Plant Species Evaluation Form

Lupinus croceus Eastw. **var.** *pilosellus* (Eastw.) Munz

SAFFRON-FLOWERED LUPINE

Family: Fabaceae (CNPS 2018)

PLANTS Symbol: LUCRP (USDA 2018)

Calif. Endemic: Yes (CNPS 2018)

Synonyms/Other Names: *Lupinus pilosellus* Eastw (Tropicos 2018).

Identification Issues: A formal treatment for *Lupinus pilosellus* is not given within either edition of *The Jepson Manual* or the *Jepson eFlora* (Jepson Flora Project 2012; Hickman 1993; Sholars and Riggins 2012). An unabridged note accompanying description of *L. croceus* states that if *L. croceus* var. *pilosellus* is, in fact, recognized taxonomically, then plants with spreading hairs and subequal calyx lips are assigned to variety *pilosellus*. It is worth noting is that the distribution of variety *pilosellus* is nested within the broader distribution of the northern California endemic *L. croceus* var. *croceus*. Variety *pilosellus* is, on average, found at elevations slightly lower than the nominotypical variety (Sholars and Riggins 2012). For an extended discussion on phenotypic plasticity and the relationship between genotype and phenotype, see Pigliucci (2010).

Taxonomy:

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Species In Genus: +- 220 species: especially western North America, western South America to eastern United States, also tropical South America, Mediterranean to western Asia, eastern tropical Africa; some cultivated for fodder, green manure, edible seed, ornamental. Etymology: (Latin: wolf, from mistaken idea that plants rob soil of nutrients). Toxicity: Some (e.g. *Lupinus arboreus, Lupinus latifolius, Lupinus leucophyllus*) have alkaloids (especially in seeds, fruits, young herbage) TOXIC to livestock (especially sheep). Note: Inflorescence length excludes peduncle; some California species naturalized in eastern North America, South America, Australia, southern Africa.

Genus Description – Habit: Annual to shrub; cotyledons generally petioled, withering early. Stem: generally erect. Leaf: palmately compound [or not], generally cauline; stipules fused to petiole; leaflets 3--17, generally oblanceolate, entire. Inflorescence: raceme, flowers spiraled or whorled, occasionally also in lower leaf axils; bracts generally deciduous. Flower: calyx 2-lipped, lobes entire or toothed, generally appendaged between; corolla blue, purple, white, or yellow, banner glabrous to densely hairy, centrally grooved, sides reflexed, wing tips +- fused, keel generally beaked; stamens 10, filaments fused, 5 long with short anthers, 5 short with long anthers; style brush-like. Fruit: dehiscent, generally oblong. Seed: 2--12, generally smooth.

Species Description – Habit: Perennial herb 4--6 dm, green, glabrous to sparsely hairy. Stem: erect. Leaf: cauline; stipules 4--10 mm; petiole 2--8 cm; leaflets 5--9, 30--60 mm. Inflorescence: 6--28 cm, flowers whorled or not; peduncle 2--6 cm; pedicels 3--6 mm; bracts 2--7 mm, late-deciduous. Flower: 12--15 mm; calyx upper lip 4--6 mm, 2-toothed, lower 6--7 mm, 2--3-toothed; petals bright yellow to orange-yellow, banner back generally glabrous (sparsely hairy on ridge), keel glabrous. Fruit: 2--3.5 cm, hairy. Seed: 3--5, 6--8 mm, mottled tan. eFlora Treatment Author: Teresa Sholars & Rhonda Riggins.

Status:

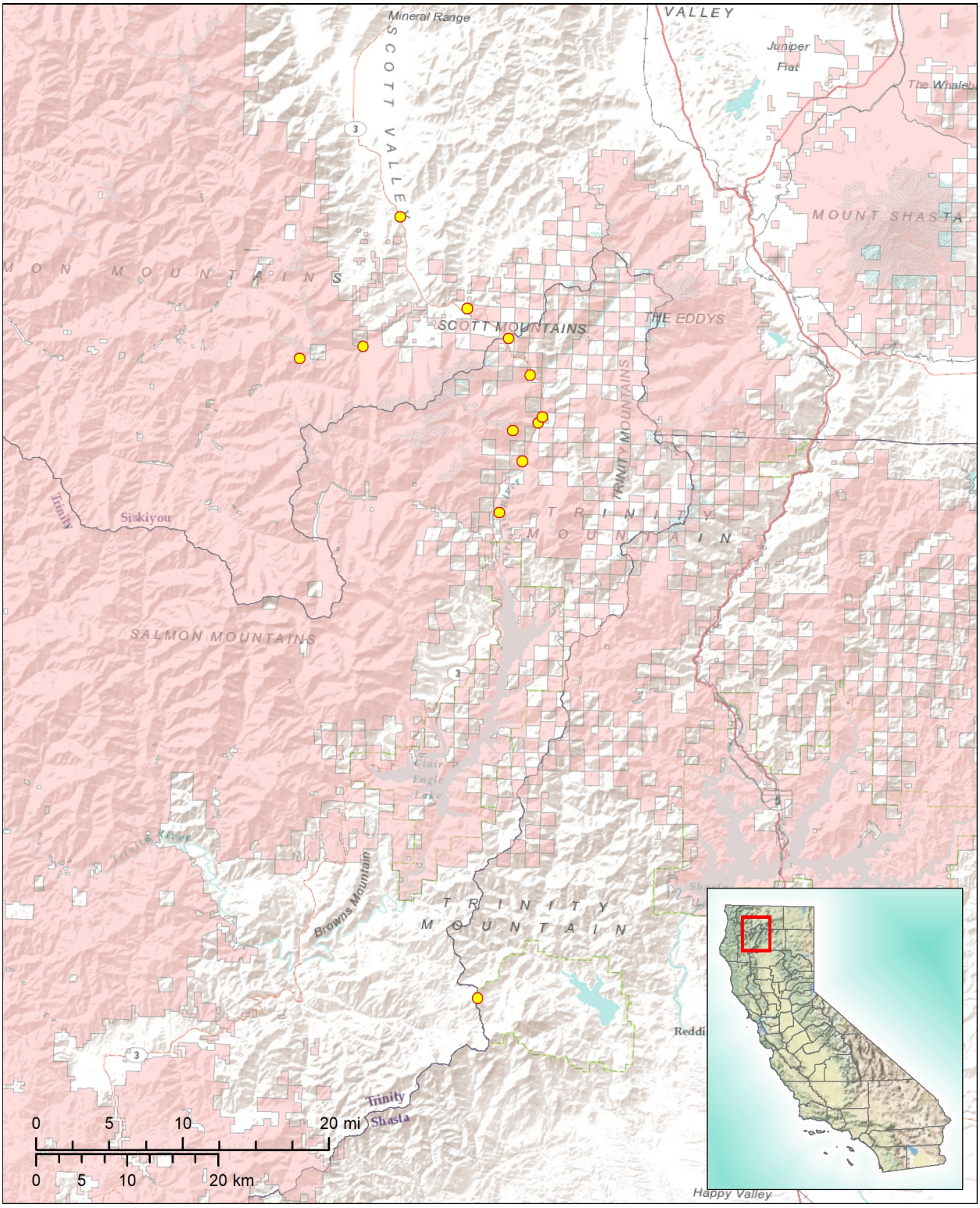
Note: Federally recognized Endangered, Threatened, Proposed, or Candidate species under the Endangered Species Act are omitted as they do not meet the definition of a Species of Conservation Concern (FSH 1909.12 § 12.52).

State Listing	G-rank	S-rank	CRPR	R5 FSS	NFP SM	CA BLM
CA: Not listed NV: Not listed OR: Not listed	G3T3	CA: S3 NV: Not listed OR: Not listed	4.3	Not listed	Not listed	Not listed

SWAP:	NNHP:	NNPS:	ORBIC:	OCS:	IUCN:
Not listed	Not listed	Not listed	Not listed	Not listed	Not listed

Expanded abbreviations and citations: State Listing=California Endangered Species Act Listing (CDFW 2018b), Nevada Division of Forestry Fully Protected Plant Species (NAC 527) (NDF 2012), Oregon Department of Agriculture Listed Plants (ODA 2014); G-rank=Global Conservation Status (CDFW 2018a; NatureServe 2018); S-rank=Subnational (state or province-level) Conservation Status (CDFW 2018a; NatureServe 2018; NNHP 2017; ORBIC 2016); CRPR=California Rare Plant Rank (CNPS 2018); R5 FSS=USDA Forest Service Region 5 Regional Forester Sensitive Plant Species List (USDA 2013); NFP SM=Forest Service and Bureau of Land Management Northwest Forest Plan Survey and Manage Species (USDA 2001); CA BLM=California Bureau of Land Management Designated Sensitive Species (BLM 2010); SWAP=California State Wildlife Action Plan Status (CDFW 2015); NNHP=Nevada Natural Heritage Program Status (NNHP 2017); NNPS=Nevada Native Plant Society Status (NNHP 2017); ORBIC=Oregon Biological Information Center Status (ORBIC 2016); OCS=Oregon Conservation Strategy Species (ODFW 2016); IUCN=International Union for Conservation of Nature Red List Status (IUCN 2017).

Distribution: Western North America – endemic to northern California. Occurrences are found in Shasta, Siskiyou, and Trinity counties within the Klamath Ranges (KR) bioregion (CCH 2017; Sholars and Riggins 2012). Over half (6/11, ~55%) of all occurrences are found on NFS lands within Shasta-Trinity NF (4/6, ~67%) and Klamath NF (2/6, ~33%) (CCH 2017).



Sources: *Distribution*: CCH 2017. *Layers*: USDA Forest Service, Pacific Southwest National Forests: CPAD 2016. California counties: CDF 2009. *Basemaps*: California inset map: © 2013 National Geographic Society, i-cubed (Esri 2017a). Main map: Esri, DeLorme, USGS, NPS (Esri 2012) and Esri, USGS, NOAA (Esri 2017b).

Locations within California:

Record numbers indicate sites that contain an individual, population, or groups of populations located within ¼ mile of each other, per the California Natural Diversity Database (CNDDB 2017) definition of Element Occurrences (EOs) in California. Official EO numbers for plants in California are determined solely by the CNDDB and are included within the Reference (Source) column for CNDDB data. Duplicate records from the same site are given the same record number and included in red. The Population Info column includes total number of individuals and total number and size of populations/sub-populations when provided. Elevations provided in meters from source have been converted to feet. If not provided in original source, Land Manager information was obtained using the California Protected Areas Database (CPAD 2016) and Quad information was obtained using 24K Quads, SDE Feature Class (CDFG 2013). All other information is directly from the Reference (Source) unless additional citation is given.

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	Near summit Buckhorn Bally ca. 3.3 mi. S. from U.S. Hwy. 299 W. 19.5 mi. E. of Douglas City	Shasta	Shasta Bally (4012256)	CCH, Jan 2017 (CHSC9177)	21-Jun-1970			Whiskeytown-Shasta-Trinity NRA	4825
2	Trinity County: Trinity Camp; along Scorpion Creek. Road to Bonanza King Lookout off Hwy 3	Trinity	Carrville (4112216)	CCH, Jan 2017 (UCD107617)	3-May-1992			Shasta-Trinity NF	
3	Eagle Creek Public Campground.	Trinity	Tangle Blue Lake (4112226)	CCH, Jan 2017 (RSA49320)	17-May-1949			Shasta-Trinity NF	3002
4	Between Eagle and Bear Creeks	Trinity	Tangle Blue Lake (4112226)	CCH, Jan 2017 (CAS247216)	25-Jun-1937			Shasta-Trinity NF	
4	Between Eagle and Bear Creeks	Trinity	Tangle Blue Lake (4112226)	CCH, Jan 2017 (CAS247880)	25-Jun-1937			Shasta-Trinity NF	
5	Mouth of Bear Creek	Trinity	Tangle Blue Lake (4112226)	CCH, Jan 2017 (HSC82309)	15-Jun-1979			Shasta-Trinity NF	3002
6	3.5 miles from Eagle Creek on road to Scott Mountain, north of Trinity Center.	Trinity	Tangle Blue Lake (4112226)	CCH, Jan 2017 (RSA49915)	7-Jul-1949				2700

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
7	Road between Trinity Center and Callahan (over Scott Mountain), just above base of grade in canyon of Blue Creek	Trinity	Tangle Blue Lake (4112226)	CCH, Jan 2017 (RSA151973)	17-Jun-1952				3301
8	17.4 miles northeast of Cecilville Store, on road to Callahan	Siskiyou	Eaton Peak (4112238)	CCH, Jan 2017 (RSA300986)	2-Jun-1973			Klamath NF	6801
8	17.4 miles NE of Cecilville Store on the road to Callahan	Siskiyou	Eaton Peak (4112238)	CCH, Jan 2017 (SD106936)	2-Jun-1973			Klamath NF	6802
8	on road to Callahan, ne Cecilville Store; ne of Cecilville Store	Siskiyou	Eaton Peak (4112238)	CCH, Jan 2017 (UC1481294)	2-Jun-1973			Klamath NF	6800
9	along road from Cecilville to Callahan 6.4 mi w Callahan; w of Callahan	Siskiyou	Eaton Peak (4112238)	CCH, Jan 2017 (UC1482884)	4-Jun-1973			Klamath NF	5700
9	Along road from Cecilville to Callahan, 6.4 miles W of Callahan	Siskiyou	Mcconaughy Gulch (4112247)	CCH, Jan 2017 (RSA372147)	4-Jun-1973				5702
10	Scott Mountains, 5 miles above Callahan	Siskiyou	Scott Mountain (4112236)	CCH, Jan 2017 (RSA94035)	17-May-1954				4101
11	At Mule Creek crossing of Scott Mountain Road.	Siskiyou	Scott Mountain (4112236)	CCH, Jan 2017 (RSA47662)	12-Jun-1948				5000

Distribution on National Forest System (NFS) Lands:

(Please see Reference column of Locations table above for references pertaining to Record Numbers indicated on NFS lands.)

National Forest System (NFS) lands	Record #s (from Locations table above)	CNDDB EOs	Non-CNDDB Records	Recent (seen in past 20 yrs.)	Historic (not seen in past 20 yrs.)	Most Recent Obs.	EOs/ Recs. (5 mile buffer)	Total Records on NFS lands
Angeles:	-	-	-	-	-	-	-	0
Cleveland:	-	-	-	-	-	-	-	0
Eldorado:	-	-	-	-	-	-	-	0
Inyo:	-	-	-	-	-	-	-	0
Klamath:	8, 9	-	2	-	2	4-Jun-1973	4	2
Lake Tahoe Basin MU:	-	-	-	-	-	-	-	0
Lassen:	-	-	-	-	-	-	-	0
Los Padres:	-	-	-	-	-	-	-	0
Mendocino:	-	-	-	-	-	-	-	0
Modoc:	-	-	-	-	-	-	-	0
Plumas:	-	-	-	-	-	-	-	0
San Bernardino:	-	-	-	-	-	-	-	0
Sequoia:	-	-	-	-	-	-	-	0
Shasta-Trinity:	2, 3, 4, 5	-	4	-	4	3-May-1992	6	4
Sierra:	-	-	-	-	-	-	-	0
Six Rivers:	-	-	-	-	-	-	-	0
Stanislaus:	-	-	-	-	-	-	-	0
Tahoe:	-	-	-	-	-	-	-	0
Totals:	N/A	0	6	0	6	N/A	10	6

Demographic and Population Trends: *Lupinus croceus* var. *pilosellus* is known from approximately 11 occurrences. Total number of occurrences for this taxon were estimated using GIS tools and methods described by Green and Sims (2018). All 11 occurrences are historic and have not been documented in over 20 years. Demographic and population trends are lacking for *L. croceus* var. *pilosellus* (CCH 2017). Further documentation and fieldwork is encouraged.

Life History: *Lupinus croceus* var. *pilosellus* is a perennial herb that begins to flower as early as May, but typically blooms from June through August (CNPS 2018). *Lupinus* is a nitrogen fixing legume that develops root nodules that house diazotrophic bacteria in the genus *Bradyrhizobium* and *Rhizobium* (Barrera et al. 1997). These microbes are able to fix atmospheric nitrogen into bioavailable ammonia, which the host plant incorporates into developing tissue. Nitrogen fixation in legumes also enriches soil fertility around the host plant through the decomposition of aged roots and nodules (Ledgard and Steele 1992). Certain members of

Lupinus are known to be toxic to livestock (Keeler and Panter 1989). Within-species variation in response to seed vernalisation is known for plants in the genus *Lupinus*. Seed production is often greater among perennial lupines. Physical dormancy of seeds via hardened seed coats that are often impermeable to water or gases is common in Fabaceae. Permeability of seed coats increases with greater moisture content (*L. digitatus* seed coat fully permeable above 14% moisture). Seeds are entirely impermeable when moisture is very low (below 11% in *L. digitatus*).

Plants in the genus *Lupinus* are known to produce sticky pollen that is not conducive to wind dispersal (OGTR 2013). Members of *Lupinus* are visited by an assortment of insect pollinators, including anthophorine bees (*Anthophora* spp.), bumble bees (*Bombus* spp.), carpenter bees (*Xylocopa* spp.), honey bees (*Apis* spp.), leaf-cutting bees (*Anthidium*, *Anthidiellum, Megachile, Osmia*, and *Protosmia* spp.), long-horned bees (*Eucera* spp.), beetles (Coleoptera), blues butterflies (*Echinargus* and *Plebejus* spp.), brush-footed butterflies (*Vanessa, Junonia, Phyciodes*, and *Limenitis* spp.), hairstreak butterflies (*Satyrium* spp.), skipper butterflies (*Pholisora, Polites, Hesperia, Oarisma, Paratrytone, Erynnis, Epargyreus*, and *Euphyes* spp.), sulphur butterflies (*Colias* spp.), swallowtail butterflies (*Papilio* spp.), root-maggot flies (*Delia* spp.), and syrphid flies (*Eristalis* spp.) (CPC 2018). An extended discussion on the biology of plants in the genus *Lupinus* is found in the included document from the Australian Office of the Gene Technology Regulator (OGTR 2013).

Diversity: *Lupinus* is a prominent member of Faboideae. This subfamily is represented by upward of 500 genera and ca. 14,000 species with zygomorphic flowers that have a prominent banner sitting outside the lateral wings, have dry and elongate fruit that dehisce along two edges, and nodule forming roots that house diazotrophic microbes (Stevens 2001).

Lupinus is group of roughly 250 species in the Genisteae (Drummond 2008; Stevens 2001). The Genisteae is a tribe of roughly 25 northern temperate genera. Plants commonly referred to as "brooms" or "gorse" in the genera *Cytisus, Genista*, and *Ulex* are also members of this tribe alongside *Lupinus* (Stevens 2001). Roughly 12 species of *Lupinus* are found in Mediterranean Europe. Eastern South America is home to roughly 24 species, whereas eight are found in eastern North America. A bulk of the diversity is represented by taxa in the highlands of Mexico and Central America (~30 species), the Andes of western South America (~85 species), and western North America in the Rockies, Great Basin, and along the Pacific slope (~88 species).

Studies on molecular divergence times of taxa in Fabaceae demonstrate that *Lupinus* and *Spartium* split nearly 16.0 Mya. Data based on cpDNA suggest that *Lupinus* arose 5.8-10.0 Mya, long after the breakup of Gondwanaland (~100 Mya) and the breakdown of the North Atlantic land bridge (~50 Mya). This suggests amphi-Atlantic distributions are best explained by long-distance dispersal. Mapping of ancestral biogeography places the origin of *Lupinus* in the Old World, indicating later migration into the New World and subsequent radiation among the species-rich western New World clade (200 of the roughly 250 species in *Lupinus*). Andean-Mexican perennials and western North American perennials occupy a single clade among the western New World taxa, where each regional subclade underwent respective radiations 0.8-3.4 Mya and 0.7-2.1 Mya. Speciation rates among both Andean-Mexican and Western North American subclades are substantially higher than what is measured elsewhere. The positive correlation between perennials and high elevation habitat suggests that speciation in these perennial groups is linked to habitat formation as a result of uplift of the Andes (2-4 Mya) and the mountain ranges of the Pacific Slope (2-5 Mya) (Drummond 2008).

Habitat: Rocky and dry substrates within openings of lower montane coniferous forests (CNPS 2018; CalPhotos 2018; Sholars and Riggins 2012). More often than not (at least 65% of occurrences), this lupine occurs on ultramafic substrates (Safford and Miller 2020).

Habitat Status or Trend: Most occurrences are located along the Highway 3 corridor to the north of Trinity Lake (CCH 2017). Roads and recreation are two of the top five most impactful threats to rare plant habitat in the United States (Hernández-Yañez et al. 2016). In addition, fire suppression impacts the open forest habitat preferred by *L. croceus* var. *pilosellus*. Forest openings behave as microsites for species requiring varying intensities of light. Significant changes to the size and spatial characteristics of openings within forests of the Klamath Mountains of California have taken place in the last century (Skinner 1995). Satellite imagery displays broad patches of clear-cut forest at the southern end of the *L. croceus* var. *pilosellus* distribution, along Highway 3, within the immediate vicinity of Trinity Lake (CCH 2017; Google Maps 2018).

Capacity for the Species to Disperse: Members of the genus *Lupinus* produce dense seeds without appendages that are not conducive to wind dispersal over long distances. Waterways, animals, and human activities may foster long distance dispersal in some cases. A feeding study demonstrated a low rate of *L. arboreus* seed survival after ingestion by deer. Most lupines exhibit mechanical dispersal and are commonly dispersed one to several meters from parent plants each year (OTGR 2013).

Threats: Direct threats to this taxon remain unreported (CNPS 2018; NatureServe 2018).

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Julie Ann Kierstead, USDA Forest Service Region 5 Ecosystem Planning, 6 January 2022.

Formatting: Form is set up as 508 compliant. Please use the "styles" if further formatting is necessary.

Purpose: This is to maintain the best available science on a species that could be used by the Forest Service in a variety of functions. Specifically, there would be additional steps and evaluations to determine whether or not this species would be considered a Species of Conservation Concern under the 2012 Planning Rule or a Sensitive Species under the 1982 Planning Rule.

Additional Considerations at the Forest Level: Habitat amount and juxtaposition of both the species and habitat locations.