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

Pesticide Effects Determination

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1.0 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, Rodenticide, Act (FIFRA) regulatory actions regarding use of triclopyr 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 (U.S. FWS) and National Marine Fisheries Service (NMFS) Endangered Species Consultation Handbook (U.S. FWS/NMFS 1998) and procedures outlined in the Agency's Overview Document (U.S. EPA 2004).

The CRLF was listed as a threatened species by U.S. FWS 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 (U.S. FWS 1996) in California.

Triclopyr [((3,5,6-trichloro-2-pyridinyl)oxy)acetic acid] is a systemic non-selective herbicide used to control broadleaf weeds and woody plants. It is a member of the pyridinyloxyacetic acid chemical family, and the picolinic acid group, whose mode of action is growth regulation, resulting in abnormal growth of plants. Triclopyr acid is formulated as a manufacturing use product, and there are currently no pesticide uses for triclopyr acid itself. Triclopyr acid is formulated into two end use products; triclopyr butoxyethyl ester (triclopyr BEE, [((3,5,6-trichloro-2-pyridinyl)oxy)-2-butoxyethyl ester]) and triclopyr triethylamine salt (triclopyr TEA, [((3,5,6-trichloro-2-pyridinyl)oxy)acetic acid triethylamine)]). As a result, there are three PC codes associated with triclopyr. For triclopyr acid the PC code is 116001, for triclopyr triethylamine salt (TEA) the PC code is 116002, and for triclopyr butoxyethyl ester (BEE) the PC code is 116004. Formulation types registered include emulsifiable concentrate, liquid, and granular. Currently, labeled uses of triclopyr include rice, waterways, pasture, wetlands, orchard stump treatments, ornamentals, forests, rights-of-way, commercial and industrial outdoor premises and lawns, and residential outdoor premises and lawns. All of these uses are considered as part of the federal action evaluated in this assessment.

Both triclopyr TEA and BEE active ingredients are formulated from triclopyr acid, and they both rapidly degrade back to triclopyr acid within an aqueous environment. Triclopyr TEA rapidly dissociates in water to the triclopyr acid/anion and triethanolamine. Triclopyr BEE rapidly hydrolyzes in the environment to the triclopyr acid/anion and butoxyethanol. Both triethanolamine and butoxyethanol are also rapidly dissipated by microbial degradation. In pHs > 5 the triclopyr acid will dissociate completely leaving the triclopyr anion as the moiety that is predominantly present. Therefore, triclopyr anion will be the predominant moiety present in the environment when products containing either triclopyr BEE or triclopyr TEA are used. For this assessment, the direct and indirect effects of triclopyr (acid, TEA, and BEE) on the CRLF will be examined in terms of the triclopyr acid equivalent incorporating both triclopyr TEA and BEE.

In the environment the triclopyr acid/anion is somewhat persistent, and is mobile. For triclopyr the predominant degradation pathway in water is photodegradation, and the predominant degradation pathway in soil is microbial degradation to the major degradate 3,5,6-trichloro-2-pyridinol (TCP), which is both persistent and mobile. Triclopyr acid is non-volatile (vapor pressure 1.26×10^{-6} mm Hg) and highly soluble (water solubility of 440 mg/L [WSSA, 1989]). It is stable to hydrolysis and anaerobic aquatic metabolism, and does not bioaccumulate in aquatic organisms. In lab studies triclopyr acid photodegrades rapidly (less than 1 day) with TCP as the major degradate, whereas in field studies (aquatic conditions) it photodegrades in less than 5 days. In aerobic soil triclopyr acid degrades in 8-18 days to TCP and 3,5,6-trichloro-2-methoxypyridine (TMP), ultimately degrading to carbon dioxide.

The degradation products TCP and TMP were recovered in the terrestrial field dissipation studies, with TCP found at higher concentrations than TMP in both the bare and vegetated soil plots. In the forestry studies, TCP was generally limited to the upper 30 cm of the soil, with sporadic detections in deeper soil depths. Based on these observations it appears that TCP is persistent and mobile in the field. However, the TCP endpoints (in terms of acid equivalency) are not more sensitive than the lowest triclopyr endpoints, and as a result, TCP is not considered to be of toxicological concern and will not be further evaluated in this assessment.

Since CRLFs exist within aquatic and terrestrial habitats, exposure of the CRLF, its prey and its habitats to triclopyr acid are assessed separately for the two habitats. Tier-II aquatic exposure models are used to estimate high-end exposures of triclopyr in aquatic habitats resulting from runoff and spray drift from different uses. Peak model-estimated environmental concentrations resulting from different triclopyr uses range from 5.26 to 2500 µg/L. In addition to the Tier II PRZM/EXAMS model, the Tier I Rice model was used for all of the uses where triclopyr was applied directly to water. Both of these methods were very conservative due to assumptions made regarding application intervals and the number of allowable applications per year since these values were not explicitly defined on the labels. For further information on how these were determined, please see Section 3.2.

These estimates are usually supplemented with analysis of available California surface water monitoring data from U. S. Geological Survey's National Water Quality Assessment (NAWQA) program and the California Department of Pesticide Regulation (CDPR). The NAWQA database did not have any samples containing triclopyr for groundwater or surface water. The CDPR collected samples of triclopyr from surface water in six California counties from March 1993 to March 2006. Out of 583 samples, 102 samples contained triclopyr. The highest concentration detected was 14.5 ppb. This value is approximately 167 times *less than* the maximum model-estimated environmental concentration (2500 ppb). The mean concentration for all counties was found to be 1.7 ppb.

To estimate triclopyr exposures to the terrestrial-phase CRLF, and its potential prey resulting from uses involving triclopyr applications, the T-REX model is used for both foliar and granular uses. The AgDRIFT model is also used to estimate deposition of triclopyr on terrestrial and aquatic habitats from spray drift. The TerrPlant model is used to estimate triclopyr exposures to terrestrial-phase CRLF habitat, including plants inhabiting semi-aquatic and dry areas, resulting from uses involving foliar triclopyr applications. The T-HERPS model is used to allow for further characterization of dietary exposures of terrestrial-phase CRLFs.

The effects determination 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 triclopyr 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 each particular type of effect are below LOCs, the pesticide is determined to have "no effect" on the CRLF. 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 triclopyr 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. Similarly for critical habitat, additional information is considered to refine the potential for exposure and effects to distinguish those actions that do or do not result in modification of its critical habitat.

Based on the best available information, the Agency makes a **May Affect, and Likely to Adversely Affect determination for the CRLF based on the direct and indirect**

effects to the aquatic and terrestrial-phase CRLF from the use of triclopyr. Additionally, the Agency has determined that there is the potential for modification of CRLF designated critical habitat from the use of triclopyr. A summary of the risk conclusions and effects determinations for the CRLF and its critical habitat is presented in Table 1-1 and Table 1-2. Use-specific determinations for direct and indirect effects to the CRLF are provided in Table 1-3 and Table 1-4. 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 Triclopyr Use and the CRLF

Assessment Endpoint	Effects Determination [1]	Basis for Determination
Survival, growth, and/or reproduction of CRLF individuals		**Potential for Direct Effects**
	LAA	***Aquatic-phase (Eggs, Larvae, and Adults)***: The aquatic phase amphibian acute LOCs for listed species (0.05) are exceeded for most uses of triclopyr in California. The chance of individual mortality for which the RQs exceed the LOC (0.05) range from approximately 1 in $2.51*10^6$ (<1%) at an RQ of 0.08 (Ornamental sod farm, turf) to 1 in 1 (100%) at an RQ of 9.62 (Lakes/ponds/reservoirs). The chronic RQs for most uses of triclopyr exceed the chronic species LOC (1.0), and range from 131.58 (Lakes/ponds/reservoirs) to 0.21 for (Ornamental lawns and turf).
	LAA	***Terrestrial-phase (Juveniles and Adults)***: Acute dietary-based RQs exceed the acute listed species LOC (0.1) for all uses of triclopyr except rice. The chance of individual mortality for which the RQs exceed the LOC (0.1) range from approximately 1 in $1.21*10^3$ (<1%) at an RQ 0.20 (Douglas-Fir, Forest/Shelterbelt) to approximately 1 in 1.03 (100%) at an RQ of 2.70 (Agricultural Uncultivated Areas). For refined dose-based RQs for CRLFs of varying weights (1.4g, 37g, and 238g) the chance of individual mortality for which the RQs exceed the LOC (0.1) range from approximately 1 in $2.94*10^5$ (<1%) at an RQ of 0.10 (Agricultural Uncultivated Areas, small insectivore mammals weighing 15g, 238g CRLF) to approximately 1 in 1 (100%) at an RQ of 10.3 (Agricultural Uncultivated Areas, small herbivore mammals weighing 15g, 37g CRLF), and from approximately 1 in $9.56*10^3$ (<1%) at an RQ 0.15 (Forest Tree/Pest Management, small insects 238 g CRLF) to approximately 1 in 1 (100%) at an RQ of 16.61 (Agricultural Uncultivated Areas, small herbivore mammals weighing 35g, 37g CRLF). These ranges of RQs is relevant to all sizes of CRLF consuming small insects, and small herbivore and insectivore mammals (mammals weighing 15g or 35g), for uses in which there were exceedances. Refined chronic dietary-based RQs for CRLFs consuming small insects exceed the chronic species LOC (1.0) for all foliar application uses of triclopyr except rice. Refined chronic dietary-based RQs for CRLFs consuming small herbivore mammals (either 15g or 35g) exceed the chronic species LOC (1.0) for all foliar application uses of triclopyr. Refined chronic dietary-based RQs for CRLFs consuming large insects, small insectivore mammals (either 15g or 35g), and small terrestrial-phase amphibians (weighing 2.3g) exceed the chronic species LOC (1.0) for foliar uses of triclopyr with application rates greater than or equal to 8 lb ae/A. For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for birds weighing 20 and 100g, ranging from 2.05 (Commercial/Industrial Lawns)

Assessment Endpoint	Effects Determination [1]	Basis for Determination
		to 0.32 (Ornamental Lawns and Turf) for 20g birds, and 1.04 (Commercial/Industrial Lawns) to 0.16 (Ornamental Lawns and Turf) for 100g birds. The probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 1.09 (92%) at an RQ of 2.05 (Commercial/Industrial Lawns) to 1 in 1.88 (53%) at an RQ of 1.04 (Ornamental Lawns and Turf) for birds weighing 20g. For birds weighing 100 g LD_{50}/ft^2 the probability of individual effect at the endangered species LOC (0.1) ranges from 1 in $7.70*10^1$ (1.3%) at an RQ of 0.32 (Commercial/Industrial Lawns) to 1 in $5.85*10^3$ (0.02%) at an RQ of 0.16 (Ornamental Lawns and Turf).
		Potential for Indirect Effects
	LAA	***Aquatic prey items, aquatic habitat, cover and/or primary productivity*** LOCs for non-vascular plants are exceeded for most uses of triclopyr. The non-vascular plant RQs range from 35.71 for lakes/ponds/reservoirs to 0.08 for ornamental lawns and turf. LOCs for vascular plants are exceeded for many uses of triclopyr. The vascular plant RQs range from 2.91 for lakes/ponds/reservoirs to 0.01 for ornamental lawns and turf. LOCs for aquatic invertebrates are exceeded for most uses of triclopyr. The acute RQs range from 10.00 (Lakes/ponds/reservoirs) to 0.02 (Ornamental lawns and turf). Population reduction in aquatic invertebrate prey items for the CRLF from application of triclopyr ranges from 100% (Lakes/ponds/reservoirs) to < 0.1% (Ornamental lawns and turf). The chronic RQs range from 0.10 for lakes/ponds/reservoirs to <0.01 for ornamental lawns and turf. For fish/and aquatic-phase amphibians most uses of triclopyr exceed the acute and chronic LOCs for listed species (acute, 0.05 and chronic, 1.0). The RQs range from 0.02 (Ornamental lawns and turf) to 9.62 (Lakes/ponds/reservoirs). The chronic RQs range from 131.58 (Lakes/ponds/reservoirs) to 0.21 for (Ornamental lawns and turf).
	LAA	***Terrestrial prey items, riparian habitat*** RQs could not be calculated for terrestrial invertebrates as the toxicity endpoint was not a definitive value. But because the calculated terrestrial small insect EEC's exceed the highest levels tested, there is a potential indirect impact to the terrestrial-phase CRLF from a reduction of invertebrate food items. For small terrestrial mammals, the acute dose-based RQs exceed the acute risk LOC (0.1) for all foliar application uses of triclopyr ranging from 10.7 (Agricultural Uncultivated Areas) to 0.11 (Rice). Both dietary and dose-based chronic RQs exceed the chronic risk LOC (1.0) for all foliar application uses of triclopyr ranging from 1222.9 (Agricultural Uncultivated Areas) to 13.1 (Rice) [Dose-based] and 141 (Agricultural Uncultivated Areas) to 1.51 (Rice) [Dietary-based]. Population reduction in small mammal prey items for the CRLF from application of triclopyr ranges from 100% (agricultural uncultivated areas) to 0.0008% (rice) for foliar applications of triclopyr. For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for mammals weighing 15g and 35g, ranging from 0.83 (Commercial/Industrial Lawns) to 0.42 (Ornamental Lawns and Turf) for mammals weighing 15g, and 0.44 (Commercial/Industrial Lawns) to 0.22 (Ornamental Lawns and Turf) for mammals weighing 35g. Population reduction in small mammal prey items for

Assessment Endpoint	Effects Determination [1]	Basis for Determination
		the CRLF from application of triclopyr ranges from 36% (Commercial/Industrial Lawns) to 0.15% (Ornamental Lawns and Turf) for granular applications of triclopyr to mammals weighing 15g and 35g. The refined acute RQs (dietary- and dose-based) for small terrestrial-phase amphibians did not exceed the listed species LOC (0.1) for any use of triclopyr. However, the refined chronic dietary-based RQs exceed the chronic species LOC (1.0) for small terrestrial-phase amphibians (weighing 2.3g) for foliar uses of triclopyr with application rates greater than or equal to 8 lb ae/A. Reduction in amphibian prey items, specifically other frogs may potentially be affected from chronic exposure of triclopyr as the result of triclopyr use. The RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr both foliar (aerial and ground) and granular applications. RQs for non-target terrestrial monocots and dicot plants inhabiting upland dry areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr except rice both foliar (aerial and ground) and granular applications. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for dicot non-target species for all uses of triclopyr. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for monocots for all uses except rice uses. Ground foliar applications result in spray drift RQ exceedances for both monocots and dicots for all uses except rice.

[1] No effect (NE); May affect, but not likely to adversely affect (NLAA); May affect, likely to adversely affect (LAA)

Table 1-2 Effects Determination Summary for Triclopyr Use and CRLF Critical Habitat Impact Analysis

Assessment Endpoint	Effects Determination [1]	Basis for Determination
Modification of aquatic-phase PCE	**Habitat Modification**	Due to aquatic vascular and terrestrial plant communities being reduced from a majority of use sites, there is potential for alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond. These plant communities provide shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs. In addition, there is potential for 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. LOCs are exceeded for terrestrial riparian plants and for aquatic vascular plants from exposure to triclopyr from spray drift. LOCs for non-vascular plants are exceeded for many uses of triclopyr.
Modification of terrestrial-phase PCE	**Habitat Modification**	The use of triclopyr at all sites may create the following effects to PCE: elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs, elimination and/or disturbance of dispersal habitat, reduction and/or modification of food sources for terrestrial phase juveniles and adults, and alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source. The RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr both foliar (aerial and ground) and granular applications. RQs for

Assessment Endpoint	Effects Determination [1]	Basis for Determination
		non-target terrestrial monocots and dicot plants inhabiting upland dry areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr except rice both foliar (aerial and ground) and granular applications. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for dicot non-target species for all uses of triclopyr. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for monocots for all uses except and rice. Ground foliar applications result in spray drift RQ exceedances for both monocots and dicots for all uses except rice. The use of triclopyr on most use sites will exceed the refined acute dietary- and dose-based LOC and chronic LOC for prey food items of small mammals, and invertebrates (foliar and granular applications). Food sources for the CRLF are reduced, and the CRLF is indirectly affected from this reduction.

[1] Habitat Modification or No effect (NE)

Table 1-3 Triclopyr Use-specific Direct Effects Determinations[1] for the CRLF

Use(s)	Aquatic Habitat		Terrestrial Habitat	
	Acute	Chronic	Acute	Chronic
Agricultural Uncultivated Areas (Max. Foliar)	LAA	LAA	LAA	LAA
Forest Tree/Pest Management (Median Foliar)	LAA	LAA	LAA	LAA
Douglas-Fir (Forest/Shelterbelt) (Median Foliar)	LAA	LAA	LAA	LAA
Rice (Min Foliar)	LAA	LAA	NLAA	LAA
Commercial/Industrial Lawns (Max. Granular)	LAA	LAA	LLA	LAA
Ornamental Lawns and Turf (Min Granular)	NLAA	NLAA	LAA	LAA

[1] NE = No effect; NLAA = May affect, but not likely to adversely affect; LAA = Likely to adversely affect

Table 1-4 Triclopyr Use-specific Indirect Effects Determinations[1] Based on Effects to Prey

Use(s)	Algae	Aquatic Invertebrates		Terrestrial Invertebrates (Acute)	Aquatic-phase frogs and fish		Terrestrial-phase frogs		Small Mammals	
		Acute	Chronic		Acute	Chronic	Acute	Chronic	Acute	Chronic
Agricultural Uncultivated Areas (Max. Foliar)	LAA	LAA	NLAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Forest Tree/Pest Management (Median Foliar)	LAA	LAA	NLAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Douglas-Fir (Forest/Shelterbelt) (Median Foliar)	NLAA	LAA	NLAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Rice (Min Foliar)	LAA	LAA	NLAA	LAA	LAA	LAA	NLAA	LAA	NLAA	LAA
Commercial/Industrial Lawns (Max. Granular)	NLAA	LAA	NLAA	LAA	LAA	LAA	LAA	N/A	LAA	N/A
Ornamental Lawns and Turf (Min Granular)	NLAA	NLAA	NLAA	LAA	NLAA	NLAA	LAA	N/A	LAA	N/A

[1] NE = No effect; NLAA = May affect, not likely to adversely affect; LAA = Likely to adversely affect

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.

2.0 Problem Formulation

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

2.1 Purpose

The purpose of this endangered species assessment is to evaluate potential direct and indirect effects on individuals of the federally threatened California red-legged frog (*Rana aurora draytonii*) (CRLF) arising from FIFRA regulatory actions regarding use of triclopyr on rice, waterways, pasture, wetlands, orchard stump treatments, ornamentals, forests, rights-of-way, commercial and industrial outdoor premises and lawns, and residential outdoor premises and lawns. In addition, this assessment evaluates whether use on these sites 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 (U.S. EPA 2004). Screening level methods include use of standard models such as PRZM-EXAMS, Tier I Rice Model, T-REX, TerrPlant, and AgDRIFT all of which are described at length in the Overview Document. Additional refinements include the use of the T-HERPS model to predict concentrations of triclopyr granules in terrestrial invertebrates food items for terrestrial-phase CRLFs and mammals. Use of such information is consistent with the methodology described in the Overview Document (U.S. EPA 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 U.S. EPA 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 triclopyr 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 triclopyr 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 triclopyr 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 triclopyr 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 triclopyr.

If a determination is made that use of triclopyr 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 triclopyr use sites) and further evaluation of the potential impact of triclopyr 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 triclopyr is expected to directly impact living organisms within the action area (defined in Section 2.7), critical habitat analysis for triclopyr 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 triclopyr 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

Triclopyr is a systemic non-selective herbicide used to control broadleaf weeds and woody plants. It is a member of the pyridinyloxyacetic acid chemical family, and its mode of action is growth regulation, resulting in abnormal growth of plants. Formulation types that are registered include emulsifiable concentrate, liquid, and granular. Currently, the labeled uses of triclopyr include rice, waterways, pasture, wetlands, orchard stump treatments, ornamentals, forests, rights-of-way, commercial and industrial outdoor premises and lawns, and residential outdoor premises and lawns. All of these uses are considered as part of the federal action evaluated in this assessment.

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 triclopyr in accordance with the approved product labels for California is "the action" relevant to this ecological risk assessment.

Although current registrations of triclopyr allow for use nationwide, this ecological risk assessment and effects determination addresses currently registered uses of triclopyr 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.

Triclopyr acid is formulated as a manufacturing use product which is then formulated int two end use products; triclopyr butoxyethyl ester (triclopyr BEE) and triclopyr triethylamine salt (triclopyr TEA). Both triclopyr TEA and BEE active ingredients rapidly degrade back to triclopyr acid within an aqueous environment. Triclopyr TEA rapidly dissociates in water to the triclopyr acid/anion and triethanolamine. Triclopyr BEE rapidly hydrolyzes in the environment to the triclopyr acid/anion and butoxyethanol. Both triethanolamine and butoxyethanol are also rapidly dissipated by microbial degradation, and thus are not being evaluated any further in this assessment. Triclopyr acid forms the degradation products; 3,5,6-trichloro-2-pyridinal (TCP) and 3,5,6-trichloro-2-methoxypyridine (TMP) as a result of microbial degradation in aerobic soil. TMP is considered a minor degradate and TCP, although a major degradate, is not of toxicological concern since (in terms of acid equivalency) it is not more sensitive than the lowest triclopyr endpoints. As a result, neither TCP nor TMP will be further evaluated in this assessment.

The Agency does not routinely include, in its risk assessments, an evaluation of mixtures of active ingredients, either those mixtures of multiple active ingredients in product formulations or those in the applicator's tank. In the case of the product formulations of active ingredients (that is, a registered product containing more than one active ingredient), each active ingredient is subject to an individual risk assessment for regulatory decision regarding the active ingredient on a particular use site. If effects data are available for a formulated product containing more than one active ingredient, they may be used qualitatively or quantitatively in accordance with the Agency's Overview Document and the Services' Evaluation Memorandum (U.S. EPA 2004; U.S. FWS/NMFS 2004).

An analysis of the available open literature and acute mammalian toxicity data for multiple active ingredient products relative to the single active ingredient (triclopyr) is provided in Appendix B. The resulting analysis of the LD50 values and associated 95% confidence intervals (CIs) that are available for multiple active ingredient products containing triclopyr, found that toxicity of these compounds was not significantly different than the single active ingredient products of triclopyr alone. Therefore, the assessment is based on the toxicity of the single active ingredient of triclopyr.

As discussed in USEPA (2000) a quantitative component-based evaluation of mixture toxicity requires data of appropriate quality for each component of a mixture. In this mixture evaluation an LD50 with associated 95% Confidence Interval (CI) is needed for the formulated product. The same quality of data is also required for each component of the mixture. In the case of triclopyr, only one product (EPA Reg. No. 71085-29) has a definitive LD50 value with an associated 95% CI. In the case of EPA Reg No. 71085-29, the toxicity can be attributed to propanil (the other active ingredient in the formulated product). When the LD50 (1750 mg/kg) for this product and its confidence interval (1239-4450 mg/kg) are adjusted for the percent propanil (36.5%), the adjusted LD50 value of 639 mg/kg (CI: 452-1624 mg/kg), the adjusted confidence interval falls within the confidence interval for the propanil technical (868-1343 mg/kg), Appendix B.

Given that the active would not be expected to have similar mechanisms of action, metabolites or toxicokinetic behavior it is also reasonable to conclude that an assumption of dose-addition would be inappropriate. Consequently, an assessment of triclopyr's potential effect on the CRLF when it is co-formulated with other active ingredients can be based on the toxicity of triclopyr.

2.3 Previous Assessments

Triclopyr TEA was first registered on May 8, 1979 as an herbicide on non-crop areas and forestry use for the control of broadleaf weeds and woody plants. Triclopyr BEE was subsequently registered on June 11, 1980 for use on the same sites. Both formulations were registered for use on turf sites in 1984. On April 16, 1985, triclopyr BEE was registered for use on rangeland and permanent grass pastures. Most recently (January 11, 1995), triclopyr TEA was registered for use on rice to manage many hard to control broadleaf weed species.

At the time of the Reregistration Eligibility Decision (RED, 1998) an application for registration on aquatic use sites was pending. A Data Call-In Notice (DCI) was issued in August 1991 requiring the submission of product chemistry, residue chemistry, ecological and environmental fate data for both triclopyr TEA and BEE and toxicological data for TEA.

A Reregistration Eligibility Decision (RED) on triclopyr was issued in October 1998. This RED largely addressed the human health issues required by the Food Quality Protection Act but some ecological issues were raised as well. EPA worked with the registrant to define mitigation measures including label improvements to reflect lower maximum application rates and to implement spray drift management practices that would reduce calculated risks to non-target organisms. The highest application rate (12 lbs ae/A) used to calculate RQs would no longer be permitted. Rather, maximum application rates of 1-9 lbs ae/A would be used dependent on the type of site. Despite more restrictive application rates, the LOC was still exceeded for mammals (chronic), fish (BEE; acute) aquatic plants (BEE) and terrestrial plants.

The risks associated with a toxic metabolite of triclopyr, 3,5,6-trichloro-2-pyridinol (TCP), had not been fully characterized at the time of the RED. TCP data gaps were indicated and required for early life stage fish and aerobic aquatic metabolism. A TCP early life stage fish study has been submitted and rated as invalid. A TCP aerobic aquatic metabolism study has not been submitted.

In May 2004 the Agency completed an Effects Determination for 3 threatened or endangered Pacific anadromous salmon and steelhead based on triclopyr BEE uses in California forestry applications. That Effects Determination concluded that triclopyr BEE would have no effect on 1 ESU and was Not Likely to Adversely Affect the other 2 ESUs from registered uses on Forestry in California. In spite of the NLAA and No Effect findings, EPA initiated formal consultation with the National Marine Fisheries Service consistent with a Consent Decree in the litigation brought by the Californians for Alternatives to Pesticides (CATs v. EPA).

The Agency also completed an Effects Determination for 26 threatened and endangered Pacific anadromous salmon and steelhead in December 2004 based on all registered uses of triclopyr BEE in the Pacific Northwest and California, consistent with a court order in WTC v. EPA (Case No. 1:04-Cv-00126-Ckk, 2004). The results of that endangered species risk assessment showed that the use of triclopyr BEE may affect and was likely to adversely affect 16 Evolutionary Significant Units (ESUs) and may affect but is not likely to adversely affect 10 ESUs of Pacific salmon and steelhead when used according to labeled application directions (http://www.epa.gov/oppfead1/endanger/litstatus/effects/#trifluralin). The National Marine Fisheries Service has indicated it will review EPA's determinations regarding effects of triclopyr to the Pacific salmon and steelhead, and complete consultation with issuance of a Biological Opinion in November 2010.

2.4 Stressor Source and Distribution

2.4.1 Environmental Fate Assessment

Triclopyr TEA rapidly dissociates in water to the triclopyr acid/anion and triethanolamine. Triclopyr BEE rapidly hydrolyzes in the environment to the triclopyr acid/anion and butoxyethanol. Both triethanolamine and butoxyethanol are rapidly dissipated by microbial degradation. Triclopyr acid is a weak acid which will dissociate completely to the triclopyr anion at pHs > 5 (dissociation constant pKa 2.93). Therefore, the triclopyr anion will be the predominant moiety present in the environment when products containing either triclopyr BEE or triclopyr TEA are used. In the environment triclopyr acid/anion is somewhat persistent, and is mobile. For triclopyr the predominant degradation pathway in water is photodegradation, and the predominant degradation pathway in soil is microbial degradation to the major degradate 3,5,6-trichloro-2-pyridinal (TCP), which is both persistent and mobile, but (in terms of acid equivalency) it is not more sensitive than the endpoints used to evaluate ecological risk in this assessment (see Table 4-1 and Table 4-3, and Appendix A for endpoints).

Triclopyr TEA is a non-volatile, very soluble salt (vapor pressure < $1x10^{-8}$; solubility $4.12x10^{5}$ mg/L at pH 7). Triclopyr BEE is non-volatile (vapor pressure $3.6x10^{-6}$ mm Hg) and shows relatively low solubility (6.8 ppm). The primary degradation pathway for triclopyr TEA is dissociation to the triclopyr acid and triethanolamine. Triethanlamine is then degraded by aerobic microbial processes to CO_2 (soil half-life 5.6 – 13.7 days) (MRID 43837501). It is stable in aquatic conditions with a half-life 14-18 days and then proceeds to rapid degradation (MRID 43837503). Triethanolamine is stable to degradation under anaerobic aquatic conditions (half-life > 2 years). Because of the rapid microbial degradation under aerobic conditions, it is not expected that volatilization, photodegradation, or bioaccumulation in fish will contribute significantly to the dissipation of triethanolamine (MRID 41219101).

Triclopyr TEA will not persist as the salt under normal environmental conditions. In measurements of conductance of a solution of triclopyr TEA in water as a function of time, triclopyr TEA dissolved and dissociated completely to the acid within one minute. As a result, triclopyr TEA will be looked at with respect to the triclopyr acid.

The primary degradation pathway for triclopyr BEE is hydrolysis to triclopyr acid and 2-butoxyethanol, with hydrolysis occurring more rapidly at higher pHs (MRID 134174). 2-Butoxyethanol is then rapidly degraded by microbial processes (aerobic soil and aquatic) to 2-butoxyacetic acid (half-lives of 0.9 hrs – 1.4 hrs in soil; half-life of 0.6-3.4 days in a sediment/water mixture), with the final degradate as CO_2 (MRID 43799101). 2-Butoxyethanol and 2 butoxyacetic acid are somewhat more persistent under anaerobic aquatic conditions (half-lives of 1.4 and 73.3 days respectively in an anaerobic sediment/water mixture) with the final degradate as CO_2 (MRID 43799103). It is not expected that volatilization will contribute significantly to the dissipation of 2-butoxyethanol. Because of the rapid microbial degradation, it is not expected that photodegradation or bioaccumulation in fish will contribute significantly to the dissipation of butoxyethanol.

Triclopyr BEE will persist in the environment as the ester for only a limited duration. Triclopyr BEE hydrolyzed quickly to triclopyr acid in natural waters (pH 6.7; half-life of 0.5 days; MRID 134174). Supplemental information indicates that triclopyr BEE degrades to triclopyr acid with a half-life of about three hours when applied to silty clay loam, silt loam, and sandy loam soils. In all three soils, less than 3.2% of the applied triclopyr BEE in a terrestrial field dissipation study was detected at 1.1 days, while total triclopyr (BEE plus triclopyr) half-life was 10.6 days (MRID 43837503). Since triclopyr BEE also degrades relatively quickly to triclopyr acid, the acid will be focused on in the assessment.

Both triclopyr BEE and triclopyr TEA may produce TCP which is relatively mobile and persistent and has the potential to reach groundwater. Triclopyr and TCP do not adsorb to soil and sediment particles, and may be transported in surface waters; information from two aquatic field dissipation studies conducted on rice indicate that following application of triclopyr, TCP can persist in flood waters. However, toxicity data for the degradate indicates that when converted to the acid equivalent TCP is less toxic than the most sensitive endpoint for triclopyr, and as a result, TCP is not being further evaluated in this assessment (see Table 4-1, Table 4-3, and Appendix A for more information regarding the endpoints).

Based on laboratory studies, triclopyr acid is stable to hydrolysis (MRID 41879601) and anaerobic aquatic metabolism (MRID 151967), and it degrades slowly under aerobic aquatic conditions (MRID 40479101). Triclopyr acid does not bioaccumulate in aquatic organisms. It appears that aqueous photolysis is a predominant degradation mechanism in aquatic media. Photodegradation of triclopyr acid was less than 1 day in sterile solutions and approximately 1 day in natural water (MRID 41732201, MRID 42411804). The major photodegradation products observed were 5-chloro-3,6-dihydroxy-2-pyridinoloxyacetic acid in sterile solutions and oxamic acid in natural river water.

In soil, the predominant degradation mechanism for triclopyr acid is biotic metabolism. Triclopyr acid degraded in aerobic soil with half-lives of 8 to 18 days to intermediate degradates 3,5,6-trichloro-2-pyridinol (TCP) and 3,5,6-trichloro-2-methoxypyridine (TMP); the ultimate degradate is carbon dioxide (MRID 40346304). TCP was also observed as a minor degradate in the aerobic aquatic metabolism study. Based on adsorption/desorption studies, triclopyr acid and its major degradate TCP are expected to be very mobile in soils. Freundlich K_{ads} for triclopyr were 0.165-0.975 mL/g (MRID 40749801). In the field dissipation studies, low concentrations of triclopyr were found in soil depths of up to 45 cm; however, triclopyr did not persist (MRID 43955901, MRID 43033401).

Triclopyr acid degraded in 7.6 days to 10.6 days in field dissipation studies (MRID 43955901, MRID 43033401). TCP was detected up to 36 weeks after treatment in vegetated soil; it represented a considerable amount (0.131 ppm) at 63 weeks (last test interval) in bare soil. In the forestry studies, TCP was generally limited to the upper 30 cm of the soil, with sporadic detections in deeper soil depths (MRID 43033401). Although, these observations appear to represent TCP as persistent and mobile in the field, it is not being assessed in this document since toxicity data for the degradate indicates that when converted to the acid equivalent TCP is less toxic than the most sensitive endpoint for triclopyr that are used to evaluate ecological risk (see Table 4-1, Table 4-3, and Appendix A for more information regarding the endpoints). Table 2-1 lists the environmental fate properties of triclopyr acid, along with the major and minor degradates detected in the submitted environmental fate and transport studies.

Below is a schematic showing the relationship between triclopyr acid, TEA, BEE, and their degradates. For chemical properties of TEA and BEE, please see Appendix P.

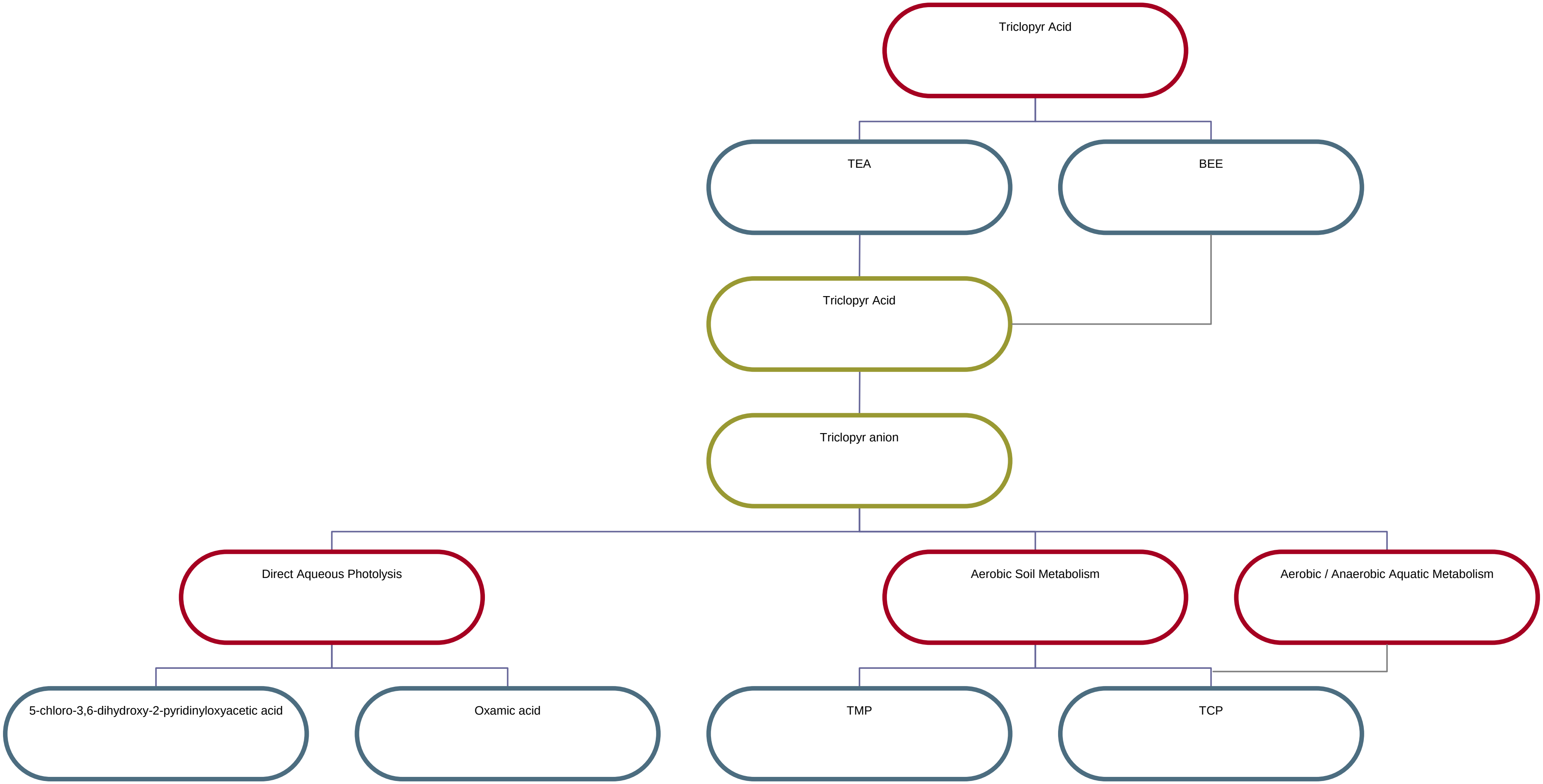

Triclopyr Acid
TEA
BEE
Triclopyr Acid
Triclopyr anion
Direct Aqueous Photolysis
Aerobic Soil Metabolism
Aerobic / Anaerobic Aquatic Metabolism
5-chloro-3,6-dihydroxy-2-pyridinyloxyacetic acid
Oxamic acid
TMP
TCP

Table 2-1 Summary of Triclopyr Acid Environmental Fate Properties

Study	Value (units)	Major Degradates *Minor Degradates*	Source/ MRID	Study Status
Molecular Weight	256.47 g/mol	NA	http://toxnet.nlm.nih.gov	NA
Aqueous Solubility (25o C)	440 mg/L	NA	http://toxnet.nlm.nih.gov	NA
Vapor Pressure (25o C)	1.26×10^{-6} torr	NA	http://toxnet.nlm.nih.gov	NA
Henry's Law constant	9.66×10^{-7} atm m^3 mol^{-1}	NA	Estimated by Calculation (VP*MW)÷(760*solubility)	NA
Hydrolysis	Stable at pH 5, 7, 9	No degradates reported	MRID 41879601	Acceptable
Direct Aqueous Photolysis	8-9 hours (natural light)	5-Chloro-3,6-dihydroxy-2-pyridinyloxyacetic acid and oxamic acid (combined = 48%)	MRID 41732201 & 42411804	Acceptable
	1.7 days (In river water)	Oxamic acid (16%)	MRID 41732201 & 42411804	Supplemental
Soil Photolysis	No acceptable data	No acceptable data	No acceptable data	Soil Photolysis
Aerobic Soil Metabolism	8 days in silty clay loam soil at 25 °C	TCP (26.4%)	MRID 40346304	Acceptable
	18 days in silt loam soil at 25 °C	3,5,6-trichloro-2-methoxypyridine (7.8%)		
		CO_2 (79.3%)		
Anaerobic Aquatic Metabolism	Stable (1300 days)	TCP (26%)	MRID 151967	Acceptable
Aerobic Aquatic Metabolism	142 Days in silty clay soil at 24° - 26° C	TCP (< 5%)	MRID 40479101	Acceptable
$K_{d\text{-}ads}$ / $K_{d\text{-}des}$ (mL/g)	0.975 in Kalkasda Sand	Treated soil: TCP (2%) Treated soil: CO_2 (28.3%) Supernatant: TCP (12.24%) Supernatant: Unidentified residues (3.4%)	MRID 40749801	Acceptable
	0.571 in Londo sandy loam			
	0.165 in Commerce silty loam			
	0.733 in Mahoun clay loam			
$K_{oc\text{-}ads}$ / $K_{oc\text{-}des}$ (mL/g)	134 in Kalkasda Sand (% OC 0.73)		MRID 40749801	Acceptable
	25 in Londo sandy loam (% OC 2.25)			
	25 in Commerce silty loam (% OC 0.67)			
	53 in Mahoun clay loam (% OC 1.38)			
Terrestrial Field Dissipation	7.6 to 10.6 days	No degradates reported	MRID 43955901 43033401	Acceptable
Aquatic Field Dissipation	Lake: Triclopyr 3.6 days (30 ° C) Aquatic Plants: Triclopyr 3.4 days (30 ° C) Crayfish: Triclopyr 11.5 days (30 ° C) Clam Tissue: Triclopyr 1.5 days (30 ° C)	No degradation products reported.	MRID 41714304	Acceptable

NA: Not Applicable

2.4.2 Environmental Transport Assessment

Potential transport mechanisms expected to be the major routes of exposure for triclopyr include pesticide spray drift, runoff, and direct application.

AIR

Triclopyr is applied by broadcast to the paddy water surface using ground or aerial equipment, suggesting that there is a possibility of drift. Likewise, triclopyr is applied by broadcast using ground or aerial equipment to a variety of other agricultural and non-agricultural sites. Triclopyr is relatively non-volatile, as indicated by its vapor pressure (1.26×10^{-6} torr) and Henry's Law Constant (9.66×10^{-7} atm m^3 mol^{-1}). These properties indicate that long range transport of triclopyr is unlikely.

In general, deposition of drifting pesticides is expected to be greatest close to the site of application. A computer model of spray drift (AgDRIFT) is used to determine potential exposures to aquatic and terrestrial organisms via spray drift. The distance of potential impact away from the use sites is determined by the distance required to fall below the LOC for the use with the greatest application rate, greatest number of applications per season, and the least amount of time between applications. For triclopyr, this use would be agricultural uncultivated areas.

WATER/RICE

Triclopyr is applied directly to water for its use on rice, thus exposure in water is expected, especially if rice paddies and receiving waters are used as CRLF habitat. Monitoring data indicate that triclopyr is frequently detected in receiving waters.

Exposure due to runoff is determined using PRZM/EXAMS. Again, the greatest application rate, greatest number of applications per season, and the least amount of time between applications is used to determine the maximum amount of triclopyr that would be expected in run off. An additional factor taken into account is the crop scenario which incorporates meteorological data that is specific to the date of application. In addition to the physical-chemical properties of a compound, the season in which a crop is grown can also determine the probability of runoff as well as the quantity of chemical found in the runoff.

SOIL

The SCI-GROW model (Screening Concentration in Ground Water Program (SCI-GROW) VERSION 2.3 was used to predict the maximum chronic and acute concentration of triclopyr derived from shallow ground water based on the maximum application rate of 20 lb ae/A, 17 times per year. The screening concentration was found to be 132 ppb. However, all of the aquatic uses have much larger concentrations (2500 ppb) and all of the aquatic uses have EECs greater than the LOC (See Section 3.0). As a result, base flow is a potential route of exposure for triclopyr, but is more than a magnitude less than the concentrations due to direct aquatic application.

2.4.2 Mechanism of Action

BEE is rapidly hydrolyzed to the triclopyr acid when absorbed by plants. Triclopyr acid readily penetrates foliage, and is readily absorbed by plant roots. The mode of action is growth regulation, resulting in abnormal growth. Specifically, the primary action appears to involve cell wall plasticity and nucleic acid metabolism, similar to that of endogenous auxins (IAAs). Triclopyr is believed to acidify the cell wall by stimulating the activity of a membrane-bound ATPase proton pump. In high concentrations, triclopyr and other auxin type herbicides reduces cell division and growth. Also, auxin type herbicides cause chlorosis (yellowing of leaves due to lack of chlorophyll), and leaves to curl up/bend (known as epinasty). Due to triclopyr's mechanism and mode of action it is considered to be less effective if not given at least four hours to dry.

2.4.3 Use Characterization

Analysis of labeled use information is the critical first step in evaluating the federal action. The current label for triclopyr represents the FIFRA regulatory action; therefore, labeled use and application rates specified on the label 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.

Table 2-2 presents the uses and corresponding application rates and methods of application considered in this assessment.

Table 2-2 Triclopyr Uses Assessed for the CRLF[1]

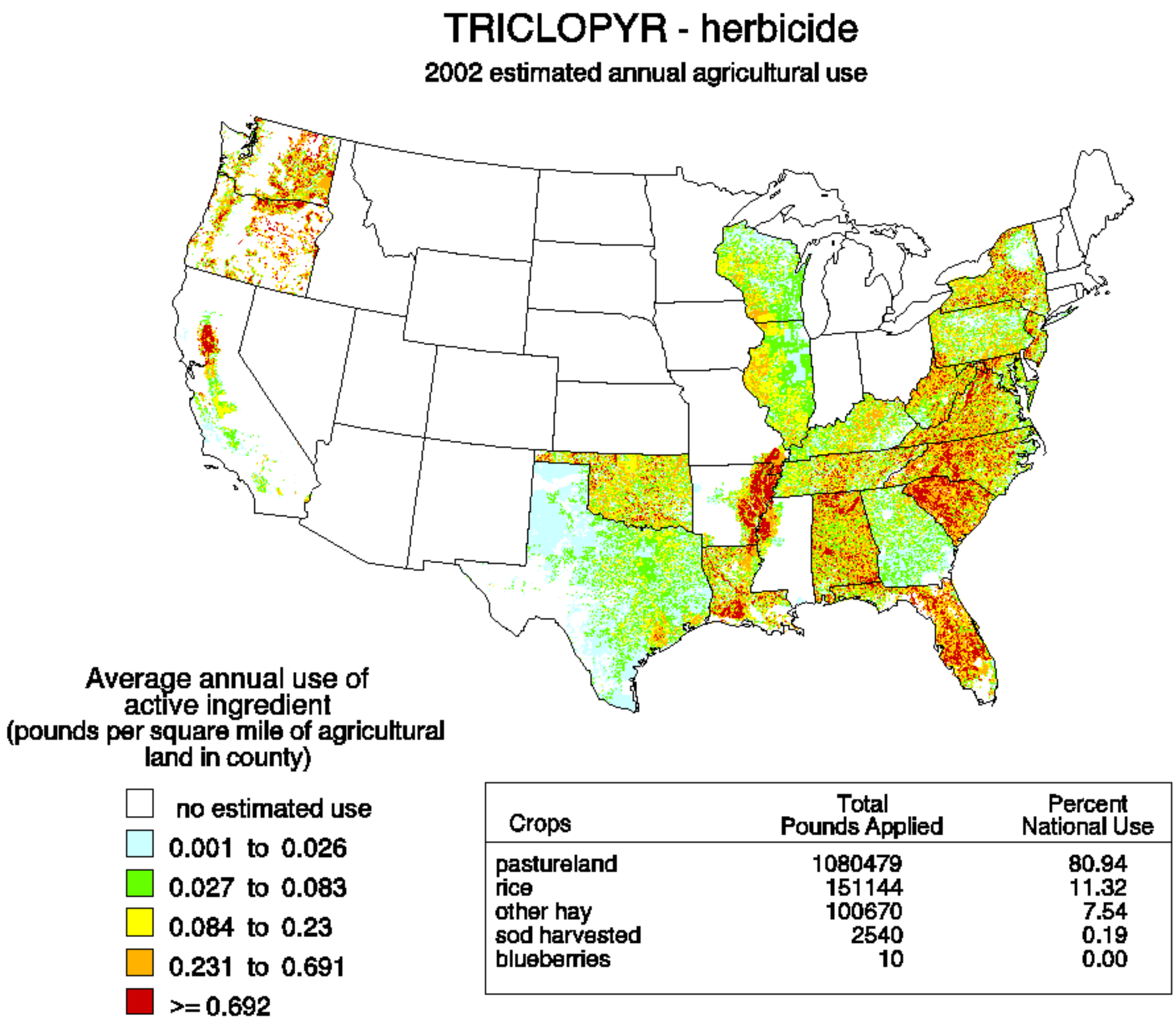
Use (Application Method)	Max. Single Appl. Rate (lb ae/A)	Max. Number of Application per Year	Interval Between Application (Day)	Application Method
AGRICULTURAL FALLOW/IDLELAND	12	1	0	Aircraft Ground
AGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	4.5	1	0	Aircraft
	9	17	21	Ground
AGRICULTURAL UNCULTIVATED AREAS	20	17	21	Ground
AGRICULTURAL/FARM PREMISES	2	17	21	Aircraft
	20	17	21	Ground
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT	1.5	17	21	Aircraft
	20	17	21	Ground
AIRPORTS/LANDING FIELDS	12	17	21	Ground
AQUATIC AREAS/WATER	NA	NA	NA	Aircraft Ground
CHRISTMAS TREE PLANTATIONS	6	17	21	Ground spray Injection
COMMERCIAL STORAGES/WAREHOUSES PREMISES	20	17	21	Ground
COMMERCIAL/INDUSTRIAL LAWNS	9	2	21	Ground

Use (Application Method)	Max. Single Appl. Rate (lb ae/A)	Max. Number of Application per Year	Interval Between Application (Day)	Application Method
	1.5	17	21	Spreader
COMMERCIAL/INSTITUTIONAL/INDUSTRIAL PREMISES/EQUIPMENT (OUTDOOR)	12	17	21	Ground
CONIFER RELEASE	3.2	17	21	Aircraft
	6	17	21	Ground
				Injection
DOUGLAS-FIR (FOREST/SHELTERBELT)	1.5	17	21	Sprayer
DRAINAGE SYSTEMS	12	1	0	Aircraft
	20	17	21	Ground
FENCEROWS/HEDGEROWS	3	2	30	Aircraft
				Ground
FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT	8	17	21	Aircraft
				Ground
FOREST TREES (ALL OR UNSPECIFIED)	6	17	21	Aircraft
	20	17	21	Ground
GOLF COURSE TURF	12	17	21	Ground
HOUSEHOLD/DOMESTIC DWELLINGS OUTDOOR PREMISES	12	17	21	Ground
INDUSTRIAL AREAS (OUTDOOR)	12	1	0	Aircraft
	20	17	21	Ground
INTERMITTENTLY FLOODED AREAS/WATER	6	17	21	Aircraft
				Ground
LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE)	NA	NA	NA	Aircraft
	NA	NA	NA	Ground
NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	12	1	0	Aircraft
	20	17	21	Ground
NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	12	1	0	Aircraft
	20	17	21	Ground
ORCHARDS (non-food stump treatment)	9	17	21	Ground
ORNAMENTAL AND/OR SHADE TREES	6	17	21	Aircraft
				Ground
ORNAMENTAL HERBACEOUS PLANTS	0.53	17	21	Package applicator
ORNAMENTAL LAWNS AND TURF	0.76	1	0	Spreader
	2	17	21	Ground
ORNAMENTAL NONFLOWERING PLANTS	0.53	17	21	Package applicator
ORNAMENTAL SOD FARM (TURF)	9	4	21	Ground
	1.5	2	21	Spreader
ORNAMENTAL WOODY SHRUBS AND VINES	6	17	21	Aircraft
				Ground
PASTURES	4.5	1	0	Aircraft
	9	17	21	Ground
PAVED AREAS (PRIVATE ROADS/SIDEWALKS)	12	1	0	Aircraft
	20	17	21	Ground

Use (Application Method)	Max. Single Appl. Rate (lb ae/A)	Max. Number of Application per Year	Interval Between Application (Day)	Application Method
RANGELAND	4.5	1	0	Aircraft
	9	17	21	Ground
RECREATION AREA LAWNS	12	17	21	Ground
	1.5	2	28	Spreader
RESIDENTIAL LAWNS	9	2	21	Ground
	1.5	2	28	Spreader
RICE	0.38	2	21	Aircraft
				Ground
SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	NA	NA	NA	Aircraft
	NA	NA	NA	Ground

*Note: The values above are very conservative. See Section 3.2 on how the intervals and maximum applications per year were derived.
NA: Not applicable. These uses have a maximum allowable concentration of 2.5 ppm. Therefore, application rates are dependant on volume of the body of water.

Provided below, Figure 2-1 shows the estimated poundage of triclopyr uses across the United States. The map was downloaded from a U.S. Geological Survey (USGS), National Water Quality Assessment Program (NAWQA) website.



Crops	Total Pounds Applied	Percent National Use
pastureland	1080479	80.94
rice	151144	11.32
other hay	100670	7.54
sod harvested	2540	0.19
blueberries	10	0.00

Figure 2-1 Triclopyr Use for Agricultural Uses in Total Pounds per County

The Agency's Biological and Economic Analysis Division (BEAD) provides an analysis of both national- and county-level usage information (County-Level Usage for Strychnidin; Strychnin, Triclopyr, butoxyethyl ester; Triclopyr, triethalamine salt; Diflubenzuron; Trifluralin; Thiobencarb; Chlorpyrifos; Vinclozolin; Iprodione in California in Support of a Red Legged Frog Endangered Species Assessment, June 08, 2009) using state-level usage data obtained from USDA-NASS[1], Doane (www.doane.com; the full dataset is not provided due to its proprietary nature) and the California's Department of Pesticide Regulation Pesticide Use Reporting (CDPR PUR)

[1] United States Depart 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.

database[2] . 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 triclopyr by county in this California-specific assessment were generated using CDPR PUR data. Eight years (1999-2006) 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 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 eight years. The units of area treated are also provided where available.

The usage data reported by CDPR PUR summarizing triclopyr's usage for all California use sites is provided below in Table 2-3. The uses range from commercial and industrial non-agricultural uses to agricultural uses, residential uses, and forestry uses, and water uses. The uses considered in this risk assessment represent all currently registered uses according to a review of all current labels. No other uses are relevant to this assessment. Any reported use other than currently registered uses represent either historic uses that have been canceled, mis-reported uses, or mis-use. Historical uses, mis-reported uses, and misuse are not considered part of the federal action and, therefore, are not considered in this assessment.

Table 2-3 Summary of California Department of Pesticide Registration (CDPR) Pesticide Use Reporting (PUR) Data from 1999 to 2006 for Triclopyr Uses

Site Name	Average Annual lbs ae/A Applied [2]	Average Application Rate (lbs ae/A)[2]	Maximum Application Rate (lbs ae/A)[1]
BUILDINGS/NON-AG OUTDROOR	0.01	0.0	12
CHRISTMAS TREE	0.81	1.9	6.0
COUNTY AG COMM	0.00	0.0	12
DITCH BANK	1.36	1.4	20
FOREST, TIMBERLAND	1.08	0.8	8.0
INDUSTRIAL SITE	0.69	0.8	12
LANDSCAPE MAINTENANCE	0.85	1.2	12
N-GRNHS FLOWER	1.01	1.5	0.53
N-GRNHS PLANTS IN CONTAINERS	0.22	0.2	0.53
N-GRNHS TRANSPLANTS	0.11	0.2	6.0
N-OUTDR FLOWER	1.03	0.9	0.53
N-OUTDR PLANTS IN CONTAINERS	0.87	1.0	0.53
N-OUTDR TRANSPLANTS	1.27	1.7	6.0

[2] The California Department of Pesticide Regulation's Pesticide Use Reporting database provides a census of pesticide applications in the state. See http://www.cdpr.ca.gov/docs/pur/purmain.htm.

Site Name	Average Annual lbs ae/A Applied [2]	Average Application Rate (lbs ae/A)[2]	Maximum Application Rate (lbs ae/A)[1]
ORCHARD FLOOR	1.60	1.6	9.0
PASTURELAND	0.69	0.7	9.0
PUBLIC HEALTH	0.00	0.0	12
RANGELAND	0.54	0.7	9.0
RECREATION AREA	1.98	2.2	12
REGULATORY PEST CONTROL	2.73	2.7	20
RICE	0.14	0.2	0.38
RICE, WILD	0.70	0.7	0.38
RIGHTS OF WAY	2.04	1.8	20
STORAGE AREA/BOX	0.98	1.0	12
STRUCTURAL PEST CONTROL	0.00	0.0	20
TURF/SOD	0.95	0.6	12
UNCULTIVATED AG	0.86	1.0	20
UNCULTIVATED NON-AG	1.12	1.0	20
VERTEBRATE CONTROL	0.39	0.2	20
WATER (INDUSTRLIAL)	0.50	0.5	9.0
WATER AREA	2.10	2.7	9.0

1-Based on data supplied by BEAD (cite transmittal memo of data).
2- The average annual pounds applied and average application rate was calculated as the weighted average of the average application rate for one county or average annual pounds applied for one county. The values reflect the average annual pounds applied to that site across all counties and the average application rate for that site across all counties.

2.5 Assessed Species

The CRLF was federally listed as a threatened species by U.S. FWS effective June 24, 1996 (U.S. FWS 1996). It is one of two subspecies of the red-legged frog and is the largest native frog in the western United States (U.S. FWS 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 I.

Final critical habitat for the CRLF was designated by U.S. FWS on April 13, 2006 (U.S. FWS 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 (U.S. FWS 1996). Its range has been reduced by about 70%, and the species currently resides in 22 counties in California (U.S. FWS 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) (U.S. FWS 2002).

Populations currently exist along the northern California coast, northern Transverse Ranges (U.S. FWS 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 (U.S. FWS 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) (U.S. FWS 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 Attachment I). Recovery units, core areas, and other known occurrences of the CRLF from the CNDDB are described in further detail in Attachment I, 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 U.S. FWS 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.

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.

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

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

Figure 2-2 Recovery Unit, Core Area, Critical Habitat, and Occurrence Designations for CRLF

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 (U.S. FWS 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, U.S. FWS 2002); tadpoles have been observed to over-winter (delay metamorphosis until the following year) (Fellers 2005b; U.S. FWS 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 (U.S. FWS 2002). Figure 2-3 depicts CRLF annual reproductive timing.

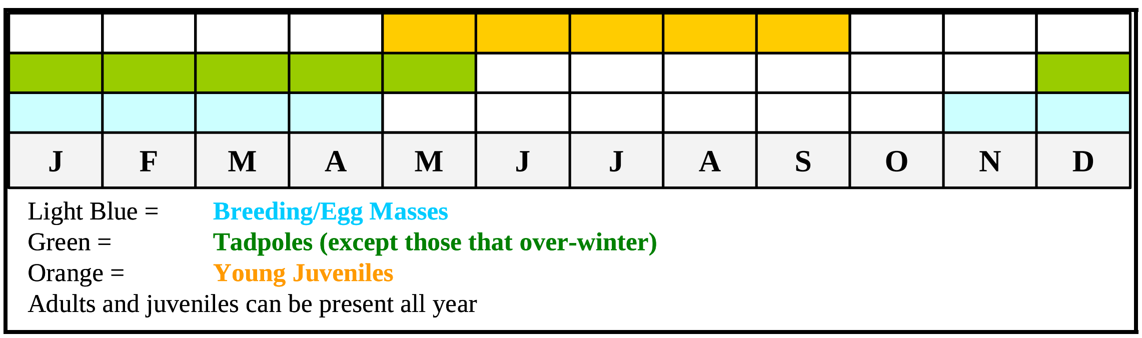


Figure 2-3 CRLF Reproductive Events by Month

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 (U.S. FWS 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 (U.S. FWS 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 (U.S. FWS 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 (U.S. FWS 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://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode=D02D).

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 (U.S. FWS 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 (U.S. FWS 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 U.S. FWS (U.S. FWS 2006; FR 51 19244-19346). A summary of the 34 critical habitat units relative to U.S. FWS-designated recovery units and core areas (previously discussed in Section 2.5.1) is provided in Attachment I.

'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 (Section 7) 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 I.

Occupied habitat may be included in the critical habitat only if essential features within the habitat may require special management or protection. Therefore, U.S. FWS 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 the Final Rule (FR) listing notice in April 2006 (71 FR 19243, 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 I for a full explanation on this special rule.

U.S. FWS has established adverse modification standards for designated critical habitat (U.S. FWS 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 triclopyr that may alter the PCEs of the CRLF's critical habitat form the basis of the critical habitat impact analysis. According to U.S. FWS (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) 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 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.
(4) 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.
(5) Elimination of upland foraging and/or aestivating habitat or 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 (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 triclopyr is expected to directly impact living organisms within the action area, critical habitat analysis for triclopyr 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 triclopyr is likely to encompass considerable portions of the United States based on the large array of agricultural 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. The Agency's approach to defining the action area under the provisions of the Overview Document (U.S. EPA 2004) considers the results of the risk assessment process to establish boundaries for that action area with the understanding that exposures below the Agency's defined Levels of Concern (LOCs) constitute a no-effect threshold. For the purposes of this assessment, attention will be focused on the footprint of the action (i.e., the area where pesticide application occurs), plus all areas where offsite transport (i.e., spray drift, downstream dilution, etc.) may result in potential exposure within the state of California that exceeds the Agency's LOCs.

Deriving the geographical extent of this portion of the action area is based on consideration of the types of effects that triclopyr may be expected to have on the environment, the exposure levels to triclopyr that are associated with those effects, and the best available information concerning the use of triclopyr and its fate and transport within the state of California. Specific measures of ecological effect that define the action area include any direct and indirect toxic effect and any potential modification of its critical habitat, including reduction in survival, growth, and fecundity as well as the full suite of sublethal effects available in the effects literature. Therefore, the action area extends to a point where environmental exposures are below any measured lethal or sublethal effect threshold for any biological entity at the whole organism, organ, tissue, and cellular level of organization. In situations where it is not possible to determine the threshold for an observed effect, the action area is not spatially limited and is assumed to be the entire state of California.

The definition of action area requires a stepwise approach that begins with an understanding of the federal action. The federal action is defined by the currently labeled uses for triclopyr. An analysis of labeled uses and review of available product labels was completed. Several of the currently labeled uses are special local needs (SLN) uses or are restricted to specific states and are excluded from this assessment. In addition, a distinction has been made between food use crops and those that are non-food/non-agricultural uses. The only food use crop for triclopyr is on rice. The remainder of triclopyr uses, relevant to the CRLF, includes agricultural, non-agricultural, and non-food uses which can be found in Table 2-2.

Following a determination of the assessed uses, an evaluation of the potential "footprint" of triclopyr use patterns (i.e., the area where pesticide application occurs) is determined. This "footprint" represents the initial area of concern, based on an analysis of available land cover data for the state of California. The initial area of concern is defined as all land cover types and the stream reaches within the land cover areas that represent the labeled uses described above. A map representing all the land cover types that make up the initial area of concern for triclopyr is presented in Figure 2-4.

The uses represented by triclopyr are depicted by the following land cover types: cultivated crops (21%), developed/high intensity (16%), developed/low intensity (2.6%), developed/open space (6.5%), forest (16%), orchards/vineyards (6.5%), pasture/hay (6.5%), wetlands (6.5%), and open water (8%). Cultivated crops are areas used for the production of annual crops, such as corn, soybeans, vegetables, and cotton. This class also includes all land being actively tilled. Developed/high intensity areas are where people reside, or work in high numbers. The impervious surfaces account for 80-100% of the total cover. Developed/low intensity areas include a mixture of constructed materials and vegetation with impervious surfaces accounting for 20-40% of total cover. Developed/open space includes areas with a mixture of constructed materials, but mainly vegetation in the form of lawn grasses. Impervious surfaces account for lass than 20% of total cover. Forest represents deciduous, evergreen, and mixed vegetation. These areas are dominated by trees that are generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Orchards/vineyards represent areas used for the cultivation of crops, such as fruits and nuts, which grow on vines or trees. Lastly, pasture/hay represents areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops. Typically, pasture/hay vegetation accounts for greater than 20% of total vegetation. More information regarding which specific uses are represented for each land cover types can be found in Appendix D.

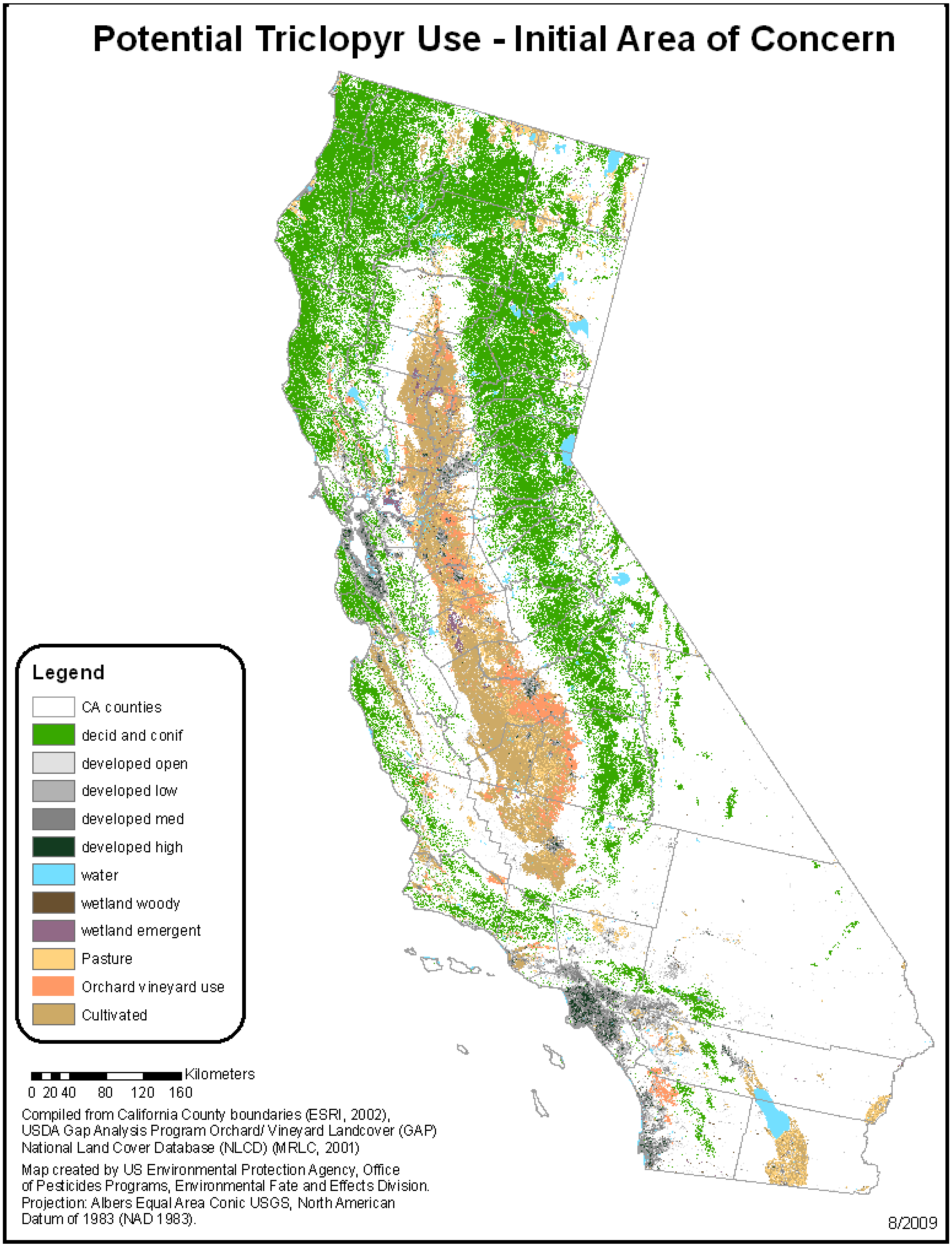


Figure 2-4. Initial area of concern, or "footprint" of potential use, for Triclopyr

Once the initial area of concern is defined, the next step is to define the potential boundaries of the action area by determining the extent of offsite transport via spray drift and runoff where exposure of one or more taxonomic groups to the pesticide exceeds the listed species LOCs.

As previously discussed, the action area is defined by the most sensitive measure of direct and indirect ecological toxic effects including reduction in survival, growth, reproduction, and the entire suite of sublethal effects from valid, peer-reviewed studies. However, due to the widespread use of triclopyr throughout the state of California, the initial area of concern only includes agricultural uses and not the residential or other non-agricultural uses in California. As a result the initial area of concern may be an underestimation of the actual usage of triclopyr in California, therefore, in order to incorporate all of the uses of Triclopyr within California, the initial area of concern is the entire state of California.

The AgDRIFT model (Version 2.01) is used to define how far from the initial area of concern an effect to a given species may be expected via spray drift. The spray drift analysis for triclopyr using the most sensitive endpoint (Sunflower – vegetative vigor) suggests that a maximum spray drift distance of at least 1000 feet was derived. Further detail on the spray drift analysis is provided in Section 5.2.5.1.

In addition to the buffered area from the spray drift analysis, the final action area also considers the downstream extent of triclopyr that exceeds the LOC (discussed in Section 5.2.5.2).

An evaluation of usage information was conducted to determine the area where use of triclopyr may impact the CRLF. This analysis is used to characterize where predicted exposures are most likely to occur, but does not preclude use in other portions of the action area. A more detailed review of the county-level use information was also completed. These data suggest that triclopyr has historically been used on a wide variety of agricultural and non-agricultural uses in all 58 counties in California. As a result, since triclopyr has both agricultural and non-agricultural uses, it is applied in 58 of 58 counties, and has a buffer zone greater than 1,000 feet, with such widespread use the action area is the entire state of California.

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."[3] 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 triclopyr (*e.g.*, runoff, spray drift, etc.), and the routes by which ecological receptors are exposed to triclopyr (*e.g.*, direct contact, etc.).

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

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. It should be noted that assessment endpoints are limited to direct and indirect effects associated with survival, growth, and fecundity, and do not include the full suite of sublethal effects used to define the action area. According to the Overview Document (U.S. EPA 2004), the Agency relies on acute and chronic effects endpoints that are either direct measures of impairment of survival, growth, or fecundity or endpoints for which there is a scientifically robust, peer reviewed relationship that can quantify the impact of the measured effect endpoint on the assessment endpoints of survival, growth, and fecundity.

A 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 4.0 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 triclopyr is provided in Table 2-4.

Table 2-4 Assessment Endpoints and Measures of Ecological Effects

Assessment Endpoint	Measures of Ecological Effects[4]
Aquatic-Phase CRLF (Eggs, larvae, juveniles, and adults)[a]	
Direct Effects	
1. Survival, growth, and reproduction of CRLF	1a. Bluegill sunfish (*Lepomis macrochirus*) LC_{50} 1b. Rainbow Trout(*Oncorhynchus mykiss*) NOAEC
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. Bluegill sunfish (*L. macrochirus*) LC_{50} 2b. Rainbow Trout (*O. mykiss*) NOAEC 2c. Water Flea (*Daphnia magna*) EC_{50} 2d. Water Flea (*D. magna*) NOAEC 2e. Freshwater diatom (*Navicula pelliculosa*) EC_{50}
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. Duckweed (*Lemna gibba*) EC_{50} 3b. Freshwater diatom (*N. pelliculosa*) EC_{50}
4. Survival, growth, and reproduction of CRLF individuals via effects to riparian vegetation	4a. Onion (*Allium cepa*) EC_{25} (seedling emergence) 4b. Alfalfa (*Medicago sativa*) EC_{25} (seedling emergence) 4c. Onion (*A. cepa*) EC_{25} (vegetative vigor) 4d. Sunflower (*Helianthus annus*) EC_{25} (vegetative vigor)
Terrestrial-Phase CRLF (Juveniles and adults)[b]	
Direct Effects	
5. Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	5a. Northern Bobwhite Quail (*Colinus virginianus*) LC_{50} 5b. Northern Bobwhite Quail (*C. virginianus*) LD_{50} 5c. Mallard Duck (*Anas platyrhynchos*) NOAEC
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. Northern Bobwhite Quail (*C. virginianus*) LC_{50} 6b. Northern Bobwhite Quail (*C. virginianus*) LD_{50} 6c. Laboratory Rat (*Rattus norvegicus*) LD_{50} 6d. Honey Bee (*Apis mellifera*) LD_{50} 6e. Mallard Duck (*A. platyrhynchos*) NOAEC 6f. Laboratory Rat (*R. norvegicus*) NOAEL
7. Survival, growth, and reproduction of CRLF individuals via indirect effects on habitat (*i.e.*, riparian and upland vegetation)	7a. Onion (*A. cepa*) EC_{25} (seedling emergence) 7b. Alfalfa (*M. sativa*) EC_{25} (seedling emergence) 7c. Onion (*A. cepa*) EC_{25} (vegetative vigor) 7d. Sunflower (*H. annus*) EC_{25} (vegetative vigor)

[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.

[4] Citations for all registrant-submitted and open literature toxicity data reviewed for this assessment are included in Appendix A.

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 triclopyr 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 triclopyr effects data are available. Adverse modification to the critical habitat of the CRLF includes, but is not limited to, those listed in Section 2.6.

Measures of such possible effects by labeled use of triclopyr on critical habitat of the CRLF are described in Table 2-5. 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 U.S. FWS (2006).

Table 2-5 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.	1a. Duckweed (*Lemna gibba*) EC_{50} 1b. Freshwater diatom (*Navicula pelliculosa*) EC_{50} 1c. Onion (*Allium cepa*) EC_{25} (seedling emergence) 1d. Alfalfa (*Medicago sativa*) EC_{25} (seedling emergence) 1e. Onion (*A. cepa*) EC_{25} (vegetative vigor) 1f. Sunflower (*Helianthus annus*) EC_{25} (vegetative vigor)
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.	2a. Duckweed (*Lemna gibba*) EC_{50} 2b. Freshwater diatom (*Navicula pelliculosa*) EC_{50} 2c. Onion (*Allium cepa*) EC_{25} (seedling emergence) 2d. Alfalfa (*Medicago sativa*) EC_{25} (seedling emergence) 2e. Onion (*A. cepa*) EC_{25} (vegetative vigor) 2f. Sunflower (*Helianthus annus*) EC_{25} (vegetative vigor)
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	3a. Bluegill sunfish (*L. macrochirus*) LC_{50} 3b. Rainbow Trout (*O. mykiss*) NOAEC 3c. Water Flea (*Daphnia magna*) EC_{50} 3d. Water Flea (*D. magna*) NOAEC
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (*e.g.*, algae)	4a. Freshwater diatom (*Navicula pelliculosa*) EC_{50} 4b. Duckweed (*Lemna gibba*) EC_{50}
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	5a. Onion (*A. cepa*) EC_{25} (seedling emergence) 5b. Alfalfa (*M. sativa*) EC_{25} (seedling emergence) 5c. Onion (*A. cepa*) EC_{25} (vegetative vigor) 5d. Sunflower (*H. annus*) EC_{25} (vegetative vigor) 5e. Northern Bobwhite Quail (*C. virginianus*) LC_{50} 5f. Northern Bobwhite Quail (*C. virginianus*) LD_{50} 5g. Laboratory Rat (*Rattus norvegicus*) LD_{50} 5h. Honey Bee (*Apis mellifera*) LD_{50} 5i. Mallard Duck (*A. platyrhynchos*) NOAEC 5j. Laboratory Rat (*R. norvegicus*) NOAEL
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 (U.S. EPA 1998). For this assessment, the risk is stressor-linked, where the stressor is the release of triclopyr to the environment. The following risk hypotheses are presumed for this endangered species assessment:

The labeled use of triclopyr 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; or
- 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 triclopyr release mechanisms, biological receptor types, and effects endpoints of potential concern. The conceptual models for terrestrial and aquatic exposures are shown in Figure 2-5 and Figure 2-6, respectively, which include the conceptual models for the aquatic and terrestrial PCE components of critical habitat. 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.

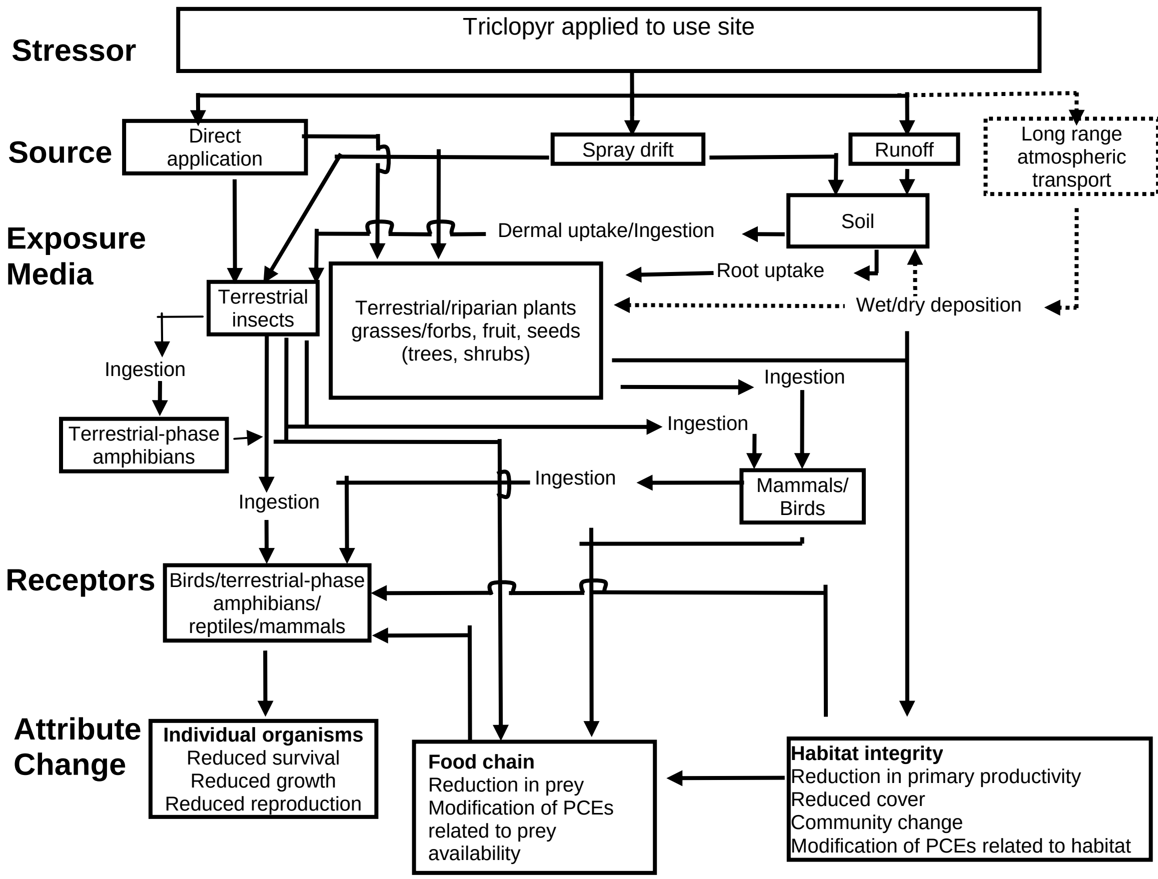
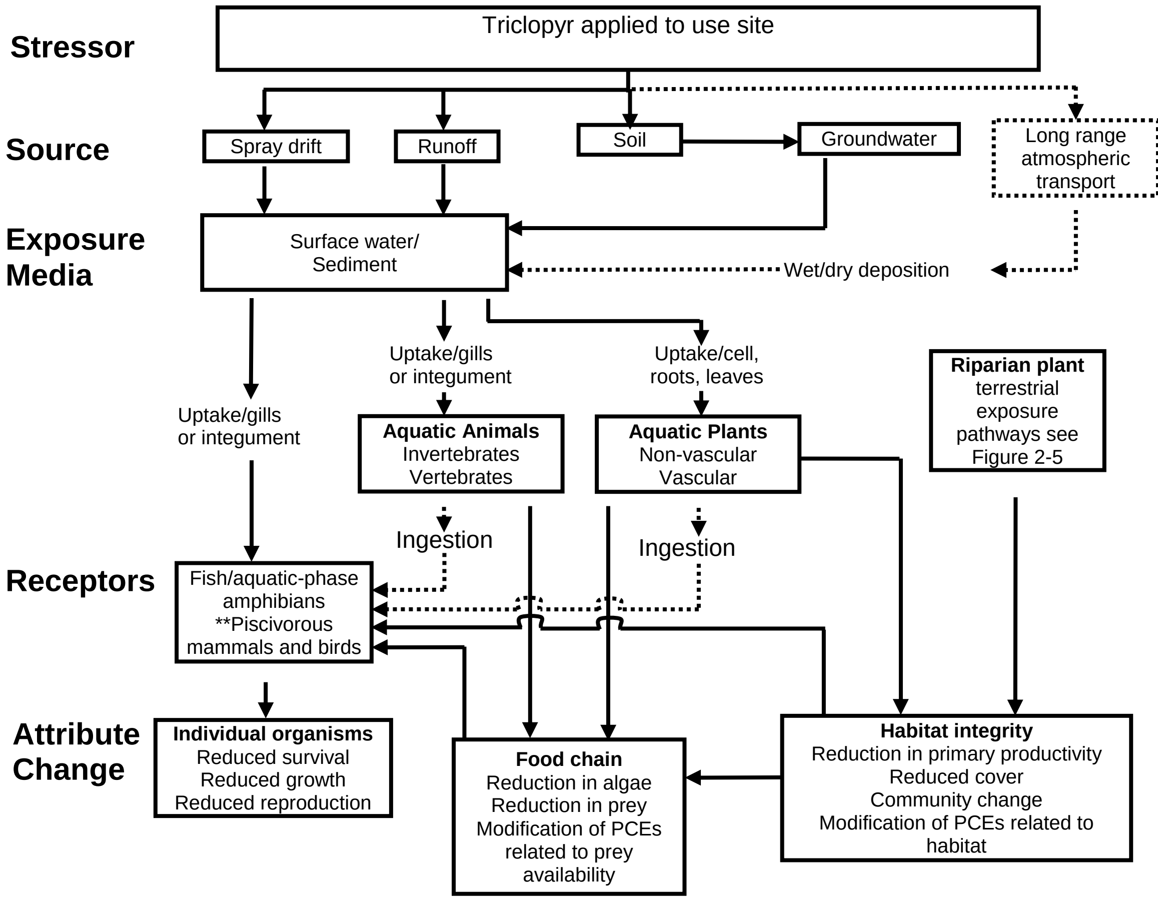


Figure 2-5 Conceptual Model for Pesticide Effects on Terrestrial Phase of the CRLF



** Route of exposure includes only ingestion of aquatic fish and invertebrates

Figure 2-6 Conceptual Model for Pesticide Effects on Aquatic Phase of the CRLF

2.10 Analysis Plan

In order to address the risk hypotheses, 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 triclopyr 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 (U.S. EPA 2004), the likelihood of effects to individual organisms from particular uses of triclopyr 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 triclopyr along with available monitoring data indicate that runoff and spray drift are the principle potential transport mechanisms of triclopyr to the aquatic and terrestrial habitats of the CRLF. In this assessment, transport of triclopyr through runoff and spray drift is considered in deriving quantitative estimates of triclopyr exposure to CRLF, its prey and its habitats. Triclopyr is not expected to volatilize once applied to soil due to its Henry's Law Constant (9.66×10^{-7} atm m^3 mol^{-1}) and its vapor pressure (1.26×10^{-6} atm^3/mol). As a result, atmospheric transport is not expected to be a likely route of exposure for triclopyr. See Section 3.2.4 for an explanation of existing monitoring data.

Measures of exposure are based on aquatic and terrestrial models that predict estimated environmental concentrations (EECs) of triclopyr using maximum labeled application rate and method of application. The models used to predict aquatic EECs are the Pesticide Root Zone Model coupled with the Exposure Analysis Model System (PRZM/EXAMS). The model used to predict terrestrial EECs on food items is 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, May 2005) and EXAMS (v2.98.4.6, April 2005) are screening simulation models coupled with the input shell pe5.pl (Aug 2007) to generate daily exposures and 1-in-10 year EECs of triclopyr that may occur in surface water bodies adjacent to application sites receiving triclopyr 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 triclopyr. 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.

The EFED Tier 1 Rice Model (v1.0) is a screening simulation model which generates a maximum exposure value for rice paddies based upon the maximum rate of application to the surface of the paddy water (10 cm), the volume of water in the paddy, and an assumption of instantaneous partitioning into 1 cm sediment through sorption to the soil calculated using the average laboratory K_d value. The Tier 1 Rice Model does not take into consideration movement or transformation on or in the agricultural rice paddy, or the resultant pesticide loadings to a receiving water body via paddy release water, erosion and spray drift. This model was used to estimate conservative screening-level exposure of aquatic organisms to triclopyr. In the Tier 1 Rice Model, the measure of acute exposure for triclopyr is considered to be the concentration on the day of application.

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 from foliar applications and granules from granular applications are derived using the T-REX model (version 1.3.1, 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 triclopyr 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 (15g) 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 triclopyr 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. Therefore, 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 (version 1.3.1) has been refined to the T-HERPS model (v. 1.0), which allows for an estimation of food intake for poikilotherms using the same basic procedure as T-REX to estimate avian food intake.

EECs for terrestrial plants inhabiting dry and wetland areas are derived using TerrPlant (version 1.2.2, 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.

Spray drift model AgDRIFT is used to assess exposures of terrestrial phase CRLF and its prey to triclopyr deposited on terrestrial habitats by spray drift. In addition to the buffered area from the spray drift analysis, the downstream extent of triclopyr that exceeds the LOC for the effects determination is also considered.

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 single chemical toxicity data for aquatic life, terrestrial plants, and wildlife. ECOTOX was created and is maintained by the U.S. EPA, 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 triclopyr 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).

It is important to note that the measures of effect for direct and indirect effects to the CRLF and its designated critical habitat are associated with impacts to survival, growth, and fecundity, and do not include the full suite of sublethal effects used to define the action area. According the Overview Document (USEPA 2004), the Agency relies on effects endpoints that are either direct measures of impairment of survival, growth, or fecundity or endpoints for which there is a scientifically robust, peer reviewed relationship that can quantify the impact of the measured effect endpoint on the assessment endpoints of survival, growth, and fecundity.

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 triclopyr, 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 triclopyr 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) (U.S. EPA 2004) (see Appendix C).

For this endangered species assessment, listed species LOCs are used for comparing RQ values for acute and chronic exposures of triclopyr directly to the CRLF. If estimated exposures directly to the CRLF of triclopyr 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 triclopyr 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, then 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.

2.10.1.4 Data Gaps

No acceptable toxicity studies have been submitted to the Agency, nor were any acceptable studies found in the open literature for the chronic effects of the degradate TCP on avian, aquatic-phase amphibian species, or terrestrial-phase amphibian species. There are three multi-ai products, in which triclopyr is mixed with another chemical; TAILSPIN (EPA Reg. No. 34704-958) triclopyr (16.1% ai) with Fluroxypyr (5.6 % ai), GF-1249 (EPA Reg. No. 62719-528) triclopyr (22.2% ai) with Picloram (potassium salt, 4.07 % ai), and RICEPYR (EPA Reg. No. 71085-29) triclopyr (3.8% ai) with Propanil (36.5% ai), Appendix B. In the case of triclopyr, only one product (EPA Reg. No. 71085-29) has a definitive LD50 value with an associated 95% CI, and the toxicity can be attributed to propanil (the other active ingredient in the formulated product). The other two products (EPA Reg. No. 34704-958 and 62719-528) no definitive LD50 values are available with an associated 95% CI. There is an LD50 value of 1847 mg/kg (410 mg/kg adjusted for active ingredient triclopyr) available for EPA Reg. No. 62719-528, however it is not considered to be a definitive number by HED, as no confidence intervals are available for the LD50 (see Appendix B). Therefore, no definitive statement of toxicity can be made for the other two products regarding if they pose any toxic risk greater or less than triclopyr alone. The best available information, and definitive endpoints from one of the three multi-ai products, suggests that the assessment based on triclopyr alone is adequate to understand risk to non-target receptors.

3.0 Exposure Assessment

Triclopyr is formulated as an emulsifiable concentrate, liquid, and granular. Application equipment and methods include ground application, aerial application, injection, hand held sprayers, and spreaders for granular applications. Risks from ground boom and aerial applications are expected to result in the highest off-target levels of triclopyr due to generally higher spray drift levels. Ground boom and aerial modes of application tend to use lower volumes of application applied in finer sprays than applications coincident with sprayers and spreaders and thus have a higher potential for off-target movement via spray drift.

3.1 Label Application Rates and Intervals

Triclopyr labels may be categorized into two types: labels for manufacturing uses (including technical grade triclopyr and its formulated products) and end-use products. While technical products, which contain triclopyr of high purity, are not used directly in the environment, they are used to make formulated products or used for research. The formulated product labels legally limit triclopyr's potential use to only those sites that are specified on the labels.

Mitigation from the 1998 RED stated changes to the labels to reflect the following:

- 2 lbs ae/A per year on pasture and rangeland and all sites where cattle can be grazed.
- 6 lbs ae/A per year for forestry applications.
- 8 lbs ae/A per year for all other use sites of triclopyr BEE
- 9 lbs ae/A per year for all other use sites of triclopyr TEA

However, the label information provided by BEAD, as described in the Use Characterization (Section 2.4.3), represents the values used for this assessment. As a result, the maximum application rates used in the modeling may be more conservative than that reflected by the maximum application rates represented in the mitigation from the 1998 RED.

Currently registered agricultural and non-agricultural uses of triclopyr within California include rice, waterways, pasture, wetlands, orchard stump treatments, ornamentals, forests, rights-of-way, commercial and industrial outdoor premises and lawns, and residential outdoor premises and lawns. Mitigation from the 1998 RED stated changes to the labels, and recommended a maximum application rate of 9 lbs ae/A down from the 20 lbs ae/A. However, these have not been implemented on the labels, and therefore, the maximum application rate on the current registered labels is used. Currently registered agricultural and non-agricultural uses of triclopyr within California are listed in Table 2-2. The uses being assessed are summarized in Table 3-1 below.

When determining how to model the use of triclopyr on rice, the crop profile provided by NSF Center for Integrated Pest Management (October 1998) was referred to. It helped determine how rice is treated, cultivated, and the conditions that exist during the production of rice. Rice production in California begins with land preparation (leveling for proper stand establishment, weed control and drainage), and is followed by fertilizer and insect control application. Once the land has been properly prepared, it is flooded with water and the seed is applied by airplane into the water. The rice is grown primarily in a continuously flooded, flow-through system. Weed control begins within days of planting and continues until the canopy closes over. Occasional "clean-up" operations are required for weeds after the canopy closes. Per NSF, triclopyr is applied between the third to fifty-fifth days for the early variety, and the third to sixty-fifth for the late variety.

Table 3-1 Triclopyr Uses, Scenarios, and Application Information for the CRLF risk assessment[1]

Scenario	Uses Represented by Scenario	Application Rate (lb ae/A)	Number of Applications	Application Interval	Application Method
CA forestry RLF	DOUGLAS-FIR (FOREST/SHELTERBELT)	1.5	17	21	Sprayer
CA forestry RLF	CONIFER RELEASE	3.2	17	21	Aircraft
CA forestry RLF	CHRISTMAS TREE PLANTATIONS, CONIFER RELEASE, FOREST TREES (ALL OR UNSPECIFIED), FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT	6	17	21	Ground Spray
CA forestry RLF	CHRISTMAS TREE PLANTATIONS, FOREST TREES (ALL OR UNSPECIFIED), CONIFER RELEASE	6	17	21	Injection
CA forestry RLF	FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT, FOREST TREES (ALL OR UNSPECIFIED)	6	17	21	Aircraft
CA fruit STD	ORCHARDS (non-food stump treatment)	9	17	21	Ground
CA impervious RLF	AIRPORTS/LANDING FIELDS, COMMERCIAL/INSTITUTIONAL/INDUSTRIAL PREMISES/EQUIPMENT (OUTDOOR)	12	17	21	Ground
CA impervious RLF	PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR), NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	12	1	0	Aircraft
CA impervious RLF	COMMERCIAL STORAGES/WAREHOUSES PREMISES, PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR)	20	17	21	Ground
CA impervious RLF and CA residential RLF	AGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	4.5	1	0	Aircraft
		9	17	21	Ground
CA impervious RLF and CA residential RLF	NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	20	17	21	Ground
CA Nursery	ORNAMENTAL HERBACEOUS PLANTS, ORNAMENTAL NONFLOWERING PLANTS	0.53	17	21	Package applicator
CA Nursery	ORNAMENTAL AND/OR SHADE TREES, ORNAMENTAL WOODY SHRUBS AND VINES	6	17	21	Aircraft Ground
CA rangeland hay RLF	AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT	1.5	17	21	Aircraft
CA rangeland hay RLF	AGRICULTURAL/FARM PREMISES	2	17	21	Aircraft

Scenario	Uses Represented by Scenario	Application Rate (lb ae/A)	Number of Applications	Application Interval	Application Method
CA rangeland hay RLF	AGRICULTURAL FALLOW/IDLELAND, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	12	1	0	Aircraft
CA rangeland hay RLF	AGRICULTURAL FALLOW/IDLELAND	12	1	0	Ground
CA rangeland hay RLF	AGRICULTURAL/FARM PREMISES	20	17	21	Ground
CA rangeland hay RLF	AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT, AGRICULTURAL UNCULTIVATED AREAS, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	20	17	21	Ground
CA Rangeland Hay_V2 RLF	PASTURES, RANGELAND	4.5	1	0	Aircraft
		9	17	21	Ground
CA residential RLF	RECREATION AREA LAWNS, RESIDENTIAL LAWNS	1.5	2	28	Spreader
CA residential RLF	RESIDENTIAL LAWNS	9	2	21	Ground
CA residential RLF	HOUSEHOLD/DOMESTIC DWELLINGS OUTDOOR PREMISES, RECREATION AREA LAWNS	12	17	21	Ground
CA turf RLF	ORNAMENTAL LAWNS AND TURF	0.76	1	0	Spreader
CA turf RLF	COMMERCIAL/INDUSTRIAL LAWNS, ORNAMENTAL LAWNS AND TURF	1.5	17	21	Spreader
CA turf RLF	ORNAMENTAL SOD FARM (TURF)	1.5	2	21	Spreader
CA turf RLF	COMMERCIAL/INDUSTRIAL LAWNS	9	2	21	Ground
CA turf RLF	ORNAMENTAL SOD FARM (TURF)	9	4	21	Ground
CA turf RLF	GOLF COURSE TURF	12	17	21	Ground
Rice Model	RICE	0.38	2	21	Aircraft Ground
NA	AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER, LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE)	NA	NA	NA	Aircraft
NA	AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER	NA	NA	NA	Ground
NA	SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	NA	NA	NA	Aircraft
NA	LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE), SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	NA	NA	NA	Ground

1 Uses assessed based on memorandum from SRRD dated April 14, 2009.
NA: Not applicable. These uses have a maximum allowable concentration of 2.5 ppm. Therefore, application rates are dependant on volume of the body of water

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 triclopyr 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 large 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 triclopyr were used for modeling, including application rates, number of applications per year, application intervals, and the first application date for each crop. The date of first application was developed based on several sources of information including data provided by BEAD, a summary of individual applications from the CDPR PUR data, and Crop Profiles maintained by the USDA. More detail on the crop profiles may be found at: http://www.ipmcenters.org/CropProfiles/

3.2.2 Model Inputs

Triclopyr is an herbicide applied to a wide variety of agricultural and non-agricultural use sites. Triclopyr's environmental fate data used for generating model parameters is listed in Table 2-2. The input parameters for PRZM and EXAMS are in Table 3-2.

Table 3-2 Summary of PRZM/EZAMS Environmental Fate Data Used for Aquatic Exposure Inputs for Triclopyr Endangered Species Assessment for the CRLF [1]

Fate Property	Value (unit)	MRID (or source)
Molecular Weight	256.47 g/mol	http://toxnet.nlm.nih.gov
Henry's Law constant	9.66×10^{-7} atm m^3 mol^{-1}	Calculated
Vapor Pressure	1.26×10^{-6} torr	http://toxnet.nlm.nih.gov
Solubility in Water	440 mg/L	http://toxnet.nlm.nih.gov
Photolysis in Water	0.375 days (Assuming 24 hours of daylight) 0.75 days (Adjusted for 12 hours of daylight)	MRID 41732201 MRID 42411804
Aerobic Soil Metabolism Half-lives	28.39 days	MRID 40346304 (per Input Parameter Guidance)
Hydrolysis	0 (Stable)	MRID 41879601
Aerobic Aquatic Metabolism (water column)	426 days	MRID 40479101 (per Input Parameter Guidance)

Fate Property	Value (unit)	MRID (or source)
Anaerobic Aquatic Metabolism (benthic)	0 (stable)	MRID 151967
Koc	59.25 (average)	MRID 40749801 (per Input Parameter Guidance)
Application rate and frequency	Various (see Table 3.3)	Per Label Instructions
Application intervals	Various (see Table 3.3)	Per Label Instructions
Chemical Application Method (CAM)	1-ground (preplant), aerial (bare) 2-ground (foliar), aerial (foliar) 5- granular (at plant) 8- soil injection	Input Parameter Guidance
Application Efficiency	0.99 (ground) 0.95 (aerial)	Input Parameter Guidance
Spray Drift Fraction	0.01 (ground) 0.05 (aerial)	Input Parameter Guidance

1 – Inputs determined in accordance with EFED "Guidance for Chemistry and Management Practice Input Parameters for Use in Modeling the Environmental Fate and Transport of Pesticides" dated February 28, 2002

For the direct water applications and for rice, the model used to predict aquatic EECs is the EFED Tier 1 Rice Model (v1.0, May 8, 2007). Using the Tier 1 Rice Model, aquatic exposures are quantitatively estimated for rice use with conservative, maximum values that represent high exposure sites for triclopyr use. Each of these sites represents a rice paddy (or water body) holding a 10 cm water depth. When a pesticide is applied to the rice paddy (or water body), the model assumes that it will instantaneously partition between a water phase and a sediment phase based on the partition coefficients of the chemical. The formula of the Tier I Rice Model v1.0 is as follows:

$$C_w = \frac{m_{ai}'}{0.00105 + 0.00013 K_d}$$

and, if appropriate:

$$K_d = 0.01 K_{oc}$$

where:

C_w = water concentration [µg/L]
m_{ai}' = mass applied per unit area [kg/ha]
K_d = water-sediment partitioning coefficient [L/kg]
K_{oc} = organic carbon partitioning coefficient [L/kg]

3.2.3 Results

The aquatic EECs for the various scenarios, models used (PRZM/EXAMS, and the Tier I Rice Model), and application practices are listed in Table 3-3**.** The maximum non-agricultural and agricultural application rate/interval/applications per year were calculated, along with the median use application rate/interval/applications per year, and minimum use application rate/interval/applications per year. See Appendix J and K for a summary of the outputs for the Rice Model and PRZM/EXAMS, respectively. Peak EECs ranged from 5.26 to 2500 µg/L for use on ornamental lawns and turf and lakes/ponds/reservoirs/swamps/marshes respectively.

Since some of the application data needed for modeling was not stated on the labels, assumptions were made by EFED analysts regarding the maximum number of applications allowed per season, and/or the interval between applications. The assumptions were as follows:

- For the application intervals that were not stated, the most conservative (minimum) known application interval was used (21 days). Twenty-one days was chosen because it was the minimum known interval that was registered.
- If the maximum number of applications was not stated, the most conservative (maximum) known number of applications was used (17 applications). Seventeen applications were chosen because 365 days per year divided by 21 days per application results in 17 applications allowed per year.

Table 3-3 Aquatic EECs (µg/L) for Triclopyr Uses in California

Crops Represented	Date of First Application	Peak EEC	21-day average EEC	60-day average EEC
DOUGLAS-FIR (FOREST/SHELTERBELT)	1-Jan	44.0	40.4	35.5
CONIFER RELEASE	1-Jan	127.7	116.6	107.6
CHRISTMAS TREE PLANTATIONS, CONIFER RELEASE, FOREST TREES (ALL OR UNSPECIFIED), FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT	2-Jan	194.7	176.5	136.9
CHRISTMAS TREE PLANTATIONS, FOREST TREES (ALL OR UNSPECIFIED), CONIFER RELEASE	1-Jan	534.6	491.9	426.3
FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT, FOREST TREES (ALL OR UNSPECIFIED)	2-Jan	337.9	309.8	286.0
ORCHARDS (non-food stump treatment)	1-Apr	148.4	131.0	109.7
AIRPORTS/LANDING FIELDS, COMMERCIAL/INSTITUTIONAL/INDUSTRIAL PREMISES/EQUIPMENT (OUTDOOR)	2-Jan	3479.0	3141.0	2864.0
PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR), NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	2-Jan	1363.0	1242.0	1006.5
COMMERCIAL STORAGES/WAREHOUSES PREMISES, PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR)	2-Jan	5802.0	5244.0	4770.0
AGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	2-Jan	250.1 1319.2	226.9 1200.2	190.7 1098.5
NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	2-Jan	2929.6	2666.9	2442.3
ORNAMENTAL HERBACEOUS PLANTS, ORNAMENTAL NONFLOWERING PLANTS	1-Apr	34.0	30.2	23.9
ORNAMENTAL AND/OR SHADE TREES, ORNAMENTAL WOODY SHRUBS AND VINES	1-Apr	415.3 382.6	376.2 338.4	308.5 268.7

Crops Represented	Date of First Application	Peak EEC	21-day average EEC	60-day average EEC
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT	1-Apr	77.3	70.0	65.0
AGRICULTURAL/FARM PREMISES	1-Apr	103.1	93.7	87.1
AGRICULTURAL FALLOW/IDLELAND, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	1-Apr	87.8	81.2	66.5
AGRICULTURAL FALLOW/IDLELAND	1-Apr	64.6	60.6	49.9
AGRICULTURAL/FARM PREMISES	1-Apr	990.2	908.2	793.9
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT, AGRICULTURAL UNCULTIVATED AREAS, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	1-Apr	990.2	908.2	793.9
	1-Apr	32.9	30.4	24.9
PASTURES, RANGELAND	1-Apr	394.8	354.8	321.9
RECREATION AREA LAWNS, RESIDENTIAL LAWNS	1-Feb	75.0	69.1	61.7
RESIDENTIAL LAWNS	1-Feb	415.0	376.3	309.0
HOUSEHOLD/DOMESTIC DWELLINGS OUTDOOR PREMISES, RECREATION AREA LAWNS	1-Feb	1499.4	1317.2	1171.6
ORNAMENTAL LAWNS AND TURF	2-Jan	5.3	4.7	4.0
COMMERCIAL/INDUSTRIAL LAWNS, ORNAMENTAL LAWNS AND TURF	2-Jan	34.6	31.7	28.6
ORNAMENTAL SOD FARM (TURF)	2-Jan	20.8	18.9	15.7
COMMERCIAL/INDUSTRIAL LAWNS	2-Jan	124.8	113.1	94.3
ORNAMENTAL SOD FARM (TURF)	2-Jan	165.1	154.6	133.8
GOLF COURSE TURF	2-Jan	270.0	245.9	219.5
		763.0	763.0	763.0
RICE	NA	763.0	763.0	763.0
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER, LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE)	NA	2500.0	2500.0	2500.0
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER	NA	2500.0	2500.0	2500.0
SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	NA	2500.0	2500.0	2500.0
LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE), SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	NA	2500.0	2500.0	2500.0

NA: (Not Applicable). This information is not necessary in order to determine the EEC.

It is important to note for those uses modeled using PRZM/EXAMS, the calculated EECs would increase by 25% when the half-life for the aquatic photolysis study is calculated to reflect 12 hours of continuous sunlight (0.75 days). In the modeling shown above, 0.375 days was used as the aquatic photolysis study half-life; however, this value assumes 24 hours of daylight when adjusting the 8 hour value to days. (i.e., for the use on outdoor industrial areas would increase the peak EEC from 5802 ppb to 7782 ppb).

Likewise, it is important to note that when the mitigation from the 1998 RED are implemented on the labels for triclopyr the maximum application rate would be 9 lbs ae/A as opposed to 20 lbs ae/A as modeled above. This will decrease the calculated EECs by approximately 50%. (i.e., for the use on outdoor industrial areas, the peak EEC would decrease from 5802 ppb (or 7782 ppb as mentioned above) to 2808 ppb). When looking at Section 5.0, although there may be a decrease in EECs, the determinations for the direct effects, indirect effects, and effects to aquatic plants remain the same. Please see Appendix Q.

3.2.4 Existing Monitoring Data

Whenever it is available, monitoring data are included in assessments in OPPs pesticide ecological risk assessments in order to better characterize the modeled. In this assessment, monitoring data were sought from the following sources: the USGS NAWQA program (http://water.usgs.gov/nawqa), the California Department of Pesticide Regulation (CDPR), and the California Air Review Board.

3.2.4.1 USGS NAWQA Surface Water Data

The USGS has not looked for any samples containing triclopyr. Therefore, no surface water data are available.

3.2.4.2 USGS NAWQA Groundwater Data

The USGS has not collected any samples looking for triclopyr. Therefore, no ground water data are available.

3.2.4.3 California Department of Pesticide Regulation (CDPR) Data

The California Department of Pesticide Regulation (CDPR) has been collecting surface water data on triclopyr for many years. Samples were taken in six California counties from March 1993 to March 2006. Out of 583 samples, 102 samples contained triclopyr. The median concentration of positive samples was 0.65 ppb and the mean concentration was 1.7 ppb. The highest detected concentration of 14.5 ppb was recorded on June 21, 2001 at Colusa Basin Drain #5 in Colusa County, which is in the main rice-growing region of California. Triclopyr concentrations were consistently elevated at this site through the months of June and July, 2001 with an average concentration of 3.5 ppb. This is probably due to the use of triclopyr on rice, as the same location is also the most contaminated for other rice herbicides (for example, propanil, thiobencarb and molinate). Colusa County is one of four leading counties for rice production in California. The Rice Model predicted a concentration of 763.00 ppb. This is about twenty times larger than the observed peak in Colusa Basin Drain #5, and shows that the Tier 1 Rice model is conservative. Due to the relatively short aqueous photolysis half-life, concentrations in rice paddies probably decline quickly before canopy closure.

3.2.4.4 Atmospheric Monitoring Data

The California Air Review Board has not conducted ambient air monitoring for triclopyr. Therefore, no atmospheric monitoring data are available.

3.3 Terrestrial Animal Exposure Assessment

T-REX (Version 1.3.1) is used to calculate dietary and dose-based EECs of triclopyr 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, foliar and granular applications of triclopyr are considered, as discussed below.

Terrestrial EECs for foliar formulations of triclopyr were derived for the uses summarized in Table 3-4. Given that no data on interception and subsequent dissipation from foliar surfaces is available for triclopyr, 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 3-4. Since mitigation from the 1998 RED has not been implemented yet, the current label application rates are used to calculate risk to terrestrial organisms. The current maximum application rate for foliar application is 20 lbs ae/A, and the mitigated maximum application rate for foliar application would be 9 lbs ae/A. The current median foliar application rate is 8 lbs ae/A, therefore, to assess the difference in exceedances the 8 lbs ae/A will be used to compare to the recommended mitigated maximum application rate. An example output from T-REX is available in Appendix E.

Table 3-4 Input Parameters for Foliar and Granular Applications Used to Derive Terrestrial EECs for Triclopyr with T-REX

Use (Application method)	Application rate (lbs ae/A)	Number of Applications
Agricultural Uncultivated Areas (Max. Foliar)	20	17
Forest Tree/Pest Management (Median Foliar)	8	17
Douglas-Fir (Forest/Shelterbelt) (Median Foliar)	1.5	17
Rice (Min. Foliar)	0.38	2
Commercial/Industrial Lawns (Max. Granular)	1.5	17
Ornamental Lawns and Turf (Min. Granular)	0.76	1

T-REX is also used to calculate EECs for terrestrial insects exposed to triclopyr. Dietary-based EECs calculated by T-REX for small and large insects (units of a.e./g) are used to bound an estimate of exposure to terrestrial insects. Available acute contact toxicity data for bees exposed to triclopyr (in units of µg a.e./bee), are converted to µg a.e./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 triclopyr 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 3-5). Dietary-based EECs for small and large insects reported by T-REX as well as the resulting adjusted EECs are available in Table 3-7. An example output from T-REX v. 1.3.1 is available in Appendix E.

For granular uses of triclopyr the LD_{50}/ft^2 is used to estimate risk to the CRLF both directly and indirectly (via prey items). The LD_{50}/ft^2 is the amount of a pesticide estimated to kill 50% of exposed animals in each square foot of an applied area.

Although a square foot does not have a defined ecological relevance, risk presumably increases as the number of LD_{50}/ft^2 increases (USEPA 1992). The LD_{50}/ft^2 is calculated using a toxicity value (the adjusted LD_{50}) and the EC (mg a.e./ft^2), and is compared to the Agency's LOC. For broadcast granular applications the mg a.e./ft^2 is calculated by the following formula: (application rate* % a.i. * 453,590 mg/lb)/43,560 ft^2 $acre^{-1}$. Results are presented in terms of the acid equivalent. Estimated EECs for broadcast granular application for both direct and indirect effects to the CRLF are presented in Table 3-6.

Table 3-5 Upper-bound Kenega Nomogram EECs for Dietary- and Dose-based Exposures of the CRLF and its Prey to Triclopyr (Foliar Applications)

Use	EECs for CRLF (Avian, 20 g)		EECs for Prey (small mammals, 15 g)	
	Dietary-based EEC (ppm)	Dose-based EEC (mg/kg-bw)	Dietary-based EEC (ppm)	Dose-based EEC (mg/kg-bw)
Agricultural Uncultivated Areas	7929	9030	14095	13439
Forest Tree/Pest Management	3171	3612	5638	5376
Douglas-Fir (Forest/Shelterbelt)	595	677	1057	1008
Rice	85	97	151	144

Table 3-6 EECs (mg a.e./ft^2) for Direct and Indirect Effects to the Terrestrial-Phase CRLF (Granular Applications)

Use	EECs for CRLF (mg a.e./ft^2)
Commercial/Industrial Lawns (Max.)	15.62
Ornamental Lawns and Turf (Min.)	7.91

Table 3-7 EECs (ppm) for Indirect Effects to the Terrestrial-Phase CRLF via Effects to Terrestrial Invertebrate Prey Items (Foliar Applications)

Use	Small Insect	Large Insect
Agricultural Uncultivated Areas	7930	881
Forest Tree/Pest Management	3171	352
Douglas-Fir (Forest/Shelterbelt)	595	66
Rice	85	9.5

3.4 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 3-8). A runoff value greater than 1,000 feet is utilized based on triclopyr's solubility, which is classified in TerrPlant as 440 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 3-8. Since mitigation from the 1998 RED has not been implemented yet, the current label application rates are used to calculate risk to terrestrial organisms. The current maximum application rate for foliar application is 20 lbs ae/A, and the mitigated maximum application rate for foliar application would be 9 lbs ae/A. The current median foliar application rate is 8 lbs ae/A, therefore, to assess the difference in exceedances the 8 lbs ae/A will be used to compare to the recommended mitigated maximum application rate. An example output from TerrPlant v.1.2.2 is available in Appendix G.

Table 3-8 TerrPlant Inputs and Resulting EECs for Plants Inhabiting Dry and Semi-aquatic Areas Exposed to Triclopyr (acid equivalent) via Runoff and Drift (Foliar and Granular Applications)

Use	Application rate (lbs ae/A)	Application method	Drift Value (%)	Spray drift EEC	Dry area EEC	Semi-aquatic area EEC
				(lbs a.e./A)	(lbs a.e./A)	(lbs a.e./A)
Agricultural Uncultivated Areas (Max.)	20	Foliar – ground	1	0.2	1.2	10.2
Forest Tree/Pest Management (Median)	8	Foliar – ground	1	0.08	0.48	4.08
Forest Tree/Pest Management (Median)	8	Foliar – aerial	5	0.4	0.8	4.4
Douglas-Fir (Forest/Shelterbelt) (Median)	1.5	Early Spring – sprayer	5	0.075	0.15	0.825
Rice (Min)	0.38	Ratoon - ground	1	0.0038	0.228	0.1938
Rice (Min)	0.38	Ratoon - aerial	5	0.019	0.038	0.209
Commercial/Industrial Lawns (Max)	1.5	Granular – spreader	0	0	0.075	0.75
Ornamental Lawns and Turf (Min)	0.76	Granular – spreader	0	0	0.038	0.38

4.0 Effects Assessment

This assessment evaluates the potential for triclopyr 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 effects determination 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. 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 triclopyr.

As described in the Agency's Overview Document (U.S. EPA 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 ECOTOX information obtained on June 30, 2009. 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;[5]
(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 for the effects determination is dependent on

[5] The studies that have information on mixtures are listed in the bibliography as rejected due to the presence of mixtures. These studies are evaluated by EFED when applicable to the assessment; however, the data is not used quantitatively in the assessment.

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. Although the effects determination relies on endpoints that are relevant to the assessment endpoints of survival, growth, or reproduction, it is important to note that the full suite of sublethal endpoints potentially available in the effects literature (regardless of their significance to the assessment endpoints) are considered to define the action area for triclopyr.

A detailed spreadsheet of the available ECOTOX open literature data for Triclopyr (acid, TEA, and BEE), including the full suite of lethal and sublethal endpoints is presented in Appendix N. The endpoints from the studies were classified as being more or less sensitive (toxic) than the registrant studies. After review of these open literature studies, there were no studies that could be used quantitatively or qualitatively within the assessment.

Citations of all open literature that were not considered as part of this assessment because they were either rejected by the ECOTOX screen (excluded from ECOTOX entirely, not acceptable for ECOTOX, or efficacy papers examining the target species) are included in Appendix H. Open literature toxicity data for 'target' terrestrial plant species, which include efficacy studies, are not currently considered in deriving the most sensitive endpoint for terrestrial plants. Efficacy studies do not typically provide endpoint values that are useful for risk assessment (e.g., NOAEC, EC50, etc.), but rather are intended to identify a dose that maximizes a particular effect (e.g., EC100). Therefore, efficacy data and non-efficacy toxicological target data are not included in the ECOTOX open literature summary table provided in Appendix N. The list of citations including toxicological and/or efficacy data on target plant species not considered in this assessment is provided in Appendix H. Also included is 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 for Triclopyr (acid, TEA, and BEE). Citations of all open literature data, including studies accepted by ECOTOX but not used (e.g., the endpoint is less sensitive), studies that have been reviewed accepted by ECOTOX but not OPP, and those studies that are more sensitive and used or not used within the assessment are found in Appendix I.

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 triclopyr. A summary of the available aquatic and terrestrial ecotoxicity information, use of the probit dose response relationship, and the incident information for triclopyr are provided in Sections 4.1 through 4.4, respectively.

The major degradate of triclopyr is 3,5,6-trichloro-2-pyridinol (TCP), which is both persistent and mobile. Toxicity data for the degradate indicates that when converted to the acid equivalent TCP is less toxic than the most sensitive endpoint for triclopyr. Therefore, in terms of the acid equivalent TCP is not of toxicological concern and is not evaluated in this assessment. However, since there is a difference in toxicity between triclopyr forms (Acid, TEA, BEE, and TCP) for species, Appendix A shows a comparison of the toxicity of triclopyr in terms of the acid equivalent for each of the Triclopyr forms as well as the degradate TCP. A detailed summary of the available ecotoxicity information for all triclopyr degradates and formulated products are also presented in Appendix A.

The Agency does not routinely include, in its risk assessments, an evaluation of mixtures of active ingredients, either those mixtures of multiple active ingredients in product formulations or those in the applicator's tank. In the case of the product formulations of active ingredients (that is, a registered product containing more than one active ingredient), each active ingredient is subject to an individual risk assessment for regulatory decision regarding the active ingredient on a particular use site. If effects data are available for a formulated product containing more than one active ingredient, they may be used qualitatively or quantitatively[6, 7]. Triclopyr has three registered products that contain multiple active ingredients. They are: TAILSPIN (EPA Reg. No. 34704-958) triclopyr (16.1% ai) with Fluroxypyr (5.6 % ai), GF-1249 (EPA Reg. No. 62719-528) triclopyr (22.2% ai) with Picloram (potassium salt, 4.07 % ai), and RICEPYR (EPA Reg. No. 71085-29) triclopyr (3.8% ai) with Propanil (36.5% ai) (see Appendix B). Only one product (EPA Reg. No. 71085-29) has a definitive LD50 value with an associated 95% CI. In the case of EPA Reg No. 71085-29, the toxicity can be attributed to propanil (the other active ingredient in the formulated product). When the LD50 (1750 mg/kg) for this product and its confidence interval (1239-4450 mg/kg) are adjusted for the percent propanil (36.5%), the adjusted LD50 value of 639 mg/kg (CI: 452-1624 mg/kg), the adjusted confidence interval falls within the confidence interval for the propanil technical (868-1343 mg/kg). For EPA Reg. No. 34704-958 and 62719-528 no definitive LD50 values are available with an associated 95% CI. There is an, LD50 value of 1847 mg/kg (410 mg/kg adjusted for active ingredient triclopyr) available for EPA Reg. No. 62719-528, however it is not considered to be a definitive number by HED, as no confidence intervals are available for the LD50 (see Appendix B). Therefore, no definitive statement of toxicity can be made for the other two products regarding if they pose any toxic risk greater or less than triclopyr alone. The results of available toxicity data for mixtures of triclopyr with other pesticides are presented in Appendix B.

Given that the active would not be expected to have similar mechanisms of action, metabolites or toxicokinetic behavior it is also reasonable to conclude that an assumption of dose-addition would be inappropriate. Consequently, an assessment of triclopyr's potential effect on the CRLF when it is co-formulated with other active ingredients can be based on the toxicity of triclopyr.

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[6] Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs, Environmental Protection Agency (January 2004) (Overview Document).

[7] Memorandum to Office of Prevention, Pesticides and Toxic Substance, US EPA conveying an evaluation by the U.S. Fish and Wildlife Service and National Marine Fisheries Service of an approach to assessing the ecological risks of pesticide products (January 2004).

4.1 Evaluation of Aquatic Ecotoxicity Studies

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 and a complete list of all toxicity data available is provided in Appendix A**.**

Table 4-1 Freshwater Aquatic Toxicity Profile for Triclopyr (TEA and BEE expressed as the acid equivalent)

Assessment Endpoint	Species	Toxicity Value Used in Risk Assessment (expressed as ae)	Describe effect (i.e. mortality, growth, reproduction)	Citation MRID # (Author & Date)	Study Classification
Direct Toxicity to Aquatic-Phase CRLF					
Acute	Bluegill sunfish (*Lepomis macrochirus*)	96h LC_{50} = 0.26 mg ae/L (BEE)	Mortality	42917901 Woodburn et al. 1993	Acceptable
Chronic	Rainbow Trout (*Oncorhynchus mykiss*)	NOAEC = 0.019 LOAEC = 0.034 mg ae/L (BEE)	Growth (larval weight/ length)	43230201 Weinberg et al. 1994	Acceptable
Indirect Toxicity to Aquatic-Phase CRLF					
via Acute Toxicity to Freshwater Invertebrates (i.e. prey items)	Water Flea (*Daphnia magna*)	48h EC_{50} = 0.25 mg ae/L (BEE)	Mortality	43442603 Weinberg et al. 1994	Acceptable
via Chronic Toxicity to Freshwater Invertebrates (i.e. prey items)	Water Flea (*Daphnia magna*)	21-d NOAEC = 25 21-d LOAEC = 46.2 mg ae/L (TEA)	Growth and Reproduction (total # of young & mean brood size)	00151959, 42090411, 92189013 Gerisch 1982	Acceptable
via Acute Toxicity to Freshwater Fish (i.e. prey items)	Bluegill sunfish (*Lepomis macrochirus*)	96h LC_{50} = 0.26 mg ae/L (BEE)	Mortality	42917901 Woodburn et al. 1993	Acceptable
via Chronic Toxicity to Freshwater Fish (i.e. prey items)	Rainbow Trout (*Oncorhynchus mykiss*)	NOAEC = 0.019 LOAEC = 0.034 mg ae/L (BEE)	Growth (larval weight/ length)	43230201 Weinberg et al. 1994	Acceptable
via Toxicity to Non-vascular Aquatic Plants	Freshwater diatom (*Navicula pelliculosa*)	5d EC_{50} = 0.07 mg ae/L (BEE)	Growth (cell counts & % inhibition)	42721102 Hughes 1993	Acceptable
via Toxicity to Non-vascular Aquatic Plants	Freshwater diatom (*Navicula pelliculosa*)	5d NOEAC = 0.0014 mg ae/L (BEE)	Growth (cell counts & % inhibition)	42721102 Hughes 1993	Acceptable
via Toxicity to Vascular Aquatic Plants	Duckweed (*Lemna gibba*)	14d EC_{50} = 0.86 mg ae/L (BEE)	Growth and Reproduction (# Fronds)	42719101 Milazzo et al. 1993	Supplemental

via Toxicity to Vascular Aquatic Plants	Duckweed (*Lemna gibba*)	14d NOAEC < 0.111 mg ae/L (BEE)	Growth and Reproduction (# Fronds)	42719101 Milazzo et al. 1993	Supplemental

Toxicity to aquatic fish and invertebrates is categorized using the system shown in Table 4-2 (U.S. EPA 2004). Triclopyr falls in the range of "highly toxic" for freshwater fish and invertebrates on an acute exposure basis. Toxicity categories for aquatic plants have not been defined.

Table 4-2 Categories of Acute Toxicity for Fish and Aquatic Invertebrates

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 scientifically valid triclopyr 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 triclopyr to the CRLF. Effects to freshwater fish resulting from exposure to triclopyr may 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

Freshwater fish data are used as a surrogate to estimate direct acute risks to the CRLF. Effects to freshwater fish from direct exposure to triclopyr could also indirectly affect the CRLF from reduction in available food.

Triclopyr is classified as highly toxic to freshwater fish on an acute exposure basis. The most sensitive freshwater species tested was the bluegill sunfish, (*Lepomis macrochirus*), which exhibited a 96-hr LC_{50} value of 0.26 mg ae/L (triclopyr BEE, TGAI, MRID 4217901). The rainbow trout (*Oncorhynchus mykiss*) exhibited a 96-hr LC_{50} value of 0.47 mg ae/L (triclopyr BEE, TGAI, MRID 42884501). Registrant submitted studies for acute freshwater fish are available for both the bluegill sunfish and the rainbow trout for triclopyr acid (as TGAI), triclopyr TEA (formulation), triclopyr BEE (both TGAI and formulation), and TCP (as TGAI). The most sensitive endpoints for the bluegill sunfish range from 155 mg ae/L (triclopyr TEA, formulated product, MRID 00049637) to 0.26 mg ae/L (triclopyr BEE, TGAI, MRID 4217901). The most sensitive endpoints for the rainbow trout range from 117 mg/L (triclopyr acid, TGAI, MRID 00049637) to 0.47 mg ae/L (triclopyr BEE, TGAI, MRID 42884501). The degradate TCP for both the bluegill sunfish and rainbow trout are more toxic than the parent(s) triclopyr acid and triclopyr TEA, 16.1 mg ae/L (MRID 41829003) and 1.9 mg ae/L (TCP, TGAI, MRID 41829004).

However, for use in evaluating direct effects to aquatic-phase CRLFs, in terms of acid equivalence, it is not the most sensitive freshwater fish endpoint; as a result toxicity to non-target organisms is calculated using triclopyr acid equivalence alone.

4.1.1.2 Freshwater Fish: Chronic Exposure (Early Life Stage and Reproduction) Studies

The rainbow trout exhibited a chronic toxicity NOAEC of 0.019 mg ae/L, and a LOAEC of 0.034 mg ae/L based on growth effects (larval weight/length) (triclopyr BEE, TGAI, MRID 43230201). No other registrant submitted studies are available for the rainbow trout for triclopyr acid, triclopyr TEA or TCP. There is only one other chronic exposure study available. The fathead minnow exhibited a NOAEC > 32.2 mg ae/L and a LOAEC < 50.2 mg ae/L based on growth effects (length) (triclopyr TEA, formulated product, MRID 00151958).

4.1.1.3 Freshwater Fish: Sublethal Effects and Additional Open Literature Information

There are numerous studies found within the ECOTOX database, however they are not integrative in the measurements of growth and/or reproduction, not scientifically valid or more sensitive than registrant-submitted data. Potential sublethal effects on fish are evaluated qualitatively and not used as part of the quantitative risk characterization of triclopyr to the CRLF. Further details on ECOTOX studies are provided in Appendix I, which also contains the rejection codes and other information as to why studies from ECOTOX were not used.

4.1.1.4 Aquatic-phase Amphibian: Acute and Chronic Studies

Studies are found in ECOTOX that used aquatic-phase amphibians as study organisms. However, the studies contain numerous flaws and as a result they are not used in this risk assessment. In particular there are concerns with the husbandry of the organisms (i.e., the amount of individuals per treatment replicate), the lack of detailed information within the published literature especially in regards to the controls and the chemical solutions that are used within the experiments, and there is also some concern with the testing methods used, specifically with the Frog Embryo Teratogenesis Assay-*Xenopus* (FETAX). Some of the studies also contained numerous other variables (i.e., pH, food levels, etc) that make it difficult to determine the actual cause of any effects seen. Appendix I contains information as to why these studies and others from ECOTOX are not used within the assessment.

4.1.2 Toxicity to Freshwater Invertebrates

Freshwater aquatic invertebrate toxicity data are used to assess potential indirect effects of triclopyr to the CRLF. Effects to freshwater invertebrates resulting from exposure to triclopyr may 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 (Mortality) Studies

Triclopyr is classified as highly toxic to freshwater invertebrates on an acute exposure basis based on acceptable studies on the water flea (*Daphnia magna*). This species exhibited a 48-hr EC_{50} value of 0.25 mg ae/L (triclopyr BEE, TGAI, MRID 43442603) for BEE. Registrant submitted studies for acute freshwater invertebrates are available for *Daphnia magna* for triclopyr acid (as TGAI), triclopyr TEA (formulation), triclopyr BEE (both TGAI and formulation), and TCP (as TGAI). The most sensitive endpoints for the *Daphnia magna* range from 346 mg ae/L (triclopyr TEA, formulated product, MRID 00151956) to 0.25 mg ae/L (triclopyr BEE, TGAI, MRID 43442603). The degradate TCP for *Daphnia magna* are more toxic than the parent(s) triclopyr acid and triclopyr TEA, 13.4 mg ae/L (TCP, TGAI, MRID 41829003). However, for use in evaluating indirect effects to aquatic-phase CRLFs, in terms of acid equivalence, it is not the most sensitive freshwater invertebrate endpoint; as a result, toxicity to non-target organisms is calculated using triclopyr acid equivalence alone.

4.1.2.2 Freshwater Invertebrates: Chronic Exposure (Reproduction) Studies

Chronic toxicity studies show that the water flea (*Daphnia magna*) exhibited a 21-d NOAEC of 25 mg ae/L and a LOAEC of 46.2 mg ae/L based on the total number of young and mean brood size (triclopyr TEA, formulated, MRID 00151959, 42090411, and 92189013). No other registrant submitted chronic toxicity studies using triclopyr acid, triclopyr BEE or the degradate TCP are available.

4.1.2.3 Freshwater Invertebrates: Sublethal Effects and Open Literature Data

For freshwater invertebrates, none of the acute or chronic toxicity values reported through ECOTOX are more sensitive than the registrant-submitted data on *Daphnia magna* using any form of triclopyr expressed as the acid equivalent.

4.1.3 Toxicity to Aquatic Plants

Aquatic plant toxicity studies are used as one of the measures of effect to evaluate whether triclopyr may 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.

Two types of studies are used to evaluate the potential of triclopyr to affect aquatic plants. Laboratory and field studies are used to determine whether triclopyr may cause direct effects to aquatic plants. A summary of the laboratory data and freshwater field studies for aquatic plants is provided in Sections 4.1.3.1 and 4.1.3.2

4.1.3.1 Aquatic Plants: Laboratory Data

Both the vascular and non-vascular aquatic plant studies that include the most sensitive species are Tier II toxicity tests. The freshwater diatom (*Navicula pelliculosa*) is the most sensitive non-vascular plant with a 5d EC_{50} of 0.07 mg ae/L and a NOAEC of 0.0014 mg ae/L based on cell counts and percent inhibition (triclopyr BEE, TGAI, MRID 42721102). The vascular plant *Lemna gibba* is the most sensitive vascular plant with a 14d EC_{50} of 0.86 mg ae/L based on the number of fronds (triclopyr BEE, TGAI, MRID 42719101).

Registrant submitted studies for non-vascular aquatic plants are available for triclopyr acid (as TGAI), triclopyr TEA (formulation), triclopyr BEE (both TGAI and formulation), and TCP (as TGAI). Toxicity endpoints are available for three species of non-vascular plants: green algae (*Kirchneria subcapitata*), blue-green algae (*Anabeana flos-aquae*), and the freshwater diatom (*Navicula pelliculosa*). The most sensitive endpoints for the green algae (*Kirchneria subcapitata*), is the 5d EC_{50} which range from 29.8 mg /L (triclopyr acid, TGAI, MRID) to 2.5 mg ae/L (triclopyr BEE, formulated, MRID 41633704 and 42090422). The degradate TCP endpoint for green algae is more toxic than the parent(s) triclopyr acid, triclopyr TEA, and triclopyr BEE with a 5d EC_{50} of 2.3 mg ae/L (MRID 45312001), and NOAEC (as EC_{05}) of 0.84 mg ae/L based on yield. This endpoint is not lower than the most sensitive non-vascular aquatic plant endpoint that is used to estimate indirect effects of triclopyr on non-target aquatic plants. The most sensitive endpoint for the blue-green algae (*Anabeana flos-aquae*), is the 5d EC_{50} which range from 4.1 mg ae/L (7d EC_{50}, triclopyr TEA, formulated, MRID 41633706) to 1.42 mg ae/L (triclopyr BEE, TGAI, MRID 42721101). The degradate TCP is not more toxic than the parent(s) triclopyr TEA or BEE with a 5d EC_{50} of 2.3 mg ae/L (TCP, TGAI, MRID 45312003). For the freshwater diatom (*Navicula pelliculosa*) the most sensitive endpoints (5d EC_{50}) range from 10.6 mg ae/L (4d EC_{50}, triclopyr TEA, formulated, MRID 41633708) to 0.07 mg ae/L (triclopyr BEE, TGAI, MRID 42721102).

Registrant submitted studies for *Lemna gibba*, the vascular aquatic plant, are available for triclopyr TEA (formulation), and triclopyr BEE (TGAI), Appendix A. The most sensitive endpoint for *Lemna gibba*, the 14d EC_{50}, range from 6.1 mg ae/L (triclopyr TEA, formulated, MRID 41633709) to 0.86 mg ae/L (triclopyr BEE, TGAI, MRID 42719101. There are no valid registrant submitted studies for the degradate TCP for vascular aquatic plants.

4.1.3.2 Freshwater Field Studies

There are no submitted field studies.

4.2 Toxicity of Triclopyr 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 Triclopyr (TEA and BEE expressed as the acid equivalent)

Assessment Endpoint	Species	Toxicity Value Used in Risk Assessment (expressed as ae)	Describe effect (i.e. mortality, growth, reproduction)	Citation MRID # (Author & Date)	Study Classification
Direct Toxicity to Terrestrial-phase CRLF					
Acute Dose-based	Northern Bobwhite Quail (*Colinus virginianus*)	21d LD_{50} = 529 mg ae/kg-bw (BEE)	Mortality	41902002 Campbell & Lynn 1991	Acceptable
Acute Dietary-based	Northern Bobwhite Quail (*Colinus virginianus*)	8d LC_{50} = 2934 ppm (Acid)	Mortality	40346403 Dow Chemical 1976	Acceptable
Chronic	Mallard Duck (*Anas platyrhynchos*)	NOAEC = 100 ppm LOAEC = 200 ppm (Acid)	# of 14d old survivors	00031250 Beavers & Fink 1980	Acceptable
Indirect Toxicity to Terrestrial-phase CRLF					
via acute toxicity to mammalian prey items	Rat (*Rattus norvegicus*)	LD_{50} = 572 mg ae/kg-bw (M&F) (TEA)	Mortality	00031940 Henck et al. 1979	Acceptable
via chronic toxicity to mammalian prey items	Rat (*Rattus norvegicus*)	NOAEL = 5 mg ae/kg-bw LOAEL = 25 mg ae/kg-bw (Acid)	Reproductive Toxicity 2-generation study - Offspring	43545701 Vedula et al 1995	Acceptable (HED 2002)
via acute toxicity to terrestrial invertebrate prey items	Honeybee *(Apis mellifera)*	48h LD_{50} > 72 µg ae/bee (BEE)	Mortality (26% at highest dose)	41219109 Dingledine 1985	Acceptable
via acute toxicity to terrestrial prey items	Northern Bobwhite Quail (*Colinus virginianus*)	21d LD_{50} = 529 mg ae/kg-bw (BEE)	Mortality	41902002 Campbell & Lynn 1991	Acceptable
via acute toxicity to terrestrial prey items	Northern Bobwhite Quail (*Colinus virginianus*)	8d LC_{50} = 2934 ppm (Acid)	Mortality	40346403 Dow Chemical 1976	Acceptable
via chronic toxicity to terrestrial prey items	Mallard Duck (*Anas platyrhynchos*)	NOAEC = 100 ppm LOAEC = 200 ppm (Acid)	# of 14d old survivors	00031250 Beavers & Fink 1980	Acceptable
Indirect Toxicity to Terrestrial- and Aquatic-Phase CRLF	Dicot Seedling Emergence Alfalfa (*Medicago sativa*)	EC_{25} = 0.045 lb ae/A NOAEC = 0.0026 lb ae/A (BEE)	parameter: emergence	43650001 Schwab 1995	Acceptable

Assessment Endpoint	Species	Toxicity Value Used in Risk Assessment (expressed as ae)	Describe effect (i.e. mortality, growth, reproduction)	Citation MRID # (Author & Date)	Study Classification
(via toxicity to terrestrial plants)	Dicot Vegetative Vigor Sunflower (*Helianthus annus*)	EC_{25} = 0.005 lb ae/A NOAEC = 0.0028 lb ae/A (TEA)	parameter: shoot length	43129801 Schwab 1993	Acceptable
	Monocot Seedling Emergence Onion (*Allium cepa*)	EC_{25} = 0.053 lb ae/A NOAEC = 0.0021 lb ae/A (BEE)	parameter: shoot weight	43650001 Schwab 1995	Acceptable
	Monocot Vegetative Vigor Onion (*Allium cepa*)	EC_{25} = 0.063 lb ae/A NOAEC < 0.063 lb ae/A (BEE)	parameter: shoot weight	43650001 Schwab 1995	Acceptable

Acute toxicity to terrestrial animals is categorized using the classification system shown in Table 4-4 (U.S. EPA 2004). Triclopyr falls in the range of "Slightly toxic" for birds on an acute oral and dietary exposure basis, and mammals on an acute oral exposure basis. 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 triclopyr; therefore, acute and chronic avian toxicity data are used to assess the potential direct effects of triclopyr to terrestrial-phase CRLFs.

4.2.1.1 Birds: Acute Exposure (Mortality) Studies

Avian toxicity data are used as a surrogate to estimate direct acute risks to the CRLF. Effects to birds from direct exposure to triclopyr could also indirectly affect the CRLF from reduction in available food (that is, other terrestrial amphibians as prey).

Triclopyr is classified as being slightly toxic to practically non-toxic on an acute oral exposure basis. The most sensitive species was the northern bobwhite quail with an acute oral 21-d LD_{50} value of 529 mg ae/kg-bw (triclopyr BEE, TGAI, MRID 41902002). The mallard duck has an acute oral 14-d LD_{50} value of 1418 mg ae/kg-bw (triclopyr TEA, formulation, MRID 40346501), and triclopyr is classified as practically non-toxic on an acute oral exposure basis. There is an avian acute oral registrant submitted study available for the mallard duck using triclopyr acid. For triclopyr acid, the mallard duck acute oral LD_{50} value is 1698 mg/kg-bw (triclopyr acid, TGAI, MRID 40346401). The degradate TCP is not more toxic than the parent (triclopyr BEE) for the northern bobwhite quail; the acute oral 8-d LD_{50} value being > 2585 mg ae/kg-bw (TCP, TGAI, MRID 41829001). No registrant submitted studies are available for triclopyr acid or triclopyr TEA for the northern bobwhite quail, and no registrant submitted studies are available for triclopyr BEE or the degradate TCP for the mallard duck.

The most sensitive species is the northern bobwhite quail with a subacute dietary 8-d LC_{50} value of 2934 ppm (triclopyr acid, TGAI, MRID 40346403). The mallard duck has a subacute dietary 8-d LC_{50} value > 3885 ppm (Triclopyr BEE, TGAI, MRID 41905501). Registrant submitted studies for avian subacute dietary are available for both the northern bobwhite and mallard duck for triclopyr acid (as TGAI, northern bobwhite quail only), triclopyr TEA (formulation), triclopyr BEE (TGAI), and TCP (as TGAI, mallard duck only). The most sensitive endpoints for the northern bobwhite quail subacute dietary 8-d LC_{50} range from 5189 ppm (triclopyr TEA, formulation, MRID 40346503) to 2934 ppm (triclopyr acid, TGAI, MRID 40346403). The most sensitive endpoints for the mallard duck subacute dietary 8-d LC_{50} range from > 3885 ppm (Tirlcopyr BEE, TGAI, MRID 41905501) to > 4465 ppm (triclopyr TEA, formulation, MRID 40346502). There are no degradate subacute dietary registrant submitted studies for the northern bobwhite quail. But the degradate TCP is not more toxic than the parent(s) triclopyr TEA or triclopyr BEE on a subacute dietary basis for the mallard duck; the 8-d LC_{50} being > 7265 ppm (TCP, TGAI, MRID 41829002).

4.2.1.2 Birds: Chronic Exposure (Growth, Reproduction) Studies

The mallard duck is the most sensitive species with a NOAEC of 100 ppm, and a LOAEC value of 200 ppm based on the number of 14-d old survivors (triclopyr acid, TGAI, MRID 00031250). No other registrant submitted chronic toxicity studies using triclopyr TEA, triclopyr BEE, or the degradate TCP are available.

4.2.1.3 Terrestrial-phase Amphibian Acute and Chronic Studies

There are no terrestrial-phase amphibian acute or chronic studies submitted or available in the open literature.

4.2.2 Toxicity to Mammals

Mammalian toxicity data are used to assess potential indirect effects of triclopyr to the terrestrial-phase CRLF. Effects to small mammals resulting from exposure to triclopyr may 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). See the HED Table from the mammalian toxicity endpoints for Triclopyr (acid, TEA, and BEE) from the most recent HED Human Health Risk Assessment completed in 2002 (Appendix M).

4.2.2.1 Mammals: Acute Exposure (Mortality) Studies

Triclopyr is classified as being slightly toxic to mammals on an acute oral basis. This is based on an acute oral LD_{50} value of 572 mg ae/kg-bw (triclopyr TEA, formulation, MRID 00031940). Registrant submitted studies for acute oral rats are available for triclopyr acid (as TGAI), triclopyr TEA (formulation), triclopyr BEE (TGAI), and TCP (as TGAI). The acute oral LD_{50} values range from 572 mg ae/kg-bw (Male & Female, triclopyr TEA, formulation, MRID 00031940) to 630 mg /kg-bw (Female, triclopyr acid, TGAI, MRID 00031940). The degradate TCP is not more toxic than the parent(s) triclopyr acid, triclopyr TEA or triclopyr BEE, with an LD_{50} value of 1026 mg ae/kg-bw (Male, TCP, TGAI, MRID 00064938).

4.2.2.2 Mammals: Chronic Exposure (Growth, Reproduction) Studies

In the 2-generation reproductive toxicity study for rats, the offspring NOAEL is 5 mg ae/kg-bw and the LOAEL is 25 mg ae/kg-bw (triclopyr acid, TGAI, MRID 43545701). The LOAEL is based on an increased incidence of F_2 pups with exencephaly and ablepharia. Parental systemic toxicity resulted in a NOAEL of 5 mg ae/kg-bw, and a LOAEL of 25 mg ae/kg-bw based on increased incidence of proximal tubular degeneration in male and female P_1 and P_2 rats. HED determined that triclopyr is not a mutagen, and has not been classified in terms of carcinogenicity (HED 2002). Triclopyr has been classified as a Group D chemical, and is unable to be classified as to human carcinogenicity, based on marginal evidence of tumors in female rates and mice and benign adrenal pheochromocytomas in male rats (HED 2002). No other registrant submitted chronic toxicity studies using triclopyr TEA, triclopyr BEE, or the degradate TCP are available.

4.2.3 Toxicity to Terrestrial Invertebrates

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

4.2.3.1 Terrestrial Invertebrates: Acute Exposure (Mortality) Studies

Triclopyr is classified as moderately toxic to honeybees based on acute contact. The honeybee acute contact study resulted in a 48h LD_{50} > 72 μg ae/bee (triclopyr BEE, TGAI, MRID 41219109). Mortality at the highest dose tested (72 μg ae/bee) at 48 hours was 26% compared to 6% observed in the negative controls and the second highest dose tested (43 μg ae/bee), indicating that the mortality seen is most likely treatment related (MRID 41219109). Registrant submitted studies for honeybee acute contact exposure is also available for triclopyr acid. For triclopyr acid, the honeybee acute contact 48h LD_{50} is > 100 μg/bee (triclopyr acid, TGAI, MRID 40356602). There are no registrant submitted studies using triclopyr TEA or the degradate TCP.

4.2.3.2 Terrestrial Invertebrates: Open Literature Studies

There are no terrestrial invertebrate studies available in the open literature.

4.2.4 Toxicity to Terrestrial Plants

Terrestrial plant toxicity data are used to evaluate the potential for triclopyr 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 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 are 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. These tests 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 triclopyr, 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.

Tier I results for triclopyr observed that all species tested showed greater than 25% inhibition for seedling emergence (MRID 41734301) and vegetative vigor (MRID 41784401), which resulted in the need for Tier II testing for all ten species (six dicots and four monocots) using triclopyr (both TEA and BEE, reported in terms of acid equivalent). In seedling emergence studies, the most sensitive dicot species is alfalfa (*Medicago sativa*) with an EC_{25} of 0.045 lb ae/A, and a NOAEC of 0.0026 lb ae/A (triclopyr BEE, formulated MRID 43650001), and the most sensitive monocot species is the onion (*Allium cepa*) with an EC_{25} of 0.053 lb ae/A, and a NOAEC of 0.0021 lb ae/A (triclopyr BEE, formulated MRID 43650001). The most sensitive parameter for the alfalfa seedling emergence study is percent emergence (MRID 43650001), and the most sensitive parameter for the onion seedling emergence study is shoot weight (MRID 43650001). In the vegetative vigor studies, the most sensitive dicot species is the sunflower (*Helianthus annus*) with an EC_{25} of 0.005 lb ae/A, and a NOAEC of 0.0028 lb ae/A (triclopyr TEA, formulated, MRID 43129801), and the most sensitive monocot species is the onion (*Allium cepa*) with an EC_{25} of 0.063 lb ae/A, and a NOAEC < 0.063 lb ae/A (triclopyr BEE, formulated MRID 43650001). The most sensitive parameter for the sunflower is shoot length (MRID 43129801), and the most sensitive parameter for the onion is shoot weight (MRID 43650001).

Registrant submitted studies for non-target terrestrial plants are only available for triclopyr TEA and triclopyr BEE as formulated products (Garlon 3A and Garlon 4). No registrant submitted studies are available for triclopyr acid, or the degradate TCP. For the vegetative vigor studies, the most sensitive dicot species, the sunflower, $EC_{25's}$ range from 0.005 lb ae/A (triclopyr TEA, formulated, MRID 43129801) to 0.006 lb ae/A (triclopyr BEE, formulated MRID 43650001). The most sensitive monocot species, the onion, EC_{25} ranges from 0.063 lb ae/A (triclopyr BEE, formulated MRID 43650001) to 0.114 lb ae/A (triclopyr TEA, formulated, MRID 43129801). The most sensitive parameters for the sunflower vegetative vigor studies are shoot length (TEA), and shoot weight (BEE), and the most sensitive parameter for the onion vegetative vigor studies is shoot weight (both TEA and BEE). For the seedling emergence studies, the most sensitive dicot species is alfalfa for triclopyr BEE, and the soybean for triclopyr TEA, with EC_{25}'s that range from 0.045 lb ae/A (triclopyr BEE, formulated MRID 43650001) to > 0.23 lb ae/A (triclopyr TEA, formulated, MRID 43129801). The most sensitive parameter for the alfalfa seedling emergence study is percent emergence (MRID 43650001), and the most sensitive parameter for the soybean seedling emergence study is shoot length (MRID 43129801). For the seedling emergence studies the most sensitive monocot species is the onion for triclopyr BEE, and barley for triclopyr TEA, with EC_{25}'s that range from 0.053 lb ae/A (triclopyr BEE, formulated MRID 43650001) to > 0.23 lb ae/A (triclopyr TEA, formulated, MRID 43129801). The most sensitive parameter for the onion seedling emergence study is shoot weight (MRID 43650001), and the most sensitive parameter for the barley seedling emergence study is shoot length (MRID 43129801).

The results of the Tier II seedling emergence and vegetative vigor toxicity tests on non-target plants are summarized below in Table 4-5**.**

Table 4-5 Non-target Terrestrial Plant Seedling Emergence and Vegetative Vigor Toxicity (Tier II) Data

Crop	Species	Toxicity Value Used in Risk Assessment (expressed as ae)	Most sensitive parameter	Slope	Citation MRID# (Author & Date)	Comment
Dicot	Seedling Emergence Alfalfa (*Medicago sativa*)	EC25 = 0.045 lb ae/A NOAEC = 0.0026 lb ae/A (BEE)	emergence	N.A.	43650001 Schwab 1995	Acceptable
	Vegetative Vigor Sunflower (*Helianthus annus*)	EC25 = 0.005 lb ae/A NOAEC = 0.0028 lb ae/A (TEA)	shoot length	N.A.	43129801 Schwab 1993	Acceptable
Monocot	Seedling Emergence Onion (Allium cepa)	EC25 = 0.053 lb ae/A NOAEC = 0.0021 lb ae/A (BEE)	shoot weight	N.A.	43650001 Schwab 1995	Acceptable
	Vegetative Vigor Onion (*Allium cepa*)	EC25 = 0.063 lb ae/A NOAEC < 0.063 lb ae/A (BEE)	shoot weight	0.705	43650001 Schwab 1995	Acceptable

N.A., Not Available

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 triclopyr 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.

A probit slope value for acute freshwater fish, freshwater invertebrate, and avian toxicity tests are not available; therefore, the effect probability is 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).

4.4 Incident Database Review

A review of the EIIS for ecological incidents involving triclopyr (the acid, TEA and BEE forms) was completed on August 25, 2009. 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 triclopyr including associated uncertainties is included as Appendix O.

Of the total of 63 incidents listed for triclopyr, 43 were listed under triclopyr acid (PC code 116001), 13 incidents listed for triclopyr TEA (PC code 116002), and 7 incidents listed for triclopyr BEE (PC code 116004). Of the 43 incidents listed for triclopyr acid (PC code 116001), under further examination it was determined that 25 of those involved triclopyr TEA formulation (1 aquatic and 24 plant incidents), 9 involved triclopyr BEE formulation (1 aquatic and 8 plant incidents) and the remaining 9 incidents (1 aquatic, and 8 plant incidents) were unable to be further classified into formulation.

4.4.1 Terrestrial Incidents

No terrestrial incidents were reported within the EIIS database for triclopyr, triclopyr TEA or triclopyr BEE.

4.4.2 Plant Incidents

From a total of 41 plant incidents listed for triclopyr (PC code 116001), 8 were not able to be classified into the formulation of triclopyr (TEA or BEE) (I014409-009, I007875-001, I007834-039, I003377-027, I014404-019, I014404-018, I013883-026 and I012786-005).

Two incidents were the result of the registered use of triclopyr (I014409-009 and I007875-001). One incident was in Washington, and although the use was not reported, it was likely residential. Triclopyr was listed as a possible cause, since it was alleged that Glyphosate, 2,4-D and triclopyr drifted in to a garden, and the drift/over spray was confirmed by lab results. However, no analysis was submitted, and the state sent a warning letter regarding the incident (I014409-009). The other incident involved the registered use of triclopyr on pastures in Wisconsin (I007875-001). Garden and ornamental plants of homes bordering 55 treated acres allegedly were injured by drift (physical) and drift due to volatilization of triclopyr. The pesticides involved included triclopyr and 2,4-D which are both active ingredients in the product Crossbow (in both TEA and BEE formulations), therefore they were both classified as the probable cause of the incident.

Two incidents were the result of accidental misuse of triclopyr for the municipal operation and railroad right-of-way uses (I007834-039 and I003377-027). Triclopyr was listed as the probable cause of the incident in which $500,000 damage was sustained to grape vineyards after Garlon application to weeds alongside Highway 111 in CA (accidental misuse of a municipal operation use), adjacent to the vineyards (I007834-039). The accidental misuse of triclopyr on a railroad right-of-way, in CA resulted in an incident in which owners of grapevines adjacent to the railroad noted damage to their crops (I003377-027). Almonds also were documented as having plant damage, as a result of triclopyr residues being detected on the plants, triclopyr was classified as being the highly probable cause of the incident (I003377-027).

In the misuse incident of triclopyr in Washington during fencerow application within a residential area, triclopyr and 2,4-D were likely the probable cause of dying shrubs in an adjacent yard. Exposure potentially occurred as a result of spray drift (I014404-019). Three incidents of undetermined legality (two in Washington and one in France) resulted in damage to non-target trees including ornamentals, cypress and poplars (I014404-018, I013883-026 and I012786-005). One of the Washington incidents alleges that triclopyr may be the possible cause of damage to poplar trees and other ornamentals in a residential yard, however, it is not clear whether this was a direct application or as the result of spray drift of the pesticide (I014404-018). The other Washington incident found that triclopyr may be the highly probable cause of dying cypress tress along a fence-line as residues of triclopyr and 2,4-D were found within the plants (I013883-026). The other incident of undetermined legality occurred in France, and found that Garlon D 12 (triclopyr and 2,4-D) were the possible cause of 10 damaged ornamental trees where the symptoms were listed as “phytotoxic” (I012786-005).

Incidents identified under triclopyr (PC code 116001), and further classified as being triclopyr TEA includes 24 incidents to plants (I003147-001, I006846-003, I006846-002, I006846-001, I004846-001, I008639-001, I007340-707, I002507-001, I008571-027, I009262-093, I009262-094, I008003-001, I008188-001, I008188-003, I008188-002, I009513-001, I008884-001, I009969-006, I009513-002, I009513-003, I012366-048, I016962-005, I015748-035, and I006871-001). There were a total of 16 incidents resulting in damage to rice from registered applications of triclopyr TEA to agricultural areas or to rice. From the registered applications of triclopyr TEA (Grandstand R) on agricultural areas, four incidents resulted in a reduced yield of the rice, which listed triclopyr TEA as the probable cause of the incident in TX and AR (I003147-001, I006846-003, I006846-002, and I006846-001). A total of 12 incidents from the registered use of triclopyr TEA (Grandstand R) on rice resulted in alleged damage to the crop (I004846-001, I008639-001, I008003-001, I008188-001, I008188-003, I008188-002, I009513-001, I009969-006, I009513-002, I009513-003, I016962-005, and I015748-035). The likelihood of triclopyr TEA being responsible for the damage seen to the rice crops varied from being the possible (I008639-001, I008003-001, I008188-001, I008188-003, I008188-002, I016962-005, and I015748-035) to the probable cause (I004846-001, I009513-001, I009969-006, I009513-002, and I009513-003). For triclopyr use on rice damage and symptoms of the rice crop included twisting and knotting up in the rice (I004846-001), overall crop injury and decreased yield (I008639-001, I008188-002, I016962-005, I015748-035), root fish-hooking and dead tellers, with a decreased yield (I008003-001), root twisting and color change (I008188-001), color change alone (I008188-003), fish-hooking on roots, aborted tillers, and reduced stand (I009513-001), twisted roots and tillers falling off (I009513-002), visible tip burn and damage to the rice tillers (I009513-003), and other symptoms included rice tip burn, aerial roots, crooked neck on roots (I009969-006). The other two incidents which resulted in damage to rice included accidental misuse of triclopyr on rice, in which spray drift resulted in 124 acres of trees affected (I008884-001), and one of undetermined legality of triclopyr use on rice where the rice crop was damaged, tip burn was visible after 10 days application (I012366-048).

The registered home use of triclopyr TEA (as Garlon 3A) was a probable cause of injury seen on a cotton field that neighbored the application use site, as drift likely occurred when the product was sprayed along the fence line (I002507-001). The registered home/lawn use of triclopyr TEA (as Weed-B-Gon), was a probable cause of two incidents that resulted in damage to lawns after treatment with the product (I009262-093 and I009262-094). Accidental misuse of triclopyr TEA as Brush-B-Gon (home/lawn use), was identified as the probable cause of damage to an entire St. Augustine lawn, as the lawn was sprayed directly to control weeds which was against stated label language (I008571-027). Accidental right-of-way misuse of triclopyr TEA (as Garlon 3A), formulated in a mixture with Tordon (Picloram) was applied to an electric power line right-of-way, a rain event (1.5 inches) occurred the next evening moving product (via runoff) into an adjacent soybeans field which resulted in cupped leaves and absent plants

(I006871-001). The undetermined agricultural area use of triclopyr TEA was the possible cause of damage seen to ornamentals that were treated directly with Ortho Brush-B-Gon (I007340-707).

Incidents identified under triclopyr (PC code 116001), and further classified as being triclopyr BEE includes 8 incidents to plants (I004712-001, I004721-001, I003581-001, I015921-002, I001944-001, I005413-001, I008077-001, and I005082-001). The registered right-of-way use of triclopyr BEE (as Garlon 4) near a planted field was the probable cause of tomato crop growth regulatory type injury and damage seen in FL (I004712-001 and I004721-001). The registered pasture use of triclopyr BEE was a possible cause of alleged damage to a vineyard (over a three-year period) (I008077-001). The damage reported to the vines included severe stunting, death of shoot tios and entire shoots which resulted in low fruit, shot berries, withering and dead clusters and loss of crop yield (grapes), and budding grape plants (I008077-001). Accidental misuse of triclopyr BEE (as Garlon 4) on an agricultural area (pastureland) next to a vineyard, was the probable cause of brown/dead leaves, decreased growth and several dead vines, approximately 21 rows of grapevines were affected via spray drift (I003581-001). Another accidental misuse of triclopyr BEE (Garlon 4) in combination with Tordon K (Picloram) on a right-of-way in OK with a wind speed between 10-16.1 mph, was the possible cause of damage to hundreds of trees (including oak, walnut, hickory, pecan, sassafras, redbud, dogwood, black cherry, Chinese chestnut, apple, pear, and sycamore) in a neighboring property (I001944-001). However, the Oklahoma State Department of Agriculture investigated the incident, and found no herbicidal effect to the trees (I001944-001). An accidental road right-of-way misuse was the probable cause of damage to several wine grape fields that were adjacent to the application site (I005413-001). The day of application the weather was windy, and the potential for spray drift increased. The accidental misuse of triclopyr BEE in a rose tree nursery was the probable cause of damage to roses seen after a malfunction occurred with the equipment used for pesticide application (I005082-001). An undetermined legality use of triclopyr BEE on an agricultural area was a possible cause of the mortality seen in hundreds of trees from overspray of products (Spike 20P, Remedy, and Grazon P+D Herbicide), the chemicals suspected include Picloram, 2,4-D, Triisopropylamine, Tebuthiuron and triclopyr BEE (I015921-002). In addition to the deaths of the trees, the plaintiff alleges that the contamination of the land and water resources have diminished the property's use for deer hunting and fishing (I015921-002).

There were a total of 13 plant incidents listed for triclopyr TEA (PC code 116002), and included I012701-001, I010624-001, I010927-035, I010927-036, I010927-037, I010927-038, I010927-039, I013636-030, I013550-006, I016962-008, I016962-043, I016680-001, and I017837-003. The registered rangeland use of triclopyr TEA was a possible cause of damage seen to potatoes and tomatoes, as compost that was distributed by Washington State University, was found to contain TORDON 22X an herbicide that was used on fields where the hay was harvested to feed cattle (I010624-001). The concentration found in the home gardens was of the order of 0.01 ppb Picloram, however triclopyr TEA was also listed as a possible cause in the product Confront in which triclopyr TEA is mixed with Clopyralid (I010624-001). The registered use of triclopyr TEA (Grandstand) on rice was the probable cause of damage seen to rice crop in three incidents (I010927-035, I010927-036 and I010927-037), and possible cause of damage to rice in one incident (I013636-030). Damage to rice included tip burn, yellowing and white-spots, burned down tillers and necrotic spots on the leaf were observed (I010927-035), burn on the rice shortly after application (I010927-036), and low yield and dead plants (I010927-037). The registered use of triclopyr TEA to rice, broadleaf weeds, and curly indigo was used in combination with Stam M-4 (Propanil), and was the possible cause of injury (tillers erupting from the stalk), and a decreased yield of rice (I016962-043). The registered right-of-way use of triclopyr TEA (Garlon 3A) and DMA 4 (2,4-D) were a possible cause of mortality seen in nursery trees and greenhouse annuals, Leaf tissue samples of tree showed 0.017 ppm of 2-4-D but no detectable triclopyr (I017837-003). The accidental misuse of triclopyr TEA associated with application to rice was the probable cause of damage to rice, as application of triclopyr TEA occurred earlier than label recommendations (15 days apart instead of 20, I010927-038) or late in the season (I010927-039) which resulted in damage to the rice crop. Accidental misuse of triclopyr associated with its use on rice was the probable cause of damage to part of an alfalfa field from spray drift during aerial application to rice (I013550-006). Undetermined legality of triclopyr TEA use on rice was the possible cause of “various damage” to the 2003 rice crop experienced by a farming business in TX (I016962-008). The undetermined legality of triclopyr TEA right-of-way use was the possible cause of 13 acres of vineyards damaged as the result of overspray of a combination of chemicals including (triclopyr TEA, Sulfometuron, 2,4-D, and Hexazinone, I016680-001).

There were a total of 7 plant incidents listed for triclopyr BEE (PC code 116004), and included: I012209-003, I013550-004, I011622-003, I016940-015, I013645-010, I010927-014, and I013550-007. The registered use of triclopyr BEE on grass was the possible cause of damage to 18 acres of Bermuda grass, however one month earlier 2,4-D was applied with little success followed by Remedy (triclopyr BEE), therefore it was unclear which chemical is responsible for the damage seen (I013550-004). The registered use of triclopyr BEE on parks to control weeds was a probable cause of spray drift to a grape vineyard, olive trees and ornamental plants, and resulted in the refusal of the grapes at a winery as the pesticide was not approved for use on grapes (I016940-015). The product label prohibits Garlon 4 from being sprayed as mists and prohibits permitting direct contact with grapes, tobacco, vegetable crops, and broad leaf plants (I016940-015). Registered use of triclopyr BEE on a tree farm/plantation was the probable cause f damage seen to 1.5 acres of beans, 3 oak trees, and some grape vines, a result of probable spray drift (I013550-007). Damage seen to the beans included chlorosis and cupping, the grapes were chlorotic, and some of the oak leaves turned brown (I013550-007). Accidental misuse of triclopyr BEE during municipal operation use was a probable cause in damage to tomato plants adjacent to the application site as a result of probable drift (I011622-003). The result was the cupping and curling of the plants, and the Court's finding was in favor of the tomato farmer. Garlon and Remedy (triclopyr BEE) are registered for a number of uses but they do not include tomatoes (I011622-003). Accidental misuse of triclopyr BEE resulting from the use of improper equipment to transfer the chemical from the sprayer (a rubber hose was used instead of plastic tubing, a problem since Remedy (BEE) can penetrate the inner lining of rubber hosing), was a probable cause in mortality seen to soybeans after application of a different herbicide, Round Up (I010927-014). Triclopyr BEE was applied to mesquite trees, and when the operator transferred chemicals, it was not done the correct way (I010927-014). A Dow submitted a letter, dated June 15, 2001 (identified as I011622-001) but it had no additional information. Misuse of triclopyr BEE that was used to control blackberries was a probable cause in the crop loss and herbicide exposure symptoms seen in a grape vineyard on a neighboring farm (I012209-003). Samples were taken from the vineyard and found positive, indicating that some of the pesticides had drifted onto the grape vines causing damage valued at $84,380 (I012209-003). The misuse of triclopyr BEE (as GARLON 4) from application to a road right-of-way, and was the probable cause of severe damage sustained by two vineyards (I013645-010). Both soil and foliage samples, were then collected (although no data was supplied) and the ensuing analyses established that GARLON 4 had drifted onto the vineyards and was responsible for the damage that had been sustained (I013645-010).

4.4.3 Aquatic Incidents

There were a total of three reported aquatic incidents under triclopyr (PC code 116001). Two were further classified, one as triclopyr TEA (I008883-001) and the other as triclopyr BEE (I005004-001), while the third could not be further (I000925-001). For triclopyr TEA an incident of undetermined legality occurred in LA where triclopyr was classified as the possible cause of an allegation that 45,000 pounds of catfish had been destroyed in a catfish farm after an adjacent rice field had been sprayed with Grandstand R (triclopyr TEA) with Stam M-4 (Propanil) at the rate of 3.0 lbs/gallon (I008883-001). The manager of the catfish farm contends that the spray drift of Grandstand R had killed the fish as the consequence of oxygen starvation, a distance of 70 ft (I008883-001). There were no analyses made to support the allegation which is presumed to have been based on the herbicidal action of Grandstand R that might kill the plankton in the fish pond (I008883-001). The second reported aquatic incident involves the accidental misuse of triclopyr BEE, in AR. It was reported that aerial drift of Garlon 4 (triclopyr BEE) contaminated an adjacent pond which resulted in damage to some aquatic vegetation (I005004-001). Triclopyr is listed as a probable cause of this incident. The third reported aquatic incident from the registered use of triclopyr on railroad right-of way likely resulted in a fish kill of approximately 23000 fish below a railroad crossing and above a low retention dam on Blueston River, WV (I000925-001). The suspected route of exposure was via spray drift, and in addition to triclopyr, 2,4-D was also listed in the report as being a highly probable cause for incident.

5.0 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 triclopyr 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 terrestrial 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 label-recommended triclopyr 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 triclopyr (Table 3-5 and Table 3-7) and the appropriate toxicity endpoint from Table 4-3. Exposures are also derived for terrestrial plants, as discussed in Section 3.4 and toxicity summarized in Section 4.2.4, based on the highest application rates of triclopyr 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. In order to assess direct chronic risks to the CRLF, 60-day EECs and the lowest chronic toxicity value for freshwater fish are used. The resulting RQs for the majority of triclopyr uses exceed the Agency's acute and chronic LOC's (0.05 and 1.0) for freshwater fish (surrogates for the aquatic-phase CRLF) (Table 5-1). The acute RQs exceed the Agency's LOC for listed species (0.05), and range from 9.62 (Lakes/ponds/reservoirs) to 0.02 (ornamental lawns and turf) (Table 5-1). A probit slope value for the bluegill sunfish acute toxicity test is not available therefore; the probability of individual effect was estimated based on the default slope of 4.5. The estimated probability of an individual effect from triclopyr use at the endangered species LOC (0.05) ranges from 1 in 1 with a 95% CI of 1 in 1 to 1 in 1 for lakes/ponds/reservoirs to 1 in 2.51 x 10^6 with a 95% CI of 1 in 70.8 to 1 in 3.64 x 10^{22} for ornamental sod farm (turf) for acute aquatic-phase amphibian RQs. The estimated probability of individual effect of triclopyr ranges from approximately 100% (lakes/ponds/reservoirs) to 3.98 x 10^5 % (ornamental sod farm-turf). The chronic RQs exceed the Agency's LOC (1.0), and range from 131.58 (Lakes/ponds/reservoirs) to 0.21 (ornamental lawns and turf) (Table 5-1). Results are presented in Table 5-1. An example PRZM/EXAM and Rice model output are available in Appendix K and J, respectively. **Based on the potential for both acute and chronic effects (Table 5-1) triclopyr may directly affect the aquatic-phase of the CRLF.**

Table 5-1 Summary of Direct Effect RQs for the Aquatic-phase CRLF

Use	Peak EEC (µg/L)[b]	60-Day EEC (µg/L)[b]	Direct Acute RQ	Probability of Individual Effect at RQ[C]	Direct Chronic RQ
DOUGLAS-FIR (FOREST/SHELTERBELT)	44.02	35.50	**0.17**	1 in 3.74 x 10^3 (1 in 16.2 to 1 in 4.62 x 10^{11}) 26.7%	**1.87**
CONIFER RELEASE	127.70	107.60	**0.49**	1 in 12.2 (1 in 3.73 to 1 in 377) 8.2%	**5.66**
CHRISTMAS TREE PLANTATIONS, CONIFER RELEASE, FOREST TREES (ALL OR UNSPECIFIED), FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT	194.70	136.90	**0.75**	1 in 3.48 (1 in 2.49 to 1 in 7.67) 28.7%	**7.21**
CHRISTMAS TREE PLANTATIONS, FOREST TREES (ALL OR UNSPECIFIED), CONIFER RELEASE	534.60	426.30	**2.06**	1 in 1.09 (1 in 1.36 to 1 in 1) 91.7%	**22.44**
FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT, FOREST TREES (ALL OR UNSPECIFIED)	337.90	286.00	**1.30**	1 in 1.44 (1 in 1.69 to 1 in 1.18) 69.4%	**15.05**
ORCHARDS (non-food stump treatment)	148.40	109.68	**0.57**	1 in 7.35 (1 in 3.20 to 1 in 71.4) 13.6%	**5.77**
AIRPORTS/LANDING FIELDS, COMMERCIAL/INSTITUTIONAL/INDUSTRIAL PREMISES/EQUIPMENT (OUTDOOR)	3479.00	2864.00	**13.38**	1 in 1 (1 in 1.01 to 1 in 1) 100%	**150.74**
PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR), NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	1363.00	1006.50	**5.24**	1 in 1 (1 in 1.08 to 1 in 1) 100%	**52.97**
COMMERCIAL STORAGES/WAREHOUSES PREMISES, PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR)	5802.00	4770.00	**22.32**	1 in 1 (1 in 1 to 1 in 1) 100%	**251.05**
AGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	250.06	190.69	**0.96**	1 in 2.14 (1 in 2.06 to 1 in 2.29) 46.7%	**10.04**
	1319.20	1098.53	**5.07**	1 in 1 (1 in 1.09 to 1 in 1) 100%	**57.82**
NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	2929.60	2442.28	**11.27**	1 in 1 (1 in 1.02 to 1 in 1) 100%	**128.54**
ORNAMENTAL HERBACEOUS PLANTS, ORNAMENTAL NONFLOWERING PLANTS	34.04	23.95	**0.13**	1 in 2.99 x 10^4 (1 in 26.2 to 1 in 1.31 x 10^{15}) 0.003%	**1.26**
ORNAMENTAL AND/OR SHADE TREES, ORNAMENTAL WOODY SHRUBS AND VINES	415.30	308.50	**1.60**	1 in 1.22 (1 in 1.52 to 1 in 1.03) 82.0%	**16.24**

Use	Peak EEC (μg/L)[b]	60-Day EEC (μg/L)[b]	Direct Acute RQ	Probability of Individual Effect at RQ[C]	Direct Chronic RQ
	382.60	268.70	**1.47**	1 in 1.29 (1 in 1.58 to 1 in 1.07) 77.5%	**14.14**
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT	77.28	65.05	**0.30**	1 in 107 (1 in 6.76 to 1 in 7.91 x 10^5) 0.93%	**3.42**
AGRICULTURAL/FARM PREMISES	103.14	87.12	**0.40**	1 in 27.3 (1 in 4.69 to 1 in 5.83 x 10^3) 3.66%	**4.59**
AGRICULTURAL FALLOW/IDLELAND, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	87.78	66.49	**0.34**	1 in 57.1 (1 in 5.73 to 1 in 8.07 x 10^4) 1.75%	**3.50**
AGRICULTURAL FALLOW/IDLELAND	64.62	49.93	**0.25**	1 in 297 (1 in 8.75 to 1 in 3.33 x 10^7) 0.34%	**2.63**
AGRICULTURAL/FARM PREMISES	990.20	793.90	**3.81**	1 in 1 (1 in 1.14 to 1 in 1) 100%	**41.78**
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT, AGRICULTURAL UNCULTIVATED AREAS, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	990.20	793.90	**3.81**	1 in 1 (1 in 1.14 to 1 in 1) 100%	**41.78**
	32.91	24.93	**0.13**	1 in 2.99 x 10^4 (1 in 26.2 to 1 in 1.31 x 10^{15}) 33.4%	**1.31**
PASTURES, RANGELAND	394.80	321.90	**1.52**	1 in 1.26 (1 in 1.56 to 1 in 1.05) 79.4%	**16.94**
RECREATION AREA LAWNS, RESIDENTIAL LAWNS	75.02	61.68	**0.29**	1 in 129 (1 in 7.09 to 1 in 1.53 x 10^6) 77.5%	**3.25**
RESIDENTIAL LAWNS	415.02	309.03	**1.60**	1 in 1.22 (1 in 1.562 to 1 in 1.03) 82.0%	**16.26**
HOUSEHOLD/DOMESTIC DWELLINGS OUTDOOR PREMISES, RECREATION AREA LAWNS	1499.38	1171.65	**5.77**	1 in 1 (1 in 1.07 to 1 in 1) 100%	**61.67**
ORNAMENTAL LAWNS AND TURF	5.26	4.04	0.02	No Exceedance	0.21
COMMERCIAL/INDUSTRIAL LAWNS, ORNAMENTAL LAWNS AND TURF	34.65	28.60	**0.13**	1 in 2.99 x 10^4 (1 in 26.2 to 1 in 1.31 x 10^{15}) 33.4%	**1.51**
ORNAMENTAL SOD FARM (TURF)	20.80	15.69	**0.08**	1 in 2.51 x 10^6 (1 in 70.8 to 1 in 3.64 x 10^{22}) 3.98 x 10^5 %	0.83
COMMERCIAL/INDUSTRIAL LAWNS	124.83	94.34	**0.48**	1 in 13.2 (1 in 3.82 to1 in 485) 7.58%	**4.97**
ORNAMENTAL SOD FARM (TURF)	165.10	133.80	**0.64**	1 in 5.22 (1 in 2.86 to 1 in 24.7) 19.2%	**7.04**
GOLF COURSE TURF	270.00	219.50	**1.04**	1 in 1.88 (1 in 1.95 to 1 in 1.78) 53.2%	**11.55**
	763.00	763.00	**2.93**	1 in 1.29 (1 in 1.58 to 1 in 1.07) 77.5%	**40.16**
RICE	763.00	763.00	**2.93**	1 in 1.29 (1 in 1.58 to 1 in 1.07) 77.5%	**40.16**

Use	Peak EEC (µg/L)[b]	60-Day EEC (µg/L)[b]	Direct Acute RQ	Probability of Individual Effect at RQ[C]	Direct Chronic RQ
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER, LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE)	2500.00	2500.00	**9.62**	1 in 1 (1 in 1 to 1 in 1) 100%	**131.58**
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER	2500.00	2500.00	**9.62**	1 in 1 (1 in 1 to 1 in 1) 100%	**131.58**
SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	2500.00	**9.62**	1 in 1 (1 in 1 to 1 in 1) 100%	**131.58**
LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE), SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	2500.00	**9.62**	1 in 1 (1 in 1 to 1 in 1) 100%	**131.58**

[a] RQs associated with acute 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 maximum application rate per use (see Table 3-3).
[c] A probit slope value for the acute blue-gill sunfish 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).
[*] RQ < acute endangered species LOC of 0.05.
^ The most sensitive species used to determine the acute direct effects (surrogate species) was the Bluegill Sunfish (96h LC_{50} = 260 ppb). The most sensitive species used to determine the chronic direct effects (surrogate species) was the Rainbow Trout (NOAEC = 19 ppb).

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

a) Non-vascular Aquatic Plants

Indirect effects of triclopyr 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 toxicity value (EC_{50}) for aquatic non-vascular plants. The Agency's risk to aquatic plants LOC (1.0) is exceeded for numerous uses of triclopyr. The aquatic non-vascular plant RQs range from 35.71 (lakes/ponds/reservoirs) to 0.08 (ornamental lawns and turf). Results are presented in Table 5-2. An example PRZM/EXAM and Rice model output are available in Appendix K and J, respectively. **Based on the aquatic non-vascular plant LOC exceedances, triclopyr may indirectly affect the CRLF via reduction in non-vascular plants as food items.**

Table 5-2 Summary of 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)

Use	EEC (µg/L)[b]	RQ
DOUGLAS-FIR (FOREST/SHELTERBELT)	44.02	0.63
CONIFER RELEASE	127.70	**1.82**
CHRISTMAS TREE PLANTATIONS, CONIFER RELEASE, FOREST TREES (ALL OR UNSPECIFIED), FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT	194.70	**2.78**
CHRISTMAS TREE PLANTATIONS, FOREST TREES (ALL OR UNSPECIFIED), CONIFER RELEASE	534.60	**7.64**
FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT, FOREST TREES (ALL OR UNSPECIFIED)	337.90	**4.83**
ORCHARDS (non-food stump treatment)	148.40	**2.12**

Use	EEC (µg/L)[b]	RQ
AIRPORTS/LANDING FIELDS, COMMERCIAL/INSTITUTIONAL/INDUSTRIAL PREMISES/EQUIPMENT (OUTDOOR)	3479.00	**49.70**
PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR), NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	1363.00	**19.47**
COMMERCIAL STORAGES/WAREHOUSES PREMISES, PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR)	5802.00	**82.89**
AGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	250.06	**3.57**
	1319.20	**18.85**
NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	2929.60	**41.85**
ORNAMENTAL HERBACEOUS PLANTS, ORNAMENTAL NONFLOWERING PLANTS	34.04	0.49
ORNAMENTAL AND/OR SHADE TREES, ORNAMENTAL WOODY SHRUBS AND VINES	415.30	**5.93**
	382.60	**5.47**
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT	77.28	**1.10**
AGRICULTURAL/FARM PREMISES	103.14	**1.47**
AGRICULTURAL FALLOW/IDLELAND, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	87.78	**1.25**
AGRICULTURAL FALLOW/IDLELAND	64.62	0.92
AGRICULTURAL/FARM PREMISES	990.20	**14.15**
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT, AGRICULTURAL UNCULTIVATED AREAS, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	990.20	**14.15**
PASTURES, RANGELAND	32.91	0.47
	394.80	**5.64**
RECREATION AREA LAWNS, RESIDENTIAL LAWNS	75.02	**1.07**
RESIDENTIAL LAWNS	415.02	**5.93**
HOUSEHOLD/DOMESTIC DWELLINGS OUTDOOR PREMISES, RECREATION AREA LAWNS	1499.38	**21.42**
ORNAMENTAL LAWNS AND TURF	5.26	0.08
COMMERCIAL/INDUSTRIAL LAWNS, ORNAMENTAL LAWNS AND TURF	34.65	0.49
ORNAMENTAL SOD FARM (TURF)	20.80	0.30
COMMERCIAL/INDUSTRIAL LAWNS	124.83	**1.78**
ORNAMENTAL SOD FARM (TURF)	165.10	**2.36**
GOLF COURSE TURF	270.00	**3.86**
RICE	763.00	**10.90**
	763.00	**10.90**
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER, LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE)	2500.00	**35.71**
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER	2500.00	**35.71**
SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	**35.71**
LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE), SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	**35.71**
* LOC exceedances (RQ $\geq$ 1) are bolded and shaded. RQ = use-specific peak EEC/ [*Navicula pelliculosa* EC_{50} = 70 ppb].		

b) 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 for freshwater invertebrates. For chronic risks, 21-day EECs and the lowest chronic toxicity value for invertebrates are used to derive RQs. Acute RQs exceed the Agency's acute risk to listed species LOC (0.05) for freshwater invertebrates for a majority of triclopyr uses (Table 5-3). The acute RQs exceed the Agency's LOC for listed species (0.05), and range from 10.00 (Lakes/ponds/reservoirs) to 0.02 (ornamental lawns and turf) (Table 5-3). A probit slope value for *Daphnia magna* acute toxicity test is not available, therefore, the probability of individual effect was estimated based on the default slope of 4.5. The estimated probability of an individual effect from triclopyr use at the endangered species LOC (0.05) ranges from 1 in 1 with a 95% CI of 1 in 1 to 1 in 1 for lakes/ponds/reservoirs to 1 in 2.51 x 10^6 with a 95% CI of 1 in 70.8 to 1 in 3.64 x 10^{22} for ornamental sod farm (turf) for acute aquatic invertebrate RQs. The estimated probability of individual effect of triclopyr ranges from approximately 100% (lakes/ponds/reservoirs) to 3.98 x 10^5 % (ornamental sod farm-turf). Chronic RQs do not exceed the Agency's chronic risk to species LOC (1.0) for freshwater invertebrates for any triclopyr use (Table 5-3). The chronic RQs range from 0.10 (lakes/ponds/reservoirs) to < 0.01 (ornamental lawns and turf). The Results are presented in Table 5-3.

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. Example PRZM/EXAM and Rice model outputs are available in Appendix K and J, respectively. **Based on acute risk to listed species LOC exceedances for aquatic invertebrates, the probability of effect, triclopyr may indirectly affect the CRLF via reduction in freshwater invertebrates prey items.**

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)

Use	Peak EEC (µg/L)	21-Day EEC (µg/L)	Indirect Acute RQ	Probability of Individual Effect at RQ[C]	Indirect Chronic RQ
DOUGLAS-FIR (FOREST/SHELTERBELT)	44.02	40.37	**0.18**	1 in 2.49 x 10^3 (1 in 14.7 to 1 in 9.76 x 10^{10}) 0.04%	<0.01
CONIFER RELEASE	127.70	116.60	**0.51**	1 in 10.6 (1 in 3.58 to 1 in 2.36 x 10^2) 9.43%	<0.01
CHRISTMAS TREE PLANTATIONS, CONIFER RELEASE, FOREST TREES (ALL OR UNSPECIFIED), FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT	194.70	176.50	**0.78**	1 in 3.19 (1 in 2.41 to 1 in 6.03) 31.3%	0.01
CHRISTMAS TREE PLANTATIONS, FOREST TREES (ALL OR UNSPECIFIED), CONIFER RELEASE	534.60	491.90	**2.14**	1 in 1.07 x 10^3 (1 in 1.34 to 1 in 1) 93.5%	0.02
FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT, FOREST TREES (ALL OR UNSPECIFIED)	337.90	309.80	**1.35**	1 in 1.39 (1 in 1.66 to 1 in 1.14) 71.9%	0.01
ORCHARDS (non-food stump treatment)	148.40	131.00	**0.59**	1 in 6.61 (1 in 3.09 to 1 in 51.1) 15.1%	0.01
AIRPORTS/LANDING FIELDS, COMMERCIAL/INSTITUTIONAL/INDUSTRIAL PREMISES/EQUIPMENT (OUTDOOR)	3479.00	3141.00	**13.92**	1 in 1 (1 in 1.01 to 1 in 1) 100%	0.13
PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR), NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	1363.00	1242.00	**5.45**	1 in 1 (1 in 10.08 to 1 in 1) 100%	0.05
COMMERCIAL STORAGES/WAREHOUSES PREMISES, PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR)	5802.00	5244.00	**23.21**	1 in 1 (1 in 1 to 1 in 1) 100%	0.21
AGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	250.06	226.89	**1.00**	1 in 2 (1 in 2 to 1 in 2) 50%	0.01

	1319.20	1200.17	**5.28**	1 in 1 (1 in 1.08 to 1 in 1) 100%	0.05
NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	2929.60	2666.94	**11.72**	1 in 1 (1 in 1.02 to 1 in 1) 100%	0.11
ORNAMENTAL HERBACEOUS PLANTS, ORNAMENTAL NONFLOWERING PLANTS	34.04	30.16	**0.14**	1 in 1.64 x 10^4 (1 in 22.8 to 1 in 1.31x 10^{14}) 0.006%	<0.01
	415.30	376.20	**1.66**	1 in 1.19 (1 in 1.49 to1 in 1.02) 84.0%	0.02
ORNAMENTAL AND/OR SHADE TREES, ORNAMENTAL WOODY SHRUBS AND VINES	382.60	338.40	**1.53**	1 in 1.25 (1 in 1.55 to 1 in 1.05) 80%	0.01
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT	77.28	69.97	**0.31**	1 in 90.6 (1 in 6.47 to 1 in 4.26 x 10^5) 1.10%	<0.01
AGRICULTURAL/FARM PREMISES	103.14	93.71	**0.41**	1 in 24.6 (1 in 4.56 to 1 in 4.06 x 10^3) 4.07%	<0.01
AGRICULTURAL FALLOW/IDLELAND, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	87.78	81.19	**0.35**	1 in 49.8 (1 in 5.53 to 1 in 4.91 x 10^4) 2.01%	<0.01
AGRICULTURAL FALLOW/IDLELAND	64.62	60.58	**0.26**	1 in 236 (1 in 8.27 to 1 in 1.43 x 10^7) 0.42%	<0.01
AGRICULTURAL/FARM PREMISES	990.20	908.20	**3.96**	1 in 1 (1 in 1.13 to 1 in 1) 100%	0.04
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT, AGRICULTURAL UNCULTIVATED AREAS, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	990.20	908.20	**3.96**	1 in 1 (1 in 1.13 to 1 in 1) 100%	0.04
	32.91	30.44	**0.13**	1 in 2.99 x 10^4 (1 in 26.2 to 1 in 1.31 x 10^{15}) 33.4%	<0.01
PASTURES, RANGELAND	394.80	354.80	**1.58**	1 in 1.23 (1 in 1.53 to 1 in 1.04) 81.3%	0.01
RECREATION AREA LAWNS, RESIDENTIAL LAWNS	75.02	69.14	**0.30**	1 in 107 (1 in 6.76 to 1 in 7.91 x 10^5) 0.93%	<0.01
RESIDENTIAL LAWNS	415.02	376.34	**1.66**	1 in 1.19 (1 in 1.49 to 1 in 1.02) 84.0%	0.02
HOUSEHOLD/DOMESTIC DWELLINGS OUTDOOR PREMISES, RECREATION AREA LAWNS	1499.38	1317.17	**6.00**	1 in 1 (1 in 1.06 to 1 in 1) 100%	0.05
ORNAMENTAL LAWNS AND TURF	5.26	4.74	0.02	No Exceedances	<0.01
COMMERCIAL/INDUSTRIAL LAWNS, ORNAMENTAL LAWNS AND TURF	34.65	31.70	**0.14**	1 in 1.64 x 10^4 (1 in 22.8 to 1 in 1.31 x 10^{14}) 61.0%	<0.01
ORNAMENTAL SOD FARM (TURF)	20.80	18.87	**0.08**	1 in 2.51 x 10^6 (1 in 70.8 to 1 in 3.64 x 10^{22}) 3.98 x 10^5 %	<0.01
COMMERCIAL/INDUSTRIAL LAWNS	124.83	113.10	**0.50**	1 in 11.4 (1 in 3.66 to 1 in 2.97 x 10^2) 8.77%	<0.01
ORNAMENTAL SOD FARM (TURF)	165.10	154.60	**0.66**	1 in 4.80 (1 in 2.78 to 1 in 19.2) 20.8%	0.01
GOLF COURSE TURF	270.00	245.90	**1.08**	1 in 1.79 (1 in 1.90 to 1 in 1.62) 55.9%	0.01

	763.00	763.00	**3.05**	1 in 1.25 (1 in 1.55 to 1 in 1.05) 80.0%	0.03
RICE	763.00	763.00	**3.05**	1 in 1.25 (1 in 1.55 to 1 in 1.05) 80.0%	0.03
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER, LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE)	2500.00	2500.00	**10.00**	1 in 1 (1 in 1 to 1 in 1) 100%	0.10
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER	2500.00	2500.00	**10.00**	1 in 1 (1 in 1 to 1 in 1) 100%	0.10
SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	2500.00	**10.00**	1 in 1 (1 in 1 to 1 in 1) 100%	0.10
LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE), SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	2500.00	**10.00**	1 in 1 (1 in 1 to 1 in 1) 100%	0.10

* = LOC exceedances (acute RQ $\geq$ 0.05; chronic RQ $\geq$ 1.0) are bolded and shaded.
Acute RQ = use-specific peak EEC / [*Daphnia Magna* EC_{50} = 250 ppb].
Chronic RQ = use-specific 21-day EEC / [*Daphnia Magna* NOAEC 25000 ppb].

c) <u>Fish and Frogs</u>

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. The resulting RQs for the majority of triclopyr uses exceed the Agency's acute and chronic LOC's (0.05 and 1.0) for freshwater fish (surrogates for the aquatic-phase CRLF) (Table 5-1). The acute RQs exceed the Agency's LOC for listed species (0.05), and range from 9.62 (Lakes/ponds/reservoirs) to 0.02 (ornamental lawns and turf) (Table 5-1). The estimated probability of individual effect of triclopyr ranges from approximately 100% (lakes/ponds/reservoirs) to 3.98 x 10^{5} % (ornamental sod farm-turf), Table 5-1. The chronic RQs exceed the Agency's LOC (1.0), and range from 131.58 (Lakes/ponds/reservoirs) to 0.21 (ornamental lawns and turf), Table 5-1. **Based on the acute and chronic indirect effects, the probability of individual effect, and effects to non-listed plant species which serve as habitat for freshwater fish and frogs, triclopyr may indirectly affect the CRLF via reduction in freshwater fish and frogs as food items.**

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 EC50 values, rather than NOAEC values, were used to derive RQs. The Agency's risk to vascular aquatic plants LOC (1.0) is exceeded for numerous uses of triclopyr. The vascular aquatic plant RQs range from 2.91 (lakes/ponds/reservoirs) to 0.01 (ornamental lawns and turf). Results are presented in Table 5-4. An example PRZM/EXAM and Rice model output are available in Appendix K and J, respectively. **Based on the aquatic**

plant LOC exceedances, triclopyr may indirectly affect the CRLF via reduction in vascular aquatic plants.

Table 5-4 Summary of RQs Used to Estimate Indirect Effects to the CRLF via Effects to Vascular Aquatic Plants (habitat of aquatic-phase CRLF)[a]

Use	EEC (µg/L)	RQ*
DOUGLAS-FIR (FOREST/SHELTERBELT)	44.02	0.05
CONIFER RELEASE	127.70	0.15
CHRISTMAS TREE PLANTATIONS, CONIFER RELEASE, FOREST TREES (ALL OR UNSPECIFIED), FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT	194.70	0.23
CHRISTMAS TREE PLANTATIONS, FOREST TREES (ALL OR UNSPECIFIED), CONIFER RELEASE	534.60	0.62
FOREST TREE MANAGEMENT/FOREST PEST MANAGEMENT, FOREST TREES (ALL OR UNSPECIFIED)	337.90	0.39
ORCHARDS (non-food stump treatment)	148.40	0.17
AIRPORTS/LANDING FIELDS, COMMERCIAL/INSTITUTIONAL/INDUSTRIAL PREMISES/EQUIPMENT (OUTDOOR)	3479.00	**4.05**
PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR), NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	1363.00	**1.58**
COMMERCIAL STORAGES/WAREHOUSES PREMISES, PAVED AREAS (PRIVATE ROADS/SIDEWALKS), DRAINAGE SYSTEMS, INDUSTRIAL AREAS (OUTDOOR)	5802.00	**6.75**
	250.06	0.29
AGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	1319.20	**1.53**
NONAGRICULTURAL RIGHTS-OF-WAY/FENCEROWS/HEDGEROWS	2929.60	**3.41**
ORNAMENTAL HERBACEOUS PLANTS, ORNAMENTAL NONFLOWERING PLANTS	34.04	0.04
	415.30	0.48
ORNAMENTAL AND/OR SHADE TREES, ORNAMENTAL WOODY SHRUBS AND VINES	382.60	0.44
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT	77.28	0.09
AGRICULTURAL/FARM PREMISES	103.14	0.12
AGRICULTURAL FALLOW/IDLELAND, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	87.78	0.10
AGRICULTURAL FALLOW/IDLELAND	64.62	0.08
AGRICULTURAL/FARM PREMISES	990.20	**1.15**
AGRICULTURAL/FARM STRUCTURES/BUILDINGS AND EQUIPMENT, AGRICULTURAL UNCULTIVATED AREAS, NONAGRICULTURAL UNCULTIVATED AREAS/SOILS	990.20	**1.15**
	32.91	0.04
PASTURES, RANGELAND	394.80	0.46
RECREATION AREA LAWNS, RESIDENTIAL LAWNS	75.02	0.09
RESIDENTIAL LAWNS	415.02	0.48
HOUSEHOLD/DOMESTIC DWELLINGS OUTDOOR PREMISES, RECREATION AREA LAWNS	1499.38	**1.74**
ORNAMENTAL LAWNS AND TURF	5.26	0.01
COMMERCIAL/INDUSTRIAL LAWNS, ORNAMENTAL LAWNS AND TURF	34.65	0.04
ORNAMENTAL SOD FARM (TURF)	20.80	0.02
COMMERCIAL/INDUSTRIAL LAWNS	124.83	0.15
ORNAMENTAL SOD FARM (TURF)	165.10	0.19
GOLF COURSE TURF	270.00	0.31
	763.00	0.44
RICE	763.00	0.44
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER, LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE)	2500.00	**2.91**
AQUATIC AREAS/WATER, INTERMITTENTLY FLOODED AREAS/WATER	2500.00	**2.91**
SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	**2.91**
LAKES/PONDS/RESERVOIRS (WITH HUMAN OR WILDLIFE USE), SWAMPS/MARSHES/WETLANDS/STAGNANT WATER	2500.00	**2.91**

[a] RQs used to estimate indirect effects to the CRLF via toxicity to non-vascular aquatic plants are summarized in Table 5-2

* = LOC exceedances (RQ $\geq$ 1) are bolded and shaded.

RQ = use-specific peak EEC / [*Lemna gibba* EC_{50} = 860 ppb].

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 and granular applications of triclopyr.

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 3-5) and acute oral and subacute dietary toxicity endpoints for avian species. Acute effects are estimated using the lowest available toxicity data for birds. EECs are divided by toxicity values to estimate acute dietary and dose-based RQs (Table 5-5 and Table 5-6, respectively). The Northern bobwhite quail was the most sensitive to triclopyr on a subacute dietary basis (LC_{50} = 2934 ppm), and acute dietary basis (LD_{50} = 529 mg ae/kg-bw). These endpoints were selected to serve as a surrogate for the CRLF. Resulting acute dietary-based RQs for all foliar application uses of triclopyr except rice exceed the Agency's acute endangered species LOC of 0.1 for the CRLF (Table 5-5). The acute dose-based RQs exceed the Agency's acute endangered species LOC of 0.1 for the CRLF for all foliar application uses of triclopyr (Table 5-6). An example T-REX output is available in Appendix E.

The probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 1.03 with a 95% CI of 1 in 1.24 to 1 in 1 (for Agricultural Uncultivated Areas) to 1 in 1.21×10^3 with a 95% CI of 1 in 12.3 to 1 in 6.33×10^9 (for Douglas-Fir, Forest/Shelterbelt) for dietary-based acute RQs. For dose-based acute RQs the probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 1 with a 95% CI of 1 in 1 to 1 in 1 (for Agricultural Uncultivated Areas) to 1 in 297 with a 95% CI of 1 in 8.75 to 1 in 3.33×10^7 (for Rice). 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).

Potential direct chronic effects of triclopyr 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 (Table 5-6). Chronic reproductive effects for the Mallard duck were observed with a NOAEC of 100 ppm. The chronic dietary-based RQs for the terrestrial-phase CRLF exceed the Agency's chronic LOC of 1.0 for all foliar application uses of triclopyr except Rice (Table 5-7). The probability of individual effect probit slope analysis is not applicable for chronic endpoints. The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute and chronic endangered species LOC of 0.1 and 1.0 (respectively) for the CRLF (Table 5-5 to Table 5-7).

For granular uses of triclopyr the LD_{50}/ft^2 is used to estimate risk to the CRLF both directly and indirectly (via prey items). Estimated EECs for broadcast granular application for direct effects to the CRLF are presented in Table 3-6. The LD_{50}/ft^2 is calculated using a toxicity value (the adjusted LD_{50}) and the EEC (mg a.e./ft^2), and is compared to the Agency's LOC. Results are presented in terms of the acid equivalent. The adjusted LD_{50}s are separated out by weight class of birds (20, 100 and 1000g), and are presented in Table 5-8. However, the weight range of adult CRLFs is 1.4 – 238 g, therefore the applicable weight ranges for the CRLF is 20 and 100 g, and birds weighing 1000g were omitted. Resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for birds weighing 20 and 100g (Table 5-8). After calculation of the LD_{50}/ft^2 additional refinement to determine risks associated with granular application can be preformed by identifying the number of granules it would take to reach the LD_{50} in birds (surrogates for terrestrial-phase amphibians). However, due to limitations associated with the granular formulations (as fertilizers), the needed information concerning the weight of one granule was not available, and therefore further characterization was unable to be completed for the granular applications of triclopyr.

The probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 1.09 with a 95% CI of 1 in 1.36 to 1 in 1 (for Commercial/Industrial Lawns) to 1 in 1.88 with a 95% CI of 1 in 1.95 to 1 in 1.78 (for Ornamental Lawns and Turf) for birds weighing 20 g. For birds weighing 100 g LD_{50}/ft^2 the probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 77.0 with a 95% CI of 1 in 6.20 to 1 in $2.37*10^5$ (for Commercial/Industrial Lawns) to 1 in $5.85*10^3$ with a 95% CI of 1 in 17.9 to 1 in $2.53*10^{12}$ (for Ornamental Lawns and Turf). 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). **Based on the potential for both acute and chronic effects (Table 5-5 to Table 5-8) triclopyr may directly affect the terrestrial-phase of the CRLF.**

Table 5-5 Summary of Dietary-based Acute RQs* Used to Estimate Direct Effects to the Terrestrial-phase CRLF (Foliar applications) From T-REX

Use Application Rate (lb a.e./acre)	Dietary-based Acute RQ[1]	Probability of Individual Effect at RQ[a]
Agricultural Uncultivated (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max. Foliar)	**2.70**	1 in 1.03 (1 in 1.24 to 1 in 1) 97%
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**1.08**	1 in 1.79 (1 in 1.90 to 1 in 1.62) 56%
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**0.20**	1 in $1.21*10^3$ (1 in 12.3 to 1 in $6.33*10^9$) 0.83%
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min Foliar)	0.03	No exceedance

* = LOC exceedances (Acute RQ $\geq$ 0.1) are bolded and shaded.
[1] Based on Northern Bobwhite Quail LC_{50} = 2934 ppm.
[a] A probit slope value for the acute avian 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).

Table 5-6 Summary of Dose-based Acute RQs* Used to Estimate Direct Effects to the Terrestrial-phase CRLF (Foliar applications) From T-REX

Use Application Rate (lb a.e./acre)	Dose-based Acute RQ[1]	Probability of Individual Effect at RQ[a]
Agricultural Uncultivated (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max. Foliar)	**23.7**	1 in 1 (1 in 1 to 1 in 1) 100%
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**9.5**	1 in 1 (1 in 1.03 to 1 in 1) 100%
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**1.8**	1 in 1.14 (95% CI: 1 in 1.44 to 1 in 1.01) 88%
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min. Foliar)	**0.25**	1 in 297 (95% CI: 1 in 8.75 to 1 in $3.33*10^7$) 0.34%
* = LOC exceedances (Acute RQ $\geq$ 0.1) are bolded and shaded. [1] Based on Northern Bobwhite Quail LD_{50} = 529 mg/kg-bw. [a] A probit slope value for the acute avian 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).		

Table 5-7 Summary of Chronic RQs* Used to Estimate Direct Effects to the Terrestrial-phase CRLF (Foliar applications) From T-REX

Use (Application Rate)	Dietary-based Chronic RQ[1]
Agricultural Uncultivated (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max. Foliar)	**79.3**
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**31.7**
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**6.0**
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min. Foliar)	0.85
* = LOC exceedances (Chronic RQ $\geq$ 1) are bolded and shaded. [1] Based on Mallard duck NOAEC = 100 ppm.	

Table 5-8 Summary of LD_{50}/ft^2* Used to Estimate Direct Effects to the Terrestrial-phase CRLF (Granular applications) From T-REX

Use Application Rate (lb a.e./acre)	Size class (g)	Adjusted LD50 (mg/kg bw)	LD_{50}/ft^2	Probability of Individual Effect at LD_{50}/ft^{2a}
Commercial/Industrial Lawns (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Max. Granular)	20	381.11	**2.05**	1 in 1.09 (1 in 1.36 to 1 in 1) 92%
	100	485.17	**0.32**	1 in 77 (1 in 6.2 to 1 in $2.37*10^5$) 1.3%
Ornamental Lawns and Turf (0.76 lb ae/acre; 17 times/yr; 21 day intervals) (Min. Granular)	20	381.11	**1.04**	1 in 1.88 (1 in 1.95 to 1 in 1.78) 53%
	100	485.17	**0.16**	1 in $5.85*10^3$ (1 in 17.9 to 1 in $2.53*10^{12}$) 0.02%

* = LOC exceedances (Acute RQ $\geq$ 0.1) are bolded and shaded. LD50/ft^2 = EEC (mg a.e./ ft^2)/ (Adj. LD50 / bw (kg) assessed animal). [a] A probit slope value for the acute avian 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).

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

a) Terrestrial Invertebrates

In order to assess the risks of triclopyr 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 > 72 µg a.e./bee by 1 bee/0.128g, which is based on the weight of an adult honey bee. EECs (µg a.e./g of bee) calculated by T-REX for small and large insects are divided by the calculated toxicity value for terrestrial invertebrates, which is > 562.5 µg a.e./g of bee (ppm) to calculate RQs. However, the toxicity data are not definitive endpoints and as a result RQs were not calculated. There are no additional acceptable terrestrial invertebrate data from registrant submitted studies or from the open literature by which to calculate RQ values. **Because the calculated terrestrial small insect EEC's exceed the highest concentrations of triclopyr tested, (agricultural uncultivated areas 7930 ppm small insects and 881 ppm large insects), it is determined that triclopyr may affect the CRLF indirectly via reduction in terrestrial invertebrate prey items.**

b) 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 (LD_{50} = 572 mg ae/kg-bw, NOAEL = 5 mg ae/kg-bw and NOAEC = 100 mg ae/kg-diet). EECs are divided by the toxicity value to estimate acute and chronic dose-based RQs as well as chronic dietary-based RQs (Table 5-9). Acute and chronic-dose based and chronic dietary-based RQs exceed the Agency's acute and chronic endangered species LOC (0.1 acute and 1.0 chronic) for all foliar application uses of triclopyr (Table 5-9). The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute and chronic LOC of 0.1 and 1.0 respectively (Table 5-9).

The probability of individual effect at the acute endangered species LOC (0.1) ranges from 1 in 1 (95%CI: 1 in 1.02 to 1 in 1) for Agricultural uncultivated areas to 1 in $1.25*10^5$ (95% CI: 1 in $3.62*10^1$ to 1 in $3.19*10^{17}$) for rice. An example T-REX output is available in Appendix E. 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). Population reduction in small mammal prey items for the CRLF from application of triclopyr ranges from 100% (agricultural uncultivated areas) to

0.0008% (rice) for foliar applications of triclopyr. The probability of individual effect probit slope analysis is not applicable for chronic endpoints.

For granular uses of triclopyr the LD_{50}/ft^2 is used to estimate risk to the CRLF indirectly (via prey items). Estimated EECs for broadcast granular application for direct effects to the CRLF are presented in Table 3-6. The LD_{50}/ft^2 is calculated using a toxicity value (the adjusted LD_{50}) and the EEC (mg a.e./ft^2), and is compared to the Agency's LOC. Results are presented in terms of the acid equivalent. The adjusted LD_{50}s are separated out by weight class of mammals (15, 35 and 1000g), and are presented in Table 5-10. However, the weight range of adult CRLFs is 1.4 – 238 g, therefore they can potentially only consume mammals that weigh 15 and 35 g depending on the size of the CRLF, mammals weighing 1000g were omitted. Resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for mammals weighing 15 and 35g (Table 5-10). An example T-REX output is available in Appendix E.

The probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 2.79 with a 95% CI of 1 in 2.3 to 1 in 4.29 (for Commercial/Industrial Lawns) to 1 in $2.22*10^1$ with a 95% CI of 1 in 4.43 to 1 in $2.87*10^3$ (for Ornamental Lawns and Turf) for mammals weighing 15 g. For mammals weighing 35 g LD_{50}/ft^2 the probability of individual effect at the endangered species LOC (0.1) ranges from 1 in $1.84*10^1$ with a 95% CI of 1 in 4.20 to 1 in $1.5*10^3$ (for Commercial/Industrial Lawns) to 1 in $6.48*10^2$ with a 95% CI of 1 in $1.06*10^1$ to 1 in $6.14*10^8$ (for Ornamental Lawns and Turf). 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). Population reduction in small mammal prey items for the CRLF from application of triclopyr ranges from 36% (Commercial/Industrial Lawns) to 0.15% (Ornamental Lawns and Turf) for granular applications of triclopyr to mammals weighing 15 and 35g.

HED determined that triclopyr was not a mutagen, and but triclopyr has been classified as a Group D chemical (HED 2002). As a Group D chemical triclopyr is unable to be classified as to human carcinogenicity, based on marginal evidence of tumors in female rates and mice and benign adrenal pheochromocytomas in male rats (HED 2002, Appendix M. **Based on the acute and chronic LOC exceedances of triclopyr on small mammal prey (Table 5-9), triclopyr may indirectly affect the CRLF via reduction in small mammal prey items.**

Table 5-9 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 (Foliar applications)

Use (Application Rate)	Chronic RQ		Acute RQ	Probability of % Effect at Acute RQ[a]
	Dose-based Chronic RQ[1]	Dietary-based Chronic RQ[2]	Dose-based Acute RQ[3]	
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max. Foliar)	**1222.9**	**141**	**10.7**	1 in 1 (1 in 1.02 to 1 in 1) 100%

Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**489.2**	**56.4**	**4.3**	1 in 1 (1 in 1.11 to 1 in 1) 100%
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median Foliar)	**91.7**	**10.6**	**0.80**	1 in 3.02 (1 in 2.36 to 1 in 5.22) 33%
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min. Foliar)	**13.1**	**1.51**	**0.11**	1 in $1.25*10^5$ (1 in $3.62*10^1$ to 1 in $3.19*10^{17}$) 0.0008%

* = LOC exceedances (acute RQ > 0.1 and chronic RQ > 1) are bolded and shaded.
[1] Based on dose-based EEC and triclopyr ae rat NOAEL = 5 mg/kg-bw.
[2] Based on dietary-based EEC and triclopyr ae rat NOAEC = 100 mg/kg-diet.
[3] Based on dose-based EEC and triclopyr ae rat acute oral LD_{50} = 572 mg/kg-bw.
[a] A probit slope value for the acute mammalian 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).

Table 5-10 Summary of LD_{50}/ft^2* Used to Estimate Indirect Effects to the Terrestrial-phase CRLF via Direct Effects on Small Mammals as Dietary Food Items (Granular applications)

Use Application Rate (lb a.e./acre)	Size class (g)	Adjusted LD50 (mg/kg bw)	LD_{50}/ft^2	Probability of % Effect at LD_{50}/ft^{2a}
Commercial/Industrial Lawns (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Max. Granular)	15	1257.16	**0.83**	1 in 2.79 (1 in 2.3 to 1 in 4.29) 36%
	35	1017.18	**0.44**	1 in $1.84*10^1$ (1 in 4.20 to 1 in 1.5 $*10^3$) 5.4%
Ornamental Lawns and Turf (0.76 lb ae/acre; 17 times/yr; 21 day intervals) (Min. Granular)	15	1257.16	**0.42**	1 in $2.22*10^1$ (1 in 4.43 to 1 in 2.87 $*10^3$) 4.5%
	35	1017.18	**0.22**	1 in $6.48*10^2$ (1 in $1.06*10^1$ to 1 in 6.14 $*10^8$) 0.15%

* = LOC exceedances (Acute RQ $\geq$ 0.1) are bolded and shaded.
$LD50/ft^2$ = EEC (mg a.e./ ft^2)/ (Adj. LD50 / bw (kg) assessed animal).
[a] A probit slope value for the acute avian 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).

c) <u>Frogs</u>

An additional prey item of the adult terrestrial-phase CRLF is other species of frogs. In order to assess risks to these organisms, dietary-based and dose-based exposures from foliar applications modeled in T-REX for a small bird (20g) consuming small invertebrates are used. For granular application, the LD_{50}/ft^2 is used to estimate risk to the CRLF. See Section 5.1.2.1 and associated tables (Table 5-5 to Table 5-8) for results. The acute dietary-based RQs for all foliar application uses of triclopyr except rice exceed the Agency's acute endangered species LOC of 0.1 for the CRLF (Table 5-5). The acute dose-based RQs exceed the Agency's acute endangered species LOC of 0.1 for the CRLF for all foliar application uses of triclopyr (Table 5-6). The chronic dietary-based RQs exceed the Agency's chronic LOC of 1.0 for all foliar application uses of triclopyr except rice (Table 5-7). The LD_{50}/ft^2 Analysis of granular applications of triclopyr exceed the Agency's acute endangered LOC of 0.1 for all granular applications of triclopyr to both a 20 and 100 g bird, surrogate species for the terrestrial-phase CRLF (Table 5-8). The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute and chronic endangered species LOC of 0.1 and 1.0 (respectively) for the CRLF (Table 5-5 through Table 5-7). **Based on the acute and chronic LOC exceedances, triclopyr may indirectly affect the CRLF via reduction in frogs as prey items.**

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 riparian and upland vegetation are assessed using RQs from terrestrial plant seedling emergence and vegetative vigor EC_{25} data as a screen. Triclopyr is a systemic herbicide that is used to control broadleaf weeds and woody plants. The endpoints used for the assessment of effects to non-target Terrestrial plants were: for dicots the vegetative vigor endpoint is EC_{25} = 0.005 lb ae/A (Sunflower), and the seedling emergence endpoint is EC_{25} = 0.045 lb ae/A (Alfalfa), and for monocots the vegetative vigor endpoint is EC_{25} = 0.063 lb ae/A (Onion), and the seedling emergence endpoint is EC_{25} = 0.053 lb ae/A (Onion).

The RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr both foliar (aerial and ground) and granular applications (Table 5-11 and Table 5-12). RQs for non-target terrestrial monocots and dicot plants inhabiting upland dry areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr except rice both foliar (aerial and ground) and granular applications (Table 5-11 and Table 5-12). Aerial foliar applications of triclopyr result in spray drift RQ exceedances for non-target dicot species for all uses of triclopyr (Table 5-11). Aerial foliar applications of triclopyr result in spray drift RQ exceedances for monocots for all uses except rice (Table 5-11). Ground foliar applications result in spray drift RQ exceedances for both monocots and dicots for all uses except rice (Table 5-11). There were no spray-drift LOC exceedances for non-target monocot or dicot plants from granular application of triclopyr (Table 5-12). An example output from TerrPlant v.1.2.2 is provided in Appendix G. The recommended mitigated maximum foliar (ground and aerial) application rate of 9 lbs ae/A would still result in exceedances of the Agency's terrestrial plant LOC of 1.0 for indirect effects to the terrestrial-phase CRLF (Table 5-11). RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic and upland dry areas would still result in exceedances in the terrestrial plant LOC (1.0) (Table 5-11). Aerial and ground foliar applications would also still result in spray drift RQ exceedances for non-target terrestrial monocots and dicot plants (Table 5-11). **Based on LOC exceedances on non-target terrestrial plants, triclopyr may indirectly affect the CRLF via reduction in terrestrial plants.**

Table 5-11 RQs* Plants Inhabiting Dry and Semi-aquatic Areas Exposed to Triclopyr (acid equivalent) via Runoff and Drift (Foliar applications)

Use	Application rate (lbs ae/A)	Application method	Drift Value (%)	Group	Spray drift RQ (lbs ae/A)	Dry area RQ (lbs ae/A)	Semi-aquatic area RQ (lbs ae/A)
Agricultural Uncultivated Areas (Max)	20	Foliar – ground	1	Monocot	**3.77**	**22.64**	**192.45**
				Dicot	**40.00**	**26.67**	**226.67**
Forest Tree/Pest Management (Median)	8	Foliar – ground	1	Monocot	**1.51**	**9.06**	**76.98**
				Dicot	**16.00**	**10.67**	**90.67**
Forest Tree/Pest Management (Median)	8	Foliar – aerial	5	Monocot	**7.55**	**15.09**	**83.02**
				Dicot	**80.00**	**17.78**	**97.78**
Douglas-Fir (Forest/Shelterbelt) (Median)	1.5	Early Spring – sprayer	5	Monocot	**1.42**	**2.83**	**15.57**
				Dicot	**15.00**	**3.33**	**18.33**
Rice (Min)	0.38	Ratoon - ground	1	Monocot	< 0.1	0.43	**3.66**
				Dicot	0.76	0.51	**4.31**
Rice (Min)	0.38	Ratoon - aerial	5	Monocot	0.36	0.72	**3.94**
				Dicot	**3.80**	0.84	**4.64**
* = LOC exceedances (plant RQ > 1) are bolded and shaded.							

Table 5-12 RQs* Plants Inhabiting Dry and Semi-aquatic Areas Exposed to Triclopyr (acid equivalent) via Runoff and Drift (Granular applications)

Use	Application rate (lbs ae/A)	Application method	Drift Value (%)	Group	Spray drift RQ (lbs ae/A)	Dry area RQ (lbs ae/A)	Semi-aquatic area RQ (lbs ae/A)
Commercial/Industrial Lawns (Max)	1.5	Granular – spreader	1	Monocot	< 0.1	**1.42**	**14.15**
				Dicot	< 0.1	**1.67**	**16.67**
Ornamental Lawns and Turf (Min)	0.76	Granular – spreader	1	Monocot	< 0.1	0.72	**7.17**
				Dicot	< 0.1	0.84	**8.44**
* = LOC exceedances (plant RQ $\geq$ 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).

Based on the risk estimation for potential effects to aquatic and/or terrestrial plants provided in Sections 5.1.1.2, 5.1.1.3, and 5.1.2.3, triclopyr may affect aquatic-phase PCEs of designated critical habitat related to effects on aquatic and/or terrestrial plants.

Reduction of aquatic based food sources may occur from most use sites.
Because reduction of aquatic based food sources may occur from most use sites, triclopyr may be likely to indirectly affect the CRLF. Likewise, due to triclopyr's ability to reduce aquatic non-vascular plants used as food source and habitat for CRLF, triclopyr may be likely to indirectly affect the CRLF. Since there are LOC exceedances on non-target terrestrial dicot plants from spray drift at the minimum application rate for aerial applications, triclopyr may indirectly affect the CRLF via reduction in terrestrial plants. As a result, due to aquatic vascular and terrestrial plant communities being reduced from most use sites, there is potential for alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond and for 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.

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 triclopyr on this PCE (*i.e.*, alteration of food sources), 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. **Based on LOC exceedances for acute and chronic freshwater fish, acute invertebrates, and non-vascular plants, triclopyr may affect aquatic-phase PCEs of designated habitat related to effects of alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.**

5.1.3.2 Terrestrial-Phase (Upland Habitat and Dispersal Habitat)

The first two 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 risk estimation for terrestrial-phase PCEs of designated habitat related to potential effects on terrestrial plants is provided in Section 5.1.2.3. These results will inform the effects determination for modification of designated critical habitat for the CRLF. There were LOC exceedances for non-target monocot and dicot plants inhabiting semi-aquatic areas for all applications (foliar and granular) of triclopyr. There were also LOC exceedances for monocot and dicot plants inhabiting dry (upland-areas) for all foliar and ground applications except the minimum use (Rice and Ornamental Lawns &Turf, respectively). All foliar applications except ground rice application resulted in Spray-drift LOC exceedances for all non-target dicot plants. For non-target monocot plants all uses of triclopyr except Rice (either ground or aerial) resulted in Spray-drift LOC exceedances. There were no spray-drift LOC exceedances for non-target monocot or dicot plants from granular application of triclopyr. The buffer determined from AgDRIFT (Section 5.2.5.1) yielded a buffer of at least 1,000 feet. Therefore, any plants within a 1,000 foot radius from the application site may potentially be affected. **Based on these results, triclopyr may affect the first and second terrestrial-PCEs.**

The third terrestrial-phase PCE is "reduction and/or modification of food sources for terrestrial phase juveniles and adults." To assess the impact triclopyr 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. **Based on acute and chronic risk LOC exceedances for direct effects to the CRLF, as well as indirect effects to the CRLF prey items of small mammals, and other frogs, and because the calculated small insect EECs are greater than the highest levels tested in the terrestrial invertebrate study (Section 5.2.2.4 for terrestrial invertebrates, Section 5.2.2.5 for mammals, and 5.2.2.6 for frogs), triclopyr may result in Habitat Modification of the first three terrestrial-phase PCEs.**

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. **Due to LOC exceedances for aquatic, terrestrial and semi-aquatic plants, which modify the water chemistry to conditions for which the CRLF is adapted, triclopyr may result in Habitat Modification of the fourth terrestrial-phase PCE.**

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 its designated critical habitat.

Based on the RQs presented in the Risk Estimation (Section 5.1) a preliminary effects determination is may affect for the CRLF and critical habitat. The direct and indirect effect LOCs are exceeded and 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 triclopyr. A summary of the risk estimation results are provided in Table 5-13 for direct and indirect effects to the CRLF and in Table 5-14 for the PCEs of designated critical habitat for the CRLF.

Table 5-13 Risk Estimation Summary for Triclopyr - Direct and Indirect Effects to CRLF

Assessment Endpoint	LOC Exceedances (Y/N)	Description of Results of Risk Estimation
Aquatic Phase (eggs, larvae, tadpoles, juveniles, and adults)		
Direct Effects Survival, growth, and reproduction of CRLF individuals via direct effects on aquatic phases	Yes	The aquatic phase amphibian acute and chronic LOCs for listed species (0.05) are exceeded for most uses of triclopyr in California. The acute RQs range from 9.62 for lakes/ponds/reservoirs to 0.02 for ornamental lawns and turf). The chronic RQs range from 131.58 for lakes/ponds/reservoirs to 0.21 for ornamental lawns and turf.
Indirect Effects Survival, growth, and reproduction of CRLF individuals via effects to food supply (*i.e.*, freshwater invertebrates, non-vascular plants)	Yes	LOCs for aquatic invertebrates are exceeded for most uses on an acute basis, and some uses on a chronic basis. The acute RQs range from 10.00 for lakes/ponds/reservoirs to 0.02 for ornamental lawns and turf). The chronic RQs range from 0.10 for lakes/ponds/reservoirs to <0.01 for ornamental lawns and turf. LOCs for non-vascular plants are exceeded for most uses. The RQs range from 35.71 for lakes/ponds/reservoirs to 0.08 for ornamental lawns and turf.
Indirect Effects Survival, growth, and reproduction of CRLF individuals via effects on habitat, cover, and/or primary productivity (*i.e.*, aquatic plant community)	Yes	RQs for vascular aquatic plants exceed the Agency's LOC (1.0) for some uses. These range from 2.91 for lakes/ponds/reservoirs to 0.02 for ornamental lawns and turf.
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.	Yes	RQs for non-target terrestrial monocot and dicot plants inhabitating semi-aquatic and upland dry areas exceed the Agency's LOC for most uses. Spray drift RQs for monocots range from <0.1 to 7.55. Spray drift RQs for dicots range from 0.76 to 80.00.
Terrestrial Phase (Juveniles and adults)		
Direct Effects Survival, growth, and reproduction of CRLF individuals via direct effects on terrestrial phase adults and juveniles	Yes	The subacute dietary-based RQs exceed the acute LOC (0.1) for all foliar application uses of triclopyr except rice, ranging from 2.7 (Agricultural Uncultivated Areas) to 0.03 (Rice). The acute dose-based RQs exceed the acute endangered species LOC (0.1) for all foliar application uses of triclopyr, ranging from 23.7 (Agricultural Uncultivated Areas) to 0.25 (Rice). The chronic dietary-based RQs exceed the chronic LOC (1.0) for all foliar application uses of triclopyr except rice, ranging from 79.3 (Agricultural Uncultivated Areas) to 0.85 (Rice). For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for birds weighing 20 and 100g and range from 2.05 (Commercial/Industrial Lawns) to 0.16 (Ornamental Lawns and Turf).

Assessment Endpoint	LOC Exceedances (Y/N)	Description of Results of Risk Estimation
Indirect Effects Survival, growth, and reproduction of CRLF individuals via effects on prey (*i.e.*, terrestrial invertebrates, small terrestrial mammals and terrestrial phase amphibians)	Yes	For terrestrial invertebrates, the calculated small insect EEC range from 7930 to 85 ppm, exceeds the terrestrial invertebrate toxicity estimate 562.5 for all uses except Rice. Therefore, risk cannot be precluded for these species due to the lack of definitive data. For small terrestrial mammals, the acute dose-based RQs exceed the acute risk LOC (0.1) for all foliar application uses of triclopyr ranging from 10.7 (Agricultural Uncultivated Areas) to 0.11 (Rice). Both dietary and dose-based chronic RQs exceed the chronic risk LOC (1.0) for all foliar application uses of triclopyr ranging from 1222.9 (Agricultural Uncultivated Areas) to 13.1 (Rice) [Dose-based] and 141 (Agricultural Uncultivated Areas) to 1.51 (Rice) [Dietary-based]. For granular applications of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for mammals weighing 15 and 35g. For terrestrial-phase amphibians the subacute dietary-based RQs exceed the acute LOC (0.1) for all foliar application uses of triclopyr except ornamental herbaceous/non-flowering plants and rice, ranging from 2.7 (Agricultural Uncultivated Areas) to 0.03 (Rice). The acute dose-based RQs exceed the acute endangered species LOC (0.1) for all foliar application uses of triclopyr, ranging from 23.7 (Agricultural Uncultivated Areas) to 0.25 (Rice). The chronic dietary-based RQs exceed the chronic LOC (1.0) for all foliar application uses of triclopyr except rice, ranging from 79.3 (Agricultural Uncultivated Areas) to 0.85 (Rice). For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for birds weighing 20 and 100g, ranging from 2.05 (Commercial/Industrial Lawns) to 0.32 (Ornamental Lawns and Turf) for 20 g birds, and 1.04 (Commercial/Industrial Lawns) to 0.16 (Ornamental Lawns and Turf) for 100 g birds.
Indirect Effects Survival, growth, and reproduction of CRLF individuals via effects on habitat (*i.e.*, riparian vegetation)	Yes	RQs for vascular aquatic plants exceed the Agency's LOC (1.0) for some uses. These range from 2.91 for lakes/ponds/reservoirs to 0.02 for ornamental lawns and turf. The RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr both foliar (aerial and ground) and granular applications. RQs for non-target terrestrial monocots and dicot plants inhabiting upland dry areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr except rice both foliar (aerial and ground) and granular applications. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for dicot non-target species for all uses of triclopyr. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for monocots for all uses except rice. Ground foliar applications result in spray drift RQ

Assessment Endpoint	LOC Exceedances (Y/N)	Description of Results of Risk Estimation
		exceedances for both monocots and dicots for all uses except rice.

Table 5-14 Risk Estimation Summary for Triclopyr – PCEs of Designated Critical Habitat for the CRLF

Assessment Endpoint	Habitat Modification (Y/N)	Description of Results of Risk Estimation
Aquatic Phase 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.	Yes	LOCs are exceeded for terrestrial riparian plants and for aquatic vascular plants from exposure to triclopyr from spray drift.
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.	Yes	LOCs are exceeded for terrestrial riparian plants and for aquatic plants from exposure to triclopyr from spray drift. Alteration of riparian and vascular plants may result in alteration of temperature, turbidity, and oxygen content.
Alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source.	Yes	LOC is exceeded for indirect effects on terrestrial phase CRLF from most triclopyr applications.
Reduction and/or modification of aquatic-based food sources for pre-metamorphs (e.g., algae)	Yes	LOCs for non-vascular plants are exceeded for most uses.
Terrestrial Phase 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	Yes	AgDrift model was used to evaluate potential distances beyond which exposures would be expected to be below LOC. The buffer needed for exposures to be below the LOC is approximately 1000 ft for both aerial and ground applications based on monocot and dicot non-target plants.
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	Yes	Effects are expected to non-target terrestrial plants over 1000 ft from use site from aerial application.
Reduction and/or modification of food sources for terrestrial phase juveniles and adults	Yes	Acute dietary-based RQs for birds (surrogate terrestrial-phase CRLF) exceed the endangered species LOC for all foliar application uses of triclopyr except rice. Acute dose-based RQs for small mammals and birds (surrogate terrestrial-phase CRLF) exceed the endangered species LOC for all foliar application uses of triclopyr. Chronic dietary and dose-based RQs for small mammals and birds (surrogate terrestrial-phase CRLF) exceed the

Assessment Endpoint	Habitat Modification (Y/N)	Description of Results of Risk Estimation
		endangered species LOC for all foliar application uses of triclopyr, except dose-based birds. For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for birds weighing 20 and 100g, ranging from 2.05 (Commercial/Industrial Lawns) to 0.32 (Ornamental Lawns and Turf) for 20 g birds, and 1.04 (Commercial/Industrial Lawns) to 0.16 (Ornamental Lawns and Turf) for 100 g birds.
Alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source.	Yes	All aerial applications of triclopyr for dicots and all uses except Rice for monocots result in spray drift exceedances for non-target terrestrial plants inhabiting semi-aquatic and upland dry areas.

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 and its 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 triclopyr.

Triclopyr is considered "toxic" to the freshwater fish, which are surrogates for the aquatic phase CRLF. The aquatic animal acute LOCs for listed species (0.05) were exceeded for most of the triclopyr uses. The acute RQ's ranged from 9.62 for lakes/ponds/reservoirs to 0.02 for ornamental lawns and turf. The chronic RQ's ranged from 131.58 for lakes/ponds/reservoirs to 0.21 for ornamental lawns and turf.

There were a total of three aquatic animal incidents that were reported for triclopyr, and the certainty of triclopyr being responsible was possible, probable and highly probable.

The California Department of Pesticide Regulation (CDPR) has been collecting surface water data on triclopyr for many years. Samples were taken in six California counties from March 1993 to March 2006. Out of 583 samples, 102 samples contained triclopyr. The median concentration of positive samples was 0.65 ppb and the mean concentration was 1.7 ppb. The highest detected concentration of 14.5 ppb was recorded on June 21, 2001 at Colusa Basin Drain #5 in Colusa County, which is an area that is known for growing rice. Triclopyr concentrations were consistently elevated at this site through the months of June and July, 2001 with an average concentration of 3.5 ppb. This may be due to the use of triclopyr on rice. Colusa County is one of four leading counties for rice production in California. The Rice Model predicted a concentration of 763.00 ppb. This is a little more than a magnitude larger, and shows how conservative the model is.

Because there are LOC exceedances from registered uses of triclopyr to the CRLF surrogate species (freshwater fish), verified non-target incidents resulting from triclopyr use, and because triclopyr's presence has been observed in monitored surface water in California, the Agency concludes that triclopyr May Affect and is Likely to Adversely Affect (LAA) the CRLF.

5.2.1.2 Terrestrial-Phase CRLF

The RQs representing acute dietary-based exposures exceed the Agency's LOC (0.1) for all foliar application uses of triclopyr except rice (Section 5.1.2.1). The RQs ranged from 2.7 (Agricultural Uncultivated Areas) to 0.03 (Rice) (Table 5-5). The acute dose-based RQs exceed the acute endangered species LOC (0.1) for all foliar application uses of triclopyr, ranged from 23.7 (Agricultural Uncultivated Areas) to 0.25 (Rice) (Table 5-6). The chronic dietary-based RQs exceed the chronic LOC (1.0) for all foliar application uses of triclopyr except rice, and ranged from 79.3 (Agricultural Uncultivated Areas) to 0.85 (Rice) (Table 5-7). These RQs were derived using the T-REX model, which estimates exposures that are specific to food intake equations for birds. RQs generated for birds are used as surrogates to represent RQs for the terrestrial-phase CRLF. For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for birds weighing 20 and 100g, ranging from 2.05 (Commercial/Industrial Lawns) to 0.32 (Ornamental Lawns and Turf) for 20 g birds, and 1.04(Commercial/Industrial Lawns) to 0.16 (Ornamental Lawns and Turf) for 100 g birds (Table 5-8). The LD_{50}/ft^2 is calculated using a toxicity value (the adjusted LD_{50}) and the EEC (mg a.e./ft^2), and is compared to the Agency's LOC. Based on these exceedances to the terrestrial-phase CRLF, a "May Affect" determination was made

The T-HERPS model was therefore employed as a refinement tool to explore amphibian-specific food intake on potential exposures to the terrestrial phase CRLF. The T-HERPS model incorporates the same inputs as T-REX with equations adjusted for poikilotherm food intake. The dietary-based and dose-based EECs generated by T-HERPS are found in Table 5-15 to Table 5-17. An example output from T-HERPS is available in Appendix F.

Table 5-15 Upper-bound Kenega Nomogram T-HERPS EECs (mg/kg-diet) for Dietary-based Exposures of the CRLF and its Prey to Triclopyr, the weights of small herbivore and insectivore mammals are 15 g and 35 g (Foliar applications).

Scenario	Weight of mammals (herbivore & insectivore)	Small Insects	Large Insects	Small Herbivore Mammals	Small Insectivore Mammals	Small Terrestrial Phase Amphibians
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max-Foliar)	15g	7928.69	880.97	13438.93	839.93	275.21
	35g	7928.69	880.97	9288.10	580.51	275.21
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	15g	3171.48	352.39	5375.57	335.97	110.09
	35g	3171.48	352.39	3715.24	232.20	110.09
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	15g	594.65	66.07	1007.92	62.99	20.64
	35g	594.65	66.07	696.61	43.54	20.64
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min-Foliar)	15g	85.15	9.46	144.32	9.02	2.96
	35g	85.15	9.46	99.74	6.23	2.96

Table 5-16 Upper-bound Kenega Nomogram T-HERPS EECs (mg/kg-bw) for Dose-based Exposures of the CRLF and its Prey to Triclopyr, the weights of small herbivore and insectivore mammals are 15 g (Foliar applications).

Scenario	CRLF Size (g)	Small Insects	Large Insects	Small Herbivore Mammals	Small Insectivore Mammals	Small Terrestrial Phase Amphibians
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max-Foliar)	1.4	308.04	34.23	N/A	N/A	N/A
	37	302.74	33.64	5448.21	340.51	10.51
	238	198.41	22.05	846.99	52.94	6.89
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	123.22	13.69	N/A	N/A	N/A
	37	121.10	13.46	2179.29	136.21	4.20
	238	79.37	8.82	338.80	21.17	2.75
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	23.10	2.57	N/A	N/A	N/A
	37	22.71	2.52	408.62	25.54	0.79
	238	14.88	1.65	63.52	3.97	0.52
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min-Foliar)	1.4	3.31	0.37	N/A	N/A	N/A
	37	3.25	0.36	58.51	3.66	0.11
	238	2.13	0.24	9.10	0.57	0.07

Table 5-17 Upper-bound Kenega Nomogram T-HERPS EECs (mg/kg-bw) for Dose-based Exposures of the CRLF and its Prey to Triclopyr, the weights of small herbivore and insectivore mammals are 35 g (Foliar applications).

Scenario	CRLF Size (g)	Small Insects	Large Insects	Small Herbivore Mammals	Small Insectivore Mammals	Small Terrestrial Phase Amphibians
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max-Foliar)	1.4	308.04	34.23	N/A	N/A	N/A
	37	302.74	33.64	8786.04	549.13	10.51
	238	198.41	22.05	1365.90	85.37	6.89
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	123.22	13.69	N/A	N/A	N/A
	37	121.10	13.46	3514.41	219.65	4.20
	238	79.37	8.82	546.36	34.15	2.75
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	23.10	2.57	N/A	N/A	N/A
	37	22.71	2.52	658.95	41.18	0.79
	238	14.88	1.65	102.44	6.40	0.52
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min-Foliar)	1.4	3.31	0.37	N/A	N/A	N/A
	37	3.25	0.36	94.35	5.90	0.11
	238	2.13	0.24	14.67	0.92	0.07

Acute Exposures

Refined acute dietary-based RQs for CRLFs consuming small insects and small herbivore mammals exceed the acute listed species LOC (0.1) for all uses of triclopyr except rice (mammals weighing 15g or 35g) (Table 5-18). The acute dietary-based RQs for CRLFs consuming large insects exceed the acute listed species LOC (0.1) for all foliar uses with application rate greater than or equal to 8.0 lb ae/A. The acute dietary-based RQs for CRLFs consuming small insectivore mammals exceed the acute listed species LOC (0.1) for all foliar uses with an application rate greater than or equal to 1.5 lb ae/A for CRLFs consuming 15g mammals and greater than 8 lb ae/A for CRLFs consuming 35g mammals. No acute dietary-based LOCs were exceeded for CRLFs consuming small terrestrial-phase amphibians for any triclopyr use. The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute endangered species LOC of 0.1 for the refined dietary-based RQs for CRLFs consuming small and large insects, small herbivore (weighing 15g and 35g), and small insective mammals (weighing 15g only) (Table 5-18). Therefore, there is still potential for direct effects to the terrestrial-phase CRLF even at the mitigated maximum application rate.

Table 5-18 Refined Acute Dietary-based RQs* for CRLF consuming different food items (RQs calculated using T-HERPS), the weights of small herbivore and insectivore mammals are 15 g and 35 g (Foliar applications).

Scenario	Weight of mammals (herbivore & insectivore)	Small Insects	Large Insects	Small Herbivore Mammals	Small Insectivore Mammals	Small Terrestrial Phase Amphibians
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max-Foliar)	15g	**2.70**	**0.30**	**4.58**	**0.29**	0.09
	35g	**2.70**	**0.30**	**3.17**	**0.20**	0.09
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	15g	**1.08**	**0.12**	**1.83**	**0.11**	0.04
	35g	**1.08**	**0.12**	**1.27**	0.08	0.04
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	15g	**0.20**	0.02	**0.34**	0.02	0.01
	35g	**0.20**	0.02	**0.24**	0.01	0.01
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min-Foliar)	15g	0.03	< 0.01	0.05	< 0.01	<0.01
	35g	0.03	< 0.01	0.03	< 0.01	< 0.01

Refined dose-based RQs for CRLF of varying weights (1.4g, 37g and 238g) consuming small insects exceed the acute endangered species LOC (0.1) for all foliar uses of triclopyr with an application rate greater than or equal to 8.0 lb ae/A for all weights of CRLF (Table 5-19 and Table 5-20). There are no exceedances in the acute endangered species LOC (0.1) for any uses of triclopyr for any weight class of CRLF consuming either large insects or small terrestrial-phase amphibians (weighing 2.3g) (Table 5-19 and Table 5-20). CRLF weighing 1.4g are too small to consume small mammals or small terrestrial-phase amphibians. Medium-sized CRLFs weighing 37g consuming small herbivore mammals (both 15g and 35g mammals) exceed the acute endangered species LOC (0.1) for all foliar uses of triclopyr (Table 5-19 and Table 5-20). Medium-sized CRLFs weighing 37g consuming small insectivore mammals (both 15g and 35g mammals) exceed the acute endangered species LOC (0.1) for all uses of triclopyr with an application rate greater than and equal to 8.0 lb ae/A (Table 5-19 and Table 5-20). Large-sized CRLFs weighing 238g consuming small herbivore mammals (both 15 g and 35 g mammals) exceed the acute endangered species LOC (0.1) for all uses of triclopyr except rice (Table 5-19 and Table 5-20). Large-sized CRLFs weighing 238 g consuming small insectivore mammals (both 15g and 35g mammals) exceed the acute endangered species LOC (0.1) for the maximum application of triclopyr only (20 lb ae/A) (Table 5-19 and Table 5-20). The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute endangered species LOC of 0.1 for the refined dose-based RQs for CRLF of varying weights (Table 5-19 and Table 5-20). Refined dose-based RQs resulted in exceedances of the Agency's LOC with CRLFs of varying weights (1.4g, 37g and 238g) consuming consuming small insects, Medium (37g) and large (238g) sized CRLFs consuming small herbivore mammals (weighing both 15g and 35g), and large (238g) sized CRLFs consuming small insectivore mammals (weighing 15g only). Therefore, there is still potential for direct effects to the terrestrial-phase CRLF even at the mitigated maximum application rate.

Table 5-19 Refined Acute Dose-based RQs* for CRLF consuming different food items (RQs calculated using T-HERPS), the weights of small herbivore and insectivore mammals are 15 g (Foliar applications).

Scenario	CRLF Size (g)	Small Insects	Large Insects	Small Herbivore Mammals	Small Insectivore Mammals	Small Terrestrial Phase Amphibians
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max-Foliar)	1.4	**0.58**	0.06	N/A	N/A	N/A
	37	**0.57**	0.06	**10.30**	**0.64**	0.02
	238	**0.38**	0.04	**1.60**	**0.10**	0.01
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	**0.23**	0.03	N/A	N/A	N/A
	37	**0.23**	0.03	**4.12**	**0.26**	0.01
	238	**0.15**	0.02	**0.64**	0.04	0.01
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	0.04	< 0.01	N/A	N/A	N/A
	37	0.04	< 0.01	**0.77**	0.05	< 0.01
	238	0.03	< 0.01	**0.12**	0.01	< 0.01
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min-Foliar)	1.4	0.01	< 0.01	N/A	N/A	N/A
	37	0.01	< 0.01	**0.11**	0.01	< 0.01
	238	0.01	< 0.01	0.02	< 0.01	< 0.01
*RQs exceeding the Listed LOC (0.10) are bolded and shaded						

Table 5-20 Refined Acute Dose-based RQs* for CRLF consuming different food items (RQs calculated using T-HERPS), the weights of small herbivore and insectivore mammals are 35 g (Foliar applications).

Scenario	CRLF Size (g)	Small Insects	Large Insects	Small Herbivore Mammals	Small Insectivore Mammals	Small Terrestrial Phase Amphibians
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max-Foliar)	1.4	**0.58**	0.06	N/A	N/A	N/A
	37	**0.57**	0.06	**16.61**	**1.04**	0.02
	238	**0.38**	0.04	**2.58**	**0.16**	0.01
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	**0.23**	0.03	N/A	N/A	N/A
	37	**0.23**	0.03	**6.64**	**0.42**	0.01
	238	**0.15**	0.02	**1.03**	0.06	0.01
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	1.4	0.04	< 0.01	N/A	N/A	N/A
	37	0.04	< 0.01	**1.25**	0.08	< 0.01
	238	0.03	< 0.01	**0.19**	0.01	< 0.01

Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min-Foliar)	1.4	0.01	< 0.01	N/A	N/A	N/A
	37	0.01	< 0.01	**0.18**	0.01	< 0.01
	238	< 0.01	< 0.01	0.03	< 0.01	< 0.01
*RQs exceeding the Listed LOC (0.10) are bolded and shaded						

A probit slope value for the acute avian toxicity test was 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). For all uses with RQs that exceed the endangered species LOCs the probability of individual effects were conducted to determine the probability that one individual could be impacted by exposure to triclopyr. Using the refined acute dietary-based RQs for CRLF consuming different food items (both 15g and 35g mammals) the chance of individual mortality for which the RQs exceed the LOC (0.1) range from approximately 1 in $1.25*10^5$ (95 % CI: 1 in $3.62*10^1$ to 1 in $3.19*10^{17}$) (<1%) at an RQ 0.11 (Forest Tree/Pest Management, small insectivore mammals weighing 15g) to approximately 1 in 1 (95 % CI: 1 in 1.10 to 1 in 1) (100%) at an RQ of 4.58 (Agricultural Uncultivated Areas, small herbivore mammals weighing 15g) (Table 5-18). This range of RQs is relevant to CRLF consuming small and large insects, and small herbivore and insectivore mammals for uses in which there were LOC exceedances. This range is not relevant to CRLF consuming small terrestrial-phase amphibians modeled for any use scenario since there was no LOC exceedance.

Using the refined acute dose-based RQs for CRLF consuming different food items the chance of individual mortality for which the RQs exceed the LOC (0.1) range from approximately 1 in $2.94*10^5$ (95 % CI: 1 in $4.4*10^1$ to 1 in $8.86*10^{18}$) (<1%) at an RQ of 0.10 (Agricultural Uncultivated Areas, small insectivore mammals weighing 15g, 238 g CRLF) to approximately 1 in 1 (95 % CI: 1 in 1.02 to 1 in 1) (100%) at an RQ of 10.3 (Agricultural Uncultivated Areas, small herbivore mammals weighing 15g, 37g CRLF) (Table 5-19). This range of RQs is relevant to all sizes of CRLF consuming small insects, and small herbivore and insectivore mammals (mammals weighing 15g), for uses in which there were exceedances. This range is not relevant to CRLF (of any size) consuming large insects or small terrestrial-phase amphibians modeled for any use scenario since there were no LOC exceedances.

Using the refined acute dose-based RQs for CRLF consuming different food items the chance of individual mortality for which the RQs exceed the LOC (0.1) range from approximately 1 in $9.56*10^3$ (95 % CI: 1 in $2.01*10^1$ to 1 in $1.65*10^{13}$) (<1%) at an RQ 0.15 (Forest Tree/Pest Management, small insects 238g CRLF) to approximately 1 in 1 (95 % CI: 1 in 1.01 to 1 in 1) (100%) at an RQ of 16.61 (Agricultural Uncultivated Areas, small herbivore mammals weighing 35g, 37g CRLF) (Table 5-20). This range of RQs is relevant to all sizes of CRLF consuming small insects, and small herbivore and insectivore mammals (mammals weighing 35g), for uses in which there were LOC exceedances. This range is not relevant to CRLF (of any size) consuming large insects or small terrestrial-phase amphibians modeled for any use scenario since there were no LOC exceedances.

Chronic Exposures

Refined chronic dietary-based RQs for CRLFs consuming small insects using the T-HERPS model exceed the chronic species LOC (1.0) for all foliar application uses of triclopyr except rice (Table 5-21). Refined chronic dietary-based RQs for CRLFs consuming small herbivore mammals (either 15g or 35g) exceed the chronic species LOC (1.0) for all foliar application uses of triclopyr (Table 5-21). Refined chronic dietary-based RQs for CRLFs consuming large insects, small insectivore mammals (either 15g or 35g), and small terrestrial-phase amphibians (weighing 2.3g) exceed the chronic species LOC (1.0) for foliar uses of triclopyr with application rates greater than or equal to 8 lb ae/A (Table 5-21). The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's chronic LOC of 1.0 for the refined dietary-based RQs for CRLFs consuming small and large insects, small herbivore and insective mammals (weighing 15g and 35g), and small terrestrial-phase amphibians (Table 5-21). Therefore, there is still potential for direct effects to the terrestrial-phase CRLF even at the mitigated maximum application rate.

Table 5-21 Refined Chronic Dietary-based RQs* for CRLF consuming different food items (RQs calculated using T-HERPS), the weights of small herbivore and insectivore mammals are 15 g and 35 g (Foliar applications).

Scenario	Weight of mammals (herbivore & insectivore)	Small Insects	Large Insects	Small Herbivore Mammals	Small Insectivore Mammals	Small Terrestrial Phase Amphibians
Agricultural Uncultivated Areas (20 lb ae/acre; 17 times/yr; 21 day intervals) (Max-Foliar)	15g	**79.29**	**8.81**	**134.39**	**8.40**	**2.75**
	35g	**79.29**	**8.81**	**92.88**	**5.81**	**2.75**
Forest Tree/Pest Management (8 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	15g	**31.71**	**3.52**	**53.76**	**3.36**	**1.10**
	35g	**31.71**	**3.52**	**37.15**	**2.32**	**1.10**
Douglas-Fir (Forest/Shelterbelt) (1.5 lb ae/acre; 17 times/yr; 21 day intervals) (Median-Foliar)	15g	**5.95**	0.66	**10.08**	0.63	0.21
	35g	**5.95**	0.66	**6.97**	0.44	0.21
Rice (0.38 lb ae/acre; 2 times/yr; 21 day intervals) (Min-Foliar)	15g	0.85	0.09	**1.44**	0.09	0.03
	35g	0.85	0.09	**1.00**	0.06	0.03

*RQs exceeding the Listed LOC (1.0) are bolded and shaded

In the available chronic study where Mallard duck were exposed to triclopyr, the NOAEC was 100 ppm and the LOAEC was 200 ppm, based on effects to the number of 14-day old survivors. In comparing the LOAEC to the refined dietary-based EECs for CRLF small insects and small herbivore mammals indicate that the EECs for all uses except rice exceed the concentration where reproductive effects were observed within the laboratory. For CRLF consuming large insects or small insectivore mammals (15g or 35g mammals) and an application rate of triclopyr greater than or equal to 8 lb ae/A, exceed the concentration where reproductive effects were observed within the laboratory. CRLFs consuming small terrestrial-phase amphibians exceed the concentration where reproductive effects were observed in the lab at the maximum application rate (20 lbs ae/A) only. All other uses except those previously listed have EECs which do not exceed the LOAEC. Therefore, for some CRLF feeding categories, triclopyr EECs are at levels were reproductive effects were observed in birds, which serve as surrogates for the CRLF. The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute and chronic LOC of 0.1 and 1.0 respectively, indicating that there is still potential for direct effects to the terrestrial-phase CRLF at the recommended mitigated maximum application rate.

Based on the lines of evidence, and on these refined acute and chronic risk quotients (RQs) and their exceedances of the Agency's LOC a May Affect and Likely to Adversely Affect (LAA) determination is made for triclopyr use in California.

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. Indirect effects of triclopyr 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 Agency's LOC (1.0) is exceeded for many uses of triclopyr in California. The aquatic non-vascular plant RQs range from 35.71 (lakes/ponds/reservoirs) to 0.08 (ornamental lawns and turf). Results are presented in Table 5-2.

The fate characteristics indicate that triclopyr acid/anion is expected to be persistent in aquatic environments. As a result, the primary food source for the aquatic-phase CRLF (non-vascular aquatic plants) is expected to be affected.

One of the aquatic incidents that were reported involved impacts to aquatic vegetation. An accidental misuse of triclopyr BEE, in AR, reported that aerial drift of Garlon 4 (triclopyr BEE) contaminated an adjacent pond which resulted in damage to some aquatic vegetation (I005004-001). The California Department of Pesticide Regulation (CDPR) has been collecting surface water data on triclopyr for many years. Samples were taken in six California counties from March 1993 to March 2006. Out of 583 samples, 102 samples contained triclopyr. The median concentration of positive samples was 0.65 ppb and the mean concentration was 1.7 ppb. The highest detected concentration of 14.5 ppb was recorded on June 21, 2001 at Colusa Basin Drain #5 in Colusa County, which is an area that is known for growing rice. Colusa County is one of four leading counties for rice production in California. The Rice Model predicted a concentration of 763.00 ppb. This is a little more than a magnitude larger, and shows how conservative the model is.

Because of non-vascular LOC exceedance from registered uses of triclopyr, the presence of aquatic incident data, and because triclopyr's presence has been observed in monitored surface water in California, the Agency concludes that there is a potential of indirect impact to the aquatic-phase of the CRLF from reduction of

food items (algae). Therefore, triclopyr May Affect and is Likely to Adversely Affect (LAA) the CRLF.

5.2.2.2 Aquatic Invertebrates

The potential for triclopyr 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.

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. 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 for freshwater invertebrates. The acute RQs exceed the Agency's LOC for listed species (0.05), for a majority of triclopyr uses, and range from 10.00 (Lakes/ponds/reservoirs) to 0.02 (ornamental lawns and turf) (Table 5-3). The estimated probability of individual effect of triclopyr ranges from approximately 100% (lakes/ponds/reservoirs) to 3.98 x 10^{5} % (ornamental sod farm-turf), Table 5-3. Chronic RQs do not exceed the Agency's chronic risk to species LOC (1.0) for freshwater invertebrates for any triclopyr use, and range from 0.10 (lakes/ponds/reservoirs) to <0.01 (ornamental lawns and turf) (Table 5-3).

The California Department of Pesticide Regulation (CDPR) has been collecting surface water data on triclopyr for many years. Samples were taken in six California counties from March 1993 to March 2006. Out of 583 samples, 102 samples contained triclopyr. The median concentration of positive samples was 0.65 ppb and the mean concentration was 1.7 ppb.

Because of aquatic invertebrates LOC exceedances from registered uses of triclopyr, and because triclopyr's presence has been observed in monitored surface water in California, the Agency concludes that there is a potential indirect impact to the aquatic-phase of the CRLF from a reduction of aquatic invertebrates (aquatic phase amphibian food items). As a result, it is determined that triclopyr May Affect and is Likely to Adversely Affect (LAA) the CRLF.

5.2.2.3 Fish and Aquatic-phase Frogs

As discussed in Section 2.5.3, the diet of CRLF also includes small fish and other aquatic-phase frogs. 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. In order to assess direct chronic risks to the CRLF, 60 day EECs and the lowest chronic toxicity value for freshwater fish are used. The resulting RQs for the majority of triclopyr uses exceed the Agency's acute and chronic LOC's (0.05 and 1.0) for freshwater fish (surrogates for the aquatic-phase CRLF) (Table 5-1). The acute RQs exceed the Agency's LOC for listed species (0.05), and range from 9.62 (Lakes/ponds/reservoirs) to 0.02 (ornamental lawns and turf) (Table 5-1). The estimated probability of individual effect of triclopyr ranges from approximately 100% (lakes/ponds/reservoirs) to 3.98×10^5 % (ornamental sod farm-turf), Table 5-1. The chronic RQs exceed the Agency's LOC (1.0), and range from 131.58 (Lakes/ponds/reservoirs) to 0.21 (ornamental lawns and turf), Table 5-1.

There were a total of three aquatic animal incidents that were reported for triclopyr, and the certainty of triclopyr being responsible was possible, probable and highly probable. These were the only reported aquatic incidents, and may be represent only a small portion of potential impacts to non-target aquatic organisms as some effects may impair other functions resulting in decreased survival (i.e. harder to escape predation). The California Department of Pesticide Regulation (CDPR) has been collecting surface water data on triclopyr for many years. Samples were taken in six California counties from March 1993 to March 2006. Out of 583 samples, 102 samples contained triclopyr. The median concentration of positive samples was 0.65 ppb in the Colusa Basin and the mean concentration was 1.7 ppb. This may be due to the use of triclopyr on rice. Colusa County is one of four leading counties for rice production in California. The Rice Model predicted a concentration of 763.00 ppb. This is a little more than a magnitude larger, and shows how conservative the model is.

Because there are LOC exceedances from registered uses of triclopyr to the CRLF surrogate species (freshwater fish) in California, verified non-target incidents resulting from triclopyr use, and because triclopyr's presence has been observed in monitored surface water in California, the Agency concludes that there is a potential indirect impact to the aquatic-phase of the CRLF from a reduction of aquatic phase amphibian food items. Therefore, triclopyr May Affect and is Likely to Adversely Affect (LAA) the CRLF.

5.2.2.4 Terrestrial Invertebrates

When the terrestrial-phase CRLF reaches juvenile and adult stages, its diet is mainly composed of terrestrial invertebrates. Terrestrial invertebrate toxicity data is used to assess potential indirect effects of triclopyr to the terrestrial-phase CRLF. Effects to terrestrial invertebrates resulting from exposure to triclopyr may also indirectly affect the CRLF via reduction in available food.

Because the LD_{50} was not definitive, and there was little incidence of mortality, RQs were not calculated. However, EECs were compared to the highest concentration tested 100 µg/bee). All of estimated EEC's the level tested for all uses except rice for small insects and all of the uses greater than 17 applications per year with 21 day intervals at 8 lb ae/acre per application for large insects; therefore, a preliminary "May Affect" determination was made. However, the calculated EEC's for Agricultural uncultivated areas (7930 ppm small insects and 881 ppm large insects, Table 3-6) were 14.1 and 1.56

times the level of triclopyr tested (>72 μg ae/bee, 562.5 ppm). Without a definitive toxicity endpoint value, we cannot preclude risk to terrestrial invertebrate prey items.

Therefore, because the calculated terrestrial small insect EEC's exceed the highest levels tested, the Agency concludes that there is a potential indirect impact to the terrestrial-phase CRLF from a reduction of invertebrate food items and therefore triclopyr is Likely to Adversely Affect (LAA) the CRLF.

5.2.2.5 Mammals

Life history data for terrestrial-phase CRLFs indicate that large adult frogs consume terrestrial vertebrates, including mice. Small mammals can make up to 50% of the CRLF food intake. Acute and chronic dose-based and chronic dietary-based RQs exceed the Agency's acute and chronic risk LOCs (0.1 acute, 1.0 chronic) for all foliar application uses of triclopyr (Table 5-9). The acute RQs range from 10.7 (Agricultural Uncultivated Areas) to 0.11 (Rice), and the chronic RQs range from 1222.9 (Agricultural Uncultivated Areas) to 13.1 (Rice) [Dose-based] and 141 (Agricultural Uncultivated Areas) to 1.51 (Rice) [Dietary-based]. The probability of individual effect at the acute endangered species LOC (0.1) ranges from 1 in 1 (95%CI: 1 in 1.02 to 1 in 1) for Agricultural uncultivated areas to 1 in $1.25*10^5$ (95% CI: 1 in $3.62*10^1$ to 1 in 3.19 $*10^{17}$) for rice. 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). Population reduction in small mammal prey items for the CRLF from application of triclopyr ranges from 100% (agricultural uncultivated areas) to 0.0008% (rice) for foliar applications of triclopyr. The probability of individual effect probit slope analysis is not applicable for chronic endpoints. The dose-based and dietary-based EECs are well above the levels mortality was documented at for all uses of triclopyr except rice (acute endpoint), and all uses of triclopyr (chronic endpoint). Because environmental exposure levels are estimated to be much higher than the level which may cause acute effects to mammals, the CRLF may be indirectly affected by acute exposure of its mammal food source to triclopyr. The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute and chronic LOC of 0.1 and 1.0 respectively, indicating that there is still potential for indirect effects to the terrestrial-phase CRLF via reduction in prey at the recommended mitigated maximum application rate.

For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for mammals weighing 15g and 35g, ranging from 0.83 (Commercial/Industrial Lawns) to 0.42 (Ornamental Lawns and Turf) for mammals weighing 15g, and 0.44 (Commercial/Industrial Lawns) to 0.22 (Ornamental Lawns and Turf) for mammals weighing 35g (Table 5-10). The LD_{50}/ft^2 is calculated using a toxicity value (the adjusted LD_{50}) and the EEC (mg a.e./ft^2), and is compared to the Agency's LOC. The probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 2.79 with a 95% CI of 1 in 2.3 to 1 in 4.29 (for Commercial/Industrial Lawns) to 1 in $2.22*10^1$ with a

95% CI of 1 in 4.43 to 1 in $2.87*10^3$ (for Ornamental Lawns and Turf) for mammals weighing 15 g. For mammals weighing 35g LD_{50}/ft^2 the probability of individual effect at the endangered species LOC (0.1) ranges from 1 in $1.84*10^1$ with a 95% CI of 1 in 4.20 to 1 in $1.5*10^3$ (for Commercial/Industrial Lawns) to 1 in $6.48*10^2$ with a 95% CI of 1 in $1.06*10^1$ to 1 in $6.14*10^8$ (for Ornamental Lawns and Turf). 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). Population reduction in small mammal prey items for the CRLF from application of triclopyr ranges from 36% (Commercial/Industrial Lawns) to 0.15% (Ornamental Lawns and Turf) for granular applications of triclopyr to mammals weighing 15g and 35g.

As a Group D chemical triclopyr is unable to be classified as to human carcinogenicity, based on marginal evidence of tumors in female rates and mice and benign adrenal pheochromocytomas in male rats (HED 2002, Appendix M). Reproductive and sublethal effects (increased incidence of F_2 pups with exencephaly and ablepharia) were observed in chronic mammalian studies, and resulted in RQ values that exceeded the LOC (1.0) for all uses (both chronic dose- and dietary-based). The chronic dose-based RQs ranged from 1222.9 (Agricultural uncultivated area, maximum application rate) to 13.1 (Rice, minimum application rate), and the chronic dietary-based RQs ranged from 141 (Agricultural uncultivated area, maximum application rate) to 1.51 (Rice, minimum application rate) (Table 5-9). The acute dose-based RQs ranged from 10.7 (Agricultural uncultivated area, maximum application rate) to 0.11 (Rice, minimum application rate) (Table 5-9). Triclopyr's toxicity, when combined in the diet is lower than the gavage (dose) based treatment, indicating that the toxicity may be reduced in combination with the diet. Chronic exposure from triclopyr is likely.

Based on effects to small mammals from both foliar and granular uses, there is a potential indirect impact to the CRLF via reduction in small mammal prey items, and therefore triclopyr May Affect and is Likely to Adversely Affect (LAA) the CRLF.

5.2.2.6 Terrestrial-phase Amphibians

Terrestrial-phase adult CRLFs also consume frogs. RQ values representing direct exposures of triclopyr to terrestrial-phase CRLFs are used to represent exposures of triclopyr to frogs in terrestrial habitats. The T-HERPS model was therefore employed as a refinement tool to explore amphibian-specific food intake on potential exposure to terrestrial-phase amphibian food items for the CRLF. The T-HERPS model incorporates the same inputs as T-REX with equations adjusted for poikilotherm food intake. As described in Section 5.2.1.2, the refined acute RQs (dietary- and dose-based) for small terrestrial-phase amphibians did not exceed the listed species LOC (0.1) for any use of triclopyr. However, the refined chronic dietary-based RQs exceed the chronic species LOC (1.0) for small terrestrial-phase amphibians (weighing 2.3g) for foliar uses of triclopyr with application rates greater than or equal to 8 lb ae/A (Table 5-19). Reduction in amphibian prey items, specifically other frogs may potentially be affected from chronic exposure of triclopyr as the result of triclopyr use. Other items in the prey base all had RQs that exceeded the listed species LOC for numerous uses of triclopyr. The recommended mitigated maximum foliar application rate of 9 lbs ae/A would still result in exceedances of the Agency's acute and chronic LOC of 0.1 and 1.0 respectively, indicating that there is still potential for direct effects to the terrestrial-phase CRLF at the recommended mitigated maximum application rate.

Based on this evidence, a May Affect and is Likely to Adversely Affect (LAA) determination is made for indirect effects via reductions in prey base of the terrestrial-phase CRLF based on foliar application alone.

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 as attachment sites and refugia for many aquatic invertebrates, fish, and juvenile organisms, such as fish and frogs. In addition, vascular plants also provide primary productivity and oxygen to the aquatic ecosystem. Rooted 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. Indirect effects of triclopyr to the aquatic-phase CRLF (tadpoles) are present in the reduction of non-vascular aquatic plants in the aquatic-phase CRLFs diet. The Agency's LOC (1.0) for non-vascular plants is exceeded for most uses of triclopyr in California. The non-vascular aquatic plant RQs range from 35.71 for lakes/ponds/reservoirs to 0.08 for ornamental lawns and turf.

Indirect effects of triclopyr to the aquatic-phase CRLF (tadpoles) are also found via the reduction in vascular aquatic plants in the aquatic-phase CRLFs diet. The Agency's LOC (1.0) for vascular plants is exceeded for many uses of triclopyr in California. The acute RQs range from 2.91 for lakes/ponds/reservoirs to 0.01 for ornamental lawns and turf (Table 5-4).

An analysis of the fate characteristics of triclopyr indicates that triclopyr is expected to be persistent in aquatic environments. As a result, the primary food source for the aquatic-phase CRLF (both vascular and non-vascular aquatic plants) is expected to be adversely affected.

One of the aquatic incidents that were reported involved impacts to aquatic vegetation. An accidental misuse of triclopyr BEE, in AR, reported that aerial drift of Garlon 4 (triclopyr BEE) contaminated an adjacent pond which resulted in damage to some aquatic vegetation (I005004-001).

Because of the non-vascular aquatic plant LOC exceedances for registered uses of triclopyr, and verified non-target incidents resulting from triclopyr use, the Agency concludes that there is a potential of indirect impact to the aquatic-phase of the CRLF from reduction of food items (algae). Therefore, triclopyr May Affect and is Likely to Adversely Affect (LAA) the CRLF.

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. Terrestrial plants also provide energy to the terrestrial ecosystem through primary production. 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.

The RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr both foliar (aerial and ground) and granular applications (Table 5-11 and Table 5-12). RQs for non-target terrestrial monocots and dicot plants inhabiting upland dry areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr except rice both foliar (aerial and ground) and granular applications (Table 5-11 and Table 5-12). Aerial foliar applications of triclopyr result in spray drift RQ exceedances for non-target dicot species for all uses of triclopyr (Table 5-11). Aerial foliar applications of triclopyr result in spray drift RQ exceedances for monocots for all uses except rice (Table 5-11). Ground foliar applications result in spray drift RQ exceedances for both monocots and dicots for all uses except rice (Table 5-11). There were no spray-drift LOC exceedances for non-target monocot or dicot plants from granular application of triclopyr (Table 5-12).

The recommended mitigated maximum foliar (ground and aerial) application rate of 9 lbs ae/A would still result in exceedances of the Agency's terrestrial plant LOC of 1.0 for indirect effects to the terrestrial-phase CRLF (Table 5-11). RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic and upland dry areas would still result in exceedances in the terrestrial plant LOC (1.0) (Table 5-11). Aerial and ground foliar applications would also still result in spray drift RQ exceedances for non-target terrestrial monocots and dicot plants (Table 5-11). Thus, indicating that there is still potential for indirect effects to the terrestrial-phase CRLF via habitat degradation at the recommended mitigated maximum application rate.

There were a total of 60 incidents that have been reported for triclopyr for non-target plants, listed under triclopyr (unknown triclopyr - 8), TEA (37), and BEE (15). Some of these incidents are the result of spray drift or overspray of triclopyr onto non-target plants within the vicinity of the application site, at least 15 of 60, (I014404-019, I014404-018, I014409-009, I007875-001, I007834-039, I002507-001, I008884-001, I003581-001, I008077-001, I013550-006, I012209-003, I011622-003, I016940-015, I013645-010, and I013550-007). The incidents involve registered uses, accidental misuses, misuses, and those of undetermined legality, with triclopyr ranging from being possibly responsible to highly probably responsible for the incidents.

Based on LOC exceedances in spray drift RQs for both monocots and dicots, RQ exceedances for both monocots and dicots inhabiting semi-aquatic and upland dry habitats, and verified non-target incidents resulting from triclopyr use, triclopyr May Affect and is Likely to Adversely Affect (LAA) the CRLF indirectly via habitat degradation through reduction in terrestrial plants.

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).

Conclusions for potential indirect effects to the CRLF via direct effects to aquatic and terrestrial plants are used to determine whether modification to critical habitat may occur. LOCs are exceeded for terrestrial riparian plants and for aquatic plants from exposure to triclopyr from spray drift. Alteration of riparian and vascular plants may result in alteration of temperature, turbidity, and oxygen content.

Aquatic non-vascular plants used as a food source and habitat for CRLF may be potentially affected from many triclopyr uses. A reduction in these aquatic based food sources may occur from most use sites. Likewise, due to aquatic vascular and terrestrial plant communities being reduced from most use sites, there is potential for alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond.

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 acute LOC exceedances for aquatic plants triclopyr will result in habitat modification based on effects to aquatic-phase PCEs of designated critical habitat related to effects of alteration of other chemical characteristics necessary for normal growth and viability of CRLFs and their food source. Therefore, triclopyr is likely to result in habitat modification.

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.

There is a potential for habitat effects via impacts to terrestrial plants (Section 5.2.3.2) from triclopyr use (both aerial and ground applications).

The risk estimation for terrestrial-phase PCEs of designated habitat related to potential effects on terrestrial plants is provided in Section 5.1.2.3. These results will inform the effects determination for effects to designated critical habitat for the CRLF.

The third terrestrial-phase PCE is "reduction and/or modification of food sources for terrestrial phase juveniles and adults." To assess the impact of triclopyr on this PCE, acute and chronic toxicity endpoints for terrestrial invertebrates, mammals, and terrestrial-phase frogs are used as measures of effects. **There is potential for habitat effects via indirect effects to terrestrial-phase CRLFs via reduction in prey base (Section 5.2.2.4 for terrestrial invertebrates, Section 5.2.2.5 for mammals, and 0 for frogs.**

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. **There is potential for habitat effects via direct (Section 5.2.1.2) and indirect effects (Sections 5.2.2.4, 5.2.2.5, and 5.2.2.6) to terrestrial-phase CRLFs from triclopyr use. Triclopyr use may result in habitat effects based on effects to terrestrial PCEs related to alteration of chemical characteristics necessary for normal growth and viability.**

5.2.5 Spatial Extent of Potential Effects

An LAA effects determination applies to those areas where it is expected that the pesticide's use will directly or indirectly affect the CRLF or its designated critical habitat. To determine this area, the footprint of triclopyr's use pattern is identified, using land cover data that correspond to triclopyr's use pattern. Areas of potential exposure also include areas beyond the initial area of concern (*e.g*, use footprint) that may be impacted by runoff and/or spray drift. The identified direct/indirect effects and/or modification to critical habitat are anticipated to occur only for those currently occupied core habitat areas, CNDDB occurrence sections, and designated critical habitat for the CRLF that overlap with the initial area of concern plus at least 1,000 feet from its boundary for terrestrial uses. Since the aquatic uses are applied directly to water, a boundary cannot be established. It is assumed that non-flowing waterbodies (or potential CRLF habitat) are included within this area.

In addition to the spray drift buffer, a downstream dilution extent analysis is usually performed to represents the maximum continuous distance of downstream dilution from the edge of the initial area of concern. However, since triclopyr acid has direct water body applications, these streams flow will reach the CRLF habitat, and potentially affect either the CRLF or modify its habitat. These lotic aquatic habitats within the CRLF core areas and critical habitats potentially contain concentrations of triclopyr acid sufficient to result in LAA determination or modification of critical habitat.

The determination of the buffer distance and downstream dilution for spatial extent of the effects determination is described below.

5.2.5.1 Spray Drift

In order to determine terrestrial and aquatic habitats of concern due to triclopyr 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 AgDrift.

For triclopyr 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.

The AgDISP model was run in ground mode and aerial mode (for non-cropland use only) with the following settings beyond the standard default settings.

- 20 gal/acre spray volume rate (label specific)
- Very fine to fine spectrum (default value)
- No canopy
- Nonvolatile fraction of 0.491.
- Volatile fraction 0.119.

In order to characterize the spatial extent of the effects determination that is relevant to the CRLF (i.e. NLAA versus LAA), an analysis was conducted using the most sensitive non-endangered plant EC_{25} of 0.005 lbs ae/acre (Sunflower, Vegetative Vigor) and a NOAEC of 0.0028 lb ae/acre. Typically the NOAEC is used when there is an obligate relationship between the species being assessed and endangered plants (or other taxa). However, there is no obligate relationship between the CRLF and any endangered plant; therefore the LAA/NLAA determination is based on the area defined by the non-listed species LOC (i.e., EEC/EC_{50}).

The estimated buffer distance identifies those locations where terrestrial landscapes can be impacted by spray drift deposition alone (no runoff considered) at concentrations above the LOC for terrestrial plants. The LOC was compared to the highest RQ for aerial applications at 12.0 lbs ae/acre. The maximum distance for the aerial use of triclopyr at 12.0 lbs ae/acre is at least 1,000 feet.

An aquatic analysis was not performed because triclopyr is applied directly to water. As a result, there would not be an aquatic buffer distance established.

A summary of the terrestrial buffer analyses are listed below in Table 5-22.

Table 5-22 Summary of AgDRIFT Predicted Terrestrial Spray Drift Distances

Terrestrial Assessment

Tier I Ground Application								
Risk Class	Risk Description	App. Rate (lb ae/acre)	Toxicity Value Used	Initial Avg Conc. (ppt)	Non-volatile Rate (lb/a)	Min. Spray Volume Rate (gal/a)	Active Rate (lb ae/a)	Distance (feet)
Non-Listed Plants	Potential for effects to non-target, non-listed plants from exposures	20	EC_{25} = 0.005 lb ae/A Sunflower (Vegetative Vigor)	0.0003	Does not apply	Does not apply	Does not apply	> 1,000
Listed Plants	Potential for effects to non-target, listed plants from exposures		NOAEC= 0.0028 lb ae/A Sunflower (Vegetative Vigor)	0.0001				> 1,000
Tier I Aerial Application								
Risk Class	Risk Description	App. Rate (lb ae/acre)	Toxicity Value Used	Initial Avg Conc. (ppt)	Non-volatile Rate (lb/a)	Min. Spray Volume Rate (gal/a)	Active Rate (lb ae/a)	Distance (feet)
Non-Listed Plants	Potential for effects to non-target, non-listed plants from exposures	12	EC_{25} = 0.005 lb ae/A Sunflower (Vegetative Vigor)	0.0003	Does not apply	Does not apply	Does not apply	> 1,000

Listed Plants	Potential for effects to non-target, listed plants from exposures		NOAEC= 0.0028 lb ae/A Sunflower (Vegetative Vigor)	0.0001				> 1,000
Tier II Aerial Application								
Risk Class	Risk Description	App. Rate (lb ae/acre)	Toxicity Value Used	Initial Avg Conc. (ppt)	Non-volatile Rate (lb/a)	Min. Spray Volume Rate (gal/a)	Active Rate (lb ae/a)	Distance (feet)
Non-Listed Plants	Potential for effects to non-target, non-listed plants from exposures	12	EC_{25} = 0.005 lb ae/A Sunflower (Vegetative Vigor)	0.0003				> 1,000
Listed Plants	Potential for effects to non-target, listed plants from exposures		NOAEC= 0.0028 lb ae/A Sunflower (Vegetative Vigor)	0.0001	0.491	20	0.119	> 1,000

5.2.5.2 Downstream Dilution Analysis

In order 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 LOC, the greatest ratio of aquatic RQ to LOC would be estimated. However, due to having direct applications to water for triclopyr acid, it was determined that a downstream dilution analysis is not applicable in this case since it can be applied to any location within the water body. It is not just being transported as runoff across the landscape, into non-impacted water. The water body may be directly impacted already; therefore, possibly increasing the concentration downstream and not diluting it.

5.2.5.3 Overlap between CRLF habitat and Spatial Extent of Potential Effects

An LAA effects determination is made to those areas where it is expected that the pesticide's use will directly or indirectly affect the CRLF or its designated critical habitat and the area overlaps with the core areas, critical habitat and available occurrence data for CRLF.

For triclopyr, the use pattern in the following land cover classes (cultivated crops, developed high/low intensity areas, open space, wetlands, open water, pasture/hay, forests, and orchards/vineyards) also includes areas beyond the initial area of concern that may be impacted by runoff and/or spray drift overlaps with CRLF habitat. Appendix D provides maps of the initial area of concern, along with CRLF habitat areas, including currently occupied core areas, CNDDB occurrence sections, and designated critical habitat. It is expected that any additional areas of CRLF habitat that are located at least 1000 ft (to account for offsite migration via spray drift for terrestrial uses) outside the initial area of concern may also be impacted and are part of the full spatial extent of the LAA/modification of critical habitat effects determination. The effects area only includes those areas where predicted exposure and habitat overlap. See Figure 5-1 for a visual of where the CRLF habitat and the use of triclopyr may overlap.

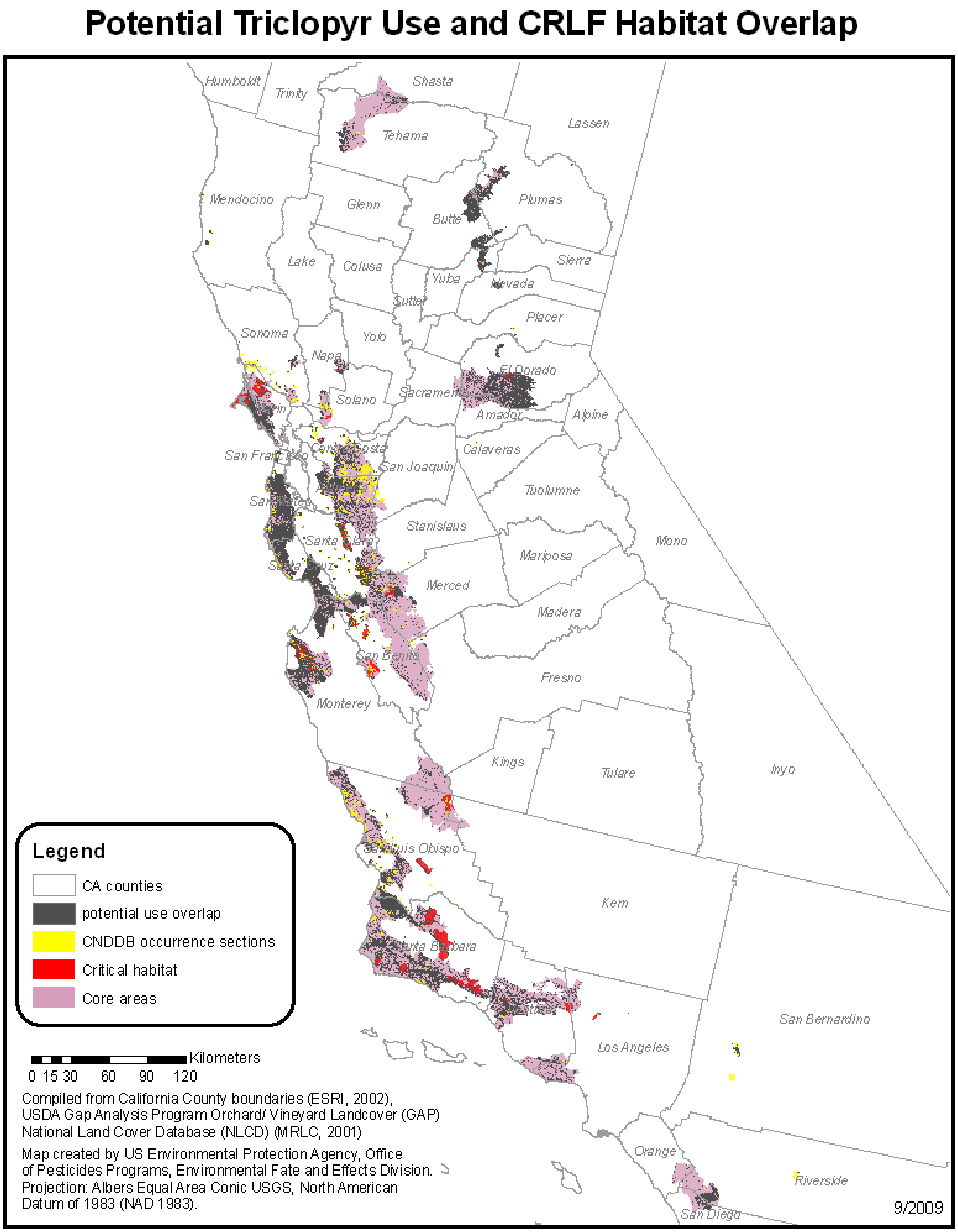

Figure 5-1 Overlap Map: CRLF Habitat and Triclopyr Initial Area of Concern

6.0 Uncertainties

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 Triclopyr

The standard ecological water body scenario (EXAMS 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 EXAMS 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 EXAMS 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 EXAMS 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 EXAMS 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 EXAMS 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 EXAMS 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 EXAMS pond is assumed to be representative of exposure to aquatic-phase CRLFs. In addition, the Services agree that the existing

EXAMS pond represents the best currently available approach for estimating aquatic exposure to pesticides (U.S. FWS/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.

The Tier 1 Rice Model used to calculate potential aquatic exposure to pesticides is intended to represent conservative screening estimates, and to avoid underestimations of the actual exposure. The standard scenario consists of application to a 10 centimeter rice paddy. This model represents peak concentrations for rice paddies after partitioning into sediment. The Tier 1 Rice Model produces estimated aquatic concentrations that are expected to be exceeded to be peak concentrations. It does not consider factors beyond initial concentration assumed instantaneous partitioning. Chemical transport is not factored into the Tier 1 Rice Model results.

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, available monitoring data were compared to PRZM/EXAMS estimates of peak EECs for the different uses. The NAWQA database did not have any samples containing triclopyr for both groundwater and surface water. The CDPR collected samples of triclopyr from surface water in six California counties from March 1993 to March 2006. Out of 583 samples, 102 samples contained triclopyr. The highest concentration detected was 14.5 ppb. This value is approximately 167 times *less than* the maximum model-estimated environmental concentration (2500 ppb). The mean concentration for all counties was found to be 1.7 ppb. Although, the specific use patterns (*e.g.* application rates and timing, crops) associated with the agricultural areas and reflected in the monitoring data are unknown, however, they are assumed to be representative of potential triclopyr use areas.

The monitoring data available are below the Tier 1 Rice Model predictions by an order of magnitude. Rice Model prediction estimated triclopyr to be in the surface waters at peak concentrations of 763 ppb.

6.1.3 Potential Groundwater Contributions to Surface Water Chemical Concentrations

Although the potential impact of discharging ground water on CRLF populations is not explicitly delineated, it should be noted that, in some areas of the country, ground water could provide a source of pesticide to surface water bodies – especially low-order streams, headwaters, and ground water-fed pools. This is particularly likely if the chemical is persistent and mobile, the pesticide is applied to highly permeable soils overlying shallow unconfined ground water, and rainfall is sufficient to drive the chemical through the soil to ground water. Soluble chemicals that are primarily subject to photolytic degradation will be very likely to persist in ground water, and can be transportable over long distances. Similarly, many chemicals degrade slowly under anaerobic conditions (common in aquifers) and are thus more persistent in ground water. Under the right hydrologic conditions, this ground water may eventually be discharged to the surface – often supporting stream flow in the absence of rainfall. Continuously flowing low-order streams in particular are sustained by ground water discharge, which can constitute 100% of stream flow during base flow (no runoff) conditions. Thus, it is important to keep in mind that pesticides in ground water may impact surface water quality during base flow conditions with subsequent impact on CRLF habitats. However, many smaller streams in CA are net dischargers of water to ground water that go dry during portions of the year and are not supplied by base flow from ground water.

Although concentrations in a receiving water body resulting from ground water discharge cannot be explicitly quantified, it should be assumed that significant attenuation and retardation of the chemical will have occurred prior to discharge. Nevertheless, where triclopyr is applied to highly permeable soils over shallow ground water where there is a net recharge to adjacent streams, ground water could still be a consistent source of chronic background concentrations in surface water, and may also add to surface runoff during storm events (as a result of enhanced ground water discharge typically characterized by the ‘tailing limb’ of a storm hydrograph).

6.1.4 Usage Uncertainties

County-level usage data were obtained from California’s Department of Pesticide Regulation Pesticide Use Reporting (CDPR PUR) database. Eight years of data (1999 – 2006) 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 Triclopyr

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. EPA 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.

6.1.5.1 Granular Composition Uncertainty

The granular formulations of triclopyr cannot be further refined to determine the number of granules it would take birds (surrogate for the terrestrial-phase CRLF) to reach the LD_{50} as they are incorporated into fertilizers. No information can be provided regarding the specific amount or size of a single granule of triclopyr as the liquid form of triclopyr is mixed with the fertilizer product. An approximate range of granule sizes, and the percent active ingredient within each product was obtained from the registrant, but due to the chemical formulation of the fertilizers it is not possible to obtain more information regarding the weight of one granule for further characterization of terrestrial exposure of birds (surrogates for the terrestrial-phase CRLF) in relation to granular applications of triclopyr.

6.1.6 Spray Drift Modeling

Although there may be multiple triclopyr applications at a single site, 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 triclopyr from multiple applications, each application of triclopyr would have to occur under identical atmospheric conditions (*e.g.*, same wind speed and – for plants – same wind direction) and (if it is an animal) the animal being exposed would have to be present directly downwind at the same distance after each application. Although there may be sites where the dominant wind direction is fairly consistent (at least during the relatively quiescent conditions that are most favorable for aerial spray applications), it is nevertheless highly unlikely that plants in any specific area would receive the maximum amount of spray drift repeatedly. It appears that in most areas (based upon available meteorological data) wind direction is temporally very changeable, even within the same day. Additionally, other factors, including variations in topography, cover, and meteorological conditions over the transport distance are not accounted for by the AgDRIFT 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 AgDRIFT may overestimate exposure even from single applications, 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 often made regarding the droplet size distributions being modeled ('ASAE Very Fine to Fine' for orchard uses and 'ASAE Very Fine' for agricultural uses), the application method (*e.g.*, aerial), release heights and wind speeds. Alterations in any of these inputs would change the area of potential effect.

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 test data for triclopyr are not available for frogs or any other aquatic-phase amphibian; therefore, freshwater fish are used as surrogate species for aquatic-phase amphibians. Although no data are available for triclopyr, the available open literature information on triclopyr is not applicable for use within the assessment as the quality of the experiments is not scientifically sound. 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.

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 effects determination t 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. However, the full suite of sublethal effects from valid open literature studies is considered for the purposes of defining the action area.

No open literature data on sublethal effects more toxic than the most sensitive endpoint were found. However, mammalian reproductive and sublethal effects (including increased incidence of F_2 pups with exencephaly and ablepharia) were observed in chronic mammalian toxicity studies (Appendix M). Without the inclusion of sublethal effects potential direct and indirect effects of triclopyr 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.

7.0 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 triclopyr to the CRLF and its designated critical habitat.

Based on the best available information, the Agency makes a **May Affect, and Likely to Adversely Affect determination for the CRLF based on the direct and indirect effects to the aquatic and terrestrial-phase CRLF from the use of triclopyr**. The Agency has determined that there is the potential for modification of CRLF designated critical habitat from the use of the chemical. The direct effect and habitat modification determinations are summarized in Table 7-1 and Table 7-2, respectively. Given the LAA determination for the CRLF and potential effects to designated critical habitat, a description of the baseline status and cumulative effects for the CRLF is provided in Attachment II.

The LAA effects determination applies to those areas where it is expected that the pesticide's use will directly or indirectly affect the CRLF or its designated critical habitat. To determine this area, the footprint of triclopyr's use pattern is identified, using land cover data that correspond to triclopyr's use pattern. The spatial extent of the LAA effects determination also includes areas beyond the initial area of concern that may be impacted by runoff and/or spray drift. The identified direct and indirect effects and modification to critical habitat are anticipated to occur only for those currently occupied core habitat areas, CNDDB occurrence sections, and designated critical habitat for the CRLF that overlap with the initial area of concern plus 1000 feet buffer from its boundary (for terrestrial uses). A buffer for aquatic uses could not be established due to having direct applications to water. For a further analysis of how the buffer was determined, please see Section 5.2.5. It is assumed that non-flowing waterbodies (or potential CRLF habitat) are included within this area.

Due to having direct applications to water bodies for triclopyr acid, triclopyr is not just being transported as runoff across the landscape, into non-impacted water (which is what is assumed for downstream dilution). As a result, the water body may be directly impacted already, possibly increasing the concentration downstream and not diluting it. For further information on the downstream dilution analysis, please see Section 5.1.4. If any of these streams reaches flow into CRLF habitat, there is potential to affect either the CRLF or modify its habitat. These lotic aquatic habitats within the CRLF core areas and critical habitats potentially contain concentrations of triclopyr sufficient to result in LAA determination or modification of critical habitat.

Appendix D provides maps of the initial area of concern, along with CRLF habitat areas, including currently occupied core areas, CNDDB occurrence sections, and designated critical habitat. It is expected that any additional areas of CRLF habitat that are located at least 1,000 ft (to account for offsite migration via spray drift for terrestrial uses) outside the initial area of concern may also be impacted and are part of the full spatial extent of the LAA/modification of critical habitat effects determination. Due to direct application for aquatic uses, triclopyr may be applied directly to the area of concern.

A summary of the risk conclusions and effects determinations for the CRLF and its critical habitat, given the uncertainties discussed in Section 6.0, is presented in Table 7-1 and Table 7-2.

Table 7-1. Effects Determination Summary for Triclopyr Use and the CRLF

Assessment Endpoint	Effects Determination [1]	Basis for Determination
Survival, growth, and/or reproduction of CRLF individuals		**Potential for Direct Effects**
	LAA	***Aquatic-phase (Eggs, Larvae, and Adults)***: The aquatic phase amphibian acute LOCs for listed species (0.05) are exceeded for most uses of triclopyr in California. The chance of individual mortality for which the RQs exceed the LOC (0.05) range from approximately 1 in $2.51*10^6$ (<1%) at an RQ of 0.08 (Ornamental sod farm, turf) to 1 in 1 (100%) at an RQ of 9.62 (Lakes/ponds/reservoirs). The chronic RQs for most uses of triclopyr exceed the chronic species LOC (1.0), and range from 131.58 (Lakes/ponds/reservoirs) to 0.21 for (Ornamental lawns and turf).
	LAA	***Terrestrial-phase (Juveniles and Adults)***: Acute dietary-based RQs exceed the acute listed species LOC (0.1) for all uses of triclopyr except rice. The chance of individual mortality for which the RQs exceed the LOC (0.1) range from approximately 1 in $1.21*10^3$ (<1%) at an RQ 0.20 (Douglas-Fir, Forest/Shelterbelt) to approximately 1 in 1.03 (100%) at an RQ of 2.70 (Agricultural Uncultivated Areas). For refined dose-based RQs for CRLFs of varying weights (1.4g, 37g, and 238g) the chance of individual mortality for which the RQs exceed the LOC (0.1) range from approximately 1 in $2.94*10^5$ (<1%) at an RQ of 0.10 (Agricultural Uncultivated Areas, small insectivore mammals weighing 15g, 238g CRLF) to approximately 1 in 1 (100%) at an RQ of 10.3 (Agricultural Uncultivated Areas, small herbivore mammals weighing 15g, 37g CRLF), and from approximately 1 in $9.56*10^3$ (<1%) at an RQ 0.15 (Forest Tree/Pest Management, small insects 238 g CRLF) to approximately 1 in 1 (100%) at an RQ of 16.61 (Agricultural Uncultivated Areas, small herbivore mammals weighing 35g, 37g CRLF). These ranges of RQs is relevant to all sizes of CRLF consuming small insects, and small herbivore and insectivore mammals (mammals weighing 15g or 35g), for uses in which there were exceedances. Refined chronic dietary-based RQs for CRLFs consuming small insects exceed the chronic species LOC (1.0) for all foliar application uses of triclopyr except rice. Refined chronic dietary-based RQs for CRLFs consuming small herbivore mammals (either 15g or 35g) exceed the chronic species LOC (1.0) for all foliar application uses of triclopyr. Refined chronic dietary-based RQs for CRLFs consuming large insects, small insectivore mammals (either 15g or 35g), and small terrestrial-phase amphibians (weighing 2.3g) exceed the chronic species LOC (1.0) for foliar uses of triclopyr with application rates greater than or equal to 8 lb ae/A. For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for birds weighing 20 and 100g, ranging from 2.05 (Commercial/Industrial Lawns) to 0.32 (Ornamental Lawns and Turf) for 20g birds, and 1.04 (Commercial/Industrial Lawns) to 0.16 (Ornamental Lawns and Turf) for 100g

Assessment Endpoint	Effects Determination [1]	Basis for Determination
		birds. The probability of individual effect at the endangered species LOC (0.1) ranges from 1 in 1.09 (92%) at an RQ of 2.05 (Commercial/Industrial Lawns) to 1 in 1.88 (53%) at an RQ of 1.04 (Ornamental Lawns and Turf) for birds weighing 20g. For birds weighing 100 g LD_{50}/ft^2 the probability of individual effect at the endangered species LOC (0.1) ranges from 1 in $7.70*10^1$ (1.3%) at an RQ of 0.32 (Commercial/Industrial Lawns) to 1 in $5.85*10^3$ (0.02%) at an RQ of 0.16 (Ornamental Lawns and Turf).
		Potential for Indirect Effects
	LAA	***Aquatic prey items, aquatic habitat, cover and/or primary productivity*** LOCs for non-vascular plants are exceeded for most uses of triclopyr. The non-vascular plant RQs range from 35.71 for lakes/ponds/reservoirs to 0.08 for ornamental lawns and turf. LOCs for vascular plants are exceeded for many uses of triclopyr. The vascular plant RQs range from 2.91 for lakes/ponds/reservoirs to 0.01 for ornamental lawns and turf. LOCs for aquatic invertebrates are exceeded for most uses of triclopyr. The acute RQs range from 10.00 (Lakes/ponds/reservoirs) to 0.02 (Ornamental lawns and turf). Population reduction in aquatic invertebrate prey items for the CRLF from application of triclopyr ranges from 100% (Lakes/ponds/reservoirs) to < 0.1% (Ornamental lawns and turf). The chronic RQs range from 0.10 for lakes/ponds/reservoirs to <0.01 for ornamental lawns and turf. For fish/and aquatic-phase amphibians most uses of triclopyr exceed the acute and chronic LOCs for listed species (acute, 0.05 and chronic, 1.0). The RQs range from 0.02 (Ornamental lawns and turf) to 9.62 (Lakes/ponds/reservoirs). The chronic RQs range from 131.58 (Lakes/ponds/reservoirs) to 0.21 for (Ornamental lawns and turf).
	LAA	***Terrestrial prey items, riparian habitat*** RQs could not be calculated for terrestrial invertebrates as the toxicity endpoint was not a definitive value. But because the calculated terrestrial small insect EEC's exceed the highest levels tested, there is a potential indirect impact to the terrestrial-phase CRLF from a reduction of invertebrate food items. For small terrestrial mammals, the acute dose-based RQs exceed the acute risk LOC (0.1) for all foliar application uses of triclopyr ranging from 10.7 (Agricultural Uncultivated Areas) to 0.11 (Rice). Both dietary and dose-based chronic RQs exceed the chronic risk LOC (1.0) for all foliar application uses of triclopyr ranging from 1222.9 (Agricultural Uncultivated Areas) to 13.1 (Rice) [Dose-based] and 141 (Agricultural Uncultivated Areas) to 1.51 (Rice) [Dietary-based]. Population reduction in small mammal prey items for the CRLF from application of triclopyr ranges from 100% (agricultural uncultivated areas) to 0.0008% (rice) for foliar applications of triclopyr. For granular uses of triclopyr the resulting LD_{50}/ft^2s for all granular application uses of triclopyr exceed the Agency's acute endangered species LOC of 0.1 for mammals weighing 15g and 35g, ranging from 0.83 (Commercial/Industrial Lawns) to 0.42 (Ornamental Lawns and Turf) for mammals weighing 15g, and 0.44 (Commercial/Industrial Lawns) to 0.22 (Ornamental Lawns and Turf) for mammals weighing 35g. Population reduction in small mammal prey items for the CRLF from application of triclopyr ranges from 36% (Commercial/Industrial Lawns) to 0.15% (Ornamental Lawns and Turf) for granular applications of

Assessment Endpoint	Effects Determination [1]	Basis for Determination
		triclopyr to mammals weighing 15g and 35g. The refined acute RQs (dietary- and dose-based) for small terrestrial-phase amphibians did not exceed the listed species LOC (0.1) for any use of triclopyr. However, the refined chronic dietary-based RQs exceed the chronic species LOC (1.0) for small terrestrial-phase amphibians (weighing 2.3g) for foliar uses of triclopyr with application rates greater than or equal to 8 lb ae/A. Reduction in amphibian prey items, specifically other frogs may potentially be affected from chronic exposure of triclopyr as the result of triclopyr use. The RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr both foliar (aerial and ground) and granular applications. RQs for non-target terrestrial monocots and dicot plants inhabiting upland dry areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr except rice both foliar (aerial and ground) and granular applications. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for dicot non-target species for all uses of triclopyr. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for monocots for all uses except rice uses. Ground foliar applications result in spray drift RQ exceedances for both monocots and dicots for all uses except rice.

[1] No effect (NE); May affect, but not likely to adversely affect (NLAA); May affect, likely to adversely affect (LAA)

Table 7-2. Effects Determination Summary for Triclopyr Use and CRLF Critical Habitat Impact Analysis

Assessment Endpoint	Effects Determination [1]	Basis for Determination
Modification of aquatic-phase PCE	**Habitat Modification**	Due to aquatic vascular and terrestrial plant communities being reduced from a majority of use sites, there is potential for alteration of channel/pond morphology or geometry and/or increase in sediment deposition within the stream channel or pond. These plant communities provide shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult CRLFs. In addition, there is potential for 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. LOCs are exceeded for terrestrial riparian plants and for aquatic vascular plants from exposure to triclopyr from spray drift. LOCs for non-vascular plants are exceeded for many uses of triclopyr.
Modification of terrestrial-phase PCE	**Habitat Modification**	The use of triclopyr at all sites may create the following effects to PCE: elimination and/or disturbance of upland habitat; ability of habitat to support food source of CRLFs, elimination and/or disturbance of dispersal habitat, reduction and/or modification of food sources for terrestrial phase juveniles and adults, and alteration of chemical characteristics necessary for normal growth and viability of juvenile and adult CRLFs and their food source. The RQs for non-target terrestrial monocots and dicot plants inhabiting semi-aquatic areas exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr both foliar (aerial and ground) and granular applications. RQs for non-target terrestrial monocots and dicot plants inhabiting upland dry areas

		exceed the Agency's risk to terrestrial plant LOC (1.0) for all uses of triclopyr except rice both foliar (aerial and ground) and granular applications. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for dicot non-target species for all uses of triclopyr. Aerial foliar applications of triclopyr result in spray drift RQ exceedances for monocots for all uses except rice. Ground foliar applications result in spray drift RQ exceedances for both monocots and dicots for all uses except rice. The use of triclopyr on most use sites will exceed the refined acute dietary- and dose-based LOC and chronic LOC for prey food items of small mammals, and invertebrates (foliar and granular applications). Food sources for the CRLF are reduced, and the CRLF is indirectly affected from this reduction.

[1] Habitat Modification or No effect (NE)

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.

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