MN NWAC Risk Assessment Worksheet (04-2011)	Common Name	*Latin Name*
	Orange Hawkweed	***Hieracium aurantiacum* L.**
Reviewer	**Affiliation/Organization**	**Date (mm/dd/yyyy)**
Roger Becker	**University of Minnesota**	**07/09/2018**

NOTE: The most complete, one-stop reference is the USDA USFS Fire Effects Information System Website (USDA USFS 2010).

Species Description: (MnDNR, 2018)
Appearance: Perennial herbaceous plant, 10-20" high; each hairy stem bears one or a dense cluster of dandelion-like, orange flower heads. The stem grows from a basal rosette of hairy leaves
Leaves: Hairy rosette made up of entire or minutely toothed leaves, spatula-shaped, 4-6" long. They are dark green above and lighter green beneath.
Flowers: Bright yellow or orange dandelion-like, 0.5" to .75" in diameter; arranged in a dense flat-topped cluster of flowers.
Seeds: Each flower bears 12-30 tiny, columnar seeds with a light-brown tuft of bristles for wind dispersal. Produces 50 to 600 seeds per plant and are viable in the soil for up to 7 years Graziano 2016).
Roots: Spreads primarily vegetatively through runners, (4-12 per flowering plant), rhizomes, (underground stems producing new plants) and sporadic root buds.
Family: Asteraceae
Habitat: Hawkweeds colonize and can rapidly dominate a site. They grow well on disturbed, dry low productivity soils.
Distribution: Orange hawkweed is a native of Europe and invades northern moist pastures, forest openings, abandoned fields, clearcuts and roadsides. Its greatest density occurs on newly disturbed sites, as it is an early succession plant. Its largest distribution is in northeastern Minnesota.

Ecological Threat: Orange hawkweed is a native of Europe and invades northern moist pastures, forest openings, abandoned fields, clearcuts and roadsides. Its greatest density occurs on newly disturbed sites, as it is an early succession plant. Its largest distribution is in northeastern Minnesota. Loss of native plant diversity in infested areas, orange hawkweed colonizes rapidly forming a solid mat of rosettes. The plant may have allelopathic effects on neighboring plants.

https://www.forestryimages.org/search/action.cfm?q=orange+hawkweed

Becca MacDonald, Sault College, Bugwood.org

Michael Shephard, USDA Forest Service, Bugwood.org

Box	Question	Answer	Outcome
1	Is the plant species or genotype non-native?	Yes (PLANTS, 2018), first reported in the U.S. in Vermont in 1875 (Voss and Böhlke 1978). Native to northern and central Europe, and has repeatedly escaped cultivation (Wilson and Callahan 1999).	Go to Box 3.
2	Does the plant species pose significant human or livestock concerns or has the potential to significantly harm agricultural production?		
	A. Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?		
	B. Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?		
3	Is the plant species, or a related species, documented as being a problem elsewhere?	Yes, particularly in the NW U.S. and western Canada and Alaska (Seefelt and Conn, 2010). Clearly shown to be invasive in New Zealand and Australia (Koltunow et al 1998, Lackschewitz 1991) and has the capacity to expand its range (Beaumont el al 2009). Of the 100 articles on *Hieracium* species in a U of M AGRICOLA Ovid search, roughly 2/3s were genetic studies on apomictic reproduction (asexual) as a model plant to understand apomixis (Catanach et al. 2006), ploidy levels, molecular markers to distinguish species, and hybridization. Most invasive references are on mouse-ear hawkweed (*H. pilosella*), the most invasive hawkweed worldwide, with a recent review article by Cipriotti et al. (2010) on mouse-ear hawkweed invasion broadly in the world and its introduction to the U.S., which has led to severe ecological and economic damage in New Zealand, (Meurk et al. 2002). Noxious weed designation in Colorado, Idaho, Washington, Oregon, and Montana (PLANTS, 2018).	Go to Box 6
4	Is the plant species' life history & Growth requirements understood?		
5	Gather and evaluate further information:	(Comments/Notes)	
6	Does the plant species have the capacity to establish and survive in Minnesota?		

Box	Question	Answer	Outcome
	A. Is the plant, or a close relative, currently established in Minnesota?	Yes. There are 54 *Hieracium* species in North America, 37 native and 16 exotic, and 1 native to Canada, but considered exotic in the U.S. (PLANTS, 2018). (See phylogenetic tree, Gaskin and Wilson 2007 Fig. 1). *Hieracium aurantiacum* is in subgenus *Pilosella.* In Minnesota, there are three related native *Hieracium* spp. *H. longipilum* (hairy hawkweed), *H. sacabrum* (sticky hawkweed), and *H. umbellatum* (narrow-leaf hawkweed, also separated into *H. kalmia* and *H. scabriusculum*), and three other exotics, *H. caespitosum* (meadow hawkweed), *H. pilosella* (mouse-ear hawkweed), and *H. piloselloides* (king-devil hawkweed) (Mn Wildflowers, 2018). The invasive *H. aurantiacum* (orange hawkweed) is more distinct as the only hawkweed with orange flowers. The first U of M Bell Museum Herbarium record of orange hawkweed in Minnesota as early as 1891 and 1892, then numerous records since 1947 (Bell Museum Herbarium U of M 2018). Figure 2 shows current records in Minnesota, Fig, 3 and 4 nationally.	Go to Box 7
	B. Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?		
7	Does the plant species have the potential to reproduce and spread in Minnesota?		
	A. Does the plant reproduce by asexual/vegetative means?	Yes, in addition to seed, can produce seed apomictically, and reproduce vegetatively via stolons (Hitchcock and Cronquist 1981). Suspected hybridization with *H. piloselloides* in the U.S. though very limited genetic diversity in populations in North America (Loomis and Fishman 2009), likely due to apomictic reproduction.	Go to 7B
	B. Are the asexual propagules effectively dispersed to new areas?	Yes. Seed fall relatively close to the parent plant (Stergios 1976), but long-distance dispersal has been reported attached to animals, people and equipment (Callihan et al 1997, Williams et al 2007).	Go to 7I

Box	Question	Answer	Outcome
	C. Does the plant produce large amounts of viable, cold-hardy seeds?		
	D. If this species produces low numbers of viable seeds, does it have a high level of seed/seedling vigor or do the seeds remain viable for an extended period?		
	E. Is this species self-fertile?		
	F. Are sexual propagules – viable seeds – effectively dispersed to new areas?		
	G. Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?		
	H. If the species is a woody (trees, shrubs, and woody vines) is the juvenile period less than or equal to 5 years for tree species or 3 years for shrubs and vines?		
	I. Do natural controls exist, species native to Minnesota, that are documented to effectively prevent the spread of the plant in question?	No. A biological control gall wasp, *Aulacidea subterminalis*, was released in the U.S. and Canada in 2011, and has been recovered on H. flagellaris *(H. flagellaris - Hieracium* x *flagellare* Willd. (*caespitosum* x *pilosella*) (whiplash hawkweed) in the western U.S., and a hoverfly *Cheilosia urbana* Meigen (Grosskopf 2005) was recommended for release for biological control of several hawkweeds including *H. aurantiacum* and *H. pratense* by APHIS PPQ TAG in 2016, is pending USFWS approval (Cortat 2017, USDA APHIS PPQ TAG 2018). *Aulacidea subterminalis* has not been confirmed as established in the U.S. (Rhinella et al 2017). Biological control is not currently managing populations in Minnesota and will not for the foreseeable future.	Go to Box 8
8	Does the plant species pose significant human or livestock concerns or has the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?		

Box	Question	Answer	Outcome
	A. Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?	No. (Yes. Pollen allelopathy shown in Murphy (2001) on other exotic sowthistle (*Sonclus oleraceus*) and speculated on native yarrow but weak.)	Go to 8B (Go to Box 9 –regardless of Yes or No here, same ending)
	B. Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?	Yes. Because of their mat-forming growth, hawkweeds are of limited value for stock (Grundy, 1989). Hawkweed expansion has also lead to detrimental economic effects, costing stakeholders an estimated $58 million per year to control (Duncan 2005).	Go to Box 9
	C. Can the plant aggressively displace native species through competition (including allelopathic effects)?		
	D. Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?		
	E. Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?		
	F. Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?		
9	Does the plant species have clearly defined benefits that outweigh associated negative impacts?		
	A. Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?	No	Go to Box 10
	B. Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized through carefully designed and executed management practices?	NPK fertilizer can increase grasses in low fertility soils in the presence of *H. floribundum* (Reader and Watt 1981), and mouseear hawkweed (*Hieracium pilosella* L.) (Davy and Bishop 1984), and was most successful when coupled to selective herbicide use with *H. caespitosum* (Wallace et al. 2010).	
	C. Is the plant native to Minnesota?		
	D. Is a non-invasive, alternative plant material commercially available that could serve the same purpose as the plant of concern?		

Box	Question	Answer	Outcome
	E. Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?		
10	Should the plant species be enforced as a noxious weed to prevent introduction &/or dispersal; designate as prohibited or restricted?		
	A. Is the plant currently established in Minnesota?	Yes	Go to 10B
	B. Does the plant pose a serious human health threat?	No	Go to 10C
	C. Can the plant be reliably eradicated (entire plant) or controlled (top growth only to prevent pollen dispersal and seed production as appropriate) on a statewide basis using existing practices and available resources?	No. Difficult to control by mowing due to prostrate growth, and can be exacerbated by mowing (Wilson and Callihan, 1999, Callihan et al.1997). Herbicides are effective, if used, but will remove some or all forbs depending on herbicide used (Seefelt and Conn 2011), and orange hawkweed is too widely dispersed in NE Minnesota to control with herbicides. Biological control not an option currently.	List as Restricted
11	Should the plant species be allowed in Minnesota via a species-specific management plan; designate as specially regulated?		

Final Results of Risk Assessment		
Review Entity	**Comments**	**Outcome**
NWAC Listing Subcommittee	We recommend not listing. So well established and widespread in NE Minnesota, do not see the benefit of a statewide noxious designation. Recommend counties in affected areas consider listing if deem appropriate. 07/11/18	Do not list
NWAC Full Committee	Vote on 12/19/18 was 16:0 in favor of not listing.	Do not list
MDA Commissioner	Commissioner agreed.	Do not list

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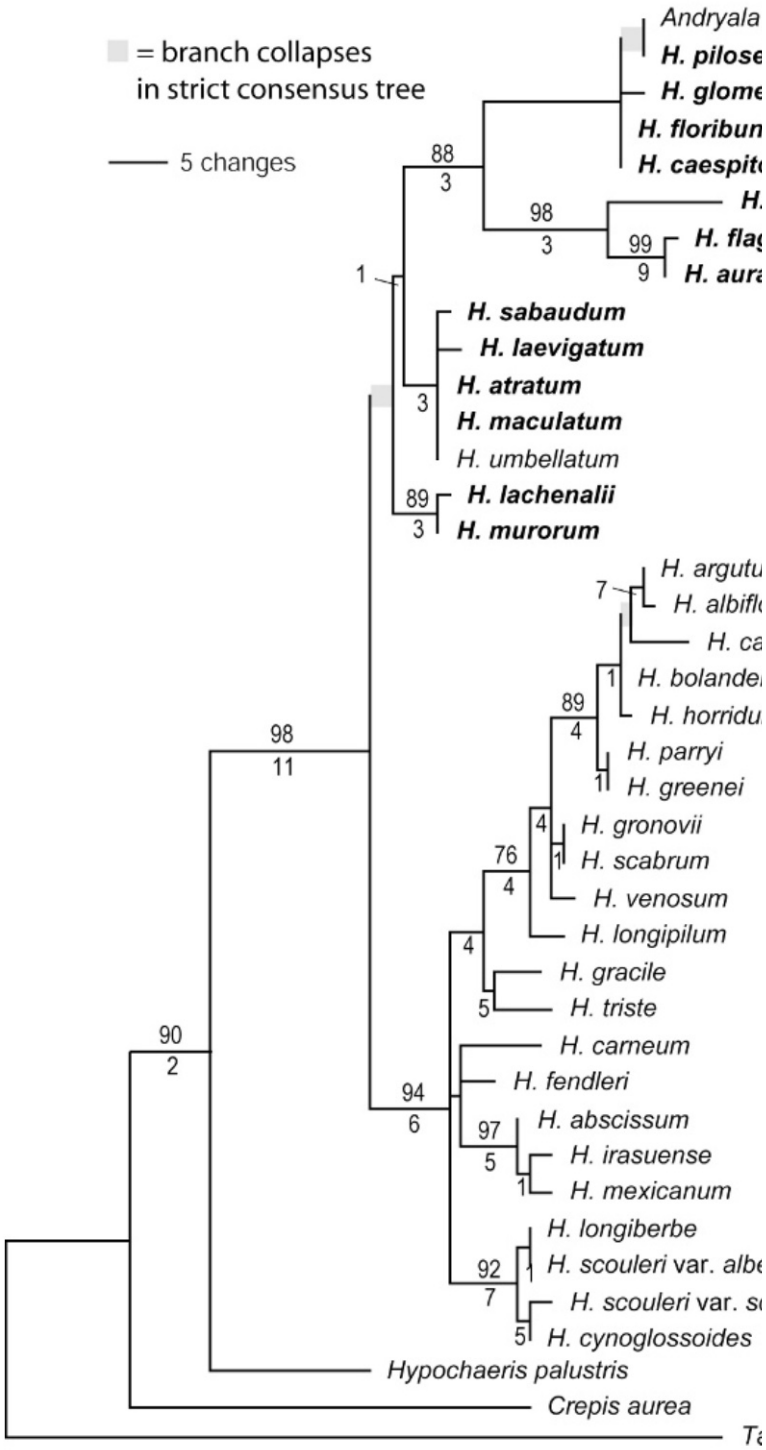

FIG. 1. One of the 104 most parsimonious trees of length 287 steps resulting
and outgroups based on the combined *trnT-trnF* and *petN-psbM* data set. Bootstr
decay indices below. Branches that collapse in the strict consensus tree are indi
listed after species name, using the following code: O = Old World; cA = Ce
U.S.A.; C = North America north of continental U.S.A. Taxa in bold type are co
al. 2006).

Gaskin and Wilson 2007.

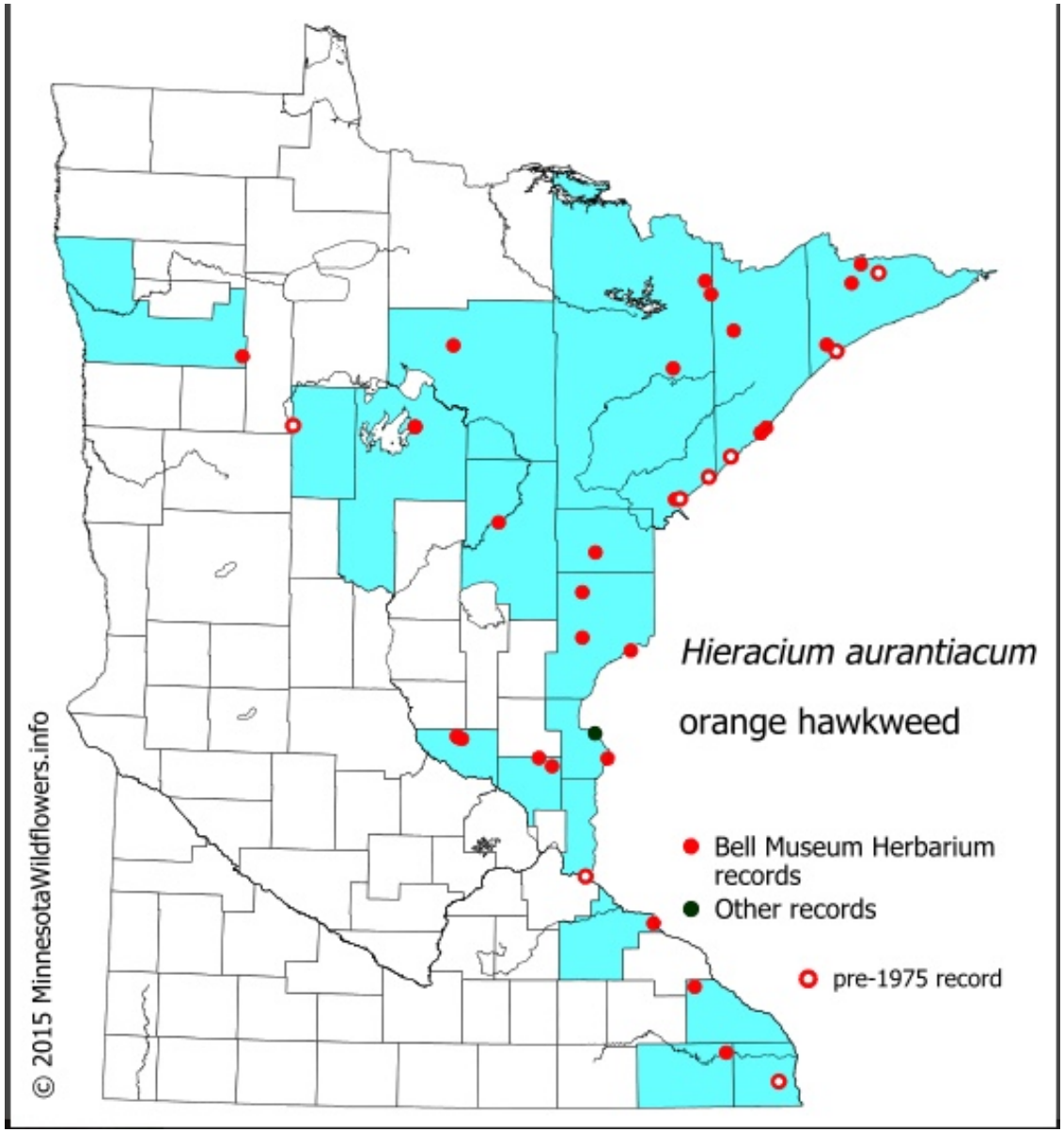

Figure 2. Orange hawkweed distribution in Minnesota. Mn Wildflower.
https://www.minnesotawildflowers.info/flower/orange-hawkweed **Accessed July 2018.**

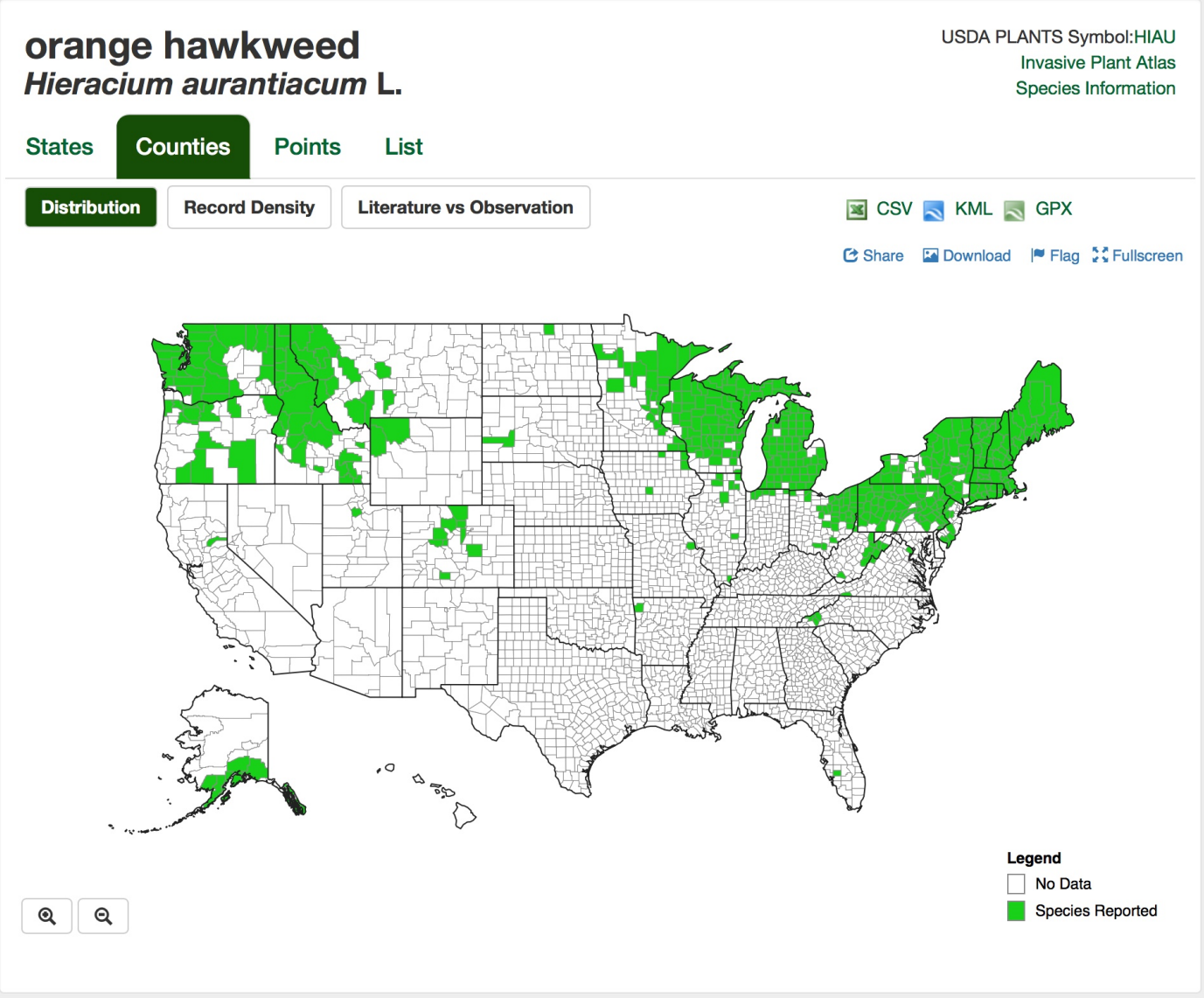

Figure 3. Orange hawkweed distribution nationally. EDDMaps.
http://www.eddmaps.org/distribution/uscounty.cfm?sub=4423 **Accessed April 2018.**

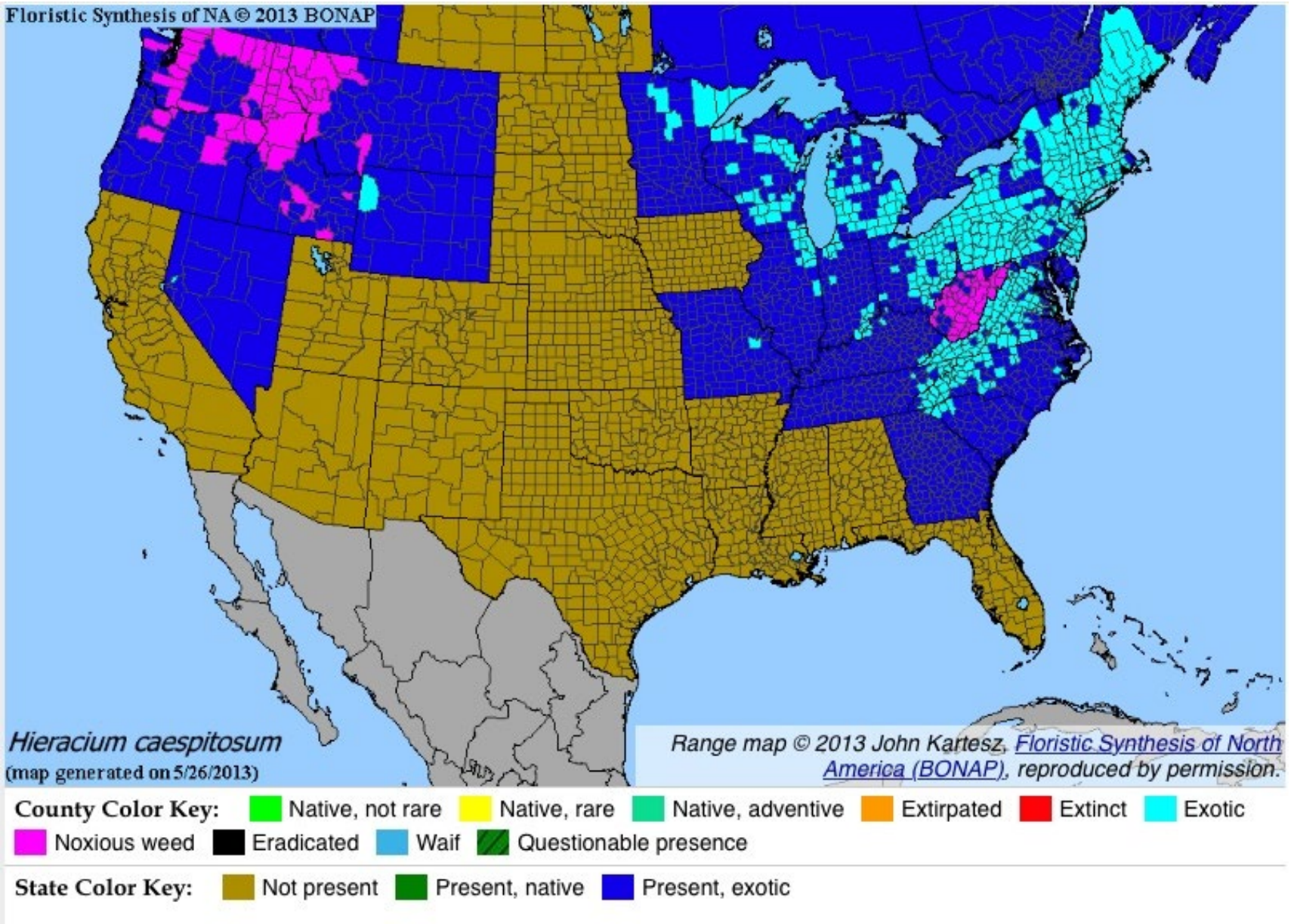

Figure 4. Orange hawkweed distribution in North America. Floristic Synthesis of NA.
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