



2. RECOMMENDATIONS FOR THE SIERRA NEVADA REGION

This chapter presents recommendations for high-priority invasive plant management opportunities in the Sierra Nevada ecoregion. Based on risk maps and assessment by regional experts, we chose a subset of the species examined for this project as the best opportunities for long-term resource protection. Chapter 3 presents recommendations specific to each Weed Management Area (WMA).

Recommendations are based on both quantitative and qualitative measures. Quantitative measures include statistics based on our mapping and suitability modeling, such as the proportion of the region currently infested, the proportion of the region predicted to be suitable, and whether infestations are spreading. The table in this chapter lists these quantitative measures for all 43 species. Qualitative measures include the Cal-IPC and CDFR ratings for each plant (listed in Appendix 1) as well as feedback provided by natural resource managers.

Of the 43 species examined for this project, we chose 15 as the highest priority opportunities for the region as a whole. Some of these species exist in scattered quads while others are more widespread. For each species see statewide maps in chapter 4 for distribution, trend and suitable range in the Sierra Nevada ecoregion. Accompanying tables rate opportunities for eradication, con-

tainment, and surveillance. (The species profiles also include short summaries of the biology and ecology of the species, as well as maps showing change in climatic suitability between now and 2050.) Some species have both eradication and containment opportunities, based on their distribution in different parts of the Sierra Nevada ecoregion.

The species and their abundances vary throughout the region. In general, the northern and central Sierra contain more of the species we considered, while the southern and eastern Sierra Nevada have fewer of these species and lower abundances. Therefore, the north and central regions have many opportunities for eradication of some species as well as opportunities for containment of those species too widespread to eradicate, while the southern and eastern Sierra can focus more on eradication of small populations before they expand.

Opportunities are described below for the species determined to have the top priority management opportunities in the Sierra Nevada. As elsewhere in this report, the species are organized by botanical family (see Appendix 1 for additional details on the plants). Refer to the map of each species in chapter 4. For specific management recommendations by WMA, refer to chapter 3.

Russian knapweed (*Acroptilon repens*): Russian knapweed is a high priority for **eradication** in isolated quads, primarily in the central, southern, and eastern Sierra, and a medium priority for **containment** where populations are too large for eradication. The southernmost population, in Madera County, is a prime eradication target. One population in Inyo County, directly adjacent to the Sierra, is not under management, and presents another prime eradication target. In the south, the major infestation in the Central Valley section of Tulare County should be prevented from moving eastward into the foothills. In the north, the spreading populations in Lassen and Plumas counties should be prevented from moving south. Our modeling suggests that the amount



of suitable range for Russian knapweed in the Sierra Nevada will increase with future climate change.

Musk thistle (*Carduus nutans*): Musk thistle is a high-priority for **containment**, with potential for **eradication** if current management by WMAs can be increased. Its distribution is focused in the northeastern Sierra in Plumas, Sierra, Nevada, and Placer counties. Areas to the north, west and south are vulnerable to spread. Our modeling suggests that the amount of suitable range for musk thistle in the Sierra Nevada will decrease with future climate change.

Spotted knapweed (*Centaurea maculosa*): Spotted knapweed is a high-priority species for **eradication** in isolated quads and **containment** elsewhere. It is distributed in many quads but in low abundance. Of the three knapweeds studied, this species is the hardest to

control. Land managers named this species as their highest priority of the three knapweeds considered. Our modeling suggests that the amount of suitable range for spotted knapweed in the Sierra Nevada will remain relatively unchanged with future climate change.

Yellow starthistle (*Centaurea solstitialis*): Possibly the most widely-distributed invasive plant in California, and the focus of an existing multi-county leading edge project in the region (CDFA 2011), yellow starthistle is a high priority for **containment**, focusing on preventing its spread eastward into higher elevations. It is still spreading in many quads. Our modeling suggests that the amount of suitable range for yellow starthistle in the Sierra Nevada will remain relatively unchanged with future climate change.

Rush skeletonweed (*Chondrilla juncea*): Rush skeletonweed is widespread and spreading in several central and northern counties but infrequent in the southern and eastern Sierra. It is a high priority for **containment** to prevent its spread north, east and south, and a medium priority for **eradication** of isolated populations in the northern Sierra and adjoining the southern Sierra in Inyo County. Continued management of the population in Fresno County's valley area is important to prevent spread into the foothills. Our modeling suggests that the amount of suitable range for trush skeletonweed in the Sierra Nevada will increase with future climate change.

Stinkwort (*Dittrichia graveolens*): Stinkwort is a relatively new weed in California and one that has been reported spreading from the San Francisco Bay Area into the Sacramento area, and from there into the foothills along roadsides. Because it is very difficult to remove entirely, it is a high priority for **containment** in the areas where it occurs, especially El Dorado County. Because stinkwort spreads along highways, working with transportation agencies on Best Management Practices for highway maintenance could slow its spread. Our modeling suggests that the amount of suitable range for stinkwort in the Sierra Nevada will increase considerably with future climate change.

Scotch thistle (*Onopordum acanthium*): Scotch thistle is a high priority for **eradication** in isolated quads and a high priority for **containment** to prevent spread into the Sierra Nevada from major infestations in Lassen County to the north. Containment of the infestation in the Central Valley portion of Tulare County is important to keep Scotch thistle from moving into the foothills.

Our modeling suggests that the amount of suitable range for Scotch thistle in the Sierra Nevada will increase with future climate change.

Dyer's woad (*Isatis tinctoria*): Dyer's woad, present in scattered quads, is a high priority for **eradication** to prevent these populations from spreading. It has become widespread in far northern counties, where it is a serious problem. Our modeling suggests that the amount of suitable range for species name in the Sierra Nevada will decrease with future climate change.

Brooms: Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*), and Spanish broom (*Spartium junceum*) all grow in the Sierra Nevada. Their relative distributions are uncertain because many managers do not distinguish between them for the purposes of management. More precise mapping would be helpful. Brooms are a high priority for **eradication** in the southern Sierra where there are fewer infestations, and high priorities for **containment** further north to prevent their continued spread. Our modeling suggests that the amount of suitable range for all species in the Sierra Nevada will increase considerably with future climate change.

Red sesbania (*Sesbania punicea*): Red sesbania is a relatively new invader to riparian areas in California and thus far grows only to the western edge of the Sierra Nevada. It is a high priority for **eradication** where possible and **containment** to prevent its spread further east and to higher elevations, particularly in Nevada, Placer, El Dorado, and Fresno counties. It was mapped in detail in much of the state in summer 2010 so its distribution is well-documented. Our modeling suggests that the amount of

suitable range for red sesbania in the Sierra Nevada will increase considerably with future climate change.

Giant reed (*Arundo donax*): Giant reed is widespread in California. It is present at the western edge of many Sierra Nevada counties and is spreading in some of them. It is also in scattered quads in Inyo County. Giant reed is a



high priority for **containment** to prevent its spread into more watersheds. Our modeling suggests that the amount of suitable range for giant reed in the Sierra Nevada will increase with future climate change.

Toadflaxes: Dalmatian toadflax (*Linaria genistifolia* subsp. *dalmatica*) and yellow toadflax (*Linaria vulgaris*) are high priorities for **eradication** in isolated quads or **containment** of larger infestations. Their current distributions are centered near Lake Tahoe. Our modeling suggests that the amount of suitable range for both species in the Sierra Nevada will increase with future climate change.

Management opportunities for the Sierra Nevada region

PRIORITY	SPECIES	OPPORTUNITIES			STATISTICS							
		ERADICATION	CONTAINMENT	SURVEILLANCE	% INFESTED	% SUITABLE INFESTED	% SPREADING	% MANAGED	% ERADICATED	% SUITABLE 2010	% SUITABLE 2050	SUITABILITY CHANGE
	FAMILY APIACEAE											
	Poison-hemlock	L	M	-	27	53	29	2	0	21	9	↓
	FAMILY ASTERACEAE											
●	Russian knapweed	H	M	-	8	8	13	11	1	76	90	↑
●	Musk thistle	H	H	-	5	19	19	27	0	13	3	↓
	Italian thistle & slenderflower thistle	-	M	-	26	-	91	0	0	-	-	-
	Woolly distaff thistle	L	-	-	1	40	25	0	0	0	5	↑↑
	Diffuse knapweed	M	M	-	10	10	4	2	1	62	56	-
●	Spotted knapweed	H	H	-	26	30	4	15	5	62	71	-
	Tocalote	-	M	-	42	-	46	1	0	-	-	-
●	Yellow starthistle	H	H	-	57	61	64	16	3	78	85	-
●	Rush skeletonweed	M	H	-	22	32	67	5	1	42	67	↑
	Canada thistle	M	M	-	20	27	24	12	1	41	27	↓
	Bull thistle	-	L	-	84	85	42	4	0	80	92	-
●	Stinkwort	-	H	-	4	39	30	30	0	3	8	↑↑
	Ox-eye daisy	L	M	-	16	23	24	0	0	38	28	↓
●	Scotch thistle	H	H	-	9	23	26	10	1	16	27	↑
	FAMILY BORAGINACEAE											
	Houndstongue	-	-	L	0	-	0	0	0	-	-	-
	FAMILY BRASSICACEAE											
	Lens-podded white-top & hoary cress	M	M	-	11	-	23	6	0	-	-	-
●	Dyer's woad	H	-	-	5	8	4	22	1	33	20	↓
	Charlock mustard	-	L	-	15	-	3	0	0	-	-	-
	FAMILY DIPSACACEAE											
	Common teasel & fuller's teasel	M	M	-	11	16	18	4	1	26	25	-
	FAMILY FABACEAE											
●	Scotch broom	H	H	-	24	44	45	19	0	33	60	↑
●	French broom	H	H	-	22	64	38	3	0	19	41	↑↑
●	Spanish broom	H	H	-	22	40	57	5	0	28	68	↑↑
	Black locust	L	L	-	15	-	18	0	0	-	-	-
●	Red sesbania	H	H	-	4	16	24	0	0	11	28	↑↑
	Gorse	L	-	-	1	100	0	0	0	0	23	↑↑
	FAMILY POACEAE											
●	Giant reed	L	H	-	13	28	36	2	0	23	38	↑
	Annual false-brome	-	L	-	12	34	43	0	0	21	18	-
	Japanese brome	L	L	-	8	-	0	0	0	-	-	-
	Red brome	-	M	-	62	77	25	0	0	59	47	↓
	Jubatagrass	-	L	-	9	-	0	0	0	-	-	-
	Pampasgrass	-	L	-	14	100	0	0	0	2	10	↑↑
	Orchardgrass	-	L	-	58	60	6	0	0	84	91	-

	Common velvet grass	-	M	-	34	39	11	1	0	60	82	↑
	Mediterranean barley	-	M	-	45	-	7	0	0	-	-	-
	Hare barley	-	M	-	54	-	15	0	0	-	-	-
	Italian ryegrass	-	M	-	40	66	28	0	0	37	35	-
	FAMILY POLYGONACEAE											
	Japanese knotweed	L	-	-	0	-	0	0	0	-	-	-
	Giant knotweed	L	-	-	0	-	0	0	0	-	-	-
	FAMILY SCROPHULARIACEAE											
●	Dalmatian toadflax	H	H	-	7	8	31	28	1	60	77	↑
●	Yellow toadflax	H	H	-	5	6	52	22	0	62	85	↑
	FAMILY SIMAROUBACEAE											
	Tree-of-heaven	L	M	-	37	55	83	2	0	44	62	↑
	FAMILY SOLANACEAE											
	Tree tobacco	L	L	-	17	69	5	0	0	9	12	↑

Opportunities: H = high priority, M = medium, L = low

% Infested: portion of USGS quads in the area in which the species is present in wildlands

% Suitable Infested: portion of quads in the area with suitable climate that are currently infested

% Spreading: portion of infested quads in which the species is spreading

% Managed: portion of infested quads where species is under management

% Eradicated: portion of all quads in the area in which the species has been eradicated

% Suitable in 2010: portion of area with current climatic suitability of at least a level of "low" or higher

% Suitable in 2050: of area with projected 2050 climatic suitability of at least a level of "low" or higher

Suitability change:

↑ = a 15% - 99% increase from 2010 to 2050

↑↑ = an increase of greater than 100%

↓ = a decrease of greater than 15%

