WEED RISK ASSESSMENT FORM

Botanical name and common name	Curly dock (*Rumex crispus* L.) Bitter dock (*R. obtusifolius* L. Dooryard dock (*R. longifolius* DC.)

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Outcome score:

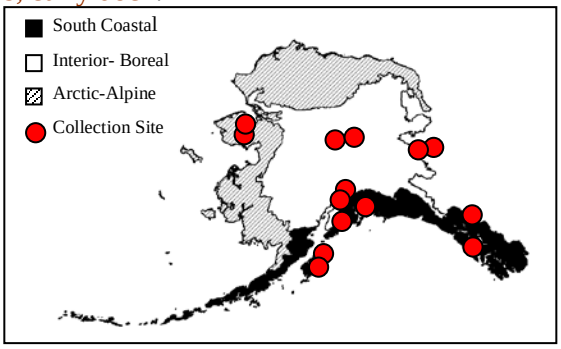
A.	**Climatic Comparison**		
	This species is present or may potentially establish in the following eco-geographic regions:		
1	South Coastal	Yes	
2	Interior-Boreal	Yes	
3	Arctic-Alpine	Yes	

B.	**Invasiveness Ranking**	Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	10
2	Biological characteristic and dispersal ability	25 (25)	16
3	Ecological amplitude and distribution	25 (25)	14
4	Feasibility of control	10 (10)	8
	Outcome score	100 (100)[b]	48 [a]
	Relative maximum score†		0.48

* For questions answered "unknown" do not include point value for the question in parentheses for "Total Answered Points Possible."
† Calculated as [a]/[b].

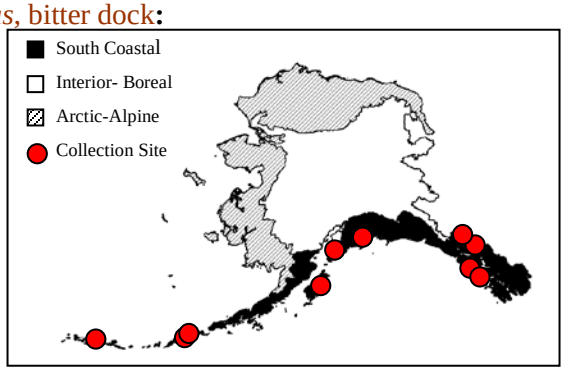
A. CLIMATIC COMPARISON for *Rumex crispus*, curly dock:

	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.*
Yes	South Coastal
Yes	Interior-Boreal
Yes	Arctic-Alpine



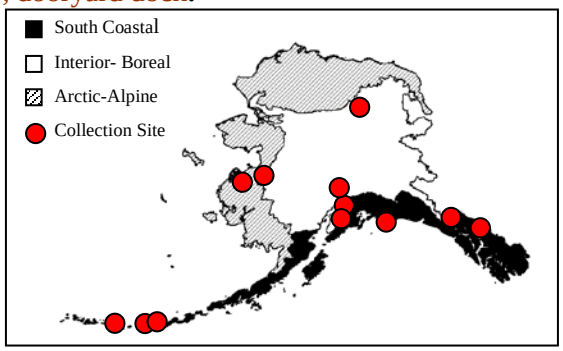
A. CLIMATIC COMPARISON for *R. obtusifolius*, bitter dock**:**

	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.*
Yes	South Coastal
	Interior-Boreal
	Arctic-Alpine



A. CLIMATIC COMPARISON for *R. longifolius*, dooryard dock**:**

	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.*
Yes	South Coastal
Yes	Interior-Boreal
Yes	Arctic-Alpine



Documentation: *Rumex crispus* and *R. longifolius* have been documented from all eco-geographic regions of Alaska. *Rumex obtusifolius* is known from the South Coastal eco-geographic region (Weeds of Alaska Database 2005, Hultén 1968, UAM 2004).

Sources of information:

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

University of Alaska Museum. University of Alaska Fairbanks. 2004. http://hispida.museum.uaf.edu:8080/home.cfm

Weeds of Alaska Database. 2005. Database of exotic vegetation collected in Alaska. University of Alaska, Alaska Natural Heritage Program – US Forest Service – National Park Service Database. Available: http://akweeds.uaa.alaska.edu/

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 – *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 the CLIMEX matching program, the climatic similarity between Nome and other areas where the species is documented is fairly high. The range of the species includes Chirka-Kem' and Arkhangel'sk, Russia (Gubanov et al. 2003), which have a 77% and 76% climatic match with Nome respectively. The range of *R. obtusifolius* includes also Røros and Dombås, Norway (Lid and Lid 1994), which have 76% and 63% climatic matches with Nome and 55% and 52% climatic matches with Fairbanks, respectively. Thus establishment of *R. obtusifolius* in Interior-Boreal and Arctic-Alpine ecogeographic regions of Alaska may be possible.

Sources of information:

CLIMEX for Windows, Version 1.1a. 1999. CISRO Publishing, Australia.

Gubanov I.A., Kiseleva K.V., Novikov V.S., Tihomirov V.N. An Illustrated identification book of the plants of Middle Russia, Vol. 2: Angiosperms (dicots: archichlamydeans). Moscow: Institute of Technological Researches; 2003. 666 p.

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.

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 1

Documentation:

Identify ecosystem processes impacted:

Impact of exotic docks on ecosystem processes has not been documented. However, population densities of exotic docks in natural or seminatural habitats of Alaska are currently low enough that likely only minor ecosystem functions are affected (M.L. Carslon – pers. obs.).

Rational:

Sources of information:

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

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 3

Documentation:

Identify type of impact or alteration:

Curly dock is capable of changing the density of the existing layer of vegetation (I. Lapina – pers. obs.).

Rational:

Sources of information:

Lapina, I., Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2710 – Pers. obs.

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	10

one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)

U. Unknown

Score 3

Documentation:

Identify type of impact or alteration:

Curly and bitter docks likely reduce the number of individuals in one or more native species in the community (Cal-IPC 2003).

Rational:

Sources of information:

Cal-IPC - California Invasive Plant Council. 2005. *Rumex crispus*. Plant Assessment Form. Available: http://www.cal-ipc.org/ [February 28, 2003].

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 3

Documentation:

Identify type of impact or alteration:

The seeds and vegetation of docks can be toxic to animals (Royer and Dickinson 1999). Bitter dock is avoided by rabbits, but it appears to be a favorite food of deer (Amphlett and Rea 1909, cited in Cavers and Harper 1964). Dock species are also an alternate host for number of viruses, fungi (Dal Bello and Carranza 1995), and nematodes (Edwards and Taylor 1963, Townshend and Davidson 1962). Hybrids between many species of the subgenus *Rumex* commonly occur. Although these hybrids are largely sterile, they can produce some viable seeds (Cavers and Harper 1964).

Rational:

Sources of information:

Amphlett, J. and C. Rea. 1909. The Botany of Worcestershire. Birmingham.

Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.

Dal-Bello, G.M. and M.R. Carranza. 1995. Weed diseases in La Plata area II. Identification of pathogens with potential for weed biocontrol programmes. Revista de la Facultad de Agronomia, La Plata 71(1): 7-14.

Edwards, D.I. and D.P. Taylor. 1963. Host range of an Illinois population of the stem nematode (*Ditylenchus dipsaci*) isolated from onion. Nematologica 9: 305-312.

Royer, F., and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

Townshend, J.L. and T.R. Davidson. 1962. Some weed hosts of the northern root-knot nematode, *Meloidogyne hapla* Chitwood, 1949, in Ontario. Canadian Journal of Botany 40: 543-548.

Total Possible 40

Total 10

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 3

Documentation:
Describe key reproductive characteristics (including seeds per plant):
Plants reproduce by seeds. The number of seeds per plant may vary from less than 100 to more than 40,000 for curly dock and more than 60,000 for bitter dock per season (Cavers and Harper 1964). Stevens (1932) reported 29,500 seeds per plant for curly dock and 23,000 seeds per plant for bitter dock. Damage plants can resprout from underground parts (Cavers and Harper 1964).
Rational:

Sources of information:
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.
Stevens, O.A. 1932. The number and weight of seeds produced by weeds. American Journal of Botany 19(9): 784-794.

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 3

Documentation:
Identify dispersal mechanisms:
Seeds can be dispersed a long distance by wind and water. The spines on the seeds of bitter dock facilitate distribution on animals' fur and birds feathers (DiTomaso and Healy 2003, Cavers and Harper 1967).
Rational:
Fruits are very light weight and winged. The outer part of perianth may be enlarged into a tubercle which facilitates water dispersal (DiTomaso and Healy 2003). Fruits of curly dock float for one to six months in fresh water and for 15 months in salt water Seeds of bitter dock remain floating in disturbed water for 24 hours (Cavers and Harper 1967).
Sources of information:
Cavers, P.B. and J.L. Harper. 1967. The comparative biology of closely related species living in the same area: IX. *Rumex*: The nature of adaptation to a sea-shore habitat. The Journal of Ecology 55(1): 73-82.
DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and riparian weeds of the West. California: University of California, Agriculture and Natural Resources; Pp. 329-341.

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 3

Documentation:
Identify dispersal mechanisms:
Seeds can be easily dispersed by attaching to clothing, and fur of domestic animals. Seeds can also pass thought the digestive system of cattle (Cavers and Harper 1964). Curly dock is a common contaminant of commercial seeds (Dorph-Petersen 1925, Singh 2001).
Rational:

Sources of information:
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.
Dorph-Petersen, K. 1925. Examination of the occurrence and vitality of various weed seed species under different conditions, made at the Danish State Seed Testing Station during the years 1896-1923. 4th International Seed Testing Congress, 1924, Cambridge, England. pp. 128-138.
Singh, S. 1925. Interception of weeds in imported wheat grain consignments. Annual of Agricultural Research 22(1): 83-87.

2.4. Allelopathic

A.	No	0
B.	Yes	2
U.	Unknown	

Score 0

Documentation:
Describe effect on adjacent plants:
Allelopathy potential has not been recorded for dock species.
Rational:

Sources of information:

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 1

Documentation:
Evidence of competitive ability:
Seedlings of docks have low competitive ability and cannot establish in vegetated areas. However, once established, these species became difficult weeds (Cavers and Harper 1964).
Rational:
The results of greenhouse experiments showed that bitter dock was more competitive than *Poa trivialis* and *Lolium perenne* (Gibson and Courtney 1977).
Sources of information:
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.
Gibson, D.I. and A.D. Courtney. 1977. Effects of *Poa trivialis, Stellaria media* and *Rumex obtusifolius* on the growth of *Lolium perenne* in the glasshouse. Annals of Applied Biology 86: 105-110.

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 0

Documentation:
Describe grow form:
Curly dock, bitter dock, and dooryard dock have not been observed forming dense thickets in Alaska (M.L. Carlson – pers. obs., I. Lapina – pers. obs.).
Rational:

Sources of information:
Carlson, M.L., Assistant Professor, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2790 – Pers. obs.
Lapina, I., Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2710 – Pers. obs.

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 0

Documentation:
Describe germination requirements:
Dock species require open soil and removed vegetation for successful germination and establishment (Cavers and Harper 1964).
Rational:
Establishment from seeds was observed only in open habitat, such as disturbed shingle beaches or on freshly cultivated field (Cavers and Harper 1964).
Sources of information:
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.

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

A.	No	0
B.	Yes	3
U.	Unknown	

Score 3

Documentation:
Species:
Rumex acetosella L. is invasive in Connecticut and Iowa (USDA, NRCS 2006).
Sources of information:
USDA, NRCS. 2006. *The PLANTS Database*, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

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 3

Documentation:
Describe type of habitat:
Despite the fact that curly, bitter, and dooryard docks are common on disturbed ground, such as agricultural fields, roadsides, and waste grounds (DiTomaso and Healy 2003, Welsh 1974), these species may also invade riparian areas, including wet meadows, riverbanks, pond edges, and irrigation ditches (DiTomaso and Healy 2003, Royer and Dickinson 1999).
Rational:

Sources of information:

DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and riparian weeds of the West. California: University of California, Agriculture and Natural Resources; Pp. 329-341.
Royer, F. and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.
Welsh, S.L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.

Total Possible 25
Total 16

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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 2

Documentation:
Identify reason for selection, or evidence of weedy history:
Curly dock and bitter dock are serious agricultural weeds in many countries (Cavers and Harper 1964, Royer and Dickinson 1999). However this weed is not a big agricultural problem in Alaska (J. Conn – pers. com.).
Rational:

Sources of information:
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.
Conn, J., Weed Scientist, USDA Agricultural Research Service PO Box 757200 Fairbanks, Alaska 99775 tel: (907) 474-7652; fax (907) 474-6184. – Pers. com.
Royer, F., and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

3.2. Known level of ecological 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 1

Documentation:
Identify type of habitat and states or provinces where it occurs:
Curly dock is recorded invading California wetlands and causing low impact on plant communities and higher trophic levels (Cal-IPC 2003).
Sources of information:
Cal-IPC - California Invasive Plant Council. 2005. *Rumex crispus.* Plant Assessment Form. Available: http://www.cal-ipc.org/ [February 28, 2003].

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 1

Documentation:
Identify type of disturbance:
Curly, bitter, and dooryard dock generally colonize disturbed ground, however it may occasionally establish in intact wetland communities (Cavers and Harper 1964, DiTomaso and Healy 2003). In Alaska these species are always associated with roadside disturbance (M.L. Carlson – pers. obs.).
Rational:

Sources of information:
Carlson, M.L., Assistant Professor, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2790 – Pers. obs.
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.
DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and riparian weeds of the West. California: University of California, Agriculture and Natural Resources; Pp. 329-341.

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 5

Documentation:
Describe distribution:
These species of docks are indigenous to Europe. They have been introduced into North and South Africa, North and South America, Asia, Australia and New Zealand. Curly dock and bitter dock are found in arctic habitats in Norway and northern Russia (Cavers and Harper 1964, Hultén 1968).
Rational:

Sources of information:
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.
Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.

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:
Curly and bitter docks are distributed throughout most of the United States. Dooryard dock can be found in the northeast United States and in Alaska (USDA, NRCS 2006). *Rumex crispus* is declared noxious in Indiana, Iowa, Michigan and Minnesota (USDA, NRCS 2006). *Rumex crispus* is a Federal Noxious weed in Canada (Royer and Dickinson 1999).
Rational:

Sources of information:
Royer, F., and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The

University of Alberta press. 434 pp.
USDA, NRCS. 2006. *The PLANTS Database*, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Total Possible	25
Total	14

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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 3

Documentation:
Identify longevity of seed bank:
Seeds of docks can remain viable in the soil for over 38 years (Toole 1946) and even over 80 years (Darlington and Steinbauer 1961).
Rational:

Sources of information:
Darlington, H.T. and G.P. Steinbauer. 1961. The eighty-year period for Dr. Beal's seed viability experiment. American Journal of Botany 48(4): 321-325.
Toole, E.H. 1946. Final results of the Duvel buried seed experiment. Journal of Agricultural Research 72(6): 201-210.

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 2

Documentation:
Describe vegetative response:
Adventitious buds on the roots and underground stems produce new shoots after damage. New shoots can produce autumn flowers very quickly (Monaco and Cumbo 1972).
Rational:

Sources of information:
Monaco, T.J. and E.L. Cumbo. 1972. Growth and development of curly dock and broadleaf dock. Weed science 20(1): 64-67.

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 3

Documentation:
Identify types of control methods and time-term required:
Hand-cutting plants below the ground or herbicide application can control infestations of exotic docks. Monitoring after treatment is required due to long-lived seed banks

and the ability to regenerate from root fragments (Cavers and Harper 1964, DiTomaso and Healy 2003).
Rational:

Sources of information:
Cavers, P.B. and J.L. Harper. 1964. *Rumex obtusifolius* L. and *R. crispus* L. The Journal of Ecology 52(3): 737-766.
DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and riparian weeds of the West. California: University of California, Agriculture and Natural Resources; Pp. 329-341.

Total Possible	10
Total	8

Total for 4 sections Possible	100
Total for 4 sections	48

References:

Amphlett, J. and C. Rea. 1909. The Botany of Worcestershire. Birmingham.

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