conditions, saturation, wide soil textures and nutrients, shade and sun, saline conditions, grazing, and fire. It can alter hydrology, alter nitrogen cycles, act as a soil binder, excrete allelopathic compounds, form monotypic stands, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Stout rhizomes	Stone 2010c, Parkinson 2010a
Large Propagule	Present	50,000-150,000 seeds/plant	Stone 2010c
Small Seeds/Fruits	Present	3mm long nutlets	Stone 2010c
Wind Dispersal	Present		Stone 2010c
Animal Dispersal	Present	Birds can disperse, manure	Stone 2010c
Water Dispersal	Present	Plants carried downstream	Stone 2010c, Parkinson 2010a
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Stone 2010c
Plasticity	Present	Hybridize with other <i>Polygonums</i>	Stone 2010c, Parkinson 2010a
Drought Tolerant	Absent		Stone 2010c
Wide Moisture Regime	Present	Xeric and saturated soil	Stone 2010c, Parkinson 2010a
Flooding/Saturation Tolerant	Present	Streamsides, riparian	Stone 2010c, Parkinson 2010a
Wide Nutrient/Soil Texture Tolerant	Present	Not limited by soil type, wide nutrients	Stone 2010c, Parkinson 2010a, Siemens 2007
Wide Light Regime	Present	Shade and sun tolerant	Stone 2010c, Parkinson 2010a, Siemens 2007
Alkaline/Saline Tolerant	Present	Establishes in salt marshes	Stone 2010c
Grazing Tolerant	Present	Grazing tolerant	Stone 2010c
Increases Post Fire	Present	Can resprout after fire	Stone 2010c
Alters Hydrology	Present	Increases streamside woody stems, alters flows	Stone 2010c, Parkinson 2010a
Alters Nutrient Cycling	Present	Uses nitrogen in soil for natives	Stone 2010c
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Used as a soil binder, facilitates soil development	Stone 2010c, Parkinson 2010a
Excretes Salts/Toxins	Present	Allelopathic properties inhibit germination of seeds	Siemens 2007, Vrchotova 2008
Forms Monocultures	Present	Monotypic stands	Parkinson 2010a
Invades Without Human Disturbance	Present	Can be found on natural habitat	Parkinson 2010a

Summary of Ranking: Strong invasive that reproduces by a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Potentilla recta* creates a seed bank and tolerates drought, xeric to mesic conditions, saturation, wide soil textures and nutrients, shade and sun, grazing, and fire. It can alter soil stability as a soil binder, form dense stands, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not strongly clonal	Endress 2005
Large Propagule	Present	>1000 seeds/m ²	Endress 2005, Rice 1991, Werner 1976, Zouhar 2003c
Small Seeds/Fruits	Present	Smaller than 5mm	Endress 2005, Hickman 1993, Rice 1999, Werner 1976, Zouhar 2003d
Wind Dispersal	Present	Blowing seeds	Endress 2005
Animal Dispersal	Present	Carried by wildlife	Endress 2005
Water Dispersal	Present	Seed laden plants carried downstream	Endress 2005
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Endress 2005, Grime 1979, Zouhar 2003d
Plasticity	Present		Werner 1976
Drought Tolerant	Present	Drought conditions	Rice 1991, Werner 1976, Zouhar 2003d
Wide Moisture Regime	Present	Xeric to mesic	Endress 2005, Rice 1991, Rice 1999, Zouhar 2003d
Flooding/Saturation Tolerant	Present	Saturation tolerant	Zouhar 2003d
Wide Nutrient/Soil Texture Tolerant	Present	Diverse soil texture tolerance	Rice 1999, Werner 1976
Wide Light Regime	Present	Shade and sun	Endress 2005, Zouhar 2003d
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	Endress 2005, Rice 1991, Rice 1999, Werner 1976, WSNWCB 2002
Increases Post Fire	Present	Fire is favorable	Endress 2005, Zouhar 2003d
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Soil binder	Werner 1976, WSNWCB 2002
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense stands	Endress 2005, Rice 1999, Werner 1976, WSNWCB 2002
Invades Without Human Disturbance	Present	Dispersal methods allow for spread to pristine locations	Endress 2005, Rice 1999, Whitson 1999, Zouhar 2003d

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and a large propagule of small, beaked seeds that can be dispersed by animals and water. *Ranunculus acris* creates a seed bank, tolerates irrigation, diverse soil types and nutrients, and partial shade to sun; and increases after grazing. It can alter the nitrogen cycle, release toxic glycoside ranunculin, form dense monocultures, and can invade natural areas without human disturbance due to its dispersal methods.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes and seeds	Strevey 2015, McGregor 1986, Lovett-Doust 1990, Lesica 2012, Jacobs 2010, Jacobs 2009b
Large Propagule	Present	>1000/m ²	Jacobs 2010, Jacobs 2009b
Small Seeds/Fruits	Present	2-3mm, with curved beak	Strevey 2015, McGregor 1986, Jacobs 2009b
Wind Dispersal	No Info Available		
Animal Dispersal	Present	Seeds contain beaks that get stuck in fur, viable in manure	Jacobs 2010, Jacobs 2009b
Water Dispersal	Present	Can be carried in water	Strevey 2015
Specialized Dispersal	Present	Hooked beak attaches	Jacobs 2010
Dispersal Over Time	Present	Seed banking	Lovett-Doust 1990, Jacobs 2010
Plasticity	Present	Morphological plasticity	Horandl 2005
Drought Tolerant	Absent	Relies on irrigation	Strevey 2015
Wide Moisture Regime	No Info Available		
Flooding/Saturation Tolerant	Present	Irrigated/subirrigated	Strevey 2015, McGregor 1986, Lesica 2012, Jacobs 2010, Jacobs 2009b
Wide Nutrient/Soil Texture Tolerant	Present	Many soil types, can tolerate increased nutrients	Strevey 2015, Jacobs 2010, Jacobs 2009b, Strevey 2014
Wide Light Regime	Present	Partial shade and full sun	Strevey 2014
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing increaser	Strevey 2015, Jacobs 2010, Strevey 2014
Increases Post Fire	No Info Available		
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Alters nitrogen cycle	Strevey 2014
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathy, glycoside ranunculin	Strevey 2014
Forms Monocultures	Present	Dense monocultures	Jacobs 2010, Strevey 2014
Invades Without Human Disturbance	Present	Doesn't need human disturbance	Strevey 2015, Lovett-Doust 1990, Jacobs 2010, Jacobs 2009b, Strevey 2014

Summary of Ranking: Strong invasive that reproduces by aggressive asexual cloning and small seeds that can be dispersed by wind and wildlife. *Rumex acetosella* can tolerate drought, xeric to mesic conditions, saturation, diverse soil textures and nutrients, shade and sun, grazing, and fire. It can alter hydrology by altering the water table, alter fire regimes, alter soil stability by depleting soil, form monocultures, and invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Aggressive clonal reproduction	Esser 1995, Hickman 1993, Taylor 1990, Weber 2003, Whitson 1999, CABI 2014b
Large Propagule	No Info Available		
Small Seeds/Fruits	Present	Smaller than 5mm	Weber 2003, Whitson 1999, CABI 2014b
Wind Dispersal	Present	Blowing seeds	Esser 1995, Weber 2003
Animal Dispersal	Present	Viable in droppings	Esser 1995, Weber 2003
Water Dispersal	No Info Available		
Specialized Dispersal	Absent	No known specialized traits	Weber 2003, CABI 2014b
Dispersal Over Time	Present	No seed bank	Weber 2003
Plasticity	Present		Weber 2003
Drought Tolerant	Present		Esser 1995
Wide Moisture Regime	Present	Xeric to mesic	Esser 1995, Weber 2003
Flooding/Saturation Tolerant	Present	Saturation tolerant	Esser 1995, Weber 2003
Wide Nutrient/Soil Texture Tolerant	Present	Diverse soil texture tolerance	Esser 1995, Whitson 1999
Wide Light Regime	Present	Shade and sun	Esser 1995, CABI 2014b
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is favorable	Esser 1995, Legee 1981
Increases Post Fire	Present	Fire is favorable	Esser 1995
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense monocultures	Esser 1995, Weber 2003
Invades Without Human Disturbance	Present	Found at pristine sites	Esser 1995, Weber 2003, CABI 2014b

Summary of Ranking: Strong invasive that reproduces by a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Rumex crispus* creates a seed bank and tolerates drought, xeric to mesic conditions, saturation, a variety of nutrients and soil textures, shade and sun, alkaline conditions, and grazing. It can act as a soil stabilizer, forms monocultures, and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking – Low

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not strongly clonal	Weber 2003, CABI 2015c
Large Propagule	Present	Large propagule	Boedeltje 2003, Weber 2003, CABI 2015c
Small Seeds/Fruits	Present	Smaller than 5mm	Hickman 1993, Weber 2003, CABI 2015c
Wind Dispersal	Present	Blowing seeds	Moffat 2004, Weber 2003, Whitson 1999
Animal Dispersal	Present		CABI 2015c
Water Dispersal	Present	Seeds and plants carried by water	Andersen 1995, Boedeltje 2003, Weber 2003, Whitson 1999
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Grime 1979, Weber 2003
Plasticity	Present		Weber 2003, CABI 2015c
Drought Tolerant	Present	Withstands drought	CABI 2015c
Wide Moisture Regime	Present	Xeric to mesic	CABI 2015c
Flooding/Saturation Tolerant	Present	Saturation tolerant	Weber 2003
Wide Nutrient/Soil Texture Tolerant	Present	Variety of textures and nutrients	Weber 2003, CABI 2015c
Wide Light Regime	Present	Shade to sun	Weber 2003
Alkaline/Saline Tolerant	Present	Alkaline tolerant	CABI 2015c
Grazing Tolerant	Present	Grazing tolerant	Crowe 1997
Increases Post Fire	No Info Available		
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Soil stabilizer	Weber 2003
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	Present	Dense stands	Weber 2003
Invades Without Human Disturbance	Present		CABI 2015c

55. *Senecio jacobaea* (Tansy Ragwort) | Montana Noxious Weed – Priority 2A | 45-Aggressive

Summary of Ranking: Aggressive invasive that reproduces by rhizomes and a large propagule of over 5,000 small seeds per plant that can be dispersed by wind and wildlife. *Senecio jacobaea* creates a seed bank; can have morphological variations; and tolerates drought, xeric to mesic conditions, saturation, wide soil nutrients and textures, alkaline conditions, grazing, and fire. It can alter soil stability by causing erosion, excrete allelopathic pyrrolizidine alkaloids, form monocultures, and invade natural areas after a minor non-human disturbance.

For Ranking Comparison: Nature Serve ranking - Low Cal IPC ranking - Limited Information

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes	Richardson 2004b, Bain 1991, Jacobs 2009c, CABI 2016b
Large Propagule	Present	5,000-200,000 seeds/ plant	Richardson 2004b
Small Seeds/Fruits	Present	2mm	Richardson 2004b
Wind Dispersal	Present	Structures for wind dispersal-pappus	Bain 1991, Jacobs 2009c, CABI 2016b
Animal Dispersal	Present	Can spread in manure	Richardson 2004b
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank viable for >6 years	Richardson 2004b
Plasticity	Present	Morphological variation	Bain 1991, CABI 2016b
Drought Tolerant	Present		Richardson 2004b, CABI 2016b
Wide Moisture Regime	Present	Xeric to mesic	Bain 1991, Jacobs 2009c
Flooding/Saturation Tolerant	Present	Riparian, saturated	Lesica 2012, McGregor 1986, Richardson 2004b, Bain 1991, Jacobs 2009c
Wide Nutrient/Soil Texture Tolerant	Present	Rich soil tolerant, loams, sands	McGregor 1986, Bain 1991
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	Present	Occurs in soils with pH greater than 7, alkaline	CABI 2016b
Grazing Tolerant	Present	Grazing tolerant/increaser	Richardson 2004b, Bain 1991, Jacobs 2009c
Increases Post Fire	Present	Can spread post fire	Richardson 2004b
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	Present	Can increase soil erosion	Richardson 2004b
Excretes Salts/Toxins	Present	Allelopathic pyrrolizidine alkaloids	Richardson 2004b, Bain 1991, Jacobs 2009c, CABI 2016b
Forms Monocultures	Present	Dense infestations	Richardson 2004b
Invades Without Human Disturbance	Present	Can invade after minor soil disturbances, rodent burrows, ungulate tracks	Richardson 2004b

Summary of Ranking: Extreme invasive that reproduces by rhizome and a large propagule of 2 billion small seeds per plant that can be dispersed by wind and water. *Tamarix ramosissima* can hybridize with *Tamarix chinensis* and tolerates drought, xeric to mesic conditions, saturation, diverse soils, shade and sun, saline and alkaline conditions, grazing, and fire. It can alter hydrology by altering the water table and stream flows, compete for nutrients, alter fire intensity, alter soil stability by allowing sedimentation, excrete salts, form monocultures, and invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - High Cal IPC ranking – High

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Some rhizomes	Zouhar 2003e, CABI 2013
Large Propagule	Present	Abundant quantities, 2 billion seeds/plant/year	Katz 2003, Zouhar 2003e, Grubb 2010, CABI 2013
Small Seeds/Fruits	Present	<0.5mm long	Katz 2003, Zouhar 2003e, Grubb 2010
Wind Dispersal	Present	Blowing seeds	Katz 2003, Zouhar 2003e
Animal Dispersal	No Info Available		
Water Dispersal	Present	Carried by water	Katz 2003
Specialized Dispersal	No Info Available		
Dispersal Over Time	Absent	Not persistent seed bank, low viability	Zouhar 2003e
Plasticity	Present	Can hybridize with <i>T. chinensis</i>	Zouhar 2003e, Grubb 2010, Lesica 2012, CABI 2013
Drought Tolerant	Present	Drought conditions	Katz 2003, Zouhar 2003e, Grubb 2010, CABI 2013
Wide Moisture Regime	Present	Xeric to mesic	Zouhar 2003, CABI 2013
Flooding/Saturation Tolerant	Present	Along rivers and flood regimes, saturation tolerant	Katz 2003, Zouhar 2003e, Lesica 2012
Wide Nutrient/Soil Texture Tolerant	Present	Soils and mineral types	Zouhar 2003e
Wide Light Regime	Present	Intolerant of shade	Zouhar 2003e, Grubb 2010
Alkaline/Saline Tolerant	Present	Saline and alkaline tolerant	Katz 2003, Zouhar 2003e, Lesica 2012
Grazing Tolerant	Present	Cutting and mowing increase	Zouhar 2003e
Increases Post Fire	Present	Increases and thrives post fire	Katz 2003, Zouhar 2003e
Alters Hydrology	Present	Roots channel streamflows, draws down water table, creates more xeric habitat	Zouhar 2003e, Grubb 2010
Alters Nutrient Cycling	Present	Nutrient uptake alterations	Zouhar 2003e, Grubb 2010
Alters Fire Regime	Present	Alters fire regimes, more conducive to fire	Zouhar 2003 e
Alters Soil Stability	Present	Stabilizes sediments	Zouhar 2003e, Grubb 2010
Excretes Salts/Toxins	Present	Salt secreting glands	Zouhar 2003e, Grubb 2010
Forms Monocultures	Present	Dense monocultures	Zouhar 2003e, Grubb 2010
Invades Without Human Disturbance	Present	Evidence of invading natural areas	Zouhar 2003e

Summary of Ranking: Extreme invasive that reproduces by rhizomes and a large propagule of 50,000 small seeds that can be dispersed by wildlife and water. *Tanacetum vulgare* creates a seed bank; can hybridize; and tolerates xeric to mesic conditions, saturation, wide nutrient content and soil types, partial shade to sun, acidic to alkaline conditions, grazing, and fire. It can alter hydrology by altering water flow, compete for nutrients, alter fire intensity, alter soil stability by depleting soil moisture, excrete an allelopathic compound, form monocultures, and invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Low Cal IPC ranking - Moderate

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Rhizomes	Gucker 2009b, LeCain 2014a, Wilson 2004, CABI 2017e
Large Propagule	Present	50,000 seeds/plant	Gucker 2009b, Wilson 2004
Small Seeds/Fruits	Present	Achenes 1-2mm	Lesica 2012, Gucker 2009b
Wind Dispersal	Absent	Unlikely	Gucker 2009b, Wilson 2004, CABI 2017e
Animal Dispersal	Present	Caught in fur, manure	Gucker 2009b, LeCain 2014a, Wilson 2004
Water Dispersal	Present	High oil content, floats	LeCain 2014a, Wilson 2004
Specialized Dispersal	No Info Available		
Dispersal Over Time	Present	Seed bank	Gucker 2009
Plasticity	Present		CABI 2017e
Drought Tolerant	No Info Available		
Wide Moisture Regime	Present	Tolerates wide range of precipitation	LeCain 2014b, Wilson 2004
Flooding/Saturation Tolerant	Present	Moist meadows, streams, saturation	Lesica 2012, Gucker 2009b, LeCain 2014b, Wilson 2004
Wide Nutrient/Soil Texture Tolerant	Present	Loams, sands, low to high nutrient content	Gucker 2009b
Wide Light Regime	Present	Partial shade to full sun	Gucker 2009b
Alkaline/Saline Tolerant	Present	Acidic to alkaline	Gucker 2009b
Grazing Tolerant	Present	Grazing tolerant/increaser	Gucker 2009b, LeCain 2014b, Wilson 2004
Increases Post Fire	Present	Increases spread	LeCain 2014a, Wilson 2004
Alters Hydrology	Present	Impact water flow	Gucker 2009b
Alters Nutrient Cycling	Present	Highly competitive for soil resources	LeCain 2014a, Wilson 2004
Alters Fire Regime	Present	Stems burn very hot and fast, can increase intensity	Gucker 2009b
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Some allelopathy	Gucker 2009b, Wilson 2004
Forms Monocultures	Present	Monocultures	Gucker 2009
Invades Without Human Disturbance	Present	Human disturbance not required for invasion	Gucker 2009b, Wilson 2004

Summary of Ranking: Strong invasive that reproduces by rhizomes and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Taraxacum officinale* creates a seed bank and tolerates drought, xeric to mesic conditions, saturation, wide nutrients and soil texture, shade and sun, grazing, and fire. It can excrete allelopathic compounds and can invade natural areas without human disturbance due to dispersal methods.

For Ranking Comparison: Nature Serve ranking - Not Available Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present		Boedeltje 2003
Large Propagule	Present	>1000 seeds/m ²	Boedeltje 2003, Esser 1993b, Stewart-Wade 2002, USDA-NRCS 2004
Small Seeds/Fruits	Present	Smaller than 5mm	Hickman 1993, Stewart-Wade 2002, USDA-NRCS 2004, Whitson 1999, CABI 2015d
Wind Dispersal	Present	Primarily wind dispersal	Esser 1993b, Stewart-Wade 2002, Taylor 1990, Whitson 1999, CABI 2015d
Animal Dispersal	Present	Caught in fur	Stewart-Wade 2002, CABI 2015d
Water Dispersal	Present	Floating seeds	Boedeltje 2003, Stewart-Wade 2002
Specialized Dispersal	Absent	No known specialized traits	
Dispersal Over Time	Present	Seed bank	Esser 1993b, Stewart-Wade 2002
Plasticity	No Info Available		
Drought Tolerant	Present		Stewart-Wade 2002, USDA-NRCS 2004
Wide Moisture Regime	Present	Xeric to mesic	Esser 1993b, Leege 1981, Stewart-Wade 2002, USDA-NRCS 2004
Flooding/Saturation Tolerant	Present	Saturation tolerant	Esser 1993b, Leege 1981, CABI 2015d
Wide Nutrient/Soil Texture Tolerant	Present	Wide nutrients and soil texture tolerance	Esser 1993b, Stewart-Wade 2002, USDA-NRCS 2004, CABI 2015d
Wide Light Regime	Present	Shade and sun	Stewart-Wade 2002, USDA-NRCS 2004, CABI 2015d
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	Crowe 1997, Esser 1993b, Green 1995, Leege 1981, Stewart-Wade 2002, USDA-NRCS 2004, CABI 2015d
Increases Post Fire	Present	Fire is favorable	Esser 1993b, Stewart-Wade 2002
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathic	Stewart-Wade 2002, CABI 2015d
Forms Monocultures	Absent		Boedeltje 2003
Invades Without Human Disturbance	Present	Dispersal methods allow colonization without human disturbance	Esser 1993b, Stewart-Wade 2002, CABI 2015d

Summary of Ranking: Strong invasive that reproduces by a large propagule of over 5,000 small seeds that can be dispersed by wind and wildlife. *Tragopogon dubius* creates a seed bank and tolerates drought, xeric to mesic conditions, diverse nutrients and soil textures, some shade and sun, and grazing. It can alter hydrology by altering water availability, excrete allelopathic latex, and invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	Not strongly clonal	USDA-NRCS 2004, Gucker 2008b
Large Propagule	Present	>5000 seeds/m ²	USDA-NRCS 2004, Gucker 2008b
Small Seeds/Fruits	Absent	Larger than 5mm	USDA-NRCS 2004
Wind Dispersal	Present	Seeds blown in wind, pappus	Hickman 1993, Hitchcock 1969, Taylor 1990
Animal Dispersal	Present	Caught in fur, carried by insects	USDA-NRCS 2004, Gucker 2008b
Water Dispersal	No Info Available		
Specialized Dispersal	No Info Available		
Dispersal Over Time	No Info Available		
Plasticity	Present		Clements 1999, Gucker 2008b
Drought Tolerant	Present	Drought conditions	APRS 2000, Hitchcock 1969, Taylor 1990, USDA-NRCS 2004
Wide Moisture Regime	Present	Xeric to mesic	Clements 1999, Gucker 2008b
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Diverse nutrient and texture regimes	USDA-NRCS 2004
Wide Light Regime	Present	Some shade to sun	Clements 1999
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is favorable	USDA-NRCS 2004
Increases Post Fire	No Info Available		
Alters Hydrology	Present	Competitive for water resources	Clements 1999, Gucker 2008b
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Latex	USDA-NRCS 2004
Forms Monocultures	Absent		USDA-NRCS 2004
Invades Without Human Disturbance	Present	Dispersal methods allow for colonization without human disturbance	Clements 1999

Summary of Ranking: Moderate invasive that reproduces by rhizomes and a large propagule of small seeds that can be dispersed by wind, wildlife, and water. *Trifolium repens* creates a seed bank and tolerates semi-xeric to mesic conditions, wide nutrient conditions, shade and sun, and grazing. It alters nutrient cycles by competing for soil nutrients and can invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking - Not Available

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Present	Aggressive clonal reproduction	Coladonato 1993, Crowe 1997, Grime 1979, Taylor 1990, Turkington 1983, USDA-NRCS 2004, Weber 2003
Large Propagule	Present	>1000 seeds/m ²	Turkington 1983
Small Seeds/Fruits	Present	Smaller than 5mm	Turkington 1983, USDA-NRCS 2004, Weber 2003
Wind Dispersal	Present	Blowing seeds	Coladonato 1993
Animal Dispersal	Present	Viable in droppings	Coladonato 1993, Moffat 2004, Turkington 1983, Weber 2003
Water Dispersal	Present	Floating seeds	Coladonato 1993
Specialized Dispersal	Absent	No known specialized traits	Coladonato 1993
Dispersal Over Time	Present	Seed bank	Coladonato 1993, Turkington 1983
Plasticity	Present		Turkington 1983, USDA-NRCS 2004, Weber 2003
Drought Tolerant	No Info Available		
Wide Moisture Regime	Present	Semi-xeric to mesic	Coladonato 1993
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Wide nutrients and textures	Coladonato 1993, Turkington 1983, USDA-NRCS 2004
Wide Light Regime	Present	Shade and sun	Coladonato 1993, USDA-NRCS 2004
Alkaline/Saline Tolerant	No Info Available		
Grazing Tolerant	Present	Grazing is a favorable disturbance	Crowe 1997, Grime 1979, Turkington 1983, Weber 2003
Increases Post Fire	No Info Available		
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	Present	Competes for soil nutrients	Coladonato 1993, Turkington 1983, USDA-NRCS 2004, Weber 2003
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	No Info Available		
Forms Monocultures	No Info Available		
Invades Without Human Disturbance	Present	Can colonize without human disturbance	Turkington 1983, Weber 2003

Summary of Ranking: Strong invasive that reproduces by a large propagule of over 130,000 small seeds that can be dispersed by wind, wildlife, and water. *Verbascum thapsus* creates a seed bank and tolerates drought, xeric to mesic conditions, a variety of soil types, grazing, and fire. It can excrete an allelopathic compound, form dense stands, and invade natural areas without human disturbance.

For Ranking Comparison: Nature Serve ranking - Medium Cal IPC ranking – Limited

Trait	Presence/Absence	Comments	Resources
Strongly Clonal	Absent	No aggressively clonal	Gross 1978
Large Propagule	Present	>130,000 seeds/plant	Gross 1978, Hoshovsky 1986, Pitcairn 2000, Whitson 1999
Small Seeds/Fruits	Present	1mm long	Gross 1978, Hoshovsky 1986, Pitcairn 2000, Whitson 1999
Wind Dispersal	Present	Blowing seeds	Gross 1978, CABI 2015e
Animal Dispersal	Present	Carried by animals	Gross 1978, CABI 2015e
Water Dispersal	Present	Floating seeds and plants	Gross 1978, CABI 2015e
Specialized Dispersal	Absent	No specializations	Gross 1978, CABI 2015e
Dispersal Over Time	Present	Seed bank, viable over 10 years	Gross 1978, Pitcairn 2000, Weber 2003
Plasticity	Present		Gross 1978
Drought Tolerant	Present	Drought conditions	Gross 1978, Hoshovsky 1986, Pitcairn 2000, Weber 2003
Wide Moisture Regime	Present	Xeric to mesic conditions	Hoshovsky 1986, Pitcairn 2000, Weber 2003
Flooding/Saturation Tolerant	No Info Available		
Wide Nutrient/Soil Texture Tolerant	Present	Variety of soil types	CABI 2015
Wide Light Regime	No Info Available		
Alkaline/Saline Tolerant	Absent	pH 6.5-7.5	Gross 1978
Grazing Tolerant	Present	Grazing is a favorable disturbance	Gross 1978, Hoshovsky 1986, Pitcairn 2000, Whitson 1999, CABI 2015
Increases Post Fire	Present	Fire is a favorable disturbance	Hoshovsky 1986, Pitcairn 2000
Alters Hydrology	No Info Available		
Alters Nutrient Cycling	No Info Available		
Alters Fire Regime	No Info Available		
Alters Soil Stability	No Info Available		
Excretes Salts/Toxins	Present	Allelopathy	CABI 2015e
Forms Monocultures	Present	Dense stands	Gross 1978, Weber 2003
Invades Without Human Disturbance	Present	Can colonize without human disturbance	Pitcairn 2000, Weber 2003

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