Risks of Propyzamide Use to Federally Threatened California Red-legged Frog
(*Rana aurora draytonii*)

Pesticide Effects Determination

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1. Executive Summary

The purpose of this assessment is to evaluate potential direct and indirect effects on the California red-legged frog *(Rana aurora draytonii*) (CRLF) arising from Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulatory actions regarding use of propyzamide on agricultural and non-agricultural sites. In addition, this assessment evaluates whether these actions can be expected to result in modification of the species' designated critical habitat. This assessment was completed in accordance with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) *Endangered Species Consultation Handbook* (USFWS/NMFS 1998) and procedures outlined in the Agency's Overview Document (USEPA 2004).

The CRLF was listed as a threatened species by USFWS in 1996. The species is endemic to California and Baja California (Mexico) and inhabits both coastal and interior mountain ranges. A total of 243 streams or drainages are believed to be currently occupied by the species, with the greatest numbers in Monterey, San Luis Obispo, and Santa Barbara counties (USFWS 1996) in California.

Propyzamide is a selective, systemic, restricted–use, organochlorine herbicide that is currently labeled for use on artichokes, cane berries, blueberries, alfalfa and related feed crops, lettuce and related leafy greens, rhubarb, pome and stone fruit, grapes, winter peas, sod, turf, fallow land, conservation reserve land, Christmas trees, and ornamentals. Propyzamide is not labeled for use on cane berries, winter peas, rhubarb, or conservation reserves in California. The remaining current uses are considered as part of the federal action evaluated in this assessment.

Propyzamide has relatively low volatility and is soluble in water. Therefore, potential transport mechanisms considered in this assessment include spray drift and runoff, as volatilization and atmospheric transport are not expected to occur. The compound is stable to hydrolysis, mobile in some soils, and has been detected in surface water and ground water monitoring studies. The major routes of degradation appear to be aerobic metabolism in soil and photolysis in water. In anaerobic environments, propyzamide may be moderately persistent.

Toxicity data are not available for degradates of propyzamide; however, all identified degradates other than carbon dioxide retain the 3,5-dichlorobenzoyl moiety and in the absence of data to the contrary are considered residues of concern for mammals. Therefore, a total residues of concern (TRC) approach was used to evaluate the potential exposure to the residues of risk concern, which include propyzamide and all identified degradates other than carbon dioxide.

Since CRLFs exist within aquatic and terrestrial habitats, exposure of the CRLF, its prey and its habitats to propyzamide are assessed separately for the two habitats. The Tier-II aquatic exposure models Pesticide Root Zone Model (PRZM) and EXposure Analysis Modeling System (EXAMS) are used to estimate high-end exposures of propyzamide in aquatic habitats resulting from runoff and spray drift from different uses. Peak aquatic model-estimated environmental concentrations (EEC) of total residues resulting from different propyzamide uses range from 13.9 to 225 µg/L. These estimates are supplemented with analysis of available California surface water monitoring data from the U. S. Geological Survey's National Water Quality Assessment (NAWQA) program and the California Department of Pesticide Regulation (DPR) surface water database. However, exposure estimates cannot be directly evaluated with the monitoring data because the parent compound alone is monitored, whereas all residues of concern are estimated in modeling. The maximum concentration of propyzamide reported by the California Department of Pesticide Regulation surface water database from 1990-2005 is 0.25 µg/L. The maximum concentration of propyzamide reported by NAWQA from 1992-2005 for California surface waters with agricultural watersheds is 0.11 µg/L. These values are three orders of magnitude less than the maximum model-estimated environmental concentration of total residues, but not inconsistent with the peak (3.7-10.3 µg/L) and annual mean (0.53-4.45 µg/L) drinking water exposure estimates of propyzamide *per se* that were generated in support the 2002 Tolerance Reregistration Eligibility Decision (TRED) (USEPA 2002a).

To estimate propyzamide exposures to the terrestrial-phase CRLF, and its potential prey resulting from uses involving propyzamide applications, the Terrestrial Residue EXposure (T-REX) model is used for foliar treatment uses. The AGricultural DISPersal (AGDISP) model is used to estimate deposition of propyzamide on terrestrial and aquatic habitats from spray drift. The TerrPlant model is used to estimate propyzamide exposures to terrestrial-phase CRLF habitat, including plants inhabiting semi-aquatic and dry areas, resulting from uses involving foliar propyzamide applications. The Terrestrial Herptafaunal Exposure and Residue Program Simulation (T-HERPS) model is used to allow for further characterization of dietary exposures of terrestrial-phase CRLFs.

The assessment endpoints for the CRLF include direct toxic effects on the survival, reproduction, and growth of the CRLF itself, as well as indirect effects, such as reduction of the prey base or modification of its habitat. Direct effects to the CRLF in the aquatic habitat are based on toxicity information for freshwater fish, which are generally used as a surrogate for aquatic-phase amphibians. In the terrestrial habitat, direct effects are based on toxicity information for birds, which are used as a surrogate for terrestrial-phase amphibians. Given that the CRLF's prey items and designated critical habitat requirements in the aquatic habitat are dependant on the availability of freshwater aquatic invertebrates and aquatic plants, toxicity information for these taxonomic groups is also discussed. In the terrestrial habitat, indirect effects due to depletion of prey are assessed by considering effects to terrestrial insects, small terrestrial mammals, and frogs. Indirect effects due to modification of the terrestrial habitat are characterized by available data for terrestrial monocots and dicots.

Risk quotients (RQs) are derived as quantitative estimates of potential high-end risk. Acute and chronic RQs are compared to the Agency's levels of concern (LOCs) to identify instances where propyzamide use within the action area has the potential to adversely affect the CRLF and its designated critical habitat via direct toxicity or indirectly based on direct effects to its food supply (*i.e.*, freshwater invertebrates, algae, fish, frogs, terrestrial invertebrates, and mammals) or habitat (*i.e.*, aquatic plants and terrestrial upland and riparian vegetation). When RQs for a particular type of effect are below LOCs, the pesticide is determined to have "no effect" on the subject species. Where RQs exceed LOCs, a potential to cause adverse effects is identified, leading to a conclusion of "may affect." If a determination is made that use of propyzamide use within the action area "may affect" the CRLF and its designated critical habitat, additional information is considered to refine the potential for exposure and effects, and the best available information is used to distinguish those actions that "may affect, but are not likely to adversely affect" (NLAA) from those actions that are "likely to adversely affect" (LAA) the CRLF and its critical habitat.

Based on the best available information, the Agency makes a Likely to Adversely Affect determination for the CRLF from the use of propyzamide. Additionally, the Agency has determined that there is the potential for modification of CRLF designated critical habitat from the use of the chemical. The use of propyzamide as an herbicide is likely to adversely affect terrestrial-phase CRLF through chronic effects. Additionally, as an herbicide, propyzamide is likely to adversely affect the terrestrial-phase CRLF through reductions in terrestrial plants that serve as cover. The decrease in terrestrial plants along riparian zones is also likely to adversely affect the aquatic-phase CRLF through indirect effects on water quality. The use of propyzamide is also likely to modify the principle constituent elements (PCEs) of designated critical habitat for both aquatic- and terrestrial-phase CRLF. A summary of the risk conclusions and effects determinations for the CRLF and its critical habitat is presented in **Tables 1.1** and **1.2**. Further information on the results of the effects determination is included as part of the Risk Description in Section 5.2.

Table 1.1 Effects Determination Summary for Direct and Indirect Effects of propyzamide on the CRLF

Assessment Endpoint	Effects Determination[1]	Basis for Determination
	Aquatic-Phase CRLF (Eggs, Larvae, and Adults)	
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on aquatic phases	**NE**	RQ values for CRLF are below acute and chronic LOCs.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to food supply (*i.e.*, freshwater invertebrates, non-vascular plants, fish, and frogs)	Freshwater invertebrates: **NE**	RQ values for freshwater invertebrates are below acute and chronic LOCs
	Non-vascular aquatic plants: **NE**	RQ values for non-vascular aquatic plants are below the LOC.
	Fish and frogs: **NE**	RQ values for freshwater vertebrates (fish and amphibians) are below acute and chronic LOCs.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, and/or primary productivity (*i.e.*, aquatic plant community)	Non-vascular aquatic plants: **NE**	RQ values for non-vascular aquatic plants are below the LOC.
	Vascular aquatic plants: **NE**	RQ values for vascular aquatic plants are below the LOC.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation, required to maintain acceptable water quality and habitat in ponds and streams comprising the species' current range.	**LAA**	Terrestrial plant RQ values exceeded and riparian vegetation is likely to be adversely affected which in turn could indirectly affect water quality and habitat in ponds and streams comprising the species' current range.
	Terrestrial-Phase CRLF (Juveniles and adults)	
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	**LAA**	Chronic RQ values exceed the chronic risk LOC.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects on prey (*i.e.*, terrestrial invertebrates, small terrestrial vertebrates, including mammals and terrestrial phase amphibians)	Terrestrial invertebrates: **NLAA**	Terrestrial insects serving as prey would have a likelihood of individual mortality of 1 in 20. Based on this relatively low likelihood of mortality, the potential effect is considered insignificant and the determination is for a not likely to adversely affect (NLAA)
	Mammals: **LAA**	None of the RQ values exceed the acute risk LOC while both dose-based and dietary-based chronic RQ values exceed the chronic risk LOC. No additional information is available to refine these initial chronic risk estimates; therefore, the determination is for a likely to adversely affect (LAA) terrestrial-phase CRLF based on indirect adverse chronic effects on mammals serving as food for terrestrial-phase CRLF
	Frogs: **LAA**	There is uncertainty regarding the chronic toxicity endpoint used to assess direct chronic risk to terrestrial-phase CRLF. This same uncertainty would apply to other terrestrial-phase amphibians and therefore, the determination is for a likely to adversely affect (LAA) terrestrial-phase CRLF through indirect chronic effects on other terrestrial-phase frogs serving as prey

Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian vegetation)	**LAA**	Terrestrial plant RQ values for semi-aquatic and dry areas exceed the LOC.

[1] NE = no effect; NLAA = may affect, but not likely to adversely affect; LAA = likely to adversely affect

Table 1.2 Effects Determination Summary for the Critical Habitat Impact Analysis

Assessment Endpoint	Effects Determination[1]	Basis for Determination
Aquatic-Phase CRLF PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)		
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	**HM**	Although aquatic plants are not affected by the assessed uses of propyzamide, terrestrial plants are likely to be adversely affected from the use of the herbicide. Reductions in the extent of riparian cover may lead to reductions in water quality due to increased runoff of sediments, decreased shading leading to increased water temperatures, and decreased structure
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.[1]	**HM**	
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	**HM**	
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.,* algae)	**NE**	RQ values for freshwater vertebrates (fish and amphibians) and aquatic nonvascular plants are below acute and chronic LOCs.
Terrestrial-Phase CRLF PCEs (Upland Habitat and Dispersal Habitat)		
Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance	**HM**	Terrestrial plant RQ values exceed the LOC. Terrestrial plants are adversely affected by propyzamide and the determination is for a likely to adversely affect the two terrestrial-phase PCE through disturbance of upland habitat to support food sources of CRLF and through elimination and/or disturbance of dispersal habitat.
Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal	**HM**	
Reduction and/or modification of food sources for terrestrial phase juveniles and adults	**HM**	The likelihood of reductions in the prey base of terrestrial-phase CRLF cannot be discounted; therefore, the determination is for a likely to adversely affect (LAA) the third terrestrial-phase CRLF PCE through reduction and/or modification of food sources for terrestrial-phase juvenile and adult CRLF.
Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	**HM**	Although direct effects to the terrestrial-phase CRLF are not considered likely, indirect effects through reductions in the availability of its food items are considered likely to adversely affect the species; therefore, the determination is for a likely to adversely affect (LAA) the fourth terrestrial-phase PCE.

[1] NE = No effect; HM = Habitat modification

Based on the conclusions of this assessment, a formal consultation with the U. S. Fish and Wildlife Service under Section 7 of the Endangered Species Act should be initiated.

[1] Physico-chemical water quality parameters such as salinity, pH, and hardness are not evaluated because these processes are not biologically mediated and, therefore, are not relevant to the endpoints included in this assessment.

When evaluating the significance of this risk assessment's direct/indirect and adverse habitat modification effects determinations, it is important to note that pesticide exposures and predicted risks to the species and its resources (*i.e.*, food and habitat) are not expected to be uniform across the action area. In fact, given the assumptions of drift and downstream transport (*i.e.*, attenuation with distance), pesticide exposure and associated risks to the species and its resources are expected to decrease with increasing distance away from the treated field or site of application. Evaluation of the implication of this non-uniform distribution of risk to the species would require information and assessment techniques that are not currently available. Examples of such information and methodology required for this type of analysis would include the following:

- Enhanced information on the density and distribution of CRLF life stages within specific recovery units and/or designated critical habitat within the action area. This information would allow for quantitative extrapolation of the present risk assessment's predictions of individual effects to the proportion of the population extant within geographical areas where those effects are predicted. Furthermore, such population information would allow for a more comprehensive evaluation of the significance of potential resource impairment to individuals of the species.
- Quantitative information on prey base requirements for individual aquatic- and terrestrial-phase frogs. While existing information provides a preliminary picture of the types of food sources utilized by the frog, it does not establish minimal requirements to sustain healthy individuals at varying life stages. Such information could be used to establish biologically relevant thresholds of effects on the prey base, and ultimately establish geographical limits to those effects. This information could be used together with the density data discussed above to characterize the likelihood of adverse effects to individuals.
- Information on population responses of prey base organisms to the pesticide. Currently, methodologies are limited to predicting exposures and likely levels of direct mortality, growth or reproductive impairment immediately following exposure to the pesticide. The degree to which repeated exposure events and the inherent demographic characteristics of the prey population play into the extent to which prey resources may recover is not predictable. An enhanced understanding of long-term prey responses to pesticide exposure would allow for a more refined determination of the magnitude and duration of resource impairment, and together with the information described above, a more complete prediction of effects to individual frogs and potential modification to critical habitat.

2. Problem Formulation

Problem formulation is intended to provide a strategic framework for an ecological risk assessment. By identifying the important components of potential ecological risk, it focuses the assessment on the most relevant life history stages of affected organisms, habitat components, chemical properties, exposure routes, and endpoints. The structure of this ecological risk assessment is based on guidance contained in U.S. EPA's *Guidance for Ecological Risk Assessment* (USEPA 1998), the Services' *Endangered Species Consultation Handbook* (USFWS/NMFS 1998) and is consistent with procedures and methodology outlined in the Overview Document (USEPA 2004) and reviewed by the U.S. Fish and Wildlife Service and National Marine Fisheries Service (USFWS/NMFS 2004).

2.1 Purpose

The purpose of this threatened species assessment is to evaluate potential direct and indirect effects on individuals of the federally-listed threatened California red-legged frog *(Rana aurora draytonii*) (CRLF) arising from FIFRA regulatory actions regarding use of propyzamide on artichokes, blueberries, alfalfa and related feed crops, lettuce and related leafy greens, pome and stone fruit, grapes, sod, turf, fallow land, Christmas trees, and ornamentals. In addition, this assessment evaluates whether use on these crops or areas is expected to result in modification of the species' designated critical habitat. This ecological risk assessment has been prepared consistent with a settlement agreement in the case *Center for Biological Diversity (CBD) vs. EPA et al*. (Case No. 02-1580-JSW(JL)) settlement entered in Federal District Court for the Northern District of California on October 20, 2006.

In this assessment, direct and indirect effects to the CRLF and potential modification to its designated critical habitat are evaluated in accordance with the methods described in the Agency's Overview Document (USEPA 2004). Screening level methods include use of standard models such as PRZM-EXAMS, T-REX, TerrPlant, and AGDISP, all of which are described at length in the Overview Document. Additional refinements include an analysis of the usage data, a spatial analysis, and use of the T-HERPS model to predict concentrations of propyzamide on terrestrial-phase CRLF food items. Use of such information is consistent with the methodology described in the Overview Document (USEPA 2004), which specifies that "the assessment process may, on a case-by-case basis, incorporate additional methods, models, and lines of evidence that EPA finds technically appropriate for risk management objectives" (Section V, page 31 of USEPA 2004).

In accordance with the Overview Document, provisions of the ESA, and the Services' *Endangered Species Consultation Handbook*, the assessment of effects associated with registrations of propyzamide is based on an action area. The action area is the area directly or indirectly affected by the federal action, as indicated by the exceedance of the Agency's Levels of Concern (LOCs). It is acknowledged that the action area for a national-level FIFRA regulatory decision associated with a use of propyzamide may potentially involve numerous areas throughout the United States and its Territories. However, for the purposes of this assessment, attention will be focused on relevant sections of the action area including those geographic areas associated with locations of the CRLF and its designated critical habitat within the state of California.

As part of the "effects determination," one of the following three conclusions will be reached regarding the potential use of propyzamide in accordance with current labels:

- "No effect";
- "May affect, but not likely to adversely affect"; or
- "May affect and likely to adversely affect".

Designated critical habitat identifies specific areas that have the physical and biological features, (known as primary constituent elements or PCEs) essential to the conservation of the listed species. The PCEs for CRLFs are aquatic and upland areas where suitable breeding and non-breeding aquatic habitat is located, interspersed with upland foraging and dispersal habitat.

If the results of initial screening-level assessment methods show no direct or indirect effects (no LOC exceedances) upon individual CRLFs or upon the PCEs of the species' designated critical habitat, a "no effect" determination is made for use of propyzamide as it relates to this species and its designated critical habitat. If, however, potential direct or indirect effects to individual CRLFs are anticipated or effects may impact the PCEs of the CRLF's designated critical habitat, a preliminary "may affect" determination is made for the FIFRA regulatory action regarding propyzamide.

If a determination is made that use of propyzamide within the action area(s) associated with the CRLF "may affect" this species or its designated critical habitat, additional information is considered to refine the potential for exposure and for effects to the CRLF and other taxonomic groups upon which these species depend (*e.g.*, aquatic and terrestrial vertebrates and invertebrates, aquatic plants, riparian vegetation, *etc.*). Additional information, including spatial analysis (to determine the geographical proximity of CRLF habitat and propyzamide use sites) and further evaluation of the potential impact of propyzamide on the PCEs is also used to determine whether modification of designated critical habitat may occur. Based on the refined information, the Agency uses the best available information to distinguish those actions that "may affect, but are not likely to adversely affect" from those actions that "may affect and are likely to adversely affect" the CRLF or the PCEs of its designated critical habitat. This information is presented as part of the Risk Characterization in Section 5 of this document.

The Agency believes that the analysis of direct and indirect effects to listed species provides the basis for an analysis of potential effects on the designated critical habitat. Because propyzamide is expected to directly impact living organisms within the action area (defined in Section 2.7), critical habitat analysis for propyzamide is limited in a practical sense to those PCEs of critical habitat that are biological or that can be reasonably linked to biologically mediated processes (*i.e.*, the biological resource requirements for the listed species associated with the critical habitat or important physical aspects of the habitat that may be reasonably influenced through biological processes). Activities that may modify critical habitat are those that alter the PCEs and appreciably diminish the value of the habitat. Evaluation of actions related to use of propyzamide that may alter the PCEs of the CRLF's critical habitat form the basis of the critical habitat impact analysis. Actions that may affect the CRLF's designated critical habitat have been identified by the Services and are discussed further in Section 2.6.

2.2 Scope

Propyzamide is a selective, systemic, restricted–use, organochlorine herbicide that is formulated as a wettable powder in water soluble pouches and can be applied pre-plant, pre-emergence, or post-emergence by ground or aerial spray equipment, depending on the use. Wetting in of applications is recommended with rainfall or irrigation so that the compound is available for uptake into the root system. Most application timing occurs in the fall or early winter prior to freezing. Propyzamide is currently registered for use on a variety of outdoor crops, orchards, and other areas.

The end result of the EPA pesticide registration process (*i.e.*, the FIFRA regulatory action) is an approved product label. The label is a legal document that stipulates how and where a given pesticide may be used. Product labels (also known as end-use labels) describe the formulation type (*e.g.*, liquid or granular), acceptable methods of application, approved use sites, and any restrictions on how applications may be conducted. Thus, the use or potential use of propyzamide in accordance with the approved product labels for California is "the action" relevant to this ecological risk assessment.

Although current registrations of propyzamide allow for use nationwide on most crops, this ecological risk assessment and effects determination addresses currently registered uses of propyzamide in portions of the action area that are reasonably assumed to be biologically relevant to the CRLF and its designated critical habitat. Further discussion of the action area for the CRLF and its critical habitat is provided in Section 2.7.

This assessment analyzes potential exposure to the total residues of concern (TRC) of propyzamide. A tolerance reregistration eligibility decision (TRED) completed in 2002 identified the residues of concern for dietary risk assessment as propyzamide and its degradates containing the 3,5-dichlorobenzoyl moiety, which includes all identified degradates other than carbon dioxide (USEPA 2002). These degradates were assumed to be no more or less toxic than the parent compound in the absence of toxicity data. Similarly, propyzamide and its degradates containing the 3,5-dichlorobenzoyl moiety are the residues of concern for all taxa for this assessment, with the toxicities of the residues of concern assumed to be similar to the parent compound.

There are no registered products that contain propyzamide along with other active ingredients. Therefore, this analysis is based on the toxicity of the single active ingredient, propyzamide, as it extends to the total residues of concern.

2.3 Previous Assessments

Ecological risk assessments completed for propyzamide include two emergency exemption (FIFRA Section 18) assessments conducted in 1994 for use on grass grown for seed in Oregon and in 1998 for use on cranberries in Massachusetts. The FIFRA Section 18 assessment for use on grass grown for seed identified potential risk to terrestrial and wetland plants, including the listed plant Bradshaw's Lomatium, and identified significant data gaps for aquatic plants and other taxa. The FIFRA Section 18 assessment for use on cranberries in Massachusetts found no potential risk to listed or nonlisted organisms.

A Reregistration Eligibility Decision (RED) document was prepared for pronamide (propyzamide) in 1994 (USEPA 1994). The RED identified no potential risk to terrestrial animals, aquatic animals, or aquatic plants. Studies of toxicity to aquatic invertebrates (chronic), aquatic plants, and terrestrial dicots were requested to eliminate data gaps. Potential risk to terrestrial monocots was identified from all registered uses.

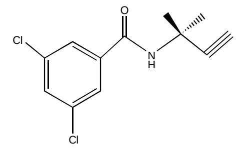
An ecological risk assessment of proposed uses on chicory, Belgian endive, dandelion, and berries was completed in 2007. This assessment identified potential chronic risk to mammals and potential risk to terrestrial and semi-aquatic plants. Potential risk of direct effects was identified to listed mammals, birds, estuarine invertebrates, and terrestrial and semi-aquatic plants. Potential risk of indirect effects was identified for most taxa due to potential risk to plants. An addendum to the ecological risk assessment indicated no potential risk to listed estuarine invertebrates.

2.4 Stressor Source and Distribution

2.4.1 Environmental Fate Properties

Propyzamide [3,5-dichloro-N-(1,1-dimethylprop-2-ynyl)benzamide] is a moderately to slightly mobile chemical that is expected to dissipate in terrestrial and aquatic aerobic environments over weeks or possibly months. The compound is expected to persist longer in terrestrial and aquatic anaerobic environments, dissipating over months to more than one year.

Propyzamide is soluble in water up to 15 mg/L at 25°C (USEPA 1994) and is not expected to volatilize significantly due to the compound's relatively low vapor pressure of 8.5 x 10^{-5} torr at 25°C (USEPA 1994). The compound is moderately mobile in organic carbon-poor soils and slightly mobile in other soils, with organic carbon-normalized Freundlich adsorption coefficients that range from 548 to 1340 L/kg_{OC} for six soils (MRID 40211103). Mobility is partially explained by affinity to organic matter, as the coefficient of variation (CV) across six soils for K_{FOC} (40%) is less than that for K_F (47%). Due to low fish bioconcentration factors (range of 21-77), propyzamide is not expected to bioconcentrate in aquatic environments (MRID 43196701). General chemical properties of the compound are summarized in **Table 2.1**.

Table 2.1 General Chemical Properties of Propyzamide		
Chemical/Fate Parameter	**Value**	**Source**
Structure		USEPA 1994
Molecular mass	256.13 g/mol	USEPA 1994
Vapor pressure (25°C)	8.5×10^{-5} torr	USEPA 1994
Solubility (25°C)	15 mg/L	USEPA 1994
Octanol-water partition coefficient (K_{OW})	427-1600	MRID 46284603 MRID 46413408
Freundlich adsorption coefficient ($K_{F\text{-}ads}$); Organic carbon-normalized Freundlich adsorption coefficient ($K_{FOC\text{-}ads}$)	3.15 (1/n=1.22); 1340L/kg_{OC} 3.47 (1/n=1.14); 1180 L/kg_{OC} 4.85 (1/n=1.10); 688 L/kg_{OC} 5.16 (1/n=1.07); 548 L/kg_{OC} 8.05 (1/n=1.01); 578 L/kg_{OC} 10.1 (1/n=1.00); 714 L/kg_{OC}	MRID 40211103
Fish Bioconcentration Factor	21 (edible) 77 (non-edible) 50 (whole fish)	MRID 43196701

Propyzamide undergoes both biotic (aerobic metabolism) and abiotic (aqueous photolysis) degradation on the order of weeks to months. Half-lives for total residues of concern, however, are estimated to be on the order of months to years (all identified degradates except carbon dioxide are presumed to be of toxicological concern). **Table 2.2** lists the environmental fate properties of propyzamide, along with the major and minor degradates detected in the submitted environmental fate and transport studies. The maximum reported amounts of propyzamide's degradates are listed in **Table K1** and the structures of the degradates are listed in **Table K2** of **Appendix K**.

Table 2.2 Summary of Propyzamide Environmental Fate Properties				
Study	**Value (units)**	**Major Degradates (Minor Degradates)**	**MRID #**	**Study Status**
Hydrolysis	No significant degradation at pH 4.7, 7.4, or 8.8 (20°C)	None	00107980	Acceptable
Aqueous Photolysis	$t_{1/2}$ = 41.7 d (parent) 217 d (TRC)	RH-26059 (RH-24644, RH-20839, RH-24580, RH-25891, RH-26702, 3,5-dichlorobenzamide)	40420301, 40320601	Acceptable (supplement)
Soil Photolysis	$t_{1/2}$ = 249 d (parent) Stable (TRC)	RH-24580 (RH-24644, RH-26702)	41913504	Acceptable
Aerobic Soil Metabolism	$t_{1/2}$ = 20.1, 21.5, 44.6, 392 d (parent) 64.9, 96.6, 166, 2340 d (TRC)	RH-24644, RH-24580, carbon dioxide (RH-20839, RH-26521)	41568901 46413407	Supplemental (in review)
Anaerobic Soil Metabolism	$t_{1/2}$ = 450 d (parent) Stable (TRC)	RH-24644, RH-24580 (RH-25891)	41913505 263649 (accsn. #)	Acceptable Supplemental

Table 2.2 Summary of Propyzamide Environmental Fate Properties				
Study	**Value (units)**	**Major Degradates (Minor Degradates)**	**MRID #**	**Study Status**
Anaerobic Aquatic Metabolism	$t_{1/2}$ = 127 d (parent) 402 d (TRC)	RH-24644 (RH-24655, RH-20839, RH-24580, RH- 26521, M5, M6, M8, M10, M11, carbon dioxide)	46413408	(in review)
Aerobic Aquatic Metabolism	$t_{1/2}$ = 69.0, 119 d (parent) 899, 782 d (TRC)	RH-24655 (RH-24644, RH-24580, RH-26521, UK 1, UK 3)	46427901	(in review)
Terrestrial Field Dissipation	$t_{1/2}$ = 31 d (sandy loam), 56 d (loam)	(RH-24644, RH-24580)	44078601	Supplemental

2.4.1 Environmental Transport Mechanisms

Potential transport mechanisms include pesticide surface water runoff, spray drift, and secondary drift of volatilized or soil-bound residues leading to deposition onto nearby or more distant ecosystems. Secondary drift of propyzamide is not expected to significantly occur due to the compound's water solubility and relatively low vapor pressure. Surface water runoff and spray drift are expected to be the major routes of exposure for the compound.

2.4.2 Mechanism of Action

Propyzamide is a selective, systemic, restricted–use herbicide. The compound is absorbed by plants via the root system and distributed throughout the plant. The mode of action of propyzamide is largely unknown although it has been shown to inhibit cell division by preventing the formation of spindle fibers during mitosis via binding to proteins associated with microtubule assembly (Griffen 2003). The details regarding the active site of the chemical are not known.

2.4.3 Use Characterization

Analysis of labeled use information is the critical first step in evaluating the federal action. The current labels for propyzamide represent the FIFRA regulatory action; therefore, labeled uses and application rates specified on the labels form the basis of this assessment. The assessment of use information is critical to the development of the action area and selection of appropriate modeling scenarios and inputs.

Current labels allow use of propyzamide on blueberries, alfalfa, clover, birdsfoot trefoil, crown vetch, sainfoin, lettuce, endive, escarole, radicchio, apples, apricots, cherries, nectarines, peaches, pears, plums, prunes, grapes, sod, turf, fallow land, Christmas trees, and ornamentals without restriction to the region of application (EPA Reg. No. 62719-397, 70506-78). Current labels also allow the following uses of propyzamide within the specified States: globe artichokes in California, leaf lettuce in California and Arizona, cane berries and rhubarb in Oregon and Washington, and winter peas and conservation reserves in Idaho, Oregon, and Washington. There are no indoor uses of propyzamide. Unlike EPA Reg. No. 70506-78, EPA Reg. No. 62719-397 does not restrict use on turf to non-residential sites. Neither label restricts use on ornamentals to non-residential sites. Because cane berries, rhubarb, winter peas, and conservation reserves are not labeled for use in California, use on these crops/areas is not evaluated in this assessment. The remaining crops are evaluated as part of the exposure analysis for the CRLF.

Table 2.3 presents the uses and corresponding application rates considered in this assessment. Leafy vegetables treated by propyzamide were assumed to be cropped twice per year because rotation was expected to occur during the year with other crops. Alfalfa crops were labeled for use in fall or winter, followed by a use on alfalfa grown for seed in the spring. Therefore, two seasons were assumed to occur per year (winter and spring). Turf uses were labeled for control of annual bluegrass (*Poa Annua*), which is expected to occur in fall or winter (UCANR 2003), and control of perennial rye grass (*Lolium perenne*) in the spring. Therefore, three seasons of use were assumed for turf (fall, winter, and spring).

Table 2.3 Propyzamide Uses Assessed for the CRLF

Use Group	Current Uses	Max. Single Appl. Rate (lbs a.i./A)	Max. Number of Applications per Year
Leafy vegetables	Lettuce, leaf lettuce, endive, escarole, radicchio	2.00 (per crop)	2 (assuming two crops/year)
Root and tuber vegetables	Globe artichokes	4.08	2
Fruit	Apples, pears, apricots, cherries, nectarines, peaches, plums, prunes, grapes (including wine grapes)	4.08	1
Berries	Blueberries	2.04	1
Forage, feed, and seed crops	Alfalfa, clover, birdsfoot trefoil, crown vetch, sainfoin	2.00 (per season)	2 (assuming two seasons/year)
Ornamentals[1]	Ornamental trees, plants, and shrubs, Christmas trees	2.04	1
Turf[1]	Sod, turf	1.53 (per season)	3 (assuming three seasons/year)
Fallow areas	Fallow land	0.510	1

[1] This Use Group may include residential as well as non-residential uses.

Figure 2.1 presents the national usage pattern of propyzamide in 2002. Usage was concentrated in California, the Pacific Northwest, and a few states in the eastern U.S. Note that lettuce was estimated to represent 61% of propyzamide usage at that time. Alfalfa and other field crops accounted for an additional 29% of propyzamide usage (USGS 2007).

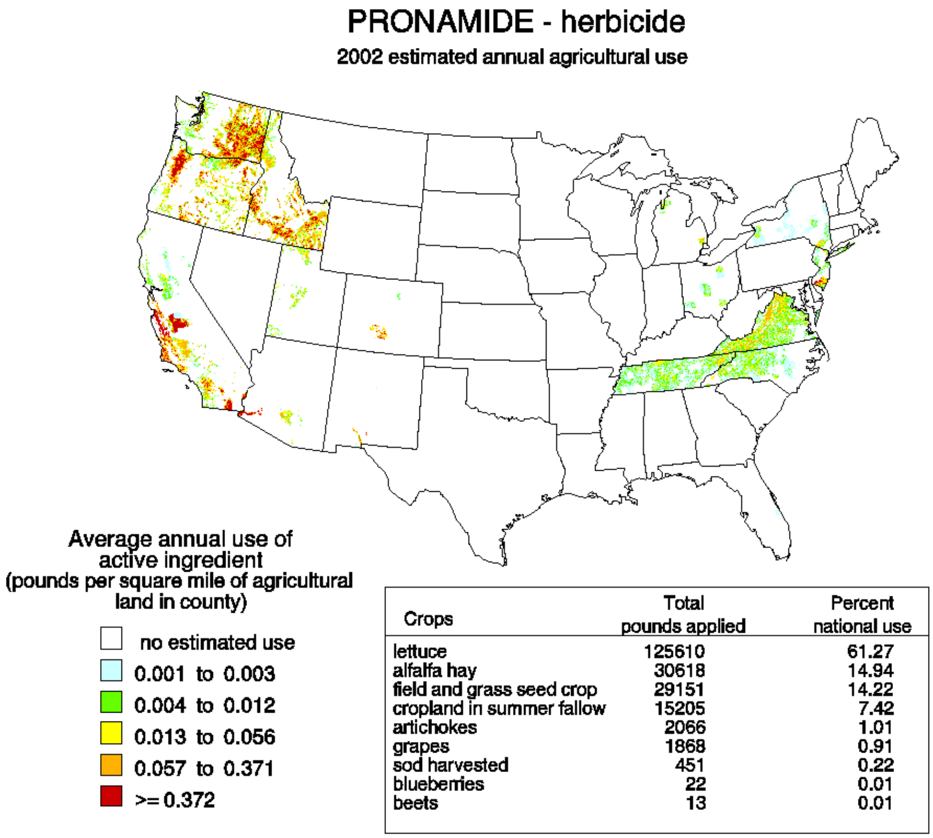


Figure 2.1 National Propyzamide Usage in 2002 (USGS 2007)

The Agency's Biological and Economic Analysis Division (BEAD) provides an analysis of both national- and county-level usage information (Kaul and Jones 2006) using state-level usage data obtained from the U. S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS)[2], Doane (www.doane.com; the full dataset is not provided due to its proprietary nature) and the California's Department of Pesticide Regulation (CDPR) Pesticide Use Reporting (PUR) database[3]. CDPR PUR is considered a more comprehensive source of usage data than USDA NASS or EPA proprietary databases, and thus the usage data reported for propyzamide by county in this California-specific assessment were generated using CDPR PUR data. Four years (2002-2005) of usage data were included in this analysis. Data from CDPR PUR were obtained for every pesticide application made on every use site at the section level (approximately one square mile) of the public land survey system. BEAD summarized these data to the county level by site, pesticide, and unit treated. Calculating county-level usage involved summarizing across all applications made within a section and then across all sections

[2] United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS) Chemical Use Reports provide summary pesticide usage statistics for select agricultural use sites by chemical, crop and state. See http://www.usda.gov/nass/pubs/estindx1.htm#agchem.
[3] The California Department of Pesticide Regulation's (CDPR) Pesticide Use Reporting (PUR) database provides a census of pesticide applications in the state. See http://www.cdpr.ca.gov/docs/pur/purmain.htm.

within a county for each use site and for each pesticide. The county level usage data that were calculated include: average annual pounds applied, average annual area treated, and average and maximum application rate across all four years.

A summary of propyzamide usage for all California use sites based on CDPR PUR data is provided below in **Table 2.4**. The use sites of highest average annual usage in California are head lettuce (55,000 lbs) and leaf lettuce (48,000 lbs). These use sites are followed by globe artichokes and landscape maintenance at approximately 2,000 lbs, and endive/escarole, chicory, and turf/sod at approximately 1,000 lbs. High reported maximum application rates, such as for chicory, may reflect reporting errors or misuse of the product. Because commercial applicators are required to report their usage, these data are believed to be of high quality; the number of records reported for each site is likely to reflect the actual number of commercial uses on that site in California from 2002 to 2005.

Table 2.4 Summary of California Department of Pesticide Registration (CDPR) Pesticide Use Reporting (PUR) Data from 2002 to 2005 for Currently Registered Propyzamide Uses

Site Name (number of records)	Avg Annual Application (lbs a.i.)	Avg App Rate (lbs a.i./A)	95th %-ile App Rate (lbs a.i./A)	99th %-ile App Rate (lbs a.i./A)	Max App Rate (lbs a.i./A)
Alfalfa (22)	193	0.92	1.03	1.03	1.53
Apples (1)	2.30	1.15	1.15	1.15	1.15
Arrugula (1)	0.31	1.89	1.89	1.89	1.89
Artichoke, globe (511)	1,939	0.98	1.65	1.65	2.04
Beets (2)	6.26	2.04	2.04	2.04	2.04
Blueberries (1)	6.63	0.51	0.51	0.51	0.51
Bok choy (11)	14.6	1.79	1.79	1.79	2.04
Broccoli (39)	87.8	0.86	3.17	3.21	7.09
Cabbage (7)	15.2	1.21	1.22	1.22	2.06
Carrots (3)	1.48	1.59	2.00	2.00	2.00
Cauliflower (14)	15.8	0.45	1.02	1.02	1.02
Celery (4)	6.98	0.72	0.72	0.72	1.28
Chicory (484)	991	1.17	1.69	2.90	20.83
Chinese cabbage (1)	1.28	1.02	1.02	1.02	1.02
Chinese greens (11)	19.7	1.28	1.28	1.28	2.04
Christmas trees (3)	18.2	0.64	0.64	0.64	0.77
Clover (39)	410	0.97	1.02	1.02	1.02
Coconuts (1)	1.14	0.38	0.38	0.38	0.38
Corn (1)	0.13	1.02	1.02	1.02	1.02
Endive/escarole (1,492)	1,338	1.05	0.46	0.73	20.0
Fennel (1)	0.50	2.00	2.00	2.00	2.00
Grapes (1)	0.13	0.51	0.51	0.51	0.51
Grapes, wine (45)	73.2	0.64	1.26	4.26	19.5
Kale (1)	0.38	0.47	0.47	0.47	0.47

Table 2.4 Summary of California Department of Pesticide Registration (CDPR) Pesticide Use Reporting (PUR) Data from 2002 to 2005 for Currently Registered Propyzamide Uses					
Site Name (number of records)	**Avg Annual Application (lbs a.i.)**	**Avg App Rate (lbs a.i./A)**	**95th %-ile App Rate (lbs a.i./A)**	**99th %-ile App Rate (lbs a.i./A)**	**Max App Rate (lbs a.i./A)**
Landscape maintenance (520)	1,910	Not reported	Not reported	Not reported	Not reported
Leeks (1)	0.89	2.10	2.10	2.10	2.10
Lettuce, head (20,897)	55,021	0.90	1.32	1.51	10.2
Lettuce, leaf (24,577)	48,222	0.95	1.43	1.76	6.22
Mizuna (1)	0.33	0.66	0.66	0.66	0.66
Mustard (9)	31.1	2.05	2.15	2.15	2.15
Nectarine (1)	0.13	1.55	1.55	1.55	1.55
Outdoor flowers (4)	0.63	1.03	1.34	1.34	1.53
Outdoor plants in containers (14)	161	1.25	2.04	2.04	2.04
Outdoor transplants (17)	14.1	0.27	0.38	0.38	1.02
Onions, dry (1)	0.38	1.53	1.53	1.53	1.53
Peaches (1)	0.26	1.02	1.02	1.02	1.02
Peppers, spice (1)	12.8	5.10	5.10	5.10	5.10
Pumpkins (1)	0.59	0.38	0.38	0.38	0.38
Radishes (1)	0.06	1.92	1.92	1.92	1.92
Rangeland (2)	0.38	1.79	2.04	2.04	2.04
Research commodity (58-lbs, 4-rates)	26.6	1.22	2.18	2.18	2.32
Rights of way (14-lbs, 2-rates)	39.9	0.52	0.52	0.52	1.02
Soil fumigation/preplant (25)	49.9	1.09	1.23	1.23	2.04
Spinach (6)	10.2	0.96	1.19	1.19	1.53
Structural pest control (1)	0.89	Not reported	Not reported	Not reported	Not reported
Swiss chard (2)	2.13	1.05	1.05	1.05	2.04
Tropical/subtropical fruit (1)	3.83	0.76	0.76	0.76	0.76
Turf/sod (138)	921	1.36	3.65	3.84	17.6
Turnip (2)	0.50	1.52	1.52	1.52	1.52
Uncultivated agriculture (3)	5.29	2.60	2.74	2.74	3.40
Unknown (16)	79.1	1.16	1.56	1.56	2.81
Vegetables, leafy (10)	95.8	1.46	1.74	1.74	2.00
Vertebrate control (2)	2.75	0.79	1.02	1.02	1.02

2.5 Assessed Species

The CRLF was federally listed as a threatened species by USFWS effective June 24, 1996 (USFWS 1996). It is one of two subspecies of the red-legged frog and is the largest native frog in the western United States (USFWS 2002). A brief summary of information regarding CRLF distribution, reproduction, diet, and habitat requirements is provided in Sections 2.5.1 through 2.5.4, respectively. Further information on the status, distribution, and life history of and specific threats to the CRLF is provided in Attachment 1.

Final critical habitat for the CRLF was designated by USFWS on April 13, 2006 (USFWS 2006; 71 FR 19244-19346). Further information on designated critical habitat for the CRLF is provided in Section 2.6.

2.5.1 Distribution

The CRLF is endemic to California and Baja California (Mexico) and historically inhabited 46 counties in California including the Central Valley and both coastal and interior mountain ranges (USFWS 1996). Its range has been reduced by about 70%, and the species currently resides in 22 counties in California (USFWS 1996). The species has an elevational range of near sea level to 1,500 meters (5,200 feet) (Jennings and Hayes, 1994); however, nearly all of the known CRLF populations have been documented below 1,050 meters (3,500 feet) (USFWS 2002).

Populations currently exist along the northern California coast, northern Transverse Ranges (USFWS 2002), foothills of the Sierra Nevada (5-6 populations), and in southern California south of Santa Barbara (two populations) (Fellers, 2005a). Relatively larger numbers of CRLFs are located between Marin and Santa Barbara Counties (Jennings and Hayes, 1994). A total of 243 streams or drainages are believed to be currently occupied by the species, with the greatest numbers in Monterey, San Luis Obispo, and Santa Barbara counties (USFWS 1996). Occupied drainages or watersheds include all bodies of water that support CRLFs (*i.e.*, streams, creeks, tributaries, associated natural and artificial ponds, and adjacent drainages), and habitats through which CRLFs can move (*i.e.*, riparian vegetation, uplands) (USFWS 2002).

The distribution of CRLFs within California is addressed in this assessment using four categories of location including recovery units, core areas, designated critical habitat, and known occurrences of the CRLF reported in the California Natural Diversity Database (CNDDB) that are not included within core areas and/or designated critical habitat (see **Figure 2.2**). Recovery units, core areas, and other known occurrences of the CRLF from the CNDDB are described in further detail in this section, and designated critical habitat is addressed in Section 2.6. Recovery units are large areas defined at the watershed level that have similar conservation needs and management strategies. The recovery unit is primarily an administrative designation, and land area within the recovery unit boundary is not exclusively CRLF habitat. Core areas are smaller areas within the recovery units that comprise portions of the species' historic and current range and have been determined by USFWS to be important in the preservation of the species. Designated critical habitat is generally contained within the core areas, although a number of critical habitat units are outside the boundaries of core areas, but within the boundaries of the recovery units. Additional information on CRLF occurrences from the CNDDB is used to cover the current range of the species not included in core areas and/or designated critical habitat, but within the recovery units.

Recovery Units

Eight recovery units have been established by USFWS for the CRLF. These areas are considered essential to the recovery of the species, and the status of the CRLF "may be considered within the smaller scale of the recovery units, as opposed to the statewide range" (USFWS 2002). Recovery units reflect areas with similar conservation needs and population statuses, and therefore, similar recovery goals. The eight units described for the CRLF are delineated by watershed boundaries defined by US Geological Survey hydrologic units and are limited to the elevational maximum for the species of 1,500 m above sea level. The eight recovery units for the CRLF are listed in **Table 2.5** and shown in **Figure 2.2**.

Core Areas

USFWS has designated 35 core areas across the eight recovery units to focus their recovery efforts for the CRLF (see **Figure 2.2**). **Table 2.5** summarizes the geographical relationship among recovery units, core areas, and designated critical habitat. The core areas, which are distributed throughout portions of the historic and current range of the species, represent areas that allow for long-term viability of existing populations and reestablishment of populations within historic range. These areas were selected because they: 1) contain existing viable populations; or 2) they contribute to the connectivity of other habitat areas (USFWS 2002). Core area protection and enhancement are vital for maintenance and expansion of the CRLF's distribution and population throughout its range.

For purposes of this assessment, designated critical habitat, currently occupied (post-1985) core areas, and additional known occurrences of the CRLF from the CNDDB are considered. Each type of locational information is evaluated within the broader context of recovery units. For example, if no labeled uses of propyzamide occur (or if labeled uses occur at predicted exposures less than the Agency's LOCs) within an entire recovery unit, a "no effect" determination would be made for all designated critical habitat, currently occupied core areas, and other known CNDDB occurrences within that recovery unit. Historically occupied sections of the core areas are not evaluated as part of this assessment because the USFWS Recovery Plan (USFWS 2002) indicates that CRLFs are extirpated from these areas. A summary of currently and historically occupied core areas is provided in **Table 2.5** (currently occupied core areas are bolded). While core areas are considered essential for recovery of the CRLF, core areas are not federally-designated critical habitat, although designated critical habitat is generally contained within these core recovery areas. It should be noted, however, that several critical habitat units are located outside of the core areas, but within the recovery units. The focus of this assessment is currently occupied core areas, designated critical habitat, and other known CNDDB CRLF occurrences within the recovery units. Federally-designated critical habitat for the CRLF is further explained in Section 2.6.

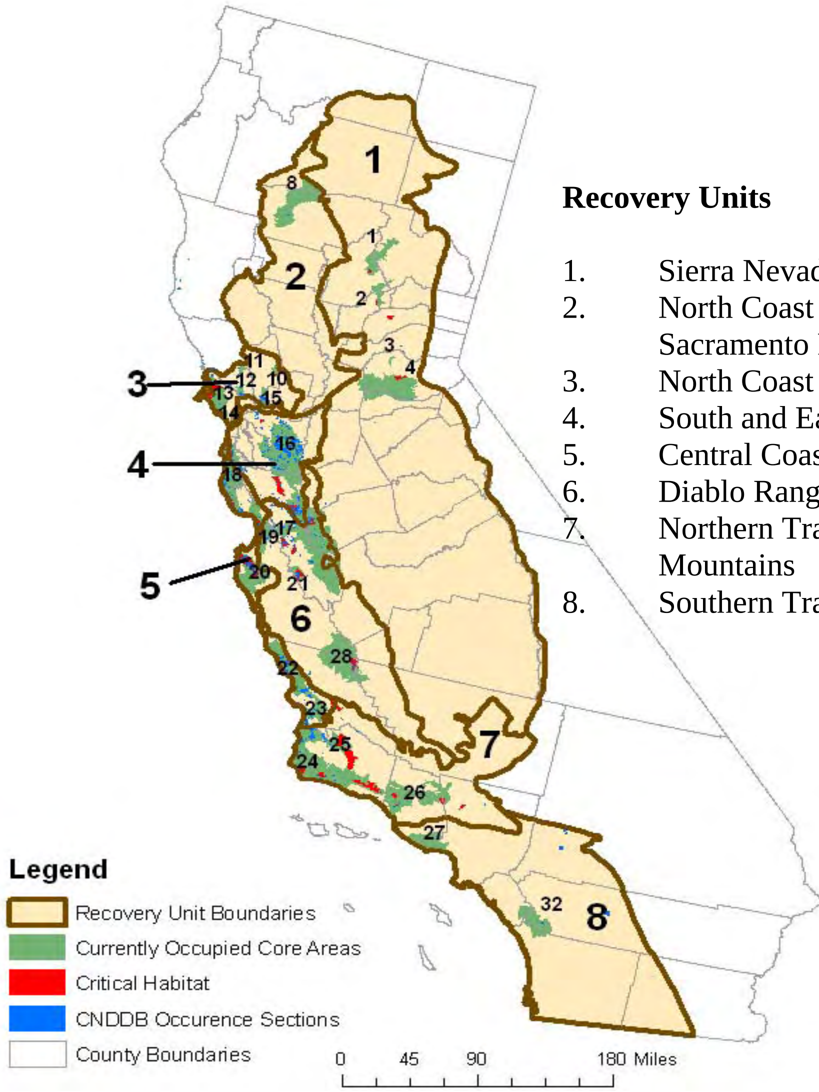
Table 2.5 California Red-legged Frog Recovery Units with Overlapping Core Areas and Designated Critical Habitat

Recovery Unit [1] (Figure 2.a)	Core Areas [2,7] (Figure 2.a)	Critical Habitat Units [3]	Currently Occupied (post-1985) [4]	Historically Occupied [4]
Sierra Nevada Foothills and Central Valley (1) (eastern boundary is the 1,500m elevation line)	**Cottonwood Creek (partial) (8)**	--	✓	
	Feather River (1)	BUT-1A-B	✓	
	Yuba River-S. Fork Feather River (2)	YUB-1	✓	
	--	NEV-1[6]		
	Traverse Creek/Middle Fork American River/Rubicon (3)	--	✓	
	Consumnes River (4)	ELD-1	✓	
	S. Fork Calaveras River (5)	--		✓
	Tuolumne River (6)	--		✓
	Piney Creek (7)	--		✓
	East San Francisco Bay (partial)(16)	--	✓	
North Coast Range Foothills and Western Sacramento River Valley (2)	**Cottonwood Creek (8)**	--	✓	
	Putah Creek-Cache Creek (9)	--		✓
	Jameson Canyon – Lower Napa Valley (partial) (15)	--	✓	
	Belvedere Lagoon (partial) (14)	--	✓	
	Pt. Reyes Peninsula (partial) (13)	--	✓	
North Coast and North San Francisco Bay (3)	Putah Creek-Cache Creek (partial) (9)	--		✓
	Lake Berryessa Tributaries (10)	NAP-1	✓	
	Upper Sonoma Creek (11)	--	✓	
	Petaluma Creek-Sonoma Creek (12)	--	✓	
	Pt. Reyes Peninsula (13)	MRN-1, MRN-2	✓	
	Belvedere Lagoon (14)	--	✓	
	Jameson Canyon-Lower Napa River (15)	SOL-1	✓	
South and East San Francisco Bay (4)	--	CCS-1A[6]		
	East San Francisco Bay (partial) (16)	ALA-1A, ALA-1B, STC-1B	✓	
	--	STC-1A[6]		
	South San Francisco Bay (partial) (18)	SNM-1A	✓	
Central Coast (5)	**South San Francisco Bay (partial) (18)**	SNM-1A, SNM-2C, SCZ-1	✓	
	Watsonville Slough- Elkhorn Slough (partial) (19)	SCZ-2 [5]	✓	
	Carmel River-Santa Lucia (20)	MNT-2	✓	
	Estero Bay (22)	--	✓	

Table 2.5 California Red-legged Frog Recovery Units with Overlapping Core Areas and Designated Critical Habitat

Recovery Unit [1] (Figure 2.a)	Core Areas [2,7] (Figure 2.a)	Critical Habitat Units [3]	Currently Occupied (post-1985) [4]	Historically Occupied [4]
	--	SLO-8[6]		
	Arroyo Grande Creek (23)	--	✓	
	Santa Maria River-Santa Ynez River (24)	--	✓	
Diablo Range and Salinas Valley (6)	**East San Francisco Bay (partial) (16)**	MER-1A-B, STC-1B	✓	
	--	SNB-1[6], SNB-2[6]		
	Santa Clara Valley (17)	--	✓	
	Watsonville Slough- Elkhorn Slough (partial)(19)	MNT-1	✓	
	Carmel River-Santa Lucia (partial)(20)	--	✓	
	Gablan Range (21)	SNB-3	✓	
	Estrella River (28)	SLO-1A-B	✓	
Northern Transverse Ranges and Tehachapi Mountains (7)	--	SLO-8[6]		
	Santa Maria River-Santa Ynez River (24)	STB-4, STB-5, STB-7	✓	
	Sisquoc River (25)	STB-1, STB-3	✓	
	Ventura River-Santa Clara River (26)	VEN-1, VEN-2, VEN-3	✓	
	--	LOS-1[6]		
Southern Transverse and Peninsular Ranges (8)	**Santa Monica Bay-Ventura Coastal Streams (27)**	--	✓	
	San Gabriel Mountain (29)	--		✓
	Forks of the Mojave (30)	--		✓
	Santa Ana Mountain (31)	--		✓
	Santa Rosa Plateau (32)	--	✓	
	San Luis Rey (33)	--		✓
	Sweetwater (34)	--		✓
	Laguna Mountain (35)	--		✓

[1] Recovery units designated by the USFWS (USFWS 2000, pg 49).
[2] Core areas designated by the USFWS (USFWS 2000, pg 51).
[3] Critical habitat units designated by the USFWS on April 13, 2006 (USFWS 2006; 71 FR 19244-19346).
[4] Currently occupied (post-1985) and historically occupied core areas as designated by the USFWS (USFWS 2002, pg 54).
[5] Critical habitat unit where identified threats specifically included pesticides or agricultural runoff (USFWS 2002).
[6] Critical habitat units that are outside of core areas, but within recovery units.
[7] Currently occupied core areas that are included in this effects determination are bolded.



Recovery Units

1. Sierra Nevada Foothills and Central Valley
2. North Coast Range Foothills and Western Sacramento River Valley
3. North Coast and North San Francisco Bay
4. South and East San Francisco Bay
5. Central Coast
6. Diablo Range and Salinas Valley
7. Northern Transverse Ranges and Tehachapi Mountains
8. Southern Transverse and Peninsular Ranges

Figure 2.2 Recovery Unit, Core Area, Critical Habitat, and Occurrence Designations for CRLF

Core Areas

1. Feather River
2. Yuba River- S. Fork Feather River
3. Traverse Creek/ Middle Fork/ American R. Rubicon
4. Cosumnes River
5. South Fork Calaveras River*
6. Tuolumne River*
7. Piney Creek*
8. Cottonwood Creek
9. Putah Creek – Cache Creek*
10. Lake Berryessa Tributaries
11. Upper Sonoma Creek
12. Petaluma Creek – Sonoma Creek
13. Pt. Reyes Peninsula
14. Belvedere Lagoon
15. Jameson Canyon – Lower Napa River
16. East San Francisco Bay
17. Santa Clara Valley
18. South San Francisco Bay
19. Watsonville Slough-Elkhorn Slough
20. Carmel River – Santa Lucia
21. Gablan Range
22. Estero Bay
23. Arroyo Grange River
24. Santa Maria River – Santa Ynez River
25. Sisquoc River
26. Ventura River – Santa Clara River
27. Santa Monica Bay – Venura Coastal Streams
28. Estrella River
29. San Gabriel Mountain*
30. Forks of the Mojave*
31. Santa Ana Mountain*
32. Santa Rosa Plateau
33. San Luis Ray*
34. Sweetwater*
35. Laguna Mountain*

* Core areas that were historically occupied by the California red-legged frog are not included in the map

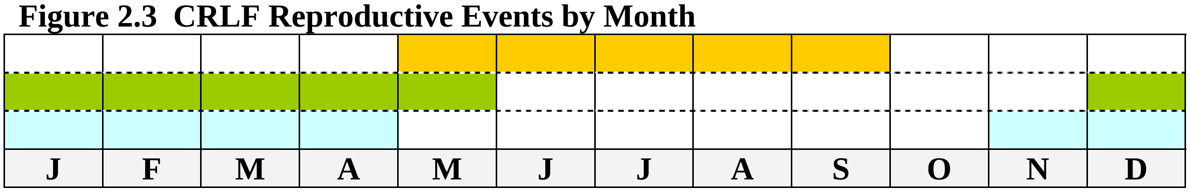
Other Known Occurrences from the CNDBB

The CNDDB provides location and natural history information on species found in California. The CNDDB serves as a repository for historical and current species location sightings. Information regarding known occurrences of CRLFs outside of the currently occupied core areas and designated critical habitat is considered in defining the current range of the CRLF. See: http://www.dfg.ca.gov/bdb/html/cnddb_info.html for additional information on the CNDDB.

2.5.2 Reproduction

CRLFs breed primarily in ponds; however, they may also breed in quiescent streams, marshes, and lagoons (Fellers 2005a). According to the Recovery Plan (USFWS 2002), CRLFs breed from November through late April. Peaks in spawning activity vary geographically; Fellers (2005b) reports peak spawning as early as January in parts of coastal central California. Eggs are fertilized as they are being laid. Egg masses are typically attached to emergent vegetation, such as bulrushes (*Scirpus* spp.) and cattails (*Typha* spp.) or roots and twigs, and float on or near the surface of the water (Hayes and Miyamoto 1984). Egg masses contain approximately 2000 to 6000 eggs ranging in size between 2 and 2.8 mm (Jennings and Hayes 1994). Embryos hatch 10 to 14 days after fertilization (Fellers 2005a) depending on water temperature. Egg predation is reported to be infrequent and most mortality is associated with the larval stage (particularly through predation by fish); however, predation on eggs by newts has also been reported (Rathburn 1998). Tadpoles require 11 to 28 weeks to metamorphose into juveniles (terrestrial-phase), typically between May and September (Jennings and Hayes 1994, USFWS 2002); tadpoles have been observed to over-winter (delay metamorphosis until the following year) (Fellers 2005b; USFWS 2002). Males reach sexual maturity at 2 years, and females reach sexual maturity at 3 years of age; adults have been reported to live 8 to 10 years (USFWS 2002). **Figure 2.3** depicts CRLF annual reproductive timing.

Figure 2.3 CRLF Reproductive Events by Month



Light Blue = **Breeding/Egg Masses**
Green = **Tadpoles (except those that over-winter)**
Orange = **Young Juveniles**
Adults and juveniles can be present all year

2.5.3 Diet

Although the diet of CRLF aquatic-phase larvae (tadpoles) has not been studied specifically, it is assumed that their diet is similar to that of other frog species, with the aquatic phase feeding exclusively in water and consuming diatoms, algae, and detritus

(USFWS 2002). Tadpoles filter and entrap suspended algae (Seale and Beckvar 1980) via mouthparts designed for effective grazing of periphyton (Wassersug 1984; Kupferberg *et al.* 1994; Kupferberg 1997; Altig and McDiarmid 1999).

Juvenile and adult CRLFs forage in aquatic and terrestrial habitats, and their diet differs greatly from that of larvae. The main food source for juvenile aquatic- and terrestrial-phase CRLFs is thought to be aquatic and terrestrial invertebrates found along the shoreline and on the water surface. Hayes and Tennant (1985) report, based on a study examining the gut content of 35 juvenile and adult CRLFs, that the species feeds on as many as 42 different invertebrate taxa, including Arachnida, Amphipoda, Isopoda, Insecta, and Mollusca. The most commonly observed prey species were larval alderflies (*Sialis* cf. *californica*), pillbugs (*Armadilliadrium vulgare*), and water striders (*Gerris* sp). The preferred prey species, however, was the sowbug (Hayes and Tennant 1985). This study suggests that CRLFs forage primarily above water, although the authors note other data reporting that adults also feed under water, are cannibalistic, and consume fish. For larger CRLFs, over 50% of the prey mass may consists of vertebrates such as mice, frogs, and fish, although aquatic and terrestrial invertebrates were the most numerous food items (Hayes and Tennant 1985). For adults, feeding activity takes place primarily at night; for juveniles feeding occurs during the day and at night (Hayes and Tennant 1985).

2.5.4 Habitat

CRLFs require aquatic habitat for breeding, but also use other habitat types including riparian and upland areas throughout their life cycle. CRLF use of their environment varies; they may complete their entire life cycle in a particular habitat or they may utilize multiple habitat types. Overall, populations are most likely to exist where multiple breeding areas are embedded within varying habitats used for dispersal (USFWS 2002). Generally, CRLFs utilize habitat with perennial or near-perennial water (Jennings et al. 1997). Dense vegetation close to water, shading, and water of moderate depth are habitat features that appear especially important for CRLF (Hayes and Jennings 1988).
Breeding sites include streams, deep pools, backwaters within streams and creeks, ponds, marshes, sag ponds (land depressions between fault zones that have filled with water), dune ponds, and lagoons. Breeding adults have been found near deep (0.7 m) still or slow moving water surrounded by dense vegetation (USFWS 2002); however, the largest number of tadpoles have been found in shallower pools (0.26 – 0.5 m) (Reis 1999). Data indicate that CRLFs do not frequently inhabit vernal pools, as conditions in these habitats generally are not suitable (Hayes and Jennings 1988).

CRLFs also frequently breed in artificial impoundments such as stock ponds, although additional research is needed to identify habitat requirements within artificial ponds (USFWS 2002). Adult CRLFs use dense, shrubby, or emergent vegetation closely associated with deep-water pools bordered with cattails and dense stands of overhanging vegetation (http://www.fws.gov/endangered/features/rl_frog/rlfrog.html#where).

In general, dispersal and habitat use depends on climatic conditions, habitat suitability, and life stage. Adults rely on riparian vegetation for resting, feeding, and dispersal. The foraging quality of the riparian habitat depends on moisture, composition of the plant community, and presence of pools and backwater aquatic areas for breeding. CRLFs can be found living within streams at distances up to 3 km (2 miles) from their breeding site and have been found up to 30 m (100 feet) from water in dense riparian vegetation for up to 77 days (USFWS 2002).

During dry periods, the CRLF is rarely found far from water, although it will sometimes disperse from its breeding habitat to forage and seek other suitable habitat under downed trees or logs, industrial debris, and agricultural features (UWFWS 2002). According to Jennings and Hayes (1994), CRLFs also use small mammal burrows and moist leaf litter as habitat. In addition, CRLFs may also use large cracks in the bottom of dried ponds as refugia; these cracks may provide moisture for individuals avoiding predation and solar exposure (Alvarez 2000).

2.6 Designated Critical Habitat

In a final rule published on April 13, 2006, 34 separate units of critical habitat were designated for the CRLF by USFWS (USFWS 2006; FR 51 19244-19346). A summary of the 34 critical habitat units relative to USFWS-designated recovery units and core areas (previously discussed in Section 2.5.1) is provided in **Table 2.5**.

'Critical habitat' is defined in the ESA as the geographic area occupied by the species at the time of the listing where the physical and biological features necessary for the conservation of the species exist, and there is a need for special management to protect the listed species. It may also include areas outside the occupied area at the time of listing if such areas are 'essential to the conservation of the species.' All designated critical habitat for the CRLF was occupied at the time of listing. Critical habitat receives protection under Section 7 of the ESA through prohibition against destruction or adverse modification with regard to actions carried out, funded, or authorized by a federal Agency. Section 7 requires consultation on federal actions that are likely to result in the destruction or adverse modification of critical habitat.

To be included in a critical habitat designation, the habitat must be 'essential to the conservation of the species.' Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species or areas that contain certain primary constituent elements (PCEs) (as defined in 50 CFR 414.12(b)). PCEs include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. The designated critical habitat areas for the CRLF are considered to have the following PCEs that justify critical habitat designation:

- Breeding aquatic habitat;
- Non-breeding aquatic habitat;

- Upland habitat; and
- Dispersal habitat.

Further description of these habitat types is provided in Attachment 1.

Occupied habitat may be included in the critical habitat only if essential features within the habitat may require special management or protection. Therefore, USFWS does not include areas where existing management is sufficient to conserve the species. Critical habitat is designated outside the geographic area presently occupied by the species only when a designation limited to its present range would be inadequate to ensure the conservation of the species. For the CRLF, all designated critical habitat units contain all four of the PCEs, and were occupied by the CRLF at the time of FR listing notice in April 2006. The FR notice designating critical habitat for the CRLF includes a special rule exempting routine ranching activities associated with livestock ranching from incidental take prohibitions. The purpose of this exemption is to promote the conservation of rangelands, which could be beneficial to the CRLF, and to reduce the rate of conversion to other land uses that are incompatible with CRLF conservation. Please see Attachment 1 for a full explanation on this special rule.

USFWS has established adverse modification standards for designated critical habitat (USFWS 2006). Activities that may destroy or adversely modify critical habitat are those that alter the PCEs and jeopardize the continued existence of the species. Evaluation of actions related to use of propyzamide that may alter the PCEs of the CRLF's critical habitat form the basis of the critical habitat impact analysis. According to USFWS (2006), activities that may affect critical habitat and therefore result in adverse effects to the CRLF include, but are not limited to the following:

(1) Significant alteration of water chemistry or temperature to levels beyond the tolerances of the CRLF that result in direct or cumulative adverse effects to individuals and their life-cycles.
(2) Significant increase in sediment deposition within the stream channel or pond or disturbance of upland foraging and dispersal habitat that could result in elimination or reduction of habitat necessary for the growth and reproduction of the CRLF by increasing the sediment deposition to levels that would adversely affect their ability to complete their life cycles.
(3) Significant alteration of channel/pond morphology or geometry that may lead to changes to the hydrologic functioning of the stream or pond and alter the timing, duration, water flows, and levels that would degrade or eliminate the CRLF and/or its habitat. Such an effect could also lead to increased sedimentation and degradation in water quality to levels that are beyond the CRLF's tolerances.
(4) Elimination of upland foraging and/or aestivating habitat or dispersal habitat.
(5) Introduction, spread, or augmentation of non-native aquatic species in stream segments or ponds used by the CRLF.
(6) Alteration or elimination of the CRLF's food sources or prey base (also evaluated as indirect effects to the CRLF).

As previously noted in Section 2.1, the Agency believes that the analysis of direct and indirect effects to listed species provides the basis for an analysis of potential effects on the designated critical habitat. Because propyzamide is expected to directly impact living organisms within the action area, critical habitat analysis for propyzamide is limited in a practical sense to those PCEs of critical habitat that are biological or that can be reasonably linked to biologically mediated processes.

2.7 Action Area

For listed species assessment purposes, the action area is considered to be the area affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). It is recognized that the overall action area for the national registration of propyzamide is likely to encompass considerable portions of the United States based on its uses. However, the scope of this assessment limits consideration of the overall action area to those portions that may be applicable to the protection of the CRLF and its designated critical habitat within the state of California. Deriving the geographical extent of this portion of the action area is the product of consideration of the types of effects that propyzamide may be expected to have on the environment, the exposure levels to propyzamide that are associated with those effects, and the best available information concerning the use of propyzamide and its fate and transport within the state of California.

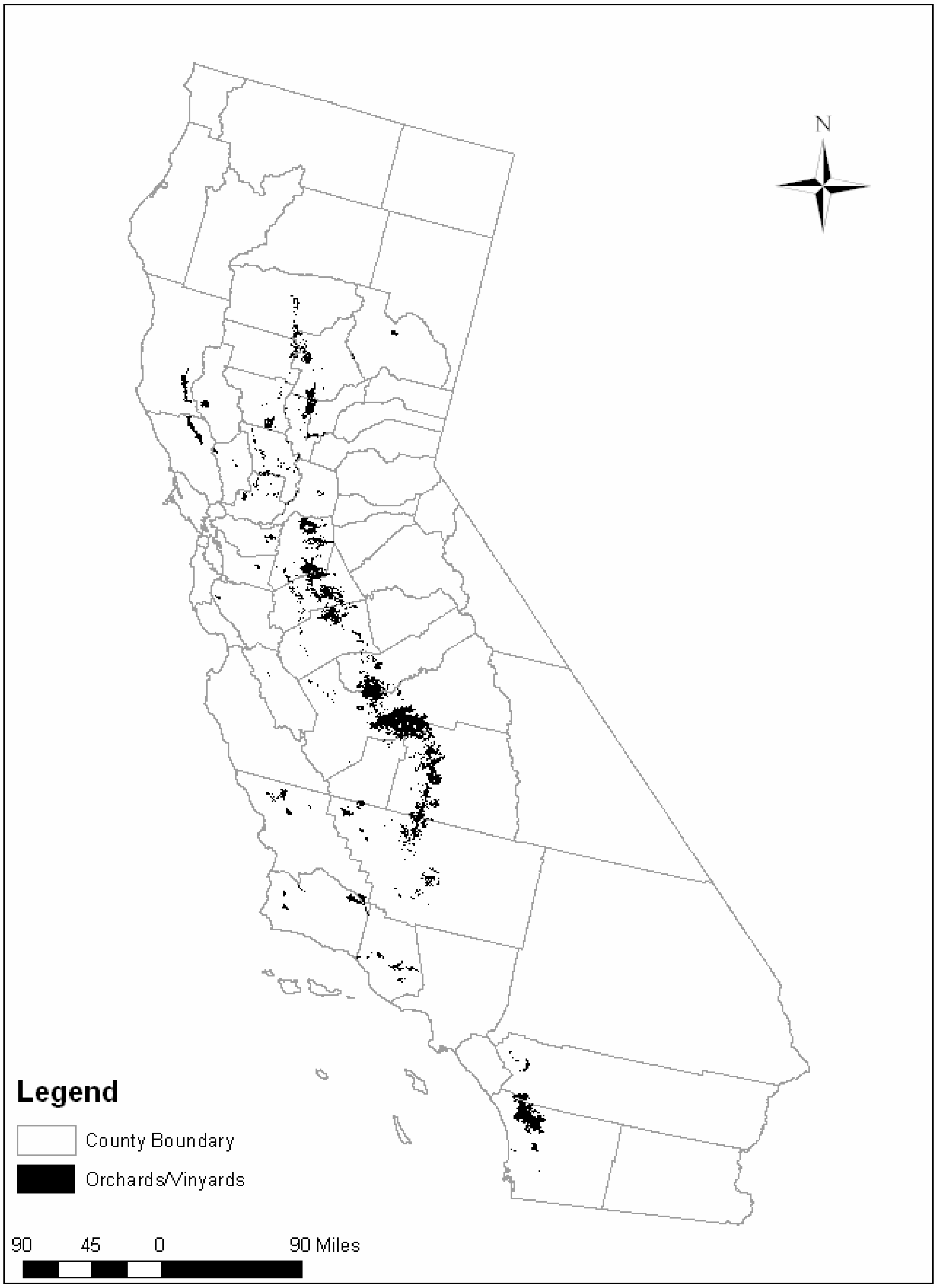
The definition of action area requires a stepwise approach that begins with an understanding of the federal action. As discussed earlier, the federal action is defined by the currently labeled uses for propyzamide. An analysis of labeled uses and review of available product labels was completed. This analysis indicates that the following uses are considered as part of the federal action evaluated in this assessment: artichokes, stone/pome fruit, grapes, alfalfa, clover, trefoil, crown vetch, sainfoin, blueberries, lettuce, turf/grass for seed, ornamental trees/plants/shrubs, Christmas trees, and fallow land.

After determination of which uses will be assessed, an evaluation of the potential "footprint" of the use pattern is determined. This "footprint" represents the initial area of concern and is typically based on available land cover data. Local land cover data available for the state of California were analyzed to refine the understanding of potential propyzamide uses. The initial area of concern is defined as all land cover types that represent the labeled uses described above. The initial area of concern is represented by 1) agricultural land covers, which are assumed to represent vegetable and non-orchard fruit crops as well as ornamental crops; 2) orchard and vineyard land covers; (3) pasture; and (4) turf. The specific uses which correspond to each of these land covers are depicted in **Table 2.6**. Maps representing the land cover types that make up the initial areas of concern for these separate uses are depicted in **Figures 2.4-2.7**. These maps represent the areas that may be directly affected by the federal action. It should be noted that the action area for propyzamide is based on the endangered species LOCs for aquatic and terrestrial plants. However, the portion of the action area that is relevant to the CRLF is based on the non-listed species LOCs for aquatic and terrestrial plants because the CRLF does not have an obligate relationship w/plants.

Table 2.6 Propyzamide uses and their respective GIS land covers used to depict the initial propyzamide action area for this assessment.	
GIS Land Cover	**Uses**
Orchards/vineyards	Stone fruit, pome fruit, grapes, wine grapes
Cultivated Crops	Alfalfa and related crops, artichokes, blueberries, lettuce and leafy greens, ornamentals
Pasture	Fallow land
Turf	Turf, grass for seed

Once the initial area of concern is defined, the next step is to compare the extent of that area with the results of the screening-level risk assessment. In this assessment, transport of propyzamide through runoff and spray drift is considered in deriving quantitative estimates of propyzamide exposure to CRLF, its prey and its habitats.

Since this screening-level risk assessment defines taxa that are predicted to be exposed through runoff and drift to propyzamide at concentrations above the Agency's Levels of Concern (LOC), there is need to expand the action area to include areas that are affected indirectly by this federal action. Two methods are employed to define the areas indirectly affected by the federal action, and thus the total action area. These are the down stream dilution assessment for determining the extent of the affected lotic aquatic habitats (flowing water) and the spray drift assessment for determining the extent of the affected terrestrial habitats and lentic aquatic habitats (non-flowing water). In order to define the final action area relevant to uses of propyzamide, it is necessary to combine areas directly affected, as well as aquatic and terrestrial habitats indirectly affected by the federal action. It is assumed that lentic (standing water) aquatic habitats (*e.g.* ponds, pools, marshes) overlapping with the terrestrial areas are also indirectly affected by the federal action. **The analysis of areas indirectly affected by the federal action, as well as the determination of the final action area for propyzamide is described in the risk discussion (Section 7.1).** The action area for propyzamide, including the full extent (based on the listed species LOCs) of the action area that is relevant for the CRLF is presented graphically in **Figure 2.8.** Additional analysis related to the intersection of the propyzamide action area and CRLF habitat used in determining the final action area is described in **Appendix D**.



Compiled from California County boundaries (ESRI, 2002), USDA National Agriculture Statistical Service (NASS, 2002) Gap Analysis Program Orchard/ Vineyard Landcover (GAP) National Land Cover Database (NLCD) (MRLC, 2001)

Map created by U.S. Environmental Protection Agency, Office of Pesticides Programs, Environmental Fate and Effects Division. April 11, 2007. Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983)

Figure 2.4 Initial area of concern for crops described by orchard/vineyard land cover which corresponds to potential propyzamide use sites. This map represents the area potentially directly affected by the federal action.

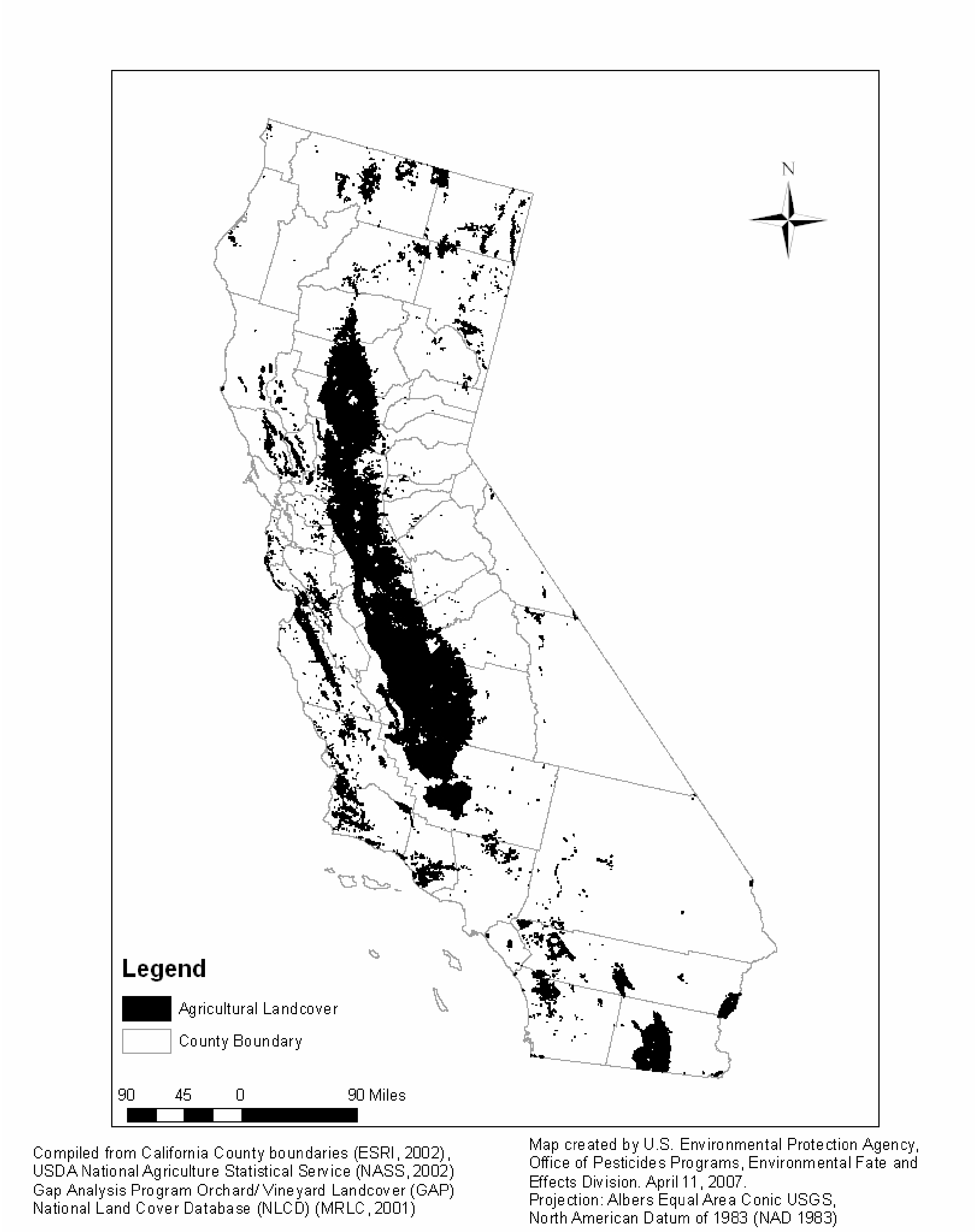
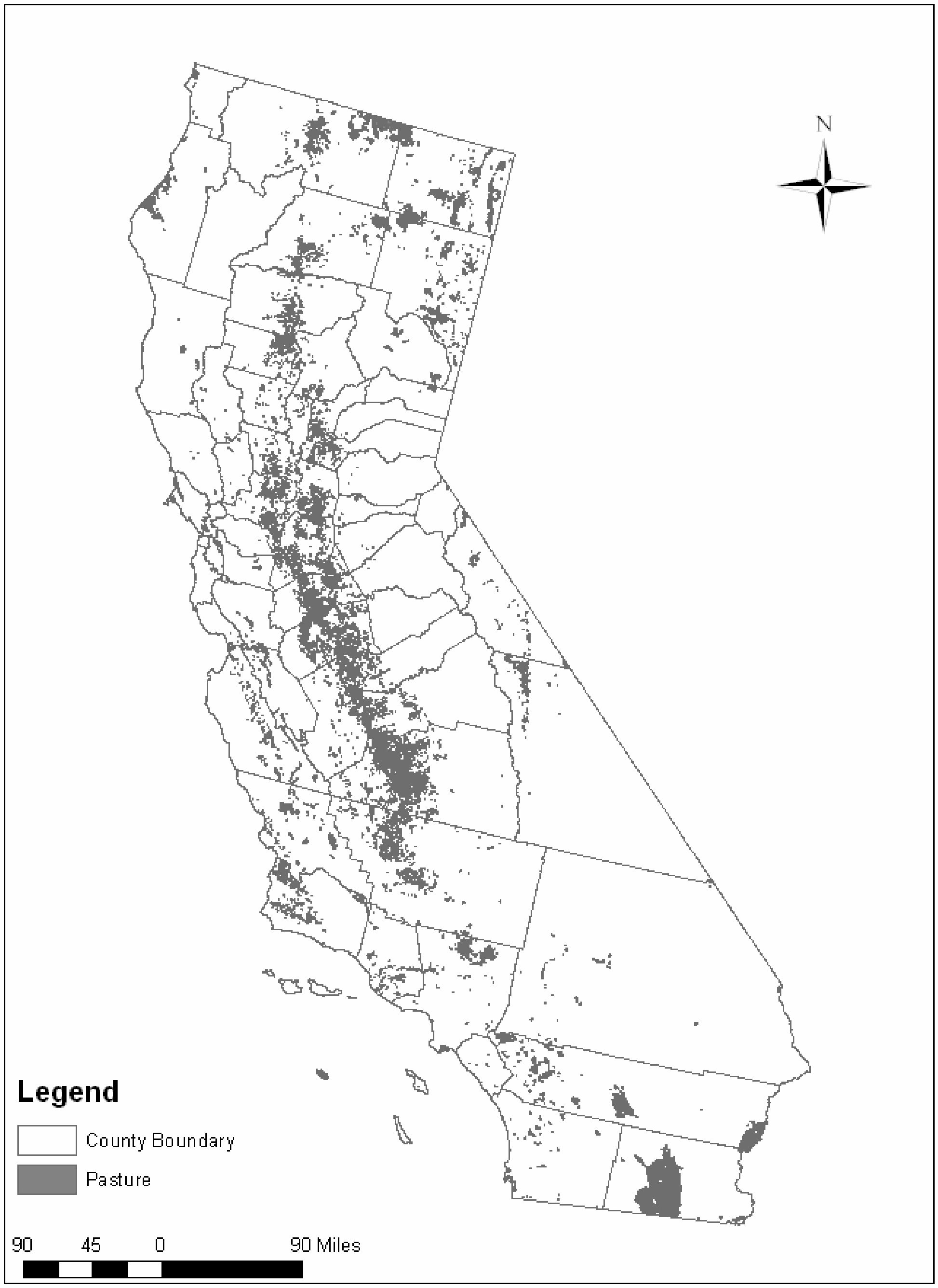


Figure 2.5 Initial area of concern for crops described by agricultural land cover which corresponds to potential propyzamide use sites. This map represents the area potentially directly affected by the federal action.



Compiled from California County boundaries (ESRI, 2002), USDA National Agriculture Statistical Service (NASS, 2002) Gap Analysis Program Orchard/ Vineyard Landcover (GAP) National Land Cover Database (NLCD) (MRLC, 2001)

Map created by U.S. Environmental Protection Agency, Office of Pesticides Programs, Environmental Fate and Effects Division. April 11, 2007.
Projection: Albers Equal Area Conic USGS, North American Datum of 1983 (NAD 1983)

Figure 2.6 Initial area of concern for crops described by pasture land cover which corresponds to potential propyzamide use sites. This map represents the area potentially directly affected by the federal action.

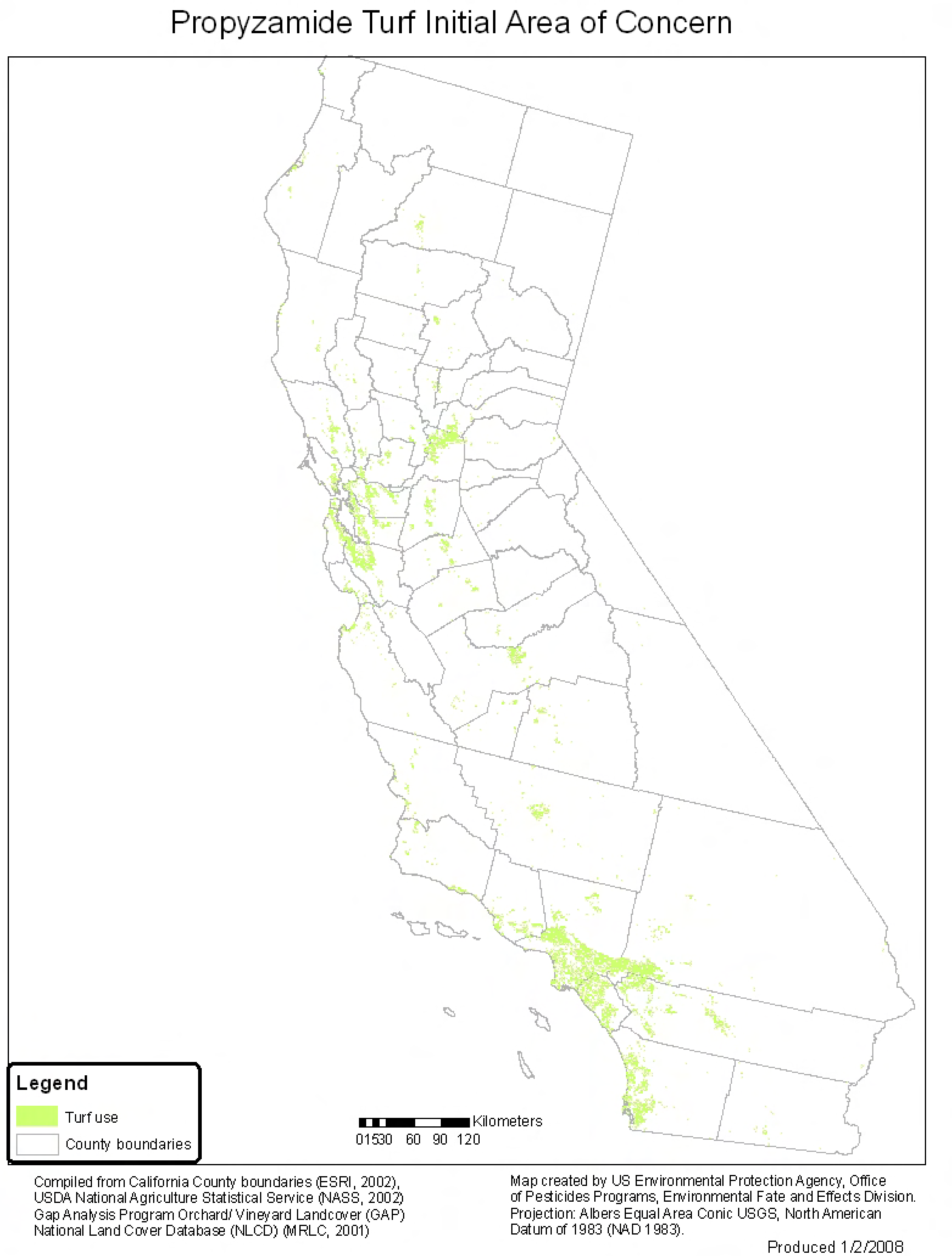


Figure 2.7 Initial area of concern for crops described by turf land cover which corresponds to potential propyzamide use sites. This map represents the area potentially directly affected by the federal action.

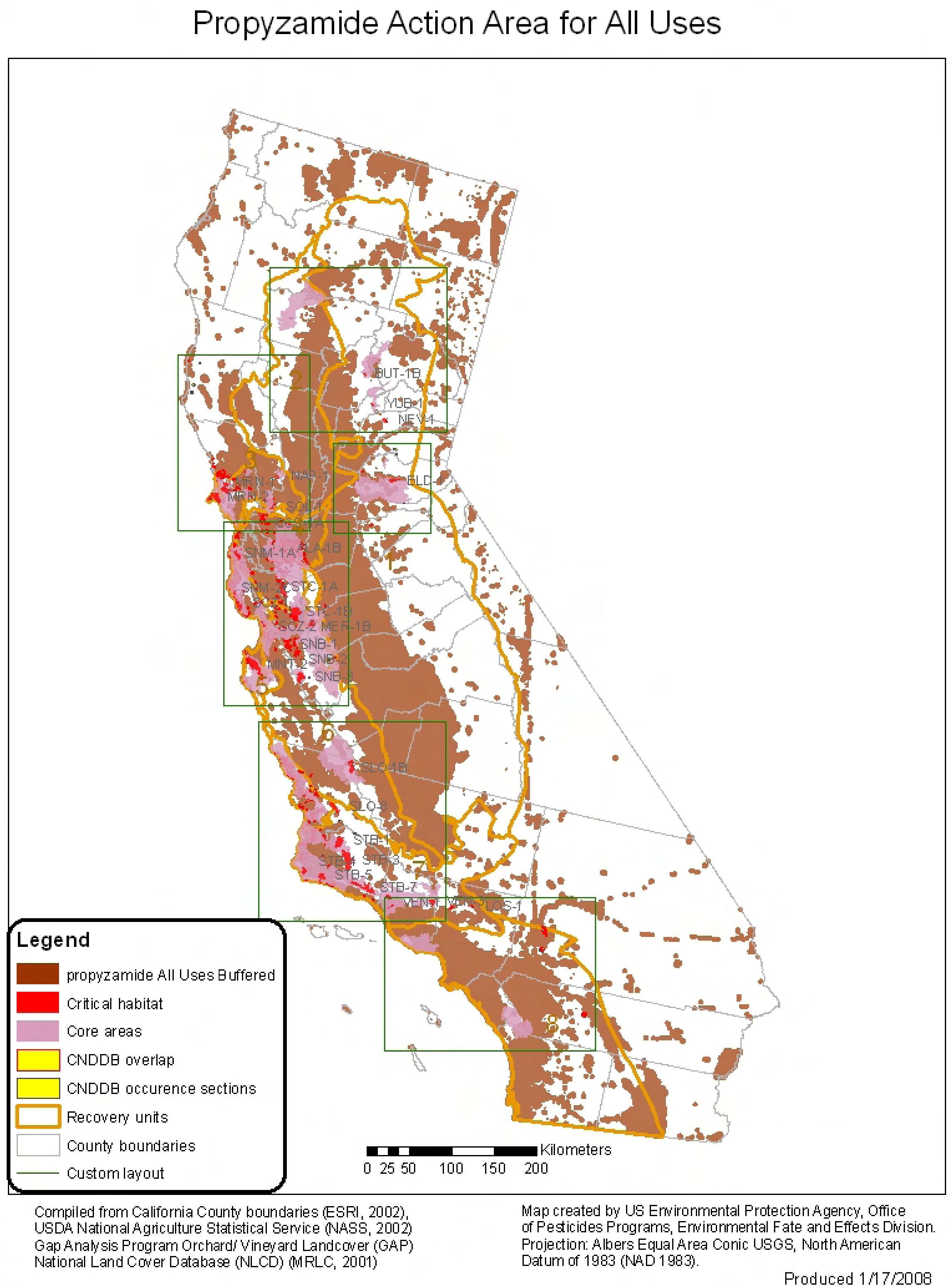


Figure 2.8 Total action area for all propyzamide uses. This map represents the area potentially directly and indirectly affected by the federal action.

2.8 Assessment Endpoints and Measures of Ecological Effect

Assessment endpoints are defined as "explicit expressions of the actual environmental value that is to be protected."[4] Selection of the assessment endpoints is based on valued entities (*e.g.,* CRLF, organisms important in the life cycle of the CRLF, and the PCEs of its designated critical habitat), the ecosystems potentially at risk (*e.g.,* waterbodies, riparian vegetation, and upland and dispersal habitats), the migration pathways of propyzamide (*e.g.,* runoff, spray drift, etc.), and the routes by which ecological receptors are exposed to propyzamide *(e.g.,* direct contact, *etc.).*

2.8.1. Assessment Endpoints for the CRLF

Assessment endpoints for the CRLF include direct toxic effects on the survival, reproduction, and growth of the CRLF, as well as indirect effects, such as reduction of the prey base or modification of its habitat. In addition, potential modification of critical habitat is assessed by evaluating potential effects to PCEs, which are components of the habitat areas that provide essential life cycle needs of the CRLF. Each assessment endpoint requires one or more "measures of ecological effect," defined as changes in the attributes of an assessment endpoint or changes in a surrogate entity or attribute in response to exposure to a pesticide. Specific measures of ecological effect are generally evaluated based on acute and chronic toxicity information from registrant-submitted guideline tests that are performed on a limited number of organisms. Additional ecological effects data from the open literature are also considered.

A complete discussion of all the toxicity data available for this risk assessment, including resulting measures of ecological effect selected for each taxonomic group of concern, is included in Section 4 of this document. A summary of the assessment endpoints and measures of ecological effect selected to characterize potential assessed direct and indirect CRLF risks associated with exposure to propyzamide is provided in **Table 2.7**.

[4] From U.S. EPA (1992). *Framework for Ecological Risk Assessment.* EPA/630/R-92/001.

Table 2.7 Assessment Endpoints and Measures of Ecological Effects	
Assessment Endpoint	**Measures of Ecological Effects**
Aquatic-Phase CRLF (Eggs, larvae, and adults)[a]	
Direct Effects	
1. Survival, growth, and reproduction of CRLF	1a. Most sensitive fish acute LC_{50} (guideline study) since no suitable amphibian data are available 1b. Estimated fish chronic NOAEC (based on freshwater invertebrate acute-to-chronic ratio)
Indirect Effects and Critical Habitat Effects	
2. Survival, growth, and reproduction of CRLF individuals via indirect effects on aquatic prey food supply (*i.e.*, fish, freshwater invertebrates, non-vascular plants)	2a. Most sensitive fish, aquatic invertebrate, and aquatic plant EC_{50} or LC_{50} (guideline studies) 2b. Most sensitive aquatic invertebrate and fish chronic NOAEC (fish NOAEC based on estimate using mammalian acute-to-chronic ratio)
3. Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, food supply, and/or primary productivity (*i.e.*, aquatic plant community)	3a. Vascular plant acute EC_{50} (duckweed guideline test) 3b. Non-vascular plant acute EC_{50} (freshwater algae)
4. Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation	4a. Most sensitive EC_{25} values for monocots (guideline seedling emergence and vegetative vigor studies) 4b. Most sensitive EC_{25} values for dicots (guideline seedling emergence and vegetative vigor studies)
Terrestrial-Phase CRLF (Juveniles and adults)	
Direct Effects	
5. Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	5a. Most sensitive bird[b] acute LD_{50} (guideline study) 5b. Most sensitive bird[b] chronic NOAEC (estimated using mammalian acute-to-chronic ratio)
Indirect Effects and Critical Habitat Effects	
6. Survival, growth, and reproduction of CRLF individuals via effects on terrestrial prey (*i.e.,*terrestrial invertebrates, small mammals , and frogs)	6a. Most sensitive terrestrial invertebrate and vertebrate acute EC_{50} or LC_{50} (guideline studies)[c] 6b. Most sensitive terrestrial invertebrate and vertebrate chronic NOAEC (guideline studies)
7. Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian and upland vegetation)	7a. Most sensitive EC_{25} for monocots (guideline seedling emergence and vegetative vigor studies) 7b. Most sensitive EC_{25} for dicots (guideline seedling emergence and vegetative vigor studies)

[a] Adult frogs are no longer in the "aquatic-phase" of the amphibian life cycle; however, submerged adult frogs are considered "aquatic" for the purposes of this assessment because exposure pathways in the water are considerably different that exposure pathways on land.
[b] Birds are used as surrogates for terrestrial-phase amphibians.

2.8.2 Assessment Endpoints for Designated Critical Habitat

As previously discussed, designated critical habitat is assessed to evaluate actions related to the use of propyzamide that may alter the PCEs of the CRLF's critical habitat. PCEs for the CRLF were previously described in Section 2.6. Actions that may modify critical habitat are those that alter the PCEs and jeopardize the continued existence of the CRLF.

Therefore, these actions are identified as assessment endpoints. It should be noted that evaluation of PCEs as assessment endpoints is limited to those of a biological nature (*i.e.*, the biological resource requirements for the listed species associated with the critical habitat) and those for which propyzamide effects data are available.

Adverse modification to the critical habitat of the CRLF includes, but is not limited to, the following, as specified by USFWS (2006):

1. Alteration of water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs.
2. Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs.
3. Significant increase in sediment deposition within the stream channel or pond or disturbance of upland foraging and dispersal habitat.
4. Significant alteration of channel/pond morphology or geometry.
5. Elimination of upland foraging and/or aestivating habitat, as well as dispersal habitat.
6. Introduction, spread, or augmentation of non-native aquatic species in stream segments or ponds used by the CRLF.
7. Alteration or elimination of the CRLF's food sources or prey base.

Measures of such possible effects by labeled use of propyzamide on critical habitat of the CRLF are described in **Table 2.8**. Some components of these PCEs are associated with physical abiotic features (*e.g.*, presence and/or depth of a water body, or distance between two sites), which are not expected to be measurably altered by use of pesticides. Assessment endpoints used for the analysis of designated critical habitat are based on the adverse modification standard established by USFWS (2006).

Table 2.8 Summary of Assessment Endpoints and Measures of Ecological Effect for Primary Constituent Elements of Designated Critical Habitat[a]	
Assessment Endpoint	**Measures of Ecological Effect**
Aquatic-Phase CRLF PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)	
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	a. Most sensitive EC_{50} values for aquatic plants (guideline studies) b. Most sensitive EC_{25} values for terrestrial monocots (guideline seedling emergence and vegetative vigor studies) c. Most sensitive EC_{25} values for terrestrial dicots (guideline seedling emergence and vegetative vigor studies)
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	a. Most sensitive EC_{50} or LC_{50} values for fish and aquatic invertebrates (guideline studies) b. Most sensitive NOAEC values for fish and aquatic invertebrates (guideline studies). Chronic NOAEC for fish based on estimate derived using mammalian acute-to-chronic ratio.
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae)	a. Most sensitive aquatic plant EC_{50} (guideline study)
Terrestrial-Phase CRLF PCEs (Upland Habitat and Dispersal Habitat)	
Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance	a. Most sensitive EC_{25} values for monocots (guideline seedling emergence and vegetative vigor studies) b. Most sensitive EC_{25} values for dicots (guideline seedling emergence and vegetative vigor studies) c. Most sensitive food source acute EC_{50}/LC_{50} and NOAEC values for terrestrial vertebrates (mammals) and invertebrates, birds, and freshwater fish. (NOAEC for birds and fish derived using mammalian acute-to-chronic ratio)
Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal	
Reduction and/or modification of food sources for terrestrial phase juveniles and adults	
Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	

[a] Physico-chemical water quality parameters such as salinity, pH, and hardness are not evaluated because these processes are not biologically mediated and, therefore, are not relevant to the endpoints included in this assessment.

2.9 Conceptual Model

2.9.1 Risk Hypotheses

Risk hypotheses are specific assumptions about potential adverse effects (*i.e.*,changes in assessment endpoints) and may be based on theory and logic, empirical data, mathematical models, or probability models (USEPA 1998). For this assessment, the risk is stressor-linked, where the stressor is the release of propyzamide to the environment. The following risk hypotheses are presumed for this endangered species assessment:

The labeled use of propyzamide within the action area may:

- directly affect the CRLF by causing mortality or by adversely affecting growth or fecundity;
- indirectly affect the CRLF by reducing or changing the composition of food supply;
- indirectly affect the CRLF or modify designated critical habitat by reducing or changing the composition of the aquatic plant community in the ponds and streams comprising the species' current range and designated critical habitat, thus affecting primary productivity and/or cover;
- indirectly affect the CRLF or modify designated critical habitat by reducing or changing the composition of the terrestrial plant community (*i.e.*, riparian habitat) required to maintain acceptable water quality and habitat in the ponds and streams comprising the species' current range and designated critical habitat;
- modify the designated critical habitat of the CRLF by reducing or changing breeding and non-breeding aquatic habitat (via modification of water quality parameters, habitat morphology, and/or sedimentation);
- modify the designated critical habitat of the CRLF by reducing the food supply required for normal growth and viability of juvenile and adult CRLFs;
- modify the designated critical habitat of the CRLF by reducing or changing upland habitat within 200 ft of the edge of the riparian vegetation necessary for shelter, foraging, and predator avoidance.
- modify the designated critical habitat of the CRLF by reducing or changing dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal.
- modify the designated critical habitat of the CRLF by altering chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs.

2.9.2 Diagram

The conceptual model is a graphic representation of the structure of the risk assessment. It specifies the propyzamide release mechanisms, biological receptor types, and effects endpoints of potential concern. The conceptual models for aquatic and terrestrial phases of the CRLF are shown in **Figures 2.9 and 2.10**, respectively, and the conceptual models for the aquatic and terrestrial PCE components of critical habitat are shown in **Figures**

2.11 and 2.12, respectively. Exposure routes shown in dashed lines are not quantitatively considered because the contribution of those potential exposure routes to potential risks to the CRLF and modification to designated critical habitat is expected to be negligible.

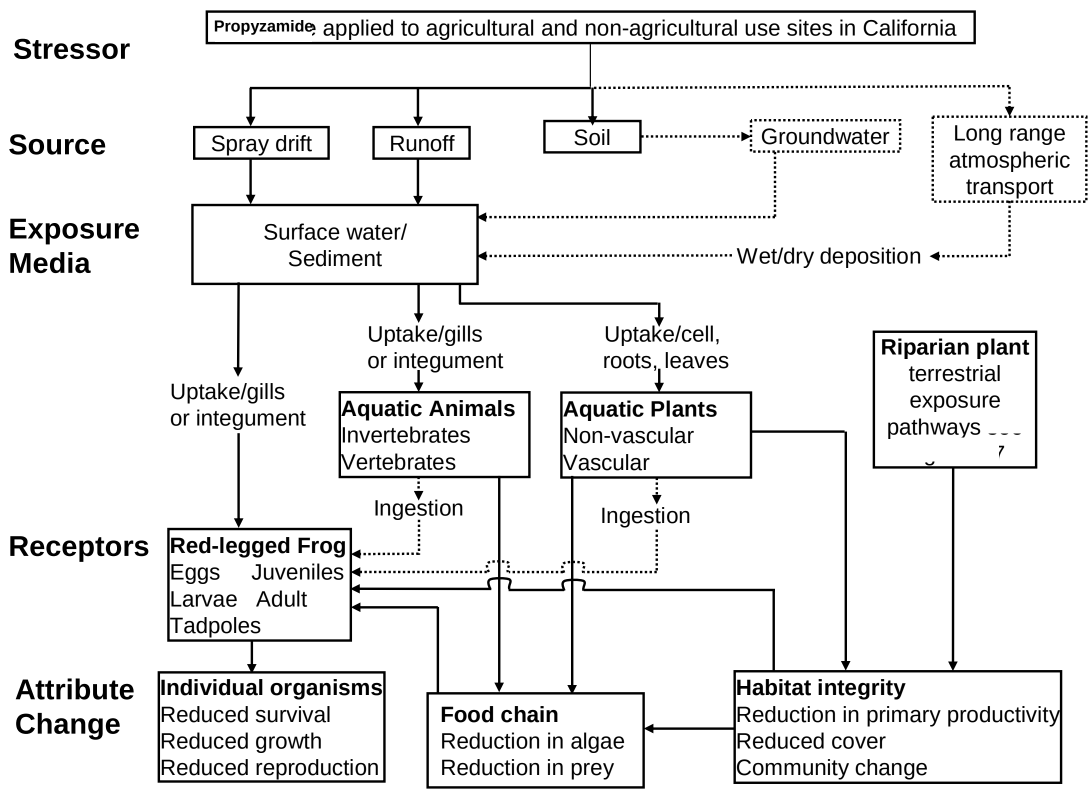


Figure 2.9 Conceptual Model for Aquatic-Phase of the CRLF

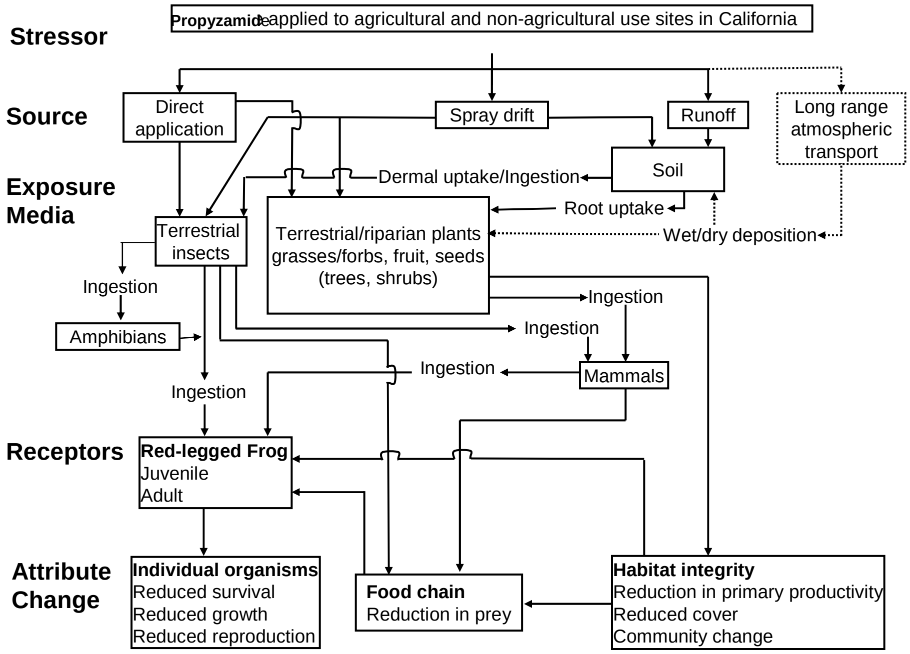


Figure 2.10 Conceptual Model for Terrestrial-Phase of the CRLF

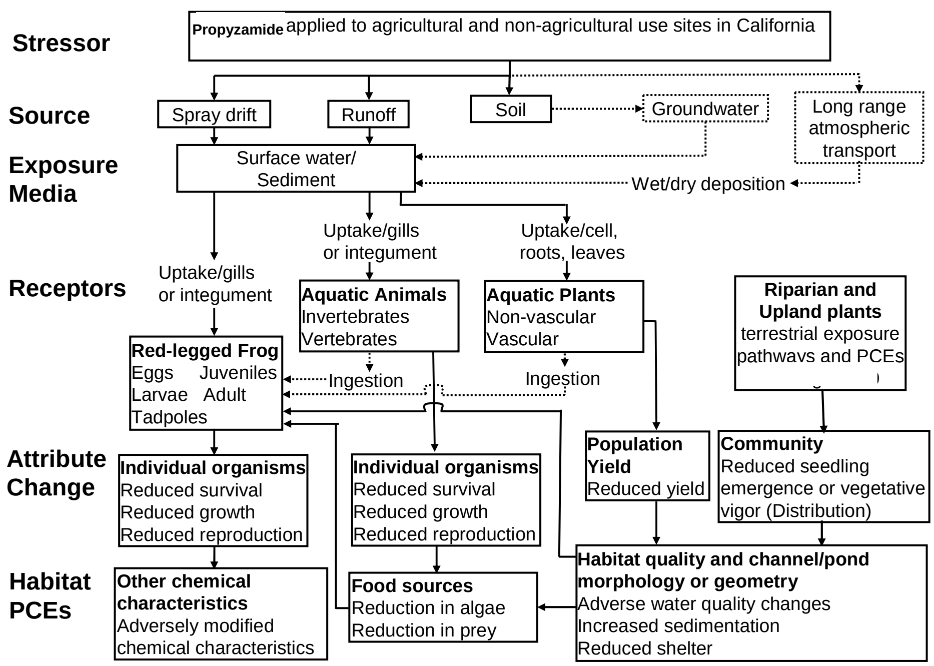


Figure 2.11 Conceptual Model for Pesticide Effects on Aquatic Component of CRLF Critical Habitat

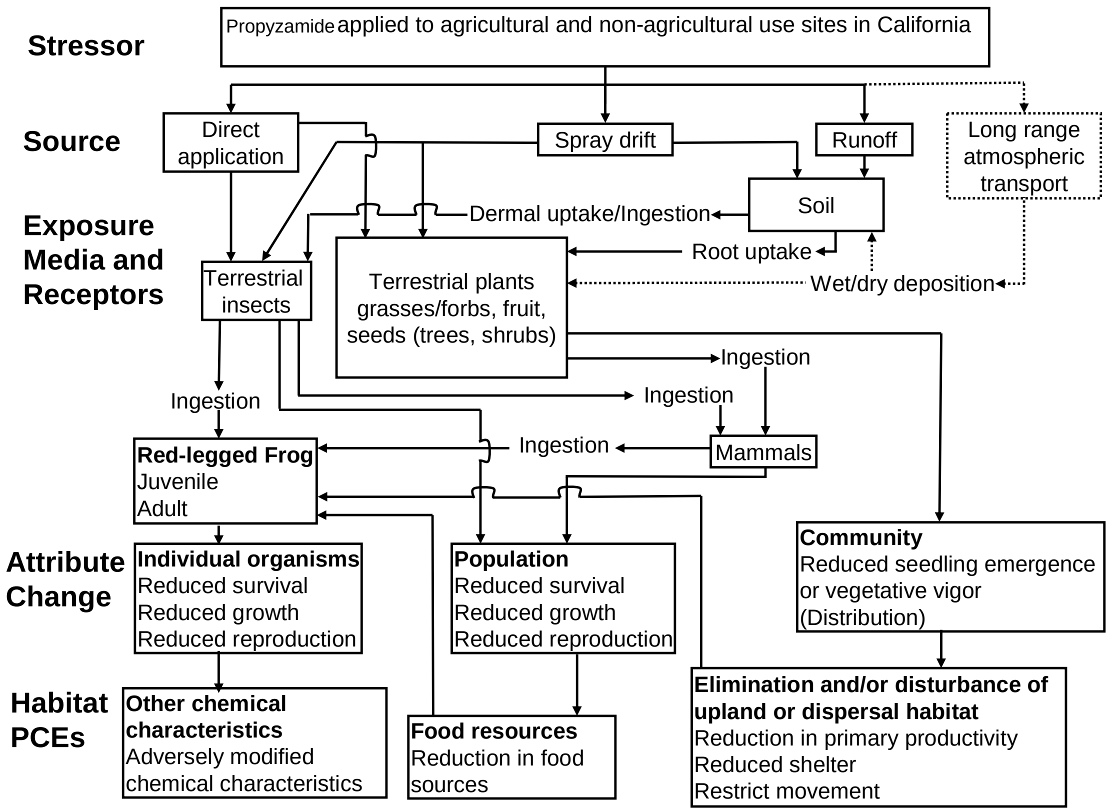


Figure 2.12 Conceptual Model for Pesticide Effects on Terrestrial Component of CRLF Critical Habitat

2.10 Analysis Plan

In order to address the risk hypothesis, the potential for direct and indirect effects to the CRLF, its prey, and its habitat is estimated. In the following sections, the use, environmental fate, and ecological effects of propyzamide are characterized and integrated to assess the risks. This is accomplished using a risk quotient (ratio of exposure concentration to effects concentration) approach. Although risk is often defined as the likelihood and magnitude of adverse ecological effects, the risk quotient-based approach does not provide a quantitative estimate of likelihood and/or magnitude of an adverse effect. However, as outlined in the Overview Document (USEPA 2004), the likelihood of effects to individual organisms from particular uses of propyzamide is estimated using the probit dose-response slope and either the level of concern (discussed below) or actual calculated risk quotient value.

2.10.1 Measures to Evaluate the Risk Hypothesis and Conceptual Model

2.10.1.1 Measures of Exposure

The environmental fate properties of propyzamide along with available monitoring data indicate that runoff and spray drift are the principle potential transport mechanisms of propyzamide to the aquatic and terrestrial habitats of the CRLF. Due to the water solubility and relatively low vapor pressure of propyzamide, atmospheric transport is considered unlikely. In this assessment, transport of propyzamide through runoff and spray drift is considered in deriving quantitative estimates of exposure to CRLF, its prey and its habitats.

Measures of exposure are based on aquatic and terrestrial models that predict estimated environmental concentrations (EECs) of propyzamide using maximum labeled application rates and methods of application. The models used to predict aquatic EECs are the Pesticide Root Zone Model coupled with the EXposure Analysis Modeling System (PRZM/EXAMS). The model used to predict terrestrial EECs on food items is Terrestrial Residue Exposure (T-REX). The model used to derive EECs relevant to terrestrial and wetland plants is TerrPlant. These models are parameterized using relevant reviewed registrant-submitted environmental fate data.

PRZM (v3.12.2, 5/12/2005) and EXAMS (v2.98.4.6, 4/25/2005) are screening simulation models coupled with the input shell PE (v5.0, 11/15/2006) to generate daily exposures and 1-in-10 year EECs of propyzamide that may occur in surface water bodies adjacent to application sites receiving propyzamide through runoff and spray drift. PRZM simulates pesticide application, movement and transformation on an agricultural field and the resultant pesticide loadings to a receiving water body via runoff, erosion and spray drift. EXAMS simulates the fate of the pesticide and resulting concentrations in the water body. The standard scenario used for ecological pesticide assessments assumes application to a 10-hectare agricultural field that drains into an adjacent 1-hectare water body, 2-meters deep (20,000 m^3 volume) with no outlet. PRZM/EXAMS was used to estimate screening-level exposure of aquatic organisms to propyzamide. The measure of exposure for aquatic species is the 1-in-10 year return peak or rolling mean concentration. The 1-in-10 year peak is used for estimating acute exposures of direct effects to the CRLF, as well as indirect effects to the CRLF through effects to potential prey items, including: algae, aquatic invertebrates, fish and frogs. The 1-in-10-year 60-day mean is used for assessing chronic exposure to the CRLF and fish and frogs serving as prey items; the 1-in-10-year 21-day mean is used for assessing chronic exposure for aquatic invertebrates, which are also potential prey items.

Exposure estimates for the terrestrial-phase CRLF and terrestrial invertebrates and mammals (serving as potential prey) assumed to be in the target area or in an area exposed to spray drift are derived using the T-REX model (v1.3.1, 12/07/2006). This model incorporates the Kenega nomograph, as modified by Fletcher *et al.* (1994), which is based on a large set of actual field residue data. The upper limit values from the nomograph represented the 95th percentile of residue values from actual field measurements (Hoerger and Kenega 1972). For modeling purposes, direct exposures of the CRLF to propyzamide through contaminated food are estimated using the EECs for the small bird (20 g) which consumes small insects. Dietary-based and dose-based exposures of potential prey (small mammals) are assessed using the small mammal (15 g) which consumes short grass. The small bird (20g) consuming small insects and the small mammal (15g) consuming short grass are used because these categories represent the largest RQs of the size and dietary categories in T-REX that are appropriate surrogates for the CRLF and one of its prey items. Estimated exposures of terrestrial insects to propyzamide are bound by using the dietary based EECs for small insects and large insects.

Birds are currently used as surrogates for terrestrial-phase CRLF. However, amphibians are poikilotherms (body temperature varies with environmental temperature) while birds are homeotherms (temperature is regulated, constant, and largely independent of environmental temperatures). Therefore, amphibians tend to have much lower metabolic rates and lower caloric intake requirements than birds or mammals. As a consequence, birds are likely to consume more food than amphibians on a daily dietary intake basis, assuming similar caloric content of the food items. The use of avian food intake allometric equation as a surrogate to amphibians is likely to result in an over-estimation of exposure and risk for reptiles and terrestrial-phase amphibians. Therefore, T-REX (v1.3.1) has been refined to the Terrestrial Herptafaunal Exposure and Residue Program Simulation (T-HERPS) model (v1.0, 5/15/2007), which allows for an estimation of food intake for poikilotherms using the same basic procedure as T-REX to estimate food intake.

EECs for terrestrial plants inhabiting dry and wetland areas are derived using TerrPlant (v1.2.2, 12/26/2006). This model uses estimates of pesticides in runoff and in spray drift to calculate EECs. EECs are based upon solubility, application rate and minimum incorporation depth.

The spray drift model AGricultural DISPersal (AGDISP v8.15; 5/12/2005) was used to assess exposures of terrestrial-phase CRLF and its prey to propyzamide deposited on terrestrial and aquatic lentic habitats by spray drift (Teske and Curbishley 2003). AGDISP was used to simulate aerial and ground applications using the Gaussian farfield extension. The mechanistic ground boom component of AGDISP has not been approved for use in risk assessment and, therefore, generates exposure estimates of greater uncertainty than those based on aerial applications. Due to this uncertainty, exposure estimates from aerial application were used to characterize exposure estimates based on ground applications.

2.10.1.2 Measures of Effect

Data identified in Section 2.8 are used as measures of effect for direct and indirect effects to the CRLF. Data were obtained from registrant submitted studies or from literature studies identified by ECOTOX. The ECOTOXicology database (ECOTOX) was searched in order to provide more ecological effects data and in an attempt to bridge existing data gaps. ECOTOX is a source for locating chemical toxicity data for aquatic life, terrestrial plants, and wildlife. ECOTOX was created and is maintained by the USEPA, Office of Research and Development, and the National Health and Environmental Effects Research Laboratory's Mid-Continent Ecology Division.

The assessment of risk for direct effects to the terrestrial-phase CRLF makes the assumption that toxicity of propyzamide to birds is similar to or less than the toxicity to the terrestrial-phase CRLF. The same assumption is made for fish and aquatic-phase CRLF. Algae, aquatic invertebrates, fish, and amphibians represent potential prey of the CRLF in the aquatic habitat. Terrestrial invertebrates, small mammals, and terrestrial-phase amphibians represent potential prey of the CRLF in the terrestrial habitat. Aquatic, semi-aquatic, and terrestrial plants represent habitat of CRLF.

The acute measures of effect used for animals in this screening-level assessment are the LD_{50}, LC_{50} and EC_{50}. LD stands for "Lethal Dose", and LD_{50} is the amount of a material, given all at once, that is estimated to cause the death of 50% of the test organisms. LC stands for “Lethal Concentration” and LC_{50} is the concentration of a chemical that is estimated to kill 50% of the test organisms. EC stands for “Effective Concentration” and the EC_{50} is the concentration of a chemical that is estimated to produce a specific effect in 50% of the test organisms. Endpoints for chronic measures of exposure for listed and non-listed animals are the NOAEL/NOAEC and NOEC. NOAEL stands for “No Observed-Adverse-Effect-Level” and refers to the highest tested dose of a substance that has been reported to have no harmful (adverse) effects on test organisms. The NOAEC (*i.e.*, “No-Observed-Adverse-Effect-Concentration”) is the highest test concentration at which none of the observed effects were statistically different from the control. The NOEC is the No-Observed-Effects-Concentration. For non-listed plants, only acute exposures are assessed (*i.e.*, EC_{25} for terrestrial plants and EC_{50} for aquatic plants).

2.10.1.3 Integration of Exposure and Effects

Risk characterization is the integration of exposure and ecological effects characterization to determine the potential ecological risk from agricultural and non-agricultural uses of propyzamide, and the likelihood of direct and indirect effects to CRLF in aquatic and terrestrial habitats. The exposure and toxicity effects data are integrated in order to evaluate the risks of adverse ecological effects on non-target species. For the assessment of propyzamide risks, the risk quotient (RQ) method is used to compare exposure and measured toxicity values. EECs are divided by acute and chronic toxicity values. The resulting RQs are then compared to the Agency’s levels of concern (LOCs) (USEPA 2004) (see **Appendix C**).

For this endangered species assessment, LOCs are used for comparing RQ values for acute and chronic exposures of propyzamide to the CRLF and its habitat. If estimated exposures of propyzamide resulting from a particular use are sufficient to exceed the listed species LOC, then the effects determination for that use is “may affect”. When considering indirect effects to the CRLF due to effects to animal prey (aquatic and terrestrial invertebrates, fish, frogs, and mice), the listed species LOCs are also used. If estimated exposures to CRLF prey of propyzamide resulting from a particular use are sufficient to exceed the listed species LOC, then the effects determination for that use is a “may affect.” If the RQ being considered also exceeds the non-listed species acute risk LOC, then the effects determination is a LAA. If the acute RQ is between the listed species LOC and the non-listed acute risk species LOC, further lines of evidence (*i.e.*

probability of individual effects, species sensitivity distributions) are considered in distinguishing between a determination of NLAA and a LAA. When considering indirect effects to the CRLF due to effects to algae as dietary items or plants as habitat, the non-listed species LOC for plants is used because the CRLF does not have an obligate relationship with any particular aquatic and/or terrestrial plant. If the RQ being considered for a particular use exceeds the non-listed species LOC for plants, the effects determination is “may affect”. Further information on LOCs is provided in **Appendix C**.

2.10.2 Data Gaps

Neither acute nor chronic amphibian toxicity data are available for propyzamide; therefore, surrogate species are used for estimating the toxicity of propyzamide to amphibians. Chronic toxicity data are not available for fish and birds, which serve as surrogates for aquatic-phase and terrestrial-phase amphibians, respectively. In the absence of these data, an acute to chronic ratio was developed (see Section 4.2.2.2) and used to estimate the chronic toxicity of propyzamide to birds and fish.

3. Exposure Assessment

Propyzamide is formulated as a wettable powder in water soluble pouches and can be applied pre-plant, pre-emergence, and post-emergence by ground or aerial spray equipment, depending on the use. Wetting in of applications is recommended with rainfall or irrigation so that the compound is available for uptake into the root system. Most application timing occurs in the fall or early winter prior to freezing. The maximum annual application rate for current propyzamide uses is 8.16 pounds of active ingredient per acre (lbs a.i./A).

3.1 Label Application Rates and Intervals

Propyzamide labels may be categorized into two types: labels for manufacturing uses (including technical grade propyzamide and its formulated products) and end-use products. While technical products, which contain propyzamide of high purity, are not used directly in the environment, they are used to make formulated products, which can then be applied in specific areas to control weeds. The formulated product labels legally limit propyzamide’s potential use to only those sites that are specified on the labels.

Currently registered agricultural and non-agricultural uses of propyzamide within California include those listed in **Table 2.3**. The maximum use patterns being assessed are summarized in **Table 3.1**.

Table 3.1 Propyzamide Maximum Use Patterns in the CRLF Action Area					
Use(s)	**Max. Single App. Rate (lbs a.i./A)**	**Number of App. per Year**	**Annual App. Rate (lbs a.i./A)**	**App. Interval (days)**	**App. Method**
Stone fruit, pome fruit, grapes	4.08	1	4.08	Not applicable	Ground
Blueberries	2.04	1	2.04	Not applicable	Ground
Artichokes	4.08	2	8.16	Not specified	Aerial/ground
Lettuce, endive, escarole and radicchio	2.00 (per crop)	2 (assuming two crops/year)	4.00	Not specified	Ground
Alfalfa, clover, trefoil, crown vetch, sainfoin	2.00 (per season)	2 (assuming two seasons/year)	4.00	Not specified	Ground
Turf, grass for seed	1.53	3 (assuming three seasons/year)	4.59	Not specified	Ground
Ornamental trees, plants, shrubs and Christmas trees	2.04	1	2.04	Not applicable	Ground
Fallow land	0.510	1	0.510	Not applicable	Aerial/ ground

3.2 Aquatic Exposure Assessment

3.2.1 Modeling Approach

Aquatic exposures are quantitatively estimated for all of assessed uses using scenarios that represent high exposure sites for propyzamide use. Each of these sites represents a 10-hectare field that drains into a 1-hectare pond that is 2 meters deep and has no outlet. Exposure estimates generated using the standard pond are intended to represent a wide variety of vulnerable water bodies that occur at the top of watersheds including prairie pot holes, playa lakes, wetlands, vernal pools, man-made and natural ponds, and intermittent and first-order streams. As a group, there are factors that make these water bodies more or less vulnerable than the standard surrogate pond. Static water bodies that have larger ratios of drainage area to water body volume would be expected to have higher peak EECs than the standard pond. These water bodies will be either shallower or have larger drainage areas (or both). Shallow water bodies tend to have limited additional storage capacity, and thus, tend to overflow and carry pesticide in the discharge whereas the standard pond has no discharge. As watershed size increases beyond 10 hectares, at some point, it becomes unlikely that the entire watershed is planted to a single crop, which is all treated with the pesticide. Headwater streams can also have peak concentrations higher than the standard pond, but they tend to persist for only short periods of time and are then carried downstream.

Crop-specific management practices for all of the assessed uses of propyzamide were used for modeling, including application rates, number of applications per year, application intervals, and the first application date for each crop. Application dates and intervals were developed based on several sources of information including product labels, crop profiles maintained by the USDA (USDA 2007), and publications maintained by the University of California (UCANR 2003).

3.2.2 Model Inputs

The model input parameters used in PRZM/EXAMS to simulate propyzamide application and crop management practices are listed in **Table 3.2**. The input files used for modeling are listed in **Appendix B**. Grapes were modeled with each applicable scenario to estimate exposure from use on table grapes and wine grapes. Alfalfa and related crops were modeled with the representative alfalfa application scenario for both seed and forage uses and not with the more vulnerable rangeland scenario for forage uses because the latter was not representative of legume crops.

Applications to ornamentals were timed to precede leaf drop. Applications to Christmas trees, fallow land, berries, and fruit were timed to occur in the fall prior to ground freezing. Leafy vegetables treated by propyzamide were assumed to be cropped twice per year because rotation was expected to occur during the year with other crops. Applications were modeled in February and August. Alfalfa crops are labeled for use in fall or winter, followed by a use on alfalfa grown for seed in the spring. Therefore, two seasons were assumed to occur per year (winter and spring), with applications modeled in January and April. Turf uses are labeled for control of annual bluegrass (*Poa Annua*), which is expected to occur in fall or winter (UCANR 2003), and control of perennial rye grass (*Lolium perenne*) in the spring. Therefore, three seasons of use were assumed for turf (fall, winter, and spring), with applications modeled in March, September, and December. Ground application equipment is required for all uses except for use on artichokes and fallow land.

Table 3.2 PRZM/EXAMS Crop Input Parameters for Propyzamide

Use Pattern(s)	Scenario	App. Rate in lbs a.i./A (kg a.i./ha)	App. per Year	App. Interval (days)	Date of Initial App.	App. Method	CAM Input	IPSCND Input
Artichoke	CArowcropRLF	4.08 (4.57)	2	120 d	Jan. 15	Aerial	2	1
Stone fruit, pome fruit	CAfruitSTD	4.08 (4.57)	1	N/A	Nov. 21	Ground	1	3
Grapes, wine grapes[1]	CAgrapesSTD, CAwinegrapesRLF	4.08 (4.57)	1	N/A	Nov. 21	Ground	1	1
Alfalfa, clover, trefoil, crown vetch, sainfoin	CAalfalfaOP	2.00 (2.24)	2	98 d	Jan. 7	Ground	1	1
Blueberries	CAwinegrapesRLF	2.04 (2.29)	1	N/A	Nov. 21	Ground	1	3
Lettuce	CAlettuceSTD	2.00 (2.24)	2	180 d	Feb. 2	Ground	1	1
Turf, grass for seed	CAturfRLF	1.53 (1.72)	3	180 d, 90 d	Mar. 15	Ground	2	1
Ornamentals	CAnurserySTD	2.04 (2.29)	1	N/A	Nov. 1	Ground	2	1

Table 3.2 PRZM/EXAMS Crop Input Parameters for Propyzamide								
Use Pattern(s)	**Scenario**	**App. Rate in lbs a.i./A (kg a.i./ha)**	**App. per Year**	**App. Interval (days)**	**Date of Initial App.**	**App. Method**	**CAM Input**	**IPSCND Input**
Christmas trees	CAforestryRLF	2.04 (2.29)	1	N/A	Nov. 21	Ground	2	1
Fallow land	CArangelandRLF	0.510 (0.572)	1	N/A	Nov. 21	Aerial	1	1

[1] Both scenarios available for use on grapes were modeled.

The general chemical and environmental fate data for propyzamide listed in **Table 3.3** were used for generating model input parameters for PRZM/EXAMS. The chemical and mobility inputs were based on propyzamide parent and used as representative estimates for the residues of concern. Degradation half-lives were calculated directly accounting for the residues of concern. High-end confidence bounds on the mean half-life for total residues were used to represent biodegradation half-life inputs.

Table 3.3 PRZM/EXAMS Chemical Input Parameters for Propyzamide Based on Total Residues.			
Input Parameter	**Value**	**Justification**	**Source**
Molecular Mass (g/mol)	256.13	Product chemistry data	USEPA 1994
Vapor Pressure at 25°C (torr)	8.5×10^{-5}	Study value	USEPA 1994
Solubility in Water at 25°C (mg/L)	150	Represents 10x the measured water solubility value.	USEPA 1994
Freundlich Organic Carbon Partition Coefficient (K_{FOC}) (L/kg_{OC})	841	Represents the average K_{FOC}.	MRID 40211103
Aerobic Soil Metabolism Half-life (days)	1580	Represents the 90th percentile confidence bound on the mean total residue half-life.	MRID 41568901 MRID 46413407
Aerobic Aquatic Metabolism Half-life (days)	1020	Represents the 90th percentile confidence bound on the mean total residue half-life.	MRID 46427901
Anaerobic Aquatic Metabolism Half-life (days)	1210	Represents 3 times a single total residue half-life.	MRID 46413408
Hydrolysis Half-lives (days)	Stable (pH 5) Stable (pH 7) Stable (pH 9)	Study values	MRID 00107980
Aqueous Photolysis Half-life (days)	217	Represents the single environmental phototransformation total residue half-life.	MRID 40420301

3.2.3 Results

The aquatic total residue EECs for the various scenarios and application practices are listed in **Table 3.4**. The highest exposure estimates are for lettuce, although this use does not have the highest use rate in terms of pounds of active ingredient per acre (lbs a.i./A).

Table 3.4 Surface Water 1-in-10-year Total Residue EECs of Propyzamide from Use Patterns in the CRLF Action Area (maximum values in bold)						
Crop	**Annual App. Rate (lbs a.i./A)**	**Peak EEC (ppb)**	**4-Day Avg EEC (ppb)**	**21-Day Avg EEC (ppb)**	**60-Day Avg EEC (ppb)**	**90-Day Avg EEC (ppb)**
Artichokes	8.16	155	154	150	145	143
Stone fruit, pome fruit	4.08	35.4	35.0	32.9	29.6	28.7
Grapes	4.08	37.2	36.8	33.2	30.8	30.0
Wine grapes	4.08	64.9	61.4	57.3	54.5	53.3
Blueberries	2.04	32.4	30.7	28.7	27.3	26.6
Alfalfa, clover, trefoil, crown vetch, sainfoin	4.00	31.2	30.9	30.0	28.7	28.2
Lettuce	4.00	**225**	**225**	**220**	**211**	**207**
Turf, grass for seed	4.59	40.8	40.7	40.1	39.1	38.6
Ornamentals	2.04	51.8	51.4	50.0	47.7	45.7
Christmas trees	2.04	47.0	46.7	45.4	40.6	39.8
Fallow land	0.510	13.9	13.8	13.4	12.9	12.6

3.2.4 Existing Monitoring Data

Reviews of both ground water and surface water monitoring data on propyzamide were conducted for the 2002 TRED (USEPA 2002a) and the 2007 new use drinking water exposure assessment (USEPA 2007). This assessment contains additional cursory review of currently available monitoring data. The available monitoring data are consistent with the peak (3.7-10.3 µg/L) and annual mean (0.53-4.45 µg/L) exposure estimates of propyzamide *per se* in support the 2002 TRED (USEPA 2002a). Monitoring data are not available on the degradates of propyzamide. Therefore, exposure estimates of total residues of concern (which are up to three orders of magnitude higher than detected concentrations of the parent compound) cannot be predicted with monitoring data.

3.2.4.1 California Department of Pesticide Regulation Data

The California Department of Pesticide Regulation (DPR) Surface Water Database contains monitoring data of pesticides in California from 1990 to 2005 (CDPR 2006). Propyzamide was detected in 8% of 1,678 samples in the state, with the majority of detections occurring in water bodies of the Sacramento Valley. The maximum concentration of propyzamide reported in this database was 0.25 µg/L, detected in Yolo County in February, 1994.

3.2.4.2 USGS NAWQA Data

The USGS NAWQA national database currently contains monitoring data of pesticides from 1992 through 2005 (USGS 2006). In surface water, propyzamide was detected above the level of quantitation (0.003 µg/L) in 2.2% of samples (459 of 20,720 samples).

The maximum measured surface water concentration was 1.12 µg/L in Shelby County, Tennessee in January, 2003. In ground water, propyzamide was detected above the level of quantitation in 0.05% of samples (5 of 9,624 samples). The maximum measured ground water concentration was 0.820 µg/L in Benton County, Arkansas in April, 1994.

Propyzamide was analyzed in surface water within the State of California 2,003 times, yielding 71 detections (3.5%). **Table 3.5** lists the water body sites where detections of propyzamide occurred. Concentrations at these sites were often near the detection limits of 0.0030–0.0041 µg/L and as high as 0.110 µg/L (Stanislaus County). The highest detection rates tended to occur at sites within Yolo and Merced Counties.

Table 3.5 California Water Body Sites with Detections of Propyzamide Reported in NAWQA (USGS 2006)

Sites Name	County	# Samples	Detection Rate	Sampling Dates	Detected Concentration(s) (µg/L)
CULVERT DISCHARGE TO MUSTANG C AT MONTE VISTA AVE	MERCED	26	3.8%	Dec. 2002 – Feb. 2004	0.00670
MUD SLOUGH NR GUSTINE CA	MERCED	24	4.2%	Jun. 1994 – Aug. 2001	0.00388
MUSTANG C AT MONTE VISTA AVE NR MONTPELIER CA	MERCED	23	8.7%	Dec. 2002 – Mar. 2004	0.00730, 0.00860
MUSTANG C AT NEWPORT RD NR BALLICO CA	MERCED	7	29%	Nov. 2002 – Dec. 2002	0.00390, 0.00480
SALT SLOUGH AT HWY 165 NR STEVINSON CA	MERCED	49	18%	Jan. 1993 – Aug. 2001	0.00330 – 0.0414
SAN JOAQUIN R NR STEVINSON CA	MERCED	62	9.7%	Jun. 1994 – Aug. 2001	0.00374 – 0.0298
SANTA ANA R BL PRADO DAM CA	RIVERSIDE	44	2.3%	Jul. 2000 – Aug. 2005	0.0367
SACRAMENTO R AT FREEPORT CA	SACRAMENTO	105	0.95%	Nov. 1996 – Sep. 2005	0.00414
SAN JOAQUIN R NR VERNALIS CA	SAN JOAQUIN	300	0.67%	Apr. 1992 – Aug. 2005	0.00250 – 0.00530
HARDING DRAIN AT CARPENTER RD NR PATTERSON CA	STANISLAUS	37	2.7%	Apr. 1992 – Aug. 2001	0.110
ORESTIMBA CR AT RIVER RD NR CROWS LANDING CA	STANISLAUS	271	5.5%	Apr. 1992 – Sep. 2005	0.0030 – 0.0070
SAN JOAQUIN R AT PATTERSON BR NR PATTERSON CA	STANISLAUS	47	8.5%	Jun. 1994 – Aug. 2001	0.00796, 0.00907, 0.0126, 0.0158
STANISLAUS R AT CASWELL STATE PARK NR RIPON CA	STANISLAUS	64	3.1%	Feb. 1994 – Aug. 2001	0.00502, 0.0107
SACRAMENTO SLOUGH NR KNIGHTS LANDING CA	SUTTER	35	2.9%	Nov. 1996 – Sep. 2004	0.0030

Table 3.5 California Water Body Sites with Detections of Propyzamide Reported in NAWQA (USGS 2006)					
Sites Name	**County**	**# Samples**	**Detection Rate**	**Sampling Dates**	**Detected Concentration(s) (µg/L)**
COLUSA BASIN DR AT RD 99E NR KNIGHTS LANDING CA	YOLO	21	38%	Nov. 1996 – Apr. 1998	0.00941 – 0.0347
YOLO BYPASS AT I-80 NR W SACRAMENTO CA	YOLO	7	14%	Jan. 1997 – Mar. 2004	0.00307

NAWQA reports 678 analyses of propyzamide in ground water within the State of California from August 1992 to September 2005. No detections were found above detection limits (0.0030–0.0041 µg/L).

The NAWQA program is designed to broadly characterize water quality and is thus not targeted to any particular pesticide or use site. Surface water sites are almost exclusively on flowing water bodies and the majority of these are third-order streams or higher. NAWQA water sampling for pesticides is biased toward sampling during the spring and summer, which is when most pesticide applications are expected to occur. This would be sub-optimal for propyzamide, as it usually applied in the fall and early winter.

3.2.4.3 USGS NASQAN Data

The USGS NASQAN national database contains monitoring data of pesticides by regional basin from 1996 to 2000 (USGS 2006a). The maximum concentration of propyzamide detected in this program was 0.125 µg/L in the Colorado Basin in June, 1997. Concentrations of propyzamide were detected above the reporting limit in the Columbia, Colorado, Rio Grande, and Mississippi Basins; however, detections only occurred in the Northwest and Southwest at sites outside of the State of California, as shown in **Figure 3.1**.

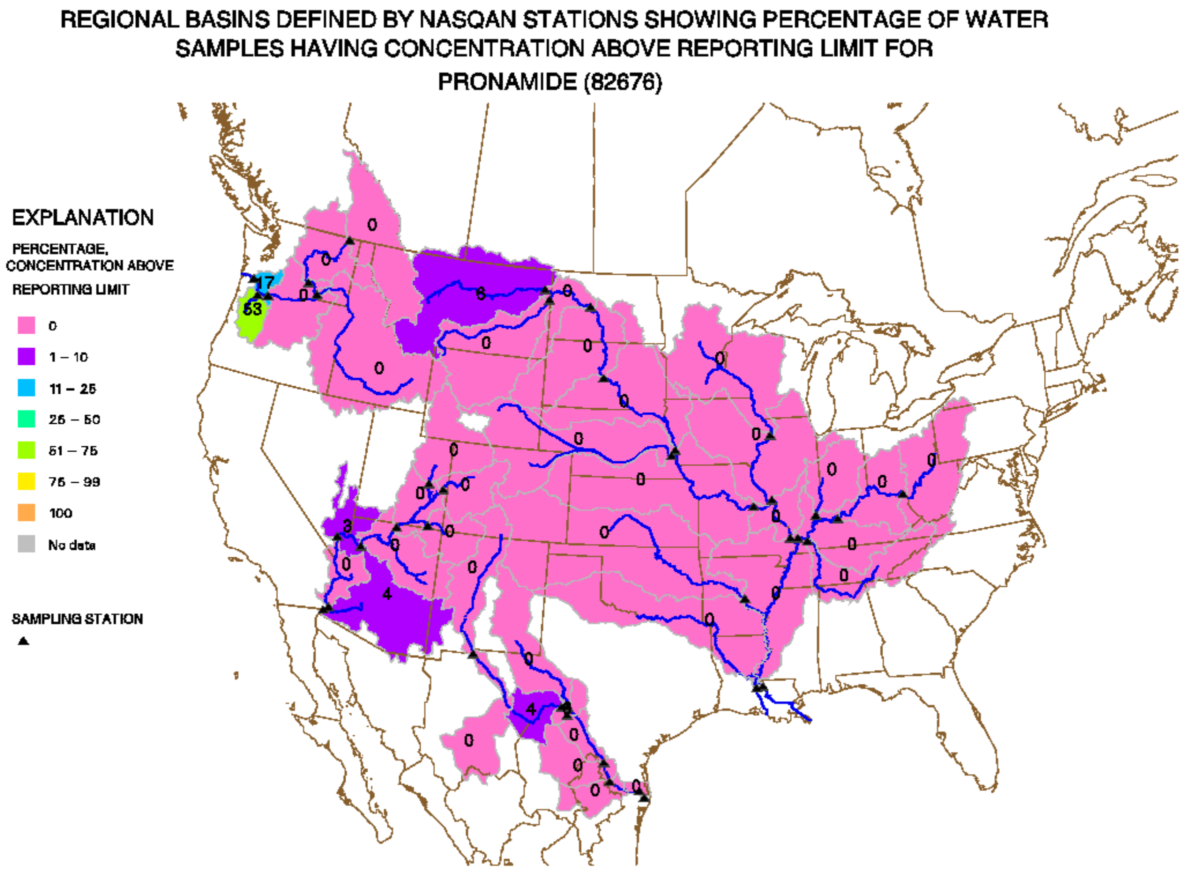


Figure 3.1 Percent Detection Map for Propyzamide Based on the USGS NASQAN Database (USGS 2006a)

3.2.4.3 USEPA STORET Data

The USEPA STORET database reports 2,194 analyses of propyzamide in surface waters and wells found in Arizona, Florida, Indiana, Kentucky, Minnesota, Tennessee, and Virginia. Only three detections are reported above detection limits (0.011—0.715 µg/L), originating from a surface water stream in Yuba County, Arizona in 2001 and 2002 (USEPA 2007c); there were no detections above the detection limits in California.

3.2.4.4 Other Monitoring Data

Propyzamide was detected in one Oklahoma reservoir out of twelve, which were monitored in the Pilot Reservoir Monitoring Program due to their particular vulnerability to pesticide contamination (USEPA 2002a). The compound was detected at up to 0.044 µg/L in 83% of 41 raw water samples and up to 0.012 µg/L in 42% of 19 finished water samples.

Propyzamide was not detected in 432 wells from 1984 to 1990, according to the EPA Pesticides in Ground Water Database (USEPA 1992). Propyzamide is not a regulated chemical under the Safe Water Drinking Act (SWDA) or related statutes. Therefore, it is not listed in the EPA Safe Drinking Water Information System (SDWIS/FED) database (USEPA 2007a) nor is it found in the EPA Unregulated Contaminants Monitoring Rules (UCMR) chemical monitoring database (USEPA 2006b).

3.2.5 Spray Drift Buffer Analysis

In order to determine terrestrial and aquatic habitats of concern due to propyzamide exposures through spray drift, it is necessary to estimate the distance that spray applications can drift from the treated area and still be present at concentrations that exceed levels of concern. An analysis of spray drift distances was completed using AGDISP (v8.15; 5/12/2005) and the Gaussian extension to AGDISP.

For the terrestrial-phase CRLF, this analysis was conducted using the most sensitive terrestrial endpoint, *i.e.*, vegetative vigor EC_{05} for terrestrial monocots (EC_{05}=0.0001 lbs a.i./acre). This endpoint was used to identify those locations where terrestrial and lentic aquatic landscapes can be impacted by spray drift deposition alone (no runoff considered) at concentrations above the listed species LOC for terrestrial plants (RQ≥1.0).

NLCD land covers were used to represent the NASS use patterns of propyzamide labeled for California. **Table 3.6** lists the land covers used, which use patterns they include, and the maximum application rate per land cover.

Table 3.6 NLCD Land Covers and Maximum Use Patterns for Propyzamide in the State of California

GIS Land Cover	Use Pattern	Max App. Rate	Spray Method
Cultivated Crops	Artichokes, blueberries, alfalfa and related crops, lettuce and leafy greens, ornamental trees, plants, and shrubs	4.08 lbs a.i./A	Aerial
Orchards/vineyards	Stone fruit, pome fruit, grapes	4.08 lbs a.i./A	Ground
Turf	Turf, grass for seed	1.53 lbs a.i./A	Ground
Pasture	Fallow land	0.510 lbs a.i./A	Aerial

For propyzamide use relative to the terrestrial-phase CRLF, the results of the screening-level risk assessment indicate that spray drift using the most sensitive endpoints for terrestrial plants exceeds the 1,000-foot range of the AgDrift model for the Tier I ground mode (no higher tier modeling for ground applications is available in AgDrift) and the extent of the original AGDISP model. Subsequently, the AGDISP model and its Gaussian extension for longer-range transport were used to evaluate potential distances beyond which exposures would be expected to be below the LOC.

The AGDISP model was run in ground mode and aerial mode with the following settings listed in **Table 3.7** beyond the standard default settings. Modeled release heights were the highest allowed for each use pattern, which were assumed to be 4 feet and 15 feet for ground and aerial applications, respectively. In the absence of a labeled maximum wind speed, 15 mph was assumed. Modeled spray droplet size distributions and tank spray volume rates were the finest and miminum, respectively, permitted on the label for each use pattern (EPA Reg. No. 70506-78). Nonvolatile fractions of spray were calculated by dividing the maximum application rate of product by the minimum spray volume rate. Active fractions of spray were calculated by multiplying the active fraction of product by the nonvolatile fraction of spray. No canopy was assumed. The bulk density of propyzamide was reported in product chemistry submissions (MRID 46284603).

Because the ground mode has not been approved for use in risk assessment, the model was run in both modes for ground applications to characterize buffer distance outputs.

Table 3.7 AGDISP Non-default Input Parameters for Propyzamide

Land cover	App. method	Release height (ft)	Wind speed (mph)	Droplet size dist.	Tank spray volume rate (gal H_2O/A)	Nonvol. fraction	Active fraction	Canopy Type	Bulk Density (kg/L)
Cultivated Crops	Aerial	15	15	ASAE coarse	10	0.1084	0.0614	None	0.796
Orchards/ vineyards	Ground	4	15	ASAE very fine to fine	40	0.0271	0.0154	None	0.796
Turf	Ground	4	15	ASAE very fine to fine	20	0.0203	0.0115	None	0.796
Pasture	Aerial	15	15	ASAE coarse	10	0.0136	0.0077	None	0.796

When modeling ground applications, the aerial mode of AGDISP yielded shorter buffer distances than the ground mode. Therefore, the outputs from the ground mode were considered conservative for this analysis regardless of the uncertainty in their values. A summary of the modeled spray drift buffer distances required for deposition levels below the LOC for the maximum application rate per land cover is presented in **Table 3.8.**

Table 3.8 Spray Drift Buffer Distances per Land Cover for the Maximum Use Patterns of Propyzamide in the State of California

Land Cover	Max App. Rate	Spray Method	Buffer Distance
Cultivated Crops	4.08 lbs a.i./A	Aerial	11,000 ft
Orchards/vineyards	4.08 lbs a.i./A	Ground	16,200 ft
Turf	1.53 lbs a.i./A	Ground	9,620 ft
Pasture	0.510 lbs a.i./A	Aerial	4,240 ft

The modeled buffer distances were added to their respective land covers to define the action area (*i.e.*, these buffer distances were added to the initial areas of concern depicted in **Figures 2.4-2.7**).

3.2.6 Downstream Dilution Analysis

The final step in defining the action area is to determine the downstream extent of exposure in streams and rivers where the EEC could potentially be above levels that would exceed the most sensitive toxicity LOC. Using an assumption of uniform runoff across the landscape, it is assumed that streams flowing through treated areas (*i.e.*, the initial area of concern) are represented by the modeled EECs; as those waters move downstream, it is assumed that the influx of non-impacted water will dilute the concentrations of propyzamide present, as the area of watershed upstream increases and its percent crop area (PCA) likely decreases. The lowest LOC/RQ ratio (or inverse of the highest RQ/LOC ratio) for any aquatic organism for which toxicity data are available is used to represent the lowest percent crop area (PCA) of watershed upstream of water bodies potentially of concern. In other words, stream reaches downstream of watershed areas with PCA equal to or higher than the lowest LOC/RQ ratio are potentially of concern and are included in and expand the action area. Stream reaches downstream of watershed areas with PCA below the lowest LOC/RQ ratio are not of concern and are not included in the action area.

No LOCs were exceeded for aquatic organisms using the exposure estimates for the highest use patterns of propyzamide. Therefore, all LOC/RQ ratios were greater than one (*i.e.*, the target percent crop area (PCA) is >100%), which means that no waterbodies downstream from the initial area of concern were included in the action area.

3.2 Terrestrial Animal Exposure Assessment

T-REX (Version 1.3.1) is used to calculate dietary and dose-based EECs of propyzamide for the CRLF and its potential prey (*e.g.* small mammals and terrestrial insects) inhabiting terrestrial areas. EECs used to represent the CRLF are also used to represent exposure values for frogs serving as potential prey of CRLF adults. T-REX simulates a 1-year time period. For this assessment, spray applications of propyzamide are considered, as discussed in below.

Terrestrial EECs for foliar formulations of propyzamide were derived for the uses summarized in **Table 3.7**. Given that no data on interception and subsequent dissipation from foliar surfaces is available for propyzamide, a default foliar dissipation half-life of 35 days is used based on the work of Willis and McDowell (1987). Use-specific input values, including number of applications, application rate and application interval are provided in **Table 3.9**. An example output from T-REX is available in **Appendix E**. Unlike aquatic exposure estimates, terrestrial exposure is not based on total residues of concern; however, the use of a 35-day foliar dissipation value is conservative and likely accounts for degradates that may form.

Table 3.9 Input Parameters for Foliar Applications Used to Derive Terrestrial EECs for Propyzamide with T-REX			
Use (Application method)	**Application rate (lbs ai/A)**	**Number of Applications**	**Reapplication Interval (days)**
Artichoke	4.08	2	120
Stone fruit, pome fruit, grapes	4.08	1	NA
Alfalfa, clover, trefoil, crown fetch, sainfoin	2.0	2	98
Blueberries, ornamental trees, plants and shrubs, Christmas trees	2.04	1	NA
Lettuce	2.0	2	180
Turf grass	1.53	3	90
Fallow land	0.510	1	NA

NA—not applicable since only one application per year.

T-REX is also used to calculate EECs for terrestrial insects exposed to propyzamide. Dietary-based EECs calculated by T-REX for small and large insects (units of a.i./g) are used to bound an estimate of exposure to bees. Available acute contact toxicity data for bees exposed to propyzamide (in units of µg a.i./bee), are converted to µg a.i./g (of bee) by multiplying by 1 bee/0.128 g. The EECs are later compared to the adjusted acute contact toxicity data for bees in order to derive RQs.

For modeling purposes, exposures of the CRLF to propyzamide through contaminated food are estimated using the EECs for the small bird (20 g) which consumes small insects. Dietary-based and dose-based exposures of potential prey are assessed using the small mammal (15 g) which consumes short grass. Upper-bound Kenega nomogram values reported by T-REX for these two organism types are used for derivation of EECs for the CRLF and its potential prey (**Table 3.10**). Dietary-based EECs for small and large insects reported by T-REX as well as the resulting adjusted EECs are available in **Table 3.11**. An example output from T-REX v. 1.3.1 is available in **Appendix E**.

Table 3.10 Upper-bound Kenega Nomogram EECs for Dietary- and Dose-based Exposures of the CRLF and its Prey to propyzamide				
Use	EECs for CRLF		EECs for Prey (small mammals)	
	Dietary-based EEC (ppm)	Dose-based EEC (mg/kg-bw)	Dietary-based EEC (ppm)	Dose-based EEC (mg/kg-bw)
Artichokes	602	686	1070	1,020
Stone fruit, pome fruit, grapes	551	627	979	934
Alfalfa, clover, trefoil, crown vetch, sainfoin	309	352	549	523
Blueberries, ornamental trees, plants and shrubs, Christmas trees	275	314	490	467
Lettuce	278	316	494	471
Turf	247	281	439	419
Fallow land	69	78	122	117

Table 3.11 EECs (ppm) for Indirect Effects to the Terrestrial-Phase CRLF via Effects to Terrestrial Invertebrate Prey Items		
Use	Small Insect	Large Insect
Artichokes	602	67
Stone fruit, pome fruit, grapes	551	61
Alfalfa, clover, trefoil, crown vetch, sainfoin	309	34
Blueberries, ornamental trees, plants and shrubs, Christmas trees	275	31
Lettuce	278	31
Turf	247	27
Fallow land	69	7.7

3.3 Terrestrial Plant Exposure Assessment

TerrPlant (Version 1.1.2) is used to calculate EECs for non-target plant species inhabiting dry and semi-aquatic areas. Parameter values for application rate, drift assumption and incorporation depth are based upon the use and related application method (**Table 3.12**). A runoff value of 2% is utilized based on propyzamide's solubility, which is classified by TerrPlant as 15 mg/L. For aerial and ground application methods, drift is assumed to be 5% and 1%, respectively. EECs relevant to terrestrial plants consider pesticide concentrations in drift and in runoff. These EECs are listed by use in **Table 3.12**. An example output from TerrPlant v.1.2.2 is available in **Appendix F.**

Table 3.12 TerrPlant Inputs and Resulting EECs for Plants Inhabiting Dry and Semi-aquatic Areas Exposed to propyzamide via Runoff and Drift

Use	Application rate (lbs a.i./A)	Application method	Drift Value (%)	Spray drift EEC (lbs a.i./A)	Dry area EEC (lbs a.i./A)	Semi-aquatic area EEC (lbs a.i./A)
Artichokes	4.08	Foliar - aerial	5%	0.204	0.29	1.02
Stone fruit, pome fruit, grapes	4.08	Foliar - ground	1%	0.041	0.12	0.86
Alfalfa, clover, trefoil, crown vetch, sainfoin, lettuce	2.0	Foliar - ground	1%	0.02	0.06	0.42
Blueberries, ornamental trees, plants and shrubs, Christmas trees	2.04	Foliar - ground	1%	0.02	0.06	0.42
Turf, grass for seed	1.53	Foliar - ground	1%	0.02	0.05	0.32
Fallow land	0.51	Foliar - aerial	5%	0.03	0.04	0.13

4. Effects Assessment

This assessment evaluates the potential for propyzamide to directly or indirectly affect the CRLF or modify its designated critical habitat. As previously discussed in Section 2.7, assessment endpoints for the CRLF include direct toxic effects on the survival, reproduction, and growth of CRLF, as well as indirect effects, such as reduction of the prey base or modification of its habitat. In addition, potential modification of critical habitat is assessed by evaluating effects to the PCEs, which are components of the critical habitat areas that provide essential life cycle needs of the CRLF. Direct effects to the aquatic-phase of the CRLF are based on toxicity information for freshwater fish, while terrestrial-phase effects are based on avian toxicity data, given that birds are generally used as a surrogate for terrestrial-phase amphibians. Because the frog’s prey items and habitat requirements are dependent on the availability of freshwater fish and invertebrates, small mammals, terrestrial invertebrates, and aquatic and terrestrial plants, toxicity information for these taxa are also discussed. Acute (short-term) and chronic (long-term) toxicity information is characterized based on registrant-submitted studies and a comprehensive review of the open literature on propyzamide.

As described in the Agency’s Overview Document (USEPA 2004), the most sensitive endpoint for each taxon is used for risk estimation. For this assessment, evaluated taxa include aquatic-phase amphibians, freshwater fish, freshwater invertebrates, aquatic plants, birds (surrogate for terrestrial-phase amphibians), mammals, terrestrial invertebrates, and terrestrial plants.

Toxicity endpoints are established based on data generated from guideline studies submitted by the registrant, and from open literature studies that meet the criteria for inclusion into the ECOTOX database maintained by EPA/Office of Research and

Development (ORD) (U.S. EPA, 2004). Open literature data presented in this assessment were obtained from the 1994 RED (USEPA 1994) and recently completed new use evaluations (DP Barcode D329358) as well as ECOTOX information obtained on June 30, 2007. In order to be included in the ECOTOX database, papers must meet the following minimum criteria:

(1) the toxic effects are related to single chemical exposure;
(2) the toxic effects are on an aquatic or terrestrial plant or animal species;
(3) there is a biological effect on live, whole organisms;
(4) a concurrent environmental chemical concentration/dose or application rate is reported; and
(5) there is an explicit duration of exposure.

Data that pass the ECOTOX screen are evaluated along with the registrant-submitted data, and may be incorporated qualitatively or quantitatively into this endangered species assessment. In general, effects data in the open literature that are more conservative than the registrant-submitted data are considered. The degree to which open literature data are quantitatively or qualitatively characterized is dependent on whether the information is relevant to the assessment endpoints (*i.e.,* maintenance of CRLF survival, reproduction, and growth) identified in Section 2.8. For example, endpoints such as behavior modifications are likely to be qualitatively evaluated, because quantitative relationships between modifications and reduction in species survival, reproduction, and/or growth are not available.

Citations of all open literature not considered as part of this assessment because they were either rejected by the ECOTOX screen or accepted by ECOTOX but not used (*e.g.*, the endpoint is less sensitive and/or not appropriate for use in this assessment) are included in **Appendix G. Appendix G** also includes a rationale for rejection of those studies that did not pass the ECOTOX screen and those that were not evaluated as part of this endangered species risk assessment.

In addition to registrant-submitted and open literature toxicity information, other sources of information, including use of the acute probit dose response relationship to establish the probability of an individual effect and reviews of the Ecological Incident Information System (EIIS), are conducted to further refine the characterization of potential ecological effects associated with exposure to propyzamide. A summary of the available aquatic and terrestrial ecotoxicity information, use of the probit dose response relationship, and the incident information for propyzamide are provided in Sections 4.1 through 4.4, respectively.

No data were available on the toxicity of the major degradates of propyzamide.

No toxicity data were available on propyzamide mixtures with other pesticides.

4.1 Toxicity of Propyzamide to Aquatic Organisms

Table 4.1 summarizes the most sensitive aquatic toxicity endpoints for the CRLF, based on an evaluation of both the submitted studies and the open literature, as previously discussed. A brief summary of submitted and open literature data considered relevant to this ecological risk assessment for the CRLF is presented below. Additional information on the probit dose-response relationships for selected species is provided in **Appendix A.**

Table 4.1 Freshwater Aquatic Toxicity Profile for Propyzamide

Assessment Endpoint	Species (Common Name)	Endpoint	Mean Concentration (mg/L)	Reference (MRID)
Acute Direct Toxicity to Aquatic-Phase CRLF	*Oncorhyncus mykiss* (Rainbow Trout)	96-hr LC_{50}	72[a]	001079-96
Chronic Direct Toxicity to Aquatic-Phase CRLF	*Oncorhyncus mykiss* (Rainbow Trout)	NOAEC	7.7[b]	Estimated
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Freshwater Invertebrates (*i.e.* prey items)	*Daphnia magna* (Waterflea)	48-hr EC_{50}	>5.6	98313
Indirect Toxicity to Aquatic-Phase CRLF via Chronic Toxicity to Freshwater Invertebrates (*i.e.* prey items)	*Daphnia magna* (Waterflea)	NOAEC/LOAEC	0.60 / 1.2	436799-01
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Non-vascular Aquatic Plants	*Anabaena flos-aquae* (Blue-green algae)	5-day EC_{50} NOAEC	>4.0 0.39	437383-04
Indirect Toxicity to Aquatic-Phase CRLF via Acute Toxicity to Vascular Aquatic Plants	*Lemna gibba* (Duckweed)	14-day EC_{50} NOAEC	1.18 0.56	437383-01

[a] Rainbow trout acute toxicity study conducted using formulated endproduct 75% a.i.

[b] Freshwater invertebrate acute to chronic ratio (ACR=9.3) used to estimate fish chronic toxicity value since no chronic toxicity data are available for fish.

Toxicity to aquatic fish and invertebrates is categorized using the system shown in **Table 4.2** (U.S. EPA, 2004). Toxicity categories for aquatic plants have not been defined.

Table 4.2 Categories of Acute Toxicity for Aquatic Organisms	
LC_{50} (ppm)	**Toxicity Category**
< 0.1	Very highly toxic
> 0.1 - 1	Highly toxic
> 1 - 10	Moderately toxic
> 10 - 100	Slightly toxic
> 100	Practically nontoxic

4.1.1 Toxicity to Freshwater Fish

Given that no propyzamide toxicity data are available for aquatic-phase amphibians, freshwater fish data were used as a surrogate to estimate direct acute and chronic risks to the CRLF. Freshwater fish toxicity data were also used to assess potential indirect effects of propyzamide to the CRLF. Effects to freshwater fish resulting from exposure to propyzamide could indirectly affect the CRLF via reduction in available food. As discussed in Section 2.5.3, over 50% of the prey mass of the CRLF may consist of vertebrates such as mice, frogs, and fish (Hayes and Tennant, 1985).

A summary of acute and chronic freshwater fish data, including data from the open literature, is provided below in Sections 4.1.1.1 through 4.1.1.3.

4.1.1.1 Freshwater Fish: Acute Exposure (Mortality) Studies

There are several reviewed studies that have evaluated the acute toxicity of propyzamide to freshwater fish. Based on reported study results, 96-hr LC_{50}s ranged from 72 mg/L for rainbow trout, (*Oncorhynchus mykiss*) to 350 mg/L for goldfish (*Carassius auratus*) (**Table 8**). There are several uncertainties, however, associated with the acute fish studies and all were classified as supplemental. Notably, for all tests, nominal concentrations were reported despite the solubility of propyzamide (15 mg/L; USEPA 1994) and formulated product was used instead of technical grade active ingredient. No data are available for freshwater fish to determine the toxicity of technical grade active ingredient relative to formulated product. Given the use of nominal concentrations instead of measured and the reported low solubility of propyzamide, it is likely that actual exposure concentrations were lower than the reported nominal concentrations; however, it is not possible to guage the extent to which propyzamide was in solution without measured concentrations. The toxicity categorization of propyzamide based on nominal concentrations is slightly toxic to freshwater fish on an acute exposure basis.

4.1.1.2 Freshwater Fish: Chronic Exposure (Growth/Reproduction) Studies

No studies on the chronic toxicity of propyzamide to freshwater fish were conducted due to the apparent low acute toxicity. To estimate the chronic toxicity endpoint for fish, an acute-to-chronic ratio of 9.3, derived for freshwater invertebrates and discussed below, was used. The estimated NOAEC for fish is 7.7 mg/L and is less sensitive than the chronic toxicity endpoint for freshwater invertebrates (NOAEC=0.6 mg/L) discussed below.

4.1.1.3 Freshwater Fish: Sublethal Effects and Additional Open Literature Information

No data are available on either the acute or chronic sublethal toxicity of propyzamide to freshwater fish.

4.1.1.4 Aquatic-phase Amphibian: Acute and Chronic Studies

No registrant-submitted nor ECOTOX data are available on either the acute or chronic toxicity of propyzamide to aquatic-phase amphibians.

4.1.2 Toxicity to Freshwater Invertebrates

Freshwater aquatic invertebrate toxicity data were used to assess potential indirect effects of propyzamide to the CRLF. Effects to freshwater invertebrates resulting from exposure to propyzamide could indirectly affect the CRLF via reduction in available food items. As discussed in Section 2.5.3, the main food source for juvenile aquatic- and terrestrial-phase CRLFs is thought to be aquatic invertebrates found along the shoreline and on the water surface, including aquatic sowbugs, larval alderflies and water striders.

A summary of acute and chronic freshwater invertebrate data, including data published in the open literature, is provided below in Sections 4.1.2.1 through 4.1.2.3.

4.1.2.1 Freshwater Invertebrates: Acute Exposure Studies

There is one study on the acute toxicity of propyzamide to freshwater aquatic invertebrates, *i.e.*, waterfleas (*Daphnia magna*). The EC_{50} is greater than 5.6 mg/L, the highest tested concentration tested, which categorizes propyzamide as moderately toxic to freshwater invertebrates on an acute exposure basis. No daphnid mortality was observed at the highest concentration tested; therefore, the acute NOAEC is 5.6 mg/L. No additional data are available on sublethal effects to aquatic invertebrates.

4.1.2.2 Freshwater Invertebrates: Chronic Exposure Studies

Data from a flow-through life-cycle test with *D. magna* were reviewed. There were effects of propyzamide on daphnid egg production (20% reduction at 2.4 mg/L) and larval survival (28% reduction at 1.2 ppm). The NOAEC for the daphnid life-cycle test is 0.6 mg/L. This chronic toxicity endpoint for freshwater invertebrates was used to develop an acute-to-chronic ratio for aquatic animals. The ratio of the acute NOAEC to the chronic NOAEC is 5.6/0.6 or 9.3.

4.1.2.3 Freshwater Invertebrates: Open Literature Data

No data are available in the open literature to characterize the toxicty of propyzamide to freshwater invertebrates.

4.1.3 Toxicity to Aquatic Plants

Aquatic plant toxicity studies were used as one of the measures of effect to evaluate whether propyzamide could affect primary production and the availability of aquatic plants as food for CRLF tadpoles. Primary productivity is essential for indirectly supporting the growth and abundance of the CRLF.

Laboratory studies were used to determine whether propyzamide may cause direct effects to aquatic plants. A summary of the laboratory data for aquatic plants is provided in Section 4.1.3.1; no field/mesocosm data are available to evaluate the toxicity of propyzamide to aquatic plants.

4.1.3.1 Aquatic Plants: Laboratory Data

Several studies on the toxicity of propyzamide to freshwater and marine aquatic plants were submitted for review. A 14-day EC_{50} was estimated only for the aquatic vascular plant, duckweed (*Lemna gibba*) and is 1.18 mg/L; the associated NOAEC is 0.56 mg/L. For the other three non-vascular aquatic plant species, an EC_{50} could not be estimated because effects did not exceed the 50% level; in all three cases, the EC_{50} is greater than the highest tested concentration (4 mg/L). There were, however, estimated NOAECs (0.39 mg/L) associated with the freshwater blue-green algae, *Anabaena flos-aquae*.

4.1.4 Freshwater Field/Mesocosm Studies

No freshwater field and/or mesocosm studies are available for propyzamide.

4.2 Toxicity of Propyzamide to Terrestrial Organisms

Table 4.3 summarizes the most sensitive terrestrial toxicity endpoints for the CRLF, based on an evaluation of both the submitted studies and the open literature. A brief summary of submitted and open literature data considered relevant to this ecological risk assessment for the CRLF is presented below.

Table 4.3 Terrestrial Toxicity Profile for Propyzamide				
Endpoint	**Species**	**Endpoint**	**Mean Concentration**	**Reference (MRID)**
Acute Direct Toxicity to Terrestrial-Phase CRLF (LD_{50})	*Coturnex japonica* Japanese Quail	24-hr LD_{50}	8870 mg/kg bw [a]	001079-97
Acute Direct Toxicity to Terrestrial-Phase CRLF (LC_{50})	*Colinus virginianus* Bobwhite Quail	8-day LC_{50}	>10,000 mg/kg diet	001080-03
Chronic Direct Toxicity to Terrestrial-Phase CRLF	Estimated based on mammalian ACR	NOAEC	267 ppm 20[b] mg/kg day	--
Indirect Toxicity to Terrestrial-Phase CRLF (via acute toxicity to mammalian prey items)	Laboratory rat	96-hr LD_{50}	5620 mg/kg bw	000855-05
Indirect Toxicity to Terrestrial-Phase CRLF (via chronic toxicity to mammalian prey items)	Laboratory rat	NOAEC / LOAEC	200 ppm / 1500 ppm 15 mg/kg/day / 114 mg/kg/day)	415403-01
Indirect Toxicity to Terrestrial-Phase CRLF (via acute toxicity to terrestrial invertebrate prey items)	*Apis mellifera* Honey bee	48-hr LD_{50}	>181 µg/bee	00028772
Indirect Toxicity to Terrestrial- and Aquatic-Phase CRLF (via toxicity to terrestrial plants)	<u>Seedling Emergence</u> Monocots	14-day EC_{25} / EC_{05}	0.03 / 0.015 lbs a.i./A	421768-01
	<u>Seedling Emergence</u> Dicots	14-day EC_{25} / EC_{05}	0.015 / 0.004 lbs a..i./A	440290-01
	<u>Vegetative Vigor</u> Monocots	EC_{25} / EC_{05}	0.088 / 0.0001 lbs a.i./A	421768-01
	<u>Vegetative Vigor</u> Dicots	EC_{25} / EC_{05}	0.0104 / 0.0079 lbs a.i./A	421768-01

[a] Japanese quail acute oral toxicity study conducted with formulated endproduct 75% a.i.
[b] chronic toxicity endpoint based on mammalian acute to chronic ratio of 436

Acute toxicity to terrestrial animals is categorized using the classification system shown in **Table 4.4** (U.S. EPA, 2004). Toxicity categories for terrestrial plants have not been defined.

Table 4.4 Categories of Acute Toxicity for Avian and Mammalian Studies

Toxicity Category	Oral LD_{50}	Dietary LC_{50}
Very highly toxic	< 10 mg/kg	< 50 ppm
Highly toxic	10 - 50 mg/kg	50 - 500 ppm
Moderately toxic	51 - 500 mg/kg	501 - 1000 ppm
Slightly toxic	501 - 2000 mg/kg	1001 - 5000 ppm
Practically non-toxic	> 2000 mg/kg	> 5000 ppm

4.2.1 Toxicity to Birds

As specified in the Overview Document, the Agency uses birds as a surrogate for terrestrial-phase amphibians when amphibian toxicity data are not available (U.S. EPA, 2004). No terrestrial-phase amphibian data are available for propyzamide; therefore, acute and chronic bird toxicity data are used to assess the potential direct effects of propyzamide to terrestrial-phase CRLFs.

4.2.1.1 Birds: Acute Exposure (Mortality) Studies

Avian acute toxicity tests show that a formulated product of propyzamide (RH-315, 75% ai) is practically nontoxic to birds on an acute oral exposure basis. The LD_{50} is 8770 mg/kg bw for Japanese quail (*Coturnix japonica*) and >14,000 mg/kg bw for mallard ducks (*Anas platyrhynchos*). Although these supplemental studies provide some insight into the acute toxicity of propyzamide to avian species, the studies deviated from guidelines because; (1) formulated product was used instead of technical product, (2) Japanese quail are not considered a suitable representative species for an upland game bird, and (3) less than 10 birds per treatment were used. No acute sublethal effects were reported.

In addition to the oral acute studies, four subacute dietary studies were submitted as well. Three bobwhite and one mallard study showed that propyzamide (technical grade ai) is practially nontoxic to avian species on a subacute dietary exposures basis with LC_{50} values ranging from >30 to >10000 mg/kg diet. Note that for the LC_{50} of >30 mg/kg diet, this value represented the highest exposure level tested and subsequent studies in the same species (Bobwhite quail) indicate that the LC_{50} is at least >4000 mg/kg diet and likely exceeds 10,000 mg/kg diet. No sublethal subacute effects were reported.

4.2.1.2 Birds: Chronic Exposure (Growth, Reproduction) Studies

There are no chronic toxicity data available on propyzamide from either registrant-submitted studies or ECOTOX. Since there are no chronic toxicity data for birds, the acute-to-chronic ratio (ACR=436) for mammals (discussed below) was used to estimate a chronic toxicity value for birds. Based on an avian acute oral toxicity of 8870 mg/kg bw, the estimated chronic toxicity endpoint for birds is 20 mg/kg (267 mg/kg diet).

4.2.1.3 Terrestrial-phase Amphibian Acute and Chronic Studies

There are no acute or chronic toxicity data for terrestrial-phase amphibians available from either registrant-submitted studies or ECOTOX.

4.2.2 Toxicity to Mammals

Mammalian toxicity data are used to assess potential indirect effects of propyzamide to the terrestrial-phase CRLF. Effects to small mammals resulting from exposure to propyzamide could also indirectly affect the CRLF via reduction in available food. As discussed in Section 2.5.3, over 50% of the prey mass of the CRLF may consist of vertebrates such as mice, frogs, and fish (Hayes and Tennant, 1985).

4.2.2.1 Mammals: Acute Exposure (Mortality) Studies

The acute oral LD_{50} for rats dosed with propyzamide is 8350 mg/kg bw for males and 5620 mg/kg bw for females, which classifies propyzamide as practically non-toxic to mammals on an acute oral exposure basis.

4.2.2.2 Mammals: Chronic Exposure (Growth, Reproduction) Studies

A 2-generation reproduction study in rats showed that propyzamide caused effects on adult and offspring body size at the highest exposure level of 1500 ppm (114 mg/kg bw males, 127.3 mg/kg bw females), which is the LOAEC. There was a 7-13% reduction in male body weights and a 12-18% reduction in female body weights for rats exposed to 1500 ppm. The NOAEC is the next lowest exposure level of 200 ppm (15.4 mg/kg bw males, 16.5 mg/kg bw females) where no adverse effects were observed. The large difference in the LOAEC and the NOAEC is due to the chosen experimental design. In all likelihood, the NOAEC, or the threshold where effects may become ecologically relevant, is higher than 200 ppm. For the purposes of this screening-level assessment, however, 200 ppm is used to estimate chronic risks to mammals.

An acute-to-chronic ratio (ACR) was determined for mammals using the mean (average of male and female) acute oral LD_{50} (6985 mg/kg bw) and the mean (average of male and female) chronic NOAEC (16 mg/kg/day) yielding an ACR of 437.

4.2.3 Toxicity to Terrestrial Invertebrates

Terrestrial invertebrate toxicity data are used to assess potential indirect effects of propyzamide to the terrestrial-phase CRLF. Effects to terrestrial invertebrates resulting from exposure to propyzamide could also indirectly affect the CRLF via reduction in available food.

4.2.3.1 Terrestrial Invertebrates: Acute Exposure (Mortality) Studies

Propyzamide is characterized as practically nontoxic to terrestrial insects (honeybee acute contact LD_{50}=181 μg/bee); mortality in the highest dose (181 μg/bee) was 4.9%. For the purposes of this assessment, the honeybee endpoint is used to derive RQs. This toxicity value is converted to units of μg a.i./g (of bee) by multiplying by 1 bee/0.128 g thereby resulting in an LD_{50} = 1414 μg a.i./g.

4.2.3.2 Terrestrial Invertebrates: Open Literature Studies

There are no data on the toxicity of propyzamide to terrestrial invertebrates in the open literature available through ECOTOX.

4.2.4 Toxicity to Terrestrial Plants

Terrestrial plant toxicity data are used to evaluate the potential for propyzamide to affect riparian zone and upland vegetation within the action area for the CRLF. Impacts to riparian and upland (*i.e.*, grassland, woodland) vegetation may result in indirect effects to both aquatic- and terrestrial-phase CRLFs, as well as modification to designated critical habitat PCEs via increased sedimentation, alteration in water quality, and reduction in of upland and riparian habitat that provides shelter, foraging, predator avoidance and dispersal for juvenile and adult CRLFs.

Plant toxicity data from both registrant-submitted studies and studies in the scientific literature were reviewed for this assessment. Registrant-submitted studies are conducted under conditions and with species defined in EPA toxicity test guidelines. Sub-lethal endpoints such as plant growth, dry weight, and biomass are evaluated for both monocots and dicots, and effects are evaluated at both seedling emergence and vegetative life stages. Guideline studies generally evaluate toxicity to ten crop species. A drawback to these tests is that they are conducted on herbaceous crop species only, and extrapolation of effects to other species, such as the woody shrubs and trees and wild herbaceous species, contributes uncertainty to risk conclusions.

Commercial crop species have been selectively bred, and may be more or less resistant to particular stressors than wild herbs and forbs. The direction of this uncertainty for specific plants and stressors, including propyzamide, is largely unknown. Homogenous test plant seed lots also lack the genetic variation that occurs in natural populations, so the range of effects seen from tests is likely to be smaller than would be expected from wild populations.

The effects of propyzamide on terrestrial monocotyledonous and dicotyledonous plants were tested in Tier II seedling emergence and vegetative vigor tests. Results of the Tier II seedling emergence study identify cucumber as the most sensitive dicot with an EC_{25} and NOAEC of 0.015 and 0.004 lb ai/A, respectively, based on a decrease in shoot length compared to the control (MRID 440290-01). The most sensitive monocot, based on seedling emergence, is ryegrass with an EC_{25} of 0.03 lb ai/A and a NOAEC of 0.015 lb ai/A, based on a decrease in percent emergence.

Results of the Tier II vegetative vigor studies identify oat as the most sensitive monocot and tomato as the most sensitive dicot, with decreased shoot weight and root weight, respectively, as the most sensitive endpoints. The EC_{05} and EC_{25} values of 0.0001 lbs a.i./A and 0.088 lbs a.i./A, respectively, for oat, and the EC_{05} and EC_{25} values of 0.0079 lbs a.i./A and 0.0104 lbs a.i./A, respectively, for tomato, are used to assess the effects of exposure to propyzamide on vegetative vigor in non-listed and listed terrestrial plants.

No data more sensitive than those discussed above from registrant-submitted guideline studies were available through the open literature.

4.3 Use of Probit Slope Response Relationship to Provide Information on the Endangered Species Levels of Concern

The Agency uses the probit dose response relationship as a tool for providing additional information on the potential for acute direct effects to individual listed species and aquatic animals that may indirectly affect the listed species of concern (U.S. EPA 2004). As part of the risk characterization, an interpretation of acute RQ for listed species is discussed. This interpretation is presented in terms of the chance of an individual event (*i.e.*, mortality or immobilization) should exposure at the EEC actually occur for a species with sensitivity to propyzamide on par with the acute toxicity endpoint selected for RQ calculation. To accomplish this interpretation, the Agency uses the slope of the dose-response relationship available from the toxicity study used to establish the acute toxicity measures of effect for each taxonomic group that is relevant to this assessment. The individual effects probability associated with the acute RQ is based on the mean estimate of the slope and an assumption of a probit dose response relationship. In addition to a single effects probability estimate based on the mean, upper and lower estimates of the effects probability are also provided to account for variance in the slope, if available.

Individual effect probabilities are calculated based on an Excel spreadsheet tool IECV1.1 (Individual Effect Chance Model Version 1.1) developed by the U.S. EPA, OPP, Environmental Fate and Effects Division (June 22, 2004). The model allows for such calculations by entering the mean slope estimate (and the 95% confidence bounds of that estimate) as the slope parameter for the spreadsheet. In addition, the acute RQ is entered as the desired threshold. Dose response slopes used in determing the acute 96-hr LC_{50} for rainbow trout and the acute oral LD_{50} for Japanes quail are 2.55 and 8.18, respectively. An example of the IECV model output is in **Appendix I**.

4.4 Incident Database Review

A review of the Ecological Incident Information System (EIIS) database for ecological incidents involving propyzamide was completed on December 3, 2007. The results of this review for terrestrial, plant, and aquatic incidents are discussed below in Sections 4.4.1 through 4.4.3, respectively. A complete list of the incidents involving propyzamide including associated uncertainties is included as **Appendix H**.

4.4.1 Terrestrial Incidents

No incidents have been reported involving terrestrial animals from the use of propyzamide.

4.4.2 Plant Incidents

A total of three incidents involving terrestrial plants are reported in the EIIS database over the period of 2001 through 2004. Two incidents (IO14702-047 and IO12525-008) occurred from the registered use of propyzamide on lettuce (*Lactuca sativa*) in California and Arizona. The third incident (IO 16962-004) resulted from the registered use of propyzamide on broccoli (*Brassica oleracea*) in Japan.

4.4.3 Aquatic Incidents

No incidents involving aquatic animals have been reported for the use of propyzamide.

5. Risk Characterization

Risk characterization is the integration of the exposure and effects characterizations. Risk characterization is used to determine the potential for direct and/or indirect effects to the CRLF or for modification to its designated critical habitat from the use of propyzamide in CA. The risk characterization provides an estimation (Section 5.1) and a description (Section 5.2) of the likelihood of adverse effects; articulates risk assessment assumptions, limitations, and uncertainties; and synthesizes an overall conclusion regarding the likelihood of adverse effects to the CRLF or its designated critical habitat (*i.e.*, "no effect," "likely to adversely affect," or "may affect, but not likely to adversely affect").

5.1 Risk Estimation

Risk is estimated by calculating the ratio of exposure to toxicity. This ratio is the risk quotient (RQ), which is then compared to pre-established acute and chronic levels of concern (LOCs) for each category evaluated (**Appendix C**). For acute exposures to the CRLF and its animal prey in aquatic habitats, as well as terrestrial invertebrates, the LOC is 0.05. For acute exposures to the CRLF and mammals, the LOC is 0.1. The LOC for chronic exposures to CRLF and its prey, as well as acute exposures to plants is 1.0.

Risk to the aquatic-phase CRLF is estimated by calculating the ratio of exposure to toxicity using 1-in-10 year EECs based on the labeled propyzamide usage scenarios summarized in **Table 3.3** and the appropriate aquatic toxicity endpoint from **Table 4.1**. Risks to the terrestrial-phase CRLF and its prey (*e.g.* terrestrial insects, small mammals and terrestrial-phase frogs) are estimated based on exposures resulting from applications of propyzamide (**Tables 3.5 through 3.6**) and the appropriate toxicity endpoint from **Table 4.3**. Exposures are also derived for terrestrial plants, as discussed in Section 3.3 and summarized in **Table 3.7**, based on the highest application rates of propyzamide use within the action area.

5.1.1 Exposures in the Aquatic Habitat

5.1.1.1 Direct Effects to Aquatic-Phase CRLF

Direct effects to the aquatic-phase CRLF are based on peak EECs in the standard pond and the lowest acute toxicity value for freshwater fish, *i.e.*, LC_{50} of 72 mg/L or 72,000 μg/L. In order to assess direct chronic risks to the CRLF, 60-day EECs and the lowest chronic toxicity value for freshwater fish are used. Since chronic toxicity data are not available for freshwater fish, the freshwater invertebrate acute-to-chronic ratio (ACR=9.3) was used to estimate a chronic toxicity value. Based on the highest estimated acute exposure value and the most sensitive toxicity endpoint the acute endangered species LOC is not exceeded; therefore, the determination is for a “no effect” based on potential direct acute effects to aquatic-phase CRLF. Although there is uncertainty regarding the use of a nominal toxicity endpoint based on formulated endproduct when that value exceeds the solubility limit of propyzamide (15 mg/L), even if the RQ had been based on the solubility limit, the RQ value (RQ=0.02) would still not exceed the acute LOC.

Based on the highest 60-day chronic exposure value and the estimated chronic toxicity value for freshwater fish (NOAEC=7,700 μg/L), the risk quotient is below the chronic risk LOC. Based on the estimated exposure values presented in **Table 3.4**, none of the propyzamide uses evaluated exceed the chronic risk LOC. The determination is a “no effect” based on potential direct chronic effects to aquatic-phase CRLF.

Table 5.1 Summary of Direct Effect RQs for the Aquatic-phase CRLF						
Direct Effects to CRLF[a]	**Surrogate Species**	**Toxicity Value (µg/L)**	**EEC (µg/L)[b]**	**RQ**	**Probability of Individual Effect[c]**	**LOC Exceedance and Risk Interpretation**
Acute Direct Toxicity	Trout	LC_{50} = 72,000	Peak: 225	0.003	1 in 1.6 X10^{10}	No[d]
Chronic Direct Toxicity		7,700[e]	60-day: 211	0.03	NA	No

[a] RQs associated with acute and chronic direct toxicity to the CRLF are also used to assess potential indirect effects to the CRLF based on a reduction in freshwater fish and frogs as food items.
[b] The highest EEC based on foliar use of propyzamide on lettuce at 4.00 lbs a.i./A (see Table 3.4).
[c] A probit slope value for the acute fathead minnow toxicity test is not available; therefore, the effect probability was calculated based on a default slope assumption of 4.5 with upper and lower 95% confidence intervals of 2 and 9 (Urban and Cook, 1986).
[d] RQ < acute endangered species LOC of 0.05.
[e] Chronic toxicity endpoint estimated using the mammalian acute to chronic ratio.

5.1.1.2 Indirect Effects to Aquatic-Phase CRLF via Reduction in Prey (non-vascular aquatic plants, aquatic invertebrates, fish, and frogs)

Non-vascular Aquatic Plants

Indirect effects of propyzamide to the aquatic-phase CRLF (tadpoles) via reduction in non-vascular aquatic plants in its diet are based on peak EECs from the standard pond and the lowest acute toxicity value for aquatic non-vascular plants. The most sensitive nonvascular aquatic plant toxicity estimate is for blue-green algae with an EC_{50}>4,000 µg/L. At the peak estimated environmental concentration of 225 µg/L, the acute RQ is well below the LOC. Even if the NOAEC for blue-green algae (390 µg/L) is used to calculate the RQ, the RQ (0.57) is below the LOC. The determination is “no effect” for indirect effects to aquatic-phase CRLF through reductions in non-vascular plant food items.

Table 5.2 Summary of Acute RQs Used to Estimate Indirect Effects to the CRLF via Effects to Non-Vascular Aquatic Plants (diet of CRLF in tadpole life stage and habitat of aquatic-phase CRLF)			
Uses	**Application rate (lb ai/A) and type**	**Peak EEC (µg/L)**	**Indirect effects RQ* (food and habitat)**
Lettuce	4.0	225[a]	<0.056

[a] Highest estimated environmental concentration based on propyzamide use on lettuce.

Aquatic Invertebrates

Indirect acute effects to the aquatic-phase CRLF via effects to prey (invertebrates) in aquatic habitats are based on peak EECs in the standard pond and the lowest acute toxicity value (EC_{50}>5600 µg/L) for freshwater invertebrates. For chronic risks, 21-day EECs and the lowest chronic toxicity value for invertebrates (NOAEC=600 µg/L) are used to derive RQs. A summary of the acute and chronic RQ values for exposure to aquatic invertebrates (as prey items of aquatic-phase CRLFs) is provided in **Table 5.3**. Based on the highest estimated environmental concentrations, neither acute nor chronic risk LOCs are exceeded. Therefore, the determination is for a “no effect” for indirect effect to aquatic-phase CRLF for effects to prey in aquatic habitats.

Table 5.3 Summary of Acute and Chronic RQs Used to Estimate Indirect Effects to the CRLF via Direct Effects on Aquatic Invertebrates as Dietary Food Items (prey of CRLF juveniles and adults in aquatic habitats)

Uses	Application rate (lb ai/A) and type	Peak EEC (µg/L)	21-day EEC (µg/L)	Indirect Effects Acute RQ[a]	Indirect Effects Chronic RQ[b]
Lettuce	4.0	225	220	<0.04	0.37

[a] Acute RQ value based on most sensitive freshwater invertebrate (*Daphnia magna* EC_{50}>5,600 µg/L.
[b] Chronic RQ value based on most sensitive freshwater invertebrat (*D. magna* NOAEC=600 µg/L)

Fish and Frogs

Fish and frogs also represent potential prey items of adult aquatic-phase CRLFs. RQs associated with acute and chronic direct toxicity to the CRLF (**Table 5.1**) are used to assess potential indirect effects to the CRLF based on a reduction in freshwater fish and frogs as food items. Since at the highest estimated environmental concentration, acute and chronic RQ values are below the acute and chronic risk LOCs, the determination is “no effect” on fish and frogs.

5.1.1.3 Indirect Effects to CRLF via Reduction in Habitat and/or Primary Productivity (Freshwater Aquatic Plants)

Indirect effects to the CRLF via direct toxicity to aquatic plants are estimated using the most sensitive non-vascular and vascular plant toxicity endpoints. Because there are no obligate relationships between the CRLF and any aquatic plant species, the most sensitive EC_{50} values, rather than NOAEC values, were used to derive RQs. As discussed in Section 5.1.1.2, RQ values for aquatic nonvascular plants do not exceed the LOC. The most sensitive vascular aquatic plant toxicity estimate is for duckweed with an EC_{50} of 1,180 µg/L. At the peak estimated environmental concentration of 225 µg/L, the acute RQ is well below the LOC. Therefore, the determination is “no effect” for indirect effects to CRLF via reduction in habitat and/or primary productivity through adverse effects on freshwater [aquatic] vascular and nonvascular plants.

Table 5.4 Summary of Acute RQs Used to Estimate Indirect Effects to the CRLF via Effects to Vascular Aquatic Plants (habitat of aquatic-phase CRLF)[a]			
Uses	**Application rate (lb ai/A) and type**	**Peak EEC (µg/L)**	**Indirect effects RQ* (food and habitat)**
Lettuce	4.0	225[a]	0.19

[a] highest estimated environmental concentration based on propyzamide use on lettuce.

5.1.2 Exposures in the Terrestrial Habitat

5.1.2.1 Direct Effects to Terrestrial-phase CRLF

As previously discussed in Section 3.3, potential direct effects to terrestrial-phase CRLFs are based on foliar applications of propyzamide.

Potential direct acute effects to the terrestrial-phase CRLF are derived by considering dose- and dietary-based EECs modeled in T-REX for a small bird (20 g) consuming small invertebrates (**Table 3.10**) and acute oral and subacute dietary toxicity endpoints for avian species. Results are presented in **Table 5.5** and indicate that at the current maximum application rates for propyzamide on artichokes and orchard/vineyard crops, the acute dose-based RQ exceeds the acute risk to endangered species LOC (RQ≥0.1). The determination is for a "may affect" for direct acute effects to the terrestrial-phase CRLF.

Table 5.5 Acute and chronic, dietary-based RQs and dose-based RQs for direct effects to the terrestrial-phase CRLF. RQs calculated using T-REX.			
Crop Group[1]	**Acute Dose-Based RQ[2]**	**Dietary - Based, acute RQ[3]**	**Dietary-based, chronic RQ[5]**
Artichokes	**0.11[4]**	0.06	**2.3[6]**
Stone fruit, pome fruit, grapes	**0.10[4]**	0.06	**2.1[6]**
Alfalfa, clover, trefoil, crown vetch, sainfoin	0.06	0.03	**1.2[6]**
Blueberries, ornamental trees, plants and shrubs, Christmas trees	0.05	0.03	**1.0[6]**
Lettuce	0.05	0.03	**1.0[6]**
Turf	0.04	0.02	0.93
Fallow land	0.01	0.01	0.26

[1]For specific uses associated with each crop group see **Table 5**.
[2]Based on LD_{50} 8870 ppm (for Japanese quail)
[3] Based on LC_{50} >10,000 ppm (for Bobwhite quail)
[4]Exceeds acute listed species LOC (RQ≥0.1)
[5]Based on estimated NOAEC = 20 ppm (for Bobwhite quail)
[6]Exceeds chronic listed species LOC (RQ≥1.0)

Potential direct chronic effects of propyzamide to the terrestrial-phase CRLF are derived by considering dietary-based exposures modeled in T-REX for a small bird (20g) consuming small invertebrates. Chronic effects are estimated using the lowest available toxicity data for birds. EECs are divided by toxicity values to estimate chronic dietary-based RQs. Using the estimated avian NOAEC (based on the acute-to-chronic ratio derived for mammals), dietary-based RQ values for all of the current modeled uses exceed the chronic risk LOC (RQ≥1.0) (**Table 5.5**).

Estimates of potential direct effects on the terrestrial-phase CRLF were further refined using the T-HERPS spreadsheet. Based on this refinement no acute (dose-based or dietary-based) RQ (RQ≤0.06) exceeds the acute risk to listed species LOC for direct effects on terrestrial-phase CRLF foraging on small insects. However, the chronic risk LOC is still exceeded (RQ range 1 – 2.3) for all uses except turf and fallow land.

5.1.2.2 Indirect Effects to Terrestrial-Phase CRLF via Reduction in Prey (terrestrial invertebrates, mammals, and frogs)

5.1.2.2.1 Terrestrial Invertebrates

In order to assess the risks of propyzamide to terrestrial invertebrates, which are considered prey of CRLF in terrestrial habitats, the honey bee is used as a surrogate for terrestrial invertebrates. The toxicity value for terrestrial invertebrates is calculated by multiplying the lowest available acute contact LD_{50} of >181 µg a.i./bee by 1 bee/0.128g, which is based on the weight of an adult honey bee. EECs calculated by T-REX for small and large insects (see **Table 3.11**) are divided by the calculated toxicity value for terrestrial invertebrates, which is >1,414 µg a.i./g of bee. All of the modeled uses, at the maximum application rate, exceed the acute risk to endangered species LOC (RQ≥0.05), based on small insect forage items except at the maximum application rate used on fallow ground. None of the RQ vales for large insect forage items exceed the acute risk LOC. The determination is "may affect" for indirect effects to terrestrial-phase CRLF via direct effects on small insects as dietary food items.

Table 5.6 Summary of RQs Used to Estimate Indirect Effects to the Terrestrial-phase CRLF via Direct Effects on Terrestrial Invertebrates as Dietary Food Items

Use	Small Insect RQ*	Large Insect RQ*
Artichokes	**0.43**	0.04
Stone fruit, pome fruit, grapes	**0.39**	0.04
Alfalfa, clover, trefoil, crown vetch, sainfoin	**0.22**	0.02
Blueberries, ornamental trees, plants and shrubs, Christmas trees	**0.19**	0.02

Lettuce	**0.20**	0.02
Turf	**0.17**	0.02
Fallow land	0.04	0.01
* = LOC exceedances (RQ ≥ 0.05) are bolded and shaded.		

5.1.2.2.2 Mammals

Risks associated with ingestion of small mammals by large terrestrial-phase CRLFs are derived for dietary-based and dose-based exposures modeled in T-REX for a small mammal (15g) consuming short grass. Acute and chronic effects are estimated using the most sensitive mammalian toxicity data. EECs (**Table 3.11**) are divided by the toxicity value to estimate acute and chronic dose-based RQs as well as chronic dietary-based RQs. None of the modelded uses exceed the acute LOC while both dose-based and dietary-based chronic RQ values exceed the chronic risk LOC except for the dietary-based chronic RQ value for use of propyzamide on fallow land.

Table 5.7 Summary of Acute and Chronic RQs* Used to Estimate Indirect Effects to the Terrestrial-phase CRLF via Direct Effects on Small Mammals as Dietary Food Items.

Use (Application Rate)	Chronic RQ		Acute RQ
	Dose-based Chronic RQ[1]	Dietary-based Chronic RQ[2]	Dose-based Acute RQ[3]
Artichokes	**31**	**5.4**	0.08
Stone fruit, pome fruit, grapes	**28**	**4.9**	0.08
Alfalfa, clover, trefoil, crown vetch, sainfoin	**16**	**2.7**	0.04
Blueberries, ornamental trees, plants and shrubs, Christmas trees	**14**	**2.5**	0.04
Lettuce	**14**	**2.5**	0.04
Turf	**13**	**2.2**	0.03
Fallow land	**3.5**	0.61	0.01

* = LOC exceedances (acute RQ ≥ 0.1 and chronic RQ ≥ 1) are bolded and shaded.
[1] Based on dose-based EEC and propyzamide rat NOAEL = 200 mg/kg-bw.
[2] Based on dietary-based EEC and propyzamide rat NOAEC = 15 mg/kg-diet.
[3] Based on dose-based EEC and propyzamide rat acute oral LD_{50} = 5,620 mg/kg-bw.

Risk estimates for potential indirect effects to terrestrial-phase CRLF via direct effects on small mammals serving as prey were further refined using T-HERPS; however, the chronic risk LOC was still exceeded. Dietary-based chronic RQ values for small insectivorous mammals ranged from 0.61 to 5.4 and exceed the chronic risk LOC for all uses except fallow land. Dietary-based chronic risk quotients for small herbivorous mammals ranged from 3.5 to 31 across all of the uses evaluated. Based on these results the determination is "may affect" based on indirect effects to terrestrial-phase CRLF from chronic effects on small mammals serving as prey.

5.1.2.2.3 Frogs

An additional prey item of the adult terrestrial-phase CRLF is other frogs. In order to assess risks to these organisms, dietary-based and dose-based exposures modeled in T-REX for a small bird (20g) consuming small invertebrates are used. As indicated by RQ values for direct effects to terrestrial-phase frogs (**Table 5.5),** at current maximum application rates, acute dose-based RQ values exceed the acute risk to endangered species LOC (RQ≥0.1) at rates equivalent to those used on artichokes and stone fruits. Additionally, dietary-based chronic RQ values exceed the chronic risk LOC across all uses except turf and fallow land.

Risk estimates for small amphibians were further refined using T-HERPS. Based on this refinement, all of acute RQ values dropped below the acute risk LOC. The chronic risk LOC was only exceeded for the use of propyzamide on artichokes (RQ=1.04). The determination is a "may affect" for direct chronic effects on terrestrial-phase frogs.

5.1.2.3 Indirect Effects to CRLF via Reduction in Terrestrial Plant Community (Riparian and Upland Habitat)

Potential indirect effects to the CRLF resulting from direct effects on semi-aquatic, riparian and upland vegetation, *i.e.*, primary constituent elements of CRLF habitat, are assessed using RQs from terrestrial plant seedling emergence and vegetative vigor EC_{25} data as a screen. Based on RQ values, the LOC (RQ≥1) is exceeded for terrestrial monocotyledonous plants inhabiting semi-aquatic and dry areas for all of the uses evaluated. For use of propyzamide on artichokes and orchard crops/vineyards at the highest maximum application rate of 4.08 lbs a.i./A alone, RQ values for spray drift exceed the LOC (**Table 5.8**). For terrestrial dicotyledonous plants inhabiting semi-aquatic and dry areas and for spray drift, RQ values exceed the LOC across all of the uses evaluated (**Table 5.9**). Example output from TerrPlant v.1.2.2 is provided in **Appendix F**. Based on these results, the determination is "may affect" for indirect effects to the terrestrial and aquatic-phase CRLF via reductions in terrestrial plant communities.

Table 5.8 RQs* for Monocots Inhabiting Dry and Semi-Aquatic Areas Exposed to Propyzamide via Runoff and Drift

Use	Application rate (lbs a.i./A)	Application method	Drift Value (%)	Spray drift RQ	Dry area RQ	Semi-aquatic area RQ
Artichokes	4.08	Foliar – aerial	5	**6.8**	**9.5**	**34**
Stone fruit, pome fruit, grapes	4.08	Foliar – ground	1	**1.4**	**4.1**	**29**
Alfalfa, clover, trefoil, crown vetch, sainfoin, lettuce	2.0	Foliar – ground	1	0.67	**2.0**	**14**
Blueberries,	2.04	Foliar – ground	1	0.68	**2.0**	**14**

ornamental trees, plants and shrubs, Christmas trees						
Turf	1.53	Foliar – ground	1	0.51	**1.5**	**11**
Fallow land	0.51	Foliar - aerial	5	0.85	**1.2**	**4.3**
* = LOC exceedances (RQ ≥ 1) are bolded and shaded.						

Table 5.9 RQs* for Dicots Inhabiting Dry and Semi-Aquatic Areas Exposed to Propyzamide via Runoff and Drift

Use	Application rate (lbs a.i./A)	Application method	Drift Value (%)	Spray drift RQ	Dry area RQ	Semi-aquatic area RQ
Artichokes	4.08	Foliar – aerial	5	**20**	**19**	**68**
Stone fruit, pome fruit, grapes	4.08	Foliar – ground	1	**3.9**	**8.2**	**57**
Alfalfa, clover, trefoil, crown vetch, sainfoin, lettuce	2.0	Foliar – ground	1	**1.9**	**4.0**	**28**
Blueberries, ornamental trees, plants and shrubs, Christmas trees	2.04	Foliar – ground	1	**2.0**	**4.1**	**29**
Turf	1.53	Foliar – ground	1	**1.5**	**3.1**	**21**
Fallow land	0.51	Foliar - aerial	5	**2.5**	**2.4**	**8.5**
* = LOC exceedances (RQ ≥ 1) are bolded and shaded.						

5.1.3 Primary Constituent Elements of Designated Critical Habitat

5.1.3.1 Aquatic-Phase (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)

Three of the four assessment endpoints for the aquatic-phase primary constituent elements (PCEs) of designated critical habitat for the CRLF are related to potential effects to aquatic and/or terrestrial plants:

- Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.
- Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.
- Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae).

The preliminary effects determination for aquatic-phase PCEs of designated habitat related to potential effects on aquatic is "no effect", however, effects on designated habitat due to potential effects on terrestrial plants is a "may affect", based on the risk estimation provided in Sections 5.1.1.2, 5.1.1.3, and 5.1.2.3.

The remaining aquatic-phase PCE is "alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source." To assess the impact of propyzamide on this PCE, acute and chronic freshwater fish and invertebrate toxicity endpoints, as well endpoints for aquatic non-vascular plants, are used as measures of effects. RQs for these endpoints were calculated in Sections 5.1.1.1 and 5.1.1.2. Neither acute nor chronic risk LOC is exceeded for aquatic nonvascular plants and/or animals; therefore, the determination is that use will not modify aquatic-phase PCEs.

5.1.3.2 Terrestrial-Phase (Upland Habitat and Dispersal Habitat)

Two of the four assessment endpoints for the terrestrial-phase PCEs of designated critical habitat for the CRLF are related to potential effects to terrestrial plants:

- Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance
- Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal

The preliminary effects determination for terrestrial-phase PCEs of designated habitat related to potential effects on terrestrial plants is habitat modification, based on the risk estimation provided in Section 5.1.2.3.

The third terrestrial-phase PCE is "reduction and/or modification of food sources for terrestrial-phase juveniles and adults." To assess the impact of propyzamide on this PCE, acute and chronic toxicity endpoints for birds, mammals, and terrestrial invertebrates are used as measures of effects. RQs for these endpoints were calculated in Section 5.1.2.2. The habitat modification determination of the terrestial-phase PCE is based on modifications of food items.

The fourth terrestrial-phase PCE is based on alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source. Direct acute and chronic RQs for terrestrial-phase CRLFs are presented in Section 5.2.1.2. As discussed previously, the acute risk LOC is exceeded for terrestrial-phase amphibians at the maximum application rates for artichokes and orchard/vineyard crops. The acute risk LOC is exceeded for terrestrial invertebrates. Additionally, the chronic risk LOC is exceeded across all uses evaluated for terrestrial-phase amphibians and for mammalian food items. Based on these exceedances, the determination is habitat modification based on alteration of chemical characteristics necessary for normal growth and vaiability of juvenile and adult CRLF and their food source.

5.2 Risk Description

The risk description synthesizes an overall conclusion regarding the likelihood of adverse impacts leading to an effects determination (*i.e.*, “no effect,” “may affect, but not likely to adversely affect,” or “likely to adversely affect”) for the CRLF and whether designated critical habitat may be adversely modified.

If the RQs presented in the Risk Estimation (Section 5.1) show no direct or indirect effects for the CRLF, and no modification to PCEs of the CRLF’s designated critical habitat, a “no effect” determination is made, based on the use of propyzamide within the action area. However, if direct or indirect effect LOCs are exceeded or effects may modify the PCEs of the CRLF’s critical habitat, the Agency concludes a preliminary “may affect” determination for the FIFRA regulatory action regarding propyzamide. A summary of the results of the risk estimation (*i.e.*, “no effect” or “may affect” finding) is provided in **Table 5.10** for direct and indirect effects to the CRLF and in **Table 5.11** for the PCEs of designated critical habitat for the CRLF.

Table 5.10 Preliminary Effects Determination Summary for propyzamide - Direct and Indirect Effects to CRLF		
Assessment Endpoint	**Preliminary Effects Determination**	**Basis For Preliminary Determination**
Aquatic-Phase (eggs, larvae, tadpoles, juveniles, and adults)		
Survival, growth, and reproduction of CRLF individuals via direct effects on aquatic phases	no effect	RQ values for aquatic-phase CRLF are below the acute and chronic risk LOCs
Survival, growth, and reproduction of CRLF individuals via effects to food supply (*i.e.*, freshwater invertebrates, non-vascular plants)	no effect	RQ values for aquatic invertebrates and aquatic plants are below the LOC
Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, and/or primary productivity (*i.e.*, aquatic plant community)	no effect	RQ values for aquatic plants (vascular and nonvascular) are below the LOC
Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation, required to maintain acceptable water quality and habitat in ponds and streams comprising the species' current range.	may affect	RQ values for terrestrial plants in riparian habitat exceed the LOC.
Terrestria- Phase (Juveniles and adults)		
Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	may affect	RQ values exceed the acute risk LOC for terrestrial-phase CRLF at the highest maximum application rates for artichokes and orchard/vineyard uses. RQ values exceed the chronic risk LOC for terrestrial-phase CRLF across all of the uses evaluated.
Survival, growth, and reproduction of CRLF individuals via effects on prey (*i.e.*, terrestrial invertebrates, small terrestrial mammals and terrestrial phase amphibians)	may affect	RQ values exceed LOC for small insect forage items; chronic risk LOC exceeded for mammalian prey items; acute and chronic RQ values exceed for terrestrial amphibians serving as food for terrestrial-phase CRLF.
Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian vegetation)	may affect	RQ values exceed LOC for terrestrial plants in terrestrial-phase CRLF habitat.

Table 5.11 Preliminary Effects Determination Summary for propyzamide – PCEs of Designated Critical Habitat for the CRLF		
Assessment Endpoint	**Preliminary Effects Determination**	**Basis For Preliminary Determination**
Aquatic-Phase CRLF PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)		
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	may affect	Terrestrial plant (riparian vegetation) RQ values exceed the LOC.
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	may affect	Terrestrial plant (riparian vegetation) RQ values exceed the LOC.
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	may affect	Terrestrial plant (riparian vegetation) RQ values exceed the LOC.
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae)	no effect	Aquatic non-vascular plant RQ values are below the LOC.
Terrestrial-Phase CRLF PCEs (Upland Habitat and Dispersal Habitat)		
Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance	habitat modification	Terrestrial plant (riparian vegetation) RQ values exceed the LOC.
Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal	habitat modification	Terrestrial plant (riparian vegetation) RQ values exceed the LOC.
Reduction and/or modification of food sources for terrestrial-phase juveniles and adults	habitat modification	Terrestrial plant (riparian vegetation) RQ values exceed the LOC. RQ values exceed chronic risk LOC for terrestrial insects, mammals and small amphibian serving as prey for terrestrial-phase CRLF.
Alteration of chemical characteristics necessary for normal growth and viability of	habitat modification	Terrestrial plant (riparian vegetation) RQ values exceed the LOC.

Table 5.11 Preliminary Effects Determination Summary for propyzamide – PCEs of Designated Critical Habitat for the CRLF		
Assessment Endpoint	**Preliminary Effects Determination**	**Basis For Preliminary Determination**
juvenile and adult CRLFs and their food source.		

Following a "may affect" determination, additional information is considered to refine the potential for exposure at the predicted levels based on the life history characteristics (*i.e.*, habitat range, feeding preferences, etc.) of the CRLF. Based on the best available information, the Agency uses the refined evaluation to distinguish those actions that "may affect, but are not likely to adversely affect" from those actions that are "likely to adversely affect" the CRLF or modify designated critical habitat.

The criteria used to make determinations that the effects of an action are "not likely to adversely affect" the CRLF and its designated critical habitat include the following:

- Significance of Effect: Insignificant effects are those that cannot be meaningfully measured, detected, or evaluated in the context of a level of effect where "take" occurs for even a single individual. "Take" in this context means to harass or harm, defined as the following:
  - Harm includes significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.
  - Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.
- Likelihood of the Effect Occurring: Discountable effects are those that are extremely unlikely to occur.
- Adverse Nature of Effect: Effects that are wholly beneficial without any adverse effects are not considered adverse.

A description of the risk and effects determination for each of the established assessment endpoints for the CRLF and its designated critical habitat is provided in **Sections 5.2.1 through 5.2.3**.

5.2.1 Direct Effects

5.2.1.1 Aquatic-Phase CRLF

The aquatic-phase considers life stages of the frog that are obligatory aquatic organisms, including eggs and larvae. It also considers submerged terrestrial-phase juveniles and adults, which spend a portion of their time in water bodies that may receive runoff and spray drift containing propyzamide. As discussed previously, with a dose-response slope of 2.55 and at the highest acute RQ value (lettuce RQ=0.003) for freshwater fish, *i.e*, the surrogate for aquatic-phase amphibians, the likelihood of an individual effect is 1 in 1.6 x 10^{10}. This low likelihood individual acute mortality further supports the no effect determination for aquatic-phase amphibians based on acute effects.

Chronic RQs discussed in Section 5.1.1.1 and **Table 5.1** indicate that across all of the uses evaluated, the chronic risk LOC is not exceeded. The highest chronic RQ value (RQ=0.03) is well below the chronic risk LOC. However, there is considerable uncertainty regarding the chronic toxicity of propyzamide to aquatic vertebrates because no chronic toxicity data are available to assess risk. Rather, the freshwater invertebrate acute-to-chronic ratio was used to estimate a chronic toxicity value for fish. The resulting estimate (NOAEC=7.7 mg/L) is roughly an order of magnitude less sensitive than the measured NOAEC for aquatic invertebrates (NOAEC=0.6 mg/L). Although propyzaimde is used as a herbicide and aquatic animals are not expected to be particularly sensitive, the mode of action of propyzamide is uncertain. The hypothesized mode of action, *i.e.*, inhibition of spindle fiber formation during mitosis, involves a process that is common to both plants and animals and as such, the effects of propyzamide may not be limited to plants alone.

The estimated NOAEC for aquatic-phase amphibians also depends on the acute toxicity of propyzamide to fish; however, the most sensitive acute toxicity value (rainbow trout LC_{50}= 72 mg/L) was used in the assessment. The rainbow trout acute toxicity estimate is roughly 50% more sensitive that the next most sensitive species, *i.e.*, guppy LC_{50}=150 mg/L and roughly 5 times more sensitive than the third most sensitive species, *i.e.*, goldfish LC_{50}=350 mg/L. If the chronic toxicity value for freshwater fish had been estimated using the mean of the three lowest toxicity values, *i.e.*, 190 mg/L, the estimated NOAEC would be 20 mg/L and would be more 30 times less sensitive than what was measured for chronic toxicity to freshwater invertebrates.

5.2.1.2 Terrestrial-Phase CRLF

RQ values exceed the acute risk LOC for terrestrial-phase amphibians for use of propyzamide at the highest maximum application rate for use on artichokes and orchard/vineyard crops. However, a more refined assessment using T-HERPS indicates a “not likely to adversely affect” determination since RQ values are below the acute risk LOC for all of the uses evaluated.

Initially, chronic RQ values exceeded the chronic risk LOC for all of the uses evaluated. A refined assessment using T-HERPS indicates that all but propyzamide use on fallow land exceeds the chronic risk LOC. As was the case for evaluating potential chronic risk to aquatic-phase CRLF, no chronic toxicity data are available with which to evaluate chronic risk to the terrestrial-phase CRLF. Again, the chronic toxicity endpoint had to be estimated using the acute-to-chronic ratio developed using mammalian toxicity data. The estimated NOAEC (20 mg/kg/day) is based on the acute 24-hr LD_{50} (8870 mg/kg bw) for Japanese quail; however, there are no other definitive acute or subacute dietary toxicity studies available. Therefore, the degree of conservatism in the estimated chronic toxicity value is uncertain. Because of this uncertainty, the chronic toxicity estimate cannot be further refined and the determination is likely to adversely affect (LAA) the terrestrial-phase CRLF through direct chronic effects.

5.2.2 Indirect Effects (via Reductions in Prey Base)

5.2.2.1 Algae (non-vascular plants)

As discussed in Section 2.5.3, the diet of CRLF tadpoles is composed primarily of unicellular aquatic plants (*i.e.*, algae and diatoms) and detritus. None of the uses assessed exceed the LOC for nonvascular plants, therefore, the determination is "no effect" for indirect effects to aquatic-phase CRLF based in reductions in algae/diatoms serving as food.

5.2.2.2 Aquatic Invertebrates

The potential for propyzamide to elicit indirect effects to the CRLF via effects on freshwater invertebrate food items is dependent on several factors including: (1) the potential magnitude of effect on freshwater invertebrate individuals and populations; and (2) the number of prey species potentially affected relative to the expected number of species needed to maintain the dietary needs of the CRLF. Together, these data provide a basis to evaluate whether the number of individuals within a prey species is likely to be reduced such that it may indirectly affect the CRLF.

As discussed in Section 5.1.1.2 (**Table 5.3**), acute RQs < 0.05 and are below the LOC; therefore, the determination is "no effect" for indirect effects to aquatic-phase CRLF due to reductions in aquatic invertebrates serving as food.

5.2.2.3 Fish and Aquatic-phase Frogs

Similar to the direct effects discussion for aquatic-phase CRLFs, the potential indirect acute effects to aquatic-phase CRLF from reductions in fish and other frogs serving as prey is determined to be a "no effect".

5.2.2.4 Terrestrial Invertebrates

When the terrestrial-phase CRLF reaches juvenile and adult stages, its diet is mainly composed of terrestrial invertebrates. As discussed in Section 5.1.2.2.1, all of the modeled uses, with the exception of fallow land, exceed the acute risk to endangered species LOC (RQ≥0.05), based on small insect forage items. However, there is considerable uncertainty regarding the toxicity of propyzamide to terrestrial invertebrates; the available data indicate that the 48-hr LD50 exceeded the highest concentration tested (LD50>181 μg/bee). It is uncertain how much higher the concentration would have to be to result in bee mortality though. Based on a default dose-response slope of 4.5 and at the highest RQ values (RQ=0.43), terrestrial insects serving as prey would have a likelihood of individual mortality of 1 in 20. Based on this relatively low likelihood of mortality and the fact that the LD50 value exceeded the highest concentration tested, the potential effect is considered insignificant and the determination is not likely to adversely affect (NLAA).

5.2.2.5 Mammals

Life history data for terrestrial-phase CRLFs indicate that large adult frogs consume terrestrial vertebrates, including mice. Based on the assessed uses or propyzamide, none of the RQ values exceed the acute risk LOC while both dose-based and dietary-based chronic RQ values exceed the chronic risk LOC. There is uncertainty though in the wide difference between the observed NOAEC (200 ppm) and LOAEC (1500 ppm) for the chronic rat reproduction study. It is likely that the NOAEC is higher than reported; however, the extent to which it is higher is uncertain. No additional information is available to refine these initial chronic risk estimates; therefore, the determination is likely to adversely affect (LAA) terrestrial-phase CRLF based on indirect adverse chronic effects on mammals serving as food for terrestrial-phase CRLF.

5.2.2.6 Terrestrial-phase Amphibians

Terrestrial-phase adult CRLFs also consume frogs. RQ values representing direct exposures of propyzamide to terrestrial-phase CRLFs are used to represent exposures of propyzamide to frogs in terrestrial habitats. As discussed previously, there is uncertainty regarding the chronic toxicity endpoint used to assess direct chronic risk to terrestrial-phase CRLF. This same uncertainty would apply to other terrestrial-phase amphibians and therefore, the determination is likely to adversely affect (LAA) terrestrial-phase CRLF through indirect chronic effects on other terrestrial-phase frogs serving as prey.

5.2.3 Indirect Effects (via Habitat Effects)

5.2.3.1 Aquatic Plants (Vascular and Non-vascular)

Aquatic plants serve several important functions in aquatic ecosystems. Non-vascular aquatic plants are primary producers and provide the autochthonous energy base for aquatic ecosystems. Vascular plants provide structure, rather than energy, to the system, as attachment sites for many aquatic invertebrates, and refugia for juvenile organisms, such as fish and frogs. Emergent plants help reduce sediment loading and provide stability to nearshore areas and lower streambanks. In addition, vascular aquatic plants are important as attachment sites for egg masses of CRLFs.

Potential indirect effects to the CRLF based on impacts to habitat and/or primary production were assessed using RQs from freshwater aquatic vascular and non-vascular plant data. None of the RQ values for either vascular on non-vascular aquatic plants exceed the LOC, therefore the determination is "no effect" via indirect effects on the aquatic-phase CRLF through reductions in primary productivity and/or emergent vegetation.

5.2.3.2 Terrestrial Plants

Terrestrial plants serve several important habitat-related functions for the CRLF. In addition to providing habitat and cover for invertebrate and vertebrate prey items of the CRLF, terrestrial vegetation also provides shelter for the CRLF and cover from predators while foraging. Upland vegetation including grassland and woodlands provides cover during dispersal. Riparian vegetation helps to maintain the integrity of aquatic systems by providing bank and thermal stability, serving as a buffer to filter out sediment, nutrients, and contaminants before they reach the watershed, and serving as an energy source.

Propyzamide is toxic to both monocotyledonous and dicotyledonous plants. RQ values for both groups exceed LOCs for plants in dry and semi-aquatic habitats. Therefore, the determination is likely to adversely affect (LAA) the CRLF through indirect effects on terrestrial plant habitats.

5.2.4 Modification to Designated Critical Habitat

5.2.4.1 Aquatic-Phase PCEs

Three of the four assessment endpoints for the aquatic-phase primary constituent elements (PCEs) of designated critical habitat for the CRLF are related to potential effects to aquatic and/or terrestrial plants:

- Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.
- Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.
- Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae).

The effects determinations for indirect effects to the CRLF via direct effects to aquatic and terrestrial plants are used to determine whether modification to critical habitat may occur. Although aquatic plants are not affected by the assessed uses of propyzamide, terrestrial plants are likely to be adversely affected from the use of the herbicide. Reductions in the extent of riparian cover may lead to reductions in water quality due to increased runoff of sediments, decreased shading leading to increased water temperatures, and decreased structure.

The remaining aquatic-phase PCE is "alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source." Other than impacts to algae as food items for tadpoles (discussed above), this PCE is assessed by considering direct and indirect effects to the aquatic-phase CRLF via acute and chronic freshwater fish and invertebrate toxicity endpoints as measures of effects. Based on the fact that acute and chronic RQ values are below LOCs, current registered uses of propyzaimide are expected to have no effect on the remaining aquatic-phase PCE. Therefore, the determination is "no effect".

5.2.4.2 Terrestrial-Phase PCEs

Two of the four assessment endpoints for the terrestrial-phase PCEs of designated critical habitat for the CRLF are related to potential effects to terrestrial plants:

- Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or drip line surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance.

- Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal.

As discussed previously, terrestrial plants are adversely affected by propyzamide and the determination is habitat modification for the two terrestrial-phase PCE through disturbance of upland habitat to support food sources of CRLF and through elimination and/or disturbance of dispersal habitat.

The third terrestrial-phase PCE is "reduction and/or modification of food sources for terrestrial-phase juveniles and adults." To assess the impact of propyzamide on this PCE, acute and chronic toxicity endpoints for terrestrial invertebrates, mammals, and terrestrial-phase frogs are used as measures of effects. As discussed previously, the likelihood of reductions in the prey base of terrestrial-phase CRLF cannot be discounted; therefore, the determination is habitat modification for the third terrestrial-phase CRLF PCE through reduction and/or modification of food sources for terrestrial-phase juvenile and adult CRLF.

The fourth terrestrial-phase PCE is based on alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source. Although direct effects to the terrestrial-phase CRLF are not considered likely, indirect effects through reductions in the availability of its food items are considered likely to adversely affect the species; therefore, the determination is habitat modification for the fourth terrestrial-phase PCE.

6. Uncertainties

As discussed in the problem formulation, the process used in assessing the risks associated with the currently labeled uses of propyzamide is consistent with that discussed in the Agency's document entitled "*Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs*" (http://www.epa.gov/oppfead1/endanger/consultation/ecorisk-overview.pdf). Throughout this document a number of uncertainties have been characterized. These uncertainties arise from a lack of data and *in lieu* of data the Agency relies on standard assumptions. The Overview Document provides a relatively thorough review of the uncertainties and underlying assumptions associated with screening-level risk assessments; however, some areas of uncertainty are also described below.

6.1 Exposure Assessment Uncertainties

6.1.1 Maximum Use Scenario

The screening-level risk assessment focuses on characterizing potential ecological risks resulting from a maximum use scenario, which is determined from labeled statements of maximum application rate and number of applications with the shortest time interval between applications. The frequency at which actual uses approach this maximum use scenario may be dependant on pest resistance, timing of applications, cultural practices, and market forces.

6.1.2 Aquatic Exposure Modeling of Propyzamide

The standard ecological water body scenario (standard farm pond) used to calculate potential aquatic exposure to pesticides is intended to represent conservative estimates, and to avoid underestimations of the actual exposure. The standard scenario consists of application to a 10-hectare field bordering a 1-hectare, 2-meter deep (20,000 m^3) pond with no outlet. Exposure estimates generated using the standard farm pond are intended to represent a wide variety of vulnerable water bodies that occur at the top of watersheds including prairie pot holes, playa lakes, wetlands, vernal pools, man-made and natural ponds, and intermittent and lower order streams. As a group, there are factors that make these water bodies more or less vulnerable than the standard farm pond. Static water bodies that have larger ratios of pesticide-treated drainage area to water body volume would be expected to have higher peak EECs than the standard farm pond. These water bodies will be either smaller in size or have larger drainage areas. Smaller water bodies have limited storage capacity and thus may overflow and carry pesticide in the discharge, whereas the standard farm pond has no discharge. As watershed size increases beyond 10-hectares, it becomes increasingly unlikely that the entire watershed is planted with a single crop that is all treated simultaneously with the pesticide. Headwater streams can also have peak concentrations higher than the standard farm pond, but they likely persist for only short periods of time and are then carried and dissipated downstream.

The Agency acknowledges that there are some unique aquatic habitats that are not accurately captured by this modeling scenario and modeling results may, therefore, under- or over-estimate exposure, depending on a number of variables. For example, aquatic-phase CRLFs may inhabit water bodies of different size and depth and/or are located adjacent to larger or smaller drainage areas than the standard farm pond. The Agency does not currently have sufficient information regarding the hydrology of these aquatic habitats to develop a specific alternate scenario for the CRLF. CRLFs prefer habitat with perennial (present year-round) or near-perennial water and do not frequently inhabit vernal (temporary) pools because conditions in these habitats are generally not suitable (Hayes and Jennings 1988). Therefore, the standard farm pond is assumed to be representative of exposure to aquatic-phase CRLFs. In addition, the Services agree that the existing standard farm pond represents the best currently available approach for estimating aquatic exposure to pesticides (USFWS/NMFS 2004).

In general, the linked PRZM/EXAMS model produces estimated aquatic concentrations that are expected to be exceeded once within a ten-year period. The Pesticide Root Zone Model is a process or "simulation" model that calculates what happens to a pesticide in an agricultural field on a day-to-day basis. It considers factors such as rainfall and plant transpiration of water, as well as how and when the pesticide is applied. It has two major components: hydrology and chemical transport. Water movement is simulated by the use of generalized soil parameters, including field capacity, wilting point, and saturation water content. The chemical transport component can simulate pesticide application on the soil or on the plant foliage. Dissolved, adsorbed, and vapor-phase concentrations in the soil are estimated by simultaneously considering the processes of pesticide uptake by plants, surface runoff, erosion, decay, volatilization, foliar wash-off, advection, dispersion, and retardation.

Uncertainties associated with each of these individual components add to the overall uncertainty of the modeled concentrations. Additionally, model inputs from the environmental fate degradation studies are chosen to represent the upper confidence bound on the mean values that are not expected to be exceeded in the environment approximately 90 percent of the time. Mobility input values are chosen to be representative of conditions in the environment. The natural variation in soils adds to the uncertainty of modeled values. Factors such as application date, crop emergence date, and canopy cover can also affect estimated concentrations, adding to the uncertainty of modeled values. Factors within the ambient environment such as soil temperatures, sunlight intensity, antecedent soil moisture, and surface water temperatures can cause actual aquatic concentrations to differ for the modeled values.

Unlike spray drift, tools are currently not available to evaluate the effectiveness of a vegetative setback on runoff and loadings. The effectiveness of vegetative setbacks is highly dependent on the condition of the vegetative strip. For example, a well-established, healthy vegetative setback can be a very effective means of reducing runoff and erosion from agricultural fields. Alternatively, a setback of poor vegetative quality or a setback that is channelized can be ineffective at reducing loadings. Until such time as a quantitative method to estimate the effect of vegetative setbacks on various conditions on pesticide loadings becomes available, the aquatic exposure predictions are likely to overestimate exposure where healthy vegetative setbacks exist and underestimate exposure where poorly developed, channelized, or bare setbacks exist.

In order to account for uncertainties associated with modeling, PRZM/EXAMS acute and chronic exposure estimates were evaluated with the available monitoring data. Modeled exposure estimates reflect total residues of concern, whereas monitoring data reflect detections of propyzamide parent only. Therefore, the evaluative power of the monitoring data is poor. Peak and 90-day average total residue EECs from the maximum use pattern of each potential propyzamide use in California range from 13.9-225 µg/L and 12.6-207 µg/L, respectively. The maximum concentrations of propyzamide detected in California reported in the California DPR surface water database and NAWQA are 0.25 µg/L and 0.11 µg/L, respectively. These values for propyzamide *per se* are 2-3 orders of magnitude below those estimated for the total residues. However, they are consistent with the peak (3.7-10.3 µg/L) and annual mean (0.53-4.45 µg/L) drinking water exposure estimates of propyzamide *per se* that were generated in support the 2002 TRED (USEPA 2002a). The modeled total residue exposure estimates of this assessment are, therefore, expected to be reasonably conservative measures of exposure.

6.1.3 Action Area Uncertainties

An example of an important simplifying assumption that may require future refinement is the assumption of uniform runoff characteristics throughout a landscape. It is well documented that runoff characteristics are highly non-uniform and anisotropic, and become increasingly so as the area under consideration becomes larger. The assumption made for estimating the aquatic action area (based on predicted in-stream dilution) was that the entire landscape exhibited runoff properties identical to those commonly found in agricultural lands in this region. However, considering the vastly different runoff characteristics of: a) undeveloped (especially forested) areas, which exhibit the least amount of surface runoff but the greatest amount of groundwater recharge; b) suburban/residential areas, which are dominated by the relationship between impermeable surfaces (roads, lots) and grassed/other areas (lawns) plus local drainage management; c) urban areas, that are dominated by managed storm drainage and impermeable surfaces; and d) agricultural areas dominated by Hortonian and focused runoff (especially with row crops), a refined assessment should incorporate these differences for modeled stream flow generation. As the zone around the immediate (application) target area expands, there will be greater variability in the landscape; in the context of a risk assessment, the runoff potential that is assumed for the expanding area will be a crucial variable (since dilution at the outflow point is determined by the size of the expanding area). Thus, it is important to know at least some approximate estimate of types of land use within that region. Runoff from forested areas ranges from 45 – 2,700% less than from agricultural areas; in most studies, runoff was 2.5 to 7 times higher in agricultural areas (*e.g.*, Okisaka *et al*., 1997; Karvonen *et al*., 1999; McDonald *et al*., 2002; Phuong and van Dam 2002). Differences in runoff potential between urban/suburban areas and agricultural areas are generally less than between agricultural and forested areas. In terms of likely runoff potential (other variables – such as topography and rainfall – being equal), the relationship is generally as follows (going from lowest to highest runoff potential):

Three-tiered forest < agroforestry < suburban < row-crop agriculture < urban.

There are, however, other uncertainties that should serve to counteract the effects of the aforementioned issue. For example, the dilution model considers that 100% of the agricultural area has the chemical applied, which is almost certainly a gross over-estimation. Thus, there will be assumed chemical contributions from agricultural areas that will actually be contributing only runoff water (dilutant); so some contributions to total contaminant load will really serve to lessen rather than increase aquatic concentrations. In light of these (and other) confounding factors, the Agency believes that this model gives us the best available estimates under current circumstances.

6.1.4 Usage Uncertainties

County-level usage data were obtained from California's Department of Pesticide Regulation Pesticide Use Reporting (CDPR PUR) database. Four years of data (2002 – 2005) were included in this analysis because statistical methodology for identifying outliers, in terms of area treated and pounds applied, was provided by CDPR for these years only. No methodology for removing outliers was provided by CDPR for 2001 and earlier pesticide data; therefore, this information was not included in the analysis because it may misrepresent actual usage patterns. CDPR PUR documentation indicates that errors in the data may include the following: a misplaced decimal; incorrect measures, area treated, or units; and reports of diluted pesticide concentrations. In addition, it is possible that the data may contain reports for pesticide uses that have been cancelled. The CPDR PUR data does not include home owner applied pesticides; therefore, residential uses are not likely to be reported. As with all pesticide usage data, there may be instances of misuse and misreporting. The Agency made use of the most current, verifiable information; in cases where there were discrepancies, the most conservative information was used.

6.1.5 Terrestrial Exposure Modeling of Propyzamide

The Agency relies on the work of Fletcher et al. (1994) for setting the assumed pesticide residues in wildlife dietary items. These residue assumptions are believed to reflect a realistic upper-bound residue estimate, although the degree to which this assumption reflects a specific percentile estimate is difficult to quantify. It is important to note that the field measurement efforts used to develop the Fletcher estimates of exposure involve highly varied sampling techniques. It is entirely possible that much of these data reflect residues averaged over entire above ground plants in the case of grass and forage sampling.

It was assumed that ingestion of food items in the field occurs at rates commensurate with those in the laboratory. Although the screening assessment process adjusts dry-weight estimates of food intake to reflect the increased mass in fresh-weight wildlife food intake estimates, it does not allow for gross energy differences. Direct comparison of a laboratory dietary concentration- based effects threshold to a fresh-weight pesticide residue estimate would result in an underestimation of field exposure by food consumption by a factor of 1.25 – 2.5 for most food items.

Differences in assimilative efficiency between laboratory and wild diets suggest that current screening assessment methods do not account for a potentially important aspect of food requirements. Depending upon species and dietary matrix, bird assimilation of wild diet energy ranges from 23 – 80%, and mammal's assimilation ranges from 41 – 85% (U.S. Environmental Protection Agency, 1993). If it is assumed that laboratory chow is formulated to maximize assimilative efficiency (*e.g.*, a value of 85%), a potential for underestimation of exposure may exist by assuming that consumption of food in the wild is comparable with consumption during laboratory testing. In the screening process, exposure may be underestimated because metabolic rates are not related to food consumption.

For the terrestrial exposure analysis of this risk assessment, a generic bird or mammal was assumed to occupy either the treated field or adjacent areas receiving a treatment rate on the field. Actual habitat requirements of any particular terrestrial species were not considered, and it was assumed that species occupy, exclusively and permanently, the modeled treatment area. Spray drift model predictions suggest that this assumption leads to an overestimation of exposure to species that do not occupy the treated field exclusively and permanently.

6.1.6 Spray Drift Modeling

It is unlikely that the same organism would be exposed to the maximum amount of spray drift from every application made. In order for an organism to receive the maximum concentration of propyzamide from multiple applications, each application of propyzamide would have to occur under identical atmospheric conditions (*e.g.*, same wind speed and same wind direction) and (if it is an animal) the animal being exposed would have to be located in the same location (which receives the maximum amount of spray drift) after each application. Additionally, other factors, including variations in topography, cover, and meteorological conditions over the transport distance are not accounted for by the AGDISP model (*i.e.*, it models spray drift from aerial and ground applications in a flat area with little to no ground cover and a steady, constant wind speed and direction). Therefore, in most cases, the drift estimates from AGDISP may overestimate exposure, especially as the distance increases from the site of application, since the model does not account for potential obstructions (*e.g.*, large hills, berms, buildings, trees, *etc*.). Furthermore, conservative assumptions are made regarding the droplet size distributions being modeled ('ASAE Very Fine to Fine' for ground applications), the application method, release heights, and wind speeds, if not specified on the labels. Alterations in any of these inputs could decrease the area of potential effect.

AGDISP has not been validated for modeling ground applications. Therefore, estimates generated from the ground application mode carry higher uncertainty than those of the aerial application mode. However, the aerial mode of AGDISP yielded shorter buffer distances than the ground mode when modeling ground applications. Therefore, the outputs from the ground mode were considered conservative for this analysis regardless of the uncertainty in their values.

6.2 Effects Assessment Uncertainties

6.2.1 Age Class and Sensitivity of Effects Thresholds

It is generally recognized that test organism age may have a significant impact on the observed sensitivity to a toxicant. The acute toxicity data for fish are collected on juvenile fish between 0.1 and 5 grams. Aquatic invertebrate acute testing is performed on recommended immature age classes (*e.g.*, first instar for daphnids, second instar for amphipods, stoneflies, mayflies, and third instar for midges).

Testing of juveniles may overestimate toxicity at older age classes for pesticide active ingredients that act directly without metabolic transformation because younger age classes may not have the enzymatic systems associated with detoxifying xenobiotics. In so far as the available toxicity data may provide ranges of sensitivity information with respect to age class, this assessment uses the most sensitive life-stage information as measures of effect for surrogate aquatic animals, and is therefore, considered as protective of the CRLF.

6.2.2 Use of Surrogate Species Effects Data

Guideline toxicity tests and open literature data on propyzamide are not available for frogs or any other aquatic-phase amphibian; therefore, freshwater fish are used as surrogate species for aquatic-phase amphibians. Therefore, endpoints based on freshwater fish ecotoxicity data are assumed to be protective of potential direct effects to aquatic-phase amphibians including the CRLF, and extrapolation of the risk conclusions from the most sensitive tested species to the aquatic-phase CRLF is likely to overestimate the potential risks to those species. Efforts are made to select the organisms most likely to be affected by the type of compound and usage pattern; however, there is an inherent uncertainty in extrapolating across phyla. In addition, the Agency's LOCs are intentionally set very low, and conservative estimates are made in the screening level risk assessment to account for these uncertainties.

As discussed previously, there is considerable uncertainty regarding the potential chronic toxicity of propyzamide. Estimates of chronic toxicity to aquatic-phase and terrestrial-phase CRLF in this assessment are based on the acute-to-chronic ratio developed for mammalian toxicity studies. The extent to which this ratio results in reasonable estimates of chronic toxicity values for surrogate fish and birds is uncertain.

6.2.3 Sublethal Effects

When assessing acute risk, the screening risk assessment relies on the acute mortality endpoint as well as a suite of sublethal responses to the pesticide, as determined by the testing of species response to chronic exposure conditions and subsequent chronic risk assessment. Consideration of additional sublethal data in the assessment is exercised on a case-by-case basis and only after careful consideration of the nature of the sublethal effect measured and the extent and quality of available data to support establishing a plausible relationship between the measure of effect (sublethal endpoint) and the assessment endpoints.

No data are available on the sublethal effects of propyzamide; however, the absence of data cannot be construed as the absence of effects. To the extent to which sublethal effects are not considered in this assessment, the potential direct and indirect effects of propyzamide on CRLF may be underestimated.

6.2.4 Location of Wildlife Species

For the terrestrial exposure analysis of this risk assessment, a generic bird or mammal was assumed to occupy either the treated field or adjacent areas receiving a treatment rate on the field. Actual habitat requirements of any particular terrestrial species were not considered, and it was assumed that species occupy, exclusively and permanently, the modeled treatment area. Spray drift model predictions suggest that this assumption leads to an overestimation of exposure to species that do not occupy the treated field exclusively and permanently.

6.2.5 Location of Wildlife Species

There is uncertainty regarding the toxicity of technical grade active ingredient relative to that of formulated endproduct. The acute toxicity estimates for freshwater fish are based on nominal concentrations from studies of formulated endproduct rather than technical grade active ingredient and these toxicity estimates exceed the solubility limit (*i.e.*, 15 mg/L) of propyzamide. However, as discussed previously, even if acute toxicity estimates had been based on the solubility limit, RQ values would have been well below the acute risk LOC.

6.2.6 Absence of Chronic Toxicity Data

This assessment has had to rely on acute-to-chronic ratios to estimate chronic toxicity endpoints for freshwater fish (serving as surrogates for aquatic-phase amphibians) and for birds (serving as surrogates for terrestrial-phase amphibians and reptiles). In the absence of data, the ACR provides a means to take advantage of the best available data to address data gaps.

6.2.7 Mechanism of Action

Propyzamide is proposed to inhibit cell division by preventing the formation of spindle fibers during mitosis via binding to proteins associated with microtubule assembly (Griffen 2003). Since the role of spindle fibers in mitosis is common to plants and animals, it is unclear why animals would not be as susceptible to propyzamide as plants; however, the avaialbe toxicity data suggest that animals are not particularly sensitive to this compound.

7. Risk Conclusions

In fulfilling its obligations under Section 7(a)(2) of the Endangered Species Act, the information presented in this endangered species risk assessment represents the best data currently available to assess the potential risks of propyzamide to the CRLF and its designated critical habitat.

Based on the best available information, the Agency makes a Likely to Adversely Affect determination for the CRLF from the use of propyzamide. Additionally, the Agency has determined that there is the potential for modification of CRLF designated critical habitat from the use of the chemical.

Based on the conclusions of this assessment, a formal consultation with the U. S. Fish and Wildlife Service under Section 7 of the Endangered Species Act should be initiated. **Attachment 2**, which includes information on the baseline status and cumulative effects for the CRLF, can be used during this consultation to provide background information on past US Fish and Wildlife Services biological opinions associated with the CRLF.

A summary of the risk conclusions and effects determinations for the CRLF and its critical habitat, given the uncertainties discussed in Section 6, is presented in **Tables 7.1** and **7.2**.

Table 7.1 Effects Determination Summary for Direct and Indirect Effects of propyzamide on the CRLF		
Assessment Endpoint	**Effects Determination[1]**	**Basis for Determination**
Aquatic-Phase CRLF (Eggs, Larvae, and Adults)		
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on aquatic phases	**NE**	RQ values for CRLF are below acute and chronic LOCs.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to food supply (*i.e.*, freshwater invertebrates, non-vascular plants, fish, and frogs)	Freshwater invertebrates: **NE**	RQ values for freshwater invertebrates are below acute and chronic LOCs
	Non-vascular aquatic plants: **NE**	RQ values for non-vascular aquatic plants are below the LOC.
	Fish and frogs: **NE**	RQ values for freshwater vertebrates (fish and amphibians) are below acute and chronic LOCs.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat, cover, and/or primary productivity (*i.e.*, aquatic plant community)	Non-vascular aquatic plants: **NE**	RQ values for non-vascular aquatic plants are below the LOC.
	Vascular aquatic plants: **NE**	RQ values for vascular aquatic plants are below the LOC.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation, required to maintain acceptable water quality and habitat in ponds and streams comprising the species' current range.	**LAA**	Terrestrial plant RQ values exceeded and riparian vegetation is likely to be adversely affected which in turn could indirectly affect water quality and habitat in ponds and streams comprising the species' current range.
Terrestrial-Phase CRLF (Juveniles and adults)		
Direct Effects: Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	**LAA**	Chronic RQ values exceed the chronic risk LOC.
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via effects on prey (*i.e.*, terrestrial invertebrates, small terrestrial vertebrates, including mammals and terrestrial phase amphibians)	Terrestrial invertebrates: **NLAA**	Terrestrial insects serving as prey would have a likelihood of individual mortality of 1 in 20. Based on this relatively low likelihood of mortality, the potential effect is considered insignificant and the determination is for a not likely to adversely affect (NLAA)
	Mammals: **LAA**	None of the RQ values exceed the acute risk LOC while both dose-based and dietary-based chronic RQ values exceed the chronic risk LOC. No additional information is available to refine these initial chronic risk estimates; therefore, the determination is for a likely to adversely affect (LAA) terrestrial-phase CRLF based on indirect adverse chronic effects on mammals serving as food for terrestrial-phase CRLF

	Frogs: **LAA**	There is uncertainty regarding the chronic toxicity endpoint used to assess direct chronic risk to terrestrial-phase CRLF. This same uncertainty would apply to other terrestrial-phase amphibians and therefore, the determination is for a likely to adversely affect (LAA) terrestrial-phase CRLF through indirect chronic effects on other terrestrial-phase frogs serving as prey
Indirect Effects: Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian vegetation)	**LAA**	Terrestrial plant RQ values for semi-aquatic and dry areas exceed the LOC.
[1] NE = no effect; NLAA = may affect, but not likely to adversely affect; LAA = likely to adversely affect		

Table 7.2 Effects Determination Summary for the Critical Habitat Impact Analysis		
Assessment Endpoint	**Effects Determination[1]**	**Basis for Determination**
Aquatic-Phase CRLF PCEs (Aquatic Breeding Habitat and Aquatic Non-Breeding Habitat)		
Alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond: aquatic habitat (including riparian vegetation) provides for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs.	**HM**	Although aquatic plants are not affected by the assessed uses of propyzamide, terrestrial plants are likely to be adversely affected from the use of the herbicide. Reductions in the extent of riparian cover may lead to reductions in water quality due to increased runoff of sediments, decreased shading leading to increased water temperatures, and decreased structure
Alteration in water chemistry/quality including temperature, turbidity, and oxygen content necessary for normal growth and viability of juvenile and adult CRLFs and their food source.[5]	**HM**	
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	**HM**	
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae)	**NE**	RQ values for freshwater vertebrates (fish and amphibians) and aquatic nonvascular plants are below acute and chronic LOCs.
Terrestrial-Phase CRLF PCEs (Upland Habitat and Dispersal Habitat)		
Elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs: Upland areas within 200 ft of the edge of the riparian vegetation or dripline surrounding aquatic and riparian habitat that are comprised of grasslands, woodlands, and/or wetland/riparian plant species that provides the CRLF shelter, forage, and predator avoidance	**HM**	Terrestrial plant RQ values exceed the LOC. Terrestrial plants are adversely affected by propyzamide and the determination is for a likely to adversely affect the two terrestrial-phase PCE through disturbance of upland habitat to support food sources of CRLF and through elimination and/or disturbance of dispersal habitat.
Elimination and/or disturbance of dispersal habitat: Upland or riparian dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites which do not contain barriers to dispersal	**HM**	
Reduction and/or modification of food sources for terrestrial phase juveniles and adults	**HM**	The likelihood of reductions in the prey base of terrestrial-phase CRLF cannot be discounted; therefore, the determination is for a likely to adversely affect (LAA) the third terrestrial-phase CRLF PCE through reduction and/or modification of food sources for terrestrial-phase juvenile and adult CRLF.
Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	**HM**	Although direct effects to the terrestrial-phase CRLF are not considered likely, indirect effects through reductions in the availability of its food items are considered likely to adversely affect the species; therefore, the determination is for a likely to adversely affect (LAA) the fourth terrestrial-phase PCE.

[5] Physico-chemical water quality parameters such as salinity, pH, and hardness are not evaluated because these processes are not biologically mediated and, therefore, are not relevant to the endpoints included in this assessment.

1 NE = No effect; HM = Habitat modification

The overall determination for the effects of propyzamide on the CRLF is LAA. Based on the conclusions of this assessment, a formal consultation with the U. S. Fish and Wildlife Service under Section 7 of the Endangered Species Act should be initiated.

When evaluating the significance of this risk assessment's direct/indirect and adverse habitat modification effects determinations, it is important to note that pesticide exposures and predicted risks to the species and its resources (*i.e.*, food and habitat) are not expected to be uniform across the action area. In fact, given the assumptions of drift and downstream transport (*i.e.*, attenuation with distance), pesticide exposure and associated risks to the species and its resources are expected to decrease with increasing distance away from the treated field or site of application. Evaluation of the implication of this non-uniform distribution of risk to the species would require information and assessment techniques that are not currently available. Examples of such information and methodology required for this type of analysis would include the following:

- Enhanced information on the density and distribution of CRLF life stages within specific recovery units and/or designated critical habitat within the action area. This information would allow for quantitative extrapolation of the present risk assessment's predictions of individual effects to the proportion of the population extant within geographical areas where those effects are predicted. Furthermore, such population information would allow for a more comprehensive evaluation of the significance of potential resource impairment to individuals of the species.
- Quantitative information on prey base requirements for individual aquatic- and terrestrial-phase frogs. While existing information provides a preliminary picture of the types of food sources utilized by the frog, it does not establish minimal requirements to sustain healthy individuals at varying life stages. Such information could be used to establish biologically relevant thresholds of effects on the prey base, and ultimately establish geographical limits to those effects. This information could be used together with the density data discussed above to characterize the likelihood of adverse effects to individuals.
- Information on population responses of prey base organisms to the pesticide. Currently, methodologies are limited to predicting exposures and likely levels of direct mortality, growth or reproductive impairment immediately following exposure to the pesticide. The degree to which repeated exposure events and the inherent demographic characteristics of the prey population play into the extent to which prey resources may recover is not predictable. An enhanced understanding of long-term prey responses to pesticide exposure would allow for a more refined determination of the magnitude and duration of resource impairment, and together with the information described above, a more complete prediction of effects to individual frogs and potential modification to critical habitat.

7.1 Action Area

7.1.1 Areas indirectly affected by the Federal action

The initial action area for propyzamide was previously discussed in Section 2.7 and depicted in **Figure 2.8** of the problem formulation. Typically, in order to determine the extent of the action area in lotic (flowing) aquatic habitats, uses resulting in the greatest ratios of the RQ to the LOC for any endpoint for aquatic organisms is used to determine the distance downstream for concentrations to be diluted below levels that would be of concern (*i.e*. result in RQs above the LOC). However, since none of the aquatic organism RQ values exceeded LOCs, downstream dilution is not considered in this assessment.

When considering the terrestrial habitats of the CRLF, spray drift from use sites onto non-target areas could potentially result in exposures of the CRLF, its prey and its habitat to propyzamide. Therefore, it is necessary to estimate the distance from the application site where spray drift exposures do not result in LOC exceedances for organisms within the terrestrial habitat. To account for this, first, the propyzamide application rate that does not result in an LOC exceedance is calculated for each terrestrial taxa of concern. The Gaussian extension of AGDISP is then used to determine the distance required to reach EECs not exceeding any LOCs. These values are defined for each use in **Table 7.3**.

Table 7.3. Spray drift buffer distances used to determine the extent of terrestrial action area for uses of propyzamide.

Land Cover	Max App. Rate	Spray Method	Buffer Distance
Cultivated Crops	4.08 lbs a.i./A	Aerial	11,000 ft
Orchards/vineyards	4.08 lbs a.i./A	Ground	16,200 ft
Turf	1.53 lbs a.i./A	Ground	9,620 ft
Pasture	0.510 lbs a.i./A	Aerial	4,240 ft

To understand the area indirectly affected by the federal action due to spray drift from application areas of propyzamide, land covers are considered as potential application areas. These areas are "buffered" using ArcGIS 9.2. In this process, the original land cover is modified by expanding the border of each polygon representing a field out to a designated distance, which in this case, is the distance estimated where propyzamide in spray drift does not exceed any LOCs. This effectively expands the action area relevant to terrestrial habitats so that it includes the area directly affected by the federal action, and the area indirectly affected by the federal action.

7.1.2 Areas indirectly affected by the Federal action

In order to define the final action areas relevant to uses of propyzamide, it is necessary to combine areas directly affected, as well as aquatic and terrestrial habitats indirectly affected by the federal action. This is done separately for each use with ArcGIS 9.2. Landcovers representing areas directly affected by propyzamide applications are overlapped with indirectly affected aquatic habitats (if determined by down stream dilution modeling) and with indirectly affected terrestrial habitats (if determined by spray drift modeling). It is assumed that lentic (standing water) aquatic habitats (*e.g*. ponds, pools, marshes) overlapping with the terrestrial areas are also indirectly affected by the federal action. The result is a final action area for propyzamide uses on agricultural lands, orchards and vineyards, pastures, and turf. The final action areas of concern for this assessment are depicted for each land cover in **Figures 7.1-7.4**.

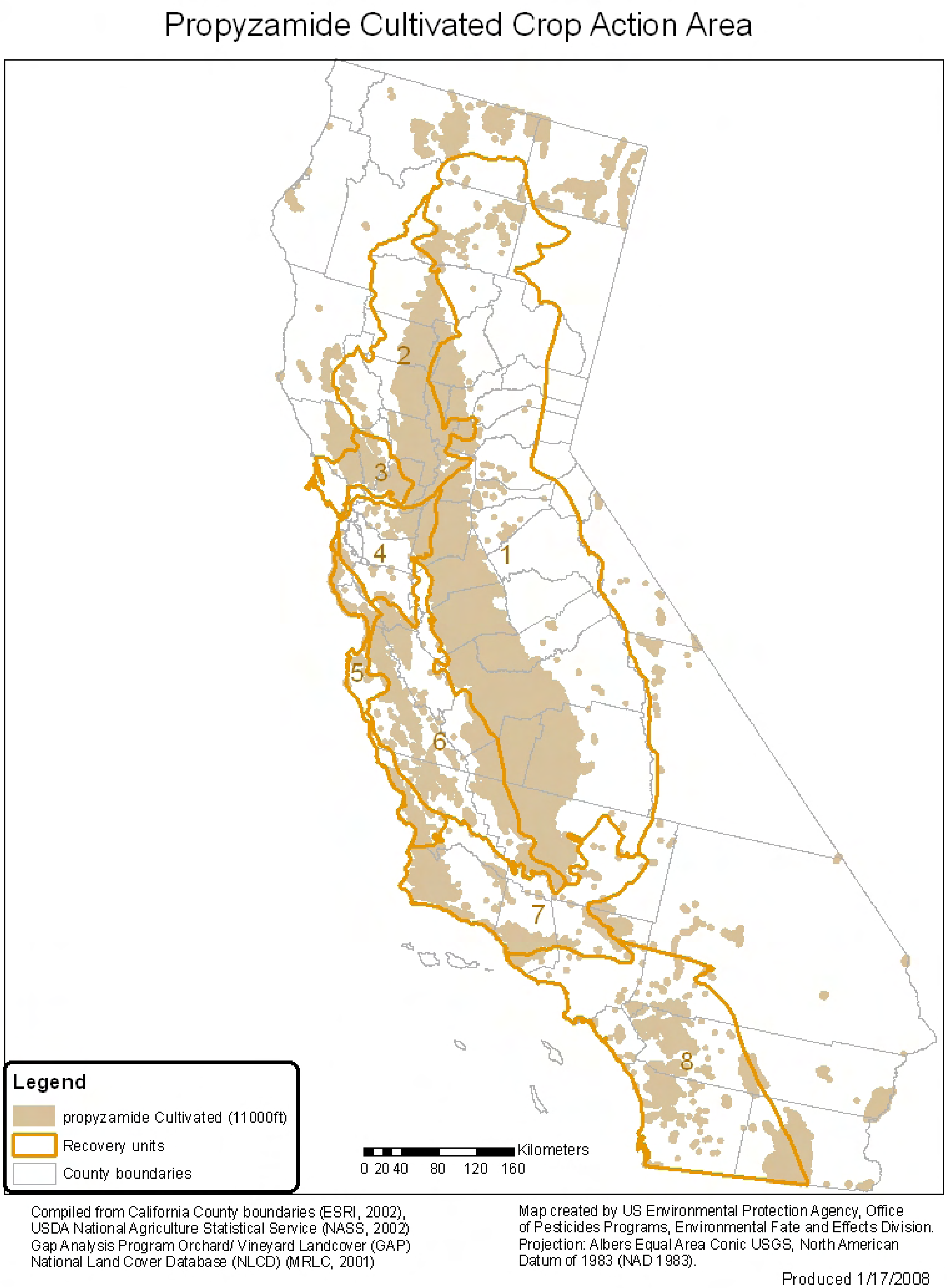


Figure 7.1. Final action area for agricultural uses of propyzamide.

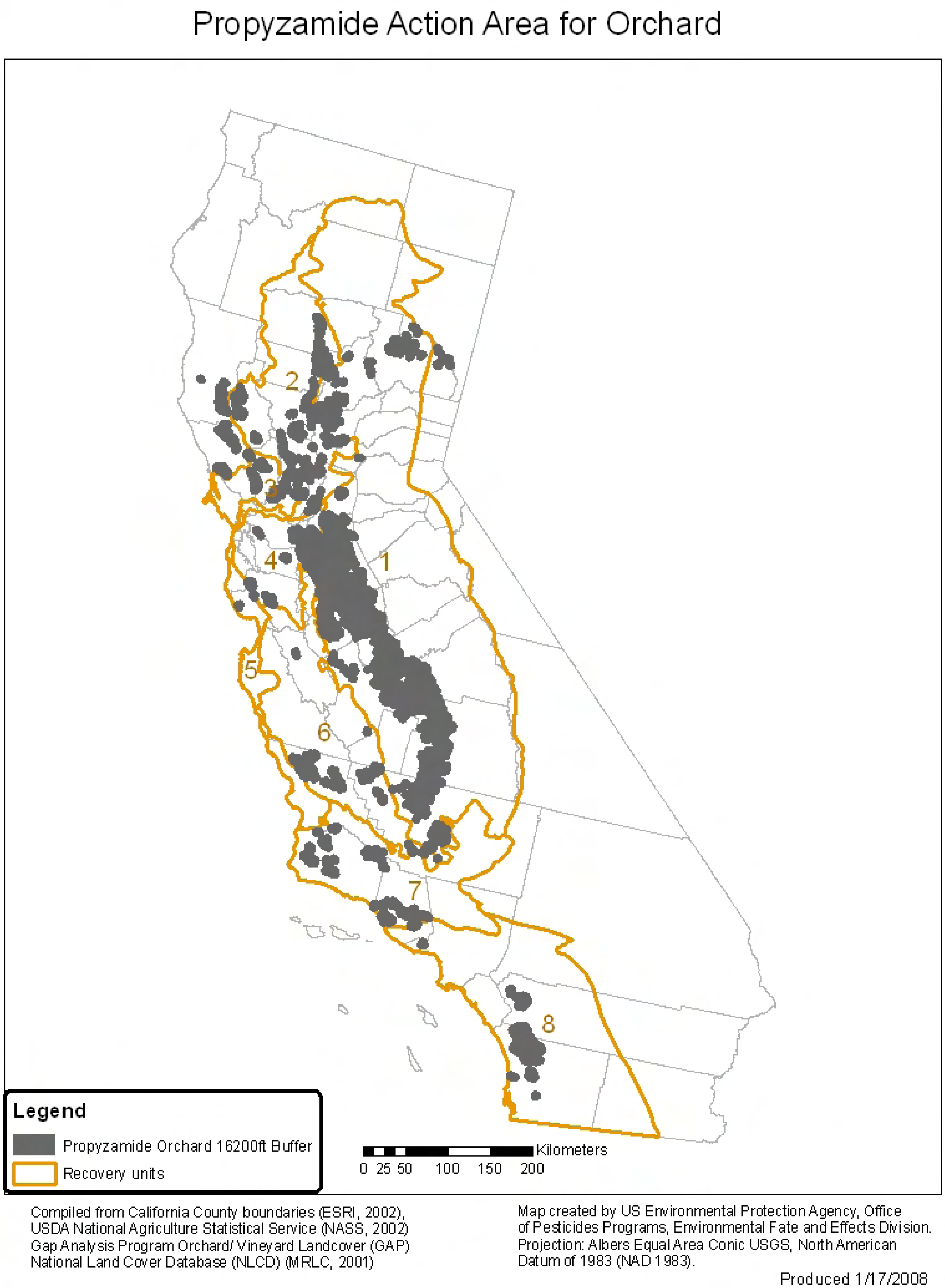


Figure 7.2. Final action area for orchard and vineyard uses of propyzamide.

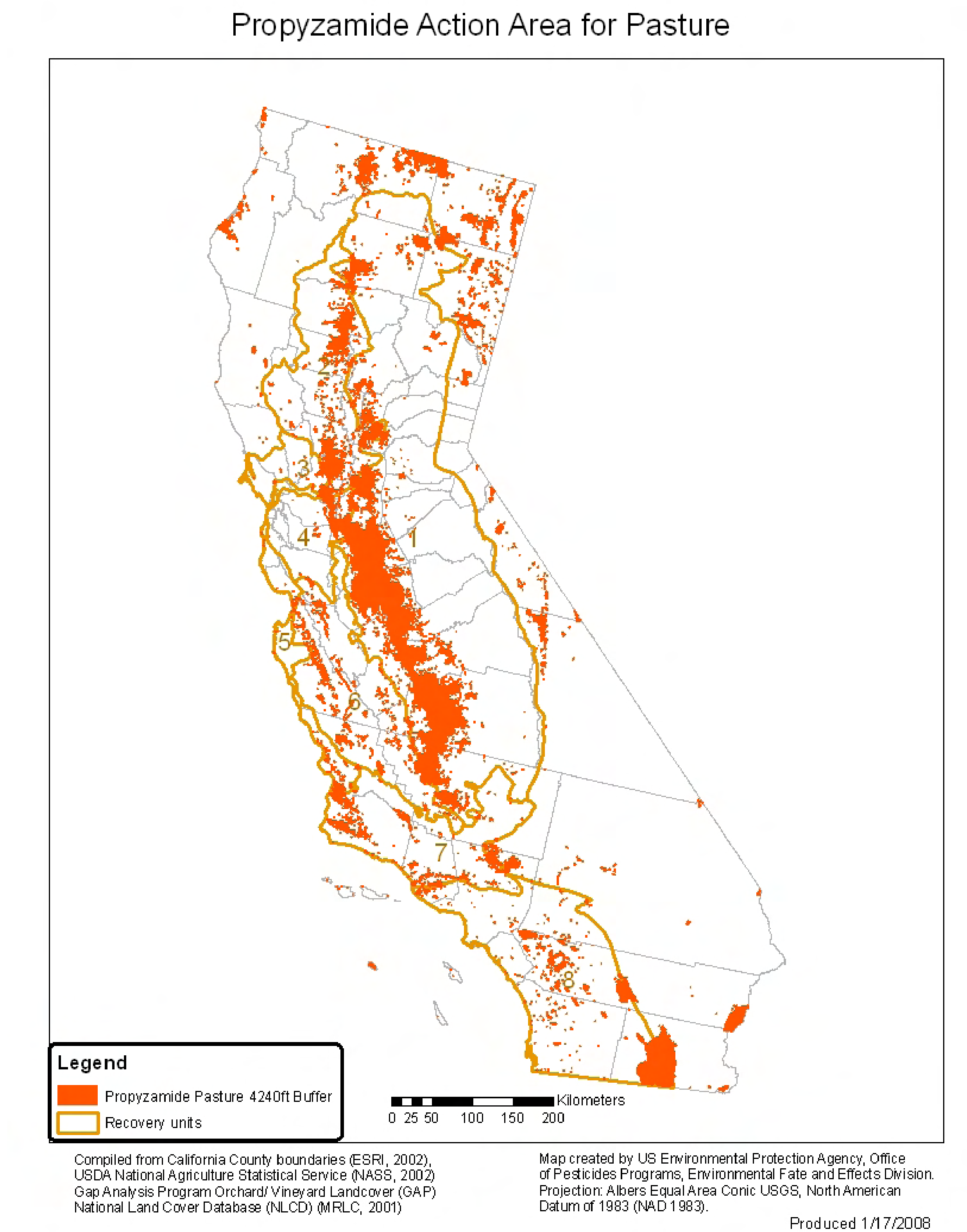


Figure 7.3. Final action area for pasture uses of propyzamide.

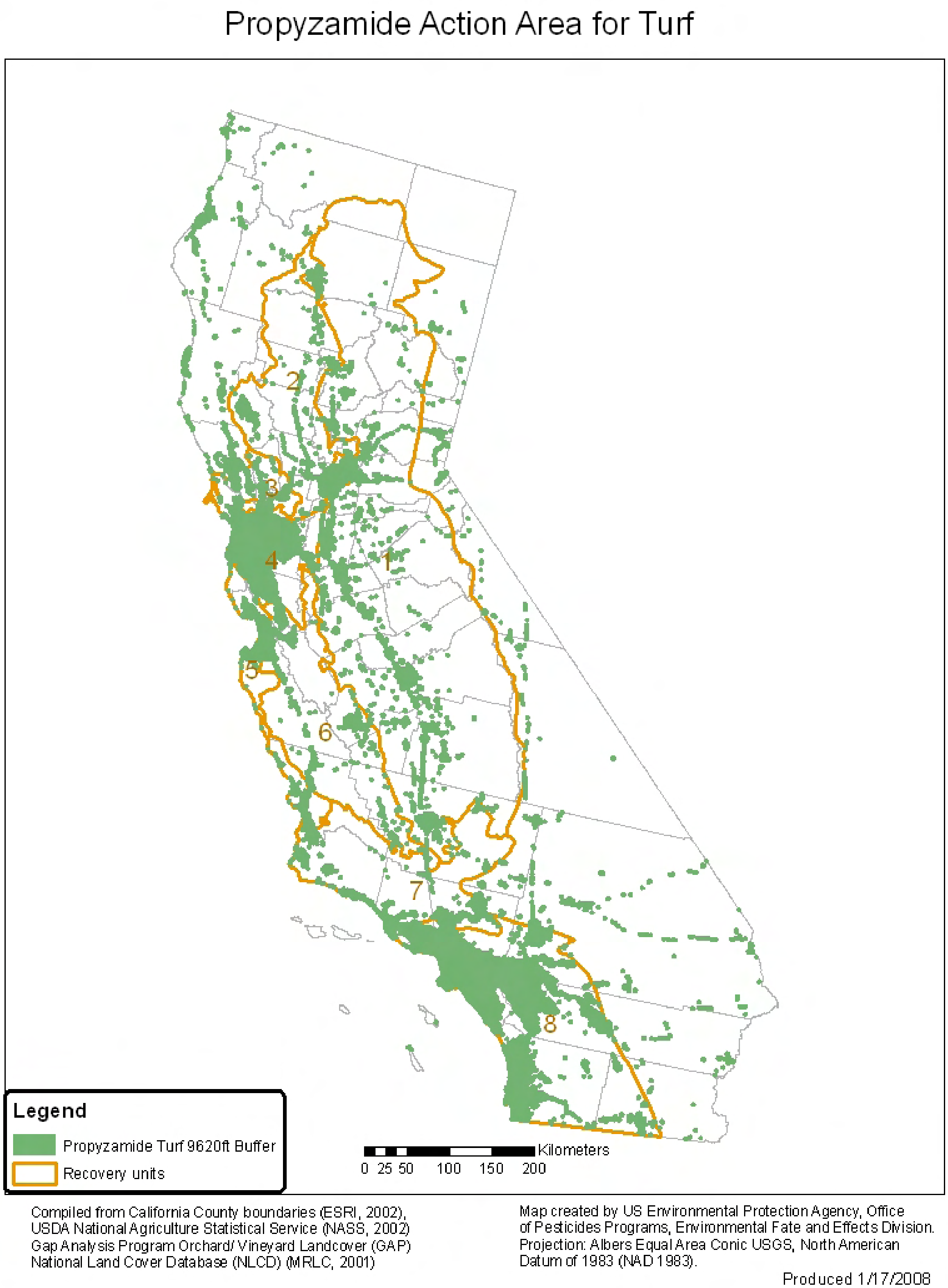


Figure 7.4. Final action area for turf uses of propyzamide.

7.1.2 Determination of overlap between propyzamide action area and CRLF habitat

There are three types of CRLF habitat areas considered in this assessment: Critical Habitat (CH); Core Areas; and California Natural Diversity Database (CNDDB) occurrence sections (EPA Region 9) (**Figure 7.5**). Critical habitat areas were obtained from the U.S. Fish and Wildlife Service's (USFWS) final designation of critical habitat for the CRLF (USFWS 2006). Core areas were obtained from USFWS's Recovery Plan for the CRLF (USFWS 2002). The occurrence sections represent an EPA-derived subset of occurrences noted in the CNDDB. They are generalized by the Meridian Range and Township Section (MTRS) one square mile units so that individual habitat areas are obfuscated. As such, only occurrence section counts are provided and not the area potentially affected.

In order to confirm that uses of propyzamide have the potential to affect CRLF through direct applications to target areas and runoff and spray drift to non-target areas, it is necessary to determine whether or not the final action areas for propyzamide uses overlap with CRLF habitats. Spatial analysis using ArcGIS 9.2 indicates that terrestrial habitats (and potentially lentic aquatic habitats) of the final action areas overlap with the core areas, critical habitat and available occurrence data for CRLF. The spatial overlap of each land cover on each recovery unit is listed in **Table 7.4** followed by more detailed tabulation on the county scale. The overlap of CRLF core areas, critical habitat, occurrences, and the total California action area are depicted in **Figure 7.6**, with magnified layouts of the recovery units depicted in **Appendix D**. Limitations and constraints associated with the geographic data sets used to assess the action area are discussed in **Appendix D**.

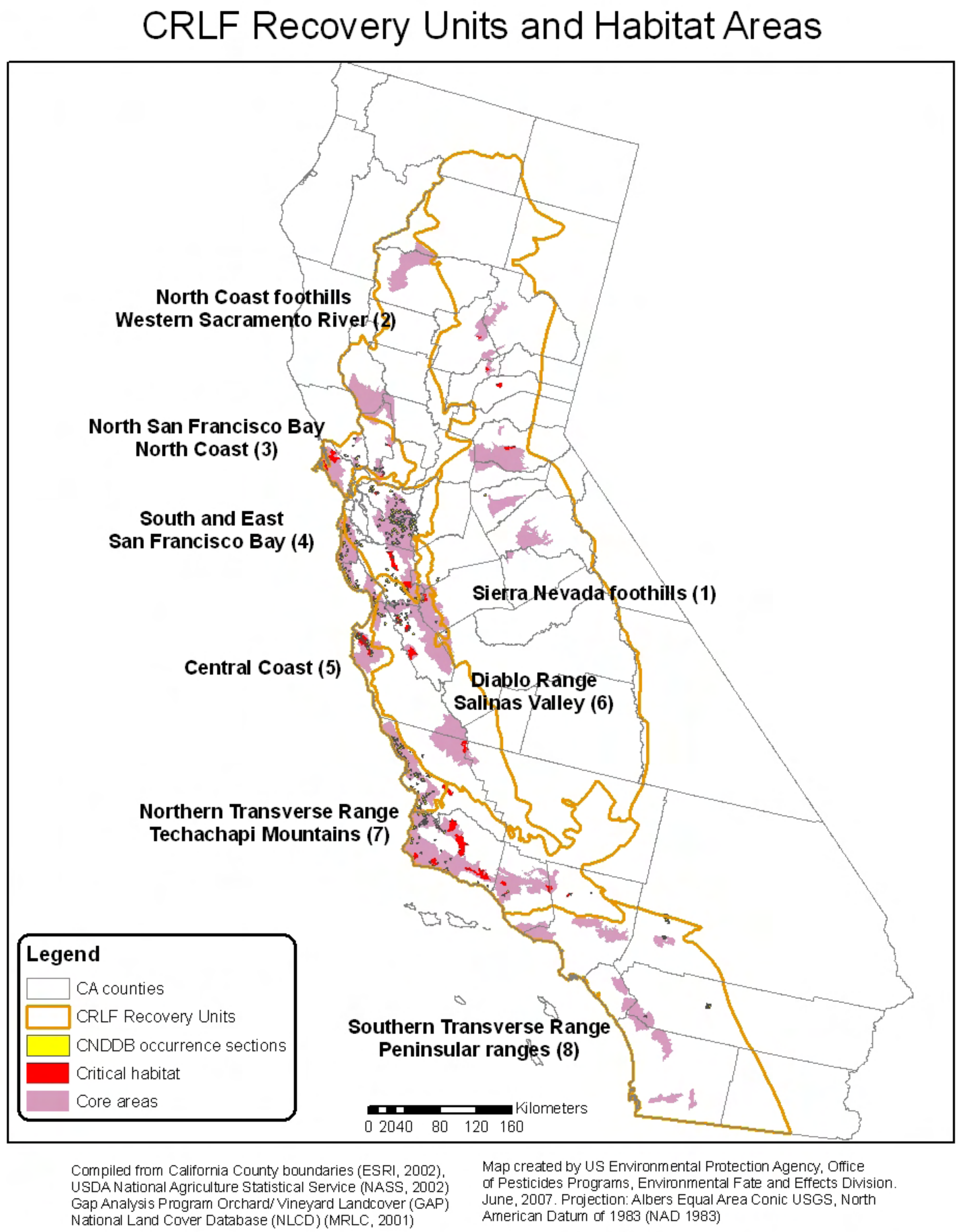


Figure 7.5. Recovery units and areas relevant to the CRLF.

Table 7.4. Spray drift action area & CRLF habitat overlap spatial summary results by recovery unit.									
Measure	**RU1**	**RU2**	**RU3**	**RU4**	**RU5**	**RU6**	**RU7**	**RU8**	**Total**
Established species habitat area (CH plus core in sq km)	2894	1224	1244	3228	3712	4921	4840	1377	23440
Established occurrence sections (972 total; 30 outside recovery units)	13	3	70	328	281	122	92	33	942
Cultivated crop use (11,000-ft buffer)									
Overlapping habitat area (sq km)	761	65	254	953	2305	1931	2466	404	9142
Percent area affected	*26%*	*5%*	*20%*	*30%*	*62%*	*39%*	*51%*	*29%*	*39%*
# Occurrence sections affected	2	0	32	144	243	81	80	28	610
Orchard/vineyard use (16,200-ft buffer)									
Overlapping habitat area (sq km)	393	0	47	354	147	375	1241	517	3074
Percent area affected	*14%*	*0%*	*4%*	*11%*	*4%*	*8%*	*26%*	*28%*	*13%*
# Occurrence sections affected	2	0	17	93	27	16	27	4	186
Pasture use (4,240-ft buffer)									
Overlapping habitat area (sq km)	155	216	27	120	539	579	1082	100	2818
Percent area affected	*5%*	*18%*	*2%*	*4%*	*15%*	*12%*	*22%*	*7%*	*12%*
# Occurrence sections affected	2	0	4	45	99	38	54	14	256
Turf use (9,620-ft buffer)									
Overlapping habitat area (sq km)	378	108	530	1764	1400	878	1370	778	7006
Percent area affected	*13%*	*9%*	*43%*	*55%*	*38%*	*18%*	*28%*	*57%*	*30%*
# Occurrence sections affected	5	1	53	239	192	51	69	26	636

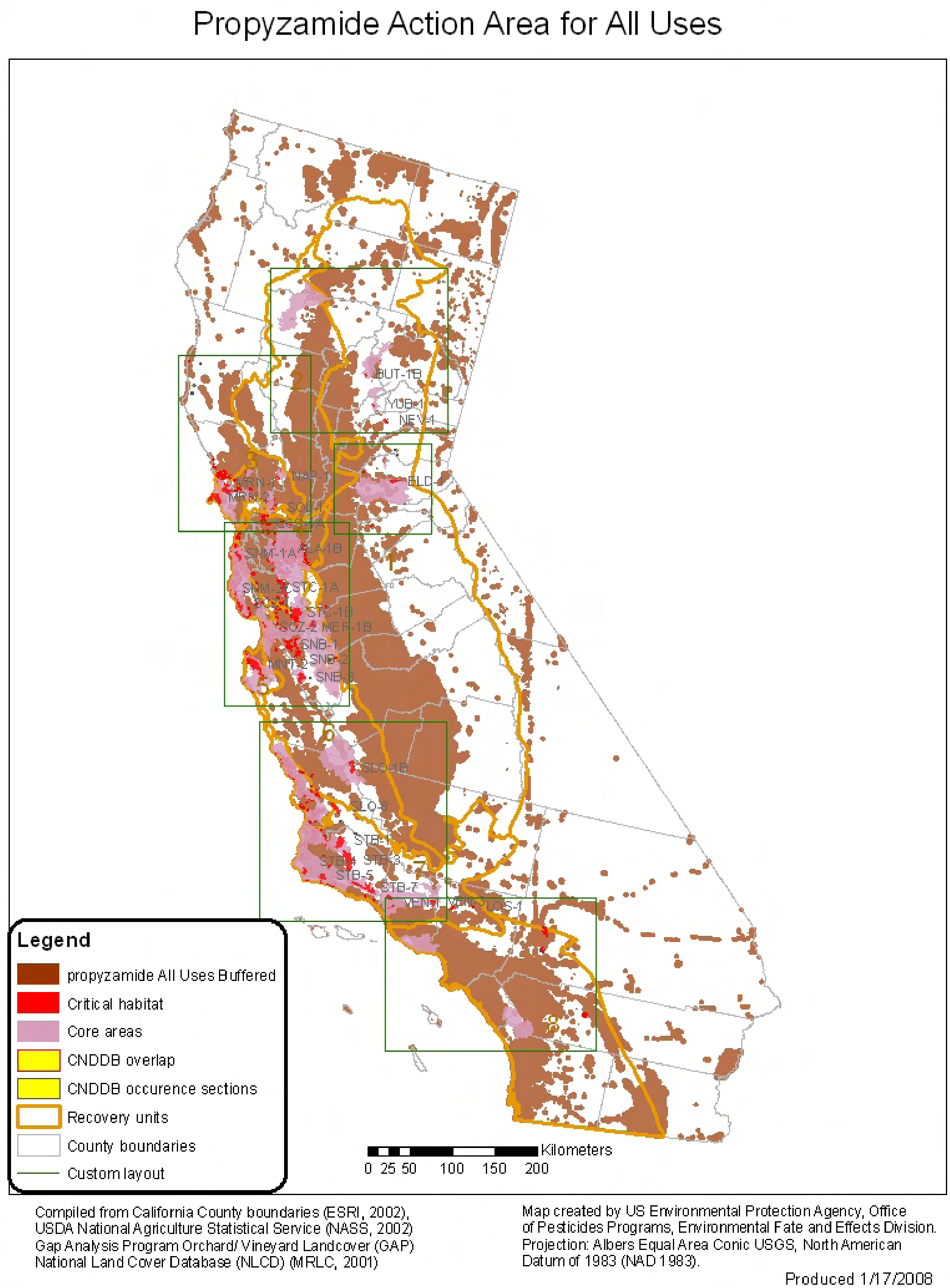


Figure 7.6. Map of overlap between action area for propyzamide and CRLF core areas and critical habitat.

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