RED LIST ASSESSMENT

Questionnaire

(please complete one questionnaire per taxon, extra sheets may be used)

1a. Scientific name (including authority details):

Bombus affinis (Cresson)

1b. Synonym/s (if there has been a taxonomic change in the last 5 years or if widely used):

1c. English Common Name (if known):

Rusty patched bumble bee (Entomological Society of America), Rusty tinged bumble bee and Affable bumble bee

1d. Other Common Names (if known and state language):

Bourdon au Tache-Rouillé (French)

2a. Order	**2b. Family**
Hymenoptera	Apidae

3. Distribution

Describe the range in terms of countries of occurrence, subcountry units (e.g., states, provinces, etc.). For an inland water taxon, record the name/s of lakes, river systems, etc. in which it occurs. For a marine taxon, record names of estuaries, territorial waters, FAO fisheries areas:

Historically, *Bombus affinis* was widely distributed in southeastern Ontario and southern Quebec and along the east coast of the United States from southern Maine south through Georgia with an extension west along the northern states through Minnesota (Mitchell 1962; Milliron 1971), with a few specimens found as far west as North Dakota (Stevens 1948). In the U.S., states in *B. affinis*' historic range included Minnesota, Wisconsin, Indiana, Ohio, Pennsylvania, New York, New Jersey, Delaware, Vermont, New Hampshire, Maine, Maryland, Massachusetts, Connecticut, West Virginia, Virginia, North Carolina, South Carolina, Georgia, and portions of Michigan, North Dakota, South Dakota, Iowa, Illinois, Kentucky, and Tennessee. Canadian provinces included in its historic range are Ontario and Quebec.

Since 2001, surveys have failed to find *B. affinis* in Iowa, Minnesota, Michigan, Ohio, Pennsylvania, West Virginia, Virginia, Tennessee, North Carolina, South Carolina, Georgia, New Hampshire, Massachusetts, New Hampshire, Maine, or New York (Colla & Packer 2008, Evans *et al*. 2008, E. Evans, personal observation, July 2008, Giles & Ascher 2006).

Since 2001, *B. affinis* has been found in isolated areas of Wisconsin, Illinois, Indiana, and Maryland in the USA, and Ontario in Canada. There are sightings dating from 2006 for Wisconsin and 2007/2008 for Illinois. Despite extensive survey efforts *B. affinis* has not been seen in Iowa since 2001 (S. Hendrix & C. Gienapp, personal communication, September 2007), Indiana since 2002 (R. Jean & P. E. Scott personal communication, September 2007), Maryland since 2002 (S. Droege, personal communication, February 2008), or Ontario since 2005 (Colla & Packer *In Prep*).

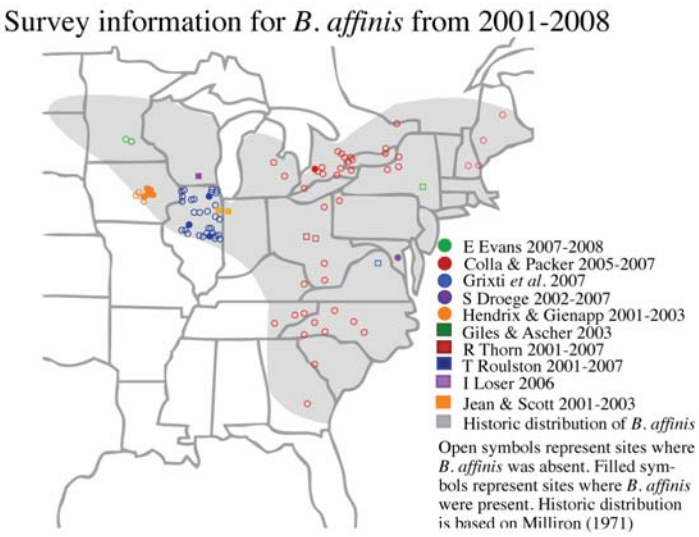

Figure 1: Distribution of *Bombus affinis* from 2001 to 2008 based on survey information.
Outlined shapes indicate survey locations where no *B. affinis* were found. Filled-in shapes indicate that *B. affinis* were found at that site. Gray shading represents the historic distribution of *B, affinis* (based on Milliron 1971).

Positive sightings took place in Iowa in 2001, central Indiana in 2001-2002, Maryland in 2002, Ontario Canada in 2005, Wisconsin in 2006, and central and northern Illinois in 2007 and 2008.

B. affinis was not found despite survey efforts in Virginia in 2001-2007; central Indiana in 2003; Maryland in 2003-2007; Michigan, Indiana, Ohio, Tennessee, West Virginia, North Carolina, South Carolina, Georgia, Pennsylvania, Massachusetts, New York, New Hampshire, or Maine in 2005-2007; Ontario Canada in 2006-2008; Minnesota in 2007-2008; or western Illinois in 2007-2008.

Note: A distribution map showing the extent of occurrence **MUST** be attached.

3a. Red List Assessment (Red List assessment using IUCN Red List Categories and Criteria: version 3.1. (IUCN 2001)). Tick (√) one of the following categories:

	Extinct (EX)
	Extinct in the Wild (EW)
X	Critically Endangered (CR)
	Endangered (EN)
	Vulnerable (VU)
	Near Threatened (NT)
	Least Concern (LC)
	Data Deficient (DD)
	Not Evaluated (NE)

3b. Red List Criteria (For threatened taxa (i.e., those assessed as CR, EN or VU) record which criteria are met (e.g., A2c+3c; B1ab(iii); D) alongside the appropriate Category. For NT taxa, record criteria nearly met):

A3bce+3ce, B1b(ii,iii, iv,v)

Note: If one of the threatened categories is selected (i.e. CR, EN or VU) then **ALL** the criteria, subcriteria and sub-subcriteria met for that category, must be listed in the box provided.

4. Rationale for the Red List Assessment (record the reasons why the taxon is assessed as above, including any population or range information used, inferences, assumptions, etc. For NT specify what criteria were nearly met and for DD specify what little information is known. Use additional sheets if necessary):

Although this species was formerly commonly found throughout most of its range, surveys

between 2001 and present have found *B. affinis* at only 6% of sites that were historically home to *B. affinis*. This drop in population and range appears to have occurred suddenly from 1999 to 2001. Since 2005, *B. affinis* has only been found in one location in southern Wisconsin and six locations in northern Illinois. Below are summaries of findings for North America. There is a lack of thorough survey information throughout most of the historic range. However, all surveys that have taken place since 2001 covering select areas throughout the historic range have shown either complete absence or a severe reduction in population. Based on this, it is assumed that *B. affinis* is either absent or severely reduced throughout its historic range. Details of the surveys are given below.

Northeastern United States and Eastern Canada:

A study sampling 1,195 bumble bees from the sites where *B. affinis* was historically abundant (Macfarlane 1974) in Ontario from 2004 to 2006 found no *B. affinis* individuals (Colla & Packer 2008). Additionally, in the same study, of approximately 9,000 bumble bees collected from 43 sites in the historic range of *B. affinis* in Canada and the eastern U.S., only a single *B. affinis* individual was found. This single *B. affinis* was collected in Ontario, Canada in 2005. In depth surveys in 2006, 2007, and 2008 have found no more *B. affinis* present (Colla & Packer *In Press*). Colla & Packer (2008) also found no *B. affinis* at twenty-five sites surveyed in the United States. *B. affinis* was formerly abundant in Toronto, Ontario in 1983 but has not been seen during regular surveys in the Toronto area from 2003 to 2008 (P. Williams, personal communication, July 2008). A 2003 survey including over 1,261 bumble bees in New York failed to find any *B. affinis* (Giles & Ascher 2006), although *B. affinis* was historically considered "moderately abundant in the eastern to southern parts of the [New York] state" (Leonard 1928). In a sample of nearly 1,000 bumble bees on the Patuxent National Wildlife Refuge in Maryland from 2002 to 2007, a single *B. affinis* specimen was collected in 2002 and none have been collected since (S. Droege, personal communication, February 2008). A 2006 to 2007 bumble bee survey revisiting eight sites *where B. affinis* were collected historically in New York, Massachusetts, Pennsylvania, New Hampshire, and Maine failed to find *B. affinis* (Colla & Packer 2008).

Midwestern United States:

A multi-year survey of bee species in northern Indiana including over 880 bumble bees found 25 *B. affinis* specimens out of 217 (12%) in 2001, two out of 451 (0.004%) in 2002, and none out of 553 in 2003 (R. Jean & P. E. Scott personal communication, September 2007). A similar pattern was seen in surveys in Iowa with five *B. affinis* found in 2000, five in 2001, and none in 2002 (S. Hendrix & C. Gienapp, personal communication, September 2007). Surveys at 20 different sites across in Illinois in 2006 found one *B. affinis* out of 583 bumble bees collected (C. North, personal communication, October 2007). In 2007, approximately 40 *B. affinis* were found at one site out of 230 bumble bees collected in McHenry County, Illinois (Grixti & Favret, personal communication, November 2007). In this 2007 survey, single *B. affinis* specimens were found at three other sites: in Champaign County one out of 70 (0.1%), in Peoria County one out of 25 (0.04%), and Dewitt County one out of 40 (0.025%) bumble bees were collected. Grixti *et al.* (2009) examined historical records for *B. affinis* and found that the distribution of *B. affinis* has declined by nearly one-third since 2000, with only 67% of its pre-2000 distribution remaining. Grixti *et al*. (2009) did find a small increase in the relative abundance of *B. affinis* between 2000 and 2007 compared to the relative abundance from 1900 to 1999 (1.4% in 2000 to 2007 compared to 0.6% for 1900 to 1949 and 0.3% for 1950 to 1999). However, Grixti *et al.* (2009) state that this finding is misleading because 90% of the 50 *B. affinis* workers that were sampled during the entire study were collected from a single site. In August of 2008, another *B. affinis* specimen was observed near Peoria, Illinois (J. James-Heinz, personal communication September 2008). A 1994 to 1995 survey including 464 bumble bees at Long Lake Regional Park in New Brighton, Minnesota found 98 (21%) *B. affinis* individuals (Reed 1995; C. Reed, personal communication, June 2007). A 2007 to 2008 survey at the same park including 593 bumble bees found no *B. affinis* (E. Evans, personal observation, July 2008). A 2006-2007 bumble bee survey including sites where *B. affinis* were collected historically and two additional sites within their historic range in Michigan and Ohio failed to find *B. affinis* (Colla & Packer

2008). One specimen was seen and photographed in Wisconsin in 2006 (http://bugguide.net/node/view/80952#93112).

Southeastern United States:
B. affinis has not been seen in the Great Smoky Mountains National Park in North Carolina and Tennessee, where it was once abundant, since 2000 (A. J. Mayor, personal communication, September 2007). A survey in Virginia between 2002 and 2005 including 283 bumble bees found no *B. affinis* (T. Roulston, personal communication, September 2007). A 2006-2007 bumble bee survey including eight sites where *B. affinis* were collected historically and six additional sites within their historic range in West Virginia, Virginia, North Carolina, South Carolina, Tennessee, Georgia failed to find *B. affinis* (Colla & Packer 2008).

5. Reason for Change from previous Red List assessment (if the taxon has changed Red List category from a previous assessment, record the reasons for this change (see www.redlist.org)). Tick (√) at least one of the following:

☐	Genuine change in status of species	☐	New or better information available
☐	Incorrect information used previously	☐	Taxonomic change affecting the species
☐	Previously incorrect application of the Red List Criteria		

6. Current Population Trend (tick (√) one of the following):

☐	Increasing	x	Decreasing	☐	Stable	☐	Unknown

7. Date of Assessment (day/month/year): 10/June/2009

8a. Name/s of the Assessor/s

Elaine Evans, Robbin Thorp, Sarina Jepsen and Scott Hoffman Black, The Xerces Society for Invertebrate Conservation

8b. Names of the Evaluators - *to be filled in By Red List Authority ONLY*
(at least TWO evaluators, and the name of the Red List Authority)

9. Text documentation
Brief notes (i.e., a short narrative, on the topics below to complement the information entered above or on the Authority Files in Annex 1 (use additional sheets if required).

9a. Taxonomy (any taxonomic notes of relevance - optional):
Bombus affinis Cresson was first described by Cresson (1863). Its status as a unique species

was recently upheld by Williams (1998) and Cameron *et al.* (2007).

9b. Geographic Range (including mention of important sites, and if known specify the extent of occurrence and area of occupancy): Since 2005, *B. affinis* has only been found at four sites in southern Wisconsin and northern Illinois. Comprehensive surveys have taken place in Ontario Canada and in Illinois in the U.S., in addition to small scale surveys at various locations throughout *B. affinis*' historic range. Although previous surveys provide ample evidence that the species has declined and is extirpated from large portions of its range, more surveys in key areas would give us additional information that would help conservation efforts for this species.

9c. Population (for example, population size, abundance (rare, scarce, common, etc.), number and size of subpopulations if known, number of locations and degree of fragmentation):
Since 2005, 56 *B. affinis* have been found at eight locations: a single location in southern Ontario, seven locations in northern and central Illinois, and one location in southern Wisconsin. One individual was found in Ontario, Canada in 2005 (Colla & Packer 2008). Intense surveys at this same location and others in Ontario from 2006 to 2008 failed to find any *B. affinis* (Colla & Packer *In Prep.)* One individual was found in northern Illinois in 2006 (C. North, personal communication, October 2007). In 2007, approximately 40 *B. affinis* were found at one site out in McHenry County, Illinois (Grixti & Favret, personal communication, November 2007). In the same study, single *B. affinis* specimens were found at three other sites: in Champaign County one out of 70 (0.1%), in Peoria County one out of 25 (0.04%), and Dewitt County one out of 40 (0.025%) bumble bees were collected. In August of 2008, another *B. affinis* specimen was observed near Peoria, Illinois (J. James-Heinz, personal communication September 2008). One specimen was seen and photographed in Wisconsin in 2006 (http://bugguide.net/node/view/80952#93112).

Since bumble bees are social insects, the sighting of one worker at a location implies that there are other bees present in the area since *B. affinis* colonies typically contain between 50 and 400 workers at their peak (Plath 1927; Macfarlane *et al.* 1994) along with the queen. All surveys (with the exception of one) found only one *B. affinis* worker. Since bumble bees are central place foragers, more bees are usually found at locations closer to bumble bee nests. Finding only one bee during a survey implies that the nest is not nearby or that the colony is small. Finding only one bee in the majority of surveys indicates that *B. affinis* colonies are sparse.

9d. Habitat and Ecology (including particulars about breeding ecology if relevant):
B. affinis requires habitats with rich supplies of floral resources with continuous blooming from spring to autumn. Landscape level habitat quality has been shown to influence bumble bee species richness and abundance, indicating that isolated patches of habitat are not sufficient to fully support bumble bee populations (Hatfield & LeBuhn 2007; Öckinger & Smith 2007). *B. affinis* primarily nests underground, typically in abandoned rodent nests located from six to eighteen inches below the surface (Plath 1927; Laverty & Harder 1988). Occasionally nests will be constructed on the surface in areas such as clumps of grass on the ground (Hobbs 1968; Macfarlane *et al.* 1994). Thus, nesting sites may be limited by the abundance of rodents and the presence of undisturbed grassland.

Bumble bees are particularly susceptible to inbreeding due to low effective population size (Packer & Owen 2001). As with all other hymenopterans, their sex determination system is haplodiploidy. The sex of offspring is determined by whether or not the egg is fertilized. Unfertilized, or haploid, eggs become males and fertilized, or diploid, eggs become females. However, when fertilized eggs are homozygous at the sex-determining locus, diploid males are produced. Homozygosity occurs when genes from both parents are the same for a particular trait. When genetic diversity in low, diploid males are more likely to be produced. Diploid males are effectively sterile, and their production generates a costly genetic load. This sex

determination system may result in lower levels of genetic diversity than diploid-diploid sex determination. Bumble bees are more vulnerable to extinction than many other species due to their haplodiploid method of sex determination (Zayed & Packer 2005).

9e. Threats (the main threats to the species, and if known, the severity and extent):
The main threat to *B. affinis* is the spread of disease and pests by the commercial bumble bee rearing industry. Habitat loss and pesiticides also threaten all bumble bees, including *B. affinis*.

The spread and possible introduction of diseases and pests by the commercial bumble bee rearing industry poses a threat to *B. affinis* populations. The commercial bumble bee rearing industry produces approximately 55,000 colonies annually for use in North America (Velthuis & van Doorn 2006), primarily for pollination of greenhouse tomatoes. In 1997, large scale commercial rearing companies began to experience problems with infection by *Nosema bombi* (a microsporidian parasite of bumble bees) in *B. occidentalis* colonies, a bumble bee native to western North America (Flanders *et al.* 2003; Velthuis & van Doorn 2006). This decline occurred after bees had been moved between North American and European rearing facilities, possibly carrying a selectively virulent strain of the pathogen *N. bombi* from the commercially reared European bumble bee *Bombus terrestris.* Declines of all North American members of the sub-genus *Bombus* sensu stricto (including *B. terricola*, *B. affinis*, *B. occidentalis*, and *B. franklini*) began several years after disease problems afflicted *B. occidentalis* commercial rearing facilities in the western U.S. (Evans *et al.* 2008). The timing, specificity to this sub-genus, and severity of the decline of *B. affinis* suggest diseases and/or pests spread by commercially raised bumble bees as the most likely cause of *B. affinis'* decline.

Bumble bee populations are threatened by many kinds of habitat alterations which may destroy, fragment, degrade, or reduce their food supplies (flowers that produce the nectar and pollen they require), nest sites (e.g. abandoned rodent burrows or undisturbed grass), and hibernation sites for over-wintering mated queens. Fragmentation of bumble bee populations can result in problems including inbreeding depression (Darvill *et al.* 2006; Ellis *et al.* 2006) and an increased risk of extinction due to demographic stochasticity. Threats that alter habitat required by bumble bees include agricultural intensification, livestock grazing, urban development, and fragmentation of landscapes.

Pesticide applications may threaten populations of *B. affinis*. Increasing numbers of insecticidal transgenic plants are being used to control pest species, and the effect of most of these transgenic plants on bumble bees is not known (Malone & Pham Delègue 2001). However, there is evidence of negative effects on bumble bees of two compounds that are produced in transgenic plants; the soybean trypsin inhibitor (a protease inhibitor) and *Galanthus nivalis* agglutinin (a lectin) have been shown to reduce bumble bee longevity and reproduction when administered experimentally (Babendreier *et al*. 2008). Neonicotinoids, such as Imidacloprid, are commonly used in North America for crop, and turf pest control as well as in products for pets, home and gardens (Cox 2001). Bumble bee workers exposed to low levels Imidacloprid show reduced pollen consumption and ovarian development (Colla & Packer 2008).

9f. Conservation Actions (including presence in protected areas and national/international legislation):

Currently bumble bees have no substantive protection for habitat or take under Canada's or the United State's federal law or individual state's laws. There are no current federal regulations that limit the interstate transport of bumble bees (Flanders 2003). Current law also allows the transport of two commercially raised species of bumble bees from Canada (*B. impatiens* and *B. occidentalis*) to all U.S. states except Hawaii under the Honeybee Act § 322.4 and § 322.5. The state of Oregon does not allow *Bombus impatiens* (a bumble bee native to the eastern U.S.) to enter the state. California allows *Bombus impatiens* to be imported into the state for greenhouse pollination only. We can find no evidence that any other states regulate the importation of bumble bees. Since these commercially raised bees may carry exotic diseases (Colla *et al*.

2006, Otterstatter & Thomson 2008), they are a potential threat even within their native range, particularly to populations in decline such as *B. affinis*. Limiting the interstate transport of potential pathogen bearing commercial bees could benefit remaining *B. affinis* populations.

The state of Wisconsin has listed *B. affinis* as a Species of Greatest Conservation Need. However, this listing does not provide means to address the main threats to the species.

Remaining *B. affinis* populations would benefit from habitat protection. *B. affinis* need flowers as their food source and undisturbed grasslands or wooded areas for nesting sites. Exposure of remaining populations to pesticides should be limited.

Extensive surveying is needed to determine the location of remaining *B. affinis* populations. Inclusion of genetic analysis in survey work would help determine the amount of fragmentation present in remaining populations.

g. Utilization (Is the taxon utilized in any way, e.g., medicinal uses, food, building material, etc.? Which parts are utilized? Is there a local, national or international trade in the taxon?

No.

10. Literature References (cited in full) used for the assessment and documentation:

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Personal Communication:
Dr. John Ascher, American Museum of Natural History, Aug. 2008, Sam Droege, USGS Patuxtent Wildlife Research Center, Feb. 2008 Elaine Evans, Xerces Society (cited: personal observation), August 2007 and July 2008, Jennifer Grixti and Colin Favret, University of Illinois, Nov. 2007, Dr. Steve Hendrix (Professor) and Chris Gienapp, University of Iowa, Sept. 2007, Johanna James-Heinz, Sept. 2008, Robert Jean and Peter E. Scott, Indiana State University, Sept. 2007, Adriean J. Mayor, Great Smoky Mountains National Park, Sept. 2007, Christina North, graduate student, University of Illinois, Oct. 2007, Dr. Catherine Reed, July 2008

Annex 1. Authority Files For Habitats, Threats and Conservation Actions and Utilization

This annex contains four Authority Files with standard categories to be used for documenting (a) the major habitats a taxon occurs in; (b) the major threats to the taxon (past, present and future); (c) what conservation actions are in place or are required for the taxon; and (d) information about the utilization of the taxon (locally, nationally or internationally). More detailed descriptors of the Authority File terms are being developed, and will be available in due course.

A. Habitats Authority File (Version 2.1)

This two-tiered habitat classification system is based on a climatic and biogeographic classification using Holdridge's life zones as a basis. The aquatic habitats (inland, marine and artificial) are based primarily on the classification system of wetland types used by the Ramsar Convention (see http://www.ramsar.org/key_ris_types.htm). The aquatic habitats are under review, particularly the marine ones, as these are far too simplistic a view of the marine environment. The categories are numbered to indicate their level in the hierarchy e.g., 1. Forest and 1.1 Boreal Forest.

There is a third level to the classification which is based on the Global Land Cover Characterization (GLCC) developed by the US Geological Survey's (USGS) Earth Resources Observation System (EROS) Data Center, the University of Nebraska-Lincoln (UNL) and the Joint Research Centre of the European Commission (see http://edcdaac.usgs.gov/glcc/glcc.html). This third level is not shown here, because without access to the Species Information Service (SIS) database or the GLCC maps, it is impossible for users to accurately record habitats at this level.

In using this classification, assessors are asked to indicate in which habitats their taxon is found. This is done by means of a simple scoring system:

1 = Suitable (main or preferred habitat/s, habitat/s containing major subpopulations, habitat/s with high population densities)
2 = Moderately suitable (secondary habitat/s, habitat/s containing minor subpopulations, habitat/s with low population densities
3 = Unsuitable (unsuitability expressly known or easily inferred from the ecology of the taxon)
9 = Undefined (data deficient, possibly suitable or moderately suitable as inferred from the ecology of the taxon)

It is important to note that if a higher level in the hierarchy is scored, this automatically implies that all the habitat types nested below that level are also scored (e.g., scoring Forest, means that all the forest types i.e. 1.1. to 1.9 are scored). This will not be the intention in most cases. Users are therefore encouraged to select the appropriate habitat type from the lowest level in the hierarchy wherever possible.

If 'Other' is selected, the habitat type must be specified. Multiple additions under 'Other' are allowed, although extensive use of this is not encouraged. If the habitat is not known, please indicate this using a score of 9 under category '15. Unknown'.

(Score: 1= primary habitat type; 2= secondary habitat type; 9 = possibly suitable habitat)

Habitat Type	Score
1. Forest	
1.1. Boreal	
1.2. Subarctic	
1.3. Subantarctic	
1.4. Temperate	**9**
1.5. Subtropical/Tropical Dry	
1.6. Subtropical/Tropical Moist Lowland	
1.7. Subtropical/Tropical Mangrove	
1.8. Subtropical/Tropical Swamp	
1.9. Subtropical/Tropical Moist Montane	
2. Savanna	
2.1. Dry	
2.2. Moist	
3. Shrubland	
3.1. Subarctic	
3.2. Subantarctic	
3.3. Boreal	
3.4. Temperate	**9**
3.5. Subtropical/Tropical Dry	
3.6. Subtropical/Tropical Moist	
3.7. Subtropical/Tropical High Altitude	
3.8. Mediterranean-type Shrubby Vegetation	
4. Grassland	
4.1. Tundra	
4.2. Subarctic	
4.3. Subantarctic	
4.4. Temperate	**1**
4.5. Subtropical/Tropical Dry Lowland	
4.6. Subtropical/Tropical Seasonally Wet/Flooded Lowland	
4.7. Subtropical/Tropical High Altitude	
5. Wetlands (inland)	
5.1. Permanent Rivers/Streams/Creeks [includes waterfalls]	
5.2. Seasonal/Intermittent/Irregular Rivers/Streams/Creeks	
5.3. Shrub Dominated Wetlands	**9**
5.4. Bogs, Marshes, Swamps, Fens, Peatlands	**9**
5.5. Permanent Freshwater Lakes [over 8 ha]	
5.6. Seasonal/Intermittent Freshwater Lakes [over 8 ha]	
5.7. Permanent Freshwater Marshes/Pools [under 8 ha]	
5.8. Seasonal/Intermittent Freshwater Marshes/Pools [under 8 ha]	
5.9. Freshwater Springs and Oases	
5.10. Tundra Wetlands [includes pools and temporary waters from snowmelt]	
5.11. Alpine Wetlands [includes temporary waters from snowmelt]	
5.12. Geothermal Wetlands	
5.13. Permanent Inland Deltas	
5.14. Permanent Saline, Brackish or Alkaline Lakes	
5.15. Seasonal/Intermittent Saline, Brackish or Alkaline Lakes and Flats	
5.16. Permanent Saline, Brackish or Alkaline Marshes/Pools	
5.17. Seasonal/Intermittent Saline, Brackish or Alkaline Marshes/Pools	
5.18. Karst and Other Subterranean Hydrological Systems [inland]	

6. Rocky Areas [e.g. inland cliffs, mountain peaks]	
7. Caves and Subterranean Habitats (non-aquatic)	
7.1. Caves	
7.2. Other Subterranean Habitats	
8. Desert	
8.1. Hot	
8.2. Temperate	
8.3. Cold	
9. Sea	
9.1. Open	
9.2. Shallow [usually less than 6 m deep at low tide; includes sea bays and straits]	
9.3. Subtidal Aquatic Beds [kelp beds, sea- grass beds and tropical marine meadows]	
9.4. Coral Reefs	
10. Coastline	
10.1. Rocky Shores [includes rocky offshore islands and sea cliffs]	
10.2. Sand, Shingle or Pebble Shores [includes sand bars, spits, sandy islets, dune systems]	
10.3. Estuarine Waters	
10.4. Intertidal Mud, Sand or Salt Flats	
10.5. Intertidal Marshes [includes salt marshes]	
10.6. Coastal Brackish/Saline Lagoons	
10.7. Coastal Freshwater Lagoons	
10.8. Karst and Other Subterranean Hydrological Systems [marine/coastal]	
11. Artificial - Terrestrial	
11.1. Arable Land	**2**
11.2. Pastureland	**2**
11.3. Plantations	**2**
11.4. Rural Gardens	**1**
11.5. Urban Areas	**2**
11.6. Subtropical/Tropical Heavily Degraded Former Forest	
12. Artificial - Aquatic	
12.1. Water Storage Areas (over 8 ha)	
12.2. Ponds (below 8 ha)	
12.3. Aquaculture Ponds	
12.4. Salt Exploitation Sites	
12.5. Excavations (open)	
12.6. Wastewater Treatment Areas	
12.7. Irrigated Land [includes irrigation channels]	
12.8. Seasonally Flooded Agricultural Land	
12.9. Canals and Drainage Channels, Ditches	
12.10. Karst and Other Subterranean Hydrological Systems [human-made]	
13. Introduced Vegetation	**2**
14. Other	
15. Unknown	

B. Major Threats (Version 2.1)

In using this hierarchical classification of causes of species decline, assessors are asked to **indicate the threats that triggered the listing of the taxon concerned.** These threats could be in the past and/or present and/or future, using a time frame of three generations or ten years, whichever is longer (not exceeding 100 years in the future) as in the Red List Criteria. Selecting past, present and future for any threat implies that it is ongoing. In this hierarchy, unlike that for the habitats, selection of a higher level threat e.g., 1.1. Agriculture, does not imply that all the threats below this e.g., 1.1.1 Crops to 1.1.7 Freshwater aquaculture, are indicated. It simply indicates that some unspecified form of agriculture is leading to habitat loss or habitat degradation for the taxon concerned. Selection of any threat category lower down the hierarchy automatically implies that the higher levels are indicated, i.e. it is not necessary to indicate all the levels met. For example, selecting threat 1.1.4.1. Nomadic, indicates that nomadic livestock is an agricultural activity (threat 1.1.) that causes habitat loss or degradation (threat 1.). It is very important for users to check the hierarchy above the level indicated to ensure that the correct threat is selected because similar terms (e.g., fire) are used in more than one place in the classification. Multiple threats can be selected as required. If 'Other' is selected, the threat or cause of the decline must be specified. Multiple additions under 'Other' are allowed, although extensive use of this is not encouraged. If no threats to the taxon are known (past and/or present and/or future this should be recorded against threat category 0. To indicate the threats use: Yes or Y or √.

Threat	Past	Present	Future
0. No threats			
1. Habitat loss/degradation (human induced)			
1.1. Agriculture	**Y**	**Y**	**Y**
1.1.1. Crops			
1.1.1.1. Shifting agriculture			
1.1.1.2. Small-holder farming			
1.1.1.3. Agro-industry farming	**Y**	**Y**	**Y**
1.1.2. Wood plantations			
1.1.2.1. Small-scale			
1.1.2.2. Large-scale			
1.1.3. Non-timber plantations			
1.1.3.1. Small-scale			
1.1.3.2. Large-scale			
1.1.4. Livestock			
1.1.4.1. Nomadic			
1.1.4.2. Small-holder			
1.1.4.3. Agro-industry	**Y**	**Y**	**Y**
1.1.5. Abandonment			
1.1.6. Marine aquaculture			
1.1.7. Freshwater aquaculture			
1.1.8. Other			
1.1.9. Unknown			
1.2. Land management of non-agricultural areas			
1.2.1. Abandonment			
1.2.2. Change of management regime			
1.2.3. Other			
1.2.4. Unknown			
1.3. Extraction			
1.3.1. Mining			
1.3.2. Fisheries			
1.3.2.1. Subsistence			
1.3.2.2. Artisinal/small-scale			

1.3.2.3. Large-scale/industrial			
1.3.3. Wood			
1.3.3.1. Small-scale subsistence			
1.3.3.2. Selective logging			
1.3.3.3. Clear-cutting			
1.3.4. Non-woody vegetation collection			
1.3.5. Coral removal			
1.3.6. Groundwater extraction			
1.3.7. Other			
1.3.8. Unknown			
1.4. Infrastructure development			
1.4.1. Industry	**Y**	**Y**	**Y**
1.4.2. Human settlement	**Y**	**Y**	**Y**
1.4.3. Tourism/recreation			
1.4.4. Transport - land/air			
1.4.5. Transport – water			
1.4.6. Dams			
1.4.7. Telecommunications			
1.4.8. Power lines			
1.4.9. Other (road expansions)			
1.4.10. Unknown			
1.5. Invasive alien species (directly impacting habitat)			
1.6. Change in native species dynamics (directly impacting habitat)	**Y**	**Y**	**Y**
1.7. Fires			
1.8. Other causes			
1.9. Unknown causes			
2. Invasive alien species (directly affecting the species)			
2.1. Competitors			
2.2. Predators			
2.3. Hybridizers			
2.4. Pathogens/parasites	**Y**	**Y**	**Y**
2.5. Other			
2.6. Unknown			
3. Harvesting [hunting/gathering]			
3.1. Food			
3.1.1. Subsistence use/local trade			
3.1.2. Sub-national/national trade			
3.1.3. Regional/international trade			
3.2. Medicine			
3.2.1. Subsistence use/local trade			
3.2.2. Sub-national/national trade			
3.2.3. Regional/international trade			
3.3. Fuel			
3.3.1. Subsistence use/local trade			
3.3.2. Sub-national/national trade			
3.3.3. Regional/international trade			
3.4. Materials			
3.4.1. Subsistence use/local trade			
3.4.2. Sub-national/national trade			
3.4.3. Regional/international trade			

3.5. Cultural/scientific/leisure activities			
3.5.1. Subsistence use/local trade			
3.5.2. Sub-national/national trade			
3.5.3. Regional/international trade			
3.6. Other			
3.7. Unknown			
4. Accidental mortality			
4.1. Bycatch			
4.1.1. Fisheries-related			
4.1.1.1. Hooking			
4.1.1.2. Netting			
4.1.1.3. Entanglement			
4.1.1.4. Dynamite			
4.1.1.5. Poisoning			
4.1.2. Terrestrial			
4.1.2.1. Trapping/snaring/netting			
4.1.2.2. Shooting			
4.1.2.3. Poisoning			
4.1.3. Other			
4.1.4. Unknown			
4.2. Collision			
4.2.1. Pylon and building collision			
4.2.2. Vehicle collision			
4.2.3. Other			
4.2.4. Unknown			
4.3. Other (killed during the removal of soil for road widening process by trolls)			
4.4. Unknown			
5. Persecution			
5.1. Pest control			
5.2. Other			
5.3. Unknown			
6. Pollution (affecting habitat and/or species)			
6.1. Atmospheric pollution			
6.1.1. Global warming/oceanic warming			**Y**
6.1.2. Acid precipitation			
6.1.3. Ozone hole effects			
6.1.4. Smog			
6.1.5. Other			
6.1.6. Unknown			
6.2. Land pollution			
6.2.1. Agricultural	**Y**	**Y**	**Y**
6.2.2. Domestic			
6.2.3. Commercial/Industrial			
6.2.4. Other non-agricultural			
6.2.5. Light pollution			
6.2.6. Other			
6.2.7. Unknown			
6.3. Water pollution			
6.3.1. Agricultural			
6.3.2. Domestic			

6.3.3. Commercial/Industrial			
6.3.4. Other non-agricultural			
6.3.5. Thermal pollution			
6.3.6. Oil slicks			
6.3.7. Sediment			
6.3.8. Sewage			
6.3.9. Solid waste			
6.3.10. Noise pollution			
6.3.11. Other			
6.3.12. Unknown			
6.4. Other			
6.5. Unknown			
7. Natural disasters			
7.1. Drought			
7.2. Storms/flooding			
7.3. Temperature extremes			
7.4. Wildfire			
7.5. Volcanoes			
7.6. Avalanches/landslides			
7.7. Other			
7.8. Unknown			
8. Changes in native species dynamics			
8.1. Competitors			
8.2. Predators			
8.3. Prey/food base			
8.4. Hybridizers			
8.5. Pathogens/parasites			
8.6. Mutualisms			
8.7. Other			
8.8. Unknown			
9. Intrinsic Factors			
9.1. Limited dispersal			
9.2. Poor recruitment/reproduction/regeneration			
9.3. High juvenile mortality			
9.4. Inbreeding			**Y**
9.5. Low densities		**Y**	**Y**
9.6. Skewed sex ratios			
9.7. Slow growth rates			
9.8. Population fluctuations		**Y**	**Y**
9.9. Restricted range		**Y**	**Y**
9.10. Other			
9.11. Unknown			
10. Human disturbance			
10.1. Recreation/tourism			
10.2. Research			
10.3. War/civil unrest			
10.4. Transport			
10.5. Fire			
10.6. Other Pet trade			

10.7. Unknown			
11. Other			
12. Unknown			

C. Conservation Actions Authority File (Version 1.0)

In using this hierarchical classification of conservation actions, assessors are asked to indicate the conservation actions or measures that are in place and/or that are needed for each taxon. In suggesting what actions are needed, **assessors are asked to be realistic and not simply select everything. The selection should be for those actions which are most needed and which could realistically be achieved in approximately the next five years.** Selection of a higher level action e.g., 1.2. Legislation, does not mean that all the actions below this e.g., 1.2.1 Development and 1.2.2. Implementation, are indicated. It simply indicates that legislation is either in place or is needed as part of a policy-based action for the taxon concerned. Selection of any action lower down the hierarchy automatically implies that the higher levels are indicated, i.e. it is not necessary to indicate all the levels, just the lowest. For example, selecting action 4.4.2. Establishment, indicates that establishment of a protected area (action 4.4) is one of the habitat and site based actions (action 4.) required for the taxon concerned. Multiple conservation actions can be selected as required. If 'Other' is selected, the conservation action or measure must be specified. Multiple additions under 'Other' are allowed, although extensive use of this is not encouraged. If no conservation actions or measures are in place, this should be recorded, against conservation action 0. Similarly, if no conservation actions are needed, then it is also important to record this against conservation action 0 (both 'In Place' and the 'Needed' columns could be ticked). To indicate the actions use: Yes or Y or √.

Conservation Action	In Place	Needed
0. No conservation actions	**Y**	
1. Policy-based actions		
1.1. Management plans		**Y**
1.1.1. Development		**Y**
1.1.2. Implementation		**Y**
1.2. Legislation		**Y**
1.2.1. Development		**Y**
1.2.1.1. International level		
1.2.1.2. National level		**Y**
1.2.1.3. Sub-national level		**Y**
1.2.2. Implementation		**Y**
1.2.2.1. International level		
1.2.2.2. National level		**Y**
1.2.2.3. Sub-national level		**Y**
1.3. Community management		**Y**
1.3.1. Governance		**Y**
1.3.2. Resource stewardship		**Y**
1.3.3. Livelihood alternatives		
1.4. Other		
2. Communication and Education		
2.1. Formal education		
2.2. Awareness		**Y**
2.3. Capacity-building/Training		
2.4. Other		
3. Research actions		
3.1. Taxonomy	**Y**	
3.2. Population numbers and range	**Y**	**Y**
3.3. Biology and Ecology	**Y**	**Y**
3.4. Habitat status	**Y**	**Y**
3.5. Threats		**Y**

3.6. Uses and harvest levels		
3.7. Cultural relevance		
3.8. Conservation measures		**Y**
3.9. Trends/Monitoring		**Y**
3.10. Other		
4. Habitat and site-based actions		
4.1. Maintenance/Conservation		**Y**
4.2. Restoration		**Y**
4.3. Corridors		
4.4. Protected areas		**Y**
4.4.1. Identification of new protected areas		**Y**
4.4.2. Establishment		**Y**
4.4.3. Management		**Y**
4.4.4. Expansion		**Y**
4.5. Community-based initiatives		**Y**
4.6. Other		
5. Species-based actions		
5.1. Re-introductions		
5.2. Benign introductions		
5.3. Sustainable use		
5.3.1. Harvest management		
5.3.2. Trade management		
5.4. Recovery management		**Y**
5.5. Disease, pathogen, parasite management		**Y**
5.6. Limiting population growth		
5.7. Ex situ conservation actions		
5.7.1. Captive breeding/Artificial propagation		
5.7.2. Genome resource bank		
5.8. Other		
6. Other		

D. Utilization Authority File (Version 1.0)

This Authority File should be filled for any taxon that is utilized locally, nationally or internationally. The purpose or type of use, the parts and proportion of the taxon used and the source of specimens in commercial trade should be indicated on the tables below by means of a tick (√) in the appropriate boxes. Text boxes are included for additional information. If a taxon is not utilized this should be recorded below and the remainder of the form left blank.

Taxon is not used locally, nationally or internationally [x]

What proportion (as a %) of the total population (i.e., global) is utilized?
This helps to place the information filled in below into context

Purpose/Type of Use

Subsistence (Sub.) Subsistence use/local trade (generally implies direct use by the harvester/family/local community; includes barter for other locally-produced goods, but not sale for profit)

National (Nat.) Sub-national/national trade (commercial trade, i.e. involving sale/barter for profit, without crossing international borders)

International (Int.) Regional/international trade (commercial trade crossing one or more international borders)

Purpose/Type of Use	Sub.	Nat.	Int.
1. Food - human Food and beverages for human consumption/nutrition			
2. Food - animal Food and liquids for consumption by domestic/captive animals			
3. Medicine - human and veterinary Materials administered specifically to treat or prevent a specific illness or injury. Items administered as vitamins, tonics etc., should be included under food.			
4. Poisons e.g. pesticides, herbicides, fish poisons			
5. Manufacturing chemicals e.g. solvents, dyes, adhesives, resins, etc. whether for domestic or commercial/industrial use			
6. Other chemicals e.g. incense, perfumes, cosmetics			
7. Fuel Including wood and charcoal production from wood, grasses, etc.			
8. Fibre e.g. for weaving, sewing, rope, paper, thatch, etc.			

9. Construction/structural materials e.g. supports, timber, fencing, etc.			
10. Wearing apparel, accessories e.g. clothing, footwear, belts, bags, trimmings			
11. Other household goods e.g. containers, furnishings, etc. with primarily utilitarian functions, though potentially highly decorated			
12. Handicrafts, jewellery, decorations, curios, etc. Finished goods with primarily ornamental/decorative rather than utilitarian functions			
13. Pets/display animals, horticulture Includes animals used as pets and for display (e.g. in zoos, circuses); plants used for re-planting for ornamental purposes, including in private gardens and public display (e.g. in botanical gardens)			
14. Research Includes specimens used in or as the subject of any type of research (e.g. behavioural, medicine, propagation, disease resistance, etc.			
15. Sport hunting/specimen collecting Includes collection and preservation of dead specimens for personal pleasure, e.g. not for research; collection of live specimens should be included under pets/display animals, horticulture			
16. Other Please specify in the "Notes" section below			
17. Unknown			

If you have filled in the "other" section for purpose/type of use please put details here:

Primary forms removed from the wild
Estimated percentage of the total harvest/offtake contributed by each form

Primary forms removed from the wild	100%	>75%	51-75%	26-50%	0-25%
1. Whole animal/plant Removal of the whole individual from the wild population					
2. Parts - non-lethal removal Removal of parts without obviously increasing the risk of death or decreasing reproductive ability of the individual, i.e. so that it remains a functional part of the wild population; includes non-reproductive parts shed without interference, e.g. antlers.					
3. Parts - lethal removal Removal of parts resulting in the death and or/reproductive incapacity of the individual and therefore its biological removal from the wild population.					
4. Eggs, fruits, seeds Removal of eggs from gravid females should be included under 'parts' above.					
5. Other Please specify in the "Notes" section below.					
6. Unknown					

If you have filled in the "other" section for primary forms removed from the wild please put details here:

Source of specimens in commercial trade
The percentage of the harvest/offtake for commercial trade (i.e. not for subsistence use) that is taken (sourced) from a particular production system.

Source of specimens in commercial trade	**100%**	**>75%**	**51-75%**	**26-50%**	**0-25%**
1. Wild Specimens taken from natural habitat, with no human intervention in terms of enhancing individual survival or production					
2. Captive breeding/farming Production of offspring in a controlled environment (*ex situ*) either from parents produced in captivity (F1) or from parents taken from the wild but maintained in captivity, where there is little further input from the wild, e.g. essentially a closed cycle production system					
3. Ranching - *ex situ* Production of saleable specimens from eggs (including within gravid females), juveniles, immature plant specimens removed from the wild and raised ex site prior to commercial sale					
4. Ranching - *in situ* Specimens maintained within confined areas of wild habitat, with or without other forms of manipulation, e.g. habitat manipulation					
5. Other Please specify in the Notes section below					
6. Unknown					

If you have ticked the "other" section for source of specimens please put details here:

Offtake/harvest trends

1. Trend in the level of wild offtake/harvest in relation to total wild population numbers over the last five years?

Increasing ☐ Stable ☐ Decreasing ☐ Unknown ☐

2. Trend in the amount of offtake/harvest produced through domestication/cultivation over the last five years?

Increasing ☐ Stable ☐ Decreasing ☐ Unknown ☐

CITES status

Is the taxon included on one of the CITES Appendices (indicate with a tick (4) if known):

Appendix I ☐ Appendix II ☐ Appendix III ☐ Not Listed ☐

If the listing is annotated for particular products, for particular populations, or there are CITES quotas in place, or recent changes in the listing, etc., these should be recorded here: