4-27-05

EPA
United States
Environmental Protection
Agency

Office of Prevention, Pesticides,
and Toxic Substances

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MEMORANDUM:

SUBJECT: Section 18 for Boscalid to control fungal disease caused by *Alternaria alternata* on mandarin oranges in California.

TO: Andrew Ertman, Reviewer
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I. Background

The state of California has requested an emergency exemption for the use of Pristine Fungicide® (US EPA Reg. No. 7969-199) on mandarin oranges and mandarin hybrids to primarily prevent diseases caused by *Alternaria spp.* Pristine fungicide is composed of 25.2 % boscalid and 12.8% pyraclostrobin; this assessment focuses on boscalid only. The fungicide will be applied to ground only as a water dispersable granule. The proposed application rate is 0.292 pounds boscalid/A and 0.148 pounds pyroclostrobin/A with a maximum of 4 applications per year. Application intervals are from 10 to 21 days and no more than two sequential applications are allowed before switching to a fungicide with a different mode of action. The total area that is likely to be treated is 5,000 acres and the total amount of product to be used is 23,125 lbs. Pristine (5,846 lbs boscalid and 2,960 lbs pyroclostrobin).

BASF has been granted registration for the use of boscalid (formerly nicobifen) on turf, vegetables, canola, fruit and nut crops in the U.S. and Canada; additionally, in the U.S. only, it is registered for use on soybeans, pome fruit and hops (EFED Risk Assessment for Section 3 Registration of BAS 510 F (nicobifen), DP Barcode D278387 and others; Risk Assessment for Proposed Uses of boscalid on Soybeans, Pome Fruit, and Hops, D293435 and D293436). The proposed Section 18 use rate falls within the range of previously assessed use rates.

II. Summary of Conclusions

The proposed use of boscalid may pose a chronic risk to mammals feeding on shortgrass and broadleaf plants and/or insects as risk quotients exceed the level of concern (LOC) of 1.0 for both non-listed and listed mammalian species. The potential effects of boscalid on mammals may result in indirect effects to two listed avian species. A brief endangered species assessment is provided below. Also, since studies have shown that boscalid causes some chronic reproductive effects in birds, this chemical may be subject to further screening and/or testing to better characterize effects related to endocrine disruption. There are no expected risks to aquatic animal species, terrestrial and aquatic plants, avian species or acute risks to mammals from the proposed use of boscalid.

III. Environmental Fate Summary

Boscalid is fairly persistent and characterized by slow biodegradation and low soil mobility. The primary pathway for degradation in soil is aerobic metabolism, which proceeds slowly and results in intermediates that are transformed to CO_2 or bound soil residues. Boscalid is stable to hydrolysis and also phytolosis in soil and water. In aquatic systems, boscalid is not significantly transformed under aerobic or anaerobic conditions but is relatively rapidly transferred from the water phase to the sediment phase through sorption to sediment (dissipation half-life < 2 weeks).

IV. Water Resource Summary

A. Surface Water

Estimates of surface water and groundwater concentrations for the proposed use of boscalid were generated using current U.S. EPA EFED models (http://www.epa.gov/oppefed1/models/water/). Groundwater concentrations were generated using SCI-GROW, drinking water estimates were generated using FIRST and surface water estimates were generated using GENEEC2(v2.0). Table IV.1. shows input parameters for the SCI-GROW, FIRST and GENEEC2 (v2.0) models. Table IV.2. shows model output for the currently proposed use of boscalid on Mandarin oranges. Output for two other, previously approved uses of boscalid are provided for comparison purposes.

Estimates of boscalid concentrations based on the proposed Section 18 use are less than concentrations for previously approved uses of boscalid (Table IV.2).

Table IV.1. Input Parameter Values for Boscalid Applied by Ground Spray for Surface and Groundwater Models (GENEEC2 (v2.0), FIRST, SCI-GROW)

Parameter	Value	Source
Application Rate	0.292 lb a.i./A	Label maximum
Application Number	4	Label Maximum
Application Interval (days)	10	Label Maximum
Organic Carbon Partitioning Coefficient (K_{oc}; mL/g)	655[1]	Swann et al., 1983
Aerobic Soil Metabolism Half-life (days)	365[2]	MRID# 45405208 MRID# 45405209 MRID# 45643802
Wetted in?	No	Standard practice
Depth of Incorporation (inches)	0	Ground application
Solubility in water (ppm)	6 mg/L (20C)	
Aerobic Aquatic Metabolism Half-life	Stable	MRID# 45405214
Hydrolysis Half-life @ pH 7	Stable	MRID# 45405205
Aquatic Photolysis Half-life @ pH 7	Stable	MRID# 45405206

[1]Represents the lowest K_{oc} for a non-sand soil, excluding the German Standard soil
[2]The aerobic soil metabolism half-life used in the models represents the 90th percentile of the upper confidence bound on the mean half-life for four soils.

Table IV.2. EEC Estimates for Proposed Use on Mandarin Oranges and Two Previously Approved Uses of Boscalid

Crop and Application Type	Max Appl. Rate (lb a.i./A) Rate and No. Appls.	Appl. Interval (days)	FIRST Results Surface Water Conc. (Acute, Chronic in ppb)	SCI-GROW Results Groundwater Conc. (ppb)	GENEEC2 Results (Surface Water Conc., Peak & 4-, 21-, 60-, and 90-day Avg. Conc. in ppb
Mandarin Oranges (ground spray)	0.292 (4)	10	50.14 14.75	0.465	34.70 34.60, 34.01, 32.74, 31.83
Bulb vegetables (ground spray)	0.298 (6)	7	76.42 22.49	0.486	52.9 52.8, 51.9, 49.9, 48.5
Strawberries (ground spray)	0.350 (5)	7	75.26 22.14	0.476	52.1 51.9, 51.1, 49.1, 47.8

V. Aquatic Organism Risk Assessment

To estimate risks of boscalid to aquatic organisms, the risk quotient (RQ) approach was used. The basis of the RQ approach is a comparison of estimated exposure concentrations to toxicity test estimates (e.g., EEC/LC_{50}). If the calculated RQs exceed a specified level of concern (LOC), then the potential for risk may exist. For the proposed use of boscalid on Mandarin oranges, no RQs exceeded acute and chronic risk LOCs for non-listed or listed aquatic species. Hence the use of boscalid on Mandarin oranges is not expected to pose acute and/or chronic risks to aquatic non-listed or listed species.

Table V.1. shows the EECs for the use of boscalid on Mandarin oranges used to determine risk quotients (RQs) for aquatic species. For all acute RQ calculations, the

peak estimated surface water concentration (0.0347 ppm) was used. Table V.1 shows aquatic toxicity estimates (LC_{50}s, EC_{50}s, NOAECs and LOAECs) and associated RQs for aquatic species. For freshwater and estuarine/marine fish and invertebrates, RQs did not exceed the acute risk LOC ($RQ \geq 0.05$). Similarly, the RQ for aquatic plants did not exceed the plant risk LOC ($RQ \geq 1$). The 21- and 60-day EECs were used in calculating RQs associated with chronic risk to freshwater fish and invertebrates; RQs did not exceed the LOC ($RQ \geq 1.0$). There were no chronic toxicity data available for estuarine/marine fish or invertebrates so RQs could not be calculated.

Risks to federally listed (endangered or threatened) aquatic species associated with the proposed use of boscalid are expected to be low. No RQs exceeded the listed species acute risk LOC ($RQ \geq 0.05$) or chronic risk LOC ($RQ \geq 1$) for all aquatic species for which toxicity estimates were available. As in the case of non-listed species, RQs could not be calculated for estuarine/marine fish and invertebrates due to a lack of toxicity data.

Table V.1. Summary of Acute and Chronic Toxicity and Risk Estimates for Aquatic Organisms Exposed to Boscalid

Species	Study Type	LC_{50} or EC_{50} mg/L	NOAEC mg/L	EEC (mg/L)	RQ	Source (MRID#)
ACUTE						
Rainbow Trout *Onchorhyncus mykiss*	FW fish acute	LC_{50} = 2.7		0.0347	0.01	454049-27
Daphnia magna	FW invert. acute	EC50 = 5.33		0.0347	0.007	454050-01
Sheepshead Minnow *Cyprinodon variegatus*	EM fish acute	LC50 > 3.86		0.0347	0.004	454050-04
Mysid Shrimp *Americamysis bahia*	EM invert. Acute	LC50 => 3.81		0.0347	0.009	454050-02
Eastern Oyster *Crossostrea virginica*	EM invert. Shell – deposition	EC50 = 1.02		0.0347	0.03	454050-03
Lemna gibba	Vascular aquatic plant acute	EC50 > 3.9		0.0347	0.009	454050-13
Pseudokirchneriella subcapitata	Non-vascular aquatic plant acute	EC50 = 1.34		0.0347	0.03	454050-17
CHRONIC						
Rainbow Trout *Onchorhyncus mykiss*	FW fish early-life stage		0.116	0.0340 (21-D)	0.29	454050-06
Daphnia magna	FW invert. Life-cycle		1.31	0.0340 (21-D)	0.026	454050-05

Fish and aquatic invertebrate acute risk LOC = 0.5
Fish and aquatic invertebrate chronic risk LOC = 1.0

Since boscalid is somewhat persistent in the environment and can sorb to sediment, risks to benthic organisms were assessed. In a previous risk assessment for boscalid, it was concluded that there were minimal risks to benthic organisms (EFED Risk Assessment for Section 3 Registration of BAS 510 F (nicobifen), DP Barcode D278387). The Pesticide Root Zone Model/Exposure Analysis Model System (PRZM/EXAMS) was used to estimate sediment pore water levels of boscalid in a standard pond. The turf scenario, which represented the highest use rates (and is higher than the proposed use rate for mandarin oranges), was used in the assessment. Results indicated that accumulation continued through the 36-year simulation period and that boscalid concentration in sediment pore water by the end of the simulation was 316 µg/l. This estimate was compared to a chronic toxicity benchmark for a benthic macroinvertebrate, *Chrironomus*

riparius (NOEC = 2,000 µg/l), which indicated that after more than 30 years of simulation, levels of boscalid in the benthos would not reach levels exceeding the chronic toxicity threshold. Since the application to mandarin oranges is expected to result in lower EECs; risks from the proposed use is also not expected.

VI. Terrestrial Organism Risk Assessment

Risk to Mammalian Species

The RQ approach was used to estimate the risks of boscalid to terrestrial species. The basis of the approach is a comparison of exposure estimates to toxicity estimates. If the RQ exceeds a specified LOC, there is potential for risk. Terrestrial exposure values for terrestrial species were estimated using T-Rex (v1.1), which is based on the methods of Hoerger and Kenaga (1972) as modified by Fletcher et al. (1994).

Data on the toxicity of boscalid to laboratory rats and mice were used to assess the potential for mammalian risk for the proposed use of boscalid. These data (Table VI.1) were obtained from the U.S. EPA Health Effects Division. Boscalid is considered practically non-toxic to rats (LD50 > 5,000 mg/kg) on an acute exposure basis. Output from T-Rex showed that for the proposed use of boscalid, no acute risk LOCs were exceeded for listed or non-listed mammalian species. For example, the highest RQ was < 0.02 for small mammals (20g) that feed on short grass only; all other RQs were lower. Chronic toxicity of boscalid to mammals was determined using a 2-generation rat reproduction study (MRID# 454049-06). Results showed decreased body weight and decreased body weight gains in F2 male pups (NOAEC = 100 ppm). The chronic risk LOCs (RQ > 1.0) were exceeded for mammals that consume short grass, broadleaf plants and small insects. For listed mammalian species, RQs did not exceed the acute risk LOCs (RQ ≥ 0.1) but did exceed chronic risk LOCs (RQ ≥ 1.0) for mammals that consume short grass, broadleaf plants and small insects.

Table VI.1. Summary of Acute and Chronic Risk Estimates for Mammals

Species	Food Type	LD_{50} or NOAEC	EEC (ppm)	Acute RQ	Chronic RQ	Source (MRID#)
Laboratory rat	Short grass	LD_{50}>5000[1]	203	0.02[3]		454048-14
Laboratory rat	Tall grass	LD_{50}>5000[1]	93	0.01[3]		
Laboratory rat	Broadleaf plants & sm. insects	LD_{50}>5000[1]	114	0.01[3]		
Laboratory rat	Fruits, pods, large insects	LD_{50}>5000[1]	13	0.0[3]		
Laboratory rat	Short grass	NOAEC=100[2]	213.42		**2.13**	454049-06
Laboratory rat	Tall grass	NOAEC=100[2]	97.82		0.98	
Laboratory rat	Broadleaf plants & sm. insects	NOAEC=100[2]	120.05		**1.20**	
Laboratory rat	Fruits, pods, large insects	NOAEC=100[2]	13.34		0.13	

[1]Acute tox value, units = mg/kg
[2]Chronic tox value, units=mg/kg d^{-1}
[3]Based on 15g mammal, which had highest exposures and acute RQ's
Mammalian acute risk LOC = 0.5
Mammalian chronic risk LOC = 1.0

Risk to Avian Species

Boscalid is considered practically non-toxic to avian species based on acute oral and subacute dietary toxicity studies (Table VI.2). The LD50 for Bobwhite quail was greater than the highest dose tested (LD50 > 2000 mg/kg) and, in fact, there were no signs of toxicity at any dose level. For both Mallard ducks and Bobwhite quail, the acute dietary LC50 was also greater than the highest tested concentration (LC50 > 5247 mg/kg). Two avian reproductive studies were conducted. There were significant effects of boscalid on Bobwhite quail; number of eggs laid, fertility rate, embryo mortality, and number of 14-day-old survivors were the most sensitive endpoints. The NOAEL for this study was 300 mg/kg diet. In a similar study with Mallard ducks, there were no observed treatment-related effects and the NOAEL for this study was greater than the highest tested concentration (NOAEL > 1000 mg/kg diet).

Acute RQs were not calculated for birds that might be exposed to boscalid since no mortality occurred during the avian acute toxicity test. For chronic exposures (Table VI.2), the non-listed species chronic risk LOC (RQ > 1.) was not exceeded. This was true for listed species LOCs as well (RQ ≥ 1.0).

Table VI.2 Summary of Chronic Risk Estimates for Birds (Dietary-based Toxicity Estimate)

Species	Food Type	NOAEL mg/kg	Max. EEC (ppm)	Chronic RQ	Source (MRID#)
Bobwhite quail	Short grass	300	213.42	0.71	454049-25
Bobwhite quail	Tall grass	300	97.82	0.33	
Bobwhite quail	Broadleaf plants & insects	300	120.05	0.40	
Bobwhite quail	Seeds	300	13.34	0.04	

Avian chronic risk LOC = 1.0

Risks to Terrestrial Plant Species

Results of the Tier 1 seedling emergence test on boscalid (MRID# 45405011) showed endpoint effects were less than 25% the pooled control values. This resulted in an estimated EC_{25} that was greater than an equivalent application rate of 0.55 lb a.i./A. The proposed application rate of boscalid for use on Mandarin oranges is 0.292 lb a.i./A. At this application rate, the calculated RQ for terrestrial plants is < 0.53 which is less than the plant risk LOC (RQ ≥ 1.0).

VII. Listed Species Risks

The screening level assessment on the risks of the proposed use of boscalid indicated that, for listed species, only the mammalian chronic risk LOC was exceeded. To examine the potential for overlap between boscalid use on mandarin oranges and listed mammalian species, EFED's LOCATES database was used. A search for listed mammalian species associated with orange groves of a minimum of 100 acres indicated that 13 listed mammalian species may occur in California counties where oranges are grown. Importantly, the database could not distinguish between types of oranges so this list of species may include counties where a variety of orange, other than mandarin is grown. A more detailed assessment of the location of mandarin orange groves and listed species is required to firmly establish any potential for overlap in addition to a clear delineation of the action area; this was not conducted for this analysis. A brief, species-by-species analysis for mammals follows below.

Of the 13 listed mammalian species associated with boscalid use on mandarin oranges, there seems to be little potential for risk. Although some risk is possible, most of the listed species prefer habitat that seems unsuitable for agriculture or food items that are not expected to result in elevated exposures. However, to reach a determination of "non likely to adversely affect" or "likely to adversely affect" would require clear delineation of the action area associated with the proposed use of boscalid and a firm knowledge of species location with respect of mandarin orange groves.

VII.a. Probability of Individual Effects

An estimate of the chance of effects to individual listed species is provided here to facilitate interpretation of the acute listed species LOCs (0.1 and 0.05 for terrestrial and aquatic animals, respectively). Moreover, the analysis provides insight in to the probability of individual effects if exposure were to occur at the level used in the RQ analysis. For this assessment, the default probit slope value of 4.5 was used for all analyses since estimates from boscalid toxicity studies were not readily available. The probability of individual effects was calculated only for those organisms for which an estimated LC50/EC50 was available.

Table VII.1. Probability of Individual Effects at the Listed Species LOC and at the Proposed Use Rate of Boscalid on Mandarin Oranges for All Taxa

Taxon	Acute Tox Value	Probability of Effect at LOC (1 in __)	RQ	Probability of Effect at RQ (1 in __)
Freshwater Fish	LC_{50} = 2.7	4.17E+08	0.01	1.00E+16
Freshwater Invertebrate	EC50 = 5.33	4.17E+08	0.007	1.00E+16
Estuarine/Marine Mollusk	EC50 = 1.02	4.17E+08	0.03	2.75E+11
Freshwater Non-vascular Plant	EC50 = 1.34	4.17E+08	0.03	2.75E+11

Default slope value of 4.5 was used for all analyses.

Based on an assumption of a probit dose response relationship with a mean estimated slope of 4.5 (default) at the listed species acute LOC is 1 in 4.17E+08 for aquatic species. The probability of effects to an individual exposed at the levels used in RQ calculations was highest for mollusks and freshwater non-vascular plants at 1 in 2.75E+11. This analysis indicates that the likelihood of an acute effect on an individual listed species associated with exposure to boscalid is unlikely.

VII.b. Indirect Effects to Listed Avian Species

Although the screening level assessment indicates that no LOCs were exceeded for listed or non-listed avian species, indirect effects on listed avian species may result from the use of boscalid on mandarin oranges. Since chronic risk LOCs were exceeded for mammals, the primary indirect effect that could result is a decrease in the mammalian forage base of carnivorous avian species. An altered forage base could cause difficulties in meeting energy requirements and/or could alter behavior in a way that impacts listed avian species in a deleterious manner. A LOCATES search indicated that there are four carnivorous listed birds in California counties where oranges (including mandarin organges) are grown. These are: the California condor, the bald eagle, the Northern spotted owl, and the San Clemente loggerhead shrike. A may affect determination was reached for the California condor and the bald eagle. The Northern spotted owl is unlikely to occupy habitats or forage in agricultural areas, as this species is almost entirely arboreal. The San Clemente loggerhead shrike only occurs on San Clemente Island, which has little, if any agriculture since it is owned and operated by the U.S. Navy. A brief, species-by-species analysis is provided below. To improve the confidence in this assessment and to move to determinations of "likely" or "not likely to adversely affect" for the California condor and the bald eagle would require more information on the action area of the proposed use and how it overlaps with the ranges of these species. In addition, the relative dietary contribution of mammalian prey items in the action area would need to be ascertained to determine if effects on mammals may result in significant reductions in available forage for California condors and bald eagles.

The California condor, *Gymnogyps californianus*, prefers low and moderate elevation mountainous country characterized by rocky and/or brushy areas with cliffs available for nest sites. This species forages on grasslands, oak savanna, mountain plateaus, ridges and canyons. It may nest on the floor of cliff cavities or caves, in crevices among boulders on steep slopes or sometimes in giant sequoia cavities. This species is a carnivore and prefers carrion of freshly killed mammals. Although much of the preferred habitat of California condors is not amenable to agricultural practices, since this species forages over a much larger range (generally 70 km from nest but up to 180 km), indirect effects are possible. However, given that the foraging range is so large, it is possible that any decreases in available mammalian prey as a result of boscalid use on mandarin oranges may not impact the overall forage base of this species. More information on the location of mammalian prey items with respect to mandarin orange groves is needed to determine whether boscalid-related effects on mammals could have an impact on California condors.

The bald eagle, *Haliaeetus leucocephalus*, is a large carnivorous raptor found throughout the United States. It occupies a variety of habitats, usually nesting near coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources. The bald eagle is opportunistic and will feed on fish, injured waterfowl and seabirds, various mammals, and carrion. This species can use large tracts of land as territory or home range. For example, the home range of immature eagles from February to April in Arizona averaged 400 sq. km. It seems possible that the bald eagle forage base could be impacted by the proposed use of boscalid on mandarin oranges. However, given that eagles can forage over a large area and that fish can also comprise much of their diet, more information on the location of mandarin orange groves with respect to bald eagles is required. Some eagles near mandarin orange groves may consume mammals as a major component of their diet. In these cases, boscalid impacts on mammals may have relatively more significant indirect effects on nearby bald eagles.

The San Clemente loggerhead shrike, *Lanius ludovicianus mearnsi*, is a fairly small (22 cm), carnivorous bird. This species is found only on San Clemente Island, which is one of the Channel Islands within Los Angeles County owned and operated by the U.S. Navy. The loggerhead shrike prefers open country with scattered trees and shrubs and nests in tall shrubs or small trees feeding mostly on large insects, small birds, lizards, and mice. Indirect effects to San Clemente loggerhead shrikes associated with the proposed boscalid use would be possible only if mandarin oranges are grown on San Clemente Island. There is little, if any, agriculture on the island since it is first and foremost a Naval station. Hence, indirect effects on loggerhead shrikes associated with the use of boscalid on mandarine oranges are not expected.

The Northern spotted owl, *Strix occidentalis caurina*, prefers old growth forests characterized by large trees with cavities, heavy accumulations of logs and other debris on the forest floor, and considerable open space within and beneath the canopy. Although the species tends to be found in older forests, some younger forests may provide suitable habitat. The species is entirely carnivorous feeding heavily on arboreal or semi-arboreal mammals. Given the preference of this species for forested habitats it seems unlikely that the use of boscalid on mandarin oranges would result in a significant decrease of the mammalian forage base.

VII.c. Mammalian Listed Species

Medium and Small Mammals

Six species of kangaroo rats are found in counties that may also grow mandarin oranges. These are, by common name; Stephen's, San Bernardino, Giant, Morro Bay, Tipton and Fresno Kangaroo rats. Kangaroo rats generally prefer to eat seeds although they may supplement their diet with invertebrates and other plant material. No RQs based on seed consumption exceeded the acute or chronic risk LOCs. Moreover, in cases where the diet may consist of 50% insects, the LOCs are still not exceeded. Similarly, the Pacific pocket mouse is also primarily a granivore, hence risks are expected to be low. The Amargosa vole also can occur in counties that grow mandarin oranges but this species

prefers marsh-like habitats and although it eats plant material (RQs exceeded chronic LOC), exposure to boscalid is only likely if a mandarin grove is near critical habitat. Similarly, the Buena Vista Shrew prefers marsh/wetland habitat. Primarily insectivorous, shrews may become exposed to boscalid, but only if mandarin orange groves are in close proximity to shrew critical habitat.

Large Mammals
The Santa Catalina Island Fox is unlikely to be exposed to boscalid since this species is only found on Santa Catalina Island, which has very little current agriculture and therefore boscalid is unlikely to be used.

The San Joaquin Kit fox is found in the San Joaquin Valley floor and surrounding foothills of the coastal range, Sierra Nevada, and the Tehachapi Mountains of CA. It eats small mammals, ground nesting birds and to a lesser degree, plants and insects. In all likelihood, the greatest risk to this species from boscalid is through secondary poisoning; consuming prey species that have become exposed to boscalid by consuming contaminated plants or insects. More information on the known location of kit foxes and mandarin orange groves would be very useful in determining a potential for excessive risk.

The Southern Sea Otter resides in the Pacific Ocean, typically not more than 1.5 miles from shore. Sea otters consume sea urchins, crabs, clams, mussels and other shellfish. Given this species habitat and diet preferences, it is unlikely to be exposed to high levels of boscalid.

Bighorn sheep typically occur on steep, open slopes, canyons, and washes in hot and dry desert regions where the land is rough, rocky, and sparsely vegetated. Most sheep live between 300 and 4000 feet in elevation. Also, alluvial fans at the base of canyons and washes are used for feeding, movement, and breeding. Their diet consists of a variety of plants including shrubs, herbaceous annuals and perennials, cacti, and grasses. Whether the use of boscalid on mandarin oranges poses any risk to bighorn ship is largely related to the overlap of sheep habitat and mandarin orange groves. More detailed information on the location of sheep and orange groves is necessary for an accurate assessment of potential risks to Peninsular Bighorn sheep.

California Mammalian Species Listing

Oranges (125)

Minimum of 100 Acre

California

County	Scientific Name	Status
Fresno (3851096 Acres)		
FOX, SAN JOAQUIN KIT known	*Vulpes macrotis mutica*	Endangered
KANGAROO RAT, FRESNO known	*Dipodomys nitratoides exilis*	Endangered
KANGAROO RAT, GIANT known	*Dipodomys ingens*	Endangered
Kern (5223304 Acres)		
FOX, SAN JOAQUIN KIT known	*Vulpes macrotis mutica*	Endangered
KANGAROO RAT, GIANT known	*Dipodomys ingens*	Endangered
KANGAROO RAT, TIPTON known	*Dipodomys nitratoides nitratoides*	Endangered
SHREW, BUENA VISTA known	*Sorex ornatus relictus*	Endangered
Los Angeles (2581148 Acres)		
FOX, SAN JOAQUIN KIT known	*Vulpes macrotis mutica*	Endangered
FOX, SANTA CATALINA ISLAND known	*Urocyon littoralis catalinae*	Endangered
MOUSE, PACIFIC POCKET known	*Perognathus longimembris pacificus*	Endangered
Madera (1378090 Acres)		
FOX, SAN JOAQUIN KIT known	*Vulpes macrotis mutica*	Endangered
KANGAROO RAT, FRESNO possible	*Dipodomys nitratoides exilis*	Endangered
Orange (510248 Acres)		
MOUSE, PACIFIC POCKET known	*Perognathus longimembris pacificus*	Endangered
Riverside (4674085 Acres)		
KANGAROO RAT, SAN BERNARDINO known	*Dipodomys merriami parvus*	Endangered

California Mammalian Species Listing Cont'd

Oranges (125)

Minimum of 100 Acre

California

County	Scientific Name	Status
Riverside (4674085 Acres)		
KANGAROO RAT, STEPHENS' known	*Dipodomys stephensi (incl. D. cascus)*	Threatened
SHEEP, PENINSULAR BIGHORN known	*Ovis canadensis*	Threatened
San Bernardino (1.28675E+07		
KANGAROO RAT, SAN BERNARDINO known	*Dipodomys merriami parvus*	Endangered
KANGAROO RAT, STEPHENS' possible	*Dipodomys stephensi (incl. D. cascus)*	Threatened
VOLE, AMARGOSA known	*Microtus californicus scirpensis*	Endangered
San Diego (2713821 Acres)		
KANGAROO RAT, STEPHENS' known	*Dipodomys stephensi (incl. D. cascus)*	Threatened
MOUSE, PACIFIC POCKET known	*Perognathus longimembris pacificus*	Endangered
SHEEP, PENINSULAR BIGHORN known	*Ovis canadensis*	Threatened
San Luis Obispo (2124438 Acres)		
FOX, SAN JOAQUIN KIT known	*Vulpes macrotis mutica*	Endangered
KANGAROO RAT, GIANT known	*Dipodomys ingens*	Endangered
KANGAROO RAT, MORRO BAY known	*Dipodomys heermanni morroensis*	Endangered
OTTER, SOUTHERN SEA known	*Enhydra lutris nereis*	Threatened
Tulare (3096901 Acres)		
FOX, SAN JOAQUIN KIT known	*Vulpes macrotis mutica*	Endangered
KANGAROO RAT, GIANT known	*Dipodomys ingens*	Endangered
KANGAROO RAT, TIPTON known	*Dipodomys nitratoides nitratoides*	Endangered
Ventura (1187974 Acres		
FOX, SAN JOAQUIN KIT possible	*Vulpes macrotis mutica*	Endangered

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