

US EPA ARCHIVE DOCUMENT



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460**

OFFICE OF PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

PC Code No.: 110003
DP Barcode: 358851, 358852

MEMORANDUM

Date: May 4, 2009

Subject: EFED Risk Assessment for the Proposed IR-4 Use of the Spinosad product
Entrust® on Pomegranate and Dates, PC Code: 110003 DP Barcodes: 358851 and
358852.

To: Richard Gebken, RM 13 (305-6701)
Kimberly Nesci, RM Reviewer
Registration Division (PY1 S7237)

From: Joseph DeCant, Ecologist
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Environmental Risk Branch V
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Through: Mah Shamim, Ph.D., Chief
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Environmental Fate and Effects Division (7507C)

The current ecological risk assessment for IR-4 registrations requested for the use of spinosad products on pomegranate and dates is attached. The following previous assessment for mint can be used in place of a new assessment for both pomegranate and dates since the application rates are the same. A listing of endangered species is also attached.

Species Listing by State with Use Criteria

No species were excluded
Minimum of 1 Acre.

All Medium Types Reported

Mammal, Bird, Amphibian, Reptile, Fish, Arachnid, Insect, Dicot, Monocot
dates

Arizona	(23) species:		<u>Taxa</u>	<u>Critical Habitat</u>
Frog, Chiricahua Leopard		Threatened	Amphibian	No
	(<i>Rana chiricahuensis</i>)		Freshwater, Terrestrial	
Bobwhite, Masked		Endangered	Bird	No
	(<i>Colinus virginianus ridgwayi</i>)		Terrestrial	
Flycatcher, Southwestern Willow		Endangered	Bird	Yes
	(<i>Empidonax traillii extimus</i>)		Terrestrial	
Owl, Mexican Spotted		Threatened	Bird	Yes
	(<i>Strix occidentalis lucida</i>)		Terrestrial	
Pygmy-owl, Cactus Ferruginous		Endangered	Bird	No
	(<i>Glaucidium brasilianum cactorum</i>)		Terrestrial	
Rail, Yuma Clapper		Endangered	Bird	No
	(<i>Rallus longirostris yumanensis</i>)		Terrestrial	
Blue-star, Kearney's		Endangered	Dicot	No
	(<i>Amsonia kearneyana</i>)		Terrestrial	
Cactus, Arizona Hedgehog		Endangered	Dicot	No
	(<i>Echinocereus triglochidiatus var. arizonicus</i>)		Terrestrial	
Cactus, Nichol's Turk's Head		Endangered	Dicot	No
	(<i>Echinocactus horizonthalonius var. nicholii</i>)		Terrestrial	
Cactus, Pima Pineapple		Endangered	Dicot	No
	(<i>Coryphantha scheeri var. robustispina</i>)		Terrestrial	
Cliffrose, Arizona		Endangered	Dicot	No
	(<i>Purshia (=cowania) subintegra</i>)		Terrestrial	
Umbel, Huachuca Water		Endangered	Dicot	Yes
	(<i>Lilaeopsis schaffneriana var. recurva</i>)		Terrestrial, Freshwater	
Chub, Gila		Endangered	Fish	Yes
	(<i>Gila intermedia</i>)		Freshwater	
Minnow, Loach		Threatened	Fish	Yes
	(<i>Tiaroga cobitis</i>)		Freshwater	
Pupfish, Desert		Endangered	Fish	Yes
	(<i>Cyprinodon macularius</i>)		Freshwater	
Spikedace		Threatened	Fish	Yes
	(<i>Meda fulgida</i>)		Freshwater	
Sucker, Razorback		Endangered	Fish	Yes
	(<i>Xyrauchen texanus</i>)		Freshwater	
Topminnow, Gila (Yaqui)		Endangered	Fish	No
	(<i>Poeciliopsis occidentalis</i>)		Freshwater	
Bat, Lesser (=Sanborn's) Long-nosed		Endangered	Mammal	No
	(<i>Leptonycteris curasoae yerbabuena</i>)		Subterranean, Terrestrial	
Jaguar		Endangered	Mammal	No
	(<i>Panthera onca</i>)		Terrestrial	
Ocelot		Endangered	Mammal	No

(*Leopardus (=Felis) pardalis*)
 Pronghorn, Sonoran
 (*Antilocapra americana sonoriensis*)
 Wolf, Gray
 (*Canis lupus*)

California (131) species:

Frog, California Red-legged
 (*Rana aurora draytonii*)
 Frog, Mountain Yellow-legged
 (*Gopherus agassizii*)
 Salamander, California Tiger
 (*Ambystoma californiense*)
 Salamander, Desert Slender
 (*Batrachoseps aridus*)
 Toad, Arroyo Southwestern
 (*Bufo californicus (=microscaphus)*)
 Condor, California
 (*Gymnogyps californianus*)
 Flycatcher, Southwestern Willow
 (*Empidonax traillii extimus*)
 Gnatcatcher, Coastal California
 (*Poliopitila californica californica*)
 Murrelet, Marbled
 (*Brachyramphus marmoratus marmoratus*)
 Pelican, Brown
 (*Pelecanus occidentalis*)
 Plover, Western Snowy
 (*Charadrius alexandrinus nivosus*)
 Rail, California Clapper
 (*Rallus longirostris obsoletus*)
 Rail, Light-footed Clapper
 (*Rallus longirostris levipes*)
 Rail, Yuma Clapper
 (*Rallus longirostris yumanensis*)
 Shrike, San Clemente Loggerhead
 (*Lanius ludovicianus mearnsi*)
 Sparrow, San Clemente Sage
 (*Amphispiza belli clementeae*)
 Tern, California Least
 (*Sterna antillarum browni*)
 Towhee, Inyo Brown
 (*Pipilo crissalis eremophilus*)
 Vireo, Least Bell's
 (*Vireo bellii pusillus*)
 Ambrosia, San Diego
 (*Ambrosia pumila*)
 Barberry, Nevin's
 (*Berberis nevinii*)
 Bird's-beak, Palmate-bracted
 (*Cordylanthus palmatus*)
 Bird's-beak, salt marsh

Terrestrial
 Endangered Mammal No
 Terrestrial
 Endangered Mammal Yes
 Terrestrial

<u>Taxa</u>	<u>Critical Habitat</u>
Amphibian	Yes
Terrestrial, Freshwater	
Amphibian	No
Terrestrial, Freshwater	
Amphibian	No
Terrestrial, Vernal pool	
Amphibian	No
Freshwater, Terrestrial	
Amphibian	Yes
Freshwater, Terrestrial	
Bird	Yes
Terrestrial	
Bird	Yes
Terrestrial	
Bird	Yes
Freshwater, Terrestrial, Saltwater	
Bird	No
Terrestrial	
Bird	Yes
Terrestrial	
Bird	No
Terrestrial	
Bird	No
Terrestrial	
Bird	No
Terrestrial	
Bird	No
Terrestrial	
Bird	No
Terrestrial	
Bird	Yes
Terrestrial	
Bird	Yes
Terrestrial	
Dicot	No
Terrestrial	
Dicot	No
Terrestrial	
Dicot	No
Terrestrial	
Dicot	No

(<i>Cordylanthus maritimus</i> ssp. <i>maritimus</i>)		Saltwater	
Bird's-beak, Soft	Endangered	Dicot	No
(<i>Cordylanthus mollis</i> ssp. <i>mollis</i>)		Brackish, Saltwater	
Bladderpod, San Bernardino Mountains	Endangered	Dicot	Yes
(<i>Lesquerella kingii</i> ssp. <i>bernardina</i>)		Terrestrial	
Bluecurls, Hidden Lake	Threatened	Dicot	No
(<i>Trichostema austromontanum</i> ssp. <i>compactum</i>)		Terrestrial	
Broom, San Clemente Island	Endangered	Dicot	No
(<i>Lotus dendroideus</i> ssp. <i>traskiae</i>)		Terrestrial	
Buckwheat, Cushenbury	Endangered	Dicot	Yes
(<i>Eriogonum ovalifolium</i> var. <i>vineum</i>)		Terrestrial	
Buckwheat, Southern Mountain Wild	Threatened	Dicot	No
(<i>Eriogonum kennedyi</i> var. <i>austromontanum</i>)		Terrestrial	
Bush-mallow, San Clemente Island	Endangered	Dicot	No
(<i>Malacothamnus clementinus</i>)		Terrestrial	
Button-celery, San Diego	Endangered	Dicot	No
(<i>Eryngium aristulatum</i> var. <i>parishii</i>)		Terrestrial	
Cactus, Bakersfield	Endangered	Dicot	No
(<i>Opuntia treleasei</i>)		Terrestrial	
Ceanothus, Vail Lake	Threatened	Dicot	No
(<i>Ceanothus ophiochilus</i>)		Terrestrial	
Centaury, Spring-loving	Threatened	Dicot	Yes
(<i>Centaurium namophilum</i>)		Terrestrial	
Checker-mallow, Pedate	Endangered	Dicot	No
(<i>Sidalcea pedata</i>)		Terrestrial	
Clover, Fleshy Owl's	Threatened	Dicot	Yes
(<i>Castilleja campestris</i> ssp. <i>succulenta</i>)		Vernal pool	
Crownscale, San Jacinto Valley	Endangered	Dicot	No
(<i>Atriplex coronata</i> var. <i>notatior</i>)		Terrestrial	
Daisy, Parish's	Threatened	Dicot	Yes
(<i>Erigeron parishii</i>)		Freshwater	
Dudleya, Marcescent	Threatened	Dicot	No
(<i>Dudleya cymosa</i> ssp. <i>marcescens</i>)		Terrestrial	
Dudleya, Santa Monica Mountains	Threatened	Dicot	No
(<i>Dudleya cymosa</i> ssp. <i>ovatifolia</i>)		Terrestrial	
Evening-primrose, Eureka Valley	Endangered	Dicot	No
(<i>Oenothera avita</i> ssp. <i>eurekensis</i>)		Terrestrial	
Fiddleneck, Large-flowered	Endangered	Dicot	Yes
(<i>Amsinckia grandiflora</i>)		Terrestrial	
Goldfields, Contra Costa	Endangered	Dicot	Yes
(<i>Lasthenia conjugens</i>)		Terrestrial	
Gumplant, Ash Meadows	Threatened	Dicot	Yes
(<i>Grindelia fraxino-pratensis</i>)		Terrestrial	
Ivesia, Ash Meadows	Threatened	Dicot	Yes
(<i>Ivesia kingii</i> var. <i>eremica</i>)		Terrestrial	
Jewelflower, California	Endangered	Dicot	No
(<i>Caulanthus californicus</i>)		Terrestrial	
Larkspur, San Clemente Island	Endangered	Dicot	No
(<i>Delphinium variegatum</i> ssp. <i>kinkiense</i>)		Terrestrial	
Mallow, Kern	Endangered	Dicot	No
(<i>Eremalche kernensis</i>)		Terrestrial	

Milk-vetch, Braunton's (<i>Astragalus brauntonii</i>)	Endangered	Dicot	No
Milk-vetch, Coachella Valley (<i>Astragalus lentiginosus</i> var. <i>coachellae</i>)	Endangered	Terrestrial Dicot	Yes
Milk-vetch, Cushenbury (<i>Astragalus albens</i>)	Endangered	Terrestrial Dicot	Yes
Milk-vetch, Fish Slough (<i>Astragalus lentiginosus</i> var. <i>piscinensis</i>)	Threatened	Terrestrial Dicot	No
Milk-vetch, Lane Mountain (<i>Astragalus jaegerianus</i>)	Endangered	Terrestrial Dicot	Yes
Milk-vetch, Pierson's (<i>Astragalus magdalenae</i> var. <i>peirsonii</i>)	Threatened	Terrestrial Dicot	Yes
Milk-vetch, Triple-ribbed (<i>Astragalus tricarinatus</i>)	Endangered	Terrestrial Dicot	No
Mint, Otay Mesa (<i>Pogogyne nudiuscula</i>)	Endangered	Terrestrial Dicot	No
Mountain-mahogany, Catalina Island (<i>Cercocarpus traskiae</i>)	Endangered	Terrestrial Dicot	No
Mustard, Slender-petaled (<i>Thelypodium stenopetalum</i>)	Endangered	Terrestrial Dicot	No
Navarretia, Few-flowered (<i>Navarretia leucocephala</i> ssp. <i>pauciflora</i> (=N. <i>pauciflora</i>))	Endangered	Vernal pool, Terrestrial Dicot	No
Navarretia, Many-flowered (<i>Navarretia leucocephala</i> ssp. <i>plieantha</i>)	Endangered	Terrestrial, Vernal pool Dicot	No
Navarretia, Spreading (<i>Navarretia fossalis</i>)	Threatened	Vernal pool Dicot	No
Niterwort, Amargosa (<i>Nitrophila mohavensis</i>)	Endangered	Terrestrial Dicot	Yes
Oxytheca, Cushenbury (<i>Oxytheca parishii</i> var. <i>goodmaniana</i>)	Endangered	Terrestrial Dicot	Yes
Paintbrush, Ash-grey Indian (<i>Castilleja cinerea</i>)	Threatened	Terrestrial Dicot	No
Paintbrush, San Clemente Island Indian (<i>Castilleja grisea</i>)	Endangered	Terrestrial Dicot	No
Pentachaeta, Lyon's (<i>Pentachaeta lyonii</i>)	Endangered	Terrestrial Dicot	No
Rock-cress, Santa Cruz Island (<i>Sibara filifolia</i>)	Endangered	Terrestrial Dicot	No
Rush-rose, Island (<i>Helianthemum greenei</i>)	Threatened	Terrestrial Dicot	No
Sandwort, Bear Valley (<i>Arenaria ursina</i>)	Threatened	Terrestrial Dicot	No
Spineflower, Slender-horned (<i>Dodecahema leptoceras</i>)	Endangered	Terrestrial Dicot	No
Stoncrop, Lake County (<i>Parvisedum leiocarpum</i>)	Endangered	Vernal pool Dicot	No
Taraxacum, California (<i>Taraxacum californicum</i>)	Endangered	Terrestrial Dicot	No
Thistle, Suisun (<i>Cirsium hydrophilum</i> var. <i>hydrophilum</i>)	Endangered	Brackish, Terrestrial Dicot	No
Watercress, Gabel's	Endangered	Dicot	No

(<i>Rorippa gambellii</i>)		Terrestrial, Brackish, Freshwater	
Woodland-star, San Clemente Island	Endangered	Dicot	No
(<i>Lithophragma maximum</i>)		Terrestrial	
Woolly-star, Santa Ana River	Endangered	Dicot	No
(<i>Eriastrum densifolium</i> ssp. <i>sanctorum</i>)		Terrestrial	
Woolly-threads, San Joaquin	Endangered	Dicot	No
(<i>Monolopia (=Lembertia) congdonii</i>)		Terrestrial	
Chub, Bonytail	Endangered	Fish	Yes
(<i>Gila elegans</i>)		Freshwater	
Chub, Mohave Tui	Endangered	Fish	No
(<i>Gila bicolor mohavensis</i>)		Freshwater	
Chub, Owens Tui	Endangered	Fish	Yes
(<i>Gila bicolor snyderi</i>)		Freshwater	
Dace, Ash Meadows Speckled	Endangered	Fish	Yes
(<i>Rhinichthys osculus nevadensis</i>)		Freshwater	
Goby, Tidewater	Endangered	Fish	Yes
(<i>Eucyclogobius newberryi</i>)		Freshwater	
Pupfish, Desert	Endangered	Fish	Yes
(<i>Cyprinodon macularius</i>)		Freshwater	
Pupfish, Owens	Endangered	Fish	No
(<i>Cyprinodon radiosus</i>)		Freshwater	
Salmon, Chinook (Central Valley Fall Run)	Threatened	Fish	No
(<i>Oncorhynchus (=Salmo) tshawytscha</i>)		Brackish, Freshwater, Saltwater	
Salmon, Chinook (Central Valley Spring Run)	Threatened	Fish	Yes
(<i>Oncorhynchus (=Salmo) tshawytscha</i>)		Brackish, Saltwater, Freshwater	
Salmon, Chinook (Sacramento River Winter Run)	Endangered	Fish	No
(<i>Oncorhynchus (=Salmo) tshawytscha</i>)		Saltwater, Freshwater, Brackish	
Smelt, Delta	Threatened	Fish	Yes
(<i>Hypomesus transpacificus</i>)		Freshwater, Brackish	
Squawfish, Colorado	Endangered	Fish	Yes
(<i>Ptychocheilus lucius</i>)		Freshwater	
Steelhead, (California Central Valley population)	Threatened	Fish	Yes
(<i>Oncorhynchus (=Salmo) mykiss</i>)		Brackish, Freshwater, Saltwater	
Steelhead, (Central California Coast population)	Threatened	Fish	Yes
(<i>Oncorhynchus (=Salmo) mykiss</i>)		Freshwater, Saltwater, Brackish	
Steelhead, (Southern California population)	Endangered	Fish	Yes
(<i>Oncorhynchus (=Salmo) mykiss</i>)		Brackish, Saltwater, Freshwater	
Stickleback, Unarmored Threespine	Endangered	Fish	No
(<i>Gasterosteus aculeatus williamsoni</i>)		Freshwater	
Sturgeon, green	Threatened	Fish	No
(<i>Acipenser medirostris</i>)			
Sucker, Razorback	Endangered	Fish	Yes
(<i>Xyrauchen texanus</i>)		Freshwater	
Sucker, Santa Ana	Threatened	Fish	Yes
(<i>Catostomus santaanae</i>)		Freshwater	
Trout, Lahontan Cutthroat	Threatened	Fish	No
(<i>Oncorhynchus clarki henshawi</i>)		Freshwater	
Beetle, Delta Green Ground	Threatened	Insect	Yes
(<i>Elaphrus viridis</i>)		Vernal pool, Terrestrial	
Beetle, Valley Elderberry Longhorn	Threatened	Insect	Yes
(<i>Desmocerus californicus dimorphus</i>)		Terrestrial	

Butterfly, El Segundo Blue (<i>Euphilotes battoides allyni</i>)	Endangered	Insect	No
Butterfly, Palos Verdes Blue (<i>Glaucopsyche lygdamus palosverdesensis</i>)	Endangered	Terrestrial Insect	Yes
Butterfly, Quino Checkerspot (<i>Euphydryas editha quino</i> (=E. e. wrighti))	Endangered	Terrestrial Insect	Yes
Fly, Delhi Sands Flower-loving (<i>Rhaphiomidas terminatus abdominalis</i>)	Endangered	Terrestrial Insect	No
Moth, Kern Primrose Sphinx (<i>Euproserpinus euterpe</i>)	Threatened	Terrestrial Insect	No
Fox, San Joaquin Kit (<i>Vulpes macrotis mutica</i>)	Endangered	Terrestrial Mammal	No
Fox, Santa Catalina Island (<i>Urocyon littoralis catalinae</i>)	Endangered	Terrestrial Mammal	Yes
Kangaroo Rat, Giant (<i>Dipodomys ingens</i>)	Endangered	Terrestrial Mammal	No
Kangaroo Rat, San Bernardino Merriam's (<i>Dipodomys merriami parvus</i>)	Endangered	Terrestrial Mammal	Yes
Kangaroo Rat, Stephens' (<i>Dipodomys stephensi</i> (incl. D. cascus))	Endangered	Terrestrial Mammal	No
Kangaroo Rat, Tipton (<i>Dipodomys nitratooides nitratooides</i>)	Endangered	Terrestrial Mammal	No
Mouse, Pacific Pocket (<i>Perognathus longimembris pacificus</i>)	Endangered	Terrestrial Mammal	No
Mouse, Salt Marsh Harvest (<i>Reithrodontomys raviventris</i>)	Endangered	Terrestrial Mammal	No
Rabbit, Riparian Brush (<i>Sylvilagus bachmani riparius</i>)	Endangered	Terrestrial Mammal	No
Sheep, Peninsular Bighorn (<i>Ovis canadensis</i>)	Endangered	Terrestrial Mammal	Yes
Sheep, Sierra Nevada Bighorn (<i>Ovis canadensis californiana</i>)	Endangered	Terrestrial Mammal	No
Shrew, Buena Vista Lake Ornate (<i>Sorex ornatus relictus</i>)	Endangered	Terrestrial Mammal	Yes
Vole, Amargosa (<i>Microtus californicus scirpensis</i>)	Endangered	Terrestrial Mammal	Yes
Woodrat, Riparian (<i>Neotoma fuscipes riparia</i>)	Endangered	Terrestrial Mammal	No
Bluegrass, San Bernardino (<i>Poa atropurpurea</i>)	Endangered	Terrestrial Monocot	No
Brodiaea, Thread-leaved (<i>Brodiaea filifolia</i>)	Threatened	Terrestrial Monocot	Yes
Grass, California Orcutt (<i>Orcuttia californica</i>)	Endangered	Vernal pool, Terrestrial Monocot	No
Grass, Colusa (<i>Neostapfia colusana</i>)	Threatened	Vernal pool Monocot	No
Grass, Eureka Dune (<i>Swallenia alexandrae</i>)	Endangered	Terrestrial Monocot	No
Grass, San Joaquin Valley Orcutt (<i>Orcuttia inaequalis</i>)	Threatened	Vernal pool Monocot	Yes
Grass, Solano	Endangered	Monocot	Yes

(<i>Tuctoria mucronata</i>)		Vernal pool, Terrestrial	
Onion, Munz's	Endangered	Monocot	No
(<i>Allium munzii</i>)		Terrestrial	
Lizard, Blunt-nosed Leopard	Endangered	Reptile	No
(<i>Gambelia silus</i>)		Terrestrial	
Lizard, Coachella Valley Fringe-toed	Threatened	Reptile	Yes
(<i>Uma inornata</i>)		Terrestrial	
Lizard, Island Night	Threatened	Reptile	No
(<i>Xantusia riversiana</i>)		Terrestrial	
Snake, Giant Garter	Threatened	Reptile	No
(<i>Thamnophis gigas</i>)		Freshwater, Terrestrial	
Tortoise, Desert	Threatened	Reptile	Yes
(<i>Gopherus agassizii</i>)		Terrestrial	

No species were selected for exclusion.

Dispersed species included in report.

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Species Listing by State with Use Criteria

No species were excluded
Minimum of 1 Acre.

All Medium Types Reported

Mammal, Bird, Amphibian, Reptile, Fish, Arachnid, Insect, Dicot, Monocot
pomegranates

Arizona	(21) species:		<u>Taxa</u>	<u>Critical Habitat</u>
Frog, Chiricahua Leopard		Threatened	Amphibian	No
(<i>Rana chiricahuensis</i>)			Freshwater, Terrestrial	
Flycatcher, Southwestern Willow		Endangered	Bird	Yes
(<i>Empidonax traillii extimus</i>)			Terrestrial	
Owl, Mexican Spotted		Threatened	Bird	Yes
(<i>Strix occidentalis lucida</i>)			Terrestrial	
Pygmy-owl, Cactus Ferruginous		Endangered	Bird	No
(<i>Glaucidium brasilianum cactorum</i>)			Terrestrial	
Rail, Yuma Clapper		Endangered	Bird	No
(<i>Rallus longirostris yumanensis</i>)			Terrestrial	
Cactus, Arizona Hedgehog		Endangered	Dicot	No
(<i>Echinocereus triglochidiatus var. arizonicus</i>)			Terrestrial	
Cactus, Nichol's Turk's Head		Endangered	Dicot	No
(<i>Echinocactus horizontalonius var. nicholii</i>)			Terrestrial	
Cliffrose, Arizona		Endangered	Dicot	No
(<i>Purshia (=cowania) subintegra</i>)			Terrestrial	
Chub, Gila		Endangered	Fish	Yes
(<i>Gila intermedia</i>)			Freshwater	
Minnow, Loach		Threatened	Fish	Yes
(<i>Tiaroga cobitis</i>)			Freshwater	
Pupfish, Desert		Endangered	Fish	Yes
(<i>Cyprinodon macularius</i>)			Freshwater	

Spikedace (<i>Meda fulgida</i>)	Threatened	Fish	Yes
Sucker, Razorback (<i>Xyrauchen texanus</i>)	Endangered	Freshwater Fish	Yes
Topminnow, Gila (Yaqui) (<i>Poeciliopsis occidentalis</i>)	Endangered	Freshwater Fish	No
Trout, Apache (<i>Oncorhynchus apache</i>)	Threatened	Freshwater Fish	No
Bat, Lesser (=Sanborn's) Long-nosed (<i>Leptonycteris curasoae yerbabuena</i>)	Endangered	Mammal Subterranean, Terrestrial	No
Jaguar (<i>Panthera onca</i>)	Endangered	Mammal Terrestrial	No
Jaguarundi, Sinaloa (<i>Herpailurus (=Felis) yagouaroundi tolteca</i>)	Endangered	Mammal Terrestrial	No
Ocelot (<i>Leopardus (=Felis) pardalis</i>)	Endangered	Mammal Terrestrial	No
Pronghorn, Sonoran (<i>Antilocapra americana sonoriensis</i>)	Endangered	Mammal Terrestrial	No
Squirrel, Mount Graham Red (<i>Tamiasciurus hudsonicus grahamensis</i>)	Endangered	Mammal Terrestrial	Yes

California (229) species:

		<u>Taxa</u>	<u>Critical Habitat</u>
Frog, California Red-legged (<i>Rana aurora draytonii</i>)	Threatened	Amphibian Terrestrial, Freshwater	Yes
Frog, Mountain Yellow-legged (<i>Gopherus agassizii</i>)	Endangered	Amphibian Terrestrial, Freshwater	No
Salamander, California Tiger (<i>Ambystoma californiense</i>)	Endangered	Amphibian Terrestrial, Vernal pool	No
Salamander, Desert Slender (<i>Batrachoseps aridus</i>)	Endangered	Amphibian Freshwater, Terrestrial	No
Salamander, Santa Cruz Long-toed (<i>Ambystoma macrodactylum croceum</i>)	Endangered	Amphibian Freshwater, Vernal pool, Terrestrial	No
Toad, Arroyo Southwestern (<i>Bufo californicus (=microscaphus)</i>)	Endangered	Amphibian Freshwater, Terrestrial	Yes
Condor, California (<i>Gymnogyps californianus</i>)	Endangered	Bird Terrestrial	Yes
Flycatcher, Southwestern Willow (<i>Empidonax traillii extimus</i>)	Endangered	Bird Terrestrial	Yes
Gnatcatcher, Coastal California (<i>Polioptila californica californica</i>)	Threatened	Bird Terrestrial	Yes
Murrelet, Marbled (<i>Brachyramphus marmoratus marmoratus</i>)	Threatened	Bird Freshwater, Terrestrial, Saltwater	Yes
Owl, Northern Spotted (<i>Strix occidentalis caurina</i>)	Threatened	Bird Terrestrial	Yes
Pelican, Brown (<i>Pelecanus occidentalis</i>)	Endangered	Bird Terrestrial	No
Plover, Western Snowy (<i>Charadrius alexandrinus nivosus</i>)	Threatened	Bird Terrestrial	Yes
Rail, California Clapper (<i>Rallus longirostris obsoletus</i>)	Endangered	Bird Terrestrial	No
Rail, Light-footed Clapper (<i>Rallus longirostris levipes</i>)	Endangered	Bird Terrestrial	No

Rail, Yuma Clapper (<i>Rallus longirostris yumanensis</i>)	Endangered	Bird	No
		Terrestrial	
Shrike, San Clemente Loggerhead (<i>Lanius ludovicianus mearnsi</i>)	Endangered	Bird	No
		Terrestrial	
Sparrow, San Clemente Sage (<i>Amphispiza belli clementeae</i>)	Threatened	Bird	No
		Terrestrial	
Tern, California Least (<i>Sterna antillarum browni</i>)	Endangered	Bird	No
		Terrestrial	
Vireo, Least Bell's (<i>Vireo bellii pusillus</i>)	Endangered	Bird	Yes
		Terrestrial	
Adobe Sunburst, San Joaquin (<i>Pseudobahia peirsonii</i>)	Threatened	Dicot	No
		Terrestrial	
Allocarya, Calistoga (<i>Plagiobothrys strictus</i>)	Endangered	Dicot	No
		Vernal pool	
Ambrosia, San Diego (<i>Ambrosia pumila</i>)	Endangered	Dicot	No
		Terrestrial	
Baccharis, Encinitas (<i>Baccharis vanessae</i>)	Threatened	Dicot	No
		Terrestrial	
Barberry, Island (<i>Berberis pinnata ssp. insularis</i>)	Endangered	Dicot	No
		Terrestrial	
Barberry, Nevin's (<i>Berberis nevinii</i>)	Endangered	Dicot	No
		Terrestrial	
Bedstraw, El Dorado (<i>Galium californicum ssp. sierrae</i>)	Endangered	Dicot	No
		Terrestrial	
Bedstraw, Island (<i>Galium buxifolium</i>)	Endangered	Dicot	No
		Terrestrial	
Bird's-beak, Palmate-bracted (<i>Cordylanthus palmatus</i>)	Endangered	Dicot	No
		Terrestrial	
Bird's-beak, Pennell's (<i>Cordylanthus tenuis ssp. capillaris</i>)	Endangered	Dicot	No
		Terrestrial	
Bird's-beak, salt marsh (<i>Cordylanthus maritimus ssp. maritimus</i>)	Endangered	Dicot	No
		Saltwater	
Bird's-beak, Soft (<i>Cordylanthus mollis ssp. mollis</i>)	Endangered	Dicot	No
		Brackish, Saltwater	
Bladderpod, San Bernardino Mountains (<i>Lesquerella kingii ssp. bernardina</i>)	Endangered	Dicot	Yes
		Terrestrial	
Bluecurls, Hidden Lake (<i>Trichostema austromontanum ssp. compactum</i>)	Threatened	Dicot	No
		Terrestrial	
Broom, San Clemente Island (<i>Lotus dendroideus ssp. traskiae</i>)	Endangered	Dicot	No
		Terrestrial	
Buckwheat, Cushenbury (<i>Eriogonum ovalifolium var. vineum</i>)	Endangered	Dicot	Yes
		Terrestrial	
Buckwheat, Lone (incl. Irish Hill) (<i>Eriogonum apricum (incl. var. prostratum)</i>)	Endangered	Dicot	No
		Terrestrial	
Buckwheat, Southern Mountain Wild (<i>Eriogonum kennedyi var. austromontanum</i>)	Threatened	Dicot	No
		Terrestrial	
Bush-mallow, San Clemente Island (<i>Malacothamnus clementinus</i>)	Endangered	Dicot	No
		Terrestrial	
Bush-mallow, Santa Cruz Island (<i>Malacothamnus fasciculatus var. nesioticus</i>)	Endangered	Dicot	No
		Terrestrial	
Butterweed, Layne's	Threatened	Dicot	No

(<i>Senecio layneae</i>)		Terrestrial	
Button-celery, San Diego	Endangered	Dicot	No
(<i>Eryngium aristulatum</i> var. <i>parishii</i>)		Terrestrial	
Cactus, Bakersfield	Endangered	Dicot	No
(<i>Opuntia treleasei</i>)		Terrestrial	
Ceanothus, Coyote	Endangered	Dicot	No
(<i>Ceanothus ferrisae</i>)		Terrestrial	
Ceanothus, Pine Hill	Endangered	Dicot	No
(<i>Ceanothus roderickii</i>)		Terrestrial	
Ceanothus, Vail Lake	Threatened	Dicot	No
(<i>Ceanothus ophiochilus</i>)		Terrestrial	
Checker-mallow, Keck's	Endangered	Dicot	Yes
(<i>Sidalcea keckii</i>)		Terrestrial	
Checker-mallow, Kenwood Marsh	Endangered	Dicot	No
(<i>Sidalcea oregana</i> ssp. <i>valida</i>)		Terrestrial	
Checker-mallow, Pedate	Endangered	Dicot	No
(<i>Sidalcea pedata</i>)		Terrestrial	
Clarkia, Pismo	Endangered	Dicot	No
(<i>Clarkia speciosa</i> ssp. <i>immaculata</i>)		Terrestrial	
Clarkia, Presidio	Endangered	Dicot	No
(<i>Clarkia franciscana</i>)		Terrestrial	
Clarkia, Springville	Threatened	Dicot	No
(<i>Clarkia springvillensis</i>)		Terrestrial	
Clarkia, Vine Hill	Endangered	Dicot	No
(<i>Clarkia imbricata</i>)		Terrestrial	
Clover, Fleshy Owl's	Threatened	Dicot	Yes
(<i>Castilleja campestris</i> ssp. <i>succulenta</i>)		Vernal pool	
Clover, Showy Indian	Endangered	Dicot	No
(<i>Trifolium amoenum</i>)		Terrestrial	
Crownbeard, Big-leaved	Threatened	Dicot	No
(<i>Verbesina dissita</i>)		Terrestrial	
Crownscale, San Jacinto Valley	Endangered	Dicot	No
(<i>Atriplex coronata</i> var. <i>notatior</i>)		Terrestrial	
Daisy, Parish's	Threatened	Dicot	Yes
(<i>Erigeron parishii</i>)		Freshwater	
Dudleya, Conejo	Threatened	Dicot	No
(<i>Dudleya abramsii</i> ssp. <i>parva</i>)		Terrestrial	
Dudleya, Marcescent	Threatened	Dicot	No
(<i>Dudleya cymosa</i> ssp. <i>marcescens</i>)		Terrestrial	
Dudleya, Santa Clara Valley	Endangered	Dicot	No
(<i>Dudleya setchellii</i>)		Terrestrial	
Dudleya, Santa Cruz Island	Threatened	Dicot	No
(<i>Dudleya nesiotica</i>)		Terrestrial	
Dudleya, Santa Monica Mountains	Threatened	Dicot	No
(<i>Dudleya cymosa</i> ssp. <i>ovatifolia</i>)		Terrestrial	
Dudleya, Verity's	Threatened	Dicot	No
(<i>Dudleya verityi</i>)		Terrestrial	
Evening-primrose, Antioch Dunes	Endangered	Dicot	Yes
(<i>Oenothera deltoides</i> ssp. <i>howellii</i>)		Terrestrial	
Fiddleneck, Large-flowered	Endangered	Dicot	Yes
(<i>Amsinckia grandiflora</i>)		Terrestrial	

Flannelbush, Mexican (<i>Fremontodendron mexicanum</i>)	Endangered	Dicot	No
Flannelbush, Pine Hill (<i>Fremontodendron californicum</i> ssp. <i>decumbens</i>)	Endangered	Terrestrial Dicot	No
Fringepod, Santa Cruz Island (<i>Thysanocarpus conchuliferus</i>)	Endangered	Terrestrial Dicot	No
Gilia, Hoffmann's Slender-flowered (<i>Gilia tenuiflora</i> ssp. <i>hoffmannii</i>)	Endangered	Terrestrial Dicot	No
Golden Sunburst, Hartweg's (<i>Pseudobahia bahiifolia</i>)	Endangered	Terrestrial Dicot	No
Goldfields, Burke's (<i>Lasthenia burkei</i>)	Endangered	Terrestrial Dicot	No
Goldfields, Contra Costa (<i>Lasthenia conjugens</i>)	Endangered	Terrestrial Dicot	Yes
Grass, Hairy Orcutt (<i>Orcuttia pilosa</i>)	Endangered	Vernal pool Dicot	Yes
Grass, Sacramento Orcutt (<i>Orcuttia viscida</i>)	Endangered	Vernal pool Dicot	Yes
Grass, Slender Orcutt (<i>Orcuttia tenuis</i>)	Threatened	Vernal pool Dicot	Yes
Jewelflower, California (<i>Caulanthus californicus</i>)	Endangered	Terrestrial Dicot	No
Larkspur, Baker's (<i>Delphinium bakeri</i>)	Endangered	Terrestrial Dicot	Yes
Larkspur, San Clemente Island (<i>Delphinium variegatum</i> ssp. <i>kinkiense</i>)	Endangered	Terrestrial Dicot	No
Larkspur, Yellow (<i>Delphinium luteum</i>)	Endangered	Terrestrial Dicot	Yes
Layia, Beach (<i>Layia carnosia</i>)	Endangered	Terrestrial, Coastal (neritic) Dicot	No
Liveforever, Laguna Beach (<i>Dudleya stolonifera</i>)	Threatened	Terrestrial Dicot	No
Liveforever, Santa Barbara Island (<i>Dudleya traskiae</i>)	Endangered	Terrestrial Dicot	No
Lupine, Clover (<i>Lupinus tidestromii</i>)	Endangered	Coastal (neritic) Dicot	No
Lupine, Nipomo Mesa (<i>Lupinus nipomensis</i>)	Endangered	Coastal (neritic) Dicot	No
Malacothrix, Island (<i>Malacothrix squalida</i>)	Endangered	Terrestrial Dicot	No
Malacothrix, Santa Cruz Island (<i>Malacothrix indecora</i>)	Endangered	Terrestrial Dicot	No
Mallow, Kern (<i>Eremalche kernensis</i>)	Endangered	Terrestrial Dicot	No
Manzanita, Del Mar (<i>Arctostaphylos glandulosa</i> ssp. <i>crassifolia</i>)	Endangered	Terrestrial Dicot	No
Manzanita, Lone (<i>Arctostaphylos myrtifolia</i>)	Threatened	Terrestrial Dicot	No
Manzanita, Morro (<i>Arctostaphylos morroensis</i>)	Threatened	Terrestrial Dicot	No
Manzanita, Pallid	Threatened	Terrestrial Dicot	No

(<i>Arctostaphylos pallida</i>)		Terrestrial		
Manzanita, Santa Rosa Island	Endangered	Dicot		No
(<i>Arctostaphylos confertiflora</i>)		Terrestrial		
Meadowfoam, Butte County	Endangered	Dicot		Yes
(<i>Limnanthes floccosa</i> ssp. <i>californica</i>)		Vernal pool		
Meadowfoam, Sebastopol	Endangered	Dicot		No
(<i>Limnanthes vinculans</i>)		Freshwater, Terrestrial		
Milk-vetch, Braunton's	Endangered	Dicot		No
(<i>Astragalus brauntonii</i>)		Terrestrial		
Milk-vetch, Clara Hunt's	Endangered	Dicot		No
(<i>Astragalus clarianus</i>)		Terrestrial		
Milk-vetch, Coachella Valley	Endangered	Dicot		Yes
(<i>Astragalus lentiginosus</i> var. <i>coachellae</i>)		Terrestrial		
Milk-vetch, Cushenbury	Endangered	Dicot		Yes
(<i>Astragalus albens</i>)		Terrestrial		
Milk-vetch, Lane Mountain	Endangered	Dicot		Yes
(<i>Astragalus jaegerianus</i>)		Terrestrial		
Milk-vetch, Triple-ribbed	Endangered	Dicot		No
(<i>Astragalus tricarinatus</i>)		Terrestrial		
Milk-vetch, Ventura Marsh	Endangered	Dicot		Yes
(<i>Astragalus pycnostachyus</i> var. <i>lanosissimus</i>)		Terrestrial, Freshwater		
Mint, Otay Mesa	Endangered	Dicot		No
(<i>Pogogyne nudiuscula</i>)		Terrestrial		
Mint, San Diego Mesa	Endangered	Dicot		No
(<i>Pogogyne abramsii</i>)		Terrestrial		
Monardella, Willow	Endangered	Dicot		No
(<i>Monardella linoidea</i> ssp. <i>viminea</i>)		Terrestrial		
Morning-glory, Stebbins	Endangered	Dicot		No
(<i>Calystegia stebbinsii</i>)		Terrestrial		
Mountainbalm, Indian Knob	Endangered	Dicot		No
(<i>Eriodictyon altissimum</i>)		Terrestrial		
Mountain-mahogany, Catalina Island	Endangered	Dicot		No
(<i>Cercocarpus traskiae</i>)		Terrestrial		
Mustard, Slender-petaled	Endangered	Dicot		No
(<i>Thelypodium stenopetalum</i>)		Terrestrial		
Navarretia, Few-flowered	Endangered	Dicot		No
(<i>Navarretia leucocephala</i> ssp. <i>pauciflora</i> (=N. <i>pauciflora</i>))		Vernal pool, Terrestrial		
Navarretia, Many-flowered	Endangered	Dicot		No
(<i>Navarretia leucocephala</i> ssp. <i>plieantha</i>)		Terrestrial, Vernal pool		
Navarretia, Spreading	Threatened	Dicot		No
(<i>Navarretia fossalis</i>)		Vernal pool		
Oxytheca, Cushenbury	Endangered	Dicot		Yes
(<i>Oxytheca parishii</i> var. <i>goodmaniana</i>)		Terrestrial		
Paintbrush, Ash-grey Indian	Threatened	Dicot		No
(<i>Castilleja cinerea</i>)		Terrestrial		
Paintbrush, San Clemente Island Indian	Endangered	Dicot		No
(<i>Castilleja grisea</i>)		Terrestrial		
Paintbrush, Soft-leaved	Endangered	Dicot		No
(<i>Castilleja mollis</i>)		Terrestrial		
Paintbrush, Tiburon	Endangered	Dicot		No
(<i>Castilleja affinis</i> ssp. <i>neglecta</i>)		Terrestrial		

Pentachaeta, Lyon's (<i>Pentachaeta lyonii</i>)	Endangered	Dicot	No
Pentachaeta, White-rayed (<i>Pentachaeta bellidiflora</i>)	Endangered	Terrestrial Dicot	No
Phacelia, Island (<i>Phacelia insularis</i> ssp. <i>insularis</i>)	Endangered	Terrestrial Dicot	No
Polygonum, Scott's Valley (<i>Polygonum hickmanii</i>)	Endangered	Terrestrial Dicot	Yes
Pussypaws, Mariposa (<i>Calyptidium pulchellum</i>)	Threatened	Terrestrial Dicot	No
Rock-cress, Hoffmann's (<i>Arabis hoffmannii</i>)	Endangered	Terrestrial Dicot	No
Rock-cress, Santa Cruz Island (<i>Sibara filifolia</i>)	Endangered	Terrestrial Dicot	No
Rush-rose, Island (<i>Helianthemum greenei</i>)	Threatened	Terrestrial Dicot	No
Sandwort, Bear Valley (<i>Arenaria ursina</i>)	Threatened	Terrestrial Dicot	No
Sandwort, Marsh (<i>Arenaria paludicola</i>)	Endangered	Freshwater, Terrestrial Dicot	No
Sea-blite, California (<i>Suaeda californica</i>)	Endangered	Terrestrial Dicot	No
Spineflower, Ben Lomond (<i>Chorizanthe pungens</i> var. <i>hartwegiana</i>)	Endangered	Terrestrial Dicot	No
Spineflower, Monterey (<i>Chorizanthe pungens</i> var. <i>pungens</i>)	Threatened	Terrestrial Dicot	Yes
Spineflower, Orcutt's (<i>Chorizanthe orcuttiana</i>)	Endangered	Terrestrial Dicot	No
Spineflower, Robust (<i>Chorizanthe robusta</i> var. <i>robusta</i>)	Endangered	Terrestrial Dicot	Yes
Spineflower, Scotts Valley (<i>Chorizanthe robusta</i> var. <i>hartwegii</i>)	Endangered	Terrestrial Dicot	Yes
Spineflower, Slender-horned (<i>Dodecahema leptoceras</i>)	Endangered	Terrestrial Dicot	No
Spineflower, Sonoma (<i>Chorizanthe valida</i>)	Endangered	Terrestrial Dicot	No
Spurge, Hoover's (<i>Chamaesyce hooveri</i>)	Threatened	Vernal pool Dicot	Yes
Stickseed, Baker's (<i>Blennosperma bakeri</i>)	Endangered	Vernal pool Dicot	No
Stoncrop, Lake County (<i>Parvisedum leiocarpum</i>)	Endangered	Vernal pool Dicot	No
Taraxacum, California (<i>Taraxacum californicum</i>)	Endangered	Terrestrial Dicot	No
Tarplant, Gaviota (<i>Deinandra increscens</i> ssp. <i>villosa</i>)	Endangered	Terrestrial Dicot	Yes
Tarplant, Otay (<i>Deinandra</i> (= <i>Hemizonia</i>) <i>conjugens</i>)	Threatened	Terrestrial Dicot	Yes
Tarplant, Santa Cruz (<i>Holocarpha macradenia</i>)	Threatened	Terrestrial Dicot	Yes
Thistle, Chorro creek Bog	Endangered	Dicot	No

(<i>Cirsium fontinale</i> var. <i>obispoense</i>) Thistle, Fountain	Endangered	Terrestrial, Freshwater Dicot	No
(<i>Cirsium fontinale</i> var. <i>fontinale</i>) Thistle, La Graciosa	Endangered	Terrestrial Dicot	Yes
(<i>Cirsium loncholepis</i>) Thornmint, San Diego	Threatened	Coastal (neritic), Freshwater, Dicot	No
(<i>Acanthomintha ilicifolia</i>) Tuctoria, Green's	Endangered	Terrestrial Dicot	Yes
(<i>Tuctoria greenei</i>) Wallflower, Ben Lomond	Endangered	Vernal pool Dicot	No
(<i>Erysimum teretifolium</i>) Wallflower, Contra Costa	Endangered	Terrestrial Dicot	Yes
(<i>Erysimum capitatum</i> var. <i>angustatum</i>) Watercress, Gambel's	Endangered	Terrestrial Dicot	No
(<i>Rorippa gambellii</i>) Woodland-star, San Clemente Island	Endangered	Terrestrial, Brackish, Freshwater Dicot	No
(<i>Lithophragma maximum</i>) Woolly-star, Santa Ana River	Endangered	Terrestrial Dicot	No
(<i>Eriastrum densifolium</i> ssp. <i>sanctorum</i>) Woolly-threads, San Joaquin	Endangered	Terrestrial Dicot	No
(<i>Monolopia (=Lembertia) congdonii</i>) Yerba Santa, Lompoc	Endangered	Terrestrial Dicot	Yes
(<i>Eriodictyon capitatum</i>) Chub, Bonytail	Endangered	Terrestrial Fish	Yes
(<i>Gila elegans</i>) Chub, Mohave Tui	Endangered	Freshwater Fish	No
(<i>Gila bicolor mohavensis</i>) Goby, Tidewater	Endangered	Freshwater Fish	Yes
(<i>Eucyclogobius newberryi</i>) Pupfish, Desert	Endangered	Freshwater Fish	Yes
(<i>Cyprinodon macularius</i>) Salmon, Chinook (California Coastal Run)	Threatened	Freshwater, Saltwater, Brackish Fish	Yes
(<i>Oncorhynchus (=Salmo) tshawytscha</i>) Salmon, Chinook (Central Valley Fall Run)	Threatened	Brackish, Freshwater, Saltwater Fish	No
(<i>Oncorhynchus (=Salmo) tshawytscha</i>) Salmon, Chinook (Central Valley Spring Run)	Threatened	Brackish, Saltwater, Freshwater Fish	Yes
(<i>Oncorhynchus (=Salmo) tshawytscha</i>) Salmon, Chinook (Sacramento River Winter Run)	Endangered	Saltwater, Freshwater, Brackish Fish	No
(<i>Oncorhynchus (=Salmo) tshawytscha</i>) Salmon, Coho (Central California Coast population)	Endangered	Saltwater, Brackish, Freshwater Fish	No
(<i>Oncorhynchus (=Salmo) kisutch</i>) Smelt, Delta	Threatened	Freshwater, Brackish Fish	Yes
(<i>Hypomesus transpacificus</i>) Squawfish, Colorado	Endangered	Freshwater Fish	Yes
(<i>Ptychocheilus lucius</i>) Steelhead, (California Central Valley population)	Threatened	Brackish, Freshwater, Saltwater Fish	Yes
(<i>Oncorhynchus (=Salmo) mykiss</i>) Steelhead, (Central California Coast population)	Threatened	Freshwater, Saltwater, Brackish Fish	Yes
(<i>Oncorhynchus (=Salmo) mykiss</i>) Steelhead, (Northern California population)	Threatened	Saltwater, Brackish, Freshwater Fish	No
(<i>Oncorhynchus (=Salmo) mykiss</i>)			

Steelhead, (South-Central California population) (<i>Oncorhynchus</i> (=Salmo) <i>mykiss</i>)	Threatened	Fish	Yes
		Freshwater, Saltwater, Brackish	
Steelhead, (Southern California population) (<i>Oncorhynchus</i> (=Salmo) <i>mykiss</i>)	Endangered	Fish	Yes
		Brackish, Saltwater, Freshwater	
Stickleback, Unarmored Threespine (<i>Gasterosteus aculeatus williamsoni</i>)	Endangered	Fish	No
		Freshwater	
Sturgeon, green (<i>Acipenser medirostris</i>)	Threatened	Fish	No
Sucker, Razorback (<i>Xyrauchen texanus</i>)	Endangered	Fish	Yes
		Freshwater	
Sucker, Santa Ana (<i>Catostomus santaanae</i>)	Threatened	Fish	Yes
		Freshwater	
Trout, Lahontan Cutthroat (<i>Oncorhynchus clarki henshawi</i>)	Threatened	Fish	No
		Freshwater	
Trout, Little Kern Golden (<i>Oncorhynchus aguabonita whitei</i>)	Threatened	Fish	Yes
		Freshwater	
Trout, Paiute Cutthroat (<i>Oncorhynchus clarki seleniris</i>)	Threatened	Fish	No
		Freshwater	
Beetle, Mount Hermon June (<i>Polyphylla barbata</i>)	Endangered	Insect	No
		Subterraneous, Terrestrial	
Beetle, Ohlone Tiger (<i>Cicindela ohlone</i>)	Endangered	Insect	No
		Terrestrial	
Beetle, Valley Elderberry Longhorn (<i>Desmocerus californicus dimorphus</i>)	Threatened	Insect	Yes
		Terrestrial	
Butterfly, Bay Checkerspot (Wright's euphydryas) (<i>Euphydryas editha bayensis</i>)	Threatened	Insect	Yes
		Terrestrial	
Butterfly, Behren's Silverspot (<i>Speyeria zerene behrensii</i>)	Endangered	Insect	No
		Terrestrial	
Butterfly, Callippe Silverspot (<i>Speyeria callippe callippe</i>)	Endangered	Insect	No
		Terrestrial	
Butterfly, El Segundo Blue (<i>Euphilotes battoides allyni</i>)	Endangered	Insect	No
		Terrestrial	
Butterfly, Lange's Metalmark (<i>Apodemia mormo langei</i>)	Endangered	Insect	No
		Terrestrial	
Butterfly, Myrtle's Silverspot (<i>Speyeria zerene myrtleae</i>)	Endangered	Insect	No
		Terrestrial	
Butterfly, Palos Verdes Blue (<i>Glaucopsyche lygdamus palosverdesensis</i>)	Endangered	Insect	Yes
		Terrestrial	
Butterfly, Quino Checkerspot (<i>Euphydryas editha quino</i> (=E. e. <i>wrighti</i>))	Endangered	Insect	Yes
		Terrestrial	
Fly, Delhi Sands Flower-loving (<i>Rhaphiomidas terminatus abdominalis</i>)	Endangered	Insect	No
		Terrestrial	
Grasshopper, Zayante Band-winged (<i>Trimerotropis infantilis</i>)	Endangered	Insect	Yes
		Terrestrial	
Moth, Kern Primrose Sphinx (<i>Euproserpinus euterpe</i>)	Threatened	Insect	No
		Terrestrial	
Skipper, Laguna Mountain (<i>Pyrgus ruralis lagunae</i>)	Endangered	Insect	No
		Terrestrial	
Fox, San Joaquin Kit (<i>Vulpes macrotis mutica</i>)	Endangered	Mammal	No
		Terrestrial	
Fox, San Miguel Island	Endangered	Mammal	Yes

(<i>Urocyon littoralis littoralis</i>)		Terrestrial	
Fox, Santa Catalina Island	Endangered	Mammal	Yes
(<i>Urocyon littoralis catalinae</i>)		Terrestrial	
Fox, Santa Cruz Island	Endangered	Mammal	Yes
(<i>Urocyon littoralis santacruzae</i>)		Terrestrial	
Fox, Santa Rosa Island	Endangered	Mammal	Yes
(<i>Urocyon littoralis santarosae</i>)		Terrestrial	
Kangaroo Rat, Fresno	Endangered	Mammal	Yes
(<i>Dipodomys nitratooides exilis</i>)		Terrestrial	
Kangaroo Rat, Giant	Endangered	Mammal	No
(<i>Dipodomys ingens</i>)		Terrestrial	
Kangaroo Rat, Morro Bay	Endangered	Mammal	Yes
(<i>Dipodomys heermanni morroensis</i>)		Terrestrial	
Kangaroo Rat, San Bernardino Merriam's	Endangered	Mammal	Yes
(<i>Dipodomys merriami parvus</i>)		Terrestrial	
Kangaroo Rat, Stephens'	Endangered	Mammal	No
(<i>Dipodomys stephensi (incl. D. cascus)</i>)		Terrestrial	
Kangaroo Rat, Tipton	Endangered	Mammal	No
(<i>Dipodomys nitratooides nitratooides</i>)		Terrestrial	
Mouse, Pacific Pocket	Endangered	Mammal	No
(<i>Perognathus longimembris pacificus</i>)		Terrestrial	
Mouse, Salt Marsh Harvest	Endangered	Mammal	No
(<i>Reithrodontomys raviventris</i>)		Terrestrial	
Sheep, Peninsular Bighorn	Endangered	Mammal	Yes
(<i>Ovis canadensis</i>)		Terrestrial	
Sheep, Sierra Nevada Bighorn	Endangered	Mammal	No
(<i>Ovis canadensis californiana</i>)		Terrestrial	
Shrew, Buena Vista Lake Ornate	Endangered	Mammal	Yes
(<i>Sorex ornatus relictus</i>)		Terrestrial	
Vole, Amargosa	Endangered	Mammal	Yes
(<i>Microtus californicus scirpensis</i>)		Terrestrial	
Alopecurus, Sonoma	Endangered	Monocot	No
(<i>Alopecurus aequalis var. sonomensis</i>)		Terrestrial	
Amole, Cammatta Canyon	Threatened	Monocot	Yes
(<i>Chlorogalum purpureum var. reductum</i>)		Terrestrial	
Amole, Purple	Threatened	Monocot	Yes
(<i>Chlorogalum purpureum var. purpureum</i>)		Terrestrial	
Bluegrass, Napa	Endangered	Monocot	No
(<i>Poa napensis</i>)		Terrestrial, Freshwater	
Bluegrass, San Bernardino	Endangered	Monocot	No
(<i>Poa atropurpurea</i>)		Terrestrial	
Brodiaea, Thread-leaved	Threatened	Monocot	Yes
(<i>Brodiaea filifolia</i>)		Terrestrial	
Grass, California Orcutt	Endangered	Monocot	No
(<i>Orcuttia californica</i>)		Vernal pool, Terrestrial	
Grass, Colusa	Threatened	Monocot	No
(<i>Neostaphia colusana</i>)		Vernal pool	
Grass, San Joaquin Valley Orcutt	Threatened	Monocot	Yes
(<i>Orcuttia inaequalis</i>)		Vernal pool	
Lily, Pitkin Marsh	Endangered	Monocot	No
(<i>Lilium pardalinum ssp. pitkinense</i>)		Freshwater	

Onion, Munz's (<i>Allium munzii</i>)	Endangered	Monocot Terrestrial	No
Sedge, White (<i>Carex albida</i>)	Endangered	Monocot Freshwater, Terrestrial	No
Lizard, Blunt-nosed Leopard (<i>Gambelia silus</i>)	Endangered	Reptile Terrestrial	No
Lizard, Coachella Valley Fringe-toed (<i>Uma inornata</i>)	Threatened	Reptile Terrestrial	Yes
Lizard, Island Night (<i>Xantusia riversiana</i>)	Threatened	Reptile Terrestrial	No
Sea turtle, olive ridley (<i>Lepidochelys olivacea</i>)	Threatened	Reptile Saltwater	No
Snake, Giant Garter (<i>Thamnophis gigas</i>)	Threatened	Reptile Freshwater, Terrestrial	No
Snake, San Francisco Garter (<i>Thamnophis sirtalis tetrataenia</i>)	Endangered	Reptile Freshwater, Terrestrial	No
Tortoise, Desert (<i>Gopherus agassizii</i>)	Threatened	Reptile Terrestrial	Yes
Whipsnake (=Striped Racer), Alameda (<i>Masticophis lateralis euryxanthus</i>)	Threatened	Reptile Terrestrial	Yes

Hawaii (103) species:

		<u>Taxa</u>	<u>Critical Habitat</u>
'Akepa, Maui (<i>Loxops coccineus ochraceus</i>)	Endangered	Bird Terrestrial	No
Coot, Hawaiian (=Alae keo keo) (<i>Fulica americana alai</i>)	Endangered	Bird Terrestrial	No
Creeper, Molokai (Kakawahie) (<i>Paroreomyza flammea</i>)	Endangered	Bird Terrestrial	No
Goose, Hawaiian (Nene) (<i>Branta (=Nesochen) sandvicensis</i>)	Endangered	Bird Terrestrial, Freshwater	No
Honeycreeper, Crested ('Akohekohe) (<i>Palmeria dolei</i>)	Endangered	Bird Terrestrial	No
Moorhen, Hawaiian Common (<i>Gallinula chloropus sandvicensis</i>)	Endangered	Bird Terrestrial	No
Nuku Pu'u (<i>Hemignathus lucidus</i>)	Endangered	Bird Terrestrial	No
Parrotbill, Maui (<i>Pseudonestor xanthophrys</i>)	Endangered	Bird Terrestrial	No
Petrel, Hawaiian Dark-rumped (<i>Pterodroma phaeopygia sandwichensis</i>)	Endangered	Bird Terrestrial	No
Po'ouli (<i>Melamprosops phaeosoma</i>)	Endangered	Bird Terrestrial	No
Stilt, Hawaiian (=Ae'o) (<i>Himantopus mexicanus knudseni</i>)	Endangered	Bird Terrestrial	No
Thrush, Molokai (Oloma'o) (<i>Myadestes lanaiensis rutha</i>)	Endangered	Bird Terrestrial	No
Abutilon eremitopetalum (ncn) (<i>Abutilon eremitopetalum</i>)	Endangered	Dicot Terrestrial	Yes
A'e (<i>Zanthoxylum hawaiiense</i>) (<i>Zanthoxylum hawaiiense</i>)	Endangered	Dicot Terrestrial	Yes
'Akoko (<i>Chamaesyce skottsbergii</i> var. <i>skottsbe</i>) (<i>Chamaesyce skottsbergii</i> var. <i>kalaeloana</i>)	Endangered	Dicot Terrestrial	No

Alani (<i>Melicope adscendens</i>) (<i>Melicope adscendens</i>)	Endangered	Dicot	Yes
Alani (<i>Melicope balloui</i>) (<i>Melicope balloui</i>)	Endangered	Terrestrial Dicot	Yes
Alani (<i>Melicope knudsenii</i>) (<i>Melicope knudsenii</i>)	Endangered	Terrestrial Dicot	Yes
Alani (<i>Melicope mucronulata</i>) (<i>Melicope mucronulata</i>)	Endangered	Terrestrial Dicot	Yes
Alani (<i>Melicope munroi</i>) (<i>Melicope munroi</i>)	Endangered	Terrestrial Dicot	No
Alani (<i>Melicope ovalis</i>) (<i>Melicope ovalis</i>)	Endangered	Terrestrial Dicot	Yes
Alani (<i>Melicope reflexa</i>) (<i>Melicope reflexa</i>)	Endangered	Terrestrial Dicot	Yes
'Awikiwiki (<i>Canavalia molokaiensis</i>) (<i>Canavalia molokaiensis</i>)	Endangered	Terrestrial Dicot	Yes
'Awiwi (<i>Centaurium sebaeoides</i>) (<i>Centaurium sebaeoides</i>)	Endangered	Terrestrial Dicot	Yes
Bonamia menziesii (ncn) (<i>Bonamia menziesii</i>)	Endangered	Terrestrial Dicot	Yes
Geranium, Hawaiian Red-flowered (<i>Geranium arboreum</i>)	Endangered	Terrestrial Dicot	Yes
Gouania hillebrandii (ncn) (<i>Gouania hillebrandii</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea copelandii</i> ssp. <i>haleakalaensis</i>) (<i>Cyanea copelandii</i> ssp. <i>haleakalaensis</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea dunbarii</i>) (<i>Cyanea dunbarii</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea glabra</i>) (<i>Cyanea glabra</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea grimesiana</i> ssp. <i>grimesiana</i>) (<i>Cyanea grimesiana</i> ssp. <i>grimesiana</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea hamatiflora</i> ssp. <i>hamatiflora</i>) (<i>Cyanea hamatiflora</i> ssp. <i>hamatiflora</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea Macrostegia</i> var. <i>gibsonii</i>) (<i>Cyanea macrostegia</i> ssp. <i>gibsonii</i>)	Endangered	Terrestrial Dicot	No
Haha (<i>Cyanea mannii</i>) (<i>Cyanea mannii</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea mceldowneyi</i>) (<i>Cyanea mceldowneyi</i>)	Endangered	Terrestrial Dicot	Yes
Haha (<i>Cyanea procera</i>) (<i>Cyanea procera</i>)	Endangered	Terrestrial Dicot	Yes
Ha'lwale (<i>Cyrtandra munroi</i>) (<i>Cyrtandra munroi</i>)	Endangered	Terrestrial Dicot	Yes
Hesperomannia arborescens (ncn) (<i>Hesperomannia arborescens</i>)	Endangered	Terrestrial Dicot	Yes
Hesperomannia arbuscula (ncn) (<i>Hesperomannia arbuscula</i>)	Endangered	Terrestrial Dicot	Yes
Kamakahala (<i>Labordia tinifolia</i> var. <i>lanaiensis</i>) (<i>Labordia tinifolia</i> var. <i>lanaiensis</i>)	Endangered	Terrestrial Dicot	No
Kamakahala (<i>Labordia triflora</i>)	Endangered	Terrestrial Dicot	No

(<i>Labordia triflora</i>)		Terrestrial	
Kanaloa kahoolawensis (ncn)	Endangered	Dicot	Yes
(<i>Kanaloa kahoolawensis</i>)		Terrestrial	
Kio'Ele (Hedyotis coriacea)	Endangered	Dicot	Yes
(<i>Hedyotis coriacea</i>)		Terrestrial	
Koki'o Ke'oke'o (Hibiscus arnottianus ssp. immaculatus)	Endangered	Dicot	Yes
(<i>Hibiscus arnottianus ssp. immaculatus</i>)		Terrestrial	
Ko'oko'olau (Bidens micrantha ssp. kalealaha)	Endangered	Dicot	Yes
(<i>Bidens micrantha ssp. kalealaha</i>)		Terrestrial	
Ko'oko'olau (Bidens wiebkei)	Endangered	Dicot	Yes
(<i>Bidens wiebkei</i>)		Terrestrial	
Ko'oloa'ula (Abutilon menziesii)	Endangered	Dicot	No
(<i>Abutilon menziesii</i>)		Terrestrial	
Kopa (Hedyotis schlechtendahliana var. remyi)	Endangered	Dicot	No
(<i>Hedyotis schlechtendahliana var. remyi</i>)		Terrestrial	
Kulu'l (Nototrichium humile)	Endangered	Dicot	Yes
(<i>Nototrichium humile</i>)		Terrestrial	
Laukahi Kuahiwi (Plantago princeps)	Endangered	Dicot	Yes
(<i>Plantago princeps</i>)		Terrestrial	
Lysimachia lydgatei (ncn)	Endangered	Dicot	Yes
(<i>Lysimachia lydgatei</i>)		Terrestrial	
Lysimachia maxima (ncn)	Endangered	Dicot	Yes
(<i>Lysimachia maxima</i>)		Terrestrial	
Mahoe (Alectryon macrococcus)	Endangered	Dicot	Yes
(<i>Alectryon macrococcus</i>)		Terrestrial	
Makou (Peucedanum sandwicense)	Threatened	Dicot	Yes
(<i>Peucedanum sandwicense</i>)		Terrestrial	
Ma'o Hau Hele (Hibiscus brackenridgei)	Endangered	Dicot	Yes
(<i>Hibiscus brackenridgei</i>)		Terrestrial	
Mehamehame (Flueggea neowawraea)	Endangered	Dicot	Yes
(<i>Flueggea neowawraea</i>)		Terrestrial	
Na'ena'e (Dubautia plantaginea ssp. humilis)	Endangered	Dicot	Yes
(<i>Dubautia plantaginea ssp. humilis</i>)		Terrestrial	
Na'u (Gardenia brighamii)	Endangered	Dicot	No
(<i>Gardenia brighamii</i>)		Terrestrial	
Naupaka, Dwarf (Scaevola coriacea)	Endangered	Dicot	No
(<i>Scaevola coriacea</i>)		Terrestrial	
Nehe (Lipochaeta kamolensis)	Endangered	Dicot	Yes
(<i>Lipochaeta kamolensis</i>)		Terrestrial	
Neraudia sericea (ncn)	Endangered	Dicot	Yes
(<i>Neraudia sericea</i>)		Terrestrial	
Nohoanu (Geranium multiflorum)	Endangered	Dicot	Yes
(<i>Geranium multiflorum</i>)		Terrestrial	
'Oha Wai (Clermontia lindseyana)	Endangered	Dicot	Yes
(<i>Clermontia lindseyana</i>)		Terrestrial	
'Oha Wai (Clermontia oblongifolia ssp. brevipes)	Endangered	Dicot	Yes
(<i>Clermontia oblongifolia ssp. brevipes</i>)		Terrestrial	
'Oha Wai (Clermontia oblongifolia ssp. mauiensis)	Endangered	Dicot	Yes
(<i>Clermontia oblongifolia ssp. mauiensis</i>)		Terrestrial	
'Oha Wai (Clermontia samuelii)	Endangered	Dicot	Yes
(<i>Clermontia samuelii</i>)		Terrestrial	

'Ohai (<i>Sesbania tomentosa</i>) (<i>Sesbania tomentosa</i>)	Endangered	Dicot	Yes
Phyllostegia mannii (ncn) (<i>Phyllostegia mannii</i>)	Endangered	Terrestrial Dicot	Yes
Phyllostegia mollis (ncn) (<i>Phyllostegia mollis</i>)	Endangered	Terrestrial Dicot	Yes
Pilo (<i>Hedyotis mannii</i>) (<i>Hedyotis mannii</i>)	Endangered	Terrestrial Dicot	Yes
Po'e (<i>Portulaca sclerocarpa</i>) (<i>Portulaca sclerocarpa</i>)	Endangered	Terrestrial Dicot	Yes
Pua'ala (<i>Brighamia rockii</i>) (<i>Brighamia rockii</i>)	Endangered	Terrestrial Dicot	Yes
Remya, Maui (<i>Remya mauiensis</i>)	Endangered	Terrestrial Dicot	Yes
Sandalwood, Lanai (=Iliahi) (<i>Santalum freycinetianum</i> var. <i>lanaiense</i>)	Endangered	Terrestrial Dicot	No
Sanicula purpurea (ncn) (<i>Sanicula purpurea</i>)	Endangered	Terrestrial Dicot	Yes
Schiedea haleakalensis (ncn) (<i>Schiedea haleakalensis</i>)	Endangered	Terrestrial Dicot	Yes
Schiedea lydgatei (ncn) (<i>Schiedea lydgatei</i>)	Endangered	Terrestrial Dicot	Yes
Schiedea sarmentosa (ncn) (<i>Schiedea sarmentosa</i>)	Endangered	Terrestrial Dicot	Yes
Silene alexandri (ncn) (<i>Silene alexandri</i>)	Endangered	Terrestrial Dicot	Yes
Silene lanceolata (ncn) (<i>Silene lanceolata</i>)	Endangered	Terrestrial Dicot	Yes
Silversword, Haleakala ('Ahinahina) (<i>Argyroxiphium sandwicense</i> ssp. <i>macrocephalum</i>)	Threatened	Terrestrial Dicot	Yes
Silversword, Mauna Kea ('Ahinahina) (<i>Argyroxiphium sandwicense</i> ssp. <i>sandwicense</i>)	Endangered	Terrestrial Dicot	No
Spermolepis hawaiiensis (ncn) (<i>Spermolepis hawaiiensis</i>)	Endangered	Terrestrial Dicot	Yes
Stenogyne bifida (ncn) (<i>Stenogyne bifida</i>)	Endangered	Terrestrial Dicot	Yes
Tetramolopium capillare (ncn) (<i>Tetramolopium capillare</i>)	Endangered	Terrestrial Dicot	Yes
Tetramolopium remyi (ncn) (<i>Tetramolopium remyi</i>)	Endangered	Terrestrial Dicot	Yes
Tetramolopium rockii (ncn) (<i>Tetramolopium rockii</i>)	Threatened	Coastal (neritic), Terrestrial Dicot	Yes
Uhiuhi (<i>Caesalpinia kavaensis</i>) (<i>Caesalpinia kavaensis</i>)	Endangered	Terrestrial Dicot	No
Ulihi (<i>Phyllostegia glabra</i> var. <i>lanaiensis</i>) (<i>Phyllostegia glabra</i> var. <i>lanaiensis</i>)	Endangered	Terrestrial Dicot	No
Vigna o-wahuensis (ncn) (<i>Vigna o-wahuensis</i>)	Endangered	Terrestrial Dicot	Yes
Viola lanaiensis (ncn) (<i>Viola lanaiensis</i>)	Endangered	Terrestrial Dicot	No
Moth, Blackburn's Sphinx	Endangered	Insect	Yes

(<i>Manduca blackburni</i>)		Terrestrial	
Bat, Hawaiian Hoary	Endangered	Mammal	No
(<i>Lasiurus cinereus semotus</i>)		Terrestrial, Subterraneous	
Gahnia Lanaiensis (ncn)	Endangered	Monocot	No
(<i>Gahnia lanaiensis</i>)		Terrestrial	
Hilo Ischaemum (Ischaemum byrone)	Endangered	Monocot	Yes
(<i>Ischaemum byrone</i>)		Terrestrial	
Kamanomano (Cenchrus agrimonioides)	Endangered	Monocot	Yes
(<i>Cenchrus agrimonioides</i>)		Terrestrial	
Lo`ulu (Pritchardia munroi)	Endangered	Monocot	Yes
(<i>Pritchardia munroi</i>)		Terrestrial	
Mariscus fauriei (ncn)	Endangered	Monocot	Yes
(<i>Mariscus fauriei</i>)		Terrestrial	
Mariscus pennatiformis (ncn)	Endangered	Monocot	Yes
(<i>Mariscus pennatiformis</i>)		Terrestrial	
Panicgrass, Carter's (Panicum fauriei var.carteri)	Endangered	Monocot	Yes
(<i>Panicum fauriei var. carteri</i>)		Terrestrial	
Platanthera holochila (ncn)	Endangered	Monocot	Yes
(<i>Platanthera holochila</i>)		Terrestrial	
Sea turtle, green	Endangered	Reptile	No
(<i>Chelonia mydas</i>)		Saltwater	
Sea turtle, hawksbill	Endangered	Reptile	Yes
(<i>Eretmochelys imbricata</i>)		Saltwater	

Nevada (10) species:

		<u>Taxa</u>	<u>Critical Habitat</u>
Flycatcher, Southwestern Willow	Endangered	Bird	Yes
(<i>Empidonax traillii extimus</i>)		Terrestrial	
Rail, Yuma Clapper	Endangered	Bird	No
(<i>Rallus longirostris yumanensis</i>)		Terrestrial	
Chub, Bonytail	Endangered	Fish	Yes
(<i>Gila elegans</i>)		Freshwater	
Chub, Virgin River	Endangered	Fish	Yes
(<i>Gila seminuda (=robusta)</i>)		Freshwater	
Dace, Moapa	Endangered	Fish	No
(<i>Moapa coriacea</i>)		Freshwater	
Poolfish, Pahrump (= Pahrump Killifish)	Endangered	Fish	No
(<i>Empetrichthys latos</i>)		Freshwater	
Pupfish, Devils Hole	Endangered	Fish	No
(<i>Cyprinodon diabolis</i>)		Freshwater	
Sucker, Razorback	Endangered	Fish	Yes
(<i>Xyrauchen texanus</i>)		Freshwater	
Woundfin	Endangered	Fish	Yes
(<i>Plagopterus argentissimus</i>)		Freshwater	
Tortoise, Desert	Threatened	Reptile	Yes
(<i>Gopherus agassizii</i>)		Terrestrial	

Texas (7) species:

		<u>Taxa</u>	<u>Critical Habitat</u>
Toad, Houston	Endangered	Amphibian	Yes
(<i>Bufo houstonensis</i>)		Terrestrial, Freshwater	
Crane, Whooping	Endangered	Bird	Yes
(<i>Grus americana</i>)		Terrestrial, Freshwater	
Plover, Piping	Endangered	Bird	Yes

(<i>Charadrius melodus</i>)		Terrestrial	
Prairie-chicken, Attwater's Greater (<i>Tympanuchus cupido attwateri</i>)	Endangered	Bird	No
Tern, Interior (population) Least (<i>Sterna antillarum</i>)	Endangered	Bird	No
Vireo, Black-capped (<i>Vireo atricapilla</i>)	Endangered	Bird	No
Warbler (=Wood), Golden-cheeked (<i>Dendroica chrysoparia</i>)	Endangered	Bird	No

Utah (10) species:

		<u>Taxa</u>	<u>Critical Habitat</u>
Flycatcher, Southwestern Willow (<i>Empidonax traillii extimus</i>)	Endangered	Bird	Yes
Owl, Mexican Spotted (<i>Strix occidentalis lucida</i>)	Threatened	Bird	Yes
Bear-poppy, Dwarf (<i>Arctomecon humilis</i>)	Endangered	Dicot	No
Cactus, Siler Pincushion (<i>Pediocactus (=Echinocactus,=Utahia) sileri</i>)	Threatened	Dicot	No
Milk-vetch, Holmgren (<i>Astragalus holmgreniorum</i>)	Endangered	Dicot	No
Milk-vetch, Shivwits (<i>Astragalus ampullarioides</i>)	Endangered	Dicot	No
Chub, Virgin River (<i>Gila seminuda (=robusta)</i>)	Endangered	Fish	Yes
Woundfin (<i>Plagopterus argentissimus</i>)	Endangered	Fish	Yes
Prairie Dog, Utah (<i>Cynomys parvidens</i>)	Threatened	Mammal	No
Tortoise, Desert (<i>Gopherus agassizii</i>)	Threatened	Reptile	Yes

No species were selected for exclusion.

Dispersed species included in report.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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Date: September 27, 2005

MEMORANDUM

Subject: EFED Risk Assessment for the Proposed IR-4 Uses of Spinosad Products on production of non-grass animal feed, legumes grown for seed, mint, green onion, pasture and rangeland.

To: Dan Rosenblatt, RM 05 (308-9366)
Sidney Jackson, RM Team Reviewer (305-7610)
Registration Division (7505C)

From: N.E. Federoff, Wildlife Biologist, Team Leader
Larry Liu, Ph.D., Chemist
Ron Parker, Ph.D., Water Modeling
Environmental Risk Branch V
Environmental Fate and Effects Division (7507C)

Through: Mah Shamim, Ph.D., Chief
Environmental Risk Branch V
Environmental Fate and Effects Division (7507C)

The IR-4 registrations requested for spinosad products is currently being proposed for the following new uses: production of non-grass animal feed, legumes grown for seed, mint, green onion, pasture and rangeland.

Major Exposure and Risk Concerns

No acute level of concern is exceeded for freshwater or estuarine/marine fish or invertebrates. Also, no chronic levels of concern were exceeded for freshwater and estuarine/marine fish or estuarine/marine invertebrates. However, chronic RQs (1.50-2.20) for endangered and non-endangered freshwater free-swimming and sediment dwelling invertebrates exceed the LOC for mint and green onion. Also, since spinosad is toxic to honeybees, risk to beneficial terrestrial invertebrates is assumed. Low risk was found for birds, mammals and plants.

Environmental fate data and modeling results indicate that spinosad is expected to dissipate rapidly in the environment with a low potential to leach or runoff to surface water. However, if spinosad residues do reach sediment, they are likely to be moderately persistent (half-life >25 days).

Endocrine Disruption

EPA is required under the FFDCFA, as amended by FQPA, to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) “may have an effect in humans that is similar to an effect produced by a naturally-occurring estrogen, or other such endocrine effects as the Administrator may designate.” Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there was scientific basis for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC’s recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use FIFRA and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCFA authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP).

When the appropriate screening and or testing protocols being considered under the Agency’s Endocrine Disruptor Screening Program have been developed, spinosad may be subjected to additional screening and/ or testing to better characterize effects related to endocrine disruption. Possible endocrine mediated effects were found in a chronic freshwater invertebrate study with *Daphnia magna*, where a NOAEC of 0.62 ppb was established based on a statistically significant reduction in egg production at the highest concentration tested, 2.19 ppb. Egg production is an endocrine-mediated process. Also, there were increases in thyroid weights as well as increased thyroid, parathyroid and pituitary gland cell vacuolation in mammalian studies. Thus, EFED will ask for additional testing when such testing is required.

Endangered Species

The Agency’s chronic level of concern for endangered and threatened freshwater free-swimming and sediment dwelling invertebrates was exceeded for the proposed use of spinosad on mint and green onion, should exposure occur. Also, since spinosad is toxic to honeybees, risk to endangered and threatened beneficial invertebrates is assumed for all uses.

Outstanding Data Requirements

OPPTS 850.1735: Whole Sediment Acute Toxicity Invertebrates, Freshwater. This is a 28 day test that measures survival, growth and emergence of *Chironomus riparius* that have been exposed to pesticide spiked sediment. EFED is requesting this acute sediment toxicity test because spinosad is toxic to aquatic invertebrates, persistent in the environment, and binds to sediment over time.

OPPTS 850.1740: Whole Sediment Acute Toxicity Invertebrates, Estuarine and Marine -

Testing with estuarine/marine invertebrates using the TGAI is required for spinosad because it is toxic to aquatic invertebrates, persistent in the environment, binds to sediment over time. and the end-use product is expected to reach the marine/estuarine environment because of its use in coastal counties.

EFED Label Recommendations

Manufacturing Use Product

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

End Use Products

This product is toxic to aquatic invertebrates. Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high-water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Apply this product only as specified on the label.

For products applied as a foliar spray, EFED recommends the following labeling statement:

“This product is toxic to bees exposed to treatment. Do not apply this product to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period, unless the application is made in response to a public health emergency declared by appropriate state or federal authorities.”

Label statements for spray drift management:

Do not allow this product to drift onto neighboring crops or non crop areas or use in a manner or at a time other than in accordance with label directions because animal, plant or crop injury, illegal residues or other undesirable results may occur.

AVOIDING SPRAY DRIFT AT THE APPLICATION SITE IS THE RESPONSIBILITY OF THE APPLICATOR. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator is responsible for considering all these factors when making decisions. Where states have more stringent regulations, they should be observed.

Data Requirement Tables A & B

Table of Ecological Toxicity Data Requirements

Guideline #	Data Requirement	MRID #	Classification	Is more data needed?
71-1	Avian acute oral LD ₅₀ (mallard duck)	434145-29	Supplemental	No
	(bobwhite quail)	434145-28	Supplemental	No
71-2	Avian subacute dietary LC ₅₀ (bobwhite quail)	434145-31	Core	No
	(mallard duck)	434145-30	Core	No
71-4	Avian reproduction (bobwhite quail)	434145-33	Core	No
	(mallard duck)	434145-32	Core	No
72-1	Freshwater fish acute LC ₅₀₀ (rainbow trout) TGAI DEG	434441-03	Core	No
	(bluegill sunfish) TGAI	434145-34	Core	No
72-2	Freshwater invertebrate acute EC ₅₀ (daphnia) TGAI DEG	434145-37	Core	
		445977-31	Supplemental	No
		465053-12	Acceptable	No
		465053-04	Acceptable	No
		465053-07	Acceptable	No
		465053-09	Acceptable	No
OPPTS 850.1735	Acute Freshwater Invertebrate Sediment Toxicity TGAI	N/A	N/A	N/A
72-3a	Estuarine/marine fish acute LC ₅₀ (sheepshead minnow)	434145-40	Core	No
72-3b	Estuarine/marine invertebrate acute EC ₅₀ (eastern oyster)	434441-04/435712-03	Core	No
	(mysid)		Supplemental	
	(other)		434145-39	No
72-4a	Freshwater fish early life stage	434145-41	Core	No
72-4b	Freshwater invertebrate life cycle (daphnia) DEG	465053-03	Supplemental	No
		465053-06	Supplemental	No
		465053-01	Invalid	No
		465053-11	Invalid	No
72-4c	Estuarine/marine fish early life stage	444206-01	Core	No
72-4d	Estuarine/marine life cycle (mysid)	444206-02	Core	No

Table of Ecological Toxicity Data Requirements

Guideline #	Data Requirement	MRID #	Classification	Is more data needed?
OPPTS 850.1740	Acute Freshwater Invertebrate Sediment Toxicity TGAI	N/A	N/A	N/A
72-7	Aquatic Field Study	N/A	N/A	N/A
81-1	Acute mammalian oral LD ₅₀ (rat) (rat)	437707-01 434145-15	Acceptable Acceptable	No No
83-1	Mammalian Chronic (rat)	437015-06	Acceptable	No
122-1(a)	Seedling Emergence - Tier I	438488-02	Core	No
122-1(b)	Vegetative Vigor - Tier I	445977-32	Core	No
122-2	Aquatic plant algae TGAI			
			Core	No
		434145-42	Core	No
		434145-43	Core	No
		434145-44	Core	No
		434145-46	Core	No
123-2	Aquatic plant acute EC ₅₀ DEG	434145-45 465053-10 465053-08 465053-05 465053-02	Core Supplemental Supplemental Supplemental Supplemental	No No No No No
141-1	Acute honey bee contact LD ₅₀	434145-47 453408-01	Core Invalid	No No
141-2	Honey Bee Residue on Foliage	450077-01 450077-02 450077-03	Core Supplemental Invalid	No No No
141-5	Honey Bee Field Testing for Pollinators	457082-01 457088-01	Supplemental Supplemental	No No
Non- guideline	Earthworm Chronic Midge Chronic 21 day tox to Rainbow trout (DEG) 28 day Midge Sediment Chronic (DEG) 28 day Midge Sediment Chronic (DEG) 28 day Midge Sediment Chronic (DEG) 28 day Midge Sediment Chronic (DEG)	434145-48 448284-02 465053-13 465053-14 465053-15 465053-16 465053-17	Supplemental Supplemental Supplemental Supplemental Supplemental Supplemental Supplemental	No No No No No No No

Environmental Fate Data Requirements for Spinosad:

Guideline Number	Data Requirement	MRID	Study Classification	Notes
161-1 835.2120	Hydrolysis	43507301	ACCEPTABLE	Spinosad Factors A and D (2 ppm) were stable in pH 5, 7, and 9 buffers at 25 ± 1°C for 30 days.
161-2 835.2240	Photodegradation in Water	43507302	ACCEPTABLE	Aglycone ring-labeled [U- ¹⁴ C]spinosad Factor A and Factor D (2 ppm) degraded with half-lives of 0.8-0.9 days in pH 7 buffer irradiated under natural sunlight at 25 ± 1°C for 48 hours. The respective β-isomer of the 13,14-dihydro of the pseudoaglycone of each factor was identified. [U- ¹⁴ C]Spinosad Factors A and D were stable in the dark controls.
161-2 835.2240	Photodegradation in Water	44597735	UNACCEPTABLE	Spinosad Factor A (2 ppm) and Factor D (0.2 ppm) degraded with half-lives of 0.54-0.55 days in pond water (pH 9.2) irradiated outdoors under natural sunlight at 25 ± 1°C for 48 hours. Degradate Factor B in Factor A-treated pond water and N-demethyl Factor D in Factor D-treated pond water were identified. Spinosad Factors A and D were stable in the dark controls.
161-3 835.2410	Photodegradation on Soil	44597733	ACCEPTABLE	Aglycone ring-labeled [U- ¹⁴ C]spinosad Factor A (1004 g/ha) degraded with a half-life of 13.6 days in Commerce silt loam soil irradiated under natural sunlight at 25.0 ± 1.0°C for 30 days. Degradate Factor B (N-demethylated Factor A) was identified. [U- ¹⁴ C]Spinosad Factor A was stable in the dark control.
161-3 835.2410	Photodegradation on Soil	43507303	ACCEPTABLE	Aglycone ring-labeled [U- ¹⁴ C]spinosad Factor A and Factor D, at 1015 g/ha, degraded with half-lives of 74 and 41 days, respectively, in Commerce silt loam irradiated at 25.0 ± 1.0°C under natural sunlight for 30 days. Factor B (demethylated Factor A) was a minor degradate of Factor A and D1 and D2 (Compound 202149) were minor degradates of Factor D. Factors A and D were stable in the dark controls.
161-4 835.2370	Photodegradation in Air	---	WAIVED	
162-1 835.4100	Aerobic Soil Metabolism	43507304	ACCEPTABLE	Aglycone ring-labeled [U- ¹⁴ C]spinosad Factor A and Factor D, at a rate of 0.1-0.4 mg/kg, degraded with half-lives of 17.3 and 14.5 days, respectively, in Commerce silt loam, incubated in the dark at 75% of MHC and 25.0 ± 1.0°C, for 1 year posttreatment. In Hanford sandy loam, Factor A degraded with a half-life of 9.4 days. Factor B (N-demethylated Factor A) was the major degradate of Factor A and N-demethylated Factor D (the Factor D analogue of Factor B) was the major degradate of Factor D.
162-2 835.4200	Anaerobic Soil Metabolism	---	162-3 replaces	

Guideline Number	Data Requirement	MRID	Study Classification	Notes
162-3 835.4400	Anaerobic Aquatic Metabolism	43507305	ACCEPTABLE	Aglycone ring-labeled [U- ¹⁴ C]spinosad Factor A and Factor D, at a rate of 0.6 µg/mL, degraded with half-lives of 161 and 250 days, respectively, in anaerobic flooded clay sediment incubated in the dark at 25 ± 2°C for up to 1 year. Three degradates of Factor A were identified: Factor B (N-demethylated Factor A), reversepseudoaglycone (806643), and ketoreversepseudoaglycone (814426). One degradate of Factor D was identified: N-demethylated Factor D (the Factor D analogue of Factor B).
162-4 835.4300	Aerobic Aquatic Metabolism	---	N/A	
163-1 835.1240	Adsorption/Desorption	43507306	ACCEPTABLE	(Factor A) K _{oc} of sand, loamy sand, sandy loam, silt loam, and clay loam was 2,862, 831, 4,237, 134,583, and 21,938, respectively (reviewer-calculated). K _{ads} of sand, loamy sand, sandy loam, silt loam, and clay loam was 8.3, 5.4, 25, 323, and 283, respectively.
163-1 835.1240	Adsorption/Desorption	43816602	ACCEPTABLE	(Factor B) K _{oc} of sand, loamy sand, sandy loam, and silt loam was 2,138, 662, 2,881, and 74,583, respectively (reviewer-calculated values). K _{ads} of sand, loamy sand, sandy loam, and silt loam was 6.2, 4.3, 17, and 179, respectively.
163-2 835.1410	Volatility (Lab)	---	WAIVED	
163-3 835.8100	Volatility (Field)	---	WAIVED	
164-1 835.6100	Terrestrial Field Dissipation	43714301	SUPPLEMENTAL	[¹⁴ C]Spinosad Factor A, at 500 g/ha (0.45 lb a.i./A), dissipated with half-lives of 0.5 and 0.3 days on Commerce silt loam and Hanford loam soil, respectively. Degradates A0, A1, and A2, isolated in both soils, represent groups of multiple minor degradates consisting of mono-di, and tetrahydroxylated derivatives of Factor A and B.
164-2 835.6200	Aquatic Field Dissipation	---	N/A	
164-3 835.6300	Forestry Dissipation	---	N/A	
164-4 835.6400	Combination and tank mixes Dissipation	---	N/A	
164-5	TFD, long term	---	WAIVED	
165-4 850.1730	Accumulation - Laboratory Fish	43557601	SUPPLEMENTAL	Rainbow trout were exposed to aglycone ring-labeled [U- ¹⁴ C]spinosad Factor A at 19.0 or 5.0 ng/mL. Maximum BCFs for parent were 28.8, 7.5, and 21.1 mL/g for nonedible, edible, and whole fish tissues,

Guideline Number	Data Requirement	MRID	Study Classification	Notes
				respectively.
165-4 850.1730	Accumulation - Laboratory Fish	44537734	SUPPLEMENTAL	Rainbow trout were exposed to aglycone ring-labeled [U- ¹⁴ C]spinosad Factor D at 33.0 and 8.2 ng/mL. At 33.0 ng/L, maximum BCFs for parent were 42, 20.5, and 41.9 mL/g for nonedible, edible, and whole fish tissues, respectively. Major metabolites were 15-Pk4, 20-Pk4 [N-monomethylated, O-demethylated spinosad Factor D], 15-Pk6, and 20-Pk6 [N-monomethylated, O-demethylated spinosad Factor D], spinosad Factor L, and spinosad Factor O.
165-5 850.1950	Accumulation - Aquatic Nontarget	---	N/A	
166-1 835.7100	Ground Water Monitoring -Small Scale Prospective	---	N/A	
201-1 840.1100	Droplet Size Spectrum	---		
201-2 840.1200	Drift Field Evaluation	---		
Non-guideline	Aquatic microcosm dissipation	43848803	SUPPLEMENTAL	Spinosad (480 g/L suspension concentrate, ratio of A:D about 85:15) was surface-applied at 100g/ha to surface to outdoor tanks containing pond water. Parent spinosad dissipated from the water with a half-life of 1.5 days. Total spinosad residues dissipated from the water with half-life of 4 days. In the clay loam sediment, spinosad Factors A and B were maximum averages of 14.9 ppb (4 days) and 11.1 ppb (15 days), respectively; Spinosad Factor D was ≤4.2 ppb and Factor B of D was not detected. Maximum total spinosad residues in sediment were 56.0 ppb (8 days).

Environmental Fate and Ecological Risk Assessment
for the Registration of
SPINOSAD for the Proposed IR-4 Uses on Production of non-grass
Animal Feed, Legumes Grown for Seed, Mint, Green Onion, Pasture
and Rangeland.

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I. Executive Summary

No acute or chronic level of concern was exceeded for terrestrial organisms. However, since spinosad is toxic to honeybees, risk to beneficial insects is assumed.

No acute level of concern is exceeded for freshwater or estuarine/marine fish or invertebrates. Also, no chronic levels of concern were exceeded for freshwater and estuarine/marine fish or estuarine/marine invertebrates. However, chronic RQs (1.50-2.20) for freshwater free-swimming and sediment dwelling invertebrates exceed the LOC for mint and green onion. Low risk was found for terrestrial and aquatic plants.

Endangered and threatened chronic levels of concern were exceeded for freshwater invertebrates for mint and green onion uses and since spinosad is toxic to honeybees, risk to beneficial insects for all uses is possible, should exposure actually occur.

Possible endocrine mediated effects were found in a chronic freshwater invertebrate study with *Daphnia magna*, where a NOAEC of 0.62 ppb was established based on a statistically significant reduction in egg production at the highest concentration tested (2.19 ppb). Egg production is an endocrine-mediated process. Also, there were increases in thyroid weights as well as increased thyroid, parathyroid and pituitary gland cell vacuolation in mammalian studies. Thus, EFED will ask for additional testing when such testing is required.

II. Physical/Chemical Properties Characterization

Pesticide Type, Class, Mode of Action

Spinosad belongs to the class of microbial insecticides. It is a secondary metabolite from the aerobic fermentation of *S. spinosa* on nutrient media. Spinosad is a mixture of two active naturally occurring metabolites (Spinosad Factors A and D) produced by the actinomycetes *Saccharopolyspora spinosa*. The IUPAC chemical name of Spinosad Factor A is: (2R,3aS,5aR,5bS,9S,13S,14R,16aS,16bR)-2-(6-deoxy-2,3,4-tri-O-methyl- α -L-mannopyranosyloxy)-13-(4-dimethylamino-2,3,4,6-tetra-deoxy- β -D-erythro-pyranosyloxy)-9-ethyl-2,3,3a,5a,6,7,9,10,11,12,13,14,15,16a,16b-hexadecahydro-14-methyl-1H-8-oxacyclododeca[b]as-indacene-7,15-dione. The IUPAC chemical name of Spinosad Factor D is: (2R,3aS,5aR,5bS,9S,13S,14R,16aS,16bR)-2-(6-deoxy-2,3,4-tri-O-methyl- α -L-mannopyranosyloxy)-13-(4-dimethylamino-2,3,4,6-tetra-deoxy- β -D-erythro-pyranosyloxy)-9-ethyl-2,3,3a,5a,6,7,9,10,11,12,13,14,15,16a,16b-hexadecahydro-4,14-dimethyl-1H-8-oxacyclododeca[b]as-indacene-7,15-dione. Trade names include Tracer, Naturalyte, and SpinTor. The primary mode of action of spinosad is the excitation of the neurons in the central nervous system. Spinosad causes involuntary muscle contractions and tremors by widespread excitation of motor neurons. The prolonged hyperexcitation causes neuromuscular fatigue, resulting in paralysis. Within minutes of field application, insects are paralyzed and feeding ceases. Spinosad has limited translaminar movement in leaf tissue; however, the addition of a penetrating surfactant increases translaminar movement and activity on pests that forage leaves.

III. Use Characterization

Application Rates

The following table is a summary of the rates for the proposed uses submitted to EFED by RD.

Use of Spinosad on various crops for this assessment.					
Crop	Appl. Rate (lb ai/A)	Max # Appl	Max Yr. Rate (lbs ai/A)	Min. Interval (days)	Application Methods
Mint	0.062-0.156	3	0.450	5	aerial or ground
Green onion	0.047-0.094	5	0.450	5	aerial or ground
Grass Forages, Grass Grown for Seed, Pastures and Rangeland	0.031-0.062	6	0.186	7	aerial or ground
Legume Forage Hay and Alfalfa Seed	0.031-0.062	6	0.186	7	aerial or ground

IV. Problem Formulation

The planning stage for an ecological risk assessment entails initial discussions between risk assessor and risk manager in order to define time lines, management goals, and the problem formulation. The management goals for the registration of the new uses of Spinosad is the protection of terrestrial and aquatic environments from unreasonable adverse effects (death or injury).

Problem formulation is the critical first step in establishing the direction and scope of an ecological risk assessment. Part A of the Guidelines for Ecological Risk assessment states that “in problem formulation, the purpose for the assessment is articulated, the problem defined, and a plan for analyzing and characterizing risk is determined.” The analysis plan and rationale for developing a risk assessment for Spinosad is an iterative procedure for determining if the proposed new uses of this compound could result in residue exposure that has the potential for unreasonable adverse effects (risk) to non-target organisms, as well as endangered/threatened organisms. The portion of the problem formulation which is an explicit statement of the characteristic of the environment to be protected is encompassed in a delineation of endpoints. These endpoints can include a particular species, a functional group of species, a community, or an ecosystem.

Environmental fate data and modeling results indicate that spinosad can be expected to dissipate rapidly in the environment with low potential to impact water resources. In the case of this assessment, EFED relied on the hazard assessment which considers standard single chemical toxicity testing (acute and chronic endpoints) submitted by the registrant and reviewed by the Agency. EFED used this information for selection of the most sensitive species tested in order to

generate RQ values. Effects data are included under the section “Characterization of Ecological Effects,” and represent registrant submitted data. The effects database is mostly complete for freshwater and estuarine/marine aquatic organisms and thus is suitable for a screening level risk assessment. The possible major endpoints related to aquatic environments at issue are:

- (a). Direct effects to aquatic invertebrates in the water column via acute toxicity.
- (b). Direct effects to benthic aquatic organisms dwelling in the sediment and/or pore water via acute and/or chronic toxicity.
- (c). Indirect effects to benthic community assemblages (i.e. reductions in diversity and abundance) dwelling in the sediment and/or pore-water.
- (d). Indirect effects to aquatic ecosystems from benthic community disturbances.

In addition to the concern for aquatic ecosystems, EFED is also concerned with potential impacts to terrestrial species and functional groups, including pollinators; nectar and fruit eating birds, mammals, and insects; and soil-inhabiting invertebrates and mammals (i.e. earthworms, burrowing mammals). Available effects data are included under the section “Characterization of Ecological Effects,” and represent registrant submitted data. Although EFED does not conduct RQ based risk assessments on beneficial insects, there is potential for direct toxic effects to honey bees as suggested by the toxicity data. The terrestrial effects database for these species and functional groups is incomplete and thus recommendations are made for additional studies or assessments to fill data gaps needed for a suitable screening level risk assessment. The possible major endpoints related to terrestrial environments are:

- (a). Direct effects to mammals, insects, and soil invertebrates via acute toxicity.
- (b). Direct effects on reproduction to birds (eggshell thinning, etc), mammals, and insects via chronic toxicity.
- (c). Direct effects to insects via toxicity of residues on foliage.
- (d). Direct effects to foraging activity of pollinators
- (e). Indirect effects from soil ecosystem alterations
- (f). Indirect effects from reduced crop yield from impact to pollinators.

Problem formulation focused mainly on laboratory and field studies which indicate that spinosad’s potential to contaminate surface water and ground water is relatively low. Thus, the initial emphasis of the screening risk assessment was primarily about possible risk to freshwater and estuarine/marine fish and invertebrates as well as to terrestrial birds, mammals, and invertebrates and beneficial insects which may be exposed to Spinosad after applications.

Toxicity Profiles

Terrestrial Species

Spinosad is categorized as slightly toxic to avian species on an acute oral basis. Both the mallard duck and the bobwhite quail LD_{50} s are >1333 mg/kg (MRIDs 434145-28 and 434145-29). Spinosad is categorized as practically nontoxic to avian species on a subacute dietary basis. Both the mallard duck and the bobwhite quail LC_{50} are >5156 ppm (MRIDs 434145-28 and 434145-29). Reproductive parameters (eggs laid, live 3-week embryos, normal hatchlings, 14 day-old survivors, etc.) were significantly reduced in both mallard ducks and bobwhite quail at 1100 ppm (MRIDs 434145-32 and 434145-33). The NOAEC for both species is 550 ppm.

Based on mammalian data in Hazard Evaluation Division's toxicity one-liner database, the rat acute oral LD_{50} is >5000 mg/kg, categorizing spinosad as practically non-toxic to small mammals. A reproductive study with rats identified a NOAEC of 200 ppm or 10 mg/kg/day, based on reproductive toxicity (reduced litter size, offspring body weights, and survival of F2 generation) at 2000 ppm.

Developmental studies with rats and rabbits showed no evidence of toxicity. The NOAEC in the rat study (MRID 435575-05) was ≥ 4000 ppm or ≥ 200 mg/kg/day, the highest dose tested. The NOAEC in the rabbit study (MRID 434145-21) was ≥ 1650 ppm or ≥ 50 mg/kg/day.

No toxicity was shown to earthworms in soil (based on reduction in biomass). The 14-day LC_{50} was >970 mg/kg (MRID 434145-48).

Acute contact toxicity tests showed that spinosad is highly toxic toward honey bees when exposed to the TGAI. The LD_{50} is 0.0029 μ g formulation/bee for the TGAI (MRID 434145-47). Data were submitted on the toxicity of formulated product residues on foliage toward honey bees (MRID 450077-01). The residual time required to reduce the activity of spinosad and elicit 25% mortality in caged bees exposed to field-weathered spray deposits (RT_{25}) was less than three hours at a single application rate of 0.16 lb/A.

Tier I studies were submitted for seedling emergence and vegetative vigor testing. The TGAI or formulated product caused no phytotoxic effects greater than 25% (based on shoot weight and shoot length) for all terrestrial plant species tested (cucumber, oat, onion, radish, soybean, sunflower, tomato, wheat, carrot, and corn). Both studies estimated the EC_{25} at a level greater than the single dose rate (>0.178 lb/A for TGAI-MRID 438488-02) and (>0.5 lb/A for the formulated product [44.2%]-MRID 445977-32). Based on these results, terrestrial plant risk is considered minimal, and further plant tests (Tier II) are not required.

Aquatic species

Spinosad is slightly toxic to rainbow trout (MRID 43444103) and moderately toxic to bluegill sunfish (MRID 434145-34) on an acute basis. The rainbow trout LC_{50} is 30.0 mg/L and the bluegill sunfish LC_{50} is 5.94 mg/L for the technical grade active ingredient (TGAI). Data were submitted for the freshwater fish early life-stage test using rainbow trout (MRID 434145-41). Significant reductions occurred in mean hatch at 0.962 ppm, survival (at 1.89 ppm), and length and weight (at 3.76 ppm). The NOAEC is 0.498 ppm.

Spinosad is categorized as moderately toxic to estuarine fish on an acute basis. The sheepshead minnow LC₅₀ is 7.87 ppm for the TGAI (MRID 434145-40). Data were submitted for the estuarine fish early life-stage test using sheepshead minnow (MRID 444206-01). Spinosad reduced fish growth at 2.38 ppm. The NOAEC is 1.15 ppm.

The TGAI of spinosad is slightly toxic to freshwater invertebrates on an acute basis (*Daphnia magna* EC₅₀ is 14.0 mg/L; MRID 434145-37 & 435712-02). Spinosad Factor B (the major transformation product of Factor A), is moderately toxic to daphnids on an acute basis (EC₅₀ is 6.39 mg/L; MRID 44597731). Data were submitted for a chronic test with *Daphnia magna* (MRID 438488-01). Spinosad reduced daphnid growth at 0.00115 ppm and reproduction at 0.00219 ppm. The NOAEC is 0.00062.

Spinosad is categorized as highly toxic to mollusks on an acute basis. The Eastern oyster EC₅₀ is 0.3 ppm (MRID 435712-03) for the TGAI. The EC₅₀ for the mysid is >9.76 ppm. Data were submitted for the estuarine invertebrate life-cycle study using mysid shrimp (MRID 444206-02). Spinosad reduced the number of young per female after 28 days of exposure at 0.173 ppm. The NOAEC is 0.0842 ppm.

Data were submitted to assess the toxicity of spinosad in sediment to chironomid larvae (MRID 448284-02). Spinosad reduced adult emergence at 0.001328 ppm. The NOAEC is 0.000622 ppm.

Four other non-guideline 28-day chronic studies (MRIDs 465053-14, -15, -16 and -17) of toxicity to midge larvae, *Chironomus riparius*, were submitted. The tests were conducted under static conditions in overlying water-spiked exposures (sediment was not spiked). Endpoints assessed included development rate (male, female, and combined sexes) and percent emerged (combined sexes). The results were as follows:

MRID 465053-14. Spinosyn A. No, statistically significant reductions ($p < 0.05$) in treatment male and female development rates compared to the pooled control were identified at any treatment level tested. No, statistically significant ($p < 0.05$) or biologically significant reductions in treatment male and female developments rates and percent emerged compared to the pooled control were identified at any treatment level tested. No additional sub-lethal effects (abnormal behavior) were reported for the controls or treatment groups during the exposure period. Consequently, the 28 Day NOAEC, LOAEC, and EC₅₀ for development rate (male and female) and percent emerged were 0.0734, >0.0734, and >0.0734 ppm metabolite, respectively, based on the mean-measured pore water treatment concentrations.

MRID 465053-15. N-demethylated Spinosyn D. Since development rates were not significantly reduced compared to the pooled control at any level tested, the Day-28 NOAEC, LOAEC and EC₅₀ for development rates (male, female, and combined sexes) was 0.14, >0.14, and >0.14 ppb a.i., respectively, based on the mean-measured pore water treatment concentrations. No additional sub-lethal effects (abnormal behavior) were reported for the controls or treatment groups during the exposure period.

MRID 465053-16. β -13,14-Dihydropseudoaglycone of Spinosyn D. No, statistically significant ($p < 0.05$) or biologically significant reductions in treatment male and female development rates and percent emerged compared to the pooled control were identified at any treatment level tested. No additional sub-lethal effects (abnormal behavior) were reported for the controls or treatment groups during the exposure period. Consequently, the 28 Day NOAEC, LOAEC, and EC_{50} for development rate (male and female) and percent emerged were 0.0388, >0.0388 , and >0.0388 ppm metabolite, respectively, based on the mean-measured pore water treatment concentrations.

MRID 465053-17. Spinosyn B. Development rates were not significantly reduced compared to the pooled control at any level tested, the Day-28 NOAEC, LOAEC and EC_{50} for development rates (male, female, and combined sexes) was 0.41, >0.41 , and >0.41 ppb a.i., respectively, based on the mean-measured pore water treatment concentrations. No additional sub-lethal effects (abnormal behavior) were reported for the controls or treatment groups during the exposure period.

The freshwater diatom, *Navicula pelliculosa*, is the most sensitive nonvascular aquatic species (EC_{50} of 0.089 ppm) in Tier II aquatic non-vascular plant tests. The vascular plant (duckweed) EC_{50} is 10.6 ppm.

V. Analysis

Analysis is a process that examines the two primary components of risk, exposure and effects, and their relationships between each other and site characteristics. The objective is to provide the ingredients necessary for determining or predicting ecological responses to pesticide uses under exposure conditions of interest. The products of analysis provide the basis for estimating and describing risks in risk characterization.

Tier I Aquatic Assessment

Risk Conclusions

EFED found chronic risk to free-swimming and sediment dwelling freshwater invertebrates (Chronic RQ range 1.50-2.20) and low risk to freshwater or estuarine/marine fish or estuarine/marine invertebrates. Low risk was also found for aquatic plants.

The Tier II PRZM/EXAMS standard ecological assessment pond modeling scenario was used to generate expected environmental concentrations to estimate exposure to aquatic organisms.

Tier II PRZM/EXAMS Surface Water EECs for Spinosad

Crop	Application Rate lb a.i./A	Number of Applications (Interval)	Acute Conc g/L	96 Hour Conc g/L	21 Day Conc g/L	60 Day Conc g/L
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Legume Forage Hay and Alfalfa Seed	0.031-0.062	6/7da	0.27	0.24	0.20	0.16
Grass Forages, Grass Grown for Seed, Pastures and Rangeland	0.031-0.062	6/7da	0.27	0.24	0.20	0.16
Mint	0.062-0.156	3/5da	1.31	1.15	0.87	0.59
Bulb Vegetables (Green Onions)	0.047-0.094	5/5da	2.15	1.91	1.32	1.12

Selection of Aquatic Toxicological Endpoints Used to Calculate Risk Quotients for Spinosad				
Type of Toxicity	Organism	Species	Toxicological Endpoint	MRID #
Acute	Freshwater Fish	Bluegill sunfish	5.94 ppm	434145-34
Chronic		Rainbow trout	0.498 ppm	434145-41
Acute	Freshwater Invertebrates	Daphnid	14 ppm	434145-37
Chronic		Daphnid	0.0006 ppm	438488-01
Acute	Estuarine Fish	Sheepshead minnow	7.87 ppm	434145-40
Chronic		Sheepshead minnow	1.15 ppm	444206-01
Acute	Estuarine Invertebrates	Eastern oyster	0.3 ppm	434441-04
Chronic		Mysid	0.0842 ppm	444206-02
Plants	Freshwater Diatom	Diatom	0.09 ppm	434145-43

Terrestrial Exposure and Risk Assessment

Risk Conclusions

EFED found low risk to birds and small mammals. No endpoints were affected in the studies.

For spinosad use on registered sites, terrestrial exposure is normally evaluated using estimated environmental concentrations generated from FATE5 or T-REX, spreadsheet-based models that calculate the decay of a chemical applied to foliar surfaces for single and multiple applications. The models assume initial concentrations on plant surfaces for single and multiple applications.

The models assume initial concentrations on plant surfaces based on Kenaga predicted maximum residues as modified by Fletcher, *et al.* (1994) and assumes 1st order dissipation.

To assess acute risk in birds and mammals, EECs on food items following product application were compared to LC₅₀ values. To assess chronic risk in birds and mammals, EECs were compared to the NOAEC values.

Selection of Terrestrial Toxicological Endpoints Used to Calculate Risk Quotients for Spinosad				
Type Of Toxicity	Organism	Species	Toxicological Endpoint	MRID #
Oral Acute		Bobwhite/Mallard	1333 mg/kg	434145-29/ 434145-28
Dietary	Bird	Bobwhite/Mallard	>5156 ppm	434145-31/ 434145-30
Chronic		Bobwhite/Mallard	550 ppm	434145-33/ 434145-32
Oral Acute		Rat	LOAEL >5000 ppm ¹	437015-01
Chronic	Mammal	Rat	NOAEL >1100 ppm ²	437015-06

¹Increased heart, kidney, liver, spleen, and thyroid weights (both sexes); corroborative histopathology in the spleen and thyroid (both sexes), heart and kidney (males only), and histopathologic lesions in the lungs and mesenteric lymph nodes (both sexes), stomach (females only), and prostate.

²Decreases in litter size, survival (F2 litters only), offspring body weights, and increased incidence of dystocia and/or vaginal bleeding after parturition with associated increases in dam mortality.

Environmental Fate Characterization

Summary

Environmental fate data and modeling results indicate that spinosad can be expected to dissipate rapidly in the environment with a low potential to impact water resources. Spinosad Factors A and D degrade in aerobic laboratory soil with half-lives of approximately 9-17 days. They photodegrade readily in sterile water (<1 day at pH 7) and on soil (about 10 days). Spinosad Factor A has a low to moderate water solubility and a low to slight mobility in sandy soils, and is immobile in silt loam and clay loam soils. Although no mobility data are available for Spinosad Factor D, it is 180x less soluble than Factor A and therefore would be expected to be less likely to leach in the soil. In terrestrial field dissipation studies with Spinosad Factor A on bareground plots, the half-life was <1 day, no leaching was observed, and 3.1% of the applied was recovered in runoff.

Although spinosad photodegrades rapidly in water, it is persistent in sediment. Spinosad has a high affinity for sediment and moves rapidly from the water to the sediment phases. In

anaerobic aquatic metabolism studies, spinosad had a half-life of 161-250 days. In an aquatic microcosm dissipation outdoor study, spinosad residues in the sediment peaked at 8 days and had an observed half-life of $\gg 25$ days. Spinosad has a relatively low bio-concentration factor (BCF's of the parent 7.5X, 28.8X, and 21.1X for muscle, viscera, and whole fish, respectively), and a relatively rapid rate of depuration (half-life of about one day). These factors generally would prevent substantial bio-concentration of the material in the food web.

Degradation and Metabolism

Spinosad Factors A and D were relatively stable in pH 5, 7, and 9 sterile aqueous buffer solutions that were incubated in the dark at 25°C.

In sterile buffered (pH 7) solutions, Spinosad Factors A and D photodegraded with half-lives of 0.8-0.9 days. The β -isomers of the 13,14-dihydro of the pseudoaglycone of Factor A and of Factor D were detected at a maximum of 20.2-24.9% of the applied at 48 hours (study termination). In alkaline (pH 9.2) pond water, Factors A and D degraded rapidly with half-lives of 0.54-0.55 days. On soil, Factors A and D had photodegradation half-life of 8.68-9.71 days. The only degradate present at $>5\%$ of the applied was Factor B (N-demethylated Factor A), which reached 14.8% of the applied at 18 days posttreatment.

In aerobic silt loam soil, Spinosad Factors A and D degraded with initial half-lives of 17.3 and 14.5 days, respectively. Factor A degraded with a half-life of 9.4 days in sandy loam soil incubated under similar conditions. Approximately 75-90% of the applied spinosad dissipated by 28 days. The major degradate of Factor A was Factor B (N-demethylated Factor A), which accumulated to a maximum 51-61% of the applied at 14-28 days posttreatment, then decreased to 12.27-21.72% at 9 months and 2.77-5.96% at 1 year. The major degradate of Factor D was N-demethylated Factor D (the Factor D analogue of Factor B), which accumulated to a maximum 68% of the applied at 28 days posttreatment and approximately 50% at 6 months. Several minor degradates, each $<10\%$ of the applied, were isolated but not conclusively identified.

In anaerobic flooded clay sediment, Factors A and D degraded with half-lives of 161 and 250 days. By 7 days posttreatment, $>90\%$ of the applied radioactivity was associated with the sediment fraction. Three major degradates of Factor A, each present at a maximum 8-12% of the applied, were identified: Factor B (N-demethylated Factor A), reversepseudoaglycone (806643), and ketoreversepseudoaglycone (814426). One major degradate of Factor D, N-demethylated Factor D (the Factor D analogue of Factor B), was present at a maximum 6.5% of the applied.

The mobility of Factor A is expected to be very low. At nominal concentrations of 0.04-5.0 $\mu\text{g/mL}$, it was investigated in sand, loamy sand, sandy loam, silt loam, and clay loam soils. K_{oc} values were 2,862, 831, 4,237, 134,583, and 21,938, respectively. Freundlich K_{des} values for both desorption phases for the sand, loamy sand, sandy loam, and silt loam soils were 8.4-9.2, 6.6-8.2, 27-30, 288-357 and 292-296, respectively; corresponding $1/n$ values ranged from 0.826-0.921. The reviewer-calculated coefficients of determination (r^2) for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.0647, 0.0498, and 0.8114, respectively.

Soil sorption and mobility

The mobility of Factor B, the major degradate of Factor A, is expected to be very low. It was investigated at 0.05-5.0 µg/mL in sand, loamy sand, sandy loam, and silt loam soils. K_{oc} values were 2,138, 662, 2,881, and 74,583, respectively. Freundlich K_{des} values for both desorption phases for the sand, loamy sand, sandy loam, and silt loam soils were 6.3-6.5, 5.3-6.3, 19-20, and 171-179, respectively; corresponding $1/n$ values ranged from 0.775-0.880. The reviewer-calculated coefficients of determination (r^2) for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.425, 0.235 and 0.957, respectively.

Factors A and D are not volatile; vapor pressures (25°C) are 2.0 to 3.0 x 10⁻¹¹ kPa. CO₂ was the only volatile compound detected in metabolism studies.

Field dissipation

Factor A, formulated as an emulsifiable concentrate, degraded with half-lives of 0.5 days in bareground plots of silt loam soil in Mississippi and 0.3 days in loam soil in California. Approximately 2-3% remained after 3-5 days. No degradates were identified. Spinosad Factor A and its degradates were not detected below the 6-inch soil depth. Unextracted [¹⁴C]residues increased to a maximum of 34-58% by 38-40 days. At the Mississippi site, total radioactivity in the runoff accounted for 3.1% of the applied radioactivity.

Pond water (pH 7.6, ca. surface area 2.2 m², depth 47.5-50 cm) and clay loam sediment (ca. depth 5.5-6 cm) maintained in outdoor tanks were treated once with a broadcast-spray application of the suspension concentrate at 100 g/ha to the water surface. Spinosad (Factors A + D) dissipated rapidly from the water with a calculated half-life of 1.5 days, and total spinosad residues dissipated from the water with a calculated half-life of 4 days. In the water, the degradates Factors B and B of D were detected at maximums of 2.3 ppb (8 hours) and 3.6 ppb (0 hour), respectively, and were <0.5 ppb at 15 days. In the sediment, Factor A was detected at a maximum average 14.9 ppb at 4 days and was 14.3 ppb at 35 days. Factor B was detected at a maximum average 11.1 at 15 days and was ≤9.4 ppb at 35 days. Factors D was ≤4.2 ppb and B of D was not detected (LOD 11.3 ppb) at any interval in the sediment. Total spinosad residues in the water had an observed half-life of <1 days. Total spinosad residues in the sediment reached a maximum concentration at 8 days posttreatment and had decreased by approximately 25% by 35 days.

Accumulation

[¹⁴C]Factors A and D accumulated at low concentrations in rainbow trout held under laboratory flow-through conditions for up to 28 days. In the high concentration experiments (19.0 ng/L for Factor A and 33.0 ng/L for Factor D), maximum BCFs for Factor A were 28.8 mL/g (at Day 28) for the nonedible tissue, 7.5 mL/g (at Day 25) for the edible tissue, and 21.1 mL/g (at Day 7) for the whole fish tissue; and for Factor D were 42 mL/g (at Day 11) for the nonedible tissue, 20.5 mL/g (at Day 11) for the edible tissue, and 41.9 mL/g (at Day 7) for the whole fish tissue. Registrant-calculated BCFs for total [¹⁴C]residues were 103-152, 16-47, and 84-115 mL/g for the nonedible, edible, and whole fish tissues, respectively.

Aglycone ring-labeled [U-¹⁴C]spinosad Factor D, at 33.0 and 8.2 ng/mL, accumulated at low

concentrations in rainbow trout held under laboratory flow-through conditions for up to 28 days. BCFs for total [¹⁴C]residues were 118-142, 32-47, and 100-115 mL/g for the nonedible, edible, and whole fish tissues, respectively.

Aquatic Exposure Characterization

Estimated Environmental Concentrations (EECs) for Aquatic Ecological Effects

The Tier II PRZM/EXAMS MS POND modeling scenario was used to generate expected environmental concentrations to estimate exposure to aquatic organisms.

Surface water EECs (ppm) for ecological risk assessment of Spinosad.						
Crop	Application rate (lbs ai/A)	Number of applications	Peak (ppm)	21 day (ppm)	60 day (ppm)	
Legume Forage Hay and Alfalfa Seed	0.031	6	0.0003	0.0002	0.00016	
Grass Forages, Grass Grown for Seed, Pastures and Rangeland	0.031	6	0.0003	0.0002	0.00016	
Mint	0.150	3	0.00131	0.0009	0.0006	
Bulb Vegetables (Green onions)	0.090	5	0.00215	0.00132	0.00112	

VI. Risk Characterization

Risk Estimation

A means of integrating the results of exposure and eco-toxicity data is called the deterministic method. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by eco-toxicity values, both acute and chronic.

$$RQ = \text{EXPOSURE}/\text{TOXICITY}$$

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action.

The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on non-target organisms. LOCs currently address the following risk presumption categories: (1) **acute high** - potential for acute risk is high, regulatory action may be warranted in addition to restricted use classification (2) **acute restricted use** - the potential for acute risk is high, but this may be mitigated through restricted use classification (3) **acute endangered species** - the potential for acute risk to endangered species is high, regulatory action may be warranted, and (4) **chronic risk** - the potential for chronic risk is high, regulatory action may be warranted. Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to non-target insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The eco-toxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of eco-toxicity values derived from the results of short-term laboratory studies that assess acute effects are: (1) LC50 (fish and birds) (2) LD50 (birds and mammals) (3) EC50 (aquatic plants and aquatic invertebrates) and (4) EC25 (terrestrial plants). An example of a toxicity test effect level derived from the results of long-term laboratory studies that assess chronic effects is: (1) NOAEC (birds, fish and aquatic invertebrates).

Risk presumptions, along with the corresponding RQs and LOCs are tabulated below:

<i>Risk Presumptions for Terrestrial Animals</i>		
<i>Risk Presumption</i>	<i>RQ</i>	<i>LOC</i>
Birds:		
Acute High Risk	EEC ¹ /LC50 or LD50/sqft ² or LD50/day ³	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOAEC	1
Wild Mammals:		
Acute High Risk	EEC/LC50 or LD50/sqft or LD50/day	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOAEC	1

EEC=abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items
 $\frac{\text{mg}/\text{ft}^2}{\text{LD50} * \text{wt. of bird}}$ $\frac{\text{mg of toxicant consumed}/\text{day}}{\text{LD50} * \text{wt. of bird}}$

Risk Presumptions for Aquatic Animals

<i>Risk Presumption</i>	<i>RQ</i>	<i>LOC</i>
Acute High Risk	EEC ¹ /LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/MATC or NOAEC	1

¹ EEC = (ppm or ppb) in water

<i>Risk Presumptions for Plants</i>		
<i>Risk Presumption</i>	<i>RQ</i>	<i>LOC</i>
Terrestrial and Semi-Aquatic Plants:		
Acute High Risk	EEC ¹ /EC25	1
Acute Endangered Species	EEC/EC05 or NOAEC	1
Aquatic Plants:		
Acute High Risk	EEC ² /EC50	1
Acute Endangered Species	EEC/EC05 or NOAEC	1

¹ EEC = lbs ai/A

² EEC = (ppb/ppm) in water

Aquatic Risk Quotients and Comparison to LOCs

Exposure and Risk to Nontarget Freshwater Aquatic Animals

Non-target aquatic organisms (freshwater and estuarine/marine fishes and invertebrates) can be exposed to spinosad by spray drift and runoff into surface water.

The risk quotients for freshwater fish and invertebrates are tabulated below.

RQs for Freshwater Fish Based On a Bluegill LC50 of 5.94 ppm and a Rainbow Trout NOAEC of 0.498 ppm

Site	LC50 (ppm)	NOAEC (ppm)	EEC Initial/Peak (ppm)	EEC 60-Day (ppm)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOEC)
Legume forage hay and alfalfa seed	5.94	0.498	0.0003	0.00016	0.00	0.00
Grass forage, pasture and rangeland	5.94	0.498	0.0003	0.00016	0.00	0.00
Mint	5.94	0.498	0.00131	0.0006	0.00	0.00
Green onion	5.94	0.498	0.00215	0.00112	0.00	0.00

RQs for Freshwater Invertebrates Based On a Daphnid EC50 of 14 ppm and NOAEC of 0.0006 ppm

Site	EC50 (ppm)	NOAEC (ppm)	EEC Initial/Peak (ppm)	EEC 21-Day Average (ppm)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOAEC)
Legume forage hay and alfalfa seed	14	0.0006	0.0003	0.0002	0.00	0.33
Grass forage, pasture and rangeland	14	0.0006	0.0003	0.0002	0.00	0.33
Mint	14	0.0006	0.00131	0.0009	0.00	1.50
Green Onion	14	0.0006	0.00215	0.00132	0.00	2.20

The results indicate no acute level of concern is exceeded for freshwater fish or invertebrates. However, chronic RQs (1.50-2.20) for freshwater invertebrates exceed the LOC for mint and green onion. No chronic LOCs were exceeded for freshwater fish.

The risk quotients for estuarine fish and invertebrates are tabulated below.

RQs for Estuarine/Marine Fish Based on a Sheepshead Minnow LC50 of 7.87 ppm and NOAEC of 1.15 ppm

Site	LC50 (ppm)	NOAEC (ppm)	EEC Initial/Peak (ppm)	EEC 60-Day Average (ppm)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOAEC)
Legume forage hay and alfalfa seed	7.87	1.15	0.0003	0.00016	0.00	0.00
Grass forage, pasture and rangeland	7.87	1.15	0.0003	0.00016	0.00	0.00
Mint	7.87	1.15	0.00131	0.0006	0.00	0.00
Green onion	7.87	1.15	0.00215	0.00112	0.00	0.00

RQs for Estuarine/Marine Aquatic Invertebrates Based on an Oyster EC50 of 0.3 ppm and Mysid NOAEC of 0.0842 ppm

Site	EC50 (ppm)	NOAEC (ppm)	EEC Initial/Peak (ppm)	EEC 21-Day Average (ppm)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOAEC)
Legume forage hay and alfalfa seed	0.3	0.0842	0.0003	0.0002	0.00	0.00
Grass forage, pasture and rangeland	0.3	0.0842	0.0003	0.0002	0.00	0.00
Mint	0.3	0.0842	0.00131	0.0009	0.00	0.01
Green onion	0.3	0.0842	0.00215	0.00132	0.00	0.02

The results indicate no acute or chronic level of concern is exceeded for estuarine fish or invertebrates.

Terrestrial Risk Quotients and Comparison to LOCs

Avian and Terrestrial Mammals

There were low risks to avian and mammalian species from the current proposed uses of Spinosad. The greatest EEC/most toxic endpoint did not produce any RQ that exceeded any acute or chronic LOC.

Nontarget Insects and Plants

Insects

Currently, EFED does not assess risk to non-target insects using an RQ method. Results of acceptable studies are used for recommending appropriate label precautions. Since spinosad is toxic to honeybees, risk to non-target and endangered/threatened beneficial insects is assumed.

Plants

No terrestrial plant species in the Tier I Seedling Emergence and Vegetative Vigor Toxicity Tests, showed more than 25% detrimental effect after application of spinosad (MRIDs 438488-02 and 445977-32). The EC₂₅ for the TGAI was >0.178 and the EC₂₅ for a formulated product (44.2% NAF-85) was >0.5. As a result, Tier II plant tests were not necessary. Guidelines 122-1(a) and (b) have been satisfied (MRIDs 438488-02 and 445977-32). Application to mint presents the highest rates of the uses presented. Thus, the application to mint is below levels expected to cause effects to terrestrial plants.

Acute risk quotients for aquatic plants are tabulated below.

Acute RQs for Aquatic Plants based on a nonvascular plant (most toxic was the freshwater diatom) EC50 of 0.09 ppm

Site	Test Species	EC50 (ppm)	EEC (ppm)	RQ (EEC/EC50)
Legume forage hay and alfalfa seed	freshwater diatom	0.09	0.0003	0.00
Grass, Pastures and Rangeland	freshwater diatom	0.09	0.0003	0.00
Mint	freshwater diatom	0.09	0.00131	0.01
Green onion	freshwater diatom	0.09	0.00215	0.02

The results indicate that no acute or endangered species level of concern is exceeded for aquatic plants.

Risk Description Characterization

No acute level of concern is exceeded for freshwater or estuarine/marine fish or invertebrates. Also, no chronic levels of concern were exceeded for freshwater and estuarine/marine fish or estuarine/marine invertebrates. However, chronic RQs (1.50-2.20) for endangered and non-

endangered freshwater free-swimming and sediment dwelling invertebrates exceed the LOC for mint and green onion. Also, since spinosad is toxic to honeybees, risk to beneficial terrestrial invertebrates is assumed. Low risk was found for birds, mammals and plants.

Endangered and threatened chronic levels of concern were exceeded for freshwater invertebrates for mint and green onion uses and since spinosad is toxic to honeybees, risk to beneficial insects for all uses is possible, should exposure actually occur.

Key Fate and Transport Conclusions

Spinosad is a mixture of two active naturally occurring isomers (Spinosad Factors A and D). Although there are more information on Factor A than Factor D, due to their similarity in chemical structures and properties, they are expected to behave very similarly in the environment and in toxicity. Therefore, spinosad is used to represent both Factors A and D.

Spinosad Factors A and D degrade in aerobic laboratory soil with half-lives of 13 and 14 days, respectively. They photodegrade readily in sterile water (<1 day at pH 7) and on soil (about 10 days). Based on McCall's relative mobility comparison, Factor A has a low to slight mobility in sandy soils and is immobile in silt loam and clay loam soils. Although no mobility data have been provided for Factor D, it is 180x less soluble than Factor A and therefore Factor D is less likely to leach in the soil or runoff to surface water. Spinosad is not volatile; vapor pressures (25°C) are 2.0 to 3.0 x 10⁻¹¹ kPa. CO₂ is the only volatile degradate. In terrestrial field dissipation studies on bareground plots, the estimated half-life of Factor A, formulated as an emulsifiable concentrate, was 0.3-0.5 days, and residues accounted for 3.1% of the applied in the runoff but did not leach. When spinosad was applied directly to the water surface in outdoor aquatic microcosm dissipation studies, total spinosad residues in the water had an observed half-life of <1 day.

Spinosad Factors A and D are stable to hydrolysis in pH 5, 7, and 9 buffer solutions. In flooded sediment, spinosad moves readily from the water to the solid phases. Spinosad degrades slowly in anaerobic sediment with half-lives of 161-250 days. Degradation rates in aerobic sediment were not determined. In an aquatic microcosm study, spinosad residues in the sediment peaked at 8 days and had an observed half-life of >25 days.

The major transformation product of Factor A is Factor B (N-demethylated Factor A). The major transformation product of Factor D is N-demethylated Factor D (the Factor D analogue of Factor B). IUPAC names were not provided for either transformation product. In aerobic soil metabolism laboratory studies using the parent, both transformation products accumulated to >50% of the applied by 28 days and had observed half-lives of >6 months. Spinosad Factor B is relatively immobile; no information is available on the mobility of N-demethylated Factor D. Neither transformation product was identified in terrestrial field dissipation studies.

Risk Discussion

EFED's main concern is for beneficial terrestrial insects and freshwater aquatic invertebrates. Because spinosad is toxic to honeybees, risk is assumed. Chronic RQs (1.50-2.20) for endangered and non-endangered freshwater free-swimming and sediment dwelling invertebrates

exceed the LOC of 1.0 for mint and green onion. Because chronic exposure to freshwater free-swimming invertebrates may produce adverse effects, their vulnerability represents potential risk from accumulations of spinosad in sediments, thus possibly affecting benthic invertebrate populations. As a dynamic trophic level, invertebrates add to the diversity of an aquatic system. Many fish species rely on these invertebrate populations for survival. Environmental fate data and modeling results indicate that spinosad is expected to dissipate rapidly in the environment with a low potential to leach or runoff to surface water. However, if spinosad residues do reach sediment, they are likely to be moderately persistent (half-life >25 days). Since spinosad may persist somewhat in the sediment, sediment toxicity testing will be needed to address the uncertainty of possible risk to the assemblages of benthic communities in order to determine potential impacts to aquatic systems. The benthos is composed of a diversity of aquatic invertebrates (e.g., insect larvae, crustaceans, mollusks), species of fish (e.g., catfish, loachs), as well as certain critical life stages of organisms that reside in the water column. The benthos is also the initial breeding strata and nursery area for several species of fish, especially commercial species such as salmonids. The benthos can also be a source of food items for several species of fish that are actively feeding on the organisms in the sediment and/or capturing organisms that are emerging from this area. Exposure to compounds in the sediment is a result of chemical binding to particulate and organic carbon in the water column and the eventual settling-out and accumulation of these compounds in the benthos.

Incident Characterization

There were 4 incidents reported in the EIIS database. All incidents reported were plant related. No residue analysis was reported for any incidents.

Incident #	Date	Crop	State	Certainty	Legality	Application	Magnitude
IO13636-036	3.15.02	Orange	CA	2 -possible	RU	Broadcast	21 acres
IO12366-001	9.10.01	Corn	CA	2- possible	UN	UN	9000 acres
IO13550-002	6.22.01	Potato	DE	2- possible	RU	Spray	65 acres
IO10927-029	4.15.00	Tobacco	TN	1- unlikely	RU	Spray	45 acres

Endocrine Disruption

EPA is required under the FFDCa, as amended by FQPA, to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) “may have an effect in humans that is similar to an effect produced by a naturally-occurring estrogen, or other such endocrine effects as the Administrator may designate.” Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there was scientific basis for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC’s recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use FIFRA and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCa authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening

Program (EDSP).

When the appropriate screening and or testing protocols being considered under the Agency's Endocrine Disruptor Screening Program have been developed, spinosad may be subjected to additional screening and or testing to better characterize effects related to endocrine disruption. Possible endocrine mediated effects were found in a chronic freshwater invertebrate study with *Daphnia magna*, where a NOAEC of 0.62 ppb was established based on a statistically significant reduction in egg production at the highest concentration tested, 2.19 ppb. Egg production is an endocrine-mediated process. Also, there were increases in thyroid weights as well as increased thyroid, parathyroid and pituitary gland cell vacuolation in mammalian studies. Thus, EFED will ask for additional testing when such testing is required.

Threatened and Endangered Species Concerns

The following section discusses the screening level assessment for Federally listed threatened and endangered species (listed species).

Risk to Federally Listed Endangered and Threatened Species

Based on available screening-level information, there is a potential concern for chronic effects on listed freshwater aquatic and acute effects on listed terrestrial invertebrates should exposure actually occur. These findings are based solely on EPA's screening level assessment and do not constitute "may affect" findings under the ESA for any specific listed species.

The Agency has developed the Endangered Species Protection Program to identify pesticides whose use may cause adverse impacts on federally listed endangered and threatened species, and to implement mitigation measures that address these impacts. The Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize listed species or adversely modify designated critical habitat. To analyze the potential of registered pesticide uses that may affect any particular species, EPA uses basic toxicity and exposure data developed for the assessments and considers ecological parameters, pesticide use information, the geographic relationship between specific pesticide uses and species locations and biological requirements and behavioral aspects of the particular species. When conducted, this analysis will consider regulatory changes recommended in this assessment that are implemented at that time. A determination that there is a likelihood of potential effects to a listed species may result in limitations on the use of the pesticide, other measures to mitigate any potential effects, or consultations with the Fish and Wildlife Service or National Marine Fisheries Service as appropriate. Until that species specific analysis is completed, the risk mitigation measures being implemented through this assessment will reduce the likelihood that endangered and threatened species may be exposed to spinosad at levels of concern.

Applications

For scenarios used to evaluate risk to aquatic organisms, the LOC (1.0) for chronic effects to listed species of freshwater invertebrates (RQs ranged from 1.50 to 2.20) were exceeded for the mint and bulb vegetable uses under multiple application scenarios.

Endangered insects and other terrestrial invertebrates may also be at risk from all uses due to the toxicity profile for honeybees (spinosad is toxic to honeybees thus risk is assumed) should exposure actually occur.

Listed Species

The following table lists the number of listed species within taxonomic groups for which RQs exceed the listed species LOCs. Some of these listed species may not be at risk through exposure to Spinosad based on size, behavior, food items and habitat. The entire list of listed endangered/threatened species is given in the Appendix.

GREEN ONION

Arkansas

The taxa Insect has 1 species affected by indicated crops.

California

The taxa Insect has 22 species affected by indicated crops.

Colorado

The taxa Insect has 2 species affected by indicated crops.

Connecticut

The taxa Insect has 1 species affected by indicated crops.

Florida

The taxa Insect has 1 species affected by indicated crops.

Georgia

The taxa Insect has 1 species affected by indicated crops.

Hawaii

The taxa Insect has 1 species affected by indicated crops.

Illinois

The taxa Insect has 2 species affected by indicated crops.

Indiana

The taxa Insect has 2 species affected by indicated crops.

Kansas

The taxa Insect has 1 species affected by indicated crops.

Kentucky

The taxa Insect has 1 species affected by indicated crops.

Maryland

The taxa Insect has 2 species affected by indicated crops.

Massachusetts

The taxa Insect has 3 species affected by indicated crops.

Michigan

The taxa Insect has 4 species affected by indicated crops.

Minnesota

The taxa Insect has 2 species affected by indicated crops.

Missouri

The taxa Insect has 3 species affected by indicated crops.

Nevada

The taxa Insect has 2 species affected by indicated crops.

New Hampshire

The taxa Insect has 1 species affected by indicated crops.

New York

The taxa Insect has 1 species affected by indicated crops.

North Carolina

The taxa Insect has 1 species affected by indicated crops.

Ohio

The taxa Insect has 3 species affected by indicated crops.

Oklahoma

The taxa Insect has 1 species affected by indicated crops.

Oregon

The taxa Insect has 2 species affected by indicated crops.

Rhode Island

The taxa Insect has 1 species affected by indicated crops.

South Dakota

The taxa Insect has 1 species affected by indicated crops.

Texas

The taxa Insect has 9 species affected by indicated crops.

Virginia

The taxa Insect has 1 species affected by indicated crops.

Washington

The taxa Insect has 1 species affected by indicated crops.

Wisconsin

The taxa Insect has 3 species affected by indicated crops.

MINT**California**

The taxa Amphibian has 4 species affected by indicated crops.

The taxa Fish has 12 species affected by indicated crops.

The taxa Insect has 3 species affected by indicated crops.

Idaho

The taxa Fish has 5 species affected by indicated crops.

The taxa Gastropod has 6 species affected by indicated crops.

Indiana

The taxa Bivalve has 3 species affected by indicated crops.

The taxa Insect has 1 species affected by indicated crops.

Michigan

The taxa Bivalve has 1 species affected by indicated crops.

The taxa Fish has 1 species affected by indicated crops.

The taxa Insect has 3 species affected by indicated crops.

Montana

The taxa Fish has 2 species affected by indicated crops.

Nevada

The taxa Fish has 3 species affected by indicated crops.

New Mexico

The taxa Fish has 2 species affected by indicated crops.

Ohio

The taxa Bivalve has 1 species affected by indicated crops.

Oregon

The taxa Fish has 19 species affected by indicated crops.

The taxa Insect has 2 species affected by indicated crops.

South Dakota

The taxa Fish has 1 species affected by indicated crops.

Utah

The taxa Fish has 1 species affected by indicated crops.

Washington

The taxa Fish has 9 species affected by indicated crops.

Wisconsin

The taxa Bivalve has 3 species affected by indicated crops.

The taxa Fish has 1 species affected by indicated crops.

The taxa Insect has 1 species affected by indicated crops.

Taxonomic Groups Potentially at Risk

For the freshwater aquatic invertebrate species evaluated in this risk assessment, RQs exceeded the LOCs for endangered species for the mint and bulb vegetable exposure scenarios considered. Also, since spinosad is toxic to honeybees, risk is assumed for beneficial terrestrial invertebrates.

Action Area

The Endangered Species Act defines the action area for a Federal action as being the footprint of possible effects stemming from the action, not necessarily limited to where the immediate action occurs. For screening-level purposes, the risk assessment conservatively assumes that listed species are co-located with the pesticide treatment area. This means that terrestrial plants and wildlife are assumed to be located on or adjacent to the treated field and aquatic organisms are assumed to be located in a surface water body adjacent to the treated field. This assumption places the listed species within an assumed area of high potential exposure to the pesticide. If these assumptions result in RQs that are below the listed species LOCs, a “no effect” conclusion is made. However, in situations where the screening assumptions lead to RQs in excess of the listed species LOCs, the potential for a “may affect” conclusion exists. In such cases, additional information on the biology of listed species, the locations of these species, and the locations of

use sites may be considered to determine the extent to which screening assumptions apply to a particular listed organism. These subsequent refinement steps would consider how this information would impact the action area for a particular listed organism and may include exposures that are downwind and downstream of the pesticide use site.

Indirect Effects Analysis

The Agency acknowledges that pesticides have the potential to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, and creating gaps in the food chain. In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle. In the case of spinosad, there may be indirect effects to endangered fish from direct impacts from chronic exposure to freshwater invertebrates.

Because screening-level acute RQs exceed the endangered species acute LOCs, the Agency uses the dose response relationship from the toxicity study used for calculating the RQ to estimate the probability of acute effects associated with an exposure equivalent to the EEC (see Probit Analysis below). This information serves as a guide to establish the need for and extent of additional analysis that may be performed using Services-provided “species profiles” as well as evaluations of the geographical and temporal nature of the exposure to ascertain if a “not likely to adversely affect” determination can be made. The degree to which additional analyses are performed is commensurate with the predicted probability of adverse effects from the comparison of the dose response information with the EECs. The greater the probability that exposures will produce effects on a taxa, the greater the concern for potential indirect effects for listed species dependent upon that taxa, and therefore, the more intensive the analysis on the potential listed species of concern, their locations relative to the use site, and information regarding the use scenario (e.g., timing, frequency, and geographical extent of pesticide application).

Birds and Mammals

Screening-level chronic RQs for birds and mammals that feed on short grass, tall grass, broadleaf plants and small insects, and fruits, pods, and large insects that exceed the LOC may indicate a potential concern for indirect effects. The Agency considers this to be indicative of a potential for adverse effects to those listed species that rely either on a specific plant species (plant species obligate) or multiple plant species (plant dependent) for some important aspect of their life cycle. The Agency may determine if listed organisms for which plants are a critical component of their resource needs are within the pesticide use area. This is accomplished through a comparison of Service-provided “species profiles” and listed species location data. If no listed organisms that are either plant species obligates or plant dependent reside within the pesticide use area, a no effect determination on listed species is made. If plant species obligate or dependent organism may reside within the pesticide use area, the Agency may consider temporal and geographical nature of exposure, and the scope of the effects data, to determine if any potential effects can be determined to not likely adversely affect a plant species obligate or dependent listed organism.

Indirect effects to terrestrial animals may result from reduced food items to animals, behavior modifications from reduced or a modified habitat, and from alterations of habitats. Alterations of habitats can affect the reproductive capacity of some terrestrial animals.

Probit Slope Analysis

The probit slope response relationship is evaluated to calculate the chance of an individual event corresponding to the listed species acute LOCs. If information is unavailable to estimate a slope for a particular study, a default slope assumption of 4.5 is used as per original Agency assumptions of typical slope cited in Urban and Cook (1986).

a. Terrestrial Species

Data from avian and mammalian terrestrial acute toxicity studies for spinosad did not provide an estimate of slope. Neither the avian LC50 study (>5156 mg/kg) nor the mammalian acute study (LD50 >5000 mg/kg) resulted in mortality.

b. Aquatic Species

Analysis of raw data from the aquatic acute toxicity studies for spinosad estimate slopes of 4.39 for freshwater fish, 1.62 for freshwater invertebrates, 7.62 for estuarine/marine fish, 2.2 for estuarine/marine invertebrates and 2.59 for aquatic plants. Based on these slopes, the corresponding estimate chance of individual mortality following spinosad exposure is 1 in 1.78×10^8 for freshwater fish, 1 in 57 for freshwater invertebrates, 1 in 1×10^{16} for estuarine/marine fish, 1 in 4.75×10^2 for estuarine/marine invertebrates and 1 in 2 for aquatic plants.

Critical Habitat

In the evaluation of pesticide effects on designated critical habitat, consideration is given to the physical and biological features (constituent elements) of a critical habitat identified by the U.S Fish and Wildlife and National Marine Fisheries Services as essential to the conservation of a listed species and which may require special management considerations or protection. The evaluation of impacts for a screening level pesticide risk assessment focuses on the biological features that are constituent elements and is accomplished using the screening-level taxonomic analysis (risk quotients, RQs) and listed species levels of concern (LOCs) that are used to evaluate direct and indirect effects to listed organisms.

The screening-level risk assessment has identified potential concerns for indirect effects on listed species. In light of the potential for indirect effects, the next step for EPA and the Service(s) is to identify which listed species and critical habitat are potentially implicated. Analytically, the identification of such species and critical habitat can occur in either of two ways. First, the agencies could determine whether the action area overlaps critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential impacts on non-endangered species would affect the listed species indirectly or directly affect a constituent element of the critical habitat. Alternatively, the agencies could determine which listed species depend on biological resources, or have constituent elements that fall into, the taxa that may be directly or indirectly impacted by the pesticide. Then EPA would determine whether use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA does not permit use of either analytical approach to make a

definitive identification of species that are potentially impacted indirectly or critical habitats that is potentially impacted directly by the use of the pesticide. EPA and the Service(s) are working together to conduct the necessary analysis.

This screening-level risk assessment for critical habitat provides a listing of potential biological features that, if they are constituent elements of one or more critical habitats, would be of potential concern. These correspond to the taxa identified above as being of potential concern for indirect effects. This list should serve as an initial step in problem formulation for further assessment of critical habitat impacts outlined above, should additional work be necessary.

Possible Risk Refinement Measures

Source control measures such as reduction in the application rate, reduction in the number of applications (especially in the presence of pollinators), and increasing the interval between applications may be implemented for Spinosad as possible risk reduction measures.

APPENDIX I. Ecological Effects Information

Summary:

This insecticide was practically non-toxic to avian species-(subacutely) and mammals (acutely and chronically). However, Spinosad was slightly toxic to avian species-(acutely), cold-water fish, and freshwater aquatic invertebrates. Spinosad was moderately toxic to warm-water fish, estuarine/marine fish(acutely) and estuarine shrimp. Furthermore, this insecticide was found to be highly toxic to estuarine/marine oysters and honey bees(acute studies)

Toxicity to Terrestrial Animal

The results of acute/subacute toxicity testing indicate that Spinosad is practically nontoxic to avian species on a subacute dietary basis and slightly toxic on an acute oral basis. Results of avian toxicity testing with spinosad are tabulated below.

Avian Acute/Subacute Toxicity

Species	% ai	LC50 (ppm)/ LD50 (ppm)	Toxicity Category	MRID No. Author/Yea r	Study Classification
*Northern bobwhite quail (<i>Colinus virginianus</i>)	88	LD50 >1333	slightly toxic	43414529 A.G. Murray <i>et al</i> (1992)	Supplemental ¹
*Mallard duck (<i>Anas platyrhynchos</i>)	88	LD50 >1333	slightly toxic	43414528 A.G. Murray <i>et al</i> (1992)	Supplemental ¹
*Northern bobwhite quail (<i>Colinus virginianus</i>)	88	LC50 >5156	practically non-toxic	43414531 A.G. Murray <i>et al</i> (1992)	Core
*Mallard duck (<i>Anas platyrhynchos</i>)	88	LC50 >5156	practically non-toxic	43414530 A.G. Murray <i>et al</i> (1992)	Core

¹ Study is classified supplemental, but does not need to be repeated (refer to Data Evaluation for details). Study is adequate for risk assessment purposes.

Avian Reproduction

Species	% ai	NOAEC/LOAE C (ppm)	Endpoints Affected	MRID No. Author/Year	Study Classification
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Avian Reproduction

Species	% ai	NOAEC/LOAE C (ppm)	Endpoints Affected	MRID No. Author/Year	Study Classification
*Northern bobwhite quail (<i>Colinus virginianus</i>)	88	550/1100	eggs laid, live 3-wk embryos, normal hatchlings, 14-day old survivors, hatchling weight	43414533 J. B. Beavers <i>et al</i> (1994)	Core
*Mallard duck (<i>Anas platyrhynchos</i>)	88	550/1100	eggs laid, eggshell thickness, viable embryos, live 3-wk embryos, normal hatchlings, 14-day old survivors, terminal female body weight	43414532 J. B. Beavers <i>et al</i> (1994)	Core

Mammals, Acute and Chronic

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. Based on a laboratory rat LD₅₀ value of >5000 mg/kg, spinosad is practically nontoxic to small mammals on an acute oral basis. These toxicity values are reported below.

Mammalian acute toxicity

Species	% ai	Test Type	Toxicity Value	Affected Endpoints	MRID
Rat (<i>Rattus norvegicus</i>)	Tech	oral LD50	>5000 mg/kg	None	437707-01 434145-15

Mammalian chronic toxicity

Species	% ai	Test Type	Toxicity Value	Affected Endpoints	MRID
Laboratory mouse (<i>Rattus norvegicus</i>)	88	Rat Reproduction	>1100 ppm	None	437015-06

Terrestrial Invertebrates

Earthworm Toxicity

Species	% ai	LC50 (mg/kg)	NOAEC (mg/kg)	Endpoints Affected	MRID	Study Classification
*Earthworm	88	>970	970	weight decreases	434145-48	Supplemental

Insects

Based on a honey bee acute contact test LD₅₀ of 0.0029 ug ai/bee, Spinosad is highly toxic to bees on an acute contact basis (43414547; K.A. Hoxter *et al* 1992). The results of spinosad testing using the honeybee are tabulated below:

Non-target insect toxicity

Species	% ai	Results	Toxicity Category/effects	MRID	Study Classification
*Honey bee (<i>Apis mellifera</i>)	88%	0.0029 _{ugai} /bee	Highly Toxic	434145-47	Core
*Honey bee (<i>Apis mellifera</i>)	0.02	N/A	N/A	453408-01	Invalid
*Honey bee (<i>Apis mellifera</i>)	22.8%	N/A	N/A	450077-04	Invalid
*Honey bee (<i>Apis mellifera</i>)	24%	RT 25 = 3hrs	Mortality	450077-02	Supplemental
*Honey bee (<i>Apis mellifera</i>)	22.8%	N/A	N/A	450077-03	Invalid
*Honey bee (residue) (<i>Apis mellifera</i>)	23.5%	RT 25 = 3hrs	Mortality	450077-01	Core
*Honey bee (field trail) (<i>Apis mellifera</i>)	GF-120 Success fruit fly	No adverse effects at use rates	N/A	457082-01/457088-01	Supplemental

Toxicity to Aquatic Animals

The results of acute testing show that Spinosad is categorized as slightly toxic to cold-water freshwater fish and freshwater invertebrates, and moderately toxic to warm-water freshwater fish. Results of freshwater animal acute toxicity testing are tabulated below.

Freshwater Animal Acute Toxicity

Species	% ai	EC50/ LC50 (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
*Waterflea (<i>Daphnia magna</i>)	88	EC ₅₀ = 14 Slope=N/A	slightly toxic	434145-37 D.P. Milazzo <i>et al</i> (1994)	Core
*Waterflea (<i>Daphnia magna</i>)	100 Factor D Static	66.8	Slightly toxic	465053-04	Acceptable
*Waterflea (<i>Daphnia magna</i>)	96 Factor D static	3.8 Slope=1.62	moderately toxic	465053-09	Acceptable
*Waterflea (<i>Daphnia magna</i>)	99 Factor A	>197	practically non-toxic	465053-07	Acceptable
*Waterflea (<i>Daphnia magna</i>)	94 Factor B	6.5	moderately toxic	465053-12	Acceptable
*Waterflea (<i>Daphnia magna</i>)	94 Factor B	6.39/21.4 Slope=1.78	moderately toxic	445977-31	Supplemental
*Rainbow trout (<i>Oncorhynchus mykiss</i>)	88	LC ₅₀ = 30 Slope=4.39	slightly toxic	434441-03 J.T. Weinberg <i>et al</i> (1993)	Core
*Bluegill sunfish (<i>Lepomis macrochirus</i>)	88	LC ₅₀ = 5.94 Slope=N/A	moderately toxic	434145-34 J.L. Newsted and D.E. Brock (1992)	Core

Based on results above, technical Spinosad and its metabolites are considered slightly to moderately toxic to freshwater aquatic invertebrates on an acute toxicity basis. Studies with Spinosad Factors resulted in limited solubility.

Technical Spinosad impacted reproduction in fish at 0.49 ppm and in invertebrates at the 0.0006

ppm. The results of freshwater fish and invertebrate chronic testing are tabulated below.

Freshwater Aquatic Invertebrate Life-Cycle Toxicity and Fish Early Life-Stage Toxicity

Species	% ai	NOAEC/LOAEC (ppm)	MATC (ppm)	Endpoints Affected	MRID No.	Study Classification
Waterflea (<i>Daphnia magna</i>)	88	0.0006/0.0012	0.0008	growth and reproductive capacity	43848801	Core
*Waterflea (<i>Daphnia magna</i>)	96 Factor D Flow-through	1.0/1.7 ppb		survival, reproduction and growth	465053-01	Invalid
*Waterflea (<i>Daphnia magna</i>)	100 Factor D Static renewal	4.85/9.32		length	465053-03	Supplemental
*Waterflea (<i>Daphnia magna</i>)	99 Factor A	1.59/3.24 (21 da)		length	465053-06	Supplemental
*Waterflea (<i>Daphnia magna</i>)	93 Factor B Flow-through	0.95/2.1 ppb		survival/growth	465053-11	Invalid
*Midge (<i>Chironomus riparius</i>)	Factor A & D	0.622/1.328 ppb	0.909 ppb	% emergence	448284-02	Supplemental
*Midge (<i>Chironomus riparius</i>)	Dihydrospinoaglycone of Spinosad 99%	0.252/>0.252 0.0734/>0.0734 (28 da)		% emergence, M & F developmental rates	465053-14	Supplemental
*Rainbow trout (<i>Oncorhynchus mykiss</i>)	Factor A & D Flow-through	1.2/2.1(21 da) LC50=4.9		Signs of toxicity mortality	465053-13	Supplemental
*Rainbow trout (<i>Oncorhynchus mykiss</i>)	88	0.498/0.962	0.692	growth, survival, day to mean hatch	434145-41 J.T. Weinberg <i>et al</i> (1993)	Core

The results show that Spinosad is categorized as moderately toxic to estuarine/marine fish and moderately to very highly toxic to estuarine/marine invertebrates on an acute basis. The results of acute toxicity testing with estuarine/marine species are tabulated below.

Estuarine/Marine Acute Toxicity

Species	% ai.	LC50/EC50 (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
*Sheepshead minnow (<i>Cypridon variegatus</i>)	87.9	LC50 =7.87 Slope=7.62	moderately toxic	434145-40	Core
*Eastern oyster (shell deposition or embryo-larvae) (<i>Crassostrea virginica</i>)	87.9	EC50 = 0.3 Slope=2.2	very highly toxic	434441-04/435712-03	Core
*Grass Shrimp (<i>Palaemonetes pugio</i>)	87.9	LC50>9.76 Slope=N/A	moderately toxic	434145-39	Supplemental
Mysid (<i>Americamysis bahia</i>)	87.9	LC50 >7.87	moderately toxic	434145-39	Supplemental ¹

¹ Although the mysid shrimp study was classified as supplemental (organisms should have been fed during the study), the study does not have to be repeated because the oyster was found to be the most sensitive invertebrate species tested, and will be used for risk assessment purposes in lieu of the mysid shrimp.

Spinosad reduced growth of sheepshead minnow with a MATC of 1.65 ppm. Reproduction is impacted at concentrations as low as 0.17 ppm in mysid shrimp. The results of estuarine animal chronic testing are tabulated below.

Estuarine/ Marine Chronic Toxicity

Species	% ai	NOAEC/LOAEC (ppm)	MATC (ppm)	Endpoints Affected	MRID No. Author/Year	Study Classification
*Sheepshead Minnow, (<i>Cyprinodon variegatus</i>)	88	1.15/2.38	1.65	growth (length and weight)	444206-01 R.L. Boeri <i>et al</i> (1997)	Core
*Mysid (<i>Mysidopsis bahia</i>)	88	0.0842/0.173	0.121	number of young female after 28 days of exposure	444206-02 R.L. Boeri <i>et al</i> (1997)	Core

Toxicity to Terrestrial and Aquatic Plants

Radish was shown to be the most sensitive Dicot for the Tier I toxicity test. The results of Tier 1 toxicity tests are tabulated below.

Nontarget Terrestrial Plant Seedling Emergence/Vegetative Vigor Toxicity (Tier I)

Species	% ai	Dose (lb ai/A)	% Response and Endpoint Affected	MRID No. Author/Year	Study Classification
*6 Dicots/4 monocots	44.2%	0.5	No phytotoxic or other effects	445977-32 D. Schwab (1997)	Core
*Monocots- corn, oat, wheat, onion Dicots- carrot, cucumber, radish, soybean, sunflower, tomato	88%	200 grams ai/Hectare (0.18 lb/ai/A)	<25%	438488-02 D. Schwab (1994)	Core

The Tier II results indicate that the freshwater diatom is the most sensitive non-vascular aquatic plant. Aquatic plant testing (Tier II) results are tabulated below.

Nontarget Aquatic Plant Toxicity (Tier II)

Species	% ai	EC50 (ppm)	NOAEC (ppm)	MRID No. Author/Year	Study Classification
Vascular Plants					
*Duckweed <i>Lemna gibba</i>	88	10.6 Slope=1.2	1.86	434145-46 D. P. Milazzo <i>et al</i> (1994)	Core
Nonvascular Plants					
*Green algae	88.2	>105.5	4.3	434145-42	Core

Nontarget Aquatic Plant Toxicity (Tier II)

Species	% ai	EC50 (ppm)	NOAEC (ppm)	MRID No. Author/Year	Study Classification
<i>Kirchneria subcapitata</i>		Slope=N/A		D.E. Brock (1992)	
*Marine diatom <i>Skeletonema costatum</i>	88	0.227 Slope=4.03	0.167	434145-45 J.S. Hughes and M.M. Alexander (1993)	Core
*Freshwater diatom <i>Navicula pelliculosa</i>	88	0.09 Slope=2.59	0.05	434145-43 J.S. Hughes and M.M. Alexander (1994)	Core
*Freshwater diatom <i>Navicula pelliculosa</i>	99 Spinosin A	31 biomass	8.34 cell density	465053-05	Supplemental
*Freshwater diatom <i>Navicula pelliculosa</i>	94 Factor B	0.16 cell density	<0.019	465053-10	Supplemental
*Freshwater diatom <i>Navicula pelliculosa</i>	96 Factor D	0.22 cell density	0.17	465053-08	Supplemental
*Freshwater diatom <i>Navicula pelliculosa</i>	100 Spinosin D	19 biomass	14.2	465053-02	Supplemental
*Blue-green algae <i>Anabaena flos-aquae</i>	88	8.9 Slope=4.05	3.9	43414544 J.S. Hughes and M.M. Alexander (1993)	Core

APPENDIX II. Endangered Species listing

* Some species listings are not likely to be exposed due to size, habitat, eating habits or other mitigating factors.

MINT

Minimum of 1 Acre.

California	(19) species affected	Taxa	Critical Habitat		
FROG, CALIFORNIA RED-LEGGED (<i>Rana aurora draytonii</i>)		Threatened	Amphibian	No	
FROG, MOUNTAIN YELLOW-LEGGED (<i>Rana muscosa</i>)		Endangered	Amphibian	No	
SALAMANDER, DESERT SLENDER (<i>Batrachoseps aridus</i>)		Endangered	Amphibian	No	
TOAD, ARROYO SOUTHWESTERN (<i>Bufo californicus (=microscaphus)</i>)		Endangered	Amphibian	Yes	
CHUB, BONYTAIL (<i>Gila elegans</i>)		Endangered	Fish	Yes	
CHUB, HUTTON TUI (<i>Gila bicolor ssp.</i>)		Threatened	Fish	No	
PUPFISH, DESERT (<i>Cyprinodon macularius</i>)		Endangered	Fish	Yes	
SALMON, CHINOOK (SACRAMENTO RIVER WINTER RUN) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)		Endangered	Fish	No	
SALMON, COHO (SOUTHERN OR/NORTHERN CA COAST) (<i>Oncorhynchus (=Salmo) kisutch</i>)		Threatened	Fish	No	
SQUAWFISH, COLORADO (<i>Ptychocheilus lucius</i>)		Endangered	Fish	Yes	
STEELHEAD, CALIFORNIA CENTRAL VALLEY POP (<i>Oncorhynchus (=Salmo) mykiss</i>)		Threatened	Fish	Yes	
SUCKER, LOST RIVER (<i>Deltistes luxatus</i>)		Endangered	Fish	No	
SUCKER, MODOC (<i>Catostomus microps</i>)		Endangered	Fish	Yes	
SUCKER, RAZORBACK (<i>Xyrauchen texanus</i>)		Endangered	Fish	Yes	
SUCKER, SANTA ANA (<i>Catostomus santaanae</i>)		Threatened	Fish	Yes	

SUCKER, SHORTNOSE (<i>Chasmistes brevirostris</i>)	Endangered	Fish	No
BUTTERFLY, QUINO CHECKERSPOT (<i>Euphydryas editha quino</i> (=E. e. wrighti))	Endangered	Insect	Yes
FLY, DELHI SANDS FLOWER-LOVING (<i>Rhaphiomidas terminatus abdominalis</i>)	Endangered	Insect	No
SKIPPER, CARSON WANDERING (<i>Pseudocopaodes eunus obscurus</i>)	Endangered	Insect	No
Idaho (11) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
SALMON, CHINOOK (SNAKE RIVER FALL RUN) (<i>Oncorhynchus</i> (=Salmo) <i>tshawytscha</i>)	Threatened	Fish	No
SALMON, CHINOOK (SNAKE RIVER SPRING/SUMMER) (<i>Oncorhynchus</i> (=Salmo) <i>tshawytscha</i>)	Threatened	Fish	Yes
STEELHEAD, SNAKE RIVER BASIN POPULATION (<i>Oncorhynchus</i> (=Salmo) <i>mykiss</i>)	Threatened	Fish	Yes
TROUT, BULL (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
TROUT, BULL (KLAMATH RIVER POPULATION) (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
LIMPET, BANBURY SPRINGS (<i>Lanx</i> sp.)	Endangered	Gastropod	No
SNAIL, BLISS RAPIDS (<i>Taylorconcha serpenticola</i>)	Threatened	Gastropod	No
SNAIL, SNAKE RIVER PHYSA (<i>Physa natricina</i>)	Endangered	Gastropod	No
SNAIL, UTAH VALVATA (<i>Valvata utahensis</i>)	Endangered	Gastropod	No
SPRINGSNAIL, BRUNEAU HOT (<i>Pyrgulopsis bruneauensis</i>)	Endangered	Gastropod	No
SPRINGSNAIL, IDAHO (<i>Fontelicella idahoensis</i>)	Endangered	Gastropod	No
Indiana (4) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
Mussel, Clubshell (<i>Pleurobema clava</i>)	Endangered	Bivalve	No
Mussel, Pink Mucket Pearly (<i>Lampsilis abrupta</i>)	Endangered	Bivalve	No

PEARLYMUSSEL, TUBERCLED-BLOSSOM (<i>Epioblasma torulosa torulosa</i>)	Endangered	Bivalve	No
BUTTERFLY, MITCHELL'S SATYR (<i>Neonympha mitchellii mitchellii</i>)	Endangered	Insect	No
Michigan (5) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
RIFFLESHELL, NORTHERN (<i>Epioblasma torulosa rangiana</i>)	Endangered	Bivalve	No
SHINER, TOPEKA (<i>Notropis topeka (=tristis)</i>)	Endangered	Fish	Yes
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No
BUTTERFLY, MITCHELL'S SATYR (<i>Neonympha mitchellii mitchellii</i>)	Endangered	Insect	No
DRAGONFLY, HINE'S EMERALD (<i>Somatochlora hineana</i>)	Endangered	Insect	No
Montana (2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
TROUT, BULL (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
TROUT, BULL (KLAMATH RIVER POPULATION) (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
Nevada (3) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
DACE, DESERT (<i>Eremichthys acros</i>)	Threatened	Fish	Yes
TROUT, BULL (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
TROUT, LAHONTAN CUTTHROAT (<i>Oncorhynchus clarki henshawi</i>)	Threatened	Fish	No
New Mexico (2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
SQUAWFISH, COLORADO (<i>Ptychocheilus lucius</i>)	Endangered	Fish	Yes
SUCKER, RAZORBACK (<i>Xyrauchen texanus</i>)	Endangered	Fish	Yes
Ohio (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
Mussel, Clubshell (<i>Pleurobema clava</i>)	Endangered	Bivalve	No

Oregon

(21) species affected

		<u>Taxa</u>	<u>Critical Habitat</u>
CHUB, OREGON (<i>Oregonichthys crameri</i>)	Endangered	Fish	No
SALMON, CHINOOK (LOWER COLUMBIA RIVER) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Threatened	Fish	Yes
SALMON, CHINOOK (SNAKE RIVER FALL RUN) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Threatened	Fish	No
SALMON, CHINOOK (SNAKE RIVER SPRING/SUMMER) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Threatened	Fish	Yes
SALMON, CHINOOK (UPPER COLUMBIA RIVER SPRING) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Endangered	Fish	Yes
SALMON, CHINOOK (UPPER WILLAMETTE RIVER) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Threatened	Fish	Yes
SALMON, CHUM (COLUMBIA RIVER POPULATION) (<i>Oncorhynchus (=Salmo) keta</i>)	Threatened	Fish	Yes
SALMON, COHO (OREGON COAST POPULATION) (<i>Oncorhynchus (=Salmo) kisutch</i>)	Threatened	Fish	Yes
SALMON, COHO (SOUTHERN OR/NORTHERN CA COAST) (<i>Oncorhynchus (=Salmo) kisutch</i>)	Threatened	Fish	No
SALMON, SOCKEYE (SNAKE RIVER POPULATION) (<i>Oncorhynchus (=Salmo) nerka</i>)	Endangered	Fish	No
STEELHEAD, LOWER COLUMBIA RIVER POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Threatened	Fish	Yes
STEELHEAD, MIDDLE COLUMBIA RIVER POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Threatened	Fish	Yes
STEELHEAD, SNAKE RIVER BASIN POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Threatened	Fish	Yes
STEELHEAD, UPPER COLUMBIA RIVER POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Endangered	Fish	Yes
STEELHEAD, UPPER WILLAMETTE RIVER POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Threatened	Fish	Yes
SUCKER, LOST RIVER (<i>Deltistes luxatus</i>)	Endangered	Fish	No
SUCKER, SHORTNOSE (<i>Chasmistes brevirostris</i>)	Endangered	Fish	No
TROUT, BULL (<i>Salvelinus confluentus</i>)	Threatened	Fish	No

TROUT, BULL (KLAMATH RIVER POPULATION) (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
BUTTERFLY, FENDER'S BLUE (<i>Icaricia icarioides fenderi</i>)	Endangered	Insect	No
BUTTERFLY, OREGON SILVERSPOT (<i>Speyeria zerene hippolyta</i>)	Threatened	Insect	Yes
South Dakota (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
STURGEON, PALLID (<i>Scaphirhynchus albus</i>)	Endangered	Fish	No
Utah (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
TROUT, LAHONTAN CUTTHROAT (<i>Oncorhynchus clarki henshawi</i>)	Threatened	Fish	No
Washington (9) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
SALMON, CHINOOK (SNAKE RIVER FALL RUN) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Threatened	Fish	No
SALMON, CHINOOK (SNAKE RIVER SPRING/SUMMER) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Threatened	Fish	Yes
SALMON, CHINOOK (UPPER COLUMBIA RIVER SPRING) (<i>Oncorhynchus (=Salmo) tshawytscha</i>)	Endangered	Fish	Yes
SALMON, SOCKEYE (SNAKE RIVER POPULATION) (<i>Oncorhynchus (=Salmo) nerka</i>)	Endangered	Fish	No
STEELHEAD, MIDDLE COLUMBIA RIVER POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Threatened	Fish	Yes
STEELHEAD, SNAKE RIVER BASIN POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Threatened	Fish	Yes
STEELHEAD, UPPER COLUMBIA RIVER POPULATION (<i>Oncorhynchus (=Salmo) mykiss</i>)	Endangered	Fish	Yes
TROUT, BULL (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
TROUT, BULL (KLAMATH RIVER POPULATION) (<i>Salvelinus confluentus</i>)	Threatened	Fish	No
Wisconsin (5) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
Mussel, Pink Mucket Pearly (<i>Lampsilis abrupta</i>)	Endangered	Bivalve	No
MUSSEL, SCALEHELL (<i>Leptodea leptodon</i>)	Endangered	Bivalve	No

PEARLYMUSSEL, HIGGINS' EYE (<i>Lampsilis higginsii</i>)	Endangered	Bivalve	No
SHINER, TOPEKA (<i>Notropis topeka</i> (=tristis))	Endangered	Fish	Yes
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No

GREEN ONIONS, Cropland used only for pasture or grazing (acres)

Minimum of 1 Acre.

Arkansas (1) species affected **Taxa** Critical Habitat

BEETLE, AMERICAN BURYING (<i>Nicrophorus americanus</i>)	Endangered	Insect	No
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California (22) species affected **Taxa** Critical Habitat

BEETLE, DELTA GREEN GROUND (<i>Elaphrus viridis</i>)	Threatened	Insect	Yes
BEETLE, MOUNT HERMON JUNE (<i>Polyphylla barbata</i>)	Endangered	Insect	No
BEETLE, OHLONE TIGER (<i>Cicindela ohlone</i>)	Endangered	Insect	No
BEETLE, VALLEY ELDERBERRY LONGHORN (<i>Desmocerus californicus dimorphus</i>)	Threatened	Insect	Yes
BUTTERFLY, BAY CHECKERSPOT (<i>Euphydryas editha bayensis</i>)	Threatened	Insect	Yes
BUTTERFLY, BEHREN'S SILVERSPOT (<i>Speyeria zerene behrensii</i>)	Endangered	Insect	No
BUTTERFLY, CALLIPPE SILVERSPOT (<i>Speyeria callippe callippe</i>)	Endangered	Insect	No
BUTTERFLY, EL SEGUNDO BLUE (<i>Euphilotes battoides allyni</i>)	Endangered	Insect	No
BUTTERFLY, LANGE'S METALMARK (<i>Apodemia mormo langei</i>)	Endangered	Insect	No
BUTTERFLY, LOTIS BLUE (<i>Lycaeides argyrognomon lotis</i>)	Endangered	Insect	No
BUTTERFLY, MISSION BLUE (<i>Icaricia icarioides missionensis</i>)	Endangered	Insect	No
BUTTERFLY, MYRTLE'S SILVERSPOT (<i>Speyeria zerene myrtleae</i>)	Endangered	Insect	No
BUTTERFLY, OREGON SILVERSPOT (<i>Speyeria zerene hippolyta</i>)	Threatened	Insect	Yes
BUTTERFLY, PALOS VERDES BLUE	Endangered	Insect	Yes

<i>(Glaucopsyche lygdamus palosverdesensis)</i>			
BUTTERFLY, QUINO CHECKERSPOT <i>(Euphydryas editha quino (=E. e. wrightii))</i>	Endangered	Insect	Yes
BUTTERFLY, SAN BRUNO ELFIN <i>(Callophrys mossii bayensis)</i>	Endangered	Insect	No
BUTTERFLY, SMITH'S BLUE <i>(Euphilotes enoptes smithi)</i>	Endangered	Insect	No
FLY, DELHI SANDS FLOWER-LOVING <i>(Rhaphiomidas terminatus abdominalis)</i>	Endangered	Insect	No
GRASSHOPPER, ZAYANTE BAND-WINGED <i>(Trimerotropis infantilis)</i>	Endangered	Insect	Yes
MOTH, KERN PRIMROSE SPHINX <i>(Euproserpinus euterpe)</i>	Threatened	Insect	No
SKIPPER, CARSON WANDERING <i>(Pseudocopaeodes eunus obscurus)</i>	Endangered	Insect	No
SKIPPER, LAGUNA MOUNTAIN <i>(Pyrgus ruralis lagunae)</i>	Endangered	Insect	No
Colorado (2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, UNCOMPAHGRE FRITILLARY <i>(Boloria acrocynema)</i>	Endangered	Insect	No
SKIPPER, PAWNEE MONTANE <i>(Hesperia leonardus montana)</i>	Threatened	Insect	No
Connecticut (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, PURITAN TIGER <i>(Cicindela puritana)</i>	Threatened	Insect	No
Florida (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, SCHAUS SWALLOWTAIL <i>(Heraclides aristodemus ponceanus)</i>	Endangered	Insect	No
Georgia (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, AMERICAN BURYING <i>(Nicrophorus americanus)</i>	Endangered	Insect	No
Hawaii (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
MOTH, BLACKBURN'S SPHINX <i>(Manduca blackburni)</i>	Endangered	Insect	Yes

Illinois	(2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No	
DRAGONFLY, HINE'S EMERALD (<i>Somatochlora hineana</i>)	Endangered	Insect	No	
Indiana	(2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No	
BUTTERFLY, MITCHELL'S SATYR (<i>Neonympha mitchellii mitchellii</i>)	Endangered	Insect	No	
Kansas	(1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, AMERICAN BURYING (<i>Nicrophorus americanus</i>)	Endangered	Insect	No	
Kentucky	(1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, AMERICAN BURYING (<i>Nicrophorus americanus</i>)	Endangered	Insect	No	
Maryland	(2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, NORTHEASTERN BEACH TIGER (<i>Cicindela dorsalis dorsalis</i>)	Threatened	Insect	No	
BEETLE, PURITAN TIGER (<i>Cicindela puritana</i>)	Threatened	Insect	No	
Massachusetts	(3) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, AMERICAN BURYING (<i>Nicrophorus americanus</i>)	Endangered	Insect	No	
BEETLE, NORTHEASTERN BEACH TIGER (<i>Cicindela dorsalis dorsalis</i>)	Threatened	Insect	No	
BEETLE, PURITAN TIGER (<i>Cicindela puritana</i>)	Threatened	Insect	No	
Michigan	(4) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, HUNGERFORD'S CRAWLING WATER (<i>Brychius hungerfordi</i>)	Endangered	Insect	No	
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No	
BUTTERFLY, MITCHELL'S SATYR (<i>Neonympha mitchellii mitchellii</i>)	Endangered	Insect	No	

DRAGONFLY, HINE'S EMERALD (<i>Somatochlora hineana</i>)	Endangered	Insect	No
Minnesota (2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No
DRAGONFLY, HINE'S EMERALD (<i>Somatochlora hineana</i>)	Endangered	Insect	No
Missouri (3) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, AMERICAN BURYING (<i>Nicrophorus americanus</i>)	Endangered	Insect	No
BUTTERFLY, MITCHELL'S SATYR (<i>Neonympha mitchellii mitchellii</i>)	Endangered	Insect	No
DRAGONFLY, HINE'S EMERALD (<i>Somatochlora hineana</i>)	Endangered	Insect	No
Nevada (2) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
NAUCORID, ASH MEADOWS (<i>Ambrysus amargosus</i>)	Threatened	Insect	Yes
SKIPPER, CARSON WANDERING (<i>Pseudocopaodes eunus obscurus</i>)	Endangered	Insect	No
New Hampshire (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No
New York (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No
North Carolina (1) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BUTTERFLY, SAINT FRANCIS' SATYR (<i>Neonympha mitchellii francisci</i>)	Endangered	Insect	No
Ohio (3) species affected		<u>Taxa</u>	<u>Critical Habitat</u>
BEETLE, AMERICAN BURYING (<i>Nicrophorus americanus</i>)	Endangered	Insect	No
BUTTERFLY, KARNER BLUE (<i>Lycaeides melissa samuelis</i>)	Endangered	Insect	No
DRAGONFLY, HINE'S EMERALD (<i>Somatochlora hineana</i>)	Endangered	Insect	No

Oklahoma (1) species affected **Taxa** Critical Habitat
 BEETLE, AMERICAN BURYING Endangered Insect No
 (*Nicrophorus americanus*)

Oregon (2) species affected **Taxa** Critical Habitat
 BUTTERFLY, FENDER'S BLUE Endangered Insect No
 (*Icaricia icarioides fenderi*)
 BUTTERFLY, OREGON SILVERSPOT Threatened Insect Yes
 (*Speyeria zerene hippolyta*)

Rhode Island (1) species affected **Taxa** Critical Habitat
 BEETLE, AMERICAN BURYING Endangered Insect No
 (*Nicrophorus americanus*)

South Dakota (1) species affected **Taxa** Critical Habitat
 BEETLE, AMERICAN BURYING Endangered Insect No
 (*Nicrophorus americanus*)

Texas (9) species affected **Taxa** Critical Habitat
 BEETLE, AMERICAN BURYING Endangered Insect No
 (*Nicrophorus americanus*)
 BEETLE, COFFIN CAVE MOLD Endangered Insect No
 (*Batrisodes texanus*)
 BEETLE, COMAL SPRINGS DRYOPID Endangered Insect No
 (*Stygoparnus comalensis*)
 BEETLE, COMAL SPRINGS RIFFLE Endangered Insect No
 (*Heterelmis comalensis*)
 BEETLE, HELOTES MOLD Endangered Insect Yes
 (*Batrisodes venyivi*)
 BEETLE, KRETSCHMARR CAVE MOLD Endangered Insect No
 (*Texamaurops reddelli*)
 BEETLE, TOOTH CAVE GROUND Endangered Insect No
 (*Rhadine persephone*)
 RHADINE EXILIS (NCN) Endangered Insect Yes
 (*Rhadine exilis*)
 RHADINE INFERNALIS (NCN) Endangered Insect Yes
 (*Rhadine infernalis*)

Virginia (1) species affected **Taxa** Critical Habitat
 BEETLE, NORTHEASTERN BEACH TIGER Threatened Insect No

(Cicindela dorsalis dorsalis)

Washington (1) species affected

BUTTERFLY, OREGON SILVERSPOT

Threatened

Taxa

Critical Habitat

Insect

Yes

(Speyeria zerene hippolyta)

Wisconsin (3) species affected

Taxa

Critical Habitat

BUTTERFLY, KARNER BLUE

Endangered

Insect

No

(Lycaeides melissa samuelis)

BUTTERFLY, MITCHELL'S SATYR

Endangered

Insect

No

(Neonympha mitchellii mitchellii)

DRAGONFLY, HINE'S EMERALD

Endangered

Insect

No

(Somatochlora hineana)

APPENDIX III. PRZM/EXAMS

Environmental Fate Input Parameters for PRZM/EXAMS Simulation.

Parameter	Spinosad A Value	Source
PC Code	110003	N/A
Water Solubility (20°C, distilled water)	235 mg/L	
Molecular Weight	732 g/mol	
Hydrolysis Half-Life (pH 7)	Stable	MRID 43507301
Aerobic Soil Metabolism $t_{1/2}$ (mean value plus $t_{90, n-1} \times \sigma$) / $n^{1/2}$)	25.54 days	MRID 43507304
Aerobic Aquatic Metab. $t_{1/2}$, (2X the Aerob. Soil Metab.)	51.08 days	MRID 43507304
Anaerobic Aquatic Metab. $t_{1/2}$	250 Days	
Aqueous Photolysis Half-Life (at pH 7)	0.93 days	MRID 43507302
Soil Water Partition Coefficient (Lowest non sand Koc)	4237	MRID 43507306
Vapor Pressure	2.4e-10 torr	
PCA	87%	Default Value
Depth of Incorporation (Aerial)	0.0	Product Label

PRZM/EXAMS Output Files

Legume Forage Hay and Alfalfa Seed

stored as OrSeedSP.out

Chemical: Spinosad

PRZM environment: ORgrasseedC.txt modified Saturday, 12 October 2002 at 17:18:50

EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30

Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10

Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.23	0.1976	0.1501	0.113	0.1019	0.0425
1962	0.2564	0.2242	0.1766	0.1417	0.1304	0.07466
1963	0.2723	0.2404	0.192	0.1566	0.1446	0.08797
1964	0.269	0.2365	0.1897	0.1571	0.1453	0.09129
1965	0.2696	0.2368	0.1904	0.159	0.1466	0.09335
1966	0.2712	0.2387	0.1914	0.1579	0.1455	0.09223
1967	0.2653	0.2324	0.1858	0.1535	0.1404	0.08782
1968	0.2657	0.2332	0.1864	0.1536	0.146	0.09469

1969	0.2767	0.2441	0.1974	0.1646	0.1522	0.1018
1970	0.2709	0.2381	0.1918	0.1597	0.1478	0.09713
1971	0.2725	0.2397	0.1933	0.1629	0.1495	0.09986
1972	0.272	0.2391	0.1929	0.1619	0.149	0.09682
1973	0.2682	0.2354	0.1891	0.1573	0.1457	0.09423
1974	0.2748	0.2424	0.195	0.1615	0.1491	0.09598
1975	0.2711	0.2386	0.1918	0.1594	0.1477	0.09327
1976	0.2731	0.2407	0.1936	0.161	0.1491	0.09221
1977	0.2693	0.2369	0.1891	0.1547	0.1424	0.08907
1978	0.2657	0.2327	0.187	0.1531	0.1414	0.08921
1979	0.2642	0.2314	0.1851	0.1528	0.1411	0.09223
1980	0.2721	0.2394	0.1929	0.1617	0.1494	0.09483
1981	0.2744	0.2419	0.1947	0.1625	0.1492	0.09769
1982	0.2738	0.2414	0.194	0.1599	0.1479	0.09556
1983	0.2745	0.2419	0.195	0.1596	0.1471	0.0932
1984	0.2702	0.2374	0.191	0.1602	0.1471	0.0932
1985	0.2658	0.2326	0.1873	0.1584	0.1461	0.09283
1986	0.2723	0.2399	0.1922	0.1564	0.1435	0.0891
1987	0.3025	0.2658	0.2279	0.1664	0.153	0.09358
1988	0.2714	0.2386	0.1922	0.1608	0.1482	0.09448
1989	0.27	0.2378	0.19	0.155	0.1435	0.09007
1990	0.2644	0.2314	0.1855	0.1547	0.142	0.09145

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly	
0.032258064516129	0.3025	0.2658	0.2279	0.1664	0.153		
0.1018							
0.0645161290322581	0.2767	0.2441	0.1974	0.1646			
0.1522	0.09986						
0.0967741935483871	0.2748	0.2424	0.195	0.1629	0.1495		
0.09769							
0.129032258064516	0.2745	0.2419	0.195	0.1625	0.1494		
0.09713							
0.161290322580645	0.2744	0.2419	0.1947	0.1619			
0.1492	0.09682						
0.193548387096774	0.2738	0.2414	0.194	0.1617	0.1491		
0.09598							
0.225806451612903	0.2731	0.2407	0.1936	0.1615			
0.1491	0.09556						
0.258064516129032	0.2725	0.2404	0.1933	0.161	0.149		
0.09483							
0.290322580645161	0.2723	0.2399	0.1929	0.1608			
0.1482	0.09469						
0.32258064516129	0.2723	0.2397	0.1929	0.1602	0.1479		
0.09448							

0.354838709677419 0.1478 0.09423	0.2721	0.2394	0.1922	0.1599	
0.387096774193548 0.09358	0.272	0.2391	0.1922	0.1597	0.1477
0.419354838709677 0.09335	0.2714	0.2387	0.192	0.1596	0.1471
0.451612903225806 0.1471 0.09327	0.2712	0.2386	0.1918	0.1594	
0.483870967741936 0.0932	0.2711	0.2386	0.1918	0.159	0.1466
0.516129032258065 0.1461 0.0932	0.2709	0.2381	0.1914	0.1584	
0.548387096774194 0.09283	0.2702	0.2378	0.191	0.1579	0.146
0.580645161290323 0.09223	0.27	0.2374	0.1904	0.1573	0.1457
0.612903225806452 0.09223	0.2696	0.2369	0.19	0.1571	0.1455
0.645161290322581 0.1453 0.09221	0.2693	0.2368	0.1897	0.1566	
0.67741935483871 0.09145	0.269	0.2365	0.1891	0.1564	0.1446
0.709677419354839 0.09129	0.2682	0.2354	0.1891	0.155	0.1435
0.741935483870968 0.1435 0.09007	0.2658	0.2332	0.1873	0.1547	
0.774193548387097 0.08921	0.2657	0.2327	0.187	0.1547	0.1424
0.806451612903226 0.0891	0.2657	0.2326	0.1864	0.1536	0.142
0.838709677419355 0.1414 0.08907	0.2653	0.2324	0.1858	0.1535	
0.870967741935484 0.1411 0.08797	0.2644	0.2314	0.1855	0.1531	
0.903225806451613 0.1404 0.08782	0.2642	0.2314	0.1851	0.1528	
0.935483870967742 0.1304 0.07466	0.2564	0.2242	0.1766	0.1417	
0.967741935483871 0.0425	0.23	0.1976	0.1501	0.113	0.1019

Prob. Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.1	0.27477	0.24235	0.195	0.16286	0.14949
Average of yearly averages:		0.0911			0.097634

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:

Output File: OrSeedSP

Metfile: w24232.dvf

PRZM scenario: ORgrasseedC.txt

EXAMS environment file: pond298.exv

Chemical Name: Spinosad

Description	Variable Name	Value	Units	Comments
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Molecular weight	mwt	732	g/mol	
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Henry's Law Const.	henry		atm-m ³ /mol	
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Vapor Pressure	vapr	2.4e-10	torr	
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Solubility	sol	235	mg/L	
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Kd	Kd		mg/L	
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Koc	Koc	4237	mg/L	
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Photolysis half-life	kdp	0.93	days	Half-life
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Aerobic Aquatic Metabolism	kbacw	25.54	days	Halfife
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Anaerobic Aquatic Metabolism	kbacs	250	days	Halfife
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Aerobic Soil Metabolism	asm	51.08	days	Halfife
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Hydrolysis: pH 5	0	days	Half-life	
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Hydrolysis: pH 7	0	days	Half-life	
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Hydrolysis: pH 9	0	days	Half-life	
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Method:	CAM	2	integer	See PRZM manual
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Incorporation Depth:	DEPI		cm	
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Application Rate:	TAPP	0.0348	kg/ha	
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Application Efficiency:	APPEFF	0.99	fraction	
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Spray Drift	DRFT	0.064	fraction of application rate applied to pond	
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Application Date	Date	01-06	dd/mm or dd/mmm or dd-mm or dd-mmm	
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Interval 1	interval	7	days	Set to 0 or delete line for single app.
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Interval 2	interval	7	days	Set to 0 or delete line for single app.
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Interval 3	interval	30	days	Set to 0 or delete line for single app.
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Interval 4	interval	7	days	Set to 0 or delete line for single app.
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Interval 5	interval	7	days	Set to 0 or delete line for single app.
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Record 17: FILTRA

IPSCND	1			
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UPTKF

Record 18: PLVKRT

PLDKRT

FEXTRC	0.5			
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Flag for Index Res. Run	IR	Pond		
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Flag for runoff calc.	RUNOFF	none	none, monthly or total(average of entire run)	
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Mint

stored as OrMintSP.out

Chemical: Spinosad

PRZM environment: ORmintC.txt modified Satday, 12 October 2002 at 17:20:16

EXAMS environment: pond298.exv modified Thuday, 29 August 2002 at 16:33:30

Metfile: w24232.dvf modified Wedday, 3 July 2002 at 09:06:10

Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	1.114	0.9509	0.6648	0.3996	0.3204	0.1264
1962	1.214	1.051	0.7652	0.4928	0.4097	0.2224
1963	1.268	1.106	0.8189	0.5464	0.461	0.2698
1964	1.285	1.123	0.8366	0.5596	0.4729	0.2855
1965	1.29	1.13	0.8443	0.5652	0.477	0.2905
1966	1.287	1.124	0.8386	0.5617	0.4742	0.2889
1967	1.282	1.117	0.8329	0.5532	0.4641	0.2818
1968	1.28	1.117	0.8316	0.5538	0.4754	0.2959
1969	1.3	1.136	0.8571	0.5972	0.5072	0.3185
1970	1.303	1.138	0.8539	0.573	0.485	0.3075
1971	1.309	1.148	0.8636	0.5868	0.4956	0.3117
1972	1.305	1.142	0.8564	0.5765	0.4871	0.3054
1973	1.298	1.135	0.8493	0.5701	0.4826	0.3001
1974	1.295	1.131	0.8464	0.5688	0.4814	0.2958
1975	1.293	1.131	0.8445	0.5671	0.4803	0.2935
1976	1.299	1.137	0.8503	0.5737	0.4867	0.2961
1977	1.289	1.125	0.8401	0.5629	0.4766	0.2941
1978	1.286	1.121	0.8368	0.5574	0.4707	0.29
1979	1.283	1.12	0.8346	0.5557	0.4688	0.2957
1980	1.304	1.144	0.8562	0.5778	0.4895	0.2999
1981	1.336	1.169	0.874	0.5859	0.4944	0.3026
1982	1.293	1.129	0.8444	0.5664	0.4796	0.2973
1983	1.29	1.128	0.8409	0.5659	0.4785	0.2918
1984	1.307	1.143	0.871	0.5872	0.495	0.298
1985	1.421	1.239	0.9369	0.6141	0.5165	0.3117
1986	1.295	1.13	0.846	0.5703	0.4823	0.2998
1987	1.279	1.114	0.8303	0.582	0.5007	0.3017
1988	1.3	1.137	0.8517	0.5723	0.4834	0.2975
1989	1.284	1.12	0.8349	0.5587	0.4731	0.2891
1990	1.287	1.124	0.838	0.558	0.469	0.2839

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129			1.421	1.239	0.9369	0.6141
	0.3185					0.5165
0.0645161290322581			1.336	1.169	0.874	0.5972
						0.5072
0.0967741935483871			1.309	1.148	0.871	0.5872
						0.5007
0.129032258064516			1.307	1.144	0.8636	0.5868
						0.4956

0.3075							
0.161290322580645	1.305	1.143	0.8571	0.5859	0.495	0.3054	
0.193548387096774	1.304	1.142	0.8564	0.582	0.4944	0.3026	
0.225806451612903	1.303	1.138	0.8562	0.5778	0.4895		
0.3017							
0.258064516129032	1.3	1.137	0.8539	0.5765	0.4871		
0.3001							
0.290322580645161	1.3	1.137	0.8517	0.5737	0.4867		
0.2999							
0.32258064516129	1.299	1.136	0.8503	0.573	0.485	0.2998	
0.354838709677419	1.298	1.135	0.8493	0.5723	0.4834	0.298	
0.387096774193548	1.295	1.131	0.8464	0.5703	0.4826		
0.2975							
0.419354838709677	1.295	1.131	0.846	0.5701	0.4823	0.2973	
0.451612903225806	1.293	1.13	0.8445	0.5688	0.4814		
0.2961							
0.483870967741936	1.293	1.13	0.8444	0.5671	0.4803		
0.2959							
0.516129032258065	1.29	1.129	0.8443	0.5664	0.4796		
0.2958							
0.548387096774194	1.29	1.128	0.8409	0.5659	0.4785		
0.2957							
0.580645161290323	1.289	1.125	0.8401	0.5652	0.477	0.2941	
0.612903225806452	1.287	1.124	0.8386	0.5629	0.4766		
0.2935							
0.645161290322581	1.287	1.124	0.838	0.5617	0.4754	0.2918	
0.67741935483871	1.286	1.123	0.8368	0.5596	0.4742	0.2905	
0.709677419354839	1.285	1.121	0.8366	0.5587	0.4731	0.29	
0.741935483870968	1.284	1.12	0.8349	0.558	0.4729	0.2891	
0.774193548387097	1.283	1.12	0.8346	0.5574	0.4707		
0.2889							
0.806451612903226	1.282	1.117	0.8329	0.5557	0.469	0.2855	
0.838709677419355	1.28	1.117	0.8316	0.5538	0.4688		
0.2839							
0.870967741935484	1.279	1.114	0.8303	0.5532	0.4641		
0.2818							
0.903225806451613	1.268	1.106	0.8189	0.5464	0.461	0.2698	
0.935483870967742	1.214	1.051	0.7652	0.4928	0.4097		
0.2224							
0.967741935483871	1.114	0.9509		0.6648	0.3996	0.3204	
0.1264							

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.1	1.3088	1.1476		0.87026	0.58716	0.50019
				0.31128		

Average of yearly averages: 0.2881

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:

Output File: OrMintSP

Metfile: w24232.dvf

PRZM scenario: ORmintC.txt

EXAMS environment file: pond298.exv

Chemical Name: Spinosad

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	732	g/mol	
Henry's Law Const.	henry		atm-m ³ /mol	
Vapor Pressure	vapr	2.4e-10	torr	
Solubility	sol	235	mg/L	
Kd	Kd		mg/L	
Koc	Koc	4237	mg/L	
Photolysis half-life	kdp	0.93	days	Half-life
Aerobic Aquatic Metabolism		kbacw	51.08	days Halfife
Anaerobic Aquatic Metabolism		kbacs	250	days Halfife
Aerobic Soil Metabolism	asm	25.54	days	Halfife
Hydrolysis:	pH 5	0	days	Half-life
Hydrolysis:	pH 7	0	days	Half-life
Hydrolysis:	pH 9	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI		cm	
Application Rate:	TAPP	0.1685	kg/ha	
Application Efficiency:	APPEFF	0.99	fraction	
Spray Drift	DRFT	0.064	fraction of application rate applied to pond	
Application Date	Date	01-06	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
Interval 2	interval	5	days	Set to 0 or delete line for single app.
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.5		
Flag for Index Res. Run	IR		Pond	
Flag for runoff calc.	RUNOFF		none	none, monthly or total(average of entire run)

Green Onions

stored as GaOnionSP.out

Chemical: Spinosad

PRZM environment: GAOOnionsC.txt modified Tuesday, 4 May 2004 at 13:18:36
 EXAMS environment: pond298.exv modified Thursday, 29 August 2002 at 16:33:30
 Metfile: w03822.dvf modified Sunday, 19 May 2002 at 06:54:12
 Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.7953	0.7332		0.5376	0.4501	0.4083
1962	1.383	1.197	0.9446	0.8497	0.7726	0.4055
1963	2.08	1.899	1.39	1.117	0.9822	0.5395
1964	3.299	3.037	2.239	1.447	1.23	0.6743
1965	1.388	1.228	0.9421	0.8537	0.7747	0.548
1966	2.035	1.768	1.295	1.12	0.9862	0.5478
1967	1.126	1.036	0.8542	0.741	0.7019	0.4696
1968	1.399	1.269	0.974	0.7846	0.7116	0.4283
1969	2.161	1.93	1.273	1.018	0.9258	0.5118
1970	1.37	1.253	0.9329	0.8471	0.8243	0.5183
1971	1.554	1.393	1.153	1.011	0.9858	0.5769
1972	1.621	1.493	1.152	0.9183	0.871	0.5495
1973	2.22	1.91	1.279	0.9727	0.8651	0.5097
1974	0.9885	0.9217		0.7666	0.6702	0.6382
1975	1.932	1.767	1.327	0.9104	0.7865	0.4535
1976	1.406	1.261	1.02	0.9325	0.8609	0.5254
1977	0.9176	0.815	0.6684		0.5942	0.5749
1978	0.9898	0.8679		0.6366	0.5327	0.4967
1979	1.828	1.688	1.208	0.8581	0.7748	0.4319
1980	1.05	0.9198		0.8064	0.7034	0.6188
1981	1.496	1.354	1.079	0.7735	0.6765	0.4082
1982	1.831	1.618	1.225	1.152	1.028	0.5672
1983	1.381	1.293	1.084	0.9362		0.8477
1984	1.264	1.194	0.9746		0.7189	0.6729
1985	1.373	1.191	0.9423		0.7435	0.6924
1986	1.141	0.9925		0.7862	0.7185	0.6471
1987	1.208	1.095	0.9228		0.7879	0.7287
1988	1.11	0.9692		0.7072	0.6074	0.5897
1989	1.078	0.9647		0.857	0.7696	0.7227
1990	0.873	0.7653		0.6215	0.5447	0.5315

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.032258064516129			3.299	3.037	2.239	1.447
0.0645161290322581			2.22	1.93	1.39	1.152
0.0967741935483871			2.161	1.91	1.327	1.12
0.129032258064516			2.08	1.899	1.295	1.117
0.161290322580645			2.035	1.768	1.279	1.018
0.193548387096774			1.932	1.767	1.273	1.011
0.225806451612903			1.831	1.688	1.225	0.9727

0.258064516129032	1.828	1.618	1.208	0.9362	0.8651	0.5379
0.290322580645161	1.621	1.493	1.153	0.9325	0.8609	0.5254
0.32258064516129	1.554	1.393	1.152	0.9183	0.8477	0.5183
0.354838709677419	1.496	1.354	1.084	0.9104	0.8243	0.5118
0.387096774193548	1.406	1.293	1.079	0.8581	0.7865	0.5097
0.419354838709677	1.399	1.269	1.02	0.8537	0.7748	0.4696
0.451612903225806	1.388	1.261	0.9746	0.8497	0.7747	
0.4535						
0.483870967741936	1.383	1.253	0.974	0.8471	0.7726	0.4485
0.516129032258065	1.381	1.228	0.9446	0.7879	0.7287	
0.4419						
0.548387096774194	1.373	1.197	0.9423	0.7846	0.7227	
0.4355						
0.580645161290323	1.37	1.194	0.9421	0.7735	0.7116	
0.4319						
0.612903225806452	1.264	1.191	0.9329	0.7696	0.7019	
0.4283						
0.645161290322581	1.208	1.095	0.9228	0.7435	0.6924	
0.4232						
0.67741935483871	1.141	1.036	0.857	0.741	0.6765	0.4115
0.709677419354839	1.126	0.9925	0.8542	0.7189	0.6729	
0.4104						
0.741935483870968	1.11	0.9692	0.8064	0.7185	0.6471	
0.4101						
0.774193548387097	1.078	0.9647	0.7862	0.7034	0.6382	
0.4082						
0.806451612903226	1.05	0.9217	0.7666	0.6702	0.6188	
0.4055						
0.838709677419355	0.9898	0.9198	0.7072	0.6074		
0.5897	0.3992					
0.870967741935484	0.9885	0.8679	0.6684	0.5942		
0.5749	0.3976					
0.903225806451613	0.9176	0.815	0.6366	0.5447	0.5315	
0.3681						
0.935483870967742	0.873	0.7653	0.6215	0.5327	0.4967	
0.3209						
0.967741935483871	0.7953	0.7332	0.5376	0.4501		
0.4083	0.1877					

Prob. Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.1	2.1529	1.9089	1.3238	1.1197	0.98616
				0.56543	

Average of yearly averages: 0.4619

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:

Output File: GaOnionSP

Metfile: w03822.dvf

PRZM scenario: GAOnionsC.txt

EXAMS environment file: pond298.exv

Chemical Name: Spinosad

Description	Variable Name	Value	Units	Comments
Molecular weight	mwt	732	g/mol	
Henry's Law Const.	henry		atm-m ³ /mol	
Vapor Pressure	vapr	2.4e-10	torr	
Solubility	sol	235	mg/L	
Kd	Kd		mg/L	
Koc	Koc	4237	mg/L	
Photolysis half-life	kdp	0.93	days	Half-life
Aerobic Aquatic Metabolism	kbacw	51.08	days	Halfife
Anaerobic Aquatic Metabolism	kbacs	250	days	Halfife
Aerobic Soil Metabolism	asm	25.54	days	Halfife
Hydrolysis:	pH 5	0	days	Half-life
Hydrolysis:	pH 7	0	days	Half-life
Hydrolysis:	pH 9	0	days	Half-life
Method:	CAM	2	integer	See PRZM manual
Incorporation Depth:	DEPI		cm	
Application Rate:	TAPP	0.1011	kg/ha	
Application Efficiency:	APPEFF	0.99	fraction	
Spray Drift	DRFT	0.064	fraction of application rate applied to pond	
Application Date	Date	01-06	dd/mm or dd/mmm or dd-mm or dd-mmm	
Interval 1	interval	5	days	Set to 0 or delete line for single app.
Interval 2	interval	5	days	Set to 0 or delete line for single app.
Interval 3	interval	30	days	Set to 0 or delete line for single app.
Interval 4	interval	5	days	Set to 0 or delete line for single app.
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.5		
Flag for Index Res. Run	IR		Pond	
Flag for runoff calc.	RUNOFF		none	none, monthly or total(average of entire run)