WEED RISK ASSESSMENT FORM

Botanical name: *Vicia villosa* Roth

Common name: winter vetch, hairy vetch

Assessors:

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Outcome score:

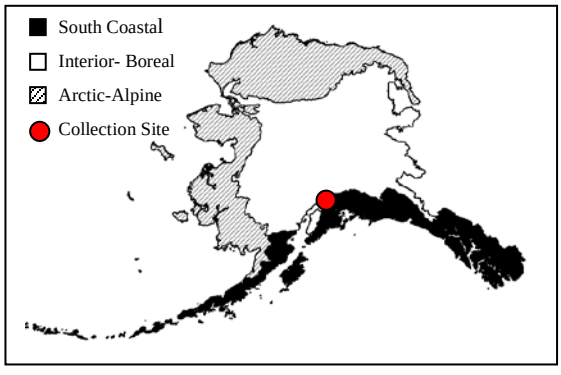
A.	**Climatic Comparison**		
	This species is present or may potentially establish in the following eco-geographic regions:		
1	South Coastal	Yes	
2	Interior-Boreal	Yes	
3	Arctic-Alpine		No

B.	**Invasiveness Ranking**	Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	22
2	Biological characteristic and dispersal ability	25 (22)	11
3	Ecological amplitude and distribution	25 (19)	12
4	Feasibility of control	10 (10)	3
	Outcome score	100 (91)[b]	48
	Relative maximum score†		0.53

* For questions answered "unknown" do not include point value for the question in parentheses for "Total Answered Points Possible."
† Calculated as $^{a}/_{b}$.

A. CLIMATIC COMPARISON:

	1.1. Has this species ever been collected or documented in Alaska?
Yes	Yes – continue to 1.2
	No – continue to 2.1
	1.2. Which eco-geographic region has it been collected or documented (see inset map)? *Proceed to Section B. Invasiveness Ranking.*
	South Coastal
Yes	Interior-Boreal
	Arctic-Alpine



Documentation: *Vicia villosa* has been reported from Interior-Boreal ecoregion of Alaska (Hultén 1968).
Sources of information:
Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.

2.1. Is there a 40% or higher similarity (based on CLIMEX climate matching) between climates any where the species currently occurs and

a. Juneau (South Coastal Region)?

Yes

Yes – *record locations and similarity; proceed to Section B. Invasiveness Ranking*

No

b. Fairbanks (Interior-Boreal)?

Yes – *record locations and similarity; proceed to Section B. Invasiveness Ranking*

No

c. Nome (Arctic-Alpine)?

Yes – *record locations and similarity; proceed to Section B. Invasiveness Ranking*

No

– *If "No" is answered for all regions, reject species from consideration*

Documentation: Using CLIMEX matching program, climatic similarity between Nome and areas where the species is documented is relatively low. This species withstands winter temperatures to -30°F (some cultivars to 7°F), and requires 100 frost free days (USDA 2002). Winter temperature in Nome can reach -54°F (WRCC 2001) and the number of frost free days is at the physiological limit of *Vicia villosa*. It is therefore unlikely to establish in the Arctic-Alpine ecogeographic region of Alaska.
Vicia villosa has been reported from Bergen, Norway (Lid and Lid 1994), which has 76% climatic similarity with Juneau (Alaska). Thus establishment in South Coastal eco region of Alaska is possible.
Sources of information: CLIMEX for Windows, Version 1.1a. 1999. CISRO Publishing, Australia.
Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.
Lid, J. and D.T. Lid. 1994. Flora of Norway. The Norske Samlaget, Oslo. Pp. 1014.
USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
WRCC - Western Regional Climate Center 2001. Desert Research Institute. http://www.wrcc.dri.edu [16 April 2001].

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes

A.	No perceivable impact on ecosystem processes	0
B.	Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
C.	Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology; hydrology; or affects fire frequency, altering community composition; species fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species)	10
U.	Unknown	

Score 7

Documentation:
Identify ecosystem processes impacted:
Hairy vetch alters edaphic conditions due to fixation of atmospheric nitrogen (USDA 2002). It can significantly reduce available soil water (Nielson and Vigil 2005).

Rational:

Sources of information:
Nielsen, D.C. and M.F. Vigil. 2005. Legume green fallow effect on soil water content at wheat planting and wheat yield. Agronomy Journal 97: 684-689.
USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

1.2. Impact on Natural Community Structure

A.	No perceived impact; establishes in an existing layer without influencing its structure	0
B.	Influences structure in one layer (e.g., changes the density of one layer)	3
C.	Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
D.	Major alteration of structure (e.g., covers canopy, eradicating most or all layers below)	10
U.	Unknown	

Score 7

Documentation:
Identify type of impact or alteration:
Hairy vetch often overgrows herbaceous vegetation and forms a dense herbaceous layer (Whitson et al. 2000).
Rational:

Sources of information:
Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee and R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

1.3. Impact on Natural Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7
D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score 3

Documentation:
Identify type of impact or alteration:
Hairy vetch overtops herbaceous and low-woody species and can cause reduction the number of individuals of native species in the community (M. Shephard – pers. com.).
Rational:

Sources of information:
Shephard, M., Vegetation Ecologist, USDA, Forest Service, Forest Health Protection, State and Private Forestry, 3301 C Street, Suite 202, Anchorage, Alaska 99503 Tel: (907) 743-9454 - Pers. com.

1.4. Impact on higher trophic levels (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades)

A.	Negligible perceived impact	0
B.	Minor alteration	3
C.	Moderate alteration (minor reduction in nesting/foraging sites, reduction in habitat connectivity, interference with native pollinators, injurious components such as spines, toxins)	7

D. Severe alteration of higher trophic populations (extirpation or endangerment of an existing native species/population, or significant reduction in nesting or foraging sites) 10

U. Unknown

Score 5

Documentation:

Identify type of impact or alteration:

Hairy vetch is reported to be both slightly toxic and highly palatable to graze animals (USDA 2002). The garbage of hairy vetch is eaten by deer (Graham 1941). *Vicia* species host several insect pests and disease organisms. Flowers are visited by native bees and may alter pollination ecology of the surrounding area (Aarssen et al. 1986).

Rational:

Sources of information:

Aarssen, L.W., I.V. Hall and K.I.N. Jensen. 1986. The biology of Canadian weeds. 76. *Vicia angustifolia* L., *V. cracca* L., *V. sativa* L., *V. tetrasperma* (L.) Schreb. and *V. villosa* Roth. Canadian Journal of Plant Science. 66 (3):711-737.

Graham, E.H. 1941. Legumes for erosion control and wildlife. U.S. Department of Agriculture. Washington. Pp. 113-116.

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Total Possible 40

Total 22

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2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode of reproduction

A. Not aggressive reproduction (few [0-10] seeds per plant and no vegetative reproduction) 0

B. Somewhat aggressive (reproduces only by seeds (11-1,000/m^2) 1

C. Moderately aggressive (reproduces vegetatively and/or by a moderate amount of seed, <1,000/m^2) 2

D. Highly aggressive reproduction (extensive vegetative spread and/or many seeded, >1,000/m^2) 3

U. Unknown

Score 1

Documentation:

Describe key reproductive characteristics (including seeds per plant):

Winter vetch reproduces by seed only (Aarssen et al. 1986). This plant produces moderate amounts of seed (USDA 2002).

Rational:

Sources of information:

Aarssen, L.W., I.V. Hall and K.I.N. Jensen. 1986. The biology of Canadian weeds. 76. *Vicia angustifolia* L., *V. cracca* L., *V. sativa* L., *V. tetrasperma* (L.) Schreb. and *V. villosa* Roth. Canadian Journal of Plant Science. 66 (3):711-737.

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

2.2. Innate potential for long-distance dispersal (bird dispersal, sticks to animal hair, buoyant fruits, wind-dispersal)

A. Does not occur (no long-distance dispersal mechanisms) 0

B. Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations) 2

C. Numerous opportunities for long-distance dispersal (species has adaptations such as pappus, hooked fruit-coats, etc.) 3

U. Unknown

Score 0

Documentation:
Identify dispersal mechanisms:
The seeds are large and are not easily dispersed (M. Shephard – pers. com.).
Rational:

Sources of information:
Shephard, M., Vegetation Ecologist, USDA, Forest Service, Forest Health Protection, State and Private Forestry, 3301 C Street, Suite 202, Anchorage, Alaska 99503 Tel: (907) 743-9454 - Pers. com.

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contamination, etc.)

A.	Does not occur	0
B.	Low (human dispersal is infrequent or inefficient)	1
C.	Moderate (human dispersal occurs)	2
D.	High (there are numerous opportunities for dispersal to new areas)	3
U.	Unknown	

Score 2

Documentation:
Identify dispersal mechanisms:
Hairy vetch is a forage plant, sometimes escapes cultivation (Welsh 1974). It is a crop seed contaminant (USDA, ARS 2004).
Rational:

Sources of information:
USDA, ARS, National Genetic Resources Program. *Germplasm Resources Information Network - (GRIN)* [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/var/apache/cgi-bin/npgs/html/taxon.pl?300618 (July 8, 2004).
Welsh, S.L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.

2.4. Allelopathic

A.	No	0
B.	Yes	2
U.	Unknown	

Score 0

Documentation:
Describe effect on adjacent plants:
None (USDA 2002).
Rational:

Sources of information:
USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

2.5. Competitive ability

A.	Poor competitor for limiting factors	0
B.	Moderately competitive for limiting factors	1
C.	Highly competitive for limiting factors and/or nitrogen fixing ability	3
U.	Unknown	

Score 3

Documentation:

Evidence of competitive ability:
Winter vetch has nitrogen fixing ability (USDA 2002) and competes for resources with other species.
Rational:
Winter vetch is very hardy species. It demonstrates high frost, drought, or flood tolerance (Brandsæter et al. 2002, Walsh and Skujins 1981, Hoveland and Donnelly 1966).
Sources of information:
Brandsæter, L.O., A. Olsmo, A.M. Tronsmo and H. Fykse. 2002. Freezing resistance of winter annual and biennial legumes at different developmental stages. Crop Science 42: 437-443.
Hoveland, C.S. and E.D. Donnelly. 1966. Response of *Vicia* genotypes to flooding. Agronomy Journal 58: 341-345.
USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
Walsh, J.F. and J. Skujins. 1981. Drought effects on the N2-fixing (acetylene reducing) ability of vetch and sweetclover growing under saline conditions. Agronomy Journal 73: 756-758.

2.6. Forms dense thickets, climbing or smothering growth habit, or otherwise taller than the surrounding vegetation

A.	No	0
B.	Forms dense thickets	1
C.	Has climbing or smothering growth habit, or otherwise taller than the surrounding vegetation	2
U.	Unknown	

Score 2

Documentation:
Describe grow form:
Winter vetch has climbing growth habit with stem up to 6 feet long (Hultén 1968).
Rational:

Sources of information:
Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.

2.7. Germination requirements

A.	Requires open soil and disturbance to germinate	0
B.	Can germinate in vegetated areas but in a narrow range or in special conditions	2
C.	Can germinate in existing vegetation in a wide range of conditions	3
U.	Unknown	

Score U

Documentation:
Describe germination requirements:
Unknown
Rational:

Sources of information:

2.8. Other species in the genus invasive in Alaska or elsewhere

A.	No	0
B.	Yes	3
U.	Unknown	

Score 3

Documentation:
Species:
Vicia cracca L., *V. sativa* ssp. *nigra* (L.) Ehrh, *V. benghalensis* L., *V. disperma* DC., *V.*

hirsuta (L.) S.F. Gray, *V. lathyroides* L., *V. pannonica* Crantz, *V. tetrasperma* (L.) Schreber (Hultén 1968, USDA 2002, Whitson et al. 2000).

Sources of information:

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee and R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

2.9. Aquatic, wetland, or riparian species

A.	Not invasive in wetland communities	0
B.	Invasive in riparian communities	1
C.	Invasive in wetland communities	3
U.	Unknown	

Score 0

Documentation:

Describe type of habitat:

Winter vetch has escaped cultivation and is common along roadsides and disturbed areas (Whitson et al. 2000). It is invading roadsides at Westchester Lagoon, Anchorage (M.L. Carlson – pers. obs.).

Rational:

Sources of information:

Carlson, M.L., Assistant Research Professor, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2790 – Pers. obs.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee and R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

Total Possible 22

Total 11

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3. DISTRIBUTION

3.1. Is the species highly domesticated or a weed of agriculture

A.	No	0
B.	Is occasionally an agricultural pest	2
C.	Has been grown deliberately, bred, or is known as a significant agricultural pest	4
U.	Unknown	

Score 4

Documentation:

Identify reason for selection, or evidence of weedy history:

Winter vetch has been used as a both a forage and rotation crop (Welsh 1974, Whitson et al. 2000).

Rational:

Sources of information:

Welsh, S.L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee and R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in

cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

3.2. Known level of impact in natural areas

A.	Not known to cause impact in any other natural area	0
B.	Known to cause impacts in natural areas, but in dissimilar habitats and climate zones than exist in regions of Alaska	1
C.	Known to cause low impact in natural areas in similar habitats and climate zones to those present in Alaska	3
D.	Known to cause moderate impact in natural areas in similar habitat and climate zones	4
E.	Known to cause high impact in natural areas in similar habitat and climate zones	6
U.	Unknown	

Score: U

Documentation:
Identify type of habitat and states or provinces where it occurs:
Unknown.
Sources of information:

3.3. Role of anthropogenic and natural disturbance in establishment

A.	Requires anthropogenic disturbances to establish	0
B.	May occasionally establish in undisturbed areas but can readily establish in areas with natural disturbances	3
C.	Can establish independent of any known natural or anthropogenic disturbances	5
U.	Unknown	

Score: 0

Documentation:
Identify type of disturbance:
Winter vetch establishes in areas with anthropogenic soil disturbance (Pojar and MacKinnon 1994, Whitson et al. 2000).
Rational:

Sources of information:
Pojar, J., and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia, and Alaska. B.C. Ministry of Forests and Lone Pine Publishing. Redmond, Washington. 527 pp.
Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee and R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

3.4. Current global distribution

A.	Occurs in one or two continents or regions (e.g., Mediterranean region)	0
B.	Extends over three or more continents	3
C.	Extends over three or more continents, including successful introductions in arctic or subarctic regions	5
U.	Unknown	

Score: 3

Documentation:
Describe distribution:
Native range of winter vetch includes Northern Africa, temperate Asia, and Europe (USDA, ARS 2004).
Rational:

Sources of information:
USDA, ARS, National Genetic Resources Program. *Germplasm Resources Information Network - (GRIN)* [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-

grin.gov/var/apache/cgi-bin/npgs/html/taxon.pl?300618 (July 8, 2004).

3.5. Extent of the species U.S. range and/or occurrence of formal state or provincial listing

A.	0-5% of the states	0
B.	6-20% of the states	2
C.	21-50%, and/or state listed as a problem weed (e.g., "Noxious," or "Invasive") in 1 state or Canadian province	4
D.	Greater than 50%, and/or identified as "Noxious" in 2 or more states or Canadian provinces	5
U.	Unknown	

Score 5

Documentation:
Identify states invaded:
Winter vetch occurs in nearly all American states (USDA 2002). It is not considered noxious in North America (Invaders Database System 2003).
Rational:

Sources of information:
Invaders Database System. The University of Montana. 2003. Montana Noxious Weed Trust Fund. Department of Agriculture. http://invader.dbs.umt.edu/.
USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Total Possible 19
Total 12

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4. FEASIBILITY OF CONTROL

4.1. Seed banks

A.	Seeds remain viable in the soil for less than 3 years	0
B.	Seeds remain viable in the soil for between 3 and 5 years	2
C.	Seeds remain viable in the soil for 5 years and more	3
U.	Unknown	

Score 0

Documentation:
Identify longevity of seed bank:
Seeds of winter vetch can remain viable for less than two years (McKee and Musil 1984).
Rational:

Sources of information:
McKee, R. and A.F. Musil. 1948. Relation of temperature and moisture to longevity of seed of blue lupin, *Lupinus angustifolium*, Austrian winter fieldpea, *Pissum arvense*, and hairy vetch, *Vicia villosa*. American Journal of Agronomy 40: 459-465.

4.2. Vegetative regeneration

A.	No resprouting following removal of aboveground growth	0
B.	Resprouting from ground-level meristems	1
C.	Resprouting from extensive underground system	2
D.	Any plant part is a viable propagule	3
U.	Unknown	

Score 1

Documentation:
Describe vegetative response:
Some of the winter vetch cultivars have good regrowth ability (Brandsæter et al.

2002).
Rational:

Sources of information:
Brandsæter, L.O., A. Olsmo, A.M. Tronsmo and H. Fykse. 2002. Freezing resistance of winter annual and biennial legumes at different developmental stages. Crop Science 42: 437-443.

4.3. Level of effort required

A.	Management is not required (e.g., species does not persist without repeated anthropogenic disturbance)	0
B.	Management is relatively easy and inexpensive; requires a minor investment in human and financial resources	2
C.	Management requires a major short-term investment of human and financial resources, or a moderate long-term investment	3
D.	Management requires a major, long-term investment of human and financial resources	4
U.	Unknown	

Score 2

Documentation:
Identify types of control methods and time-term required:
Control of winter vetch can be achieved relatively easily by mechanical methods or herbicides applications (Aarssen et al. 1986).
Rational:

Sources of information:
Aarssen, L.W., I.V. Hall and K.I.N. Jensen. 1986. The biology of Canadian weeds. 76. *Vicia angustifolia* L., *V. cracca* L., *V. sativa* L., *V. tetrasperma* (L.) Schreb. and *V. villosa* Roth. Canadian Journal of Plant Science. 66 (3):711-737.

Total Possible	10
Total	3

Total for 4 sections Possible	91
Total for 4 sections	48

References:

Aarssen, L.W., I.V. Hall and K.I.N. Jensen. 1986. The biology of Canadian weeds. 76. *Vicia angustifolia* L., *V. cracca* L., *V. sativa* L., *V. tetrasperma* (L.) Schreb. and *V. villosa* Roth. Canadian Journal of Plant Science. 66 (3):711-737.

Brandsæter, L.O., A. Olsmo, A.M. Tronsmo and H. Fykse. 2002. Freezing resistance of winter annual and biennial legumes at different developmental stages. Crop Science 42: 437-443.

Carlson, M.L., Assistant Research Professor, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2790 – Pers. obs.

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Graham, E.H. 1941. Legumes for erosion control and wildlife. U.S. Department of Agriculture. Washington. Pp. 113-116.

Hoveland, C.S. and E.D. Donnelly. 1966. Response of *Vicia* genotypes to flooding. Agronomy Journal 58: 341-345.

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 pp.

Lid, J. and D.T. Lid. 1994. Flora of Norway. The Norske Samlaget, Oslo. Pp. 1014.

McKee, R. and A.F. Musil. 1948. Relation of temperature and moisture to longevity of seed of blue lupin, *Lupinus angustifolium*, Austrian winter fieldpea, *Pissum arvense*, and hairy vetch, *Vicia villosa*. American Journal of Agronomy 40: 459-465.

Nielsen, D.C. and M.F. Vigil. 2005. Legume green fallow effect on soil water content at wheat planting and wheat yield. Agronomy Journal 97: 684-689.

Pojar, J. and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia, and Alaska. B.C. Ministry of Forests and Lone Pine Publishing. Redmond, Washington. 527 pp.

Invaders Database System. The University of Montana. 2003. Montana Noxious Weed Trust Fund. Department of Agriculture. http://invader.dbs.umt.edu/

Shephard, M., Vegetation Ecologist, USDA, Forest Service, Forest Health Protection, State and Private Forestry, 3301 C Street, Suite 202, Anchorage, Alaska 99503 Tel: (907) 743-9454 - Pers. com.

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA, ARS, National Genetic Resources Program. *Germplasm Resources Information Network - (GRIN)* [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/var/apache/cgi-bin/npgs/html/taxon.pl?300618 (July 6, 2004).

Walsh, J.F. and J. Skujins. 1981. Drought effects on the N2-fixing (acetylene reducing) ability of vetch and sweetclover growing under saline conditions. Agronomy Journal 73: 756-758.

Welsh, S.L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee and R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

WRCC - Western Regional Climate Center 2001. Desert Research Institute. http://www.wrcc.dri.edu [16 April 2001].