U. S. ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

Date: April 30, 2013
Chemical: Cyantraniliprole
PC Code: 090098
DP Barcodes: 392834, 400297

MEMORANDUM

SUBJECT: AMENDMENT – EFED Environmental Risk Assessment of Proposed New Global Chemical Cyantraniliprole on Bushberries, Citrus, Cotton, Oil Seeds, Pome Fruit, Stone Fruit, Tree Nuts, Vegetables (Bulb, Corm and Tuberous, Cucurbit, Fruiting, Leafy Brassica, and Leafy-Non-Brassica), and Professional Products (Fly Bait, Indoor and Outdoor Insect Control for Public Health Pests Such as Cockroaches, Ants, Flies, Termites, Nuisance Insect Pests, Turfgrass and Ornamentals, Tree Injection, and Production Greenhouse and Nursery Ornamentals)

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Registration Division (7505P)

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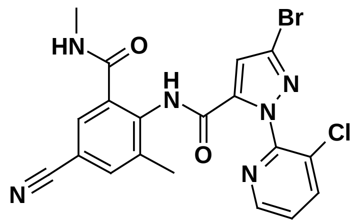
After the original submission of the cyantraniliprole risk assessment, the Environmental Fate and Effects Division (EFED) discovered a unit conversion error in the Tier II acute oral honeybee toxicity analysis. EFED is submitting a revised assessment that reflects the corrections. An updated summary of the risk concerns for terrestrial invertebrates follows.

Terrestrial Invertebrates

- Tier I risk quotient analysis indicates proposed cyantraniliprole products present potential risk concerns via the acute contact exposure route to individual honeybees (*Apis mellifera*).
- Semi-field studies indicate transient adverse effects to honeybees – increased mortality and intoxication, and decreased foraging activity for adult forage bees – for up to six days after application. Honeybee mortality and behavior subsequently returned to normal.
- Risk quotients calculated for cyantraniliprole residues on food items (pollen and nectar), based on rates up to 0.134 lb ai/A, did not identify risk concerns for the acute oral exposure pathway to honeybees. Residues from the highest application rates were not available; the dose of cyantraniliprole consumed by a honeybee would need to be 6 times higher than those measured to reach the LOC of 0.4.
- Semi-field studies indicate low likelihood for long-term honeybee hive effects for cyantraniliprole-only products up to 0.134 lb ai/A (foliar spray). Field data were not available for higher labeled rates.
- A semi-field study indicated a potential increase in honeybee susceptibility to *Varroa* mites (*Varroa destructor*) following exposure to cyantraniliprole. Uncertainty is associated with this conclusion because it was only observed in one study.
- Potential exposures to dust from cyantraniliprole-treated seed or harvesting cyantraniliprole-treated crops were not assessed and remain an uncertainty.
- Toxicity data for cyantraniliprole-thiamethoxam products indicate potential risk concerns for honeybees; no field studies were available to verify risks.
- Spray drift buffers to protect listed species from potential acute risks range from 607 to >1000 ft (cyantraniliprole-only products) and >1000 ft (cyantraniliprole-thiamethoxam products).

Environmental Fate and Ecological Risk Assessment for the Registration of the New Chemical Cyantraniliprole - Amended



Cyantraniliprole
3-bromo-1-)3-chloro-2-pyridinyl)-N-[4-cyanlo-2-methyl-6-
[{methylamino)carbonyl]phenyl]-1H-pyrazole-5-carboxamide
CAS No. 736994-63-1
PC Code 090098

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I. EXECUTIVE SUMMARY

A. Nature of Chemical Stressor

Cyantraniliprole is a new insecticide that is proposed for registration by the E. I. DuPont de Nemours and Company (DuPont) and Syngenta Crop Protection (Syngenta) for agricultural and non-agricultural uses. Proposed uses include: bushberries, citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts, vegetables (bulb, corm and tuberous, cucurbit, fruiting, leafy brassica, and leafy non-brassica), and professional products (fly bait, indoor and outdoor insect control for public health pests such as cockroaches, ants, flies and termites, nuisance insect pests and turfgrass and ornamentals). In addition to technical cyantraniliprole, DuPont has proposed eight formulations for registration and Syngenta has proposed five. Three of the Syngenta products are co-formulated with the insecticide, thiamethoxam. Cyantraniliprole would be applied via foliar spray, micro sprinkler chemigation, bark spray, drip chemigation, soil drench, soil treatment, seed treatment, seed piece treatment, or bait. Rates vary but do not exceed 0.69 lb ai/A as a seasonal maximum for agricultural uses and 0.5 lb ai/A for non-agricultural uses.

Cyantraniliprole is a systemic, broad-spectrum insecticide that belongs to the diamide class of chemistry. It translocates through plants via both the xylem and phloem. Cyantraniliprole binds with insect ryanodine receptors, which causes muscle contractions that lead to paralysis and death. It is nearly identical to the insecticide chlorantraniliprole, except for the substitution of a cyano-group instead of a chloro-group.

B. Conclusions - Exposure Characterization

Cyantraniliprole is soluble at neutral pH and given its low vapor pressure and Henry's Law constants, is not considered volatile and is not likely prone to atmospheric transport. While cyantraniliprole is subject to both abiotic (alkaline hydrolysis ($t_{1/2}$ = 21 hrs) and photodegradation in aqueous ($t_{1/2}$ = 8 hrs) and moist soil environments) and biotic (aerobic and anaerobic biotransformation in terrestrial and aquatic environments ($t_{1/2}$ range from 2 days to 3 months) degradation, the chemical degrades into a total of 13 degradation products. Of these degradates, eight are major and five are minor. Based on degradate aerobic soil metabolism and mobility studies, six of the eight major degradates had longer dissipation half-life (DT_{50}) values (more persistent) and three of the eight degradates were more mobile than the parent cyantraniliprole. According to the Food and Agriculture Organization (FAO) classification system, based on organic carbon partitioning coefficients, cyantraniliprole is characterized as moderately mobile. Bioconcentration factor data (BCF value <1 in whole fish) indicate that cyantraniliprole is not likely to bioaccumulate.

Given the uncertainty of the behavior and toxicity of these degradates, their toxicity is assumed to be equivalent to the parent compound, cyantraniliprole. For the aquatic exposure modeling, a total toxic residue approach (considers the parent compound and eight major degradates including two degradates from terrestrial field studies) was utilized. For surface water, peak estimated environmental concentrations (EECs) ranged from 0.23 µg/L from cyantraniliprole use on trees using the Oregon Christmas tree scenario to 38 µg/L from cyantraniliprole use on cotton using the North Carolina cotton scenario. For pore water, peak EECs ranged from 0.22 µg/L from cyantraniliprole use on trees using the Oregon Christmas tree scenario to 37 µg/L from cyantraniliprole use on rapeseed using the North Dakota wheat scenario.

Since cyantraniliprole is a new chemical, no monitoring data were found when searching the U.S. Geological Survey National Water Quality Assessment (USGS NAWQA) surface water and ground water database and California Department of Pesticide Regulation (CDPR) surface water database. Likewise, no monitoring data were found for the degradation products.

C. Conclusions - Effects Characterization

Based on the available data, cyantraniliprole is classified as slightly to moderately toxic to freshwater fish; slightly toxic to estuarine/marine fish; slightly to very highly toxic to freshwater invertebrates; moderately to highly toxic to estuarine/marine invertebrates, highly toxic to benthic invertebrates; highly to very highly toxic to terrestrial insects; and practically non-toxic to mammals and birds on an acute exposure basis. No chronic effects or mortality were noted for freshwater fish (NOAEC = 10.7 mg ai/L) or benthic invertebrates (overlaying water NOAEC = 10 µg ai/L). For estuarine/marine fish (NOAEC < 0.75 mg ai/L) and freshwater invertebrates (NOAEC = 6.56 µg ai/L), body length was the most sensitive endpoint. Chronic data were not available for estuarine/marine invertebrates. The reproductive studies for birds indicated no effects up to the maximum dietary level tested (NOAEC = 1000 mg ai/kg-diet). The most sensitive NOAEC for mammalian endpoints was 20 mg ai/kg-diet and was based on a decrease in thyroid weight. Offspring also showed decreases in organ weight and body weight, but at higher exposure levels (NOAEC = 200 mg ai/kg-diet). No reproductive endpoints were affected. For terrestrial plants, the EC_{25} values were greater than 0.134 lb ai/A for both seedling emergence and vegetative vigor tests. The NOAEC followed a similar pattern (= 0.134 lb ai/A), except for the monocot vegetative vigor NOAEC, which was 0.067 lb ai/A. The most sensitive non-vascular aquatic plant tested was the green algae (*Pseudokirchneriella subcapitata*) with a non-definitive EC_{50} >10 mg ai/L and a NOAEC of 1 mg ai/L; vascular aquatic plants were similar with a non-definitive EC_{50} >12.1 mg ai/L.

D. Potential Risks to Non-target Organisms

The results of this screening-level risk assessment indicate that the proposed uses for cyantraniliprole have the potential for direct adverse effects to federally listed threatened/endangered (hereafter referred to as "listed") and non-listed mammals from chronic exposure, listed freshwater invertebrates from acute exposures, listed estuarine/marine invertebrates from acute exposures, listed terrestrial invertebrates from acute exposures, listed benthic invertebrates from acute exposures, and listed and non-listed benthic invertebrates from chronic exposures. Direct effects to terrestrial monocots and estuarine/marine fish (chronic) cannot be excluded because of an absence of data. Direct effects to birds (and, thus, reptiles and terrestrial-phase amphibians), fish (and, thus, aquatic-phase amphibians), aquatic plants, and terrestrial dicots are not expected from the proposed cyantraniliprole uses. Indirect effects are possible for all species that depend on aquatic invertebrates, estuarine/marine fish, terrestrial invertebrates, terrestrial monocots, and/or mammals for food, habitat, or other environmental resources (Table 1).

Table 1. Listed Species Risks Associated with Potential Direct or Indirect Effects from the Proposed Applications of Cyantraniliprole

Listed Taxon	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants – monocots	Yes[2]	Yes[1]
Terrestrial and semi-aquatic plants – dicots	No	Yes[1]
Terrestrial invertebrates	Yes (acute)	Yes[1]
Birds	No	Yes[1]
Terrestrial-phase amphibians	No	Yes[1]
Reptiles	No	Yes[1]
Mammals	Yes (chronic)	Yes[1]
Aquatic plants	No	Yes[1]
Freshwater fish	No	Yes[1]
Aquatic-phase amphibians	No	Yes[1]
Freshwater invertebrates	Yes (acute)	Yes[1]
Benthic invertebrates	Yes (acute and chronic)	Yes[1]
Marine/estuarine fish	Yes (chronic)[3]	Yes[1]
Marine/estuarine invertebrates	Yes (acute)	Yes[1]

[1]The potential for adverse effects to those species that rely on plant and/or animal species (specifically aquatic invertebrates, terrestrial invertebrates, or mammals) cannot be precluded. Indirect effects may include general habitat modification, host plant loss, and food supply disruption.
[2]Based on monocot seedling emergence data gap.
[3]Based on a non-definitive (less than) NOAEC.

E. Uncertainties and Data Gaps

There was no independent laboratory validation (ILV) provided for the analytical methodology used for determining DPX-HGW86 in air described in the study entitled "*Analytical Method for the Determination of DPX-HGW86 in Air Using LC/MS/MS*" (MRID 48119930).

Acceptable toxicity data are not available to assess the effects of cyantraniliprole to estuarine/marine invertebrates from chronic exposure. In lieu of these data, the acute-to-chronic ratio (ACR) approach was used to generate a chronic toxicity value for the Eastern oyster and mysid shrimp (*Americamysis bahia*). Only a non-definitive NOAEC (less than) was available for chronic effects to estuarine/marine fish. There is uncertainty as to the lower bounds of the chronic toxicity of cyantraniliprole to estuarine/marine fish.

Only a partial set [1 monocot and 4 dicotyledenous (dicots)] of scientifically sound data were available for the seedling emergence test. Normal testing requires four monocot and six dicot species. A primary concern is the dearth of data for monocots because the vegetative vigor study indicated that monocots (onion) were more sensitive to cyantraniliprole than dicots. Given that only one species of monocot (corn) was tested for seedling emergence effects and it was not the onion, it is uncertain that corn is representative of the most sensitive monocot.

A larval toxicity study was not available but results from the semi- and full-field studies that examined effects to honeybee larvae and brood were used as information sources. Semi-field studies tested up to a single maximum application rate of 0.134 lb ai/A and not the single maximum application rate (0.69 lb ai/A for some uses). There is uncertainty as to whether effects at higher application rates are possible.

Finally, degradate toxicity data are limited for the major degradates and the quantitative structure-activity model ECOSAR did not produce reliable toxicity estimates. Given the uncertainty, degradates were assumed to be equally toxic to the parent; the Health Effects Division came to this same determination.

II PROBLEM FORMULATION

The purpose of this assessment is to evaluate the environmental fate and ecological risks for the registration of the new chemical, cyantraniliprole. As a new insecticide being proposed for use in the United States, EPA is required under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) to ensure that cyantraniliprole does not have the potential to cause unreasonable adverse effects to the environment. Potential effects to listed species are also considered under the Endangered Species Act to ensure that the registration of cyantraniliprole is not likely to jeopardize the continued existence of such listed species or adversely modify their habitat. To these ends, this assessment follows EPA guidance on conducting ecological risk assessments (USEPA 1998) and the Office of Pesticide Program's policies for assessing risk to non-target and listed organisms (USEPA 2004).

Among the end products of the EPA pesticide registration process is a determination of whether a product is eligible for registration and, if so, a description of how the product may be used. A label represents the legal document that stipulates how and where a given pesticide may be used. End-use labels describe the formulation type, acceptable methods of application, where the product may be applied, and any restrictions on how applications may be conducted. Thus, the use, or potential use, described by the pesticide's labels is considered "the action" being assessed. This assessment is in support of the new chemical registration of cyantraniliprole.

A. Stressor Source and Distribution

1. Source and Intensity

Cyantraniliprole, a broad spectrum insecticide, is a new chemical that is undergoing registration by DuPont and Syngenta. In addition to the technical, 13 end-use products are being proposed for registration in the United States (Table 2). According to the proposed labels, the products would be used to control a wide range of insects on both agricultural and non-agricultural areas. Cyantraniliprole is proposed as a foliar spray, bark spray, micro sprinkler chemigation, drip chemigation, soil drench, soil treatment, seed treatment, seed piece treatment, or bait, depending on the use.

Table 2. Cyantraniliprole Products Proposed for Registration in the United States

Product (registrant)	Active Ingredients (% purity)	Form	Registration Number
A17960B ST (Syngenta)	Cyantraniliprole (48.8%)	NS[1]	100-RURI
A17960A ST (Syngenta)	Cyantraniliprole (48.8%)	NS	100-RUEN
A16901B CP (Syngenta)	Cyantraniliprole (20%) Thiamethoxam (20%)	Water dispersible granule	100-RUER
Mainspring Insecticide (Syngenta)	Cyantraniliprole (20%) Thiamethoxam (20%)	Water dispersible granule	100-RUEE
A16901B Residential and Turf (Syngenta)	Cyantraniliprole (20%) Thiamethoxam (20%)	Water dispersible granule	100-RUEG/100-RUEU
Cyazypyr Technical (DuPont)	Cyantraniliprole (96.7%)	NS	352-ILA
Benevia Insect Control (DuPont)	Cyantraniliprole (10.26%)	Oil dispersion	352-ILT
Dermacor Z-103 Insecticide Seed Treatment (DuPont)	Cyantraniliprole (50%)	Flowable suspension	352-ILI
Exirel Insect Control (DuPont)	Cyantraniliprole (10.2%)	Oil in water emulsion	352-ILO
Verimark Insect Control (DuPont)	Cyantraniliprole (18.66%)	Suspension concentrate	352-IAN
HGW86 Fly Control Bait (DuPont)	Cyantraniliprole (0.5%)	Granular bait	352-IAE

Product (registrant)	Active Ingredients (% purity)	Form	Registration Number
HGW86 GH and N Insect Control (DuPont)	Cyantraniliprole (18.66%)	Suspension concentrate	352-IAG
HGW86 T and O Insect Control (DuPont)	Cyantraniliprole (18.66%)	Suspension concentrate	352-IAL
HGW86 SC Insect Control (DuPont)	Cyantraniliprole (18.66%)	Suspension concentrate	352-IAI

[1]Not specified on label

2. Physical/Chemical/Fate and Transport Properties

Cyantraniliprole is relatively soluble (14.2 mg/L) in water and its low vapor pressure (3.85×10^{-17} mm Hg), and Henry's Law constants (1.7×10^{-18} atm*m^3/mol) suggest the chemical's volatilization is limited. Based on a preliminary review of the data, the chemical is subject to both abiotic and biotic routes of dissipation whereby multiple degradates may form depending on environmental conditions.

3. Pesticide Type, Class, and Mode of Action

Cyantraniliprole is an insecticide that belongs to the diamide class of compounds. It is structurally identical to the previously registered chlorantraniliprole (CAS 500008-45-7), with the exception of a cyano-group substituted for the chloro-group. Cyantraniliprole binds with insect ryanodine receptors, causing unregulated activation of ryanodine receptor channels. This leads to internal calcium store depletion and impairs the regulation of muscle contraction. Cyantraniliprole is systemically distributed in plants and insects exposed to cyantraniliprole first exhibit lethargy, followed by muscle paralysis, and then death.

4. Overview of Pesticide Usage

Since this is a new chemical, the Agency does not have any usage information for cyantraniliprole. It is anticipated that use will be widespread. Uses cover a variety of agricultural (*e.g.*, tree nuts, leafy vegetables, potatoes, brassica, fruiting vegetables) and non-agricultural (*e.g.*, turfgrass, ornamentals, fly bait, public health pests) scenarios. Application rates vary, but most seasonal maximums are 0.4 to 0.42 lb ai/A (two uses have maximums of 0.5 and 0.69 lb ai/A). For many of the ornamental uses, the labels specify a yearly maximum of 0.42; however, the agricultural crop uses express the use in terms of seasonal maximums. For this assessment, the seasonal maximum is assumed to be a yearly maximum, but this will remain a point of uncertainty.

B. Receptors

1. Aquatic and Terrestrial Effects

Table 3 gives examples of taxonomic groups and species tested to help understand potential ecological effects of pesticides to non-target organisms. Within each of these very broad taxonomic groups, a measure of effect from either acute or chronic exposure is selected from the available test data.

Table 3. Taxonomic Groups and Test Species Evaluated for Ecological Effects in Screening-Level Risk Assessments

Taxonomic Group	Example(s) of Representative Species
Birds[1]	Mallard duck (*Anas platyrhynchos*) Bobwhite quail (*Colinus virginianus*)
Mammals	Laboratory rat (*Rattus norvegicus*)
Terrestrial invertebrates	Honeybee (*Apis mellifera L.*)
Freshwater fish[2]	Bluegill sunfish (*Lepomis macrochirus*) Rainbow trout (*Oncorhynchus mykiss*)
Freshwater invertebrates	Water flea (*Daphnia magna*)
Estuarine/marine fish	Sheepshead minnow (*Cyprinodon variegatus*)
Estuarine/marine invertebrates	Mysid (*Americamysis bahia)* Eastern oyster (*Crassostrea virginica*)
Terrestrial plants[3]	Monocots – corn (*Zea mays*) Dicots – soybean (*Glycine max*)
Aquatic plants and algae	Duckweed (*Lemna gibba*) Green algae (*Pseudokirchneriella subcapitata*)

[1] Birds represent surrogates for amphibians (terrestrial phase) and reptiles.
[2] Freshwater fish may be surrogates for amphibians (aquatic phase).
[3] Four species of two families of monocots, of which one is corn; six species of at least four dicot families, of which one is soybeans.

2. Ecosystems Potentially at Risk

The ecosystems potentially at risk include aquatic and terrestrial areas adjacent to the application sites and downstream. In addition, organisms that use the application site as part of their habitat (*e.g.*, birds foraging for insects within application areas) are also considered to be part of the ecosystems potentially at risk.

C. Assessment Endpoints

FIFRA Part 158 guideline toxicity tests (CFR 40 §158.630, 2009) are intended to determine pesticide effects on a variety of organisms, including birds, mammals, fish, terrestrial and aquatic invertebrates, and plants. These tests include both short-term and long-term exposure periods and evaluate the survival, reproduction, and/or growth of laboratory species. The studies, when available, are used to evaluate the potential of a pesticide to cause adverse effects, to determine whether further testing is required, and to determine the need for precautionary label statements to minimize the potential adverse effects to non-target animals and plants (CFR 40 §158.630, 2009).

Assessment endpoints are intended to represent valued attributes of the environment that, if detrimentally altered, could pose a risk to the environment. The assessment endpoints of this ecological risk assessment include terrestrial and aquatic animal and plant mortality following acute exposure to cyantraniliprole and terrestrial and aquatic animal reproduction, growth and survival effects from chronic exposure to cyantraniliprole.

Surrogate species are used to represent all freshwater fish (2000+) and bird (680+) species in the United States. For mammals, acute studies are usually limited to the Norway rat or the house mouse. Usually data from estuarine/marine testing are limited to a crustacean, a mollusk, and a fish. The assessment of risk or hazard makes the assumption that avian toxicity is similar to terrestrial-phase amphibians and reptiles, unless more appropriate data are available. The same assumption is made for fish and aquatic-phase amphibians. The most sensitive toxicity endpoints are used from surrogate test species to estimate treatment-related direct effects on mortality and reproductive and growth assessment endpoints.

For terrestrial and semi-aquatic plants, the screening assessment endpoints for non-target species (crops and non-crop plant species) are based on the emergence of seedlings and vegetative vigor of annuals. Measures of effect for this assessment focus on alterations to plant emergence and/or to active growth.

For aquatic plants, the assessment endpoint is the maintenance and growth of standing crop or biomass. Measures of effect for this assessment focus on non-vascular, *e.g.*, algae, and vascular plant, *e.g.*, duckweed (*Lemna gibba*), growth rates and biomass measurements.

The Agency acknowledges that pesticides have the potential to exert indirect effects upon listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, and creating gaps in the food chain. In conducting a screen for indirect effects, the endpoints for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-listed organisms as resources critical to their life cycle.

The endpoints are typically derived from registrant-submitted studies which have undergone review and were classified as “acceptable” (conducted under guideline conditions and considered to be scientifically valid) or “supplemental” (conditions deviated from guidelines but the results are considered to be scientifically valid). For more details on EFED’s study classification system and study guidelines, see USEPA 2004.

Assessment endpoints can also be derived from the open literature. Guidelines for incorporation of open literature into ecological risk assessments are described in USEPA (2004). Toxicity data from the open literature are identified via the ECOTOX[1] search engine, maintained by the U.S. EPA Office of Research and Development (ORD). To be included in the ECOTOX database, papers must meet several criteria. Data that pass the ECOTOX screen are evaluated relative to the data provided by the registrant, and may be incorporated qualitatively or quantitatively into the risk assessment. Specific studies may warrant inclusion in the risk assessment when:

(1) tested endpoints are more sensitive than those in registrant data;
(2) the test data are based on under-represented taxa;

[1] USEPA 2011. Ecotoxicity database http://cfpub.epa.gov/ecotox/

(3) the data include ecologically relevant endpoints not normally evaluated in registrant studies

There was one cyantraniliprole study (Jacobson and Kennedy 2011) from the open literature that was identified in the public version of ECOTOX (available at: http://cfpub.epa.gov/ecotox/quick_query.htm). The study was performed on the tobacco thrip (*Frankliniella fusca*); however, it was not useable for the risk assessment because the dose of cyantraniliprole was given in milligrams per plant rather than on a per acre basis. Therefore, no ecotoxicity data from the open literature are included as assessment endpoints.

Although all endpoints are measured at the individual level, they can provide some insight about the potential for adverse effects at higher levels of biological organization (*e.g*. populations and communities). For example, pesticide effects on individual survivorship have important implications for both population rates and habitat carrying capacity.

D. Conceptual Model

The conceptual model used to depict the potential ecological risk associated with cyantraniliprole is fairly generic and assumes that as an insecticide, cyantraniliprole is capable of affecting terrestrial and aquatic organisms (animals and plants) provided environmental concentrations are sufficiently elevated as a result of proposed label uses. Therefore, the risk assessment will consider potential exposure as a result of direct applications, spray drift, and runoff.

1. Risk Hypotheses

For this assessment, the risk to non-target organisms is based on potential effects from the application of cyantraniliprole to the environment. The Agency presumes the following risk hypothesis for this screening level assessment:

> *Based on mode of action, the proposed use patterns, and the sensitivity of non-target aquatic and terrestrial species, the proposed uses of cyantraniliprole have the potential to reduce survival, reproduction, and/or growth in terrestrial and aquatic animals and plants through direct application, spray drift and/or runoff.*

For a chemical to pose an ecological risk, it must reach non-target organisms at concentrations found to cause adverse effects. The analysis of ecological exposure pathways in this assessment includes an examination of the source and potential migration pathways to cyantraniliprole exposure, and the determination of potential adverse effects on non-target species.

2. Diagram

Application methods for cyantraniliprole involve foliar spray applications via ground equipment and aerial equipment, seed treatments, micro sprinkler chemigation, drip chemigation, soil treatments, soil drenches, and baits. Ecological receptors that may potentially be exposed to cyantraniliprole include terrestrial and semi-aquatic wildlife (*i.e.*, mammals, birds, amphibians, terrestrial invertebrates, and reptiles) and plants. In addition, aquatic receptors (*e.g.*, freshwater and estuarine/marine fish and invertebrates, amphibians, and plants) may also be exposed as a result of potential movement of cyantraniliprole via spray drift and/or runoff from the site of application to aquatic environments. The assessment following the process depicted in Figure 1 (aquatic exposure) and Figure 2 (terrestrial exposure) forms the basis for identifying potential endpoints, stressors, and ecological effects associated with cyantraniliprole use.

Exposure to terrestrial animals is based primarily on dietary consumption of foliar residues while aquatic assessments assume that all major potential routes of direct exposure are accounted for.

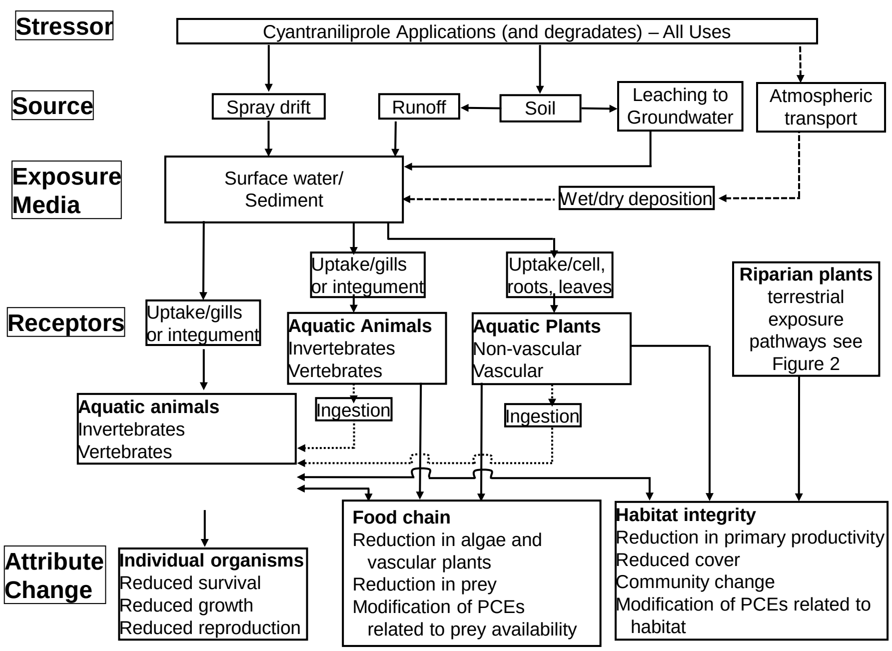


Figure 1: Conceptual model depicting stressors, exposure pathways, and potential effects to aquatic organisms from the proposed uses of cyantraniliprole. Dotted lines indicate exposure pathways that are hypothesized to have a low likelihood of contributing to ecological risk.

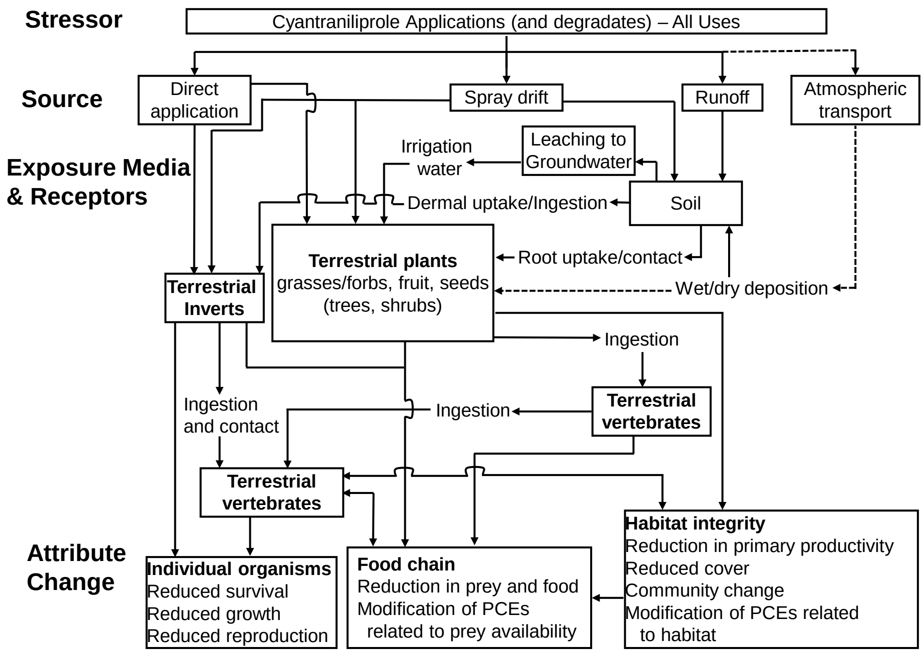


Figure 2: Conceptual model depicting stressors, exposure pathways, and potential effects to terrestrial organisms from the proposed uses of cyantraniliprole. Dotted lines indicate exposure pathways that are hypothesized to have a low likelihood of contributing to ecological risk.

E. Analysis Plan

As with any pesticide, there is concern regarding the potential effects cyantraniliprole use may pose to non-target animals and plants. This document characterizes the environmental fate of cyantraniliprole to assess whether its proposed label provide a means of exposure to non-target species. Additionally, the toxicity of cyantraniliprole is characterized, then both potential exposure and effects are integrated to estimate the likelihood of adverse effects (risk) to non-target listed and non-listed animals and plants that could potentially affect the registration decision of cyantraniliprole under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Food Quality Protection Act (FQPA), and the Endangered Species Act (ESA).

The maximum proposed label application rates for the new uses of cyantraniliprole were selected for modeling environmental concentrations for this screening-level deterministic (risk-quotient based) assessment. The most sensitive toxicity endpoints from surrogate test species are used to estimate treatment-related effects on growth, and survival. The aquatic estimated environmental concentrations (EECs) are based on the parent and the ten degradates of concern using a total toxic residue (TTR) approach. Given that a default 35-day foliar half-life is used in the terrestrial modeling, the terrestrial EECs are expected to account for both the parent and its ten degradates of concern (even though only the parent chemical is modeled).

In the following sections, the environmental fate and ecological effects of cyantraniliprole are characterized 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. Such estimates may be possible through a more refined, probabilistic assessment; however, they are beyond the scope of this screening-level assessment.

1. Preliminary Identification of Data Gaps

The following data gaps were identified in this risk assessment:

Environmental Fate:
- No independent laboratory validation (ILV) was provided for the analytical methods used to determine DPX-HGW86 in air.

Ecological Effects:
- Data were not available for the chronic toxicity to an estuarine/marine invertebrate species.

2. Measures to Evaluate Risk Hypotheses and Conceptual Model

a. Measures of Exposure

To estimate risks of cyantraniliprole exposures in aquatic and terrestrial environments, all exposure modeling and resulting risk conclusions will be made based on maximum proposed application rates (Table 5). Measures of exposure are based on aquatic and terrestrial models that estimate environmental concentrations of cyantraniliprole using maximum proposed labeled application rates and application methods that have the greatest potential for off-site transport of the chemical. Aquatic chemical concentrations are estimated using PRZM/EXAMS for surface water and the Tier I model, Screening Concentration in Ground Water (SCI-GROW, v2.3), for groundwater. Additionally, the Screening Imbibition Program (SIP) and the Screening Tool for Inhalation Risk (STIR) are used to determine if drinking water and/or inhalation, respectively, are potentially significant routes of concern for terrestrial animals. The models indicated that exposure through the drinking water or inhalation routes are unlikely to cause acute or chronic effects in birds and mammals (Appendices A and B).

Exposure estimates for terrestrial animals and insects assumed to be in the target area or in an area exposed to spray drift for the foliar spray, bark spray, and public health uses are derived using the T-REX model (version 1.5.1, 8/20/2012). T-REX also models exposures to terrestrial wildlife via seed treatments and granular applications; these analyses do not consider the spray drift exposure pathway. The model incorporates the Kenaga 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 represent the 95^{th} percentile of residue values from actual field measurements (Hoerger and Kenaga

1972). The Fletcher *et al.* (1994) modifications to the Kenaga nomograph are based on measured field residues from 249 published research papers, including information on 118 species of plants, 121 pesticides, and 17 chemical classes.

Exposure to upland and wetland plants is estimated using the TerrPlant (v1.2.1) screening model. The model examines spray drift and runoff as potential exposure pathways from a treated field adjacent to non-target species.

The Residues of Concern Knowledgebase Subcommittee (ROCKS) determined (DP Barcode D404411) that parent cyantraniliprole and 10 of its degradation products (IN-J9Z38, IN-NXX69, IN-QKV54, IN-RNU71, IN-JSE76, IN-JCZ38, IN-K5A78, IN-K5A77, IN-K5A79, and IN-PLT97) should be considered as residues of concern when evaluating human drinking water (see Appendix C for structures and basic information). These degradates will be considered in the ecological risk assessment as well.

The AgDRIFT spray drift model (v2.1.1) is used to assess exposures of organisms to cyantraniliprole deposited on terrestrial habitats by spray drift.

b. Measures of Effect

Measures of effect are obtained from a suite of registrant-submitted guideline studies conducted with a limited number of surrogate species. The test species are not intended to be representative of the most sensitive species but rather are selected based on their ability to thrive under laboratory conditions. The acute measures of effect routinely used for listed and non-listed animals in screening level assessments are the LD_{50}, LC_{50} or EC_{50}, depending on taxa (Table 3). 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 a group of test organisms. LC stands for “Lethal Concentration” and LC_{50} is the concentration of a chemical that is estimated to kill 50% of a sample population. EC stands for “Effective Concentration” and the EC_{50} is the concentration of a chemical that is estimated to produce some measured effect in 50% of the test population. Endpoints for chronic measures of exposure for listed and non-listed organisms are the NOAEL or NOAEC. 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 a test population. The NOAEC (*i.e.*, “No-Observed-Adverse-Effect-Concentration”) is the highest test concentration at which none of the observed results were statistically different from the control. For non-listed plants, only acute exposures are assessed (*i.e.*, EC_{25} for terrestrial plants and EC_{50} for aquatic plants). For listed terrestrial plants the Agency uses the EC_{05} or NOAEC (Table 4).

Table 4. Acute and Chronic Measures of Effect

TAXA	ASSESSMENT	MEASURE OF EFFECT
Aquatic Animals (freshwater fish and invertebrates and estuarine/marine fish and invertebrates)	Acute	Lowest tested EC_{50} or LC_{50} (acute toxicity tests)
	Chronic	Lowest NOAEC (early life-stage or full life-cycle tests)

TAXA	ASSESSMENT	MEASURE OF EFFECT
Terrestrial Animals Birds	Acute/Sub-acute	Lowest LD_{50} (single oral dose) and LC_{50} (sub-acute dietary)
	Chronic	Lowest NOAEC (21-week reproduction test)
Terrestrial Animals Mammals	Acute	Lowest LD_{50} (single oral dose test)
	Chronic	Lowest NOAEC (two-generation reproduction test)
Terrestrial Invertebrates	Acute	Lowest LD_{50} (acute contact toxicity test)
Plants Terrestrial non-listed (monocots and dicots)	Acute/Chronic	Lowest EC_{25} (seedling emergence and vegetative vigor)
Plants Terrestrial listed (monocots and dicots)	Acute/Chronic	EC_{05} or NOAEC associated with the lowest EC_{25} (seedling emergence and vegetative vigor)
Plants *Aquatic non-listed (vascular and non-vascular)*	Acute/Chronic	Lowest EC_{50}

III. ANALYSIS

A. Use Characterization

Proposed cyantraniliprole uses include: bushberries, citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts, vegetables (bulb, corm and tuberous, cucurbit, fruiting, leafy brassica, and leafy non-brassica), and professional products (fly bait, indoor and outdoor insect control for public health pests such as cockroaches, ants, flies and termites, nuisance insect pests and turfgrass and ornamentals). Cyantraniliprole is applied via foliar spray, bark spray, micro sprinkler chemigation, drip chemigation, soil drench, soil treatment, seed treatment, seed piece treatment, or bait. Rates are listed in Table 5.

Table 5. Application Information from the Proposed Cyantraniliprole New Uses

Crop	Product	Method	# apps	Min interval	Single max (lb ai/A)	Seasonal maximum (lb ai/A)
Brassica vegetables	A 16901B CP Insecticide	Soil	1	NS	0.35	0.4
Brassica leafy vegetables	A 16901B CP Insecticide	Foliar (aerial, ground)	2.3[a]	7 days	0.175	0.4
Brassica leafy vegetables	Exirel	High volume spray-broadcast by ground, low volume spray-aerial	3[a]	5 days	0.133	0.4
Bushberries	Exirel	High volume spray – broadcast by ground, low	3[a]	5 days	0.133	0.4

Crop	Product	Method	# apps	Min interval	Single max (lb ai/A)	Seasonal maximum (lb ai/A)
		volume spray-aerial				
Citrus	Exirel	High volume spray-broadcast by ground, low volume spray-by air, low volume fogger spray by ground	3[a]	7 days	0.133	0.4
Citrus	Verimark	Soil drench or micro sprinkler chemigation	2	7 days[b]	0.391	0.4
Cotton	Benevia	High volume spray-broadcast by ground, low volume spray-aerial	3[a]	7 days	0.133	0.4
Cucurbits	A 16901B CP Insecticide	Foliar (aerial, ground)	2.3[a]	5 days	0.175	0.4
Cucurbits	Verimark	Soil application by drip	2	10 days	0.130	0.4
Cucurbits	A 16901B CP Insecticide	Soil (furrow, at transplant, knifing, shanking, drip chemigation)	1	NS	0.35	0.4
Fruiting vegetables	A 16901B CP Insecticide	Foliar (aerial, ground)	2.3[a]	5 days	0.175	0.4
Fruiting vegetables	Verimark	Soil application by drip	2	5 days[c]	0.130	0.4
Fruiting vegetables	A 16901B CP Insecticide	Soil (furrow, at transplant, knifing, shanking, drip chemigation)	1	NS	0.35	0.4
Leafy vegetables	A 16901B CP Insecticide	Soil (furrow, at transplant, knifing, shanking, drip chemigation)	1	NS	0.35	0.4
Leafy vegetables	A 16901B CP Insecticide	Foliar (aerial, ground)	2.3[a]	7 days	0.175	0.4
Leafy vegetables (except brassica)	Exirel	High volume spray-broadcast by ground, low volume spray-aerial	3[b]	5 days	0.133	0.4
Oil seeds	Benevia	High volume spray-broadcast, low volume spray-aerial	3[b]	7 days	0.133	0.4
Pome fruit	Exirel	High volume spray-broadcast by ground, low volume spray-aerial	3	7 days	0.133	0.4
Potatoes	A17960A ST and A17960B ST	Seed treatment	NS	NS	0.69[7]	
Potatoes	Verimark	Seed piece treatment	1	NS	0.176	0.4
Corm and tuberous vegetables	Benevia	High volume spray-broadcast by ground or overhead chemigation, low volume spray-aerial	3[b]	5 days	0.133	0.4
Corm and tuberous vegetables	A 16901B CP Insecticide	Soil	1	NS	0.25	0.4

Crop	Product	Method	# apps	Min interval	Single max (lb ai/A)	Seasonal maximum (lb ai/A)
Rapeseed including canola varieties, mustard seed	Dermacor	Seed treatment	1	NS	0.4	0.4
Stone fruit	Exirel	High volume spray-broadcast by ground, low volume spray-aerial	3	7 days	0.133	0.4
Sunflower	A17960A ST and A17960B ST	Seed treatment	NS	NS	0.016[1]	0.016
Tree nuts	Exirel	High volume spray-broadcast by ground, low volume spray-aerial	3	7 days	0.133	0.4
Bulb vegetables	Benevia	High volume spray-broadcast by ground or overhead chemigation, low volume spray-aerial	3[b]	5 days	0.133	0.4
Flowerbeds and groundcovers	HGW86 T&O Insect Control	Broadcast (ground)	2[b]	7 days[d]	0.208	0.42
Ornamentals treated by commercial and consumer applicators	A 16901B Residential	Foliar	2	7 days	0.13[9]	0.26
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	Mainspring	Foliar (ground)	1.6[b]	14 days	0.26	0.42
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	Mainspring	Soil drench	1.6[b]	14 days	0.26	0.42
Ornamental plants (exterior landscapes and interior plantscapes	HGW86 T&O Insect Control	Foliar (ground) Bark application	NS	7 days	0.42	0.42
Ornamental plants (exterior landscapes and interior plantscapes	HGW86 T&O Insect Control	Soil treatment (drench and injection)	NS	NS	0.42 lb ai/A[5]	0.42 lb ai/A
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, foliage plants, groundcovers, vines, interior plantscape plants	HGW86 GH & N Insect Control	Soil treatment (drench and injection)	NS	NS	0.42 lb ai/A[5]	0.42 (per year)

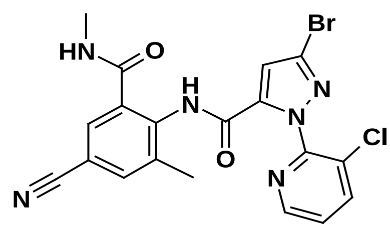
Crop	Product	Method	# apps	Min interval	Single max (lb ai/A)	Seasonal maximum (lb ai/A)
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm)	HGW86 GH & N Insect Control	Foliar (ground)	NS	NS	0.42	0.42 (per year)
Turf , golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms	A 16901B Turf	Broadcast (ground)	2	30 days	0.26	0.42
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade house, under trees and shrubs that are being grown in-ground	HGW86 GH & N Insect Control	Broadcast (ground)	1.6[b]	30 days[e]	0.26	0.42 (per year)
Fly control bait	HGW86 Fly Control Bait	Broadcast (ground)	NS	7 days	0.087 lb ai/A	0.44
Public health insect control	HGW86 SC Insect Control	Spot, crack and crevice spray	NS	7 days	0.42[5]	0.42
Potted ornamentals	HGW86 GH&N Insect Control	Soil drench	NS	NS	0.5[5]	0.5 (per year)[9]
Potted ornamentals	Mainspring	Soil drench	NS	NS	0.13[9]	0.26

NS – not specified
[1]Based on 0.00000044 lb ai/seed * 4 lb seed/A * 9000 seeds/lb (USEPA 2011b)
[5]Based on seasonal maximum application rate
[7]Based on 0.00013 lb ai/lb potato * 5271 lb potato/A (T-REX)
[9]Based on communication with registrant
[a]Assumed based on seasonal maximum rate
[b]Assumed based on citrus foliar use
[c]Assumed based on fruiting vegetable foliar use
[d]Assumed based on other ornamental uses
[e]Assumed based on turf use

B. Exposure Characterization

Cyantraniliprole is a new systemic, cross-spectrum insecticide belonging to the diamide class of chemistry, moving both in the xylem and phloem of vascular plants. Its major routes of dissipation include alkaline hydrolysis, photo degradation in aqueous and moist soil environments, and aerobic and anaerobic biotransformation in terrestrial and aquatic environments. The most prominent dissipation pathways include alkaline hydrolysis and aqueous photolysis with calculated half lives reported in hours. Table 6 provides a summary of cyantraniliprole's environmental fate profile.

Table 6. Environmental Fate Profile Summary for Cyantraniliprole

Parameter	Value	MRID #
Common name	Cyantraniliprole	48894801
CAS number	736994-63-1	48894801
Chemical name	3-Bromo-1-(3-chloro-2-pyridinyl)-N-[4-cyano-2-methyl-6-[(methylamino)carbonyl]phenyl]-1H-pyrazole-5-carboxamide	48894801
Chemical Class Chemical Category	Diamide Insecticide	48894801
Empirical formula	$C_{19}H_{14}BrClN_6O_2$	48894801
Structure		48894801
Molecular Mass	473.72 g/mole	48119904
Water Solubility (20°C)	14.2 mg/L (R.O. water)	48119901
Vapor pressure (20°C)	3.85×10^{-17} mm Hg	48122593
Henry's Law Constant(20°C)	1.70×10^{-18} atm m^3/mol	48119907
Partition coefficient (P_{ow})	79 (log Pow = 1.9)	48119904
Dissociation Constant	pKa = 8.8	48119909
Hydrolysis ($t_{1/2}$) (25°C)	pH 4 = 222 days pH 7 = 31 days pH 9 = 0.86 days (21 hrs)	48119905
Aqueous Photolysis ($t_{1/2}$)	0.33 days (8 hrs)	48119906
Soil Photolysis	12.5 days (moist soil) stable (dry soil)	48120082 48120046
Aerobic Soil Metabolism ($t_{1/2}$)	16.2 days 89.4 days	48120045
Anaerobic Soil Metabolism ($t_{1/2}$)	4.3 days	48120047
Aerobic Aquatic Metabolism ($t_{1/2}$)	3.9 days 25.1 days	48120049
Anaerobic Aquatic Metabolism ($t_{1/2}$)	2.4 days 12 days	48120071 48120081
Soil Partition Coefficient (K_{oc})	241 mL/g o.c (mean)	48120073

Parameter	Value	MRID #
Terrestrial Field Dissipation (DT_{50})	3.5-10.2 days (CA)	48120055
	3.4-9.7 days (WA)	48120054
	6-44 days (MO)	48120056
	21.6 days (NY)	48120053
	16.7 days (TX)	88120058
	13.5 days (Canada)	48120057
Bioaccumulation in Fish (BCF)	< 1 in fillet, carcass & whole fish	48120139

1. Environmental Fate and Transport Characterization

a. Degradation

Considering abiotic degradation, cyantraniliprole's hydrolytic degradation appears to be pH dependent, with degradation increasing with increasing pH (alkinity). This is evident in the DT_{50} profile. The DT_{50} values decrease from 222 days (stable) at pH 4 to 31 days at pH 7 to 0.86 days at pH 9 (T = 25ºC; MRID 48119905).

Photo degradation appears to be a major degradation pathway in aqueous and moist soil environments. The aqueous photolysis study shows a photo transformation half-life of about 7.9 hours or 0.33 days (MRID 48119906). Soil photolysis studies were conducted with both a moist soil where soil moisture was maintained and an air-dried soil where the soil was allowed to air-dry over time. The moist-soil DT_{50} value was 12.5 days (MRID 48120082) whereas the compound was considered stable in the air-dried soil photolysis study since the extrapolated half-life of 308 days was well beyond the duration of the 15 day study period (MRID 48120046).

Biodegradation is an effective dissipation pathway for cyantraniliprole, with anaerobic biodegradation occurring at a faster rate than aerobic biodegradation in terrestrial and aquatic environments. However, alkaline hydrolysis may contribute to some dissipation since the lower DT_{50} values are associated with higher pHs. Illustrating this point, aerobic system DT_{50} values ranged from 16.2 days in a silty clay loam soil (pH 8.05) to 89.4 days in a sandy loam soil (pH 4.62) in an aerobic soil metabolism study conducted at 20ºC (MRID 48120045). In addition, the DT_{50} values ranged from 3.9 days in a silt loam sediment-water system (pH 7.7) to 25.1 days in a loamy sand sediment-water system (pH 5.6) in an aerobic aquatic metabolism study conducted at 20ºC (MRID 48120049). It is important to note, other than the degradate IN-JCZ38, all other aerobic soil metabolism degradate half life values are significantly longer than the parent cyantraniliprole (Table 7).

In anaerobic systems, the DT_{50} value was 4.3 days in a sandy loam soil (pH 8.05) conducted in an anaerobic soil metabolism study conducted at 20ºC (MRID 48120047). In addition, the DT_{50} values ranged from 2.4 days in a sandy loam sediment-water system (pH 6.9; MRID 48120071) to 12 days in a sandy sediment-water system (pH 6.6) in an anaerobic aquatic metabolism study conducted at 20ºC (MRID 48120081

Table 7. Aerobic Soil Metabolism Half-Life Summaries for Cyantraniliprole and its Degradates

Chemical ID	Soil	Texture	DT_{50} (days)	MRID
Cyantraniliprole	Gross-Umstadt Sassafras Lleida	Silt Loam Sandy Loam Silty Clay Loam	41.2 89.4 16.2	48120045
IN-J9Z38	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Silt Loam Sandy Loam Loam Silty Clay Loam Silty Clay Loam	118 77.1 200 104 179	48120060
IN-JCZ38	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Silt Loam Sandy Loam Loam Silty Clay Loam Silty Clay Loam	11.6 3.48 10.1 4.81 9.41	48120061
IN-JSE76	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Silt Loam Sandy Loam Loam Silty Clay Loam Silty Clay Loam	219 84.9 336 157 840	48120062
IN-K5A77	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Silt Loam Sandy Loam Loam Silty Clay Loam Silty Clay Loam	294 23.8 340 25.9 78.6	48120064
IN-K5A78	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Silt Loam Sandy Loam Loam Silty Clay Loam Silty Clay Loam	308 1055 94 517 241	48120063
IN-K5A79	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Loam Loam Sandy Loam Silty Clay Silty Clay	46 25 107 19 131	48120070
IN-PLT97	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Loam Sandy Loam Loam Silty Clay Silty Clay Loam	1638 711 1837 439 429	48120074
IN-QKV54	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Loam Sandy Loam Loamy Sand Clay Silty Clay Loam	1187 139 462 58 184	48120083
IN-RNU71	Gross-Umstadt Nambshiem Sassafras Lleida Tama	Loam Sandy Loam Loamy Sand Clay Silty Clay Loam	107 42 400 43 28	48120087
Rate of degradation in aerobic soils at 20 degrees C and 40-60% MWHC except for IN-K5A79 which was studied at 19 degrees C (Sassafras) and 24 degrees C (all other soils) and 40-60% MWHC.				

Chemical structures for the parent compound and its principle degradates can be found in Appendix C.

b. Mobility and Transport

Cyantraniliprole appears not to volatilize. This is supported by its solubility (14.2 mg/L at 20ºC; MRID 48119901) and low vapor pressure (3.85 x 10^{-17} mm Hg at 20ºC; MRID 48122593) and Henry's Law constant (1.7 x 10^{-18} atm*m^3/mol at 20ºC; MRID 48119907). In addition, bioaccumulation data indicate that cyantraniliprole is not likely to bioaccumulate (BCF <1 in whole fish, MRID 48120139).

Batch equilibrium studies have been conducted with the same soils on cyantraniliprole and its degradates. Cyantraniliprole is characterized as being moderately mobile based on its organic carbon partition coefficient (K_{oc} = 157 to 376 mL/g_{oc}; MRID 48120073) in the test soils (FAO Classification; USEPA, 2006). Cyantraniliprole degradates have measured K_{oc} values ranging from 14 to 32,152 mL/g organic carbon indicating that some degradates are more mobile than the parent and some are less mobile than the parent (Table 8) and would be likely to sorb to organic matter in soil and sediments.

Table 8. FAO Mobility Classification of Cyantraniliprole and its Degradates

Mobility Class	Chemical ID	K_{oc} Range (mL/g_{oc})	Mean K_{oc} (mL/g_{oc})	MRID
Mobile	IN-JSE76	14-65	30	48120067
	IN-K5A79	24-85	46	48120072
Moderately Mobile	IN-RNU71	104-181	146	48120088
	IN-JCZ38	124-482	239	48120066
	DPX-HGW86*	**157-376**	**241**	48120073
Moderately Mobile - Slightly Mobile	IN-K5A78	412-2545	1048	48120068
	IN-PLT97	701-5029	2044	48120075
Slightly Mobile - Hardly Mobile	IN-J9Z38	4500-18526	8705	48120065
	IN-K5A77	3707-25306	9611	48120069
	IN-QKV54	8571-32152	14481	48120086
* **DPX-HGW86** represents the chemical ID for the parent cyantraniliprole.				

c. Field Studies

In terrestrial field dissipation studies, cyantraniliprole dissipated with DT_{50}s ranging from 3.4 to 44 days (Table 9). Seven degradates formed as cyantraniliprole degraded including IN-J9Z38, IN-JCZ38, IN-JSE76, IN-K5A77, IN-K5A78, IN-K5A79 and IN-PLT97. The majority of residues detected was confined to the uppermost soil layers (0-2 to 2-6 inches) with a small amount of the parent or degradates detected below the 12 inch soil layer, indicating a general lack of downward mobility or leaching under the study conditions. The most common degradates formed were IN-J9Z38 (~10%), IN-JCZ38 (~8%), IN-JSE76 (~10%), and IN-K5A78 (~10%). Table 9 illustrates the DT_{50} profile.

Table 9. Terrestrial Field Dissipation Half-Life Summaries

MRID	Location Duration	Plot Type	DT_{50} (days)
48120055	CA (539 days)	Bare Soil Cropped Lettuce	10.2 3.5
48120054	WA (534 days)	Bare Soil Cropped Potato	9.7 3.4
48120056	MO (541 days)	Bare Soil Cropped Alfalfa	44.0 6.0
48120053	NY (514 days)	Bare Soil	21.6
48120058	TX (539 days)	Bare Soil	16.7
48120057	CANADA (502 days)	Bare Soil	13.5

d. Degradates

Eight major degradates (*e.g.*, those present at ≥10% applied radioactivity) of cyantraniliprole include: IN-J9Z38, IN-NXX69, IN-QKV54, IN-RNU71, IN-JSE76, IN-JCZ38, IN-K5A78, and IN-PLT97. The majority of these degradates formed under both microbial-mediated and abiotic processes. The degradates IN-J9Z38, IN-RNU71, IN-JSE76, IN-JCZ38, and IN-K5A78 continued to increase over time to the termination of various fate studies. In addition, IN-K5A77, IN-K5A79, and IN-PLT97 were detected in terrestrial field studies, making it important to consider them as residues of concern. Consequently, the Health Effects Division's Residues of Concern Knowledgebase Subcommittee (ROCKS) has determined (DP 404411) that the following 10 degradates are of concern and they will be considered as part of this risk assessment. The residues of concern include: IN-J9Z38, IN-NXX69, IN-QKV54, IN-RNU71, IN-JSE76, IN-JCZ38, IN-K5A78, IN-PLT97, IN-K5A77 and IN-K5A79. Therefore, the EECs represent the combined residues of the insecticide cyantraniliprole plus these 10 degradation products. For structures of the degradates and the parent, please see Appendix C.

e. Total Toxic Residues (TTR)

To follow the total toxic residue (TTR) approach, half lives were recalculated to collectively account for the parent and the combined residues of concern. These values will be utilized in PRZM/EXAM modeling to generate aquatic exposure estimates. TTR half lives for aqueous photolysis, aerobic soil metabolism and aerobic aquatic metabolism correspond to 88 days, 1327 days, 589 days and 961 days, respectively. The hydrolysis half life was considered stable since a half life could not be calculated due to the lack of degradation needed to fit a degradation curve. In addition, the lowest Koc value of 14 mL/g o.c., was selected among parent and degradate batch equilibrium studies.

2. Measures of Aquatic Exposure

a. Aquatic Exposure Modeling

The Pesticide Root Zone Model (PRZM; v3.12.2, May 2005) and the Exposure Analysis Model System (EXAMS; v2.98.4.6, April 2005) are screening simulation models coupled with the PRZM/EXAMS (PE) graphical user interface (v5.0, November 2006) to generate daily exposures and 1-in-10-year EECs of cyantraniliprole TTR that may occur in surface water bodies adjacent to application sites receiving cyantraniliprole 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 watershed geometry used for ecological pesticide assessments assumes application to a 10-hectare agricultural field that drains into an adjacent 1-hectare water body that is 2 meters deep (20,000 m^3 volume) with no outlet. The composite model PRZM/EXAMS is used to estimate screening-level exposure of aquatic organisms to cyantraniliprole. The measure of exposure for aquatic species is the 1-in-10-year peak or rolling mean concentration. The 1-in-10-year peak is used for estimating acute exposures of direct effects to aquatic organisms. The 1-in-10-year 60-day mean is used for assessing the effects to fish and aquatic-phase amphibians from chronic exposure. The 1-in-10-year 21-day mean is used for assessing the effects on aquatic invertebrates from chronic exposure.

Since there was no PRZM/EXAM scenario available to model fly and insect control applications, the Generic Estimate Environmental Concentration 2 (GENEEC2) model was employed. The GENEEC2 model is a Tier I model which uses the soil/water partition coefficient and degradation kinetic data to estimate runoff from a 10-hectare field into a 1-hectare by 2-meter deep "standard" pond. Additional information on this and other models can be found at: http://www.epa.gov/oppefed1/models/water/index.htm.

Registrant-submitted acute toxicity data were available for nine of the ten degradates identified by the ROCKS committee (USEPA 2012c and DP 404411) and indicated that the degradates were less toxic than the parent for freshwater invertebrates (*Daphnia magna*). One chronic endpoint was available for the most toxic of the degradates and it was also much less toxic than the parent. The implications of these data are discussed further in the Risk Description section. No data were available for other aquatic species, thus ECOSAR was used to predict the toxicity of the degradates for other aquatic species (fish, estuarine/marine invertebrates, aquatic plants). However, its predictions were poor when compared with actual toxicity data. Given that toxicity information was not available for fish, estuarine/marine invertebrates, and aquatic plants, and that ECOSAR was deemed unreliable, it is assumed that the toxicity of the ten degradates are equivalent to the parent compound and EECs for all aquatic organisms will be generated using the total toxic residues (TTR) approach. This approach was used to determine the environmental fate data parameters for modeling in conjunction with the *Guidance for Selecting Input Parameters in Modeling the Environmental Fate and Transport of*

Pesticides, Version 2.1, October 22, 2009 and the draft Guidance for Modeling Pesticides Total Toxic Residues (TTR) May 20, 2009.

The environmental fate properties used for modeling the combined residues are summarized in Table 10.

Table 10. PRZM/EXAMS Input Parameters for Cyantraniliprole

Input Parameter:	Value:	Comment:	Source:
Scenario(s):	*Brassica* Vegetables: CA Cole Crop Bushberries: NY Grapes Citrus: FL Citrus Cotton: CA, MS, NC Cotton Cucurbits: FL Cucumber Fruiting Vegetables: CA Pepper CA, FL, PA Tomato Leafy Vegetables: CA Lettuce Oil Seeds: ND Canola ND Wheat Pome Fruit: NC, OR, PA Apple CA Fruit Potatoes: ID, ME Potato Corm and Tuberous Vegetables: ID, ME Potato Rapeseed, Mustard Seed: ND Canola ND Wheat Stone Fruit: MI Cherry GA Peaches CA Fruit Sunflower: ND Canola ND Wheat Tree Nuts: CA Almonds GA Pecans Bulb Vegetables: CA, GA Onions Flowerbeds and Groundcovers: CA, FL, MI, NJ, OR, TN Nursery Trees: OR Christmas Tree Turf, Golf Courses, Lawns, etc.: FL, PA Turf Potted Ornamentals: CA, FL, MI, NJ, OR, TN Nursery	representative scenarios for each use	EFED Scenarios
Maximum Single Application Rate lbs a.i./acre (kg a.i./ha)	Ranges from Table 5: 0.016 (0.018) to 0.690 (0.775)	See Table 5 for proposed rates.	Proposed labels
Applications per Year	Varies from 1 to 5, depending on crop and product (Table 5)	Label directions. Label specifies rates per crop. If there are multiple crops grown per year, yearly rates may be higher.	Proposed labels
Application Interval (days)	Varies from 5 to 30, depending on crop and product (Table 5)	Label directions	Proposed labels

Input Parameter:	Value:	Comment:	Source:
Date of Initial Application (scenario: day-month)	Varies (Table 5)	For most crops, the date of initial application was calculated from the harvest date from the crop profile and the Pre-Harvest Interval (PHI) and number and interval of applications from the proposed label. Where a pre-harvest interval was not provided, an interval of 1 day was assumed. Two weeks prior to crop emergence was assumed as the date of initial application for seed treatments. For ornamental and tree scenarios, an arbitrary date of April 15 was assumed as the date of initial application.	Crop Scenarios and proposed labels
Application Method	Aerial (foliar) Ground (foliar) Chemigation	label directions	Proposed labels
CAM Input	2 (foliar: aerial and ground) 1 (chemigation) 4 (seed treatment)	(1) Soil applied, default incorporation depth, linearly decreasing with depth (2) linear foliar based on crop canopy (4) soil applied, user defined incorporation depth (seed treatment)	US EPA, 2005
IPSCND Input	*Brassica* Vegetables: 2 Bushberries: 3 Citrus: 3 Cotton: 1 Cucurbits: 3 Fruiting Vegetables: 3 Leafy Vegetables: 2 Oil Seeds: 1 Pome Fruit: 3 Potatoes: 2 Corm and Tuberous Vegetables: 2 Rapeseed, Mustard Seed: 1 Stone Fruit: 3 Sunflower: 1 Tree Nuts: 3 Bulb Vegetables: 2 Flowerbeds and Groundcovers: 3 Trees: 3 Turf: 1 Potted Ornamentals:3	…remaining pesticide on foliage is (1) converted to surface application to the top soil layer, (2) completely removed after harvest, (3) is retained as surface residue and continues to decay. This input only applies to foliar applications (CAM 2).	US EPA, 2005
Spray Drift Fraction	0.05 (aerial) 0.01 (ground) 0 (chemigation, seed treatment)	--	Input parameter guidance (USEPA, 2009a)
Application Efficiency	0.95 (aerial) 0.99 (ground) 1.0 (chemigation, seed treatment)	--	Input parameter guidance (USEPA, 2009a)
Incorporation Depth Inches (cm)	Potato: 2.0" (5.08 cm) Rapeseed: 0.5" (1.27 cm) Sunflower: 1.0" (2.54 cm)	Seed treatment use info	Proposed Labels
Molecular Mass (g/mol)	473.72	--	MRID 48119904
Vapor Pressure (torr)	3.85×10^{-17}	20°C	MRID 48122593
Henry's Law Constant (atm-m^3/mol)	1.70×10^{-18}	20°C	MRID 48119907
Solubility in Water (mg/L)	14.2	R.O. water at 20°C	MRID 48119901

Input Parameter:	Value:	Comment:	Source:
Organic Carbon Partition Coefficient (K_{OC}) (L/kg_{OC})	14	Lowest K_{oc} value among parent and degradates	MRID 48120067
Aerobic Soil Metabolism Half-life (days)	1327	value represents the upper 90% confidence limit on the mean value of total toxic residue (TTR) values (3 soils).	MRID 48120045
Aerobic Aquatic Metabolism Half-life (days)	589	value represents the upper 90% confidence limit on the mean value of total toxic residue (TTR) values.	MRID 48120049
Anaerobic Aquatic Metabolism Half-life (days)	961	value represents the upper 90% confidence limit on the mean value of total toxic residue (TTR) values (2 systems).	MRID 48120071 MRID 48120081
Hydrolysis Half-lives (days)	0 (stable)	Half life could not be calculated because of the stability of combined residues	MRID 48119905
Aqueous Photolysis Half-life (days)	88	value represents the upper 90% confidence limit on the mean value of total toxic residue (TTR) values.	MRID 48119906
Where the TTR approach was identified, half lives were recalculated to account for the parent including the identified residues of concern. Draft Guidance for Modeling Pesticides Total Toxic Residues (TTR) in addition to the NAFTA Guidance for Evaluating and Calculating Degradation Kinetics in Environmental Media were utilized.			

The aquatic EECs for the various scenarios and application practices are listed in Tables 11 and 12. See Appendix D for a representative output from PRZM/EXAMS. Peak surface water EECs ranged from 0.23 to 38 µg/L and peak pore water EECs ranged from 0.22 to 37 µg/L for application to the proposed cyantraniliprole uses.

Table 11. Cyantraniliprole Estimated Environmental Concentrations (EECs) for Surface Water

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
Brassica vegetables	CA Cole Crop (Jan 30)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	22.58	22.45	22.19
Brassica leafy vegetables	CA Cole Crop (Feb 14)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (7-day interval)	21.01	20.89	20.66
		G			17.03	16.94	16.75
Brassica leafy vegetables	CA Cole Crop (Feb 18)	A	Exirel	3 apps at 0.133 lb a.i./acre (5-day interval)	16.90	16.81	16.64
		G			12.83	12.77	12.65
Bushberries	NY Grapes (Oct 2)	A	Exirel	3 apps at 0.133 lb a.i./acre (5-day interval)	13.28	13.24	13.17
		G			8.71	8.69	8.64
Citrus	FL Citrus (Dec 16)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	16.66	15.58	15.30
		G			14.64	13.58	13.34
Citrus	FL Citrus (Dec 30)	C	Verimark	1 app at 0.4 lb a.i./acre	11.01	10.13	9.98

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
Cotton	CA Cotton (Oct 21)	A	Benevia	3 apps at 0.133 lb a.i./acre (7-day interval)	9.21	9.16	8.98
		G			6.11	6.09	5.96
	MS Cotton (Sept 1)	A			29.45	29.07	28.50
		G			27.33	29.96	26.44
	NC Cotton (Oct 11)	A			37.97	37.78	37.42
		G			35.58	35.40	35.06
Cucurbits	FL Cucumber (Oct 31)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (5-day interval)	33.01	32.66	31.82
		G			31.79	31.38	30.57
Cucurbits	FL Cucumber (Nov 29)	C	Verimark	2 apps at 0.130 lb a.i./acre (10-day interval)	5.33	5.14	4.21
Cucurbits	FL Cucumber (Dec 9)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	9.66	9.56	7.91
Fruiting vegetables	FL Peppers (Nov 20)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (5-day interval)	15.89	15.74	14.56
		G			14.22	14.09	12.65
	CA Tomato (Aug 21)	A			15.91	15.70	15.50
		G			13.20	12.86	12.70
	FL Tomato (May 4)	A			25.73	25.37	24.67
		G			24.08	23.74	23.10
	PA Tomato (Oct 4)	A			28.14	28.07	27.95
		G			24.87	24.81	24.71
Fruiting vegetables	FL Peppers (Nov 25)	C	Verimark	2 apps at 0.130 lb a.i./acre (5-day interval)	5.03	4.98	4.38
	CA Tomato (Aug 26)	C			1.47	1.46	1.40
	FL Tomato (May 9)	C			10.17	10.04	9.78
	PA Tomato (Oct 9)	C			12.51	12.48	12.43
Fruiting vegetables	FL Peppers (Nov 1)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	25.64	25.42	25.00
	CA Tomato (Aug 2)	C			0.28	0.27	0.27
	FL Tomato (April 15)	C			16.79	16.54	16.08

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
	PA Tomato (Sept 15)	C			10.97	10.93	10.87
Leafy vegetables	CA Lettuce (April 12)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	16.04	15.95	15.30
Leafy vegetables	CA Lettuce (April 21)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (7-day interval)	14.09	14.02	13.87
		G			10.37	10.32	10.22
Leafy vegetables (except *Brassica*)	CA Lettuce (May 1)	A	Exirel	3 apps at 0.133 lb a.i./acre (5-day interval)	10.90	10.83	10.69
		G			6.81	6.78	6.71
Oil seeds	ND Canola (Aug 4)	A	Benevia	3 apps at 0.133 lb a.i./acre (7-day interval)	22.41	22.25	22.02
		G			18.31	18.18	17.97
	ND Wheat (July 15)	A			25.47	25.35	25.24
		G			21.54	21.49	21.40
Pome fruit	CA Fruit (Oct 8)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	4.98	4.96	4.93
		G			1.63	1.63	1.61
	NC Apple (Oct 14)	A			19.78	19.69	19.54
		G			16.27	16.20	16.07
	OR Apple (Sept 28)	A			12.78	12.73	12.63
		G			8.45	8.43	8.35
	PA Apple (July 15)	A			14.53	14.36	14.07
		G			11.01	10.91	10.73
Potatoes	ID Potato (May 18)	S	A17960A ST and A17960B ST	1 app at 0.690 lb a.i./acre[3]	6.53	6.51	6.45
	ME Potato (May 18)	S			8.96	8.90	8.77
Potatoes	ID Potato (May 18)	S	Verimark	1 app at 0.176 lb a.i./acre	1.67	1.66	1.65
	ME Potato (May 18)	S			2.29	2.27	2.24
Corm and tuberous vegetables	ID Potato (Aug 29)	A	Benevia	3 apps at 0.133 lb a.i./acre (5-day interval)	19.26	19.14	18.98
		G			14.52	14.43	14.32
	ME Potato (Sept 18)	A			25.49	25.43	25.33
		G			20.54	20.49	20.41
Corm and tuberous	ID Potato (Sept 14)	C	A 16901B CP Insecticide	1 app at 0.250 lb a.i./acre	6.90	6.88	6.85

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
vegetables	ME Potato (Oct 4)	C			10.67	10.65	10.60
Rapeseed including canola varieties, mustard seed	ND Canola (May 2)	S	Dermacor	1 app at 0.400 lb a.i./acre	19.82	19.72	19.61
	ND Wheat (May 2)	S			36.53	36.44	36.26
Stone fruit	MI Cherry (July 4)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	19.10	18.98	18.74
		G			14.33	14.23	14.07
	GA Peaches (Aug 14)	A			6.11	6.03	5.91
		G			3.33	3.31	3.28
	CA Fruit (July 15)	A			6.30	6.01	5.90
		G			3.40	3.11	3.07
Sunflower	ND Canola (May 2)	S	A17960A ST and A17960B ST	1 app at 0.016 lb a.i./acre[2]	0.45	0.45	0.45
	ND Wheat (May 2)	S			0.84	0.84	0.84
Tree nuts	CA Almonds (Aug 25)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	11.02	10.97	10.87
		G			8.48	8.44	8.35
	GA Pecans (Sept 12)	A			19.27	19.18	19.01
		G			17.18	17.10	16.94
Bulb vegetables	CA Onion (June 4)	A	Benevia	3 apps at 0.133 lb a.i./acre (5-day interval)	6.07	5.96	5.77
		G			3.17	3.12	3.03
	GA Onion (June 4)	A			20.84	20.59	20.11
		G			18.40	18.21	17.76
Flowerbeds and groundcovers	CA Nursery (April 15)	G	HGW86 T&O Insect Control	2 apps at 0.208 lb a.i./acre (7-day interval)	5.45	5.41	2.59
	FL Nursery (April 15)				16.09	15.96	16.65
	MI Nursery (April 15)				16.27	16.20	15.98
	NJ Nursery (April 15)				14.09	14.03	13.84
	OR Nursery (April 15)				4.25	4.22	4.18

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
	TN Nursery (April 15)				12.20	12.11	11.91
Ornamentals treated by commercial and consumer applicators	CA Nursery (April 15)	G	A 16901B Residential	2 apps at 0.130 lb a.i./acre[4] (7-day interval)	3.40	3.37	3.30
	FL Nursery (April 15)				10.04	9.95	9.77
	MI Nursery (April 15)				10.15	10.11	9.98
	NJ Nursery (April 15)				8.79	8.75	8.64
	OR Nursery (April 15)				2.65	2.64	2.61
	TN Nursery (April 15)				7.61	7.56	7.43
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	CA Nursery (April 15)	G	Mainspring	2 apps at 0.130 lb a.i./acre (14-day interval)	3.45	3.42	3.33
	FL Nursery (April 15)				6.79	6.73	6.58
	MI Nursery (April 15)				10.24	10.19	10.11
	NJ Nursery (April 15)				9.07	9.03	8.91
	OR Nursery (April 15)				2.72	2.71	2.68
	TN Nursery (April 15)				7.62	7.57	7.44
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	CA Nursery (April 15)	C	Mainspring	2 apps at 0.130 lb a.i./acre (14-day interval)	0.41	0.40	0.40
	FL Nursery (April 15)				3.65	3.60	3.50
	MI Nursery (April 15)				7.69	7.66	7.55
	NJ Nursery (April 15)				5.92	5.87	5.82
	OR Nursery (April 15)				1.49	1.49	1.47
	TN Nursery (April 15)				6.94	6.88	6.75
Ornamental plants (exterior landscapes and interior plantscapes	CA Nursery (April 15)	G	HGW86 T&O Insect Control	1 app at 0.420 lb a.i./acre	5.94	5.91	5.84
	FL Nursery (April 15)				10.20	10.12	9.90
	MI Nursery (April 15)				16.26	16.17	16.03
	NJ Nursery (April 15)				18.54	18.47	18.25
	OR Nursery (April 15)				4.21	4.19	4.15
	TN Nursery (April 15)				10.60	10.55	10.40

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
Ornamental plants (exterior landscapes and interior plantscapes	CA Nursery (April 15)	C	HGW86 T&O Insect Control	1 app at 0.420 lb a.i./acre	1.28	1.27	1.26
	FL Nursery (April 15)				6.31	6.25	6.11
	MI Nursery (April 15)				13.19	13.15	13.02
	NJ Nursery (April 15)				12.50	12.43	12.26
	OR Nursery (April 15)				1.90	1.90	1.89
	TN Nursery (April 15)				9.14	9.09	8.95
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, foliage plants, groundcovers, vines, interior plantscape plants	OR Christmas Trees (April 15)	C	HGW86 GH & N Insect Control	1 app at 0.420 lb a.i./acre	0.23	0.23	0.23
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm)	OR Christmas Trees (April 15)	G	HGW86 GH & N Insect Control	1 app at 0.420 lb a.i./acre	1.77	1.76	1.74
Turf , golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms	FL Turf (Feb 15)	G	A 16901B Turf	2 apps at 0.130 lb a.i./acre (30-day interval)	1.39	1.37	1.35
	CA Turf (April 15)				1.46	1.45	1.43
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior	FL Turf (Feb 15)	G	HGW86 GH & N Insect Control	1 app at 0.233 lb a.i./acre 1 app at 0.187 lb a.i./acre (30-day interval)	2.21	2.19	2.15
	CA Turf (April 15)				2.46	2.44	2.41

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
plantscapes, lath and shade house, under trees and shrubs that are being grown in-ground							
Fly control bait	GENEEC	E	HGW86 Fly Control Bait	5 apps at 0.087 lb a.i./acre (7-day interval)	23.67	23.49	23.16
Public health insect control	GENEEC	E	HGW86 SC Insect Control	1 app at 0.420 lb a.i./acre	23.02	22.85	22.52
Potted ornamentals	CA Nursery (April 15)	C	HGW86 GH&N Insect Control	1 app at 0.500 lb a.i./acre	1.52	1.51	1.49
	FL Nursery (April 15)				7.51	7.44	7.28
	MI Nursery (April 15)				15.71	15.66	15.51
	NJ Nursery (April 15)				14.89	14.80	14.60
	OR Nursery (April 15)				2.27	2.26	2.24
	TN Nursery (April 15)				10.88	18.82	10.65
Potted ornamentals	CA Nursery (April 15)	C	Mainspring	2 apps at 0.130 lb a.i./acre (14-day interval)	0.41	0.40	0.40
	FL Nursery (April 15)				3.65	3.60	3.50
	MI Nursery (April 15)				7.69	7.66	7.55
	NJ Nursery (April 15)				5.92	5.87	5.82
	OR Nursery (April 15)				1.49	1.49	1.47
	TN Nursery (April 15)				6.94	6.88	6.75

[1] A = foliar aerial application modeled as 95% application efficiency, 5% spray drift; G = foliar ground application modeled as 99% application efficiency, 1% spray drift; C = chemigation modeled as 100% application efficiency, 0% spray drift, E = Tier 1 GENEEC Model was utilized. S = Seed Treatment modeled as 100% application efficiency, 0% spray drift

[2] Based on 0.00000044 lb ai/seed * 4 lb seed/A * 9000 seeds/lb (USEPA 2011b). [3] Based on 0.00013 lb ai/lb potato * 5271 lb potato/A (T-REX). [4] Based on communication with registrant.

Table 12. Cyantraniliprole Estimated Environmental Concentrations (EECs) for Sediment Pore Water

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
Brassica vegetables	CA Cole Crop (Jan 30)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	20.24	20.14	20.00

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
Brassica leafy vegetables	CA Cole Crop (Feb 14)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (7-day interval)	19.07	19.07	19.04
		G			15.42	15.41	15.39
Brassica leafy vegetables	CA Cole Crop (Feb 18)	A	Exirel	3 apps at 0.133 lb a.i./acre (5-day interval)	15.44	15.44	15.41
		G			11.70	11.69	11.68
Bushberries	NY Grapes (Oct 2)	A	Exirel	3 apps at 0.133 lb a.i./acre (5-day interval)	12.90	12.89	12.57
		G			8.51	8.50	8.29
Citrus	FL Citrus (Dec 16)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	13.23	13.23	13.19
		G			11.46	11.46	11.43
Citrus	FL Citrus (Dec 30)	C	Verimark	1 app at 0.4 lb a.i./acre	9.24	9.23	9.21
Cotton	CA Cotton (Oct 21)	A	Benevia	3 apps at 0.133 lb a.i./acre (7-day interval)	8.33	8.33	8.32
		G			5.45	5.45	5.44
	MS Cotton (Sept 1)	A			25.72	25.71	25.66
		G			23.79	23.78	23.78
	NC Cotton (Oct 11)	A			34.01	33.76	33.67
		G			31.80	31.47	31.36
Cucurbits	FL Cucumber (Oct 31)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (5-day interval)	25.54	25.45	25.32
		G			24.32	24.23	24.10
Cucurbits	FL Cucumber (Nov 29)	C	Verimark	2 apps at 0.130 lb a.i./acre (10-day interval)	3.96	3.96	3.95
Cucurbits	FL Cucumber (Dec 9)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	7.78	7.74	7.71
Fruiting vegetables	FL Peppers (Nov 20)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (5-day interval)	12.96	12.95	12.92
		G			11.17	11.17	11.13
	CA Tomato (Aug 21)	A			14.41	14.40	14.34
		G			11.75	11.74	11.69
	FL Tomato (May 4)	A			20.31	20.31	20.27
		G			18.94	18.94	18.90

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
	PA Tomato (Oct 4)	A			26.49	25.87	24.61
		G			23.42	22.79	21.37
Fruiting vegetables	FL Peppers (Nov 25)	C	Verimark	2 apps at 0.130 lb a.i./acre (5-day interval)	4.01	4.01	4.00
	CA Tomato (Aug 26)	C			1.29	1.28	1.28
	FL Tomato (May 9)	C			8.65	8.65	8.62
	PA Tomato (Oct 9)	C			11.05	10.72	10.58
Fruiting vegetables	FL Peppers (Nov 1)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	24.60	23.83	20.69
	CA Tomato (Aug 2)	C			0.24	0.24	0.24
	FL Tomato (April 15)	C			12.51	12.51	12.48
	PA Tomato (Sept 15)	C			10.84	10.82	10.36
Leafy vegetables	CA Lettuce (April 12)	C	A 16901B CP Insecticide	1 app at 0.4 lb a.i./acre	14.03	14.00	13.97
Leafy vegetables	CA Lettuce (April 21)	A	A 16901B CP Insecticide	2 apps at 0.175 lb a.i./acre 1 app at 0.050 lb a.i./acre (7-day interval)	13.03	13.02	13.00
		G			9.38	9.37	9.36
Leafy vegetables (except *Brassica*)	CA Lettuce (May 1)	A	Exirel	3 apps at 0.133 lb a.i./acre (5-day interval)	10.25	10.24	10.22
		G			6.44	6.43	6.42
Oil seeds	ND Canola (Aug 4)	A	Benevia	3 apps at 0.133 lb a.i./acre (7-day interval)	20.55	20.52	20.44
		G			16.66	16.63	16.55
	ND Wheat (July 15)	A			24.65	24.58	24.34
		G			20.67	20.67	20.48
Pome fruit	CA Fruit (Oct 8)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	4.62	4.61	4.61
		G			1.49	1.48	1.48
	NC Apple (Oct 14)	A			18.14	18.13	18.11
		G			14.80	14.79	14.77
	OR Apple (Sept 28)	A			11.91	11.91	11.87
		G			7.77	7.68	7.50
	PA Apple	A			12.98	12.98	12.98

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (μg/L)	21-day EEC (μg/L)	60-day EEC (μg/L)
	(July 15)	G			9.85	9.85	9.83
Potatoes	ID Potato (May 18)	S	A17960A ST and A17960B ST	1 app at 0.690 lb a.i./acre[3]	5.80	5.80	5.79
	ME Potato (May 18)	S			8.21	8.20	8.19
Potatoes	ID Potato (May 18)	S	Verimark	1 app at 0.176 lb a.i./acre	1.48	1.48	1.48
	ME Potato (May 18)	S			2.10	2.09	2.09
Corm and tuberous vegetables	ID Potato (Aug 29)	A	Benevia	3 apps at 0.133 lb a.i./acre (5-day interval)	18.22	18.22	18.20
		G			13.77	13.77	13.76
	ME Potato (Sept 18)	A			25.22	25.20	24.62
		G			20.36	20.33	19.83
Corm and tuberous vegetables	ID Potato (Sept 14)	C	A 16901B CP Insecticide	1 app at 0.250 lb a.i./acre	6.58	6.56	6.48
	ME Potato (Oct 4)	C			10.51	10.50	10.39
Rapeseed including canola varieties, mustard seed	ND Canola (May 2)	S	Dermacor	1 app at 0.400 lb a.i./acre	17.98	17.96	17.93
	ND Wheat (May 2)	S			36.74	36.63	36.44
Stone fruit	MI Cherry (July 4)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	18.03	18.00	17.91
		G			13.52	13.50	13.39
	GA Peaches (Aug 14)	A			5.41	5.41	5.39
		G			3.32	3.28	3.00
	CA Fruit (July 15)	A			5.65	5.65	5.64
		G			3.03	3.03	3.02
Sunflower	ND Canola (May 2)	S	A17960A ST and A17960B ST	1 app at 0.016 lb a.i./acre[2]	0.41	0.41	0.41
	ND Wheat (May 2)	S			0.85	0.84	0.84
Tree nuts	CA Almonds (Aug 25)	A	Exirel	3 apps at 0.133 lb a.i./acre (7-day interval)	9.89	9.79	9.61
		G			7.17	7.06	7.04
	GA Pecans (Sept 12)	A			17.44	17.20	16.80
		G			15.41	15.19	14.68

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
Bulb vegetables	CA Onion (June 4)	A	Benevia	3 apps at 0.133 lb a.i./acre (5-day interval)	5.10	5.10	5.09
		G			2.74	2.73	2.73
	GA Onion (June 4)	A			19.76	19.69	19.54
		G			17.87	17.81	17.67
Flowerbeds and groundcovers	CA Nursery (April 15)	G	HGW86 T&O Insect Control	2 apps at 0.208 lb a.i./acre (7-day interval)	5.22	5.22	5.20
	FL Nursery (April 15)				16.24	16.09	15.82
	MI Nursery (April 15)				14.62	14.61	14.58
	NJ Nursery (April 15)				12.42	12.42	12.40
	OR Nursery (April 15)				3.91	3.91	3.90
	TN Nursery (April 15)				10.85	10.84	10.83
Ornamentals treated by commercial and consumer applicators	CA Nursery (April 15)	G	A 16901B Residential	2 apps at 0.130 lb a.i./acre[4] (7-day interval)	3.25	3.25	3.25
	FL Nursery (April 15)				10.13	10.04	9.87
	MI Nursery (April 15)				9.12	9.11	9.10
	NJ Nursery (April 15)				7.75	7.75	7.74
	OR Nursery (April 15)				2.44	2.44	2.43
	TN Nursery (April 15)				6.77	6.76	6.75
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	CA Nursery (April 15)	G	Mainspring	2 apps at 0.130 lb a.i./acre (14-day interval)	3.26	3.26	3.26
	FL Nursery (April 15)				5.76	5.76	5.74
	MI Nursery (April 15)				9.31	9.31	9.30
	NJ Nursery (April 15)				8.01	8.01	8.00
	OR Nursery (April 15)				2.47	2.47	2.46
	TN Nursery (April 15)				6.65	6.65	6.63
Ornamental plants, fruit	CA Nursery (April 15)	C	Mainspring	2 apps at 0.130 lb a.i./acre (14-day interval)	0.41	0.41	0.41

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	FL Nursery (April 15)				2.92	2.92	2.91
	MI Nursery (April 15)				6.97	6.97	6.95
	NJ Nursery (April 15)				5.29	5.29	5.28
	OR Nursery (April 15)				1.34	1.34	1.34
	TN Nursery (April 15)				5.88	5.86	5.82
Ornamental plants (exterior landscapes and interior plantscapes	CA Nursery (April 15)	G	HGW86 T&O Insect Control	1 app at 0.420 lb a.i./acre	5.49	5.49	5.47
	FL Nursery (April 15)				8.74	8.68	8.56
	MI Nursery (April 15)				14.82	14.82	14.79
	NJ Nursery (April 15)				18.03	17.98	17.88
	OR Nursery (April 15)				3.88	3.88	3.87
	TN Nursery (April 15)				9.39	9.36	9.30
Ornamental plants (exterior landscapes and interior plantscapes	CA Nursery (April 15)	C	HGW86 T&O Insect Control	1 app at 0.420 lb a.i./acre	1.30	1.30	1.28
	FL Nursery (April 15)				4.97	4.97	4.96
	MI Nursery (April 15)				11.67	11.67	11.65
	NJ Nursery (April 15)				11.59	11.59	11.58
	OR Nursery (April 15)				1.90	1.89	1.88
	TN Nursery (April 15)				7.87	7.84	7.79
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, foliage plants, groundcovers, vines, interior plantscape plants	OR Christmas Trees (April 15)	C	HGW86 GH & N Insect Control	1 app at 0.420 lb a.i./acre	0.22	0.22	0.22
Trees (including non-bearing fruit and nut	OR Christmas Trees (April 15)	G	HGW86 GH & N Insect Control	1 app at 0.420 lb a.i./acre	1.61	1.61	1.61

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm)							
Turf , golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms	FL Turf (Feb 15)	G	A 16901B Turf	2 apps at 0.130 lb a.i./acre (30-day interval)	1.31	1.30	1.29
	CA Turf (April 15)				1.37	1.37	1.37
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade house, under trees and shrubs that are being grown in-ground	FL Turf (Feb 15)	G	HGW86 GH & N Insect Control	1 app at 0.233 lb a.i./acre 1 app at 0.187 lb a.i./acre (30-day interval)	1.98	1.97	1.96
	CA Turf (April 15)				2.27	2.27	2.27
Fly control bait	GENEEC	E	HGW86 Fly Control Bait	5 apps at 0.087 lb a.i./acre (7-day interval)	23.67	23.49	23.16
Public health insect control	GENEEC	E	HGW86 SC Insect Control	1 app at 0.420 lb a.i./acre	23.02	22.85	22.52
Potted ornamentals	CA Nursery (April 15)	C	HGW86 GH&N Insect Control	1 app at 0.500 lb a.i./acre	1.55	1.54	1.53
	FL Nursery (April 15)				5.92	5.92	5.90
	MI Nursery (April 15)				13.90	13.89	13.87
	NJ Nursery (April 15)				13.81	13.80	13.78

Proposed Label Use	PRZM/EXAMS Scenario (first app date)	Method [1]	Product	Application Rate (interval between applications)	Peak EEC (µg/L)	21-day EEC (µg/L)	60-day EEC (µg/L)
	OR Nursery (April 15)				2.26	2.25	2.24
	TN Nursery (April 15)				9.37	9.34	9.27
Potted ornamentals	CA Nursery (April 15)	C	Mainspring	2 apps at 0.130 lb a.i./acre (14-day interval)	0.41	0.41	0.41
	FL Nursery (April 15)				2.92	2.92	2.91
	MI Nursery (April 15)				6.97	6.97	6.95
	NJ Nursery (April 15)				5.29	5.29	5.28
	OR Nursery (April 15)				1.34	1.34	1.34
	TN Nursery (April 15)				5.88	5.86	5.82

[1] A = foliar aerial application modeled as 95% application efficiency, 5% spray drift; G = foliar ground application modeled as 99% application efficiency, 1% spray drift; C = chemigation modeled as 100% application efficiency, 0% spray drift, E = Tier 1 GENEEC Model was utilized. S = Seed Treatment modeled as 100% application efficiency, 0% spray drift

[2] Based on 0.00000044 lb ai/seed * 4 lb seed/A * 9000 seeds/lb (USEPA 2011b).

[3] Based on 0.00013 lb ai/lb potato * 5271 lb potato/A (T-REX).

[4] Based on communication with registrant.

b. Aquatic Exposure Monitoring and Field Data

Cyantraniliprole is a new chemical, for which no monitoring data are available. The California Department of Pesticide Regulation (CDPR) surface water database (http://www.cdpr.ca.gov/docs/emon/surfwtr/surfcont.htm and USGS NAWQA surface and ground water database (http://infotrek.er.usgs.gov/apex/f?p=136:1:0::NO:::) were searched for available monitoring data, but none were located. Also, no monitoring data on the degradates were found.

3. Measures of Terrestrial Exposure

a. Terrestrial Exposure Modeling

T-REX is used to model exposures to birds, mammals, and terrestrial invertebrates. The application method for the proposed uses of cyantraniliprole include foliar spray (ground and aerial), micro sprinkler chemigation, drip chemigation, seed treatments, soil drench/injection, bark spray, spot/crack/crevice (public health use), and granular bait (Table 13). The terrestrial EECs for cyantraniliprole are derived using the maximum annual application rate (Tables 14 – 16). The default 35-day foliar half-life value was used for modeling EECs on terrestrial food items because chemical-specific foliar half-life data were not available. An example of the output is contained in Appendix E.

The use of cyantraniliprole as a fly bait is included in Table 13; however, because the acute toxicity endpoints for mammals and birds were non-definitive, the typical LD_{50}/ft^2 analysis could not be performed. See the Risk Description section for further discussion on risks to birds and mammals.

Table 13. T-REX Modeling for Foliar, Bark Spray, Seed Treatment, and Granular Applications

Use	Maximum Application Rate (lb ai/A)	Number of Applications (Interval between Applications, days)
Brassica leafy vegetables, leafy vegetables	0.175	2 at 0.175 1 at 0.05 (7 days)
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables	0.133	3 (5 days)
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts	0.133	3 (7 days)
Cucurbits, fruiting vegetables	0.175	2 at 0.175 1 at 0.05 (5 days)
Potatoes (seed treatment)	0.69	1
Potatoes (seed treatment)	0.176	1
Rapeseed including canola varieties, mustard seed	0.4	1
Sunflower (seed treatment)	0.016	1
Flowerbeds and groundcovers	0.208	2 (7 days)
Ornamentals treated by commercial and consumer applicators	0.13	2 (7 days)
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	0.26	1 at 0.26 1 at 0.16 (14 days)
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees) shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control	0.42	1

Use	Maximum Application Rate (lb ai/A)	Number of Applications (Interval between Applications, days)
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade house, under trees and shrubs that are being grown in-ground	0.26	1 at 0.26 1 at 0.16 (30 days)
Fly control bait (granular)	0.087	5 (7 days)

Table 14. Avian Foliar, Bark Spray, and Seed Treatment Upper-Bound EEC Values

Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (20 g)	Medium (100 g)	Large (1000 g)
Brassica leafy vegetables, leafy vegetables ***2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days)***				
Short grass	80.39	91.56	52.21	23.38
Tall grass	36.85	41.96	23.93	10.71
Broadleaf plants	45.22	51.50	29.37	13.15
Fruits/pods	5.02	5.72	3.26	1.46
Arthropods	31.49	35.86	20.45	9.16
Seeds	5.02	1.27	0.73	0.32
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables ***3 at 0.133 lb ai/A (5 days)***				
Short grass	87.02	99.10	56.51	25.30
Tall grass	39.88	45.42	25.90	11.60
Broadleaf plants	48.95	55.75	31.79	14.23
Fruits/pods	5.44	6.19	3.53	1.58
Arthropods	34.08	38.82	22.13	9.91
Seeds	5.44	1.38	0.78	0.35
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts ***3 apps at 0.133 lb ai/A (7 days)***				
Short grass	83.90	95.55	54.49	24.39
Tall grass	38.45	43.79	24.97	11.18
Broadleaf plants	47.19	53.75	30.65	13.72
Fruits/pods	5.24	5.97	3.41	1.52
Arthropods	32.86	37.42	21.34	9.55

Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (20 g)	Medium (100 g)	Large (1000 g)
Seeds	5.24	1.33	0.76	0.34
Cucurbits, fruiting vegetables ***2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days)***				
Short grass	84.49	96.23	54.87	24.57
Tall grass	38.73	44.11	25.15	11.26
Broadleaf plants	47.53	54.13	30.87	13.82
Fruits/pods	5.28	6.01	3.43	1.54
Arthropods	33.09	37.69	21.49	9.62
Seeds	5.28	1.34	0.76	0.34
Potatoes (seed treatment) ***1 at 0.69 lb ai/A***				
Seeds	-	113.65	64.81	29.01
Potatoes (seed treatment) ***1 app at 0.176 lb ai/A***				
Seeds	-	28.99	16.53	7.40
Rapeseed including canola varieties, mustard seed (seed treatment) ***1 app at 0.4 lb ai/A***				
Seeds	-	65.88	37.57	16.82
Sunflower (seed treatment) ***1 app at 0.016 lb ai/A***				
Seeds	-	2.64	1.50	0.67
Flowerbeds and groundcovers ***2 apps at 0.208 lb ai/A (7 days)***				
Short grass	93.38	106.35	60.64	27.15
Tall grass	42.80	48.74	27.80	12.44
Broadleaf plants	52.53	59.82	34.11	15.27
Fruits/pods	5.84	6.65	3.79	1.70
Arthropods	36.57	41.65	23.75	10.63
Seeds	5.84	1.48	0.84	0.38
Ornamentals treated by commercial and consumer applicators ***2 apps at 0.13 lb ai/A (7 days)***				
Short grass	58.36	66.47	37.90	16.97
Tall grass	26.75	30.46	17.37	7.78
Broadleaf plants	32.83	37.39	21.32	9.55
Fruits/pods	3.65	4.15	2.37	1.06
Arthropods	22.86	26.03	14.85	6.65
Seeds	3.65	0.92	0.53	0.24
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes ***1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (14 days)***				
Short grass	85.69	97.59	55.65	24.92
Tall grass	39.27	44.73	25.51	11.42

Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (20 g)	Medium (100 g)	Large (1000 g)
Broadleaf plants	48.20	54.90	31.30	14.02
Fruits/pods	5.36	6.10	3.48	1.56
Arthropods	33.56	38.22	21.80	9.76
Seeds	5.36	1.36	0.77	0.35
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees) shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control 1 app at 0.42 lb ai/A				
Short grass	100.80	114.80	65.46	29.31
Tall grass	46.20	52.62	30.00	13.43
Broadleaf plants	56.70	64.58	36.82	16.49
Fruits/pods	6.30	7.18	4.09	1.83
Arthropods	39.48	44.96	25.64	11.48
Seeds	6.30	1.59	0.91	0.41
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground 1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (30 days)				
Short grass	72.85	82.97	47.31	21.18
Tall grass	33.39	38.03	21.68	9.71
Broadleaf plants	40.98	46.67	26.61	11.91
Fruits/pods	4.55	5.19	2.96	1.32
Arthropods	28.53	32.50	18.53	8.30
Seeds	4.55	1.15	0.66	0.29

Table 15. Mammalian Foliar, Bark Spray, and Seed Treatment Upper-Bound EEC Values

Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (15 g)	Medium (135 g)	Large (1000 g)
Brassica leafy vegetables, leafy vegetables 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days)				
Short grass	80.39	76.65	52.97	12.28
Tall grass	36.85	35.13	24.28	5.63
Broadleaf plants	45.22	43.11	29.80	6.91
Fruits/pods	5.02	4.79	3.31	0.77
Arthropods	31.49	30.02	20.75	4.81
Seeds	5.02	1.06	0.74	0.17
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables 3 apps at 0.133 lb ai/A (5 days)				
Short grass	87.02	82.96	57.34	13.29

Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (15 g)	Medium (135 g)	Large (1000 g)
Tall grass	39.88	38.02	26.28	6.09
Broadleaf plants	48.95	46.67	32.25	7.48
Fruits/pods	5.44	5.19	3.58	0.83
Arthropods	34.08	32.49	22.46	5.21
Seeds	5.44	1.15	0.80	0.18
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts ***3 apps at 0.133 lb ai/ A (7 days)***				
Short grass	83.90	79.99	55.28	12.82
Tall grass	38.45	36.66	25.34	5.87
Broadleaf plants	47.19	44.99	31.10	7.21
Fruits/pods	5.24	5.00	3.46	0.80
Arthropods	32.86	31.33	21.65	5.02
Seeds	5.24	1.11	0.77	0.18
Cucurbits, fruiting vegetables ***2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days)***				
Short grass	84.49	80.56	55.68	12.91
Tall grass	38.73	36.92	25.52	5.92
Broadleaf plants	47.53	45.31	31.32	7.26
Fruits/pods	5.28	5.03	3.48	0.81
Arthropods	33.09	31.55	21.81	5.06
Seeds	5.28	1.12	0.77	0.18
Potatoes (seed treatment) ***1 app at 0.69 lb ai/A***				
Seeds	-	95.14	65.75	15.25
Potatoes (seed treatment) ***1 app at 0.176 lb ai/A***				
Seeds	-	24.27	16.77	3.89
Rapeseed including canola varieties, mustard seed (seed treatment) ***1 app at 0.4 lb ai/A***				
Seeds	-	55.15	38.12	8.84
Sunflower (seed treatment) ***1 app at 0.016 lb ai/A***				
Seeds	-	2.21	1.52	0.35
Flowerbeds and groundcovers ***2 apps at 0.208 lb ai/A (7 days)***				
Short grass	93.38	89.03	61.53	14.27
Tall grass	42.80	40.80	28.20	6.54
Broadleaf plants	52.53	50.08	34.61	8.02
Fruits/pods	5.84	5.56	3.85	0.89
Arthropods	36.57	34.87	24.10	5.59
Seeds	5.84	1.24	0.85	0.20
Ornamentals treated by commercial and consumer applicators				

Feeding Category	Dietary-based EECs (mg/kg-food item)	Dose-based EECs (mg/kg-bw)		
		Small (15 g)	Medium (135 g)	Large (1000 g)
2 apps at 0.13 lb ai/A (7 days)				
Short grass	58.36	55.64	38.46	8.92
Tall grass	26.75	25.50	17.63	4.09
Broadleaf plants	32.83	31.30	21.63	5.02
Fruits/pods	3.65	3.48	2.40	0.56
Arthropods	22.86	21.79	15.06	3.49
Seeds	3.65	0.77	0.53	0.12
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes 1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (14 days)				
Short grass	85.69	81.70	56.47	13.09
Tall grass	39.27	37.45	25.88	6.00
Broadleaf plants	48.20	45.96	31.76	7.36
Fruits/pods	5.36	5.11	3.53	0.82
Arthropods	33.56	32.00	22.12	5.13
Seeds	5.36	1.13	0.78	0.18
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control 1 app at 0.42 lb ai/A				
Short grass	100.80	96.11	66.42	15.40
Tall grass	46.20	44.05	30.44	7.06
Broadleaf plants	56.70	54.06	37.36	8.66
Fruits/pods	6.30	6.01	4.15	0.96
Arthropods	39.48	37.64	26.02	6.03
Seeds	6.30	1.33	0.92	0.21
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground 1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (7 days)				
Short grass	92.72	88.40	61.10	14.17
Tall grass	42.50	40.52	28.00	6.49
Broadleaf plants	52.16	49.73	34.37	7.97
Fruits/pods	5.80	5.53	3.82	0.89
Arthropods	36.32	34.62	23.93	5.55
Seeds	5.80	1.23	0.85	0.20

For insects, only two screening level EECs are calculated. The tall grass EEC represents the exposure through dietary intake whereas the arthropod EEC represents exposure through contact (Table 16) (USEPA 2012b). Given that honeybee larval toxicity data were not available, only cyantraniliprole doses for adult bees are considered.

Table 16. Adult Insect Foliar Spray, Bark Spray, and Granular Screening Level Upper-Bound EEC Values

Use	EEC (based on tall grass) (mg/kg-diet) (dose in µg ai/bee*)	EEC (based on arthropod) (mg/kg-diet) (dose in µg ai/bee**)
Brassica leafy vegetables, leafy vegetables 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days)	36.85 (10.76)	16.45[1] (2.11)
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables 3 apps at 0.133 lb ai/A (5 days)	39.88 (11.64)	34.08 (4.36)
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts 3 apps at 0.133 lb ai/A (7 days)	38.45 (11.23)	12.50[2] (1.6)
Cucurbits, fruiting vegetables 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days)	38.73 (11.31)	33.09 (4.24)
Flowerbeds and groundcovers 2 apps at 0.208 lb ai/A (7 days)	42.80 (12.50)	19.55[3] (2.50)
Ornamentals treated by commercial and consumer applicators 2 apps at 0.13 lb ai/A (7 days)	26.75 (7.81)	12.22[4] (1.56)
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes 1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (14 days)	39.27 (11.47)	24.44[5] (3.13)
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control 1 app at 0.42 lb ai/A	46.20 (13.49)	39.48 (5.05)
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground 1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (30 days)	42.50 (12.41)	24.44[5] (3.13)
Fly control bait (granular) 5 apps at 0.087 lb ai/A (7 days)	36.96 (10.79)	8.18[6] (3.01)

*Conversion made by multiplying EEC by food consumption rate of adult bee (0.292 g/day)
**Conversion made by multiplying EEC by body weight of adult bee (0.128 g)
[1]Based on single app of 0.175 lb ai/A because application interval is >5 days
[2]Based on single app of 0.133 lb ai/A because application interval is >5 days
[3]Based on single app of 0.208 lb ai/A because application interval is >5 days
[4]Based on single app of 0.13 lb ai/A because application interval is >5 days

Use	EEC (based on tall grass) (mg/kg-diet) (dose in µg ai/bee*)	EEC (based on arthropod) (mg/kg-diet) (dose in µg ai/bee**)
[5]Based on single app of 0.26 lb ai/A because application interval is >5 days [6]Based on single app of 0.087 lb ai/A because application interval is >5 days		

EEC Estimates for Soil Injection, Soil Drench, and Drip Irrigation (Birds and Mammals)

T-REX could not be used to calculate EECs for soil injection, soil drench, and drip irrigation. T-REX assumes that the chemical is applied over the tops of the plants and that terrestrial organisms are exposed to the chemical via the residues left on plant parts. The residues will degrade over time as they are exposed to environmental conditions; the degradation rate may not be the same for systemic chemicals distributed within the plant. For injections and drenches, cyantraniliprole is taken up into the plant via the roots. Terrestrial organisms can still be exposed to cyantraniliprole through eating leaves or other plant parts, but the chemical is contained within the vegetation (systemic) rather than on the vegetation's surface. Therefore, different methods were employed to estimate the concentrations of cyantraniliprole in plants, based on the application method.

Soil Injection/Soil Drench/Drip Irrigation and Woody Potted Ornamental Drench Leaf Biomass Estimates

An EEC is the concentration of cyantraniliprole that is expected to be present in a unit of food. Therefore, to calculate an EEC, it is necessary to determine the biomass of the food item and the amount of cyantraniliprole it is expected to contain.

For soil injection/soil drenches, drip irrigation, and drenches of woody potted ornamental plants, it is assumed that cyantraniliprole will accumulate in the leaves of the plant (a surrogate for other non-woody food items, such as fruit). Both hardwoods and softwoods were considered in this scenario. Leaf biomass (dry weight) for hardwoods and softwoods were estimated using general hardwood and softwood leaf biomass equations from Jenkins *et al*. (2003). Table 17 presents the biomass estimates for hardwoods and softwoods. See Appendix F for the calculations.

Table 17. Summary of Hardwood and Softwood Leaf Biomass Wet Weights

	6-Inch DBH (kg)	1-Inch DBH (kg)
Hardwood (wet weight)	21.44	0.95
Softwood (wet weight)	47	2.3
DBH = diameter at breast height		

Using the biomass information in Table 17, EECs can be calculated for soil injection/soil drench, and drench applications to woody potted ornamental (Table 18). See Appendix F for the complete calculations.

Table 18. Summary of Mammalian and Avian EECs for Soil Injection/Soil Drench, Potted Ornamental Drench, and Agricultural Drip Irrigation

	Bird and Mammal	Mammal		
	Dietary (mg ai/kg-plant)	Acute Dose (mg ai/kg-bw)		
		15 g	35 g	1000g
Soil injection/drench hardwood	148	141	100	22
Soil injection/drench hardwood	254	241	168	38
Soil drench (citrus)	233	221	154	35
Soil injection/drench softwood	68	65	45	10
Soil injection/drench softwood	116	110	77	17
Potted non-woody ornamental drench	4.6	4	3	0.7
Potted non-woody ornamental drench	9	9	6	1
Drip irrigation (brassica vegetables)	64	61	42	10
Drip irrigation (cucurbits)	636	604	420	95
Drip irrigation (fruiting vegetables)	182	173	120	27
Drip irrigation (leafy vegetables	54	51	36	8
Drip irrigation (corm and tuberous vegetables)	64	61	42	10

EEC Estimates for Soil Injection, Soil Drench, and Drip Irrigation (Terrestrial Invertebrates)

The method outlined in USEPA 2012b for estimating screening level pollen/nectar concentrations for soil treatments was used to develop EECs for the relevant cyantraniliprole uses. The model predicts the concentration of pesticide that is expected to be present in the stem of a plant; this is used as a surrogate for pollen/nectar. The original equation was developed by Briggs *et al*. (1982 and 1983) and was modified by Ryan *et al*. (1988) and EPA to represent an upper-bound estimate (95% transpiration stream concentration factors – TSCF).

$$SCF' = \frac{C_{stem}}{C_{soil}} = [10^{(0.95*LogKow - 2.05)}] * TSCF * \left[\frac{\rho}{\Theta + \rho + K_{0c} + f_{oc}}\right]$$

Where:

SCF' = stem concentration factor based on uptake from soil
Cstem = concentration in stems (μg a.i./g plant)
Csoil = concentration in soil (μg a.i./g soil) (derived from application rate)
foc = fraction of organic carbon in soil

θ = soil-water content by volume (cm3/cm3)
ρ = soil bulk density (g-dw/cm3)
K_{oc} = soil organic carbon-water partitioning coefficient (cm^3/g_{oc} or L/k_{goc})

For cyantraniliprole, Log K_{ow} =1.94; K_{oc} =241; and the adjusted 95% TSCF = 0.875 (USEPA 2012b). SCF' was calculated to be 0.026

Consequently, the following EECs were derived for the soil application scenarios (Table 19).

Table 19. Screening Level Pollen/Nectar EECs for Soil Application Scenarios (Terrestrial Invertebrates)

Use	Dietary EEC (mg ai/kg-food) (dose in µg ai/bee)*
Ornamental trees and potted ornamentals (soil injection/drench) 0.26 lb ai/A	0.007 (0.002)
Ornamental trees (soil injection/drench) 0.42 lb ai/A	0.011 (0.003)
Potted ornamentals (drench) 0.5 lb ai/A	0.013 (0.004)
Citrus (soil drench) 0.391 lb ai/A	0.0102 (0.003)
Brassica vegetables, cucurbits, leafy vegetables, fruiting vegetables, corm and tuberous vegetables (drip irrigation) 0.4 lb ai/A	0.0104 (0.003)
**Conversion made by multiplying EEC by food consumption rate of adult bee (0.292 g/day)	

EEC Estimates for Seed Treatments (Terrestrial Invertebrates)

Based on the EPPO 2010, a screening concentration of 1 mg ai/kg of pollen and nectar is used for the EEC for all seed treatments, regardless of application rate (USEPA 2012b). When converting to the adult bee nectar/pollen consumption rate, the equivalent dose for risk quotient calculation is 0.292 µg ai/bee.

EEC Estimates for Terrestrial Plants

TerrPlant estimates potential exposure from a single application using default assumptions for runoff (2% given solubility is 14.2 ppm) and spray drift (1% given a ground application or 5% given an aerial application of a liquid formulation) (Table 20). See Appendix G for more information.

Table 20. EECs on Plants Following Label-Specified Applications of Cyantraniliprole

Description	Equation	EEC (lb ai/A)
Brassica vegetables (soil)		

Description	Equation	EEC (lb ai/A)
1 app at 0.35 lb ai/A		
Runoff to dry areas	(A/I)*R	0.007
Runoff to semi-aquatic areas	(A/I)*R*10	0.07
Spray drift	A*D	0.0035
Total for dry areas	((A/I)*R)+(A*D)	0.0105
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0735
Brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, (aerial spray) 1 app at 0.175 lb ai/A		
Runoff to dry areas	(A/I)*R	0.0035
Runoff to semi-aquatic areas	(A/I)*R*10	0.035
Spray drift	A*D	0.00875
Total for dry areas	((A/I)*R)+(A*D)	0.01225
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.04375
Brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, (ground spray) 1 app at 0.175 lb ai/A		
Runoff to dry areas	(A/I)*R	0.0035
Runoff to semi-aquatic areas	(A/I)*R*10	0.035
Spray drift	A*D	0.00175
Total for dry areas	((A/I)*R)+(A*D)	0.00525
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.03675
Brassica leafy vegetables, bushberries, cotton, leafy vegetables (except brassica), oil seeds, pome fruit, corm and tuberous vegetables, stone fruit, tree nuts, bulb vegetables, (aerial spray) 1 app at 0.133 lb ai/A		
Runoff to dry areas	(A/I)*R	0.00266
Runoff to semi-aquatic areas	(A/I)*R*10	0.0266
Spray drift	A*D	0.00665
Total for dry areas	((A/I)*R)+(A*D)	0.00931
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.03325
Brassica leafy vegetables, bushberries, citrus, cotton, leafy vegetables (except brassica), oil seeds, pome fruit, corm and tuberous vegetables, stone fruit, tree nuts, bulb vegetables, (ground spray) 1 app at 0.133 lb ai/A		
Runoff to dry areas	(A/I)*R	0.00266
Runoff to semi-aquatic areas	(A/I)*R*10	0.0266
Spray drift	A*D	0.00133
Total for dry areas	((A/I)*R)+(A*D)	0.00399
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.02793
Citrus (chemigation) 1 app at 0.391 lb ai/A		
Runoff to dry areas	(A/I)*R	0.00782
Runoff to semi-aquatic areas	(A/I)*R*10	0.0782
Spray drift	A*D	0.01955
Total for dry areas	((A/I)*R)+(A*D)	0.02737
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.09775

Description	Equation	EEC (lb ai/A)
Cucurbits, fruiting vegetables, potted ornamentals (drip chemigation/soil drench) *1 app at 0.130 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.0026
Runoff to semi-aquatic areas	(A/I)*R*10	0.026
Spray drift	A*D	0.0013
Total for dry areas	((A/I)*R)+(A*D)	0.0039
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0273
Cucurbits, fruiting vegetables, leafy vegetables, (drip chemigation) *1 app at 0.35 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.007
Runoff to semi-aquatic areas	(A/I)*R*10	0.07
Spray drift	A*D	0.0035
Total for dry areas	((A/I)*R)+(A*D)	0.0105
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0735
Potato (seed treatment) *1 app at 0.69 lb ai/A – incorporation 3 inches*		
Runoff to dry areas	(A/I)*R	0.0046
Runoff to semi-aquatic areas	(A/I)*R*10	0.046
Total for dry areas	((A/I)*R)+(A*D)	0.0115
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0529
Potato (seed treatment) *1 app at 0.176 lb ai/A – incorporation 3 inches*		
Runoff to dry areas	(A/I)*R	0.001173333
Runoff to semi-aquatic areas	(A/I)*R*10	0.011733333
Total for dry areas	((A/I)*R)+(A*D)	0.002933333
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.013493333
Rapeseed including canola varieties, mustard seed (seed treatment) *1 app at 0.4 lb ai/A – no incorporation*		
Runoff to dry areas	(A/I)*R	0.008
Runoff to semi-aquatic areas	(A/I)*R*10	0.08
Total for dry areas	((A/I)*R)+(A*D)	0.012
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.084
Sunflower (seed treatment) *1 app at 0.016 lb ai/A – 1 inch incorporation*		
Runoff to dry areas	(A/I)*R	0.00032
Runoff to semi-aquatic areas	(A/I)*R*10	0.0032
Total for dry areas	((A/I)*R)+(A*D)	0.00048
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.00336
Corm and tuberous vegetables (soil) *1 app at 0.25 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.005
Runoff to semi-aquatic areas	(A/I)*R*10	0.05
Spray drift	A*D	0.0025

Description	Equation	EEC (lb ai/A)
Total for dry areas	((A/I)*R)+(A*D)	0.0075
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0525
Flowerbeds and groundcovers (ground spray) *1 app at 0.208 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.00416
Runoff to semi-aquatic areas	(A/I)*R*10	0.0416
Spray drift	A*D	0.00208
Total for dry areas	((A/I)*R)+(A*D)	0.00624
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.04368
Ornamental plants, fruit and nut trees (non-bearing), and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries, and interiorscapes, turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade house, under trees and shrubs that are being grown in-ground (ground spray) *1 app at 0.26 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.0052
Runoff to semi-aquatic areas	(A/I)*R*10	0.052
Spray drift	A*D	0.0026
Total for dry areas	((A/I)*R)+(A*D)	0.0078
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0546
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy corm, tuberous), public health insect control (ground spray/soil drench) *1 app at 0.42 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.0084
Runoff to semi-aquatic areas	(A/I)*R*10	0.084
Spray drift	A*D	0.0042
Total for dry areas	((A/I)*R)+(A*D)	0.0126
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0882
Fly control bait (granular) *1 app at 0.087 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.00174
Runoff to semi-aquatic areas	(A/I)*R*10	0.0174
Spray drift	A*D	0
Total for dry areas	((A/I)*R)+(A*D)	0.00174
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0174
Potted ornamentals (soil drench) *1 app at 0.5 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.01
Runoff to semi-aquatic areas	(A/I)*R*10	0.1
Spray drift	A*D	0.005
Total for dry areas	((A/I)*R)+(A*D)	0.015

Description	Equation	EEC (lb ai/A)
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.105
Potted ornamentals (soil drench) *1 app at 0.13 lb ai/A*		
Runoff to dry areas	(A/I)*R	0.0026
Runoff to semi-aquatic areas	(A/I)*R*10	0.026
Spray drift	A*D	0.0013
Total for dry areas	((A/I)*R)+(A*D)	0.0039
Total for semi-aquatic areas	((A/I)*R*10)+(A*D)	0.0273
A = application rate I = incorporation R = runoff fraction D = drift fraction		

C. Ecological Effects Characterization

Based on the available data, cyantraniliprole is classified as slightly to moderately toxic to freshwater fish; slightly toxic to estuarine/marine fish; slightly to very highly toxic to freshwater invertebrates; moderately to highly toxic to estuarine/marine invertebrates, highly toxic to benthic invertebrates; highly to very highly toxic to terrestrial insects; and practically non-toxic to mammals and birds on an acute exposure basis. Chronic exposure resulted in effects on growth in freshwater invertebrates and estuarine/marine fish. Chronic exposure in mammals resulted in effects on thyroid weight and on growth of rat offspring; however, no effects were detected in birds at the dietary levels tested. For terrestrial plants, the EC_{25} values were greater than 0.134 lb ai/A for both seedling emergence and vegetative vigor tests. Both vascular and non-vascular aquatic plants exhibited non-definitive EC_{50} >10 mg ai/L.

1. Aquatic Effects Characterization

a. Aquatic Animals

Three acute toxicity studies were submitted for freshwater fish. The LC_{50} values were all non-definitive >10 mg total ai/L (Table 21) and cyantraniliprole's toxicity may be limited by its solubility. All of the studies were classified as "supplemental" because undissolved test material was observed in several of the higher concentration levels. Samples from each treatment were measured; however, the samples were not centrifuged or filtered prior to analysis. Therefore, the amount of cyantraniliprole dissolved in the test solution is unknown. The data are still considered useable because the toxicity endpoint was assumed to be at or higher than the solubility of the test material. The product chemistry data identified a solubility limit of 14.2 mg ai/L at 20ºC, but the conditions under which it was performed (*e.g.*, temperature) were probably different than the toxicity studies, thus explaining the precipitate at the lower concentrations in the studies. No mortalities were reported. Sub-lethal effects for the technical grade active ingredient included: lethargy, surfacing for long periods of time, and lying on the bottom of the test chamber.

The four acute toxicity studies with the formulations were more varied than technical-grade cyantraniliprole (Table 22); this could be the result of emulsifiers or other inert ingredients in the formulations. Bluegill sunfish (*Lepomis macrochirus*; MRID 48120220) yielded the most sensitive toxicity value of all the acute freshwater fish toxicity tests with an LC_{50} of 2.4 mg ai/L. Endpoints from studies with typical end-use product (TEP) are not used to calculate risk quotients for aquatic species because formulation constituents are expected to move differentially through the environment and are not expected to exist in the same ratio as the original formulation upon being dissolved in water. Thus, at a screening level, it is assumed that fish would be exposed to cyantraniliprole by itself, and not in conjunction with the other ingredients in the formulation. However, as this is the most sensitive endpoint for freshwater fish, it will be discussed further in the Risk Description section of the document and will be considered in the spray drift analysis, if appropriate. The other TEP tests yielded LC_{50} values from >7.9 to >40.7 mg ai/L. Three of the studies were classified as "acceptable;" the endpoints in the one "supplemental" study were based on nominal concentrations although the measured concentrations were below 80% at the test's end. Sub-lethal effects from the studies using TEP included: surfacing for long periods of time, lethargy, lying on the bottom of the test chamber, rapid opercular movement (breathing), tumbling while swimming, and dark coloration. Overall, and based on the measured LC_{50} values, cyantraniliprole is slightly to moderately toxic to freshwater fish on an acute exposure basis.

A chronic early life-stage study was available for rainbow trout (*Oncorhynchus mykiss*; Table 21). The study yielded a NOAEC of 10.7 mg ai/L and no mortality or sub-lethal effects were observed.

Table 21. Summary of Acute and Chronic Toxicity to Freshwater Fish

Study	Test Material	Species	Toxicity Endpoint (mg ai/L)	Classification and MRID
Acute toxicity to freshwater fish	TGAI (93.4%)	Rainbow trout (*Oncorhynchus mykiss*)	96-hr LC_{50} >12.6 mg total ai/L NOAEC = 6.87 mg total ai/L	Supplemental 48120108
Acute toxicity to freshwater fish	TGAI (93.4%)	Bluegill sunfish (*Lepomis macrochirus*)	96-hr LC_{50} >13 mg total ai/L NOAEC = 6.97 mg total ai/L	Supplemental 48120104
Acute toxicity to freshwater fish	TGAI (94.5%)	Channel catfish (*Ictalurus punctatus*)	96-hr LC_{50} >10 mg total ai/L NOAEC = 10 mg total ai/L	Supplemental 48120106

Study	Test Material	Species	Toxicity Endpoint (mg ai/L)	Classification and MRID
Acute toxicity to freshwater fish	TEP (18.66%)	Bluegill sunfish (*Lepomis macrochirus*)	96-hr LC_{50} >7.9 NOAEC =1.1	Acceptable 48120321
Acute toxicity to freshwater fish	TEP (10.26%)	Bluegill sunfish (*Lepomis macrochirus*)	96-hr LC_{50} =2.4** NOAEC = 0.76	Acceptable 48120220
Acute toxicity to freshwater fish	TEP (20.6%) Other ai – thiamethoxam (20.6%)	Rainbow trout (*Oncorhynchus mykiss*)	96-hr LC_{50} >11.12 NOAEC =11.12	Supplemental 48432527
Acute toxicity to freshwater fish	TEP (40.7%)	Rainbow trout (*Oncorhynchus mykiss*)	96-hr LC_{50} >40.7 NOAEC =3.83	Acceptable 48432413
Freshwater fish early life-stage	TGAI (94.5%)	Rainbow trout (*Oncorhynchus mykiss*)	NOAEC =10.7* LOAEC >10.7 No effects	Acceptable 48120109
TGAI = technical grade active ingredient TEP = typical end-use product *denotes endpoint used in risk quotient calculations **may be considered in spray drift analysis				

One acute toxicity test for estuarine/marine sheepshead minnow (*Cyprinodon variegatus*) was submitted (Table 22). Similar to studies with freshwater fish, the test was classified as “supplemental” because undissolved test material was present in some of the test chambers. Measured samples were taken, but they were not centrifuged or filtered; thus, the actual amount of cyantraniliprole dissolved in solution is unknown. The toxicity endpoint is still considered useable because it is at the apparent solubility limit of the test chemical (see freshwater fish discussion above for more detail). No mortalities or sub-lethal effects were reported. The results of this test indicate that cyantraniliprole is slightly toxic to estuarine/marine fish on an acute exposure basis.

One chronic study was available for estuarine/marine fish using sheepshead minnow (Table 22). The study was classified as “supplemental” because there was undissolved test material in the three highest test concentrations. This is not anticipated to affect the interpretation of this study’s toxicological endpoints because the NOAEC and LOAEC were both at or below the lowest concentration tested; no undissolved test material was observed at this concentration or the concentration above it. There were no effects on survival or hatching rates. Growth parameters (length and weight) were affected with the most sensitive being fish length. Given that the NOAEC (NOAEC <0.75 mg ai/L) in this study is a “less than” value, the lower bounds of cyantraniliprole’s toxicity are unknown in estuarine/marine fish.

Table 22. Summary of Acute and Chronic Toxicity to Estuarine/Marine Fish

Study	Test Material	Species	Toxicity Endpoint (mg ai/L)	Classification and MRID
Acute toxicity to estuarine/marine fish	TGAI (94.5%)	Sheepshead minnow (*Cyprinodon variegatus*)	96-hr LC_{50} >12 mg total ai/L NOAEC = 12 mg total ai/L	Supplemental 48120105
Estuarine/marine fish early life-stage	TGAI (94.5%)	Sheepshead minnow (*Cyprinodon variegatus*)	NOAEC <0.75 LOAEC =0.75 Based on mean measured length	Supplemental 48120110
TGAI – technical grade active ingredient				

Acute toxicity studies were submitted for seven species of freshwater invertebrates (Table 23). For the seven studies conducted with the technical material, 48-hr EC_{50} values ranged from 20.4 to >14000 µg ai/L. The most sensitive species was the water flea (*Daphnia magna*) with an EC_{50} of 20.4 µg ai/L. For all species, lethargy and floating at the surface were the only sub-lethal effects reported. The amphipod study with *Hyalella azteca* was classified as "supplemental" because of a potential methodological problem at one treatment level – a number of behavioral effects were seen at the lowest concentration tested, but these did not carry through to higher concentrations. It is uncertain if these were real effects or an artifact of the experiment. The NOAEC was conservatively assigned to be lower than this value (< 76.4 µg ai/L).

Six studies were performed with various TEPs (Table 23). The 48-hr EC_{50} values ranged from 5.6 (thiamethoxam-containing product) to 18.5 µg ai/L and were all more sensitive than their TGAI counterpart conducted with *D. magna*. Two of the studies with *D. magna* (MRIDs 48432528 and 48432414) were classified as "supplemental" because the toxicity endpoints were based on nominal concentrations; whereas, measured concentrations indicated a decrease of more than 20% of the test material throughout the study. Sub-lethal effects included lethargy and floating at the surface. Overall, the TEP and TGAI tests indicate that cyantraniliprole is slightly toxic to very highly toxic to freshwater invertebrates on an acute exposure basis.

One freshwater invertebrate chronic study was available with *D. magna* (Table 23). The most sensitive endpoint was adult body length (NOAEC = 6.56 µg ai/L), but adult survival and total number of immobilized live young (NOAEC = 9.69 µg ai/L); and total number of live young and dry weight were also affected (NOAEC = 14.7 µg ai/L).

Table 23. Summary of Acute and Chronic Toxicity to Freshwater Invertebrates

Study	Test Material	Species	Toxicity Endpoint (µg ai/L)	Classification and MRID
Acute toxicity to freshwater invertebrates	TGAI (93.3%)	Water flea (*Daphnia magna*)	48-hr EC_{50} = 20.4* NOAEC = 1.70	Acceptable 48120114

Study	Test Material	Species	Toxicity Endpoint (µg ai/L)	Classification and MRID
Acute toxicity to freshwater invertebrates	TGAI (93.3%)	Mayfly (*Centroptilum triangulifer*)	48-hr LC_{50} =71.5 NOAEC =11.1	Acceptable 48120099
Acute toxicity to freshwater invertebrates	TGAI (93.3%)	Caddisfly (*Lepidostoma ontario*)	48-hr LC_{50} =74.8 NOAEC =11.5	Acceptable 48120117
Acute toxicity to freshwater invertebrates	TGAI (93.4%)	Stonefly (*Soyedina carolinensis*)	48-hr LC_{50} = 14000 NOAEC <1050	Acceptable 48120103
Acute toxicity to freshwater invertebrates	TGAI (93.4%)	Amphipod (*Gammarus pseudolimnaeus*)	48-hr LC_{50} =172 NOAEC =73.3	Acceptable 48120098
Acute toxicity to freshwater invertebrates	TGAI (93.4%)	Amphipod (*Hyalella azteca*)	48-hr LC_{50} >1370 NOAEC = <76.4	Supplemental 48120102
Acute toxicity to freshwater invertebrates	TGAI (93.4%)	Oligochaete (*Lumbriculus variegatus*)	48-hr LC_{50} >13700 NOAEC <860	Acceptable 48120101
Acute toxicity to freshwater invertebrates	TEP (10.26%)	Water flea (*Daphnia magna*)	48-hr EC_{50} = 9.47 NOAEC = <3.28	Acceptable 48120217
Acute toxicity to freshwater invertebrates	TEP (10.26%)	Water flea (*Daphnia magna*)	48-hr EC_{50} =18 NOAEC =8.13	Acceptable 48120242
Acute toxicity to freshwater invertebrates	TEP (10.26%)	Water flea (*Daphnia magna*)	48-hr EC_{50} =18.5 NOAEC =3.54	Acceptable 48120415
Acute toxicity to freshwater invertebrates	TEP (18.66%)	Water flea (*Daphnia magna*)	48-hr EC_{50} =14.5 NOAEC =9.13	Acceptable 48120319
Acute toxicity to freshwater invertebrates	TEP (20.6%) Other ai – thiamethoxam (20.6%)	Water flea (*Daphnia magna*)	48-hr EC_{50} =5.6** NOAEC <0.21	Supplemental 48432528
Acute toxicity to freshwater invertebrates	TEP (40.7%)	Water flea (*Daphnia magna*)	48-hr EC_{50} = 11 NOAEC <1.2	Supplemental 48432414
Chronic test to freshwater invertebrates	TGAI (93.3%)	Water flea (*Daphnia magna*)	NOAEC = 6.56* LOAEC = 96.9 Based on adult body length	Acceptable 48120091

TGAI – technical grade active ingredient
TEP – typical end-use product
*denotes endpoint used in risk quotient calculations
**considered in spray drift analysis

Two acute toxicity studies were available for estuarine/marine invertebrates (Table 24). The shell deposition study with the Eastern oyster yielded the most sensitive endpoints (96-hr EC_{50} = 520 µg ai/L). Oyster shell growth was the only parameter that was affected; no other sub-lethal effects or mortality were reported. In the acute toxicity test with mysid shrimp, shrimp exhibited erratic swimming and lethargy as sub-lethal effects. These results classify cyantraniliprole as moderately toxic to highly toxic to estuarine/marine invertebrates on an acute exposure basis.

Data were not available for the chronic effects of cyantraniliprole to estuarine/marine invertebrates. In lieu of actual data, the acute-to-chronic ratio was used to derive an estimate of a chronic toxicity value for estuarine/marine invertebrates using the acute-chronic relationship for the most sensitive species of freshwater invertebrates. The following equation was used:

$$\frac{EC_{50(oyster)}}{NOAEC_{(oyster)}} = \frac{EC_{50\ (water\ flea)}}{NOAEC_{(water\ flea)}} = \frac{520}{X} = \frac{20.4}{6.56} = 167 = NOAEC_{(oyster)}$$

Normally an ACR is calculated with the most sensitive mortality endpoint. For the cyantraniliprole dataset, the Eastern oyster yielded the most sensitive endpoint, but it was based on growth rather than mortality. Consequently, an ACR based on the acute mysid shrimp endpoint (mortality) was also considered.

$$\frac{EC_{50(shrimp)}}{NOAEC_{(shrimp)}} = \frac{EC_{50\ (water\ flea)}}{NOAEC_{(water\ flea)}} = \frac{1200}{X} = \frac{20.4}{6.56} = 386 = NOAEC_{(shrimp)}$$

Table 24. Summary of Acute and Chronic Toxicity to Estuarine/Marine Invertebrates

Study	Test Material	Species	Toxicity Endpoints (µg ai/L)	Classification and MRID
Acute toxicity to estuarine/marine invertebrate	TGAI (93.4%)	Mysid shrimp (*Americamysis bahia*)	96-hr LC_{50} = 1200 NOAEC = 370	Acceptable 48120096
Oyster shell deposition toxicity test	TGAI (93.4%)	Eastern oyster (*Crassostrea virginica*)	96-hr EC_{50} = 520* NOAEC = 110	Acceptable 48120095
Chronic toxicity to estuarine/marine invertebrates	ACR	Eastern oyster (*Crassostrea virginica*)	NOAEC = 167*	ACR
Chronic toxicity to estuarine/marine invertebrates	ACR	Mysid shrimp (*Americamysis bahia*)	NOAEC = 386*	ACR
TGAI – technical grade active ingredient				

Study	Test Material	Species	Toxicity Endpoints (µg ai/L)	Classification and MRID
ACR – acute-to-chronic ratio – see text above table for a description of the calculation *denotes endpoint used in risk quotient calculations				

One water column study was available for the acute toxicity effects to sediment-dwelling midge (*Chironomous riparius*) (Table 25). The study reported lethargy as the only sub-lethal effect. The data indicate that cyantraniliprole is highly toxic (48-hr LC_{50} = 719 µg ai/L) to sediment-dwelling organisms, on an acute exposure basis.

Two chronic toxicity tests were available for the midge (Table 25). MRID 48120092 used spiked sediment while MRID 48120093 used spiked water. The spiked water study was the most sensitive, but was classified as "supplemental" because of its methodology (Agency guidelines require spiked sediment, not spiked water). In addition, there was a solvent effect in the emergence endpoint. Other endpoints (development rate and time) were not affected by the solvent, and were compared directly to the negative control as stipulated by Agency guidelines. Therefore, these endpoints are considered scientifically sound and were chosen for use in the risk assessment because they are more sensitive than those presented in the "acceptable" study. No sub-lethal effects were observed in either spiked water or sediment studies.

Table 25. Summary of Acute and Chronic Toxicity to Sediment-Dwelling Organisms

Study	Test Material	Species	Toxicity Endpoint (µg ai/L)	Classification and MRID
Acute toxicity to sediment-dwelling organisms	TGAI (93.4%)	Midge (*Chironomus riparius*)	48-hr LC_{50} = 719* NOAEC <395	Acceptable 48120094
Chronic toxicity to sediment-dwelling organisms	TGAI (93.4%)	Midge (*Chironomus riparius*)	NOAEC =10* LOAEC >10 Based on development rate and time	Supplemental 48120093
Chronic toxicity to sediment-dwelling organisms	TGAI (93.4%)	Midge (*Chironomus riparius*)	NOAEC =19 LOAEC >19 Based on adult emergence	Acceptable 48120092
TGAI – technical grade active ingredient *denotes endpoint used in risk quotient calculations				

c. Aquatic Plants

One vascular aquatic plant study with duckweed (*Lemna gibba*) was submitted (Table 26). The 7-day EC_{50} was non-definitive (>12100 µg ai/L) and was based on inhibition of frond count, biomass, and growth rate. The most sensitive NOAEC (1000 µg ai/L) was associated with frond count and its corresponding growth rate.

Four studies were submitted for toxicological effects to non-vascular aquatic plants with technical-grade cyantraniliprole (Table 26). These studies included a cyanobacteria (blue-green algae; *Anabaena flos-aquae)*, a freshwater diatom (*Navicula pelliculosa*), a green algae (*Pseudokirchneriella subcapitata*), and a marine diatom (*Skeletonema costatum*). All of the EC_{50} values were non-definitive (ranging from >10000 to >15000 µg ai/L) and were based on inhibition of cell count and biomass. Three of the studies with were classified as "supplemental" because either the test duration was 72 hours versus 96 (MRID 48120107) (green algae), or precipitate was noted in the highest concentration of test solution (MRIDs 48122541, 48122542) (cyanobacteria and estuarine/marine diatoms). Measured samples from the studies containing precipitate were not centrifuged or filtered prior to analysis; thus there is uncertainty as to the amount of cyantraniliprole that was biologically available (dissolved) in the solution. Cell density was the most sensitive endpoint for the marine diatom and cyanobacteria with an EC_{50} >10000 and >15000 µg total ai/L, respectively, where inhibition ranged from 30 to 39 % in the highest concentration tested. Precipitate was not observed in the green algae and freshwater diatom studies with an EC_{50} >13000 and >14000 µg ai/L, respectively. These endpoints are similar to the studies containing precipitate and support the claim that the EC_{50} is greater than the solubility limit of the test material (*i.e.*, 14200 µg ai/L).

Five green algae studies were available for cyantraniliprole typical end-use products (Table 26). These yielded EC_{50} values that ranged from 825 to 9900 µg ai/L. The most sensitive endpoint (EC_{50} = 825 µg ai/L) was based on inhibition of cell count. Although this endpoint is more sensitive than the TGAI endpoint, it is generally not used to derive risk quotients. It may be considered in the spray drift analysis, if appropriate. Four of the studies (MRIDs 48120221, 48120416, 48120323, 48432415) were classified as "supplemental" because the test duration was 72 hours instead of 96. This may have resulted in slightly higher endpoints than if the study had been allowed to continue for another 24 hours; however, the endpoints are not expected to be appreciably different and are considered scientifically sound. The other two studies (MRIDs 48432529, 48432415) were classified as "supplemental" because the endpoints were calculated from nominal values, but measurements indicated the test concentrations deviated more than 20% from the nominal concentrations. This may have under-estimated the toxicity endpoints.

Table 26. Summary of Toxicity Data for Vascular and Non-Vascular Plants

Study	Test Material	Species	Toxicity Endpoint (µg ai/L)	Classification and MRID
Toxicity to vascular aquatic plants	TGAI (94.5%)	Duckweed (*Lemna gibba*)	7-day EC_{50} > 12100 NOAEC = 1000	Acceptable 48122543
Toxicity to non-vascular plants	TGAI (94.5%)	Green algae (*Pseudokirchneriella*	72-hr EC_{50} > 13000	Supplemental 48120107

Study	Test Material	Species	Toxicity Endpoint (µg ai/L)	Classification and MRID
		subcapitata)	NOAEC = 3200	
Toxicity to non-vascular plants	TGAI (94.5%)	Blue-green algae (cyanobacteria) (*Anabaena flos-aquae*)	96-hr EC_{50} > 15000 µg total ai/L NOAEC = 15000 µg total ai/L	Supplemental 48122541
Toxicity to non-vascular plants	TGAI (94.5%)	Freshwater diatom (*Navicula pelliculosa*)	96-hr EC_{50} > 14000 NOAEC = 14000	Acceptable 48120157
Toxicity to non-vascular plants	TGAI (94.5%)	Estuarine/marine diatom (*Skeletonema costatum*)	96-hr EC_{50} > 10000 µg total ai/L NOAEC = 1000 µg total ai/L	Supplemental 48122542
Toxicity to non-vascular plants	TEP (10.26%)	Green algae (*Pseudokirchneriella subcapitata*)	72-hr EC_{50} = 1180 NOAEC = 295	Supplemental 48120221
Toxicity to non-vascular plants	TEP (10.26%)	Green algae (*Pseudokirchneriella subcapitata*)	72-hr EC_{50} = 825** NOAEC = 217	Supplemental 48120416
Toxicity to non-vascular plants	TEP (18.66%)	Green algae (*Pseudokirchneriella subcapitata*)	72-hr EC_{50} = 7370 NOAEC = 4040	Supplemental 48120323
Toxicity to non-vascular plants	TEP (20.6%) Other ai – thiamethoxam (20.6%)	Green algae (*Pseudokirchneriella subcapitata*)	96-hr EC_{50} = 9900 NOAEC = 660	Supplemental 48432529
Toxicity to non-vascular plants	TEP (40.7%)	Green algae (*Pseudokirchneriella subcapitata*)	72-hr EC_{50} = 6500 NOAEC < 407	Supplemental 48432415

TGAI – technical grade active ingredient
TEP – typical end-use product
**may be considered in spray drift analysis

2. Terrestrial Effects Characterization

a. Terrestrial Animals

Birds

Four acute oral toxicity studies of birds were submitted for cyantraniliprole; one bobwhite quail (*Colinus virginianus*) and one zebra finch (*Poephila guttata*) study were conducted with technical grade cyantraniliprole; two quail studies were conducted with typical end-use products (Table 27). All LD_{50} values were non-definitive; no sub-lethal effects were observed. Based on the acute oral toxicity studies, cyantraniliprole is classified as practically non-toxic to moderately toxic to avian species on an acute oral exposure basis. Similarly, two sub-acute dietary studies were submitted with northern bobwhite quail and mallard ducks (*Anas platyrhynchos*). These studies resulted in non-definitive values and did not exhibit any sub-lethal effects. Based on the LC_{50} values, cyantraniliprole is practically non-toxic to birds on a sub-acute dietary exposure basis.

Two avian reproduction studies were submitted to determine the effects of cyantraniliprole on a chronic basis (Table 27). Mallard duck and northern bobwhite quail were tested; no effects were observed in either study up to the highest dietary level tested, *i.e.*, 1000 mg ai/kg diet. The NOAEC was set at the highest test concentration tested and the LOAEC was determined to be above this concentration.

Table 27. Summary of Acute and Chronic Toxicity to Birds

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
Acute avian oral toxicity	TGAI (93.3%)	Northern bobwhite quail (*Colinus virginianus*)	LD_{50} >2250 mg ai/kg-bw NOAEC = 2250 mg ai/kg-bw	Acceptable 48120153
Acute avian oral toxicity	TGAI (94.5%)	Zebra finch (*Poephila guttata*)	LD_{50} >2250 mg ai/kg-bw NOAEC = 2250 mg ai/kg-bw	Acceptable 48120171
Acute avian oral toxicity	TEP (10.26%)	Northern bobwhite quail (*Colinus virginianus*)	LD_{50} >230.85 mg ai/kg-bw NOAEC = 230 mg ai/kg-bw	Acceptable 48120218
Acute avian oral toxicity	TEP (18.66%)	Northern bobwhite quail (*Colinus virginianus*)	LD_{50} >376.9 mg ai/kg-bw NOAEC = 376.9 mg ai/kg-bw	Acceptable 48120305
Acute avian dietary toxicity	TGAI (93.3%)	Northern bobwhite quail (*Colinus virginianus*)	LC_{50} >5620 mg ai/kg-diet NOAEC = 5620 mg ai/kg-diet	Acceptable 48120128
Acute avian dietary toxicity	TGAI (93.3%)	Mallard duck (*Anas platyrhynchos*)	LC_{50} > 5620 mg ai/kg-diet NOAEC = 5620 mg ai/kg-diet	Acceptable 48120127
Chronic avian toxicity	TGAI (93.3%)	Mallard duck (*Anas platyrhynchos*)	NOAEC = 1000* mg ai/kg-diet LOAEC > 1000 mg ai/kg-diet	Acceptable 48120115

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
Chronic avian toxicity	TGAI (93.3%)	Northern bobwhite quail (*Colinus virginianus*)	NOAEC = 1000* mg ai/kg-diet LOAEC >1000 mg ai/kg-diet	Acceptable 48120116

TGAI – technical grade active ingredient
TEP – typical end-use product
*denotes endpoint used in risk quotient calculations

Mammals

The acute oral toxicity study for rats (*Rattus norvegicus*) indicated a non-definitive LD_{50} of >5000 mg ai/kg-bw (Table 28). No sub-lethal effects were observed and no mortalities occurred during the test. Based on these results, cyantraniliprole is classified as practically non-toxic to mammals on an acute oral exposure basis.

The two-generation reproduction study in rats was used to quantify the chronic effects of exposure to cyantraniliprole (Table 28). The parent NOAEL (20 mg ai/kg diet; 1.4 mg ai/kg/day) was based on thyroid weight increase and corresponding dose-related increase in the incidence of thyroid follicular epithelial cell hypertrophy/hyperplasia. The offspring NOAEL (200 mg ai/kg diet; 14 mg ai/kg/day) was based on dose-related decreases in organ weights (thymus and spleen) and pup body weight decrease in the F_2 generation. Other effects in offspring included: dehydration, decreased body weight in the F_1 generation at highest dose, decreases in brain weight, and decrease in the F_2 adrenal gland weight. No effects were observed for reproduction and fertility endpoints; thus, the NOAEL was set at the highest concentration tested (20000 mg ai/kg-diet; 1344 mg ai/kg/day).

Table 28. Summary of Acute and Chronic Toxicity for Mammals

Study	Test Material	Species	Toxicity Endpoints	MRID
Acute oral toxicity	TGAI (94.5%)	Rat (*Rattus norvegicus*)	LD_{50} >5000 mg ai/kg-bw	48208417
Two-generation reproduction study	TGAI (94.5)	Rat (*Rattus norvegicus*)	<u>Parent</u> NOAEL =20 ppm (1.4 mg ai/kg/day)* LOAEL =200 ppm (14 mg ai/kg/day) <u>Reproductive and Fertility</u> NOAEL =20000 ppm (1344 mg ai/kg/day) LOAEL >20000 ppm (1344 mg ai/kg/day) <u>Offspring</u> NOAEL = 200 ppm (14 mg ai/kg/day) LOAEL = 2000 ppm (136 mg ai/kg/day)	48119967
TGAI – technical grade active ingredient *denotes value used in risk quotient calculations				

Terrestrial Invertebrates

Given that cyantraniliprole is an insecticide, a disproportionately large number of studies were submitted for terrestrial invertebrates, in comparison with other taxa considered in ecological risk assessments. As a systemic, cross-spectrum chemical, these studies are meant to demonstrate the effects that cyantraniliprole could have on non-target and beneficial insects; studies consider different exposure levels, the nature of the effects, and their persistence. In particular, the honeybee data are tiered and offer information about potential effects to individuals and whole colony effects. As studies become more complex (semi-field and field studies), conclusions are generally qualitative as the numerous variables and lack of replicates do not allow for statistical analysis. The studies are segregated into three sections: honeybees, earthworms, and other terrestrial invertebrates.

Honeybees

One guideline honeybee (acute contact toxicity) and one non-guideline honeybee (oral toxicity) test were submitted for technical-grade cyantraniliprole (Table 29). The LD_{50} values were both non-definitive (contact LD_{50} >0.0934 and oral LD_{50} >0.1055 µg ai/bee); a NOAEC of 0.0234 µg ai/bee was established for the contact test. Lethargy was the only reported sub-lethal effect and mortality was 2% (oral) and 34% (contact) at the highest treatment level. Although both studies resulted in non-definitive endpoints, since the studies did not test higher concentrations of cyantraniliprole, the chemical is classified as highly toxic to terrestrial invertebrates on both an acute oral and acute contact exposure basis.

In addition, acute oral (5 studies) and contact tests (4 studies) were submitted using typical end-use products (Table 29). Contact LD_{50} values ranged from 0.55 to 3.03 µg ai/bee and oral LD_{50} values ranged from 0.116 to 0.92 µg ai/bee for studies with cyantraniliprole as the sole active ingredient. Sub-lethal effects included lethargy and abnormal behavior. The relative toxicity of the technical grade active ingredient to the formulated products is an uncertainty since exposure to the TGAI resulted in non-definitive values. The cyantraniliprole-thiamethoxam formulation study yielded an acute contact LD_{50} of 0.058 µg ai/bee and an acute oral LD_{50} of 0.0062 µg ai/bee indicating that this formulation is more toxic to honeybees than technical cyantraniliprole. Given that thiamethoxam is highly toxic to bees (contact LD_{50} = 0.024 µg ai/bee; oral LD_{50} = 0.005 µg ai/bee), it is likely that the presence of this insecticide is contributing to the overall toxicity of the cyantraniliprole-thiamethoxam formulation (USEPA 2011c, DP391191).

A foliage residues toxicity test (MRID 48120132) was performed to determine a residual contact toxicity duration for treated foliage. Alfalfa foliage was sprayed at a concentration of 0.12 lb ai/A and allowed to age for 3 to 72 hours. The dry foliage was then harvested and placed in test chambers with bees. The RT_{25} was less than 3 hours, indicating that at three hours after application, there was less than 25% mortality in bees coming into contact with treated foliage (actual mortality was ≤13%). Some sub-lethal effects were observed (loss of equilibrium, immobility, lethargy), but these represented less than 2% of the bees in the treatment groups. The results of this test are only applicable to contact toxicity.

Multiple semi-field and field studies were performed with the honeybee. All of the studies were classified as "supplemental" because they contained methodological inconsistencies; however, it was felt that some useful information could be gleaned from the studies. The most serious methodological problems with the studies are that 1) they did not include replication such that potential treatment effects could be statistically tested, and 2) that study colonies were apparently monitored in areas (following treatment) that did not appear to provide adequate forage and as a result, the colonies started to falter. Although the decline in colony strength was attributed by the study authors to colony overwintering, the declines were apparently in advance of when colonies would typically be adapting for winter. While it is likely that colonies will lose some bees (primarily drones) and that brood production will drop substantially as colonies prepare for overwintering, the basic number of workers should not decline. Colonies will lose workers during the overwintering process depending on weather; however, in some of the submitted field studies the colonies were showing declines by August, well before the colonies should have been preparing to overwinter. This makes it difficult to discern even qualitative differences between the treatment groups and controls in the submitted studies.

In many studies, the design placed six honeybee colonies per acre, which may be high, depending on floral resources. Across studies, the extent to which the study fields were in bloom was usually not clear. Also, given the early spring time frame in which some of the studies were conducted, agricultural crops may not have been flowering but there may have been flowering trees that could have served as alternative forage for the study bees. Weather was also a factor that influenced the extent to which bees were foraging in the study; in at least one study, bees were not foraging at all after treatments presumably because of weather conditions. If this is the case, then it is unclear whether these weather events may have also reduced the residue levels on the treated crops (*e.g.*, rain showers).

Applications of 0.0089 or 0.089 lb ai/A to wheat treated with artificial honeydew (as an attractant) under semi-field conditions (tunnel study) resulted in short-term increases in bee mortality (2 days) and reductions in worker bee foraging activities (MRID 48120135). Reductions in foraging activities persisted through the end of the experiment at 6 days after the application of cyantraniliprole. A second semi-field (tunnel) study (MRID 48120136) applied cyantraniliprole to *phacelia* (*Phacelia tanacetifolia*) at a rate of 0.089 lb ai/A during ($\geq$ 5 bees/m^2) and after bee flight (night). The study indicated that applications made while bees were foraging resulted in short-term [acute] mortality up to one day after the application; there were also changes to behavior and foraging activity. For applications at night, the only observed effect was a reduction in foraging activity when bees became active again. Reductions in foraging activity lasted two days after the application; the study was terminated after the full third day after application. A semi-field (tunnel) study on *phacelia* (MRID 48120138) examined the effects of two applications of cyantraniliprole at 0.0089 or 0.089 lb ai/A. Bee flight was reduced and mortality increased for both treatment groups when applications were made during bloom and active bee foraging. Effects lasted one (0.0089 lb ai/A) to two days (0.089 lb ai/A) after application. Sub-lethal effects, including transient signs of intoxication, repellency and decreased foraging, were observed in both treatment groups. The treatments did not appear to affect brood development.

A study of cyantraniliprole co-formulated with codacide oil applied to *phacelia* under semi-field (tunnel) conditions (MRID 48122539) tested cyantraniliprole at an application rate of 0.134 lb ai/A. The first application was made prior to hives being placed in the tunnels and the second application (15 days later) was made in the evening when bees were not foraging; hives were covered in foil to prevent contamination. The study showed that this application rate increased mortality for two days after treatment and reduced foraging activity for one day after the application. Some symptoms of increased grooming activity and intoxication were also observed on the day after treatment. There were no effects to brood development or colony strength, including brood termination rate (percent of brood that die); however brood development was only measured for 27 days after cyantraniliprole application.

The 0.134 lb ai/A application rate was tested in another study on oilseed rape (*Brassica napus*) under semi-field (tunnel) where the cyantraniliprole was once again co-formulated with codacide oil. Two applications of 0.134 lb ai/A were made prior to crop flowering and hive presence. No treatment-related effects on mortality or foraging activity were observed, although some abnormal behaviors (bees flying at hive entrance and cleaning behavior) were documented (MRID 48122546). Effects on brood development or colony strength were monitored for 28 days after treatment. No differences between the treatments and controls were noted, although the queen was replaced in one of the treatment groups, but it was not considered treatment-related.

Another study where cyantraniliprole was co-formulated with codacide oil and applied to oilseed rape under semi-field (tunnel) conditions (MRID 48122547) reported similar results for mortality and foraging activity as the study discussed in the preceding paragraph. Rates were the same and applications occurred before crop flowering and the introduction of bees into the tunnels. Normal bee behavior was recorded throughout the experiment. For brood and colony strength, observations were made for 27 days; one dead queen was noted in a treatment group, but was not considered treatment-related. Pollen and nectar stores decreased over this time at comparable rates between the treatments and controls, but enough resources remained to support the hive. Colonies treated with the reference item were completely depleted of pollen and nectar.

In a full field study with oilseed rape, cyantraniliprole, co-formulated with codacide oil (MRID 48122551) was tested at application rates of 0.134 lb ai/A (Treatment 1) and 0.011 lb ai/A (Treatment 2). The study noted an increase in mortality (32 dead bees/day in Treatment 1, 17 dead bees/day in Treatment 2, and 7-8 dead bees/day in the control) after the second application of each rate; however, no statistics were employed. Effects lasted one day after application in Treatment 1 and six days after application in Treatment 2. No effects on flight activity were identified; however, low flight activity in the control, possibly induced by cold weather, may have masked an effect in treated colonies. Cramping bees and aggressive behavior towards the observer were noted on the day of the treatment; normal behavior was observed beginning one day after application. The study followed brood development and colony strength for 346 days after treatment. The number of brood cells drastically decreased in all hives between the 27th and 41st day after cyantraniliprole application (percent decrease: controls 19%; Treatment 1 39%; Treatment 2 32%); similarly, total numbers of adult bees decreased from day 54 (June) to day 145 (percent decrease: controls 66%; Treatment 1 58%; and Treatment 2 71%). Decreases began early in the season and likely signified poor foraging conditions for all of the colonies. At the end of overwintering, colony sizes had decreased by a factor of 3.7x (Treatment 1) and a factor of roughly 6x (Treatment 2 and control) compared with hive size at the mid-June measurement the preceding summer. Despite these large decreases in colony strength, the hives survived the winter. All brood and developmental stages were present except in one control hive and one treatment hive (18 hives total in the study).

In another full-field study (MRID 48122553) in oilseed rape, researchers tested the formulated product at same application rates as the preceding study, but applications were made during active bee foraging and at night. There were no changes in mortality after two applications of 0.134 lb ai/A; flight activity could not be quantified because sampling occurred at variable intervals because of cold and rainy weather. For the 0.011 lb ai/A rate, mortality was not affected either, but there was a decrease in flight activity (3 bees/m^2 in treatment group versus 4 bees/m^2 in the control) through the third day after application.

In a study of cyantraniliprole co-formulated with codacide oil in oilseed rape (MRID 48122558), two applications at 0.08 lb ai/A were made. The first treatment occurred before flowering and the introduction of bees into the field. The second application occurred either at night (Treatment 1) or during active bee foraging (Treatment 2). The second application made at night did not increase mortality; however, foraging activity was decreased (0 to 1 bee/m^2 in treatment compared to 2 to 4 bees/m^2 in the control) for three days after application. The second application made during bee flight resulted in a 3-fold increase in mortality, compared with the control, for up to five days after the application. Flight activity was reduced (1 bee/m^2 in treatment compared to 2 to 4 bees/m^2 in the control) for three days after the application. The study evaluated brood and colony health up until the start of overwintering (170 days after application). No differences were noted in brood condition or colony health between the controls and treatment groups.

Another full field study on oilseed rape with cyantraniliprole alone (MRID 48122557) followed the hive through overwintering to the spring (323 days after treatment). Two applications of 0.08 lb ai/A were made. The first occurred before flowering and the introduction of bees into the field. The second application occurred either at night (Treatment 1) or during active bee foraging (Treatment 2). There was no effect on mortality for Treatment 1. Effects on mortality for Treatment 2 (160 dead bees/day in treatment compared to 15 dead bees/day in the control) persisted for 5 days after the second application. Flight activity was not affected for either treatment group; however, differences may have been masked by several days of bad weather. No differences were observed for brood condition or colony health between the control and Treatment 1 (application at night); however, Treatment 2 (application made during bee flight) had a much smaller average size colony (5731 bees) than either Treatment 1 (15308 bees) or the control (14086 bees) at the end of overwintering. In other words, the control colonies increased in numbers of worker bees by roughly 102%; Treatment 1 increased by roughly 3%; and Treatment 2 declined by roughly 37%. Comparing the numbers from the overwintered colonies to those for the colonies originally, *i.e.*, 1 year period, the controls and Treatment 1 had increased by factors of 1.5x and 1.3x, respectively; however, Treatment 2 had declined by a factor of 2.1x. This suggests that the colonies from Treatment 2 were not similar to Treatment 1; however, the reason for this difference is uncertain. Several colonies died during the winter: two controls and one in each treatment group.

A full field study on cyantraniliprole co-formulated with codacide oil on melon (*Cucumis melo*) (MRID 48688806) also tested two applications of 0.08 lb ai/A. For Treatment 1, applications occurred at night – one at the start of flowering and a second application 7 days later. For Treatment 2, applications occurred at the same intervals as Treatment 1, but during active bee foraging periods. No effects were observed on mortality in Treatment 1, but Treatment 2 exhibited an increase in mortality (49 dead bees/day in Treatment 2 compared with 8 dead bees/day in the control) for up to one day after the first application, but no effects after the second. No differences were documented in foraging activity in either treatment, but bad weather conditions may have masked the effects. At the start of the study (29 July 2011), the mean colony sizes were 10795, 10988 and 9157 honeybees in Treatment 1, Treatment 2 and the control, respectively. Colony size quickly declined in all groups over the following observation points, with the lowest mean colony size being observed at 8 September 2011 in all groups, i.e. 3709, 4141 and 1399 honeybees in Treatment 1, Treatment 2 and the control. The study attributes the decline to preparation for overwintering, but the decline occurs earlier in the season than would be expected for this explanation. It is uncertain whether foraging conditions for the hives were sufficient and whether the decline was a result of limited floral resources. Despite this decline, brood number counts after overwintering (202 days after application) were similar to those at the beginning of the study. At the start of the study, all hives (controls and treatments) exhibited ~15% of their combs covered in brood. After overwintering, the percent of combs covered in brood were ~18% for the controls and 23-26% for the treatment groups. Many of the hives in the study were subject to varroa mite infestations during the course of the study.

Another full-field study of cyantraniliprole plus codacide oil applied to oilseed rape also had hives that became infested with *varroa* mites (MRID 48122552). The study tested application rates of 0.134 and 0.011 lb ai/A. The first application was made before flowering and the introduction of bees to the field. The second application occurred during flowering at night (Treatment 1) or during active bee foraging (Treatment 2). An increase in mortality (84 dead bees/day in Treatment 1 compared to 12 dead bees per day in the control) persisted for one day after the second application in Treatment 1. No effects on mortality were seen in Treatment 2. Reductions in flight activity were also documented after the second applications of cyantraniliprole (Treatments 1 and 2 = 1 bee/m^2; control = 4 bees/m^2); effects lasted for one day after treatment. Sub-lethal effects included impaired locomotion and cramping. An additional observation was that hives not exposed to cyantraniliprole (controls) appeared better able to resist the infestation than those hives that were exposed. This suggests that while cyantraniliprole may have limited effects on honeybees by itself, when combined with other real-world stressors, hive health may be affected. The study did not show any effects to brood development or colony strength.

Acute oral toxicity information was available for three of cyantraniliprole's degradates (Table 30). Two of the degradates (IN-HGW87 and IN-J9Z38) may be more toxic on an acute oral exposure basis than the parent, but given that the endpoints were non-definitive, there is uncertainty. Sub-lethal effects (lethargic and moribund bees) were only reported for IN-HGW87 (MRID 48120184). This indicates that two of the cyantraniliprole degradates should be carefully considered for their toxicological effects in addition to the parent.

Several field studies measured residues of cyantraniliprole and its degradates in pollen, honey, wax, and guttation fluid (Table 31). Cyantraniliprole residues were detected in all of the studies; however, the degradate detection was more limited. Only three degradates (IN-J9Z38, IN-HGW87, IN-MYX98) were detected in guttation fluid, despite testing for a larger array of degradates across multiple food items. Of these, toxicity information is available for IN-J9Z38 and IN-HGW87.

Table 29. Summary of Honeybee Toxicity Information

Study	Test Material	Species	Toxicity Endpoint (µg ai/bee)	Classification and MRID
Acute oral and contact toxicity	TGAI (93.4%)	Honeybee (*Apis mellifera*)	Oral 48-hr LD_{50} > 0.1055 Contact 48-hr LD_{50} > 0.0934 NOAEC = 0.0234	Acceptable 48120090
Acute oral and contact toxicity	TEP (10.26%)	Honeybee (*Apis mellifera*)	Oral 48-hr LD_{50} = 0.39 NOAEL = 0.086 Contact 48-hr LD_{50} = 1.2 NOAEL = 0.19	Acceptable 48120113
Acute oral and contact toxicity	TEP (10.26%)	Honeybee (*Apis mellifera*)	Oral 96-hr LD_{50} = 0.92 Contact 48-hr LD_{50} = 3.03 NOAEL < 0.5	Acceptable 48120164
Acute oral and contact toxicity	TEP (18.66%)	Honeybee (*Apis mellifera*)	Oral 96-hr LD_{50} = 0.404 NOAEL = 0.034 Contact 48-hr LD_{50} = 0.55** NOAEL = 0.025	Acceptable 48120137
Acute oral and contact toxicity	TEP (20.6%) Other ai - thiamethoxam	Honeybee (*Apis mellifera*)	Oral 48-hr LD_{50} = 0.0062** Contact 48-hr LD_{50} = 0.058**	Acceptable 48432530
Acute oral toxicity	TEP (20%)	Honeybee (*Apis mellifera*)	Oral 48-hr LD_{50} = 0.116**	Supplemental 48432416

TGAI = technical grade active ingredient
TEP = typical end-use product
**may be considered in spray drift analysis

Table 30. Summary of Select Cyantraniliprole Degradates to Honeybees

Study	Test Material	Species	Toxicity Endpoint (µg/bee)	Classification and MRID
Acute oral toxicity	IN-HGW87 (74.1%)	Honeybee (*Apis mellifera*)	72-hr LD_{50} = 0.298 NOAEL = 0.143	Supplemental 48120184
Acute oral toxicity	IN-HGW87 (74.1%)	Honeybee (*Apis mellifera*)	48-hr LD_{50} > 0.030 NOAEL = 0.030	Supplemental 48122518
Acute oral toxicity	IN-J9Z38 (96.4%)	Honeybee (*Apis mellifera*)	48-hr LD_{50} > 0.00834	Supplemental 48120185
Acute oral toxicity	IN-K5A78 (96.1%)	Honeybee (*Apis mellifera*)	48-hr LD_{50} > 45.61 NOAEC = 45.61	Supplemental 48122514

Table 31. Summary of Cyantraniliprole and Degradate Concentrations Detected in Pollen, Nectar, Wax, Guttation Water, and Honey

Application Rate (lb ai/A)	Cyantraniliprole Residues (mg ai/kg)[1]	Other Degradates (mg ai/kg)[1]	MRID
Foliar oilseed rape 2 at 0.08 (20 days)	Honey = 0.013 Pollen = 0.019 Wax = 0.033 Guttation = 3.092 LOQ = 0.005	<u>Guttation</u> IN-J9Z38 = 0.046 IN-HGW87 = 0.010 IN-MYX98 = 0.008 LOQ = 0.005	48122557
Foliar oilseed rape 2 at 0.08 (16 days)	Honey = 0.020 Pollen = 0.065 Wax = 0.030 Guttation = 0.647 LOQ = 0.005	<u>Guttation</u> IN-J9Z38 = 0.012 IN-HGW87 = 0.008 IN-MYX98 = 0.007 LOQ = 0.005	48122558
Foliar oilseed rape 2 at 0.134 (15 days)	Pollen (median) = 0.025 Honey = 0.005 LOQ = 0.005	Not available	48122553
Foliar oilseed rape 2 at 0.011 (15 days)	Pollen (median) = 0.011 Wax = 0.008 LOQ = 0.005	Not available	48122553
Foliar oilseed rape 2 at 0.134 (17 days)	Honey = 0.005 Pollen = 0.077 LOQ = 0.005	IN-J9Z38 = 0.007 and 0.010 LOQ = 0.005	48122552
Foliar oilseed rape 2 at 0.011 (17 days)	Pollen = 0.042 LOQ = 0.005	Not available	48122552
Foliar oilseed rape 2 at 0.011 (15 days)	Honey (median) = 0.006 Pollen = 0.009 Wax = 0.011 LOQ = 0.005	Not available	48122551
Foliar oilseed rape	Honey (median) = 0.008	Not available	48122551

Application Rate (lb ai/A)	Cyantraniliprole Residues (mg ai/kg)[1]	Other Degradates (mg ai/kg)[1]	MRID
2 at 0.134 (15 days)	Pollen = 0.062 Wax = 0.017 LOQ = 0.005		
Drip irrigated melon 3 at 0.089 (7 days)	Pollen = 0.012 Nectar = 0.026 Guttation = 0.066 LOQ = 0.005	Not available	48122548
LOQ = level of quantification [1]Values reported are maximums unless otherwise stated.			

Other Terrestrial Invertebrates

Data were also available for parasitic wasp (*Aphidius rhopalosiphi*), predatory mites (*Typhlodromus pyri* and *Hypoaspis aculeifer*), rove beetles (*Aleochara bilineata*), ladybird beetles (*Coccinella septempunctata*), green lacewings (*Chrysoperla carnea*), lycosid spiders (*Pardosa spp.*), and collembolan (*Folsomia candida*) (Table 32). These are non-guideline studies and thus were classified as "supplemental" information.

Extended acute toxicity studies for parasitoids were available. Several studies determined the residue concentration (*i.e.*, residues on foliage) that results in 50% mortality for parasitoids (LR_{50}). The 48-hr LR_{50} values for cyantraniliprole ranged from 0.00008 to > 0.004 lb ai/A. In studies where parasitoids were exposed to various aged-residues (MRIDs 48120188 and 48120193), behavioral sub-lethal effects were noted (moribund and lethargic wasps). A study examining the effects of the cyantraniliprole-thiamethoxam residues on wasps (MRID 48432419) found 87.5% morality (2 apps at 0.04 lb ai/A; 14-day interval) and 27.5% mortality (2 apps at 0.004 lb ai/A; 14-day interval) after an exposure period of 48 hours immediately (after spray had dried on the leaves) following the second application of cyantraniliprole. In a study examining the effects of cyantraniliprole on wasp mummies (MRID 48122519), the hatch-rate of adults was not affected up to 0.014 lb ai/A. Several other semi-field studies examined the effects of cyantraniliprole on parasitism rates. MRID 48122501 demonstrated that the parasitism rate was not affected at application rates of 0.002 lb ai/A; whereas, MRIDs 48208411 and 48208412 documented effects a reduction (*i.e.*, decreased reproduction) on parasitism rates at 0.003 to 0.016 lb ai/A.

The effects of cyantraniliprole were evaluated using rove beetles resulting in an LR_{50} >0.027 lb ai/A; no sub-lethal effects were reported in the study. A follow-on residue study (MRID 48208413) demonstrated 100% mortality when rove beetles were exposed to 2-day aged residues at application rates of either 1.25 lb ai/A or 0.89 lb ai/A (7-day interval); however, when residues were aged 30 and 85 days, no effects were observed. The ladybird beetle yielded a LR_{50} of 0.039 to 0.055 lb ai/A; no reproductive effects were noted. A residue study (MRID 48120199) showed 66.7% mortality in ladybird beetles exposed to freshly dried residues of cyantraniliprole (10.26%). Effects on survival and reproduction were less than 50% after 14 and 28 days of residue aging. Another aged residue test (MRID 48120192) demonstrated no mortality or reproductive effects when ladybird beetles were exposed to 14 or 28 day aged residues (2 applications at 0.134 lb ai/A, 7-day interval); exposures occurred after the second application of cyantraniliprole.

Acute contact toxicity studies were provided for the predatory mite. These studies present various concentrations of dried residues to mites for 7 to 14 day exposure periods. The route of exposure is through physical contact. The acute contact toxicity of cyantraniliprole to predatory mites ranged from LR_{50} >0.205 to >0.267 lb ai/A. Contact toxicity with the cyantraniliprole-thiamethoxam product was LR_{50} >0.092 lb ai/A. Toxicity was measured with the soil mite. Mites were exposed for 14 days to soil with various concentrations of cyantraniliprole. The EC_{50} was greater than1000 mg ai/kg-soil, based on mortality and reproductive effects; no sub-lethal effects were reported. Toxicity data were available for several degradates too (see Table 32). All toxicity values were non-definitive, but several were lower (EC_{50} >100 mg ai/kg-soil) than the parent.

Several field studies were available for predatory mites as well. There was no significant reduction (≥50%) in the mite population after two cyantraniliprole applications of 0.134 lb ai/A (7-day interval) (MRID 48120189). Another mite study (MRID 48120190) exhibited similar results after testing the same rate with a 14-day application interval).

Toxicity data were available for the green lacewing. The LR_{50} ranged from 0.198 to 0.232 lb ai/A and a decrease in hatching rate was seen at concentrations greater than 0.154 lb ai/A. MRID 48120198 found no effects on mortality or reproduction on the day of application or 14 days later when two applications of 0.009 lb ai/A (7-day interval) were applied. Another residue test (MRID 48120191) found no mortality or reproductive effects when lacewings were exposed to aged residues (2 applications at 0.134 lb ai/A, 7-day interval). Lacewings were placed with residues that had been aged for various periods of time and they were followed through pupation, to adult, through 7 days after egg lying.

A number of studies were available for collembola. An EC_{50} was established at >1200 mg ai/kg-soil (no sub-lethal effects) for cyantraniliprole. A field study (MRID 48208453) showed a statistically significant ($p<0.05$) reduction in various species of collembola for up to 88 days after applying two applications of up to 1.25 lb ai/A (7-day interval). Toxicity studies for degradates also were available (see entries in Table 32). Most of the toxicity values were non-definitive; therefore, it is not possible to determine the relative toxicity to the parent compound Two degradates (IN-QKV54 and IN-RNU71) yielded definitive toxicity values that were much more toxic than the parent (EC_{50} = 98.3 and 20.3 mg ai/kg-soil, respectively).

A litterbag study with micro arthropods was conducted (MRID 48208451). Soil was treated with cyantraniliprole and then the microarthropods were sampled at 92 and 143 days after the treatment. The study showed that an application of 0.047 lb ai/A followed by an application of 0.267 lb ai/ A (11-day interval) had no effect on the abundance of micro arthropods in the soil.

The lycosid spider yielded a LR_{50} of >0.356 lb ai/A with no sub-lethal effects reported.

Table 32. Summary of Acute and Chronic Toxicity Data for Terrestrial Arthropods

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
Acute toxicity to parasitoid	TEP (18.66%)	Parasitic wasp (*Aphidius rhopalosiphi*)	48-hr LR_{50} = 0.0003 lb ai/A 48-hr ER_{50} = 0.0003 lb ai/A	Supplemental 48120155
Acute toxicity to parasitoid	TEP (10.26%)	Parasitic wasp (*Aphidius rhopalosiphi*)	48-hr LR_{50} = 0.00009 lb ai/A	Supplemental 48120130
Acute toxicity to parasitoid	TEP (10.26%)	Parasitic wasp (*Aphidius rhopalosiphi*)	48-hr LR_{50} = 0.00008 lb ai/A 48-hr ER_{50} > 0.0001 lb ai/A	Supplemental 48120163
Extended acute toxicity to parasitoid	TEP (10.26%)	Parasitic wasp (*Aphidius rhopalosiphi*)	48-hr LR_{50} = 0.001 lb ai/A	Supplemental 48120161
Extended acute toxicity to parasitoid	TEP (10.26%)	Parasitic wasp (*Aphidius rhopalosiphi*)	LR_{50} >0.004 lb ai/A ER_{50} > 0.392 lb ai/A	Supplemental 48122516
Extended acute toxicity to parasitoid	TEP (10.26%)	Parasitic wasp (*Aphidius rhopalosiphi*)	48-hr LR_{50} = 0.002 lb ai/A 48-hr ER_{50} > 0.001 lb ai/A	Supplemental 48120168
Extended acute toxicity to parasitoid	TEP (10.26%)	Parasitic wasp (*Aphidius rhopalosiphi*)	48-hr LR_{50} >0.002 lb ai/A 48-hr ER_{50} <0.002 lb ai/A	Supplemental 48122517
Extended acute toxicity to parasitoid	TEP (20%) with thiamethoxam (20%)	Parasitic wasp (*Aphidius rhopalosiphi*)	48-hr LR_{50} = 0.0037 lb ai/A NOAEC = 0.0001 lb ai/A (based on mortality)	Supplemental 48432417
Residue toxicity to parasitoid	TEP (10.26%)	Parasitic wasp (*Aphidius rhopalosiphi*)	Fresh-dried residues 48-hr LR_{50} = 0.018 lb ai/A 48-hr ER_{50} >0.017 lb ai/A Aged residues 48-hr ER_{50} >0.017 lb ai/A	Supplemental 48663805
Acute toxicity to predatory mite	TEP (10.26%)	Predatory mite (*Typhlodromus pyri*)	7-d LR_{50} > 0.205 lb ai/A	Supplemental 48120129
Acute toxicity to predatory mite	TEP (18.66%)	Predatory mite (*Typhlodromus	7-d LR_{50} >0.205 lb ai/A 14-d ER_{50} >0.205	Supplemental 48120154

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
		pyri)	lb ai/A	
Acute toxicity to predatory mite	TEP (10.26%)	Predatory mite (*Typhlodromus pyri*)	7-d LR_{50} >0.267 lb ai/A 14-d ER_{50} >0.267 lb ai/A	Supplemental 48120162
Acute contact toxicity to predatory mite	TEP (20%) with thiamethoxam	Predatory mite (*Typhlodromus pyri*)	7-day LR_{50} >0.091 lb ai/A NOAEC = 0.091 lb ai/A	Supplemental 48432418
Reproduction effects on predatory mite	TGAI (94.5%)	Predatory mite (*Hypoaspis aculeifer*)	14-day EC_{50} > 1000 mg ai/kg-soil 14-day LC_{50} > 1000 mg ai/kg-soil NOAEC = 1000 mg ai/kg-soil	Supplemental 48120183
Reproduction effects on predatory mite	Degradate IN-J9Z38 (97.2%)	Predatory mite (*Hypoaspis aculeifer*)	14-day LC_{50} > 1000 mg IN-J9Z38/kg-soil 14-day EC_{50} > 1000 mg IN-J9Z38/kg-soil NOAEC = 1000 mg IN-J9Z38/kg-soil	Supplemental 48122511
Reproduction effects on predatory mite	Degradate IN-JCZ38 (94.4%)	Predatory mite (*Hypoaspis aculeifer*)	14-day LC_{50} > 1000 mg IN-JCZ38/kg-soil 14-day EC_{50} > 1000 mg IN-JCZ38/kg-soil NOAEC = 1000 mg IN-JCZ38/kg-soil	Supplemental 41822504
Reproduction effects on predatory mite	Degradate IN-JSE76 (93.8%)	Predatory mite (*Hypoaspis aculeifer*)	14-day LC_{50} > 1000 mg IN-JSE76/kg-soil 14-day EC_{50} > 1000 mg IN-JSE76/kg-soil NOAEC = 1000 mg IN-JSE76/kg-soil	Supplemental 48122510
Reproduction effects on predatory mite	Degradate IN-K5A77 (92.3%)	Predatory mite (*Hypoaspis aculeifer*)	14-day LC_{50} > 1000 mg IN-K5A77/kg-soil 14-day EC_{50} > 1000 mg IN-K5A77/kg-soil NOAEC = 1000 mg IN-K5A77/kg-soil	Supplemental 48120197
Reproduction effects on	Degradate IN-K5A78 (96.5%)	Predatory mite	14-day LC_{50} > 1000 mg IN-	Supplemental

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
predatory mite		(*Hypoaspis aculeifer*)	K5A78/kg-soil 14-day EC_{50} > 1000 mg IN-K5A78/kg-soil NOAEC = 1000 mg IN-K5A78/kg-soil	48122507
Reproduction effects on predatory mite	Degradate IN-K5A79 (84.4%)	Predatory mite (*Hypoaspis aculeifer*)	14-day LC_{50} > 1000 mg IN-K5A79/kg-soil 14-day EC_{50} > 1000 mg IN-K5A79/kg-soil NOAEC = 1000 mg IN-K5A79/kg-soil	Supplemental 48122506
Reproduction effects on predatory mite	Degradate IN-PLT97 (87.0%)	Predatory mite (*Hypoaspis aculeifer*)	14-day LC_{50} > 1000 mg IN-PLT97/kg-soil 14-day EC_{50} > 1000 mg IN-PLT97/kg-soil NOAEC = 1000 mg IN-PLT97/kg-soil	Supplemental 48120196
Reproduction effects on predatory mite	Degradate IN-QKV54 (98.1%)	Predatory mite (*Hypoaspis aculeifer*)	14-day EC_{50} >100 mg IN-QKV54/kg-soil NOAEC = 100 mg IN-QKV54/kg-soil	Supplemental 48208415
Reproduction effects on predatory mite	Degradate IN-RNU71 (92.4%)	Predatory mite (*Hypoaspis aculeifer*)	14-day EC_{50} >100 mg IN-RNU71/kg-soil NOAEC = 100 mg IN-RNU71/kg-soil	Supplemental 48208414
Acute toxicity to beetle	TEP (18.66%)	Rove beetle (*Aleochara bilineata*)	LR_{50} > 0.027 lb ai/A ER_{50} = 0.05 lb ai/A	Supplemental 48120165
Acute toxicity to beetle	TEP (10.26%)	Ladybird beetle (*Coccinella septempunctata*)	12-day LR_{50} = 0.055 lb ai/A	Supplemental 48120160
Extended laboratory test on ladybird beetle	TEP (10.26%)	Ladybird beetle (*Coccinella septempunctata*)	12-day LR_{50} = 0.039 lb ai/A	Supplemental 48120170
Extended toxicity to green lacewing	TEP (10.26%)	Green lacewing (*Chrysoperla carnea*)	12-day LR_{50} = 0.232 lb ai/A	Supplemental 48120159
Extended toxicity to green lacewing	TEP (10.26%)	Green lacewing (*Chrysoperla*	12-day LR_{50} = 0.189 lb ai/A	Supplemental 48120169

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
		carnea)		
Acute toxicity to spider	TEP (18.66%)	Lycosid spider (*Pardosa spp.*)	14-day LR_{50} > 0.356 lb ai/A	Supplemental 48120166
Extended toxicity to collembola	TGAI (94.5%)	Collembola (*Folsomia candida*)	28-day EC_{50} > 1200 mg/kg-soil NOAEC 0.0800 mg/kg-soil	Supplemental 48122530
Extended toxicity to collembola	Degradate IN-J9Z38 (97.2%)	Collembola (*Folsomia candida*)	28-day LC_{50} > 1000 mg IN-J9Z38/kg-soil 28-day EC_{50} > 1000 mg IN-J9Z38/kg-soil NOAEC = 500 mg IN-J9Z38/kg-soil (based on mortality)	Supplemental 48122512
Extended toxicity to collembola	Degradate IN-JCZ38 (94.4%)	Collembola (*Folsomia candida*)	28-day LC_{50} > 48 mg IN-JCZ38/kg-soil 28-day EC_{50} = 47.25 mg IN-JCZ38/kg-soil NOAEC = 12 mg IN-JCZ38/kg-soil (based on reproduction)	Supplemental 48122505
Extended toxicity to collembola	Degradate IN-JSE76 (93.8%)	Collembola (*Folsomia candida*)	28-day LC_{50} > 250 mg IN-JSE76/kg-soil 28-day EC_{50} > 250 mg IN-JSE76/kg-soil NOAEC = 250 mg IN-JSE76/kg-soil	Supplemental 48122513
Extended toxicity to collembola	Degradate IN-K5A77 (92.3%)	Collembola (*Folsomia candida*)	28-day LC_{50} > 1000 mg IN-K5A77/kg-soil 28-day EC_{50} > 1000 mg IN-K5A77/kg-soil NOAEC < 62.5 mg IN-K5A77/kg-soil (based on mortality and reproduction)	Supplemental 48120194
Extended toxicity to collembola	Degradate IN-K5A78 (96.5%)	Collembola (*Folsomia candida*)	28-day LC_{50} > 1000 mg IN-K5A78/kg-soil 28-day EC_{50} > 1000 mg IN-K5A78/kg-soil	Supplemental 48122509

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
			NOAEC = 1000 mg IN-K5A78/kg-soil	
Extended toxicity to collembola	Degradate IN-K5A79 (84.4%)	Collembola (*Folsomia candida*)	28-day LC_{50} >125 mg IN-K5A79/kg-soil 28-day EC_{50} > 125 mg IN-K5A79/kg-soil NOAEC = 125 mg IN-K5A79/kg-soil	Supplemental 48122508
Extended toxicity to collembola	Degradate IN-PLT97 (87.0%)	Collembola (*Folsomia candida*)	28-day LC_{50} > 1000 mg IN-PLT97/kg-soil 28-day EC_{50} > 1000 mg IN-PLT97/kg-soil NOAEC = 1000 mg IN-PLT97/kg-soil	Supplemental 48120195
Extended toxicity to collembola	Degradate IN-QKV54 (98.3%)	Collembola (*Folsomia candida*)	28-day EC_{50} = 98.3 IN-QKV54/kg-soil NOAEC = 98.3 IN-QKV54/kg-soil	Supplemental 48122573
Extended toxicity to collembola	Degradate IN-RNU71 (92.4%)	Collembola (*Folsomia candida*)	28-day LC_{50} = 20.3 mg IN-RNU71/kg-soil 28-day EC_{50} = 18.77 mg IN-RNU71/kg-soil NOAEC = 12.5 mg IN-RNU71/kg-soil (based on reproduction)	Supplemental 48122574
TEP = typical end-use product TGAI = technical grade active ingredient				

Earthworms

Several studies measured the acute toxicity of cyantraniliprole and its typical end-use products to earthworms (*Eisenia fetida*; Table 33). The LC_{50} values were all non-definitive and ranged from >102.6 to >1030 mg ai/kg-soil, including formulations with thiamethoxam. The only sub-lethal effect observed was biomass loss in the cyantraniliprole-thiamethoxam product. Two reproduction studies with TGAI showed the NOAEC to be the highest dose tested (956 mg ai/kg-soil); tests with TEP resulted in a NOAEC of 102.6 mg ai/kg-soil. No adverse effects were observed on earthworms using either the TGAI or TEP at the maximum soil concentrations tested. Degradates were also tested for their acute and reproductive/growth toxicity. All endpoints were non-definitive and again, no adverse effects were observed at the highest soil concentrations tested.

Table 33. Summary of Toxicity Data for Earthworms

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
Acute toxicity to earthworm	TGAI (94.5%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} >945 mg ai/kg-soil NOAEC = 945 mg ai/kg-soil	Acceptable 48120158
Acute toxicity to earthworm	TEP (18.66%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} >186.6 mg ai/kg-soil NOAEC = 186.6 mg ai/kg-soil	Acceptable 48120322
Acute toxicity to earthworm	TEP (10.26%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} >102.6 mg ai/kg-soil NOAEC = 102.6 mg ai/kg-soil	Acceptable 48120219
Acute toxicity to earthworm	TEP (40.7%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} >1017.5 mg ai/kg-soil NOAEC = 1017.5 mg ai/kg-soil	Acceptable 48432420
Acute toxicity to earthworm	TEP (20.6%) with thiamethoxam	Earthworm (*Eisenia fetida*)	14-day LC_{50} >1030 mg ai/kg-soil NOAEC = 128.8 mg ai/kg-soil	Acceptable 48432531
Reproduction and growth effects on earthworm	TGAI (94.5%)	Earthworm (*Eisenia fetida*)	56-day NOAEC = 945 mg ai/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120167
Reproduction and growth effects on earthworm	TEP (10.26%)	Earthworm (*Eisenia fetida*)	28-day LC_{50} > 102.6 mg ai/kg-soil 56-day NOAEC = 102.6 mg ai/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120216
Degradates				
Acute toxicity to earthworm	Degradate IN-J9Z38 (96.4%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} > 964 mg IN-J9Z38/kg-soil NOAEC = 964 mg IN-J9Z38/kg-soil	Acceptable 48120122
Acute toxicity to earthworm	Degradate IN-JCZ38 (92.1%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} > 921 mg IN-JCZ38/kg-soil	Acceptable 48120123

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
			NOAEC = 921 mg IN-JCZ38/kg-soil	
Acute toxicity to earthworm	Degradate IN-JSE76 (93.8%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} > 938 mg IN-JSE76/kg-soil NOAEC = 938 mg IN-JSE76/kg-soil	Acceptable 48120144
Acute toxicity to earthworm	Degradate IN-K5A77 (95.3%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} > 953 mg IN-K5A77/kg-soil NOAEC = 953 mg IN-K5A77/kg-soil	Acceptable 48120126
Acute toxicity to earthworm	Degradate IN-K5A78 (94.9%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} > 949 mg IN-K5A78/kg-soil NOAEC = 949 mg IN-K5A78/kg-soil	Acceptable 48120141
Acute toxicity to earthworm	Degradate IN-K5A79 (84.4%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} > 844 mg IN-K5A79/kg-soil NOAEC = 844 mg IN-K5A79/kg-soil	Acceptable 48120150
Acute toxicity to earthworm	Degradate IN-PLT97 (87.0%)	Earthworm (*Eisenia fetida*)	14-day LC_{50} > 870 mg IN-PLT97/kg-soil NOAEC = 870 mg IN-PLT97/kg-soil	Acceptable 48120149
Reproduction and growth effects on earthworm	Degradate IN-J9Z38 (97.2%)	Earthworm (*Eisenia fetida*)	56-day NOAEC = 1000 mg IN-J9Z38/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120176
Reproduction and growth effects on earthworm	Degradate IN-JCZ38 (94.4%)	Earthworm (*Eisenia fetida*)	56-day NOAEC = 1000 mg IN-JCZ38/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120180
Reproduction and growth effects on earthworm	Degradate IN-JSE76 (93.8%)	Earthworm (*Eisenia fetida*)	56-day NOAEC = 938 mg IN-JSE76/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120181
Reproduction and growth effects on	Degradate IN-K5A77 (92.3%)	Earthworm	56-day NOAEC = 923 mg IN-	Supplemental

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
earthworm		(*Eisenia fetida*)	K5A77/kg-soil Based on no mortality or changes in growth and reproduction.	48120182
Reproduction and growth effects on earthworm	Degradate IN-K5A78 (96.5%)	Earthworm (*Eisenia fetida*)	56-day NOAEC = 1000 mg IN-K5A78/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120179
Reproduction and growth effects on earthworm	Degradate IN-K5A79 (84.4%)	Earthworm (*Eisenia fetida*)	56-day NOAEC = 1000 mg IN-K5A79/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120178
Reproduction and growth effects on earthworm	Degradate IN-PLT97 (87.0%)	Earthworm (*Eisenia fetida*)	56-day NOAEC = 1000 IN-PLT97/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48120177
Reproduction and growth effects on earthworm	Degradate IN-QKV54 (98.3%)	Earthworm (*Eisenia fetida*)	28-day LC_{50} > 98.3 mg IN-QKV54/kg-soil 56-day NOAEC = 98.3 mg IN-QKV54/kg-soil Based on no mortality or changes in growth and reproduction.	Supplemental 48122520
Reproduction and growth effects on earthworm	Degradate IN-RNU71 (92.4%)	Earthworm (*Eisenia fetida*)	28-day LC_{50} > 92.4 mg IN-RNU71/kg-soil 56-day NOAEC = 92.4 mg IN-RNU71/kg-soil Based on no mortality or changes in growth and reproduction	Supplemental 48122522
TEP = typical end-use product				

Study	Test Material	Species	Toxicity Endpoint	Classification and MRID
TGAI = technical grade active ingredient				

b. Terrestrial Plants

Results of the seedling emergence and vegetative vigor studies of various monocotyledonous and dicotyledonous plants used in agriculture indicated that the EC_{25} values are greater than the maximum application rate tested, i.e., EC_{25}>0.134 lbs ai/A (Table 34) using the technical end-product containing 10.26% active ingredient. The application rate of 0.134 lb ai/A used in the studies is one of the single maximum application rates proposed for use for many of the agricultural crops. The monocot NOAEC in vegetative vigor study (MRID 48120186) was based on decreased plant height. None of the other endpoints measured in the study had statistically significant differences from controls. The "supplemental" studies are classified as such because the controls of several of the species in each study failed to meet germination requirements or exhibited visual signs of ill-health. Only endpoints from species that had controls that performed well are considered in this risk assessment.

Table 34. Summary of Toxicity Data for Terrestrial Plants

Study	Test Material	Species	Toxicity Endpoint (lb ai/A)	Classification and MRID
Seedling emergence test	TEP (10.26%)	Corn (*Zea mays*), Cucumber (*Cucumis sativa*), oilseed rape (*Brassica napus*), soybean (*Glycine max*),	Monocot (corn) EC_{25} >0.134 NOAEC = 0.134* Dicot (all others) EC_{25} >0.134 NOAEC = 0.134*	Supplemental 48122575
Vegetative vigor test	TEP (10.26%)	Corn (*Zea mays*), oat (*Avena sativa*), ryegrass (*Lolium perenne*) Oilseed rape (*Brassica napus*), pea (*Pisum sativum*), soybean (*Glycine max*)	Monocot (all) EC_{25} >0.134 Dicot (all) EC_{25} >0.134	Supplemental 48120173
Vegetative vigor test	TEP (10.26%)	Onion (*Allium cepa*) Cucumber (*Cucumis sativa*), sugar beet (*Beta vulgaris*)	Monocot (onion) EC_{25} >0.134 NOAEC = 0.067* Dicot (cucumber, sugar beet) EC_{25} >0.134 NOAEC = 0.134*	Acceptable 48120186
TEP – typical end-use product *denotes endpoint used in risk quotient calculations				

IV. Risk Characterization

A. Risk Estimation - Integration of Exposure and Effects Data

Toxicity data and exposure estimates discussed in the preceding sections are used to evaluate the potential for adverse ecological effects on non-target species. For this screening-level assessment of cyantraniliprole, the deterministic risk quotient (RQ) method is used to provide a metric of potential risks. The RQ is a comparison of exposure estimates to toxicity endpoints; EECs are divided by acute and chronic toxicity values. The resulting unitless RQs are then compared to the Agency's levels of concern (LOCs) (see Appendix H), which are the Agency's interpretive policy such that when LOCs are exceeded, the need for regulatory action may be considered. The LOCs are used to indicate when the use of a pesticide, as directed on the label, has the potential to cause adverse effects on non-target organisms.

1. Non-target Aquatic Animals and Plants

Aquatic Animals

Cyantraniliprole is classified as "slightly to moderately toxic" to freshwater fish on an acute exposure basis. Only non-definitive data were available for cyantraniliprole TGAI, thus risk quotients were not calculated. Toxicity tests with TEP yielded definitive toxicity values that were more sensitive than cyantraniliprole TGAI, but these will be discussed in the Risk Description section. Risk quotients calculated for chronic exposures to cyantraniliprole ranged from <0.001 to 0.003 and were all well below the chronic risk to listed and non-listed species LOC of 1. Therefore, the likelihood of adverse effects to freshwater fish and by extension to aquatic-phase amphibians for which freshwater fish serve as surrogates from chronic exposure to cyantraniliprole is considered low (Table 35).

Cyantraniliprole is classified as "slightly toxic" to estuarine/marine fish on an acute exposure basis. Chronic and acute toxicity data were non-definitive, thus risk quotients were not calculated. A further description of the acute and chronic risks can be found in the Risk Description section. Therefore, the likelihood of adverse effects from either acute or chronic exposure to cyantraniliprole is considered low.

Table 35. RQs for Chronic Freshwater Fish (Based on Surface Water EECs)

Uses/Application Rate	60-day EEC (µg/L)	Freshwater Fish Chronic RQ*
Brassica vegetable - 1 app at 0.4 lb ai/A (C)	22.19	0.002
Brassica leafy vegetable – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (A)	20.66	0.002
Brassica leafy vegetable – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (G)	16.75	0.002
Brassica leafy vegetables – 3 apps at 0.133 lb ai/A (5 days) (A)	16.64	0.002

Uses/Application Rate	60-day EEC (µg/L)	Freshwater Fish Chronic RQ*
Brassica leafy vegetables – 3 apps at 0.133 lb ai/A (5 days) (G)	12.65	0.001
Bushberries – 3 apps at 0.133 lb ai/A (5 days) (A)	13.17	0.001
Bushberries – 3 apps at 0.133 lb ai/A (5 days) (G)	8.64	0.001
Citrus – 3 apps at 0.133 lb ai/A (7 days) (A)	15.30	0.001
Citrus – 3 apps at 0.133 lb ai/A (7 days) (G)	13.34	0.001
Citrus – 1 app at 0.4 lb ai/A (C)	9.98	0.001
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (CA cotton)	8.98	0.001
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (CA cotton)	5.96	0.001
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (MS cotton)	28.50	0.003
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (MS cotton)	26.44	0.002
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (NC cotton)	37.42	0.003
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (NC cotton)	35.06	0.003
Cucurbits – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A)	31.82	0.003
Cucurbits – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G)	30.57	0.003
Cucurbits – 2 apps at 0.13 lb ai/A (10 days) (C)	4.21	<0.001
Cucurbits – 1 app at 0.4 lb ai/A (C)	7.91	0.001
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (FL peppers)	14.56	0.001
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (FL peppers)	12.65	0.001
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (CA tomato)	15.50	0.001
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (CA tomato)	12.70	0.001
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (FL tomato)	24.67	0.002
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (FL tomato)	23.10	0.002
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (PA tomato)	27.95	0.003
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (PA tomato)	24.71	0.002
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (FL peppers)	4.38	<0.001
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (CA tomato)	1.40	<0.001
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (FL tomato)	9.78	0.001

Uses/Application Rate	60-day EEC (µg/L)	Freshwater Fish Chronic RQ*
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (PA tomato)	12.43	0.001
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (FL peppers)	25.00	0.002
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (CA tomato)	0.27	<0.001
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (FL tomato)	16.08	0.002
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (PA tomato)	10.87	0.001
Leafy vegetables – 1 app at 0.4 lb ai/A (C)	15.30	0.001
Leafy vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (A)	14.02	0.001
Leafy vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (G)	10.22	0.001
Leafy vegetables (except brassica) – 3 apps at 0.133 lb ai/A (5 days) (A)	10.69	0.001
Leafy vegetables (except brassica) – 3 apps at 0.133 lb ai/A (5 days) (G)	6.71	0.001
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (A) (ND canola)	22.02	0.002
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (G) (ND canola)	17.97	0.002
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (A) (ND wheat)	25.24	0.002
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (G) (ND wheat)	21.40	0.002
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (CA fruit)	4.93	<0.001
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (CA fruit)	1.61	<0.001
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (NC apple)	19.54	0.002
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (NC apple)	16.07	0.002
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (OR apple)	12.63	0.001
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (OR apple)	8.35	0.001
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (PA apple)	14.07	0.001
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (PA apple)	10.73	0.001
Potatoes – 1 app at 0.69 lb ai/A (S) (ID potato)	6.45	0.001
Potatoes – 1 app at 0.69 lb ai/A (S) (ME potato)	8.77	0.001
Potatoes – 1 app at 0.176 lb ai/A (S) (ID potato)	1.65	<0.001
Potatoes – 1 app at 0.176 lb ai/A (S) (ME potato)	2.24	<0.001
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (ID potato)	18.98	0.002

Uses/Application Rate	60-day EEC (μg/L)	Freshwater Fish Chronic RQ*
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (ID potato)	14.32	0.001
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (ME potato)	25.33	0.002
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (ME potato)	20.41	0.002
Corm and tuberous vegetables - 1 app at 0.25 lb ai/A (C) (ID potato)	6.85	0.001
Corm and tuberous vegetables - 1 app at 0.25 lb ai/A (C) (ME potato)	10.60	0.001
Rapeseed including canola varieties, mustard seed – 1 app at 0.4 lb ai/A (S) (ND canola)	19.61	0.002
Rapeseed including canola varieties, mustard seed – 1 app at 0.4 lb ai/A (S) (ND wheat)	36.26	0.003
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (MI cherry)	18.74	0.002
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (MI cherry)	14.07	0.001
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (GA peaches)	5.91	0.001
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (GA peaches)	3.28	<0.001
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (CA fruit)	5.90	0.001
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (CA fruit)	3.07	<0.001
Sunflower – 1 app at 0.016 lb ai/A (S) (ND canola)	0.45	<0.001
Sunflower – 1 app at 0.016 lb ai/A (S) (ND wheat)	0.84	<0.001
Tree nuts – 3 apps at 0.133 lb ai/A (A) (CA almonds)	10.87	0.001
Tree nuts – 3 apps at 0.133 lb ai/A (G) (CA almonds)	8.35	0.001
Tree nuts – 3 apps at 0.133 lb ai/A (A) (GA pecans)	19.01	0.002
Tree nuts – 3 apps at 0.133 lb ai/A (G) (GA pecans)	16.94	0.002
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (CA onion)	5.77	0.001
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (CA onion)	3.03	<0.001
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (GA onion)	20.11	0.002
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (GA onion)	17.76	0.002
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (CA nursery)	2.59	<0.001
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (FL nursery)	16.65	0.002
Flowerbeds and ground covers – 2 apps at 0.208	15.98	0.001

Uses/Application Rate	60-day EEC (µg/L)	Freshwater Fish Chronic RQ*
lb ai/A (7 days) (G) (MI nursery)		
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (NJ nursery)	13.84	0.001
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (OR nursery)	4.18	<0.001
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (TN nursery)	11.91	0.001
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (CA nursery)	3.30	<0.001
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (FL nursery)	9.77	0.001
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (MI nursery)	9.98	0.001
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (NJ nursery)	8.64	0.001
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (OR nursery)	2.61	<0.001
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (TN nursery)	7.43	0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (CA nursery)	3.33	<0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (FL nursery)	6.58	0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (MI nursery)	10.11	0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (NJ nursery)	8.91	0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (OR nursery)	2.68	<0.001
Ornamental plants, fruit and nut trees (non-	7.44	0.001

Uses/Application Rate	60-day EEC (µg/L)	Freshwater Fish Chronic RQ*
bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (TN nursery)		
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (CA nursery)	0.40	<0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (FL nursery)	3.50	<0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (MI nursery)	7.55	0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (NJ nursery)	5.82	<0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (OR nursery)	1.47	<0.001
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (TN nursery)	6.75	0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (CA nursery)	5.84	0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (FL nursery)	9.90	0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (MI nursery)	16.03	0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (NJ nursery)	18.25	0.002
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (OR nursery)	4.15	<0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G)	10.40	0.001

Uses/Application Rate	60-day EEC (µg/L)	Freshwater Fish Chronic RQ*
(TN nursery)		
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (CA nursery)	1.26	<0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (FL nursery)	6.11	0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (MI nursery)	13.02	0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (NJ nursery)	12.26	0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (OR nursery)	1.89	<0.001
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (TN nursery)	8.95	0.001
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, foliage plants, groundcovers, vines, interior plantscape plants – 1 app at 0.42 lb ai/A (C)	0.23	<0.001
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm) – 1 app at 0.42 lb ai/A (G)	1.74	<0.001
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms – 2 apps at 0.13 lb ai/A (30 days) (G)	1.35	<0.001
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms – 2 apps at 0.13 lb ai/A (30 days) (G) (CA turf)	1.43	<0.001
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground – 1 app at 0.233 lb ai/A and 1 app at 0.187 lb ai/A (30 days) (G) (FL turf)	2.15	<0.001
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground – 1 app at 0.233 lb ai/A and 1 app at 0.187 lb ai/A (30 days) (G) (CA turf)	2.41	<0.001
Fly control bait – 5 apps at 0.087 lb ai/A (7 days) (E)	23.16	0.002
Public health insect control – 1 app at 0.42 lb	22.52	0.002

Uses/Application Rate	60-day EEC (µg/L)	Freshwater Fish Chronic RQ*
ai/A (E)		
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (CA nursery)	1.49	<0.001
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (FL nursery)	7.28	0.001
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (MI nursery)	15.51	0.001
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (NJ nursery)	14.60	0.001
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (OR nursery)	2.24	<0.001
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (TN nursery)	10.65	0.001
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (CA nursery)	0.40	<0.001
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (FL nursery)	3.50	<0.001
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (MI nursery)	7.55	0.001
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (NJ nursery)	5.82	0.001
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (OR nursery)	1.47	<0.001
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (TN nursery)	6.75	0.001

Chronic RQ = use-specific 60-day EEC / 10700 µg ai/L (rainbow trout)
A = foliar aerial application
G = foliar ground application
C = chemigation
S = seed treatment
E = Tier 1 GENEEC Model was used

Cyantraniliprole ranged in toxicity from slightly to very highly toxic to freshwater invertebrates on an acute exposure basis. Risk quotients for acute exposures to freshwater invertebrates ranged from 0.011 to 1.9 (Table 36). Most uses exceeded the acute risk to listed species LOC of 0.05 and 55% of those exceeded the acute risk to non-listed species LOC of 0.5. Those proposed uses that did not exceed the acute risk LOCs were: fruiting vegetables chemigation at 0.4 lb ai/A (CA tomato scenario); sunflower seed treatment; trees (including non-bearing fruit and nut trees), shrubs, evergreens, foliage plants, groundcovers, vines, interior plantscape plants chemigation at 0.42 lb ai/A; and potted ornamentals chemigation at 2 apps at 0.13 lb ai/A (CA nursery scenario). Therefore, based on the screening-level assessment, acute risks (direct) may result for many of the proposed uses of cyantraniliprole.

Risk quotients for chronic exposures to freshwater invertebrates ranged from 0.035 to 5.8 (Table 36). Sixty-eight percent of the scenarios exceeded the listed and non-listed species chronic risk LOC of 1. Thus, chronic risks (direct) are possible from many of the proposed uses.

Cyantraniliprole is moderately to highly toxic to estuarine/marine invertebrates on an acute exposure basis. Acute risk quotients for estuarine/marine invertebrates ranged from <0.001 to 0.073 (Table 36). The following eight scenarios exceeded the acute risk to listed species LOC of 0.05: cotton aerial and ground spray at 3 apps at 0.133 lb ai/A (MS and NC cotton scenarios); cucurbits aerial and ground spray at 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A; fruiting vegetables aerial spray at 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (PA tomato scenario); and rapeseed including canola varieties, mustard seed treatment (ND wheat scenario). Chronic risk quotients ranged from 0.001 to 0.23 (oyster) and < 0.001 to 0.12 (mysid shrimp). No scenarios exceeded the listed and non-listed species chronic risk LOC of 1. Thus, while mortality (direct) of estuarine/marine invertebrates is possible following acute exposure for eight of the proposed uses, the likelihood of (direct) adverse effects from chronic exposure is considered low.

Table 36. RQs for Freshwater and Estuarine/Marine Invertebrates (Based on Surface Water EECs)

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
Brassica vegetable - 1 app at 0.4 lb ai/A (C)	22.5	22.45	**1.1****	**3.4*****	0.043	0.13	0.058
Brassica leafy vegetable – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (A)	21.01	20.89	**1.0****	**3.2*****	0.040	0.13	0.054
Brassica leafy vegetable – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (G)	17.03	16.94	**0.83****	**2.6*****	0.033	0.10	0.044
Brassica leafy vegetables – 3 apps at 0.133 lb ai/A (5 days) (A)	16.90	16.81	**0.83****	**2.6*****	0.033	0.10	0.044
Brassica leafy vegetables – 3 apps at 0.133 lb ai/A (5 days) (G)	12.83	12.77	**0.63****	**1.9*****	0.025	0.076	0.033
Bushberries – 3 apps at 0.133 lb ai/A (5 days) (A)	13.28	13.24	**0.65****	**2.0*****	0.026	0.079	0.034
Bushberries – 3 apps at 0.133 lb ai/A (5 days) (G)	8.71	8.69	**0.43***	**1.3*****	0.017	0.052	0.023
Citrus – 3 apps at 0.133 lb ai/A (7 days) (A)	16.66	15.58	**0.82****	**2.4*****	0.032	0.093	0.040
Citrus – 3 apps at 0.133 lb ai/A (7 days) (G)	14.64	13.58	**0.72****	**2.1*****	0.028	0.081	0.035
Citrus – 1 app at 0.4 lb ai/A (C)	11.01	10.13	**0.54****	**1.5*****	0.021	0.061	0.026
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (CA cotton)	9.21	9.16	**0.45***	**1.4*****	0.018	0.055	0.024

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (CA cotton)	6.11	6.09	**0.30***	0.93	0.012	0.036	0.016
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (MS cotton)	29.45	29.07	**1.4****	**4.4*****	**0.057***	0.17	0.075
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (MS cotton)	27.33	29.96	**1.3****	**4.6*****	**0.053***	0.18	0.078
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (NC cotton)	37.97	37.78	**1.9****	**5.8*****	**0.073***	0.23	0.098
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (NC cotton)	35.58	35.40	**1.7****	**5.4*****	**0.068***	0.21	0.092
Cucurbits – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A)	33.01	32.66	**1.6****	**5.0*****	**0.063***	0.20	0.085
Cucurbits – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G)	31.79	31.38	**1.6****	**4.8*****	**0.061***	0.19	0.081
Cucurbits – 2 apps at 0.13 lb ai/A (10 days) (C)	5.33	5.14	**0.26***	0.78	0.010	0.031	0.013
Cucurbits – 1 app at 0.4 lb ai/A (C)	9.66	9.56	**0.47***	**1.5*****	0.019	0.057	0.025
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (FL peppers)	15.89	15.74	**0.78****	**2.4*****	0.031	0.094	0.041
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (FL peppers)	14.22	14.09	**0.70****	**2.1*****	0.027	0.084	0.037
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (CA tomato)	15.91	15.70	**0.78****	**2.4*****	0.031	0.094	0.041
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (CA tomato)	13.20	12.86	**0.65****	**2.0*****	0.025	0.077	0.033
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (FL tomato)	25.73	25.37	**1.3****	**3.9*****	0.049	0.15	0.066
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (FL tomato)	24.08	23.74	**1.2****	**3.6*****	0.046	0.14	0.062

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (PA tomato)	28.14	28.07	**1.4****	**4.3*****	**0.054***	0.17	0.073
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (PA tomato)	24.87	24.81	**1.2****	**3.8*****	0.048	0.15	0.064
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (FL peppers)	5.03	4.98	**0.25***	0.76	0.010	0.030	0.013
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (CA tomato)	1.47	1.46	**0.072***	0.22	0.003	0.009	0.004
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (FL tomato)	10.17	10.04	**0.50****	**1.5*****	0.020	0.060	0.026
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (PA tomato)	12.51	12.48	**0.61****	**1.9*****	0.024	0.075	0.032
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (FL peppers)	25.64	25.42	**1.3****	**3.9*****	0.049	0.15	0.066
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (CA tomato)	0.28	0.27	0.013	0.041	0.001	0.002	<0.001
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (FL tomato)	16.79	16.54	**0.82****	**2.5*****	0.032	0.099	0.043
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (PA tomato)	10.97	10.93	**0.54****	**1.7*****	0.021	0.065	0.028
Leafy vegetables – 1 app at 0.4 lb ai/A (C)	16.04	15.95	**0.79****	**2.4*****	0.031	0.096	0.041
Leafy vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (A)	14.09	14.02	**0.69****	**2.1*****	0.027	0.084	0.036
Leafy vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (G)	10.37	10.32	**0.51****	**1.6*****	0.020	0.062	0.027
Leafy vegetables (except brassica) – 3 apps at 0.133 lb ai/A (5 days) (A)	10.90	10.83	**0.53****	**1.7*****	0.021	0.065	0.028
Leafy vegetables (except brassica) – 3 apps at 0.133 lb ai/A (5 days) (G)	6.81	6.78	**0.33***	**1.0*****	0.013	0.041	0.018

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (A) (ND canola)	22.41	22.25	**1.1****	**3.4*****	0.043	0.13	0.058
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (G) (ND canola)	18.31	18.18	**0.90****	**2.8*****	0.035	0.11	0.047
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (A) (ND wheat)	25.47	25.35	**1.2****	**3.9*****	0.049	0.15	0.066
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (G) (ND wheat)	21.54	21.49	**1.1****	**3.3*****	0.041	0.13	0.056
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (CA fruit)	4.98	4.96	**0.24***	0.76	0.010	0.030	0.013
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (CA fruit)	1.63	1.63	**0.08***	0.25	0.003	0.010	0.004
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (NC apple)	19.78	19.69	**0.97****	**3.0*****	0.038	0.12	0.051
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (NC apple)	16.27	16.20	**0.80****	**2.5*****	0.031	0.097	0.042
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (OR apple)	12.78	12.73	**0.63****	**1.9*****	0.025	0.076	0.033
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (OR apple)	8.45	8.43	**0.41***	**1.3*****	0.016	0.051	0.022
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (PA apple)	14.53	14.36	**0.71****	**2.2*****	0.028	0.086	0.037
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (PA apple)	11.01	10.91	**0.54****	**1.7*****	0.021	0.065	0.028
Potatoes – 1 app at 0.69 lb ai/A (S) (ID potato)	6.53	6.51	**0.32***	0.99	0.013	0.039	0.017
Potatoes – 1 app at 0.69 lb ai/A (S) (ME potato)	8.96	8.90	**0.44***	**1.4*****	0.017	0.053	0.023
Potatoes – 1 app at 0.176 lb ai/A (S) (ID potato)	1.67	1.66	**0.082***	0.25	0.003	0.010	0.004
Potatoes – 1 app at 0.176 lb ai/A (S) (ME potato)	2.29	2.27	**0.11***	0.35	0.004	0.014	0.006
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (ID potato)	19.26	19.14	**0.94****	**2.9*****	0.037	0.11	0.050

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (ID potato)	14.52	14.43	**0.71****	**2.2*****	0.028	0.086	0.037
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (ME potato)	25.49	25.43	**1.2****	**3.9*****	0.049	0.15	0.066
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (ME potato)	20.54	20.49	**1.0****	**3.1*****	0.040	0.12	0.053
Corm and tuberous vegetables - 1 app at 0.25 lb ai/A (C) (ID potato)	6.90	6.88	**0.34***	**1.0*****	0.013	0.041	0.018
Corm and tuberous vegetables - 1 app at 0.25 lb ai/A (C) (ME potato)	10.67	10.65	**0.52****	**1.6*****	0.021	0.064	0.028
Rapeseed including canola varieties, mustard seed – 1 app at 0.4 lb ai/A (S) (ND canola)	19.82	19.72	**0.97****	**3.0*****	0.038	0.12	0.051
Rapeseed including canola varieties, mustard seed – 1 app at 0.4 lb ai/A (S) (ND wheat)	36.53	36.44	**1.8****	**5.6*****	**0.070***	0.22	0.094
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (MI cherry)	19.10	18.98	**0.94****	**2.9*****	0.037	0.11	0.049
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (MI cherry)	14.33	14.23	**0.70****	**2.2*****	0.028	0.085	0.037
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (GA peaches)	6.11	6.03	**0.30***	0.92	0.012	0.036	0.016
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (GA peaches)	3.33	3.31	**0.16***	0.50	0.006	0.020	0.009
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (CA fruit)	6.40	6.01	**0.31***	0.92	0.012	0.036	0.016
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (CA fruit)	3.40	3.11	**0.17***	0.47	0.007	0.019	0.008
Sunflower – 1 app at 0.016 lb ai/A (S) (ND canola)	0.45	0.45	0.022	0.069	0.001	0.003	0.001
Sunflower – 1 app at 0.016 lb ai/A (S) (ND	0.84	0.84	0.041	0.13	0.002	0.005	0.002

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
wheat)							
Tree nuts – 3 apps at 0.133 lb ai/A (A) (CA almonds)	11.02	10.97	**0.54*** **	**1.7*****	0.021	0.066	0.028
Tree nuts – 3 apps at 0.133 lb ai/A (G) (CA almonds)	8.48	8.44	**0.42***	**1.3*****	0.016	0.051	0.022
Tree nuts – 3 apps at 0.133 lb ai/A (A) (GA pecans)	19.27	19.18	**0.94****	**2.9*****	0.037	0.11	0.050
Tree nuts – 3 apps at 0.133 lb ai/A (G) (GA pecans)	17.18	17.10	**0.84****	**2.6*****	0.033	0.10	0.044
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (CA onion)	6.07	5.96	**0.30***	0.91	0.012	0.036	0.015
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (CA onion)	3.17	3.12	**0.16***	0.48	0.006	0.019	0.008
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (GA onion)	20.84	20.59	**1.0****	**3.1*****	0.040	0.12	0.053
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (GA onion)	18.40	18.21	**0.90****	**2.8*****	0.035	0.11	0.047
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (CA nursery)	5.45	5.41	**0.27***	0.82	0.010	0.032	0.014
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (FL nursery)	16.09	15.96	**0.79****	**2.4*****	0.031	0.096	0.041
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (MI nursery)	16.27	16.20	**0.80****	**2.5*****	0.031	0.097	0.042
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (NJ nursery)	14.09	14.03	**0.69****	**2.1*****	0.027	0.084	0.036
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (OR nursery)	4.25	4.22	**0.21***	0.64	0.008	0.025	0.011
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (TN	12.20	12.11	**0.60****	**1.8*****	0.023	0.073	0.031

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
nursery)							
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (CA nursery)	3.40	3.37	**0.17***	0.51	0.007	0.020	0.009
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (FL nursery)	10.04	9.95	**0.49***	**1.5*****	0.019	0.060	0.12
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (MI nursery)	10.15	10.11	**0.50****	**1.5*****	0.020	0.061	0.026
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (NJ nursery)	8.79	8.75	**0.43***	**1.3*****	0.017	0.052	0.023
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (OR nursery)	2.65	2.64	**0.13***	0.40	0.005	0.016	0.007
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (TN nursery)	7.61	7.56	**0.37***	**1.2*****	0.015	0.045	0.020
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (G) (CA nursery)	3.45	3.42	**0.17***	0.52	0.007	0.020	0.009
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at	6.79	6.73	**0.33***	**1.0*****	0.013	0.040	0.017

Uses/Application Rate	Peak EEC (μg/L)	21-day EEC (μg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
0.13 lb ai/A (14 days) (G) (FL nursery)							
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (G) (MI nursery)	10.24	10.19	**0.50****	**1.6*****	0.020	0.061	0.026
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (G) (NJ nursery)	9.07	9.03	**0.44***	**1.4*****	0.017	0.054	0.023
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (G) (OR nursery)	2.72	2.71	**0.13***	0.41	0.005	0.016	0.007
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (TN nursery)	7.62	7.57	**0.37***	**1.2*****	0.015	0.045	0.020
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and	0.41	0.40	0.020	0.061	0.001	0.002	0.001

Uses/Application Rate	Peak EEC (μg/L)	21-day EEC (μg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (CA nursery)							
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (FL nursery)	3.65	3.60	**0.18***	0.55	0.007	0.022	0.009
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (MI nursery)	7.69	7.66	**0.38***	**1.2*****	0.015	0.046	0.020
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (NJ nursery)	5.92	5.87	**0.29***	0.89	0.011	0.035	0.015
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (OR nursery)	1.49	1.49	**0.073***	0.23	0.003	0.009	0.004
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers,	6.94	6.88	**0.34***	**1.0*****	0.013	0.041	0.12

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (TN nursery)							
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (CA nursery)	5.94	5.91	**0.29***	0.90	0.011	0.035	0.015
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (FL nursery)	10.20	10.12	**0.50****	**1.5*****	0.020	0.061	0.026
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (MI nursery)	16.26	16.17	**0.80****	**2.5*****	0.031	0.097	0.042
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (NJ nursery)	18.54	18.47	**0.91****	**2.8*****	0.036	0.11	0.048
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (OR nursery)	4.21	4.19	**0.21***	0.64	0.008	0.025	0.011
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (TN nursery)	10.60	10.55	**0.52****	**1.6*****	0.020	0.063	0.027
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (CA nursery)	1.28	1.27	**0.063***	0.19	0.002	0.008	0.003
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (FL nursery)	6.31	6.25	**0.31***	0.95	0.012	0.037	0.016
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (MI nursery)	13.19	13.15	**0.65****	**2.0*****	0.025	0.079	0.034

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (NJ nursery)	12.50	12.43	**0.61****	**1.9*****	0.024	0.074	0.032
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (OR nursery)	1.90	1.90	**0.093***	0.29	0.004	0.011	0.005
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (TN nursery)	9.14	9.09	**0.45***	**1.4*****	0.018	0.054	0.024
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, foliage plants, groundcovers, vines, interior plantscape plants – 1 app at 0.42 lb ai/A (C)	0.23	0.23	0.011	0.035	<0.001	0.001	0.001
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm) – 1 app at 0.42 lb ai/A (G)	1.77	1.76	**0.087***	0.27	0.003	0.011	0.005
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms – 2 apps at 0.13 lb ai/A (30 days) (G) (FL turf)	1.39	1.37	**0.068***	0.21	0.003	0.008	0.003
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms – 2 apps at 0.13 lb ai/A (30 days) (G) (CA turf)	1.46	1.45	**0.072***	0.22	0.003	0.009	0.004
Grassy, weedy, mulched, or bare soil areas in and	2.21	2.19	**0.11***	0.33	0.004	0.013	0.006

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground – 1 app at 0.233 lb ai/A and 1 app at 0.187 lb ai/A (30 days) (G) (FL turf)							
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground – 1 app at 0.233 lb ai/A and 1 app at 0.187 lb ai/A (30 days) (G) (CA turf)	2.46	2.44	**0.12***	0.37	0.005	0.015	0.006
Fly control bait – 5 apps at 0.087 lb ai/A (7 days) (E)	23.67	23.49	**1.2****	**3.6*****	0.046	0.14	0.061
Public health insect control – 1 app at 0.42 lb ai/A (E)	23.02	22.85	**1.1****	**3.5*****	0.044	0.14	0.059
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (CA nursery)	1.52	1.51	**0.075***	0.23	0.003	0.009	0.004
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (FL nursery)	7.51	7.44	**0.37***	**1.1*****	0.014	0.045	0.019
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (MI nursery)	15.71	15.66	**0.77****	**2.4*****	0.030	0.094	0.041
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (NJ nursery)	14.89	14.80	**0.73****	**2.3*****	0.029	0.089	0.038
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (OR nursery)	2.27	2.26	**0.11***	0.34	0.004	0.014	0.006
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (TN nursery)	10.88	18.82	**0.53****	**2.9*****	0.021	0.11	0.049
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (CA nursery)	0.41	0.40	0.020	0.061	0.001	0.002	0.001
Potted ornamentals – 2 apps at 0.13 lb ai/A (C)	3.65	3.60	**0.18***	0.55	0.007	0.022	0.009

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Freshwater Invertebrate Acute RQ+	Freshwater Invertebrate Chronic RQ+	Estuarine/ Marine Invertebrate Acute RQ+	Estuarine/ Marine Invertebrate Chronic RQ+	
						Oyster	Shrimp
(FL nursery)							
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (MI nursery)	7.69	7.66	**0.38***	**1.2*****	0.015	0.046	0.020
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (NJ nursery)	5.92	5.87	**0.29***	0.89	0.011	0.035	0.015
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (OR nursery)	1.49	1.49	**0.073***	0.23	0.003	0.009	0.004
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (TN nursery)	6.94	6.88	**0.34***	**1.0*****	0.013	0.041	0.018

+Acute freshwater invert RQ = use-specific peak EEC / 20.4 µg ai/L (water flea); chronic freshwater invert RQ = use-specific 21-day EEC / 6.56 µg ai/L (water flea); acute estuarine/marine invert = use-specific peak EEC / 520 µg ai/L (Eastern oyster); chronic estuarine/marine invert = use-specific 21-day EEC / 167 µg ai/L (ACR eastern oyster) and use-specific 21-day EEC / 386 µg ai/L (ACR mysid shrimp)
*Exceeds the acute risk to listed species LOC of 0.05
**Exceeds the acute risk to non-listed species LOC of 0.5
***Exceeds the chronic risk LOC of 1
A = foliar aerial application
G = foliar ground application
C = chemigation
S = seed treatment
E = Tier 1 GENEEC Model was used

Benthic Invertebrates
Cyantraniliprole is highly toxic to benthic invertebrates on an acute exposure basis. Acute risk quotients for benthic invertebrates ranged from <0.001 to 0.051 (Table 37). Only one use exceeded the acute risk to listed species LOC of 0.05: rapeseed including canola varieties, mustard seed seed treatment (ND wheat scenario). Thus, benthic invertebrate mortality from acute exposure to cyantraniliprole may occur from the proposed rapeseed seed treatment use under certain agricultural scenarios.

Chronic risk quotients ranged from 0.022 to 3.7 (Table 37). Forty-six percent of the uses exceeded the listed and non-listed species chronic risk LOC of 1. Given these results, some of the proposed uses for cyantraniliprole may result in chronic risks to benthic invertebrates.

Table 37. RQs for Benthic Invertebrates (Based on Pore Water EECs)

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
Brassica vegetable - 1 app at 0.4 lb ai/A (C)	20.24	20.14	0.028	**2.0*****

Uses/Application Rate	Peak EEC (μg/L)	21-day EEC (μg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
Brassica leafy vegetable – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (A)	19.07	19.07	0.027	**1.9*** **
Brassica leafy vegetable – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (G)	15.42	15.41	0.021	**1.5*** **
Brassica leafy vegetables – 3 apps at 0.133 lb ai/A (5 days) (A)	15.44	15.44	0.021	**1.5*** **
Brassica leafy vegetables – 3 apps at 0.133 lb ai/A (5 days) (G)	11.70	11.69	0.016	**1.2*** **
Bushberries – 3 apps at 0.133 lb ai/A (5 days) (A)	12.90	12.89	0.018	**1.3*** **
Bushberries – 3 apps at 0.133 lb ai/A (5 days) (G)	8.51	8.50	0.012	0.85
Citrus – 3 apps at 0.133 lb ai/A (7 days) (A)	13.23	13.23	0.018	**1.3*** **
Citrus – 3 apps at 0.133 lb ai/A (7 days) (G)	11.46	11.46	0.016	**1.1*** **
Citrus – 1 app at 0.4 lb ai/A (C)	9.24	9.23	0.013	0.92
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (CA cotton)	8.33	8.33	0.012	0.83
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (CA cotton)	5.45	5.45	0.008	0.55
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (MS cotton)	25.72	25.71	0.036	**2.6*** **
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (MS cotton)	23.79	23.78	0.033	**2.4*** **
Cotton – 3 apps at 0.133 lb ai/A (7 days) (A) (NC cotton)	34.01	33.76	0.047	**3.4*** **
Cotton – 3 apps at 0.133 lb ai/A (7 days) (G) (NC cotton)	31.80	31.47	0.044	**3.1*** **
Cucurbits – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A)	25.54	25.45	0.036	**2.5*** **
Cucurbits – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G)	24.32	24.23	0.034	**2.4*** **
Cucurbits – 2 apps at 0.13 lb ai/A (10 days) (C)	3.96	3.96	0.006	0.40
Cucurbits – 1 app at 0.4 lb ai/A (C)	7.78	7.74	0.011	0.77
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (FL peppers)	12.96	12.95	0.018	**1.3*** **
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (FL peppers)	11.17	11.17	0.016	**1.1*** **
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (CA tomato)	14.41	14.40	0.020	**1.4*** **
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (CA tomato)	11.75	11.74	0.016	**1.2*** **
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (FL tomato)	20.31	20.31	0.028	**2.0*** **
Fruiting vegetables – 2 apps at 0.175 lb ai/A	18.94	18.94	0.026	**1.9*** **

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
and 1 app at 0.05 lb ai/A (5 days) (G) (FL tomato)				
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (A) (PA tomato)	26.49	25.87	0.037	**2.6*** **
Fruiting vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days) (G) (PA tomato)	23.42	22.79	0.033	**2.3*** **
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (FL peppers)	4.01	4.01	0.006	0.40
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (CA tomato)	1.29	1.28	0.002	0.13
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (FL tomato)	8.65	8.65	0.012	0.87
Fruiting vegetables – 2 apps at 0.13 lb ai/A (5 days) (C) (PA tomato)	11.05	10.72	0.015	**1.1*** **
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (FL peppers)	24.60	23.83	0.034	**2.4*** **
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (CA tomato)	0.24	0.24	<0.001	0.024
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (FL tomato)	12.51	12.51	0.017	**1.3*** **
Fruiting vegetables – 1 app at 0.4 lb ai/A (C) (PA tomato)	10.84	10.82	0.015	**1.1*** **
Leafy vegetables – 1 app at 0.4 lb ai/A (C)	14.03	14.00	0.020	**1.4*** **
Leafy vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (A)	13.03	13.02	0.018	**1.3*** **
Leafy vegetables – 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days) (G)	9.38	9.37	0.013	0.94
Leafy vegetables (except brassica) – 3 apps at 0.133 lb ai/A (5 days) (A)	10.25	10.24	0.014	**1.0*** **
Leafy vegetables (except brassica) – 3 apps at 0.133 lb ai/A (5 days) (G)	6.44	6.43	0.009	0.64
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (A) (ND canola)	20.55	20.52	0.029	**2.1*** **
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (G) (ND canola)	16.66	16.63	0.023	**1.7*** **
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (A) (ND wheat)	24.65	24.58	0.034	**2.5*** **
Oil seeds – 3 apps at 0.133 lb ai/A (7 days) (G) (ND wheat)	20.67	20.67	0.029	**2.1*** **
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (CA fruit)	4.62	4.61	0.006	0.46
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (CA fruit)	1.49	1.48	0.002	0.15
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (NC apple)	18.14	18.13	0.025	**1.8*** **
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (NC apple)	14.80	14.79	0.021	**1.5*** **
Pome fruit – 3 apps at 0.133 lb ai/A (7 days)	11.91	11.91	0.017	**1.2*** **

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
(A) (OR apple)				
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (OR apple)	7.77	7.68	0.011	0.77
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (PA apple)	12.98	12.98	0.018	**1.3*** **
Pome fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (PA apple)	9.85	9.85	0.014	0.99
Potatoes – 1 app at 0.69 lb ai/A (S) (ID potato)	5.80	5.80	0.008	0.58
Potatoes – 1 app at 0.69 lb ai/A (S) (ME potato)	8.21	8.20	0.011	0.82
Potatoes – 1 app at 0.176 lb ai/A (S) (ID potato)	1.48	1.48	0.002	0.15
Potatoes – 1 app at 0.176 lb ai/A (S) (ME potato)	2.10	2.09	0.003	0.21
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (ID potato)	18.22	18.22	0.025	**1.8*** **
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (ID potato)	13.77	13.77	0.019	**1.4*** **
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (ME potato)	25.22	25.20	0.035	**2.5*** **
Corm and tuberous vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (ME potato)	20.36	20.33	0.028	**2.0*** **
Corm and tuberous vegetables - 1 app at 0.25 lb ai/A (C) (ID potato)	6.58	6.56	0.009	0.66
Corm and tuberous vegetables - 1 app at 0.25 lb ai/A (C) (ME potato)	10.51	10.50	0.015	**1.5*** **
Rapeseed including canola varieties, mustard seed – 1 app at 0.4 lb ai/A (S) (ND canola)	17.98	17.96	0.025	**1.8*** **
Rapeseed including canola varieties, mustard seed – 1 app at 0.4 lb ai/A (S) (ND wheat)	36.74	36.63	**0.051***	**3.7*** **
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (MI cherry)	18.03	18.00	0.025	**1.8*** **
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (MI cherry)	13.51	13.50	0.019	**1.4*** **
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (GA peaches)	5.41	5.41	0.008	0.54
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (GA peaches)	3.32	3.28	0.005	0.33
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (A) (CA fruit)	5.65	5.65	0.008	0.57
Stone fruit – 3 apps at 0.133 lb ai/A (7 days) (G) (CA fruit)	3.03	3.03	0.004	0.30
Sunflower – 1 app at 0.016 lb ai/A (S) (ND canola)	0.41	0.41	0.001	0.041
Sunflower – 1 app at 0.016 lb ai/A (S) (ND wheat)	0.85	0.84	0.001	0.084
Tree nuts – 3 apps at 0.133 lb ai/A (A) (CA almonds)	9.89	9.79	0.014	0.98
Tree nuts – 3 apps at 0.133 lb ai/A (G) (CA almonds)	7.17	7.06	0.010	0.71

Uses/Application Rate	Peak EEC (μg/L)	21-day EEC (μg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
Tree nuts – 3 apps at 0.133 lb ai/A (A) (GA pecans)	17.44	17.20	0.024	**1.7*** **
Tree nuts – 3 apps at 0.133 lb ai/A (G) (GA pecans)	15.41	15.19	0.021	**1.5*** **
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (CA onion)	5.10	5.10	0.007	0.51
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (CA onion)	2.74	2.73	0.004	0.27
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (A) (GA onion)	19.76	19.69	0.027	**2.0*** **
Bulb vegetables – 3 apps at 0.133 lb ai/A (5 days) (G) (GA onion)	17.87	17.81	0.025	**1.8*** **
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (CA nursery)	5.22	5.22	0.007	0.52
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (FL nursery)	16.24	16.09	0.023	**1.6*** **
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (MI nursery)	14.62	14.61	0.020	**1.5*** **
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (NJ nursery)	12.42	12.42	0.017	**1.2*** **
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (OR nursery)	3.91	3.91	0.005	0.39
Flowerbeds and ground covers – 2 apps at 0.208 lb ai/A (7 days) (G) (TN nursery)	10.85	10.84	0.015	**1.1*** **
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (CA nursery)	3.25	3.25	0.005	0.33
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (FL nursery)	10.13	10.04	0.014	**1.0*** **
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (MI nursery)	9.12	9.11	0.013	0.91
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (NJ nursery)	7.75	7.75	0.011	0.78
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (OR nursery)	2.44	2.44	0.003	0.24
Ornamentals treated by commercial and consumer applicators – 2 apps at 0.13 lb ai/A (7 days) (G) (TN nursery)	6.77	6.76	0.009	0.68
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (CA nursery)	3.26	3.26	0.005	0.33
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at	5.76	5.76	0.008	0.58

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
0.13 lb ai/A (14 days) (FL nursery)				
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (MI nursery)	9.31	9.31	0.013	0.93
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (NJ nursery)	8.01	8.01	0.011	0.80
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (OR nursery)	2.47	2.47	0.003	0.25
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (TN nursery)	6.65	6.65	0.009	0.67
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (CA nursery)	0.41	0.41	0.001	0.041
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (FL nursery)	2.92	2.92	0.004	0.29
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (MI nursery)	6.97	6.97	0.010	0.70
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (NJ nursery)	5.29	5.29	0.007	0.53
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (OR nursery)	1.34	1.34	0.002	0.13
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes – 2 apps at 0.13 lb ai/A (14 days) (C) (TN nursery)	5.88	5.86	0.008	0.59

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (CA nursery)	5.49	5.49	0.008	0.55
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (FL nursery)	8.74	8.68	0.012	0.87
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (MI nursery)	14.82	14.82	0.021	**1.5*****
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (NJ nursery)	18.03	17.98	0.025	**1.8*****
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (OR nursery)	3.88	3.88	0.005	0.39
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (G) (TN nursery)	9.39	9.36	0.013	0.94
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (CA nursery)	1.30	1.30	0.002	0.13
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (FL nursery)	4.97	4.97	0.007	0.50
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (MI nursery)	11.67	11.67	0.016	**1.2*****
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (NJ nursery)	11.59	11.59	0.016	**1.2*****
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (OR nursery)	1.90	1.89	0.003	0.19
Ornamental plants (exterior landscapes and interior plantscapes) – 1 app at 0.42 lb ai/A (C) (TN nursery)	7.87	7.84	0.011	0.78
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, foliage plants, groundcovers, vines, interior plantscape plants – 1 app at 0.42 lb ai/A (C)	0.22	0.22	<0.001	0.022
Trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm) – 1 app at 0.42 lb ai/A (G)	1.61	1.61	0.002	0.16
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms – 2 apps at 0.13 lb ai/A (30 days) (G)	1.31	1.30	0.002	0.13

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms – 2 apps at 0.13 lb ai/A (30 days) (G) (CA turf)	1.37	1.37	0.002	0.14
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground – 1 app at 0.233 lb ai/A and 1 app at 0.187 lb ai/A (30 days) (G) (FL turf)	1.98	1.97	0.003	0.20
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground – 1 app at 0.233 lb ai/A and 1 app at 0.187 lb ai/A (30 days) (G) (CA turf)	2.27	2.27	0.003	0.23
Fly control bait – 5 apps at 0.087 lb ai/A (7 days) (E)	23.67	23.49	0.033	**2.3*** **
Public health insect control – 1 app at 0.42 lb ai/A (E)	23.02	22.85	0.032	**2.3*** **
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (CA nursery)	1.55	1.54	0.002	0.15
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (FL nursery)	5.92	5.92	0.008	0.59
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (MI nursery)	13.90	13.89	0.019	**1.4*** **
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (NJ nursery)	13.81	13.80	0.019	**1.4*** **
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (OR nursery)	2.26	2.25	0.003	0.23
Potted ornamentals – 1 app at 0.5 lb ai/A (C) (TN nursery)	9.37	9.34	0.013	0.93
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (CA nursery)	0.41	0.41	0.001	0.041
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (FL nursery)	2.92	2.92	0.004	0.29
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (MI nursery)	6.97	6.97	0.010	0.70
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (NJ nursery)	5.29	5.29	0.007	0.53
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (OR nursery)	1.34	1.34	0.002	0.13
Potted ornamentals – 2 apps at 0.13 lb ai/A (C) (TN nursery)	5.88	5.86	0.008	0.59

Acute RQ = use-specific peak EEC / 719 µg ai/L (midge); chronic RQ = use-specific 21-day EEC / 10 µg ai/L (midge)
*Exceeds the acute listed species LOC of 0.05
***Exceeds the chronic species LOC of 1
A = foliar aerial application
G = foliar ground application
C = chemigation

Uses/Application Rate	Peak EEC (µg/L)	21-day EEC (µg/L)	Benthic Invertebrate Acute RQ*	Benthic Invertebrate Chronic RQ*
S = seed treatment E = Tier 1 GENEEC Model was used				

Aquatic Plants

Toxicity data for technical-grade cyantraniliprole was non-definitive for aquatic vascular and non-vascular plants. Thus, risk quotients were not calculated. Further risk analysis will be characterized in the Risk Description section of the assessment.

2. Non-target Terrestrial Animals

Birds

Cyantraniliprole is classified as 'practically nontoxic' to birds on an acute oral and sub-acute dietary exposure basis. Since all of the endpoints from the acute oral and sub-acute dietary toxicity studies with birds are non-definitive (*i.e.*, they are 'greater than' values), they were not used to calculate RQs. Further description of the risks associated with acute exposure to cyantraniliprole can be found in the Risk Description section of the document.

The chronic dietary-based RQs range from <0.01 to 0.45. Foliar sprays, bark sprays, and seed treatment exposures were calculated using T-REX while soil injection, soil drench, drip irrigation, and applications to potted ornamentals were derived by estimating the concentration of cyantraniliprole in the leaf biomass of the plant (Tables 38 and 39). Therefore, none of the avian RQs calculated for chronic exposure exceed the Agency's chronic risk LOC of 1.

Table 38. Avian and Mammalian Foliar, Bark Spray, and Seed Treatment Chronic Risk Quotients

Feeding Category	Avian chronic dietary-based RQs	Mammalian chronic dietary-based RQs
Brassica leafy vegetables, leafy vegetables 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (7 days)		
Short grass	0.08	**4.02*** **
Tall grass	0.04	**1.84*** **
Broadleaf plants	0.05	**2.26*** **
Fruits/pods	0.01	0.25
Arthropods	0.03	**1.57*** **
Seeds	0.01	0.25
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous		

Feeding Category	Avian chronic dietary-based RQs	Mammalian chronic dietary-based RQs
vegetables, bulb vegetables 3 apps at 0.133 lb ai/A (5 days)		
Short grass	0.09	**4.35*** **
Tall grass	0.04	**1.99*** **
Broadleaf plants	0.05	**2.45*** **
Fruits/pods	0.01	0.27
Arthropods	0.03	**1.70*** **
Seeds	0.01	0.27
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts 3 apps at 0.133 lb ai/A (7 days)		
Short grass	0.08	**4.19*** **
Tall grass	0.04	**1.92*** **
Broadleaf plants	0.05	**2.36*** **
Fruits/pods	0.01	0.26
Arthropods	0.03	**1.64*** **
Seeds	0.01	0.26
Cucurbits, fruiting vegetables 2 apps at 0.175 lb ai/A and 1 app at 0.05 lb ai/A (5 days)		
Short grass	0.08	**4.22*** **
Tall grass	0.04	**1.94*** **
Broadleaf plants	0.05	**2.38*** **
Fruits/pods	0.01	0.26
Arthropods	0.03	**1.65*** **
Seeds	0.01	0.26
Potatoes (seed treatment) 1 app at 0.69 lb ai/A		
Seeds	0.45	N/A
Potatoes (seed treatment) 1 app at 0.176 lb ai/A		
Seeds	0.11	N/A
Rapeseed including canola varieties, mustard seed (seed treatment) 1 app at 0.4 lb ai/A		
Seeds	0.26	N/A
Sunflower (seed treatment) 1 app at 0.016 lb ai/A		
Seeds	0.01	N/A
Flowerbeds and groundcovers 2 apps at 0.208 lb ai/A (7 days)		
Short grass	0.09	**4.67*** **
Tall grass	0.04	**2.14*** **
Broadleaf plants	0.05	**2.63*** **

Feeding Category	Avian chronic dietary-based RQs	Mammalian chronic dietary-based RQs
Fruits/pods	0.01	0.29
Arthropods	0.04	**1.83*** **
Seeds	0.01	0.29
Ornamentals treated by commercial and consumer applicators 2 apps at 0.13 lb ai/A (7 days)		
Short grass	0.06	**2.92*** **
Tall grass	0.03	**1.34*** **
Broadleaf plants	0.03	**1.64*** **
Fruits/pods	<0.01	0.18
Arthropods	0.02	**1.14*** **
Seeds	<0.01	0.18
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes 1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (14 days)		
Short grass	0.09	**5.48*** **
Tall grass	0.04	**2.51*** **
Broadleaf plants	0.05	**3.09*** **
Fruits/pods	0.01	0.34
Arthropods	0.03	**2.15*** **
Seeds	0.01	0.34
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees) shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control 1 app at 0.42 lb ai/A		
Short grass	0.10	**5.04*** **
Tall grass	0.05	**2.31*** **
Broadleaf plants	0.06	**2.84*** **
Fruits/pods	0.01	0.32
Arthropods	0.04	**1.97*** **
Seeds	0.01	0.32
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground 1 app at 0.26 lb ai/A and 1 app at 0.16 lb ai/A (30 days)		
Short grass	0.07	**4.84*** **
Tall grass	0.03	**2.22*** **
Broadleaf plants	0.04	**2.72*** **
Fruits/pods	<0.01	0.30
Arthropods	0.03	**1.90*** **
Seeds	<0.01	0.30
Fly control bait (granular)		

Feeding Category	Avian chronic dietary-based RQs	Mammalian chronic dietary-based RQs
5 apps at 0.087 lb ai/A (7 days)		
Short grass	0.08	**4.03*** **
Tall grass	0.04	**1.85*** **
Broadleaf plants	0.05	**2.27*** **
Fruits/pods	0.01	0.25
Arthropods	0.03	**1.58*** **
Seeds	0.01	0.25
***Risk quotient exceeds chronic LOC of 1		

Table 39. Summary of Avian and Mammalian Chronic RQs for Soil Injection/Soil Drench, Potted Ornamental Drench, and Agricultural Drip Irrigation

	Chronic Dietary RQ	
	Birds	**Mammals**
Soil injection/drench hardwood	0.15	**7.4*** **
Soil injection/drench hardwood	0.25	**13*** **
Soil drench (citrus)	0.23	**12*** **
Soil injection/drench softwood	0.07	**3.4*** **
Soil injection/drench softwood	0.12	**5.8*** **
Potted non-woody ornamental drench	0.005	0.23
Potted non-woody ornamental drench	0.009	0.45
Drip irrigation (brassica vegetables)	0.06	**3.2*** **
Drip irrigation (cucurbits)	0.63	**31.8*** **
Drip irrigation (fruiting vegetables)	0.18	**9.1*** **
Drip irrigation (leafy vegetables)	0.05	**2.7*** **
Drip irrigation (corm and tuberous vegetables)	0.06	**3.2*** **
***Risk quotient exceeds chronic LOC of 1		

Mammals

Cyantraniliprole is classified as 'practically nontoxic' to mammals on an acute oral exposure basis. Since the endpoint from the toxicity study is non-definitive (*i.e.*, it is a 'greater than' value), it was not used to calculate RQs. Further description of the risks associated with acute exposure to cyantraniliprole can be found in the Risk Description section of the document.

Chronic risk quotients for the proposed foliar spray, bark spray, and seed treatment uses were calculated using T-REX (Table 38). Chronic RQs ranged from 0.18 to 5.48 for these uses. Seed and fruits/pods were the only food items where RQs did not exceed the listed and non-listed species chronic risk LOC (1); all other food items (short grass, tall grass, broadleaf plants, and arthropods) exceeded.

Chronic risk quotients for soil injection, soil drench, drip irrigation, and applications to potted ornamentals were derived by estimating the concentration of cyantraniliprole in the leaf biomass of the plant (Table 39). Risk quotients ranged from 0.23 to 31.8. The proposed use on potted ornamentals was the only proposed use that did not exceed the chronic risk LOC of 1.

Terrestrial Invertebrates

Cyantraniliprole is classified as “highly toxic” to non-target terrestrial invertebrates on an acute exposure basis. Even though both the acute contact (LD_{50}>0.093 µg ai/bee) and the acute oral (LD_{50}>0.105 µg ai/bee) toxicity endpoints are non-definitive; the classification is based on the absolute value of the toxicity endpoint. Risk quotients could not be calculated for acute exposures to cyantraniliprole though because the toxicity data were non-definitive. Further discussion of this is presented in the Risk Description section. Toxicity data were also available for cyantraniliprole TEP and risk quotients were calculated for these. Most of the TEPs contain cyantraniliprole as the sole active ingredient; thus risk quotients were calculated for the most sensitive toxicity endpoints. Several products are a mixture of two active ingredients: cyantraniliprole and thiamethoxam. The toxicity endpoints for this co-formulation are much lower (oral: LD_{50}=0.0062 µg ai/bee; contact: LD_{50}=0.058 µg ai/bee) than for cyantraniliprole-only TEPs (or the TGAI) alone, so risk quotients were calculated for this product as well (Table 40).

The spray applications (foliage and bark) all yielded risk quotients that exceeded the LOC (0.4) that was identified in the recent white paper[2] that was reviewed by FIFRA Scientific Advisory Panel. The RQ values ranged from 67 to 116 (dietary) and 2.4 to 9.2 (contact) for the cyantraniliprole-only TEP and from 1260 to 2002 (dietary) and 27 to 75 (contact) for the cyantraniliprole/thiamethoxam TEP. Seed treatments (cyantraniliprole-only TEP) produced a risk quotient of 2.5, which exceeded the LOC. The risk quotients for soil applications of the cyantraniliprole-only TEP did not exceed the LOC (ranged from 0.02 to 0.03); however, the drip irrigation scenario for the cyantraniliprole/thiamethoxam TEP did exceed (RQ = 4.8). Overall, the results indicate that the TEPs for registration are of concern to bees for most of the proposed uses. Those TEPs formulated with thiamethoxam result in higher risk quotients than those formulated with cyantraniliprole alone.

[2]USEPA 2013. White Paper in Support of the Proposed Risk Assessment Process for Bees Submitted to the FIFRA Scientific Advisory Panel for Review and Comment. September 11 – 14, 2012 http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2012-0543-0004

Table 40. Risk Quotients for Cyantraniliprole TEPs for Insects

Use	TEP (cyantraniliprole only)$^{+}$		TEP (cyantraniliprole and thiamethoxam)$^{++}$	
	Dietary	**Contact**	**Dietary**	**Contact**
Brassica leafy vegetables, leafy vegetables	**93***	**3.8***	**1735***	**36***
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables	**100***	**2.4***	**1877***	**75***
Citrus, cotton, oil seeds, pome fruit, stone fruit, nut trees	**97***	**2.9***	N/A	N/A
Cucurbits, fruiting vegetables	**98***	**7.7***	**1824***	**73***
Flowerbeds and groundcovers	**108***	**4.5***	N/A	N/A
Ornamentals treated by commercial and consumer applicators	**67***	**2.8***	**1260***	**27***
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	**99***	**5.7***	**1850***	**54***
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control	**116***	**9.2***	N/A	N/A
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground	**107***	**5.7***	**2002***	**54***
Fly control bait	**93***	**5.5***	N/A	N/A
Ornamental trees and potted ornamentals (soil injection/drench)	0.02	N/A	0.32	N/A
Ornamental trees (soil injection/drench)	0.03	N/A	N/A	N/A
Potted ornamentals (drench)	0.03	N/A	N/A	N/A
Citrus (soil drench)	0.03	N/A	N/A	N/A
Brassica vegetables, cucurbits, leafy vegetables, fruiting vegetables, corm and tuberous vegetables (drip irrigation)	0.03	N/A	**0.48***	N/A
Potato, rape including canola, mustard seed, sunflower (seed treatment)	**2.5***	N/A	N/A	N/A

N/A = not applicable
$^{+}$Oral LD_{50} (0.116 µg ai/bee) is based on TEP with 20% ai and contact LD_{50} (0.55 µg ai/bee) is based on TEP with 18.66% ai
$^{++}$Oral (0.0062 µg ai/bee) and contact (0.058 µg ai/bee) LD_{50}s are based on TEP with 20% cyantraniliprole and 20% thiamethoxam
*Exceeds the acute LOC of 0.4

Potential risk to bees from chronic exposure to cyantraniliprole could not be quantitatively assessed because of a lack of exposure data as well as toxicity data for individual bees. However, as discussed in the Risk Description section, there are a number of semi-field and full-field studies that can be used to qualitatively assess potential risks to honeybee colonies.

3. Non-target Terrestrial and Semi-Aquatic Plants

Risk quotients were calculated for listed terrestrial monocots and dicots (Table 41). None of the RQ values exceeded the LOC of 1; thus, direct effects to listed dicots are not expected from the proposed cyantraniliprole uses. There is uncertainty regarding the listed monocots because seedling emergence data from the most sensitive monocot in the vegetative vigor study (onion) were not available (see Risk Description for further discussion). Only non-definitive data were available for the EC_{25} values; consequently, risk quotients for non-listed monocots and dicots were not calculated for this endpoint. See the Risk Description section for further discussion.

Table 41. Summary of Risk Quotient Values for Plants in Dry and Semi-Aquatic Areas Exposed to Cyantraniliprole through Runoff and Spray Drift

Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Brassica vegetables (soil) *1 app at 0.35 lb ai/A*				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.55	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.55	<0.1
Brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, (aerial spray) *1 app at 0.175 lb ai/A*				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.33	0.13
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.33	<0.1
Brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, (ground spray) *1 app at 0.175 lb ai/A*				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.27	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.27	<0.1
Brassica leafy vegetables, bushberries, cotton, leafy vegetables (except brassica), oil seeds, pome fruit, corm and tuberous vegetables, stone fruit, tree nuts, bulb vegetables, (aerial spray) *1 app at 0.133 lb ai/A*				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.25	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.25	<0.1
Brassica leafy vegetables, bushberries, citrus, cotton, leafy vegetables (except brassica), oil seeds, pome				

Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
fruit, corm and tuberous vegetables, stone fruit, tree nuts, bulb vegetables, (ground spray) 1 app at 0.133 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.21	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.21	<0.1
Citrus (chemigation) 1 app at 0.391 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	0.20	0.73	0.29
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	0.20	0.73	0.15
Cucurbits, fruiting vegetables, potted ornamentals (drip chemigation/soil drench) 1 app at 0.130 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.20	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.20	<0.1
Cucurbits, fruiting vegetables, leafy vegetables, (drip chemigation) 1 app at 0.35 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.55	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.55	<0.1
Potato (seed treatment) 1 app at 0.69 lb ai/A – incorporation 3 inches				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.39	N/A
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.39	N/A
Potato (seed treatment) 1 app at 0.176 lb ai/A – incorporation 3 inches				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.10	N/A
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.10	N/A
Rapeseed including canola varieties, mustard seed (seed treatment) 1 app at 0.4 lb ai/A – no incorporation				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.63	N/A
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.63	N/A

Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Sunflower (seed treatment) 1 app at 0.016 lb ai/A – 1 inch incorporation				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	<0.1	N/A
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	<0.1	N/A
Corm and tuberous vegetables (soil) 1 app at 0.25 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.39	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.39	<0.1
Flowerbeds and groundcovers (ground spray) 1 app at 0.208 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.33	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.33	<0.1
Ornamental plants, fruit and nut trees (non-bearing), and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries, and interiorscapes, turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade house, under trees and shrubs that are being grown in-ground (ground spray) 1 app at 0.26 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.41	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.41	<0.1
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy corm, tuberous), public health insect control (ground spray/soil drench) 1 app at 0.42 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.66	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.66	<0.1
Fly control bait (granular) 1 app at 0.087 lb ai/A				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.13	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.13	<0.1

Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Potted ornamentals (soil drench) *1 app at 0.5 lb ai/A*				
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	0.11	0.78	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	0.11	0.78	<0.1
N/A – RQ could not be calculated because of a non-definitive EC_{25} *Exceeds LOC of 1.				

B. Risk Description

1. Degradate Persistence and Accumulation

Although cyantraniliprole has several dissipation pathways, the degradates formed are mostly large in molecular weight (>344 g/mol) and similar in structure to the parent (Appendix C). This indicates that the parent maybe undergoing a series of modifications rather than radical changes in structure. This conclusion is supported by only trace (<2%) amounts of mineralization (CO_2 production) based on the submitted fate studies. Aerobic soil metabolism studies show six of the eight major degradates have greater DT_{50} values (more persistent) than the parent cyantraniliprole (Table 7). This persistence may result in accumulation of these residues over time.

2. Risks to Aquatic Organisms

a. Animals

Fish

The risk quotient analysis indicated that direct chronic effects to freshwater fish are not expected; none of the risk quotients exceeded the chronic risk LOC of 1. Risk quotients could not be calculated for acute exposures because the toxicity data were non-definitive. In lieu of this, the most sensitive toxicity value can be compared with the peak EEC. In the case of freshwater fish, the most sensitive LC_{50} (>10000 µg total ai/L); although this value is non-definitive, it is much larger than the peak aquatic EEC of 37.97 µg ai/L. However, there was precipitate in this toxicity test and measured concentrations were not centrifuged or filtered; the amount of dissolved cyantraniliprole is unknown, lending uncertainty to the study's results. The most sensitive definitive LC_{50} for freshwater fish was 2400 µg ai/L, but was derived from a TEP study rather than a TGAI. It would be overly conservative to calculate risk quotients from TEP toxicity data because the product dissociates in water. However, in this case, if an RQ is calculated from the peak aquatic EEC (37.97 µg ai/L) and the TEP LC_{50} (2400 µg ai/L), it would be 0.016. This is well below the acute risk to listed species LOC of 0.05. Consequently, direct acute risks to freshwater fish and aquatic-phase amphibians, for which fish serve as surrogates, from the proposed uses (TEP or TGAI) of cyantraniliprole are not considered likely. Indirect effects to freshwater fish and aquatic-phase amphibians may still be possible for those species that rely on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals, for food, habitat, or other environmental resources.

Risk quotients could not be calculated for direct acute effects to estuarine/marine fish because the toxicity value was non-definitive. In lieu of this, the most sensitive toxicity value can be compared with the peak EEC. The most sensitive LC_{50} (>12000 µg total ai/L), although non-definitive, is much larger than the peak aquatic EEC of 37.97 µg ai/L. There was precipitate in this toxicity test and measured concentrations were not centrifuged or filtered; therefore, the amount of dissolved cyantraniliprole is uncertain, lending uncertainty to the study's results. No mortality or sub-lethal effects were observed in any treatment group in the test. Furthermore, the LC_{50} would need to be 16 times more sensitive (759 µg ai/L) to even reach the acute risk to listed species LOC of 0.05. Thus, the likelihood of adverse effects on estuarine/marine fish from direct acute exposure from the proposed uses of cyantraniliprole is considered low.

Risk quotients could not be calculated for chronic effects to estuarine/marine fish because only non-definitive toxicity data were available. Given that the NOAEC was a less than value (NOAEC <750 µg ai/L), it is not possible to preclude the possibility of direct chronic risks to estuarine/marine fish. Growth parameters (length and weight) were affected at the lowest concentration tested. Although the absolute value of the NOAEC (750 µg total ai/L) is one order of magnitude higher than the highest 60-day aquatic EEC of 37.42 µg ai/L and risk concerns cannot be eliminated on this alone.

Indirect acute and chronic effects to estuarine/marine fish may be possible for those species that rely on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals, for food, habitat, or other environmental resources.

Invertebrates

The risk quotient analysis using the TTR approach indicated direct effects to acute listed and non-listed species of freshwater invertebrates. Most of the proposed uses for cyantraniliprole exceeded the acute risk to listed species LOC of 0.05 while roughly 4% of the proposed use scenarios evaluated did not. Of the former, roughly 55% of the proposed use scenarios also exceeded the acute risk to non-listed species LOC of 0.5. Many (~68%) use scenarios also exceeded the chronic risk LOC of 1.

Acute toxicity data were available for 9 of the 10 degradates identified as degradates of concern. These data indicated that the degradates were less toxic than the parent, on an acute exposure basis. Likewise, the chronic toxicity value for the most toxic degradate also suggests the degradates are less toxic on a chronic exposure basis than the parent (Table 42). Therefore, the TTR approach for generating aquatic EECs is likely overly conservative for freshwater invertebrates.

Table 42. Comparison of Toxicological Data for Aquatic Invertebrates for Cyantraniliprole and its Degradates

Test material	Molecular weight (g/mol)	Endpoint	Toxicity value (mg/L)	Degradate toxicity expressed in parent compound equivalents (mg/L)*
Freshwater invertebrates (*Daphnia magna*)				
Cyantraniliprole	473	48-hr EC_{50}	0.0204	0.0204
IN-J9Z38	454		>0.22	>0.23
IN-JCZ38	490		1.85	1.79
IN-JSE76	491		26.64	25.7
IN-K5A77	473		>0.85	>0.85
IN-K5A78	473		>31.39	>31.39
IN-K5A79	478		>31.57	>31.2
IN-PLT97	460		0.30	0.31
IN-QKV54	344		>0.287	>0.40
IN-RNU71	437		>2.7	>2.9
Cyantraniliprole	473	NOAEC	0.00656	0.00656
IN-J9Z38	454		0.24	0.25
**Degradate toxicity are in parent compound equivalents: (mg/L) = (MW_{parent} / $MW_{degradate}$) x (toxicity endpoint of degradate (mg/L))				

To further refine the assessment, EECs were generated using a parent-only approach for several of the cyantraniliprole use scenarios. Parent-only EECs were generated for the North Carolina cotton aerial application scenario (3 apps at 0.133 lb ai/A, 7-day interval), which had yielded the highest EECs (38 µg ai/L) using the TTR approach. The new peak EEC was 7.89 µg ai/L and 21-day EEC was 5.28 µg ai/L. This reduced the highest acute risk quotient for all use scenarios to 0.39; it still exceeds the acute listed species LOC of 0.05, but no longer exceeds the acute non-listed species LOC of 0.5. Likewise, the highest chronic risk quotient for all use scenarios was reduced to 0.80, well below the chronic LOC of 1. Further exploring acute exposures, it was determined that the peak EEC would need to be roughly 5.0 µg ai/L to result in an RQ below the acute listed species LOC of 0.05. This translates into roughly 20% of the use scenarios that exceeded the LOC (0.05) in the TTR approach. Thus, direct acute exposure risks are possible for listed freshwater invertebrates; but direct chronic risks are not.

Indirect effects to freshwater invertebrates are expected for those species that rely on aquatic invertebrates, terrestrial invertebrates, estuarine/marine fish, terrestrial monocots, and/or mammals for food, habitat, or other environmental resources.

The RQ analysis indicated acute risk to listed species for estuarine/marine invertebrates for eight of the proposed cyantraniliprole use scenarios. The highest risk quotient was 0.072 (compared with the LOC of 0.05); thus, reducing the application rate may lower the risk quotients for these eight use scenarios to below the acute risk to listed species LOC (RQ < 0.05). None of the risk quotients exceeded the chronic risk LOC of 1 for either the crustacean (mysid shrimp mortality-based endpoint) or mollusks (Eastern oyster growth-based endpoint); acute-to-chronic ratios are not normally based on acute growth endpoints, but the oyster shell toxicity test yielded the most sensitive endpoint for acute toxicity to estuarine/marine invertebrates. Even when this more conservative endpoint was considered (compared with the mysid acute mortality endpoint), RQ values did not exceed the chronic risk LOC. Consequently, direct acute effects to listed species of estuarine/marine invertebrates are possible for a small number of proposed uses, but no direct chronic effects are expected. Indirect effects are expected for those species that rely on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals for food, habitat, or other environmental resources.

The RQ analysis indicated potential chronic risks and limited direct acute risks for benthic invertebrates. RQ values exceeded the chronic risk LOC of 1 in 46% of the modeled scenarios. Only one use exceeded the acute risk to listed species LOC of 0.05; the proposed rapeseed/mustard seed seed treatment (modeled by ND wheat) yielded a risk quotient of 0.051. The other rapeseed/mustard seed seed treatment, evaluated using the ND canola scenario, did not exceed the acute risk to listed species LOC. The maximum proposed application rate is 0.4 lb ai/A and it is possible that by slightly lowering the application rate, RQ values may drop below the acute risk to listed species LOC; however, direct chronic effects would still remain for roughly half of the proposed uses. Indirect effects are possible for those species that rely on aquatic invertebrates, terrestrial invertebrates, estuarine/marine fish, terrestrial monocots, and/or mammals for food or other environmental resources.

b. Plants

Risk quotients for aquatic plants could not be calculated because the toxicity values were non-definitive. The most sensitive vascular aquatic plant EC_{50} is >12100 µg ai/L (duckweed). The most sensitive non-vascular plant test (EC_{50} >10000 µg total ai/L) was with an estuarine/marine diatom and contained precipitate in the highest concentration tested. There is uncertainty as to the actual amount of cyantraniliprole that was dissolved in the test solution because measured concentrations were not centrifuged or filtered. The next most sensitive toxicity value (no precipitate in the study) was for green algae (EC_{50} >13000 µg ai/L). The duckweed, estuarine/marine diatom, and green algae toxicity values are all much larger than the peak surface water EEC predicted for all of the proposed uses of cyantraniliprole (37.97 µg ai/L). In addition to technical-grade cyantraniliprole, toxicity studies with non-vascular plants were performed with typical end-use products (TEP). Such a study with green algae yielded the most sensitive EC_{50} of all the non-vascular plant studies (EC_{50} = 825 µg ai/L). Using the highest peak EEC (37.97 µg ai/L) and the TEP toxicity endpoint, the resulting RQ is 0.046 and is well below the LOC of 1 for aquatic plants. Normally results from TEP studies are not considered in aquatic assessments because they are overly conservative (organism is expected to be exposed to individual components and not the full formulation itself). Given the lines of evidence, it is unlikely that there will be direct adverse effects to aquatic plants based on exposure from the proposed uses of cyantraniliprole. Indirect effects are possible for those species that rely on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals, for habitat modification, seed/propagule dispersal, or other environmental resources.

3. Risks to Terrestrial Organisms

a. Animals

Birds, Reptiles, and Land-Phase Amphibians

Acute dose-based and dietary-based risk quotients could not be calculated to evaluate the risks to birds because only non-definitive acute toxicity data were available. Instead, the non-definitive toxicity values were directly compared to the EECs (Table 43). The most sensitive TGAI studies were selected (in two cases, there were more sensitive results for TEP studies, but these were also non-definitive and the lower toxicity value is probably an artifact of the largest dose of product that was given to the bird rather than the active ingredient itself). In all cases, none of the EECs were larger than the non-definitive toxicity values for the most sensitive avian species. No sub-lethal effects were observed in either the acute oral or sub-acute dietary studies for any of the species tested.

An LD_{50}/ft^2 analysis is usually conducted for granular pesticide applications; however, risk quotients cannot be calculated when toxicity values are non-definitive. This process is in place because using the absolute value of the non-definitive may over-estimate risk. In this case, given that no other information was available, the absolute value of the acute oral bird toxicity (LD_{50} =2250 mg ai/kg-bw) was used in T-REX to generate risk quotients which ranged from <0.01 to 0.03. These risk quotients cannot be used quantitatively in a risk assessment because they were calculated in an overly conservative manner; however, they qualitatively demonstrate that acute risks to birds for the proposed public health granular use of cyantraniliprole are unlikely. Thus, the potential for risk is considered to be low for acute dose-based and dietary-based exposure of birds, reptiles, and terrestrial-phase amphibians from cyantraniliprole for all registered uses.

None of the avian RQ values calculated for chronic exposure exceed the Agency's chronic risk LOC for listed and non-listed species. Therefore, the likelihood of chronic adverse effects in birds, reptiles, and terrestrial-phase amphibians from exposure to residues from the proposed cyantraniliprole uses is expected to be low.

Indirect effects are possible for species of birds, reptiles and terrestrial-phase amphibians that rely on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals for food or other environmental resources.

Table 43. Comparison of the Highest Calculated EEC for Each Use of Cyantraniliprole to the Most Sensitive Avian Acute Toxicity Values

Application Scenario	Dietary Item	EEC (mg ai/kg-bw)	LD_{50} (zebra finch and bobwhite quail) mg ai/kg-bw	EEC (mg ai/kg-diet)	LC_{50} (mallard and bobwhite quail) mg ai/kg-diet
Brassica leafy vegetables, leafy vegetables	Short grass	91.56	>2250	80.39	>5620

Application Scenario	Dietary Item	EEC (mg ai/kg-bw)	LD_{50} (zebra finch and bobwhite quail) mg ai/kg-bw	EEC (mg ai/kg-diet)	LC_{50} (mallard and bobwhite quail) mg ai/kg-diet
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables	Short grass	99.10	>2250	87.02	>5620
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts	Short grass	95.55	>2250	83.90	>5620
Cucurbits, fruiting vegetables	Short grass	96.23	>2250	84.49	>5620
Potatoes (seed treatment – higher rate)	Seed	113.65	>2250	N/A	>5620
Potatoes (seed treatment – lower rate)	Seed	28.99	>2250	N/A	>5620
Rapeseed including canola varieties, mustard seed (seed treatment)	Seed	65.88	>2250	N/A	>5620
Sunflower (seed treatment)	Seed	2.64	>2250	N/A	>5620
Flowerbeds and groundcovers	Short grass	106.35	>2250	93.38	>5620
Ornamentals treated by commercial and consumer applicators	Short grass	66.47	>2250	58.36	>5620
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	Short grass	97.59	>2250	85.64	>5620
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control	Short grass	114.80	>2250	100.80	>5620
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy weedy mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground	Short grass	82.97	>2250	72.85	>5620
Soil injection/drench hardwood (lower rate)	Leaves	N/A	>2250	148	>5620
Soil injection/drench hardwood (higher rate)	Leaves	N/A	>2250	254	>5620
Soil drench (citrus)	Leaves	N/A	>2250	233	>5620
Soil injection/drench softwood (lower rate)	Leaves	N/A	>2250	68	>5620
Soil injection/drench softwood (higher rate)	Leaves	N/A	>2250	116	>5620

Application Scenario	Dietary Item	EEC (mg ai/kg-bw)	LD_{50} (zebra finch and bobwhite quail) mg ai/kg-bw	EEC (mg ai/kg-diet)	LC_{50} (mallard and bobwhite quail) mg ai/kg-diet
Potted non-woody ornamental drench (lower rate)	Leaves	N/A	>2250	4.6	>5620
Potted non-woody ornamental drench (higher rate)	Leaves	N/A	>2250	9	>5620
Drip irrigation (brassica vegetables)	Leaves	N/A	>2250	64	>5620
Drip irrigation (cucurbits)	Leaves	N/A	>2250	636	>5620
Drip irrigation (fruiting vegetables)	Leaves	N/A	>2250	182	>5620
Drip irrigation (leafy vegetables)	Leaves	N/A	>2250	54	>5620
Drip irrigation (corm and tuberous vegetables)	Leaves	N/A	>2250	64	>5620

Mammals

Acute dose-based and dietary-based risk quotients could not be calculated to evaluate the risks to mammals because only non-definitive acute toxicity data were available. Instead, the non-definitive toxicity values were directly compared to the EECs (Table 44). In all cases, none of the EECs were larger than the non-definitive toxicity values. Furthermore, no sub-lethal effects were observed in the acute oral toxicity study.

An LD_{50}/ft^2 analysis is usually conducted for granular pesticide applications; however, similar to what was discussed for birds, risk quotients cannot be calculated when toxicity values are non-definitive. In this case, given that no other information was available, the absolute value of the acute oral mammal toxicity (LD_{50} =5000 mg ai/kg-bw) was used in T-REX to generate RQs. The RQs ranged from <0.01 to 0.01. These RQs cannot be used quantitatively in a risk assessment because they were calculated in an overly conservative manner; however, they qualitatively demonstrate that acute risks to mammals from the proposed public health granular use of cyantraniliprole are considered unlikely. Thus, the potential for risk is considered to be low for acute dose-based exposure of mammals from cyantraniliprole for all proposed uses.

Chronic risk quotients exceeded the chronic risk to mammals LOC of 1 for most of the proposed uses of cyantraniliprole. The few uses that did not exceed were: non-woody potted ornamental plants, and the seed treatments (potato, rapeseed/mustard seed, and sunflower). Of the uses that exceeded, mammals that consume short grass, tall grass, broadleaf plants, and arthropods are potentially at direct risk. Those mammals that strictly consume seeds, fruits, and/or pods are not expected to be at direct risk from cyantraniliprole uses. Consequently, direct chronic risks are possible for most cyantraniliprole uses, based on the screening-level RQ analysis.

Indirect effects to mammals are possible for all species that rely on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, mammals, and/or estuarine/marine fish for food, habitat, or other environmental resources.

Table 44. Comparison of the Highest Calculated EEC for Each Use of Cyantraniliprole to the Most Sensitive Mammal Acute Toxicity Value

Application Scenario	Dietary Item	EEC (mg ai/kg-bw)	LD_{50} (rat) mg ai/kg-bw
Brassica leafy vegetables, leafy vegetables	Short grass	76.65	>5000
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables	Short grass	82.96	>5000
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts	Short grass	79.99	>5000
Cucurbits, fruiting vegetables	Short grass	80.56	>5000
Potatoes (seed treatment – higher rate)	Seed	95.14	>5000
Potatoes (seed treatment – lower rate)	Seed	24.27	>5000
Rapeseed including canola varieties, mustard seed (seed treatment)	Seed	55.15	>5000
Sunflower (seed treatment)	Seed	2.21	>5000
Flowerbeds and groundcovers	Short grass	89.03	>5000
Ornamentals treated by commercial and consumer applicators	Short grass	55.64	>5000
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	Short grass	81.70	>5000
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control	Short grass	96.11	>5000
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy weedy mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground	Short grass	88.40	>5000
Soil injection/drench hardwood (lower rate)	Leaves	141	>5000
Soil injection/drench hardwood (higher rate)	Leaves	241	>5000
Soil drench (citrus)	Leaves	221	>5000
Soil injection/drench softwood (lower rate)	Leaves	65	>5000

Application Scenario	Dietary Item	EEC (mg ai/kg-bw)	LD_{50} (rat) mg ai/kg-bw
Soil injection/drench softwood (higher rate)	Leaves	110	>5000
Potted non-woody ornamental drench (lower rate)	Leaves	4	>5000
Potted non-woody ornamental drench (higher rate)	Leaves	9	>5000
Drip irrigation (brassica vegetables)	Leaves	61	>5000
Drip irrigation (cucurbits)	Leaves	604	>5000
Drip irrigation (fruiting vegetables)	Leaves	173	>5000
Drip irrigation (leafy vegetables)	Leaves	51	>5000
Drip irrigation (corm and tuberous vegetables)	Leaves	61	>5000

Terrestrial Invertebrates

Toxicity data were available for parasitic wasps, beetles, spiders, lacewings, predatory mites, and collembola. The studies indicated that cyantraniliprole is toxic to some terrestrial invertebrates at very low application rates (48-hr LR_{50} = 0.00008 lb ai/A – parasitic wasp). Conversely, collembola, which are exposed to cyantraniliprole through direct contact with the soil, were not found to be very sensitive to applications of cyantraniliprole (EC_{50} > 1200 mg ai/kg-soil. Likewise, earthworms demonstrated a low toxic effect to cyantraniliprole (EC_{50} > 102.6 mg ai/kg-soil – based on TEP).

Honeybee toxicity data for cyantraniliprole indicated that it is highly toxic on an acute oral and contact basis, but the endpoints were non-definitive and the true toxicity classification is uncertain. Tier I risk quotients for TEPs (cyantraniliprole-only and cyantraniliprole-thiamethoxam) exceeded the LOC of 0.4 for most uses. Risk quotients could not be calculated using data from technical-grade cyantraniliprole because the oral and contact toxicity endpoints were both non-definitive. In lieu of this, Table 45 presents a direct comparison of the EEC for each use with the toxicity endpoint. For technical-grade cyantraniliprole, the EEC is higher than the non-definitive toxicity value for all uses except the soil applications. This indicates that those uses may pose environmental risks to terrestrial insects. There is uncertainty, however, because the toxicity endpoints are non-definitive.

Table 45. Comparison of the EEC for Each Use of Cyantraniliprole to the Most Sensitive Honeybee Acute Toxicity Values

Application Scenario	Dietary EEC (µg ai/bee)	Oral LD_{50} µg ai/bee	Contact EEC (µg ai/bee)	Contact LD_{50} µg ai/bee
Brassica leafy vegetables, leafy vegetables	**10.76**	> 0.1055	**2.11**[1]	> 0.0934

Application Scenario	Dietary EEC (µg ai/bee)	Oral LD_{50} µg ai/bee	Contact EEC (µg ai/bee)	Contact LD_{50} µg ai/bee
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables	**11.64**	> 0.1055	**4.36**	> 0.0934
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts	**11.23**	> 0.1055	**1.6**[2]	> 0.0934
Cucurbits, fruiting vegetables	**11.31**	> 0.1055	**4.24**	> 0.0934
Potato, rapeseed including canola, mustard seed, sunflower (seed treatment)	**0.292**	> 0.1055	**N/A**	> 0.0934
Flowerbeds and groundcovers	**12.50**	> 0.1055	**2.50**[3]	> 0.0934
Ornamentals treated by commercial and consumer applicators	**7.81**	> 0.1055	**1.56**[4]	> 0.0934
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes	**11.47**	> 0.1055	**3.13**[5]	> 0.0934
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control	**13.49**	> 0.1055	**5.05**	> 0.0934
Turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy weedy mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground	**12.41**	> 0.1055	**3.13**[5]	> 0.0934
Fly control bait (granular)	**10.79**	> 0.1055	3.01[6]	N/A
Ornamental trees and potted ornamentals (soil injection/drench) (lower rate)	0.002	> 0.1055	N/A	N/A
Ornamental trees (soil injection/drench) (higher rate)	0.003	> 0.1055	N/A	N/A
Citrus (soil drench)	0.003	> 0.1055	N/A	N/A
Potted ornamental drench (higher rate)	0.004	> 0.1055	N/A	N/A
Brassica vegetables, cucurbits, fruiting vegetables, leafy vegetables, corm and tuberous vegetables (drip irrigation)	0.003	> 0.1055	N/A	N/A

Application Scenario	Dietary EEC (µg ai/bee)	Oral LD_{50} µg ai/bee	Contact EEC (µg ai/bee)	Contact LD_{50} µg ai/bee
N/A = not applicable [1]Based on single app of 0.175 lb ai/A because application interval is >5 days [2]Based on single app of 0.133 lb ai/A because application interval is >5 days [3]Based on single app of 0.208 lb ai/A because application interval is >5 days [4]Based on single app of 0.13 lb ai/A because application interval is >5 days [5]Based on single app of 0.26 lb ai/A because application interval is >5 days [6]Based on single app of 0.087 lb ai/A because application interval is >5 days				

Toxicity information was available for three of cyantraniliprole's degradates. Two of them (IN-HGW87 and IN-J9Z38) are classified as "highly toxic" to honeybees, but there is uncertainty regarding this classification because the endpoints were non-definitive. The third degradate (IN-K5A78) is classified as "practically non-toxic" to honeybees. Based on this information, it is uncertain as to whether cyantraniliprole's degradates may pose a risk to honeybees.

Residue data were also available for cyantraniliprole and some of its degradates in honey, pollen, nectar, wax, and guttation fluid. Residue samples were taken as part of semi- or full-field studies with honeybees. Pollen, nectar, and wax were collected from the hives or directly from foraging bees. Guttation water samples were collected from the crop that had been treated with cyantraniliprole. After converting the residues into doses, they could be directly compared to the oral and contact toxicity values (it should be noted that the toxicity values were non-definitive and taking them at face value may over-estimate the risk) (Table 46). Comparing the measured residue data to the model-estimated exposure values on food items, the foliar model (T-REX) yielded much higher estimates than quantified in the field. T-REX EECs (converted into a dose per bee) ranged from 7.81 to 13.49 µg ai/bee for dietary exposure and 1.56 to 5.05 µg ai/bee for contact exposure. The highest residue measurement in the field (converted into a dose per bee) was 0.0083 µg ai/bee. For drench/soil applications, the modeled EECs (converted into a dose per bee) were 0.002 to 0.007 µg ai/bee for dietary exposure whereas the maximum residue measured in the field for drip irrigation application methods was 0.003 µg ai/bee in nectar. This suggests that risk quotients based off of T-REX (foliar applications) may over-estimate the exposure potential for honeybees, and thus the risk. The risk quotients for drench/soil application methods may more accurately represent exposure conditions, and thus risk.

There was one instance in which the detection of cyantraniliprole in the field surpassed the absolute acute contact and oral LD_{50} values: guttation fluid in a study with two foliar applications of cyantraniliprole at 0.08 lb ai/A on oilseed rape. This establishes that conditions in the field are such that concentrations of cyantraniliprole can reach concentrations potentially hazardous for acute exposures to honeybees. The data set in Table 46 is very limited; oilseed rape is the only crop tested for foliar applications. Application rates vary; however, guttation fluid, which yielded the highest concentrations of cyantraniliprole compared to other food items, is only measured at the 0.08 lb ai/A rate. It is plausible that the 0.134 lb ai/A rate would yield even higher concentrations of cyantraniliprole in guttation fluid. This rate is still lower than 0.175 lb ai/A, which is the maximum rate for a number of crops, and also lower than several proposed flowerbed/ornamental foliar uses that range from 0.208 to 0.42 lb ai/A. This means that field concentrations may be higher than these studies documented for application rates of 0.175, 0.208, and 0.42 lb ai/A. Furthermore, the label stipulates that applications can be made every 7 days for most crops and the study's foliar scenarios were based on application intervals of 15 days or more. Again, residues may be higher with more frequent application intervals. Guttation fluid is considered a minor exposure pathway because of the uncertainty regarding its availability (generally mornings only) and honeybees may obtain most of their water requirements through other food sources (USEPA 2012b). Therefore, the analyses that follow focus on pollen and nectar residue data.

One drip irrigation scenario (0.089 lb ai/A with melons) was also considered in the residue studies and generally yielded lower concentrations of cyantraniliprole in pollen, and guttation fluids than the foliar application methods; however, it should be noted that the application rate used in the study was much lower than the maximum single application rate of 0.35 lb ai/A for drip chemigation in some crops.

Table 46. Residues of Cyantraniliprole and Its Degradates in Bee Food Items

Application rate (lb ai/A)	Cyantraniliprole residues in mg ai/kg (converted into a dose – µg ai/bee)[1]	Other degradates in mg ai/kg (converted into a dose – µg/bee)[1]	MRID
Oilseed rape (foliar) 2 at 0.08 (20 days)	Honey = 0.013 (0.0017) Pollen = 0.019 (0.0024) Wax = 0.033 (0.0043) **Guttation = 3.092 (0.40)***	<u>Guttation</u> IN-J9Z38 = 0.046 (0.0059) IN-HGW87 = 0.010 (0.0012) IN-MYX98 = 0.008 (0.00098)	48122557
Oilseed rape (foliar) 2 at 0.08 (16 days)	Honey = 0.020 (0.0025) Pollen = 0.065 (0.0083) Wax = 0.030 (0.0038) Guttation = 0.647 (0.083)	<u>Guttation</u> IN-J9Z38 = 0.012 (0.0015) IN-HGW87 = 0.008 (0.0010) IN-MYX98 = 0.007 (0.0009)	48122558
Oilseed rape (foliar) 2 at 0.134 (15 days)	Pollen (median) = 0.025 (0.0032) Honey = 0.005 (0.00068)	Not available	48122553
Oilseed rape (foliar) 2 at 0.011 (15 days)	Pollen (median) = 0.011 (0.0014) Wax = 0.008 (0.00097)	Not available	48122553
Oilseed rape (foliar) 2 at 0.134	Honey = 0.005 (0.00064) Pollen = 0.077 (0.0099)	<u>Pollen</u> IN-J9Z38 = 0.007 (0.00093) and 0.010 (0.0012)	48122552
Oilseed rape (foliar) 2 at 0.011 (17 days)	Pollen = 0.042 (0.0054)	Not available	48122552
Oilseed rape (foliar)	Honey (median) = 0.006 (0.00073)	Not available	48122551

2 at 0.011 (15 days)	Pollen = 0.009 (0.0012) Wax = 0.011 (0.0014)		
Oilseed rape (foliar) 2 at 0.134 (15 days)	Honey (median) = 0.008 (0.0010) Pollen = 0.062 (0.0080) Wax = 0.017 (0.0021)	Not available	48122551
Melon (drip irrigation) 3 at 0.089 (7 days)	Pollen = 0.012 (0.0015) Nectar = 0.026 (0.0033) Guttation = 0.066 (0.0084)	Not available	48122548
[1]Conversions to ai/bee were made by multiplying the residue value (converted to mg ai/kg) times the body weight of an average-sized adult bee (0.128 g) (Mayer and Johansen 1990). *Exceeds cyantraniliprole acute contact (LD_{50} >0.0934µg ai/bee) and/or acute oral (LD_{50} >0.1055 µg ai/bee) toxicity value			

Some data from magnitude of residue studies were also available for pollen (MRIDs 48119994 and 48120013) (Table 47). These studies were not performed in conjunction with a honeybee semi- or full-field experiment. In these studies, samples of pollen were collected from each crop after a period of time following the application of cyantraniliprole. Canola, sunflower, tomato, zucchini and *P. tanacetifolia* were tested and both foliar and drench application scenarios were considered. Foliar applications consisted of multiple applications of 0.12 lb ai/A applied at 7-10 day intervals while soil applications were applied once at a rate of 0.35 lb ai/A. Cyantraniliprole residues in pollen ranged from 0.016 to 5.549 mg ai/kg for foliar applications 0.023 to 1.674 mg ai/kg for soil applications. In all instances but zucchini, the soil application yielded lower residue values than the foliar applications. Some of the foliar applications were made during bloom; thus, the higher concentrations of residues detected on the pollen for foliar applications probably reflects cyantraniliprole coming into direct contact with the pollen. The soil drench applications reflect solely movement of the insecticide from the soil into the plant. Comparing the cyantraniliprole residues detected in pollen and anthers, it appears that cyantraniliprole is not equally distributed throughout the flower; residue concentrations are consistently higher in pollen samples than anther samples.

Table 47. Summary of Pollen Residue Data from Magnitude of Residue Studies

Total radioactive residues (mg/kg)										
Crop	**Canola**		**Sunflower**		**Tomato**		**Zucchini**		***Phacelia tanacetifolia***	
Treatment	**Foliar[a]**	**Soil[b]**	**Foliar[a]**	**Soil[b]**	**Foliar[a]**	**Soil[c]**	**Foliar[a]**	**Soil[b]**	**Foliar[a]**	**Soil[b]**
Pollen[d]	0.346	0.268	5.549	0.136	1.674	0.101	0.016	0.023	0.069	0.033
Anthers[d]	0.125	0.014	0.488	0.262	0.467	0.048	0.008	0.002	0.015	0.015
Anther wash[e]	0.082	0.014	0.081	0.045	0.134	0.019	0.009	0.004	0.049	0.021

[a]Three foliar applications of [14C]-cyantraniliprole were made at 0.12 lb ai/A, *ca.* 7 to 10 days apart, with the first application at *ca.* 3 to 4 weeks prior to flowering. The last foliar application to canola was 2 days after the second application to ensure completion of the treatment regime before onset of flowering.
[b]A single 0.35 lb ai/A soil drench application of [14C]-cyantraniliprole was made at sowing.
[c]A single 0.35 lb ai/A soil drench application of [14C]-cyantraniliprole was made at *ca.* 3 to 4 weeks prior to flowering.
[d]TRR = Total extractable + unextracted 14C-residues in sample
[e]A water rinse, required to separate pollen from the anthers, was analyzed by LSC

Given that acute risks were identified for cyantraniliprole applications, the residue data taken from hives were used to refine the risk assessment. Oral consumption rates of pollen and nectar are dependent on the life stage of the honeybee [guttation water is not considered here because exposures are expected to be higher for other food items (*i.e.*, pollen and nectar) (USEPA 2012b)]. Larval toxicity data are not available for cyantraniliprole, thus only adults are considered here. Table 48 depicts the expected food consumption rate for different adult honeybees. To calculate risk quotients, the estimated dose per day for each food item is divided by the oral toxicity value. Risk quotients were calculated using the oral dose for a TEP because this value was definitive, whereas the toxicity endpoints for technical-grade cyantraniliprole were not (Table 49). This is a conservative approach because some of the toxicity of a product may be associated with it non-cyantraniliprole components. However, given that the TGAI data for cyantraniliprole are non-definitive and not appropriate for risk quotient calculation, the TEP data are used, with caution.

Table 48. Estimated Consumption Rates of Pollen, Nectar and Royal Jelly by Adult Honeybees

Life Stage	**Caste**	**Daily consumption rate (mg/day)**				
		Average Age (in days)	**Brood food / royal jelly**	**Nectar[**]**	**Pollen[***]**	**Total food**
Adult	Worker (cell cleaning and capping)	0-10	none	60	5.2	65
	Worker (brood and queen tending, nurse bees)	6-17	none	140	8.85	149
	Worker (comb building, cleaning and food handling)	11-18	none	60	1.7	62

Life Stage	Caste	Daily consumption rate (mg/day)				
		Average Age (in days)	Brood food / royal jelly	Nectar**	Pollen***	Total food
	Worker (foraging for pollen)	>18	none	43.5	0.041	44
	Worker (foraging for nectar)	>18	none	292	0.041	292
	Worker (maintenance of hive in winter	0-90	none	29	2	31
	Drone	>10	none	235	0.0002	235
	Queen	0+	unknown	unknown	None	unknown

Source: USEPA 2012 Draft Pollinator Risk Assessment Framework;
NA = not applicable
*From Winston 1987
**From Rortais *et al.* 2005. Assumes that average sugar content of nectar is 30%.
*** From Crailsheim et al. (1992, 1993).

Table 49. Refined Acute Oral Risk Quotients for Adult Honeybees Using Maximum Reported Concentrations in Pollen and Nectar

Life Stage	Cast/Task	Average Age (d)	Total food Consumption (g/d)	Estimated Oral Dose (ug ai/bee/d) [1]	Acute RQ [2]
					Cyan. only
Adult	Worker (cell cleaning and capping)	0-10	0.065	0.00196	0.017
	Worker (brood and queen tending, nurse bees)	6-17	0.149	0.00432	0.037
	Worker (comb building, cleaning and food handling)	11-18	0.062	0.00169	0.015
	Worker (foraging for pollen)	>18	0.0435	0.00113	0.010
	Worker (foraging for nectar)	>18	0.292	0.0076	0.066
	Worker (maintenance of hive in winter	0-90	0.031	0.000908	0.008
	Drone	>10	0.235	0.00611	0.053
	Queen	0+	unknown	unknown	unknown

[1] Oral dose determined using maximum concentrations of cyantraniliprole in pollen (rapeseed = 0.077 mg/kg) and nectar (melon = 0.026 mg/kg) reported in Table 46 multiplied by the estimated cast-specific consumption rate. The dose is reflective of the percent pollen and nectar that adult honeybees typically consume in a day (*i.e.*, for nectar, the maximum concentration found in nectar is multiplied by the nectar consumption rate. The same is done for pollen and these are then added together for the total cyantraniliprole consumption rate).
[2] Acute RQs determined as the ratio of oral dose to the acute LD_{50} for cyantraniliprole-only TEP (0.116 µg ai/bee)

The concentrations of residues detected in hives in the semi- and full-field studies indicate that the use of cyantraniliprole products result in residues that are not expected to result in risk concerns to honeybees through the dietary exposure route. The highest concentration of cyantraniliprole in pollen was detected in samples taken directly from the hive (comb). The highest concentration of cyantraniliprole in nectar was collected from forager bees upon their return to the hive. The risk quotients are most heavily influenced by the concentration of cyantraniliprole in nectar because this is a larger part of the bee's diet than pollen. One uncertainty is that the residue samples were taken from studies that were far below the maximum application rate; higher application rates may result in higher residue concentrations in nectar and pollen. The highest cyantraniliprole concentration in nectar was derived from a study with 3 applications of cyantraniliprole at 0.089 lb ai/A (7-day interval) via drip irrigation in melons. Proposed application rates are as high as 0.35 lb ai/A for a single application via drip chemigation, thus the application rate used in the residue study with melons is far below what is proposed for other uses. In general, the magnitude of residue studies tested at application rates that were higher and/or more frequent than those tested in the honeybee field effects studies. The magnitude of residues studies did not measure nectar concentrations, but pollen concentrations are generally higher than those detected in the hive studies and likely reflect the higher application rates used in the magnitude of residue studies. However, to exceed the LOC of 0.4, an adult worker honeybee foraging for nectar would need to consume a daily dose of 0.464 µg ai/bee, which is six times greater than the maximum dose consumed using the provided residue data.

Many semi- and full-field studies were available to evaluate cyantraniliprole's effects on honeybees. Beginning with bee behavior and mortality, the field studies indicate that cyantraniliprole applications induce temporary adverse effects (cramping, lethargy, increased grooming behavior, decreased foraging activity) in honeybees. Unlike the foliage residues test, which showed negligible mortality and behavior effects on bees exposed to residues (aged 3 to 72 hours), the field studies take into consideration the dietary route of exposure as well as the contact route. Many of the field studies for honeybees reported an increased mortality for up to five days after the application. Bees exhibited decreased foraging behavior for up to six days after application and it is suggested that cyantraniliprole has a "repellent" effect on bees. Signs of intoxication were also reported (*e.g.*, cramping of bees). Not surprisingly, applications made during bee flight tended to result in a greater degree of adverse effects than applications made after bee flight. The combination of mortality, sub-lethal effects, and repellence (decreased foraging) in cyantraniliprole-treated plants may affect pollinator services. Based on the semi-field study data, the effects are expected to be transient (lasting up to six days).

Although the semi-field studies indicated transient effects on behavior, foraging activity and mortality, observations of brood health and colony strength (up to 28 days) suggested no adverse effects from cyantraniliprole applications. The results of longer-term studies must be considered in the context of some uncertainties. Namely, the health of all colonies (controls and treatment) was in decline well before overwintering reductions in colony size should have occurred. However, of the three studies that followed the hives through the overwintering period, most of the data suggest no long-term effects to honeybees that would differentiate treated from control colonies.

One semi-field study monitored the colonies up to just prior to overwintering period (170) days and detected no differences between the controls and treatments. Three studies followed the hives through the overwintering period. Two of these demonstrated that hive health and/or brood development was comparable between the treatment groups and the controls. In the third study, the control and one of the treatments were similar in their performance, but a second treatment showed decreased colony strength and a much smaller average number of bees per hive than at the start of the experiment. The second treatment involved the application of cyantraniliprole during bee flight whereas in the first treatment, applications were made after bee flight. This could be the cause behind the decreased colony size in this study. However, the other two studies, in which no differences occurred in hive strength after overwintering, also involved treatments where applications of cyantraniliprole were made during bee flight. This remains a point of uncertainty, although overall, the field studies suggest that applications of cyantraniliprole at rates of up to 0.134 lb ai/A did not adversely affect hive health/strength relative to controls.

According to label rates, cyantraniliprole can be sprayed up to 0.175 lb ai/A on brassica leafy vegetables, cucurbits, fruiting vegetables, and leafy vegetables. Foliar rates of 0.208 to 0.42 lb ai/A are permitted for flowerbeds and groundcovers, turf/grassy areas, public health insect control, and trees and ornamental plants. These rates were not addressed in the honeybee field trials and the effects to hive health from these higher rates are uncertain.

In one of the field studies, varroa mites infested all of the colonies. The hives exposed to cyantraniliprole-treated crops had higher mites loads than the control hives. This could indicate that cyantraniliprole may increase the susceptibility of hives to other environmental stressors; however there is uncertainty in this premise because the study was not designed to specifically test the effects of varroa mites on hives.

Another route of exposure is through the dust associated with planting cyantraniliprole-treated seeds or harvesting cyantraniliprole-treated crops. Bees may be exposed to dust while in flight (contact) or when visiting dust-laden flowers (contact or dietary). Dust generated from the abrasion of treated seed coats during planting has been linked to bee mortality (Pistorius *et al*. 2009; Forster et al. 2009) and is the subject of ongoing research (Tapparo et al. 2012; Krupke et al. 2012).

Finally, there is further uncertainty about the typical end-use products that contain both cyantraniliprole and thiamethoxam. Individual toxicity data for each of these chemicals indicate that they are both highly toxic to bees. The contact and dietary acute toxicity data from a laboratory study indicate that the co-formulated product is more toxic than cyantraniliprole alone, but less toxic than thiamethoxam alone. No field studies were available for this product and its short and long-term effects on pollinator services and honeybee colony health are unknown.

Data were available for a number of other terrestrial invertebrates as well. They suggested that sensitivity to cyantraniliprole varies, depending on the organisms. Parasitoid wasps were the most sensitive, while collembola, beetles, lacewings, predatory mites, and spiders were not as sensitive. Earthworms also appeared to be generally unaffected by the cyantraniliprole application rates that were tested. As with the honeybee studies, these rates did not approach the single maximum of 0.69 lb ai/A.

Overall, the combination of laboratory and field studies suggests that risk concerns are possible for cyantraniliprole. The Tier II risk quotient analysis indicated that the acute oral exposure route is likely not a risk concern; however, risk concerns for contact toxicity can not be eliminated, based on the Tier I risk quotient analysis. Transient effects were observed up to the maximum application rate tested (0.134 lb ai/A) indicate increased mortality for up to 5 days after application and decreased foraging activity for up to 6 days after application. These effects do not appear to cause long-lasting damage to the hive as hives that were monitored tended to survive the overwintering period until spring. Cyantraniliprole may increase a hive's susceptibility to varroa mite infestation, but more evidence is needed to document this premise. The highest application rates (up to 0.69 lb ai/A) were not tested, leaving uncertainty as to the effects these rates may have on honeybees. In addition, toxicity data suggest the cyantraniliprole-thiamethoxam product is more toxic that cyantraniliprole alone, but field studies are not available that assess the effects of this product.

Direct effects to terrestrial invertebrates may be reduced by limiting the times foliar applications of cyantraniliprole are made to periods when pollinators and other invertebrates are not active. There is some uncertainty associated with this action as the semi-field studies demonstrated transient changes in mortality rates and behavior for applications of cyantraniliprole made after bee flight as well as during bee flight. Sometimes the mortality rates were the same between both groups and sometimes the group receiving the application after bee flight was lower.

Indirect effects may occur for terrestrial invertebrates that depend on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals for food, habitat, or environmental services.

b. Plants

Based on the risk quotient analysis, the LOC for risk to listed terrestrial plants was not exceeded for monocots or dicots. There is some uncertainty regarding the analysis for monocots because seedling emergence data were available for only one monocot. Onion was the most sensitive monocot in the vegetative vigor test, but data from this species were found to be unacceptable in the seedling emergence study because of control performance problems. If the seedling emergence NOAEC for onion is $\leq$0.100, risk quotients would exceed the LOC for some uses. Currently, the most sensitive monocot seedling emergence NOAEC is 0.134 lb ai/A. Risk quotients could not be calculated for non-listed monocots and dicots because only non-definitive data were available for these endpoints. The listed species risk quotients are based on the NOAEC, which is more sensitive than the EC_{25}. Thus, the risk quotients for listed species are expected to be protective of non-listed species as well. No direct effects are anticipated for terrestrial dicots; however direct effects to listed monocots cannot be precluded because of an absence of data. Indirect effects may occur for plants that depend on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, or mammals for seed/propagule dispersal, habitat modification, and environmental services.

4. Review of Incident Data

Reviews of the Ecological Incident Information System (EIIS, version 2.1) and the Avian Incident Monitoring System (AIMS) were conducted on January 17, 2013. There are no reported incidents for cyantraniliprole in the EIIS or AIMS databases. In addition to the incidents recorded in EIIS and AIMS, additional pesticide incidents are reported to the Agency in aggregated incident reports. Ecological incidents reported in aggregate reports include those categorized as ‘minor fish and wildlife’ (W-B), ‘minor plant’ (P-B), and ‘other non-target’ (ONT) incidents. ‘Other non-target’ incidents include reports of adverse effects to insects and other terrestrial invertebrates. As of January 17, 2013, there have been no aggregate cyantraniliprole ecological incidents reported to the Agency. Given that this is a new chemical that has not been registered for use in the United States or other countries, the existence of ecological incident reports would be unlikely.

5. Federally Threatened and Endangered (Listed) Species Concerns

a. 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. At the initial screening-level, the risk assessment considers broadly described taxonomic groups and conservatively assumes that listed species within those broad groups are located on or adjacent to the treated site and aquatic organisms are assumed to be located in a surface water body adjacent to the treated site. The assessment also assumes that the listed species are located within an assumed area that has the relatively highest potential exposure to the pesticide, and that exposures are likely to decrease with distance from the treatment area.

If the assumptions associated with the screening-level action area result in risk quotients that are below the listed species LOCs, a "no effect" determination conclusion is made with respect to listed species in that taxa, and no further refinement of the action area is necessary. Furthermore, risk quotients below the listed species LOCs for a given taxonomic group indicate no concern for indirect effects upon listed species that depend upon the taxonomic group covered by the risk quotient as a resource. However, in situations where the screening assumptions lead to risk quotients in excess of the listed species LOCs for a given taxonomic group, a potential for a "may affect" conclusion exists and may be associated with direct effects on listed species belonging to that taxonomic group or may extend to indirect effects upon listed species that depend upon that taxonomic group as a resource. In such cases, additional information on the biology of listed species, the locations of these species, and the locations of use sites could be considered to determine the extent to which screening assumptions regarding an action area apply to a particular listed organism. These subsequent refinement steps could consider how this information would affect the action area for a particular listed organism and may potentially include areas of exposure that are downwind and downstream of the pesticide use site.

b. Taxonomic Groups Potentially at Risk

The Level I screening assessment process for listed species uses the generic taxonomic group-based process to make inferences on direct effect concerns for listed species. The first iteration of reporting the results of the Level I screening is a listing of pesticide use sites and taxonomic groups for which risk quotient calculations reveal values that meet or exceed the listed species LOCs (for more information see, USEPA 2004).

(1). Discussion of Risk Quotients

The results of this screening-level risk assessment indicate that the proposed cyantraniliprole uses have the potential for direct adverse effects to listed and non-listed mammals (chronic), freshwater invertebrates (acute), terrestrial invertebrates, estuarine/marine invertebrates (acute) and benthic invertebrates (acute and chronic). Direct effects to listed terrestrial monocots also cannot be precluded because of an absence of data. This indicates a potential risk for direct adverse effects to federally-listed aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, and mammals and indirect adverse effects to any listed species that rely on these taxa as resources critical to their life cycle.

(2). Probit Dose Response Relationship

The probit slope response relationship can be used to calculate the chance of an individual event corresponding to the listed species acute risk quotients. The analysis uses the Environmental Fate and Effects Division spreadsheet IECv1.1.xls. Slopes were not available for the acute toxicity studies, thus, a default slope assumption of 4.5 was used. Only freshwater, estuarine/marine, and benthic invertebrates were analyzed because these taxonomic groups yielded acute risk quotients above the LOC (0.05). The results of the probit-dose analyses are listed below in Table 50.

Table 50. Summary of Individual Effect Probabilities for Cyantraniliprole Exposure at Scenarios that Produce RQs that Exceed the LOC

Taxa	RQ Range	Probit Slope	Chance of Effect (1 in…) (range)
Freshwater Invertebrates EC_{50} = 20.4 µg ai/L	0.05-0.39[1]	4.5 (default slope)	30 to 418,000,000
Estuarine/Marine Invertebrate EC_{50} = 520 µg ai/L	0.05-0.073	4.5 (default slope)	6,380,000 to 418,000,000
Benthic invertebrates EC_{50} = 719 µg ai/L	0.05-0.051	4.5 (default slope)	332,000,000 to

			418,000,000
[1]Based on RQ generated in Risk Description section using the parent-only approach.			

(3). Spray Drift Analysis

To determine terrestrial habitats of concern from cyantraniliprole 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. Applications of cyantraniliprole granular formulations, seed treatments, soil injection/drench, and drip chemigation are expected to result in negligible drift. For spray applications, a quantitative analysis of spray drift distances was completed using AgDRIFT (v. 2.1.1) using default inputs for ground applications (*i.e.*, high boom, ASAE droplet size distribution = Very Fine to Fine, 90th data percentile) and aerial applications (*i.e.*, ASAE Very Fine to Fine). Only agricultural uses applied with ground boom or aerial spray equipment are modeled. Only organisms/scenarios that exceeded the acute risk to listed species LOCs are modeled. In addition to technical-grade cyantraniliprole, the typical end-use products with thiamethoxam are also modeled because they presented more sensitive toxicity values than their technical-grade counterparts. Further, definitive toxicity values were only available for typical end-use products for honeybees, thus only these are modeled here (Tables 51-53).

Table 51. Terrestrial Insect Buffers for Cyantraniliprole Calculated with AgDRIFT

Use	Single application rate (lb ai/A)	Fraction of Applied				Buffer Distance (ft)			
		TEP (cyantraniliprole only)		TEP (cyantraniliprole and thiamethoxam)		TEP (cyantraniliprole only)		TEP (cyantraniliprole and thiamethoxam)	
		Diet	Contact	Diet	Contact	Diet	Contact	Diet	Contact
Brassica leafy vegetables, leafy vegetables (aerial)	0.175	0.002	0.105	0.0001	0.011	>1000	285	>1000	>1000
Brassica leafy vegetables, leafy vegetables (ground)	0.175	0.002	0.105	0.0001	0.011	797	26	>1000	217
Cucurbits, fruiting vegetables (aerial)	0.175	0.002	0.052	0.0001	0.005	>1000	699	>1000	>1000
Cucurbits, fruiting vegetables (ground)	0.175	0.002	0.052	0.0001	0.005	797	49	>1000	>1000
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables, (aerial)	0.133	0.002	0.167	0.0001	0.005	>1000	161	>1000	>1000
Brassica leafy vegetables, bushberries, leafy vegetables (except brassica), corm and tuberous vegetables, bulb vegetables (ground)	0.133	0.002	0.167	0.0001	0.005	797	16	>1000	>1000
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts (aerial)	0.133	0.002	0.138	N/A	N/A	>1000	207	N/A	N/A
Citrus, cotton, oil seeds, pome fruit, stone fruit, tree nuts (ground)	0.133	0.002	0.138	N/A	N/A	797	20	N/A	N/A
Flowerbeds and groundcovers	0.208	0.002	0.089	N/A	N/A	797	30	N/A	N/A

Use	Single application rate (lb ai/A)	Fraction of Applied				Buffer Distance (ft)			
		TEP (cyantraniliprole only)		TEP (cyantraniliprole and thiamethoxam)		TEP (cyantraniliprole only)		TEP (cyantraniliprole and thiamethoxam)	
		Diet	Contact	Diet	Contact	Diet	Contact	Diet	Contact
(ground)									
Ornamentals treated by commercial and consumer applicators (ground)	0.13	0.003	0.143	0.0001	0.015	607	20	>1000	164
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes, turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms, grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground (ground)	0.26	0.002	0.070	0.0001	0.007	797	37	>1000	322
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control (ground)	0.42	0.002	0.043	N/A	N/A	797	59	N/A	N/A

N/A = not calculated because acute RQ did not exceed LOC

Table 52. Freshwater Invertebrate Buffers for Cyantraniliprole Calculated with AgDRIFT

Use	Single application Rate (lb ai/A)	Freshwater Invertebrate Buffer Distance (ft) cyantraniliprole-only			Freshwater Invertebrate Buffer Distance (ft) cyantraniliprole and thiamethoxam		
		Initial Average Concentration (ng ai/L)			Initial Average Concentration (ng ai/L)		
		Acute (10200)	Acute restricted (2040)	Acute listed (1020)	Acute (2800)	Acute restricted (560)	Acute listed (280)
Brassica leafy vegetable, cucurbits, fruiting vegetables, leafy vegetables, (aerial)	0.175	0	26	197	0	518	>1000
Brassica leafy vegetable, cucurbits, fruiting vegetables, leafy vegetables, (ground)	0.175	0	0	0	0	3	23

Use	Single application Rate (lb ai/A)	Freshwater Invertebrate Buffer Distance (ft) cyantraniliprole-only			Freshwater Invertebrate Buffer Distance (ft) cyantraniliprole and thiamethoxam		
		Initial Average Concentration (ng ai/L)			Initial Average Concentration (ng ai/L)		
		Acute (10200)	Acute restricted (2040)	Acute listed (1020)	Acute (2800)	Acute restricted (560)	Acute listed (280)
Brassica leafy vegetables, bushberries, citrus, cotton, leafy vegetables (except brassica), oil seeds, pome fruit, corm and tuberous vegetables, stone fruit, tree nuts, bulb vegetables, (aerial)	0.133	0	0	115	0	335	>1000
Brassica leafy vegetables, bushberries, citrus, cotton, leafy vegetables (except brassica), oil seeds, pome fruit, corm and tuberous vegetables, stone fruit, tree nuts, bulb vegetables, (ground)	0.133	0	0	0	0	0	13
Flowerbeds and ground covers (ground)	0.208	0	0	0	0	7	33
Ornamentals treated by commercial and consumer applicators, turf, golf courses, residential lawns, commercial grounds, parks, playgrounds, athletic fields, sod farms (ground)	0.13	0	0	0	0	0	10
Ornamental plants (exterior landscapes and interior plantscapes), trees (including non-bearing fruit and nut trees), shrubs, evergreens, bedding plants, flowering plants, flowers, foliage plants, groundcovers, vines, interior plantscape plants, vegetable transplants (fruiting, leafy, tuberous, corm), public health insect control (ground)	0.42	0	0	7	0	33	115
Grassy, weedy, mulched, or bare soil areas in and around greenhouses, nurseries, interior plantscapes, lath and shade houses, under trees and shrubs that are being grown in-ground (ground)	0.233	0	0	0	0	7	43
Ornamental plants, fruit and nut trees (non-bearing) and forest seedlings grown in greenhouses, lath and shade houses, containers, field nurseries and interiorscapes, (ground)	0.26	0	0	0	0	10	52
TGAI – technical grade active ingredient TEP – typical end-use product							

Table 53. Estuarine/Marine Invertebrate Buffers for Cyantraniliprole Calculated with AgDRIFT

Use	Single application Rate (lb ai/A)	Estuarine/Marine Invertebrate Buffer Distance (ft)		
		Initial Average Concentration (ng ai/L)		
		Acute (260000)	Acute restricted (52000)	Acute listed (26000)
Cotton (aerial)	0.133	0	0	0
Cotton (ground)	0.133	0	0	0
Cucurbits, fruiting vegetables, (aerial)	0.175	0	0	0
Cucurbits (ground)	0.175	0	0	0

For terrestrial insects, the AgDRIFT analysis indicates that buffers of 797 to >1000 ft would be necessary to lower risk quotients below the LOC, when applying typical end-use cyantraniliprole-only products. The cyantraniliprole-thiamethoxam mixture would require buffer in excess of 1000 ft for all uses. For freshwater invertebrate exposures, acute listed species buffers range from 0 to 197 ft (TGAI) and 0 to >1000 ft (TEP). The analysis clearly shows that, again, the cyantraniliprole-thiamethoxam mixture will require larger buffers than cyantraniliprole-only products. The limited number of uses that exceeded the LOC for estuarine/marine invertebrates indicated that buffers are not needed to protect these organisms from spray drift.

(4). Indirect Effects Analysis

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

The results of this screening-level risk assessment indicate that the proposed uses for cyantraniliprole have the potential for direct adverse effects to listed and non-listed mammals from chronic exposure, listed freshwater invertebrates from acute exposures, listed estuarine/marine invertebrates from acute exposures, listed terrestrial insects from acute exposures, listed benthic invertebrates from acute exposures, and listed and non-listed benthic invertebrates from chronic exposures. Given the absence of data, direct effects cannot be precluded for terrestrial monocots and estuarine/marine fish. This indicates a direct risk to these groups as well as indirect effects to all species that depend on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals for food, habitat, or other environmental resources. Therefore, at this time, no federally-listed taxa can be excluded from the potential for direct and/or indirect effects from the proposed uses of cyantraniliprole (Table 54). Species-specific concerns for indirect effects to listed organisms will require a determination of the coincidence of cyantraniliprole use with locations of listed species and the biologically based resources upon which they depend.

Table 54. Listed Species Risks Associated with Potential Direct or Indirect Effects from the Proposed Applications of Cyantraniliprole

Listed Taxon	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants - monocots	Yes[2]	Yes[1]
Terrestrial and semi-aquatic plants - dicots	No	Yes[1]
Terrestrial invertebrates	Yes	Yes[1]
Birds	No	Yes[1]
Terrestrial-phase amphibians	No	Yes[1]
Reptiles	No	Yes[1]
Mammals	Yes (chronic)	Yes[1]
Aquatic plants	No	Yes[1]
Freshwater fish	No	Yes[1]
Aquatic-phase amphibians	No	Yes[1]
Freshwater invertebrates	Yes (acute)	Yes[1]
Benthic invertebrates	Yes (acute and chronic)	Yes[1]
Marine/estuarine fish	Yes (chronic)[2]	Yes[1]
Marine/estuarine invertebrates	Yes (acute)	Yes[1]

[1]The potential for adverse effects to those species that rely on plant and/or animal species (specifically aquatic invertebrates, or mammals) cannot be precluded. Indirect effects may include general habitat modification, host plant loss, and food supply disruption.
[2]Risk assumed based on an absence of data.

(5). Critical Habitat

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

The screening-level risk assessment has identified potential concerns for indirect effects on listed species for those organisms dependent upon some animals (mammals, aquatic invertebrates, terrestrial monocots, estuarine/marine fish, and terrestrial invertebrates). In light of the potential for indirect effects, the next step for EPA and the Services is to identify which listed species and their designated critical habitat(s), if applicable, are potentially implicated. Analytically, the identification of such species and their critical habitat can occur by determining whether the action area overlaps designated critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential effects on non-listed species would affect the listed species indirectly, or directly affect a constituent element of the critical habitats. At present, the information reviewed by EPA does not permit use of this analytical approach to make a definitive identification of species that are potentially affected indirectly or designated critical habitats that are potentially affected directly by the proposed uses of cyantraniliprole.

This screening-level risk assessment for critical habitats provides a listing of potential biological features that, if they are constituent elements of one or more critical habitats, would be of potential concern. These correspond to the taxa identified above (*i.e.*, mammals, terrestrial monocots, estuarine/marine fish, terrestrial invertebrates, and aquatic invertebrates) as being of potential concern for adverse effects. This should serve as an initial step in problem formulation for further assessment of designated critical habitat impacts outlined above, should additional work be necessary.

(6). Co-occurrence Analysis

The goal of the analysis for co-location is to determine whether sites of pesticide use are geographically associated with known locations of listed species. At the screening level, this analysis is accomplished using the LOCATES (version 2.2.4) database. The database uses location information for listed species at the county level and compares it to agricultural census data (from 2007) for crop production at the same county level of resolution. The product is a listing of federally-listed species that are located within counties known to produce the crops upon which the pesticide will be used. The current analysis is based on the following proposed crops: almonds, apples, apricots, artichokes, beets, bittermelon, blueberries, broccoli, Brussels sprouts, Chinese cabbage, head cabbage, mustard cabbage, cantaloupe, canola, cassava, cauliflower, celery, cherries, chestnut, Christmas trees, citron, citrus, collards, cotton, crambe, cucumbers and pickles, currants, eggplant, endive and escarole, garlic, grapefruit, hazelnuts, honeydew melon, jojoba harvest, kale, kumquats, lemons, lemons and limes, lettuce, limes, macadamia nuts, muskmelons and pepinos, mustard greens, mustard seed, nectarines, nuts, okra, onions, oranges, orchards, peaches, pears, pecans, peppers, persimmons, pistachios, plums and prunes, pluots, potatoes, pumpkins, rapeseed, rhubarb, sesame, sod harvested, spinach, squash, sunflower seed, sweet potatoes, tangelos, tangerines, tomatoes, walnuts, watermelons, woodlands, and yams. For potential direct effects, only listed mammals, aquatic invertebrates, and terrestrial insects will be considered, since they were the only taxa for which direct risks were identified. For indirect effects, all other taxa will be considered since there is a potential for indirect effects to taxa that might rely on aquatic invertebrates, terrestrial invertebrates, terrestrial monocots, estuarine/marine fish, and/or mammals for some stage of their life-cycle.

LOCATES identified a total of 1377 listed species that overlap at the county-level with areas where cyantraniliprole is proposed to be used (see Appendix I for a complete species list). This preliminary analysis indicates that there is a potential for cyantraniliprole use to overlap with listed species and that a more refined assessment is warranted. The more refined assessment should involve clear delineation of the action area associated with proposed uses of cyantraniliprole and best available information on the temporal and spatial co-location of listed species with respect to the action area. This analysis has not been conducted for this assessment.

V. UNCERTAINTIES

There were a number of ecological data gaps identified during the course of the assessment.

Estuarine/Marine Fish Early Life-Stage (850.1400): The current early life-stage study for estuarine/marine fish presents a non-definitive NOAEC (less than value). Without a definitive lower bound on cyantraniliprole's toxicity, chronic risk concerns for estuarine/marine fish cannot be precluded.

Field Testing for Pollinators (850.3040): Multiple semi-field studies are available for cyantraniliprole; however, these tests were conducted up to 0.134 lb ai/A, whereas the maximum application rate for some uses is up to 0.69 lb ai/A. There is uncertainty regarding the effects to honeybee hive health and pollinator services at application rates above 0.134 lb ai/A.

Larval Honeybee Toxicity Test (Non-Guideline Study): Given that cyantraniliprole is highly toxic to adult honeybees, a larval toxicity test would provide information on the level of toxicity to larvae. Food type and consumption rates differ from adults and larvae could be more or less sensitive to the toxicity of cyantraniliprole and/or experience different exposure routes than adults. In the absence of this study, information from the semi-field studies was used to extrapolate the effects of cyantraniliprole on larvae.

Seedling Emergence Test (850.4100): Only a partial set of acceptable data were available for this test (corn, cucumber, oilseed rape, soybean, and sugar beet). Onion, the most sensitive monocot in the vegetative vigor test, was not tested. In the absence of a complete set of data, the results of the partial set were used, but there is uncertainty that the most sensitive monocot was tested.

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Submitted Studies

Ecotoxicity Studies:

48119994 – Chapleo, S., and G. Hobbs. The translocation of [14C]DPX-HGW86 into pollen and stamens of sunflower, canola, tomatoes and zucchini. Project number: DuPont/17705.

48120013 - Chapleo, S., and G. Hobbs. The translocation of [14C]DPX-HGW86 into pollen and stamens of Phacelia tanacetifolia. DuPont/26578.

48120090 - Kling, A. (2005); DPX-HGW86 technical: Acute oral and contact toxicity to the honeybee, *Apis mellifera* L. Project number: DuPont/17000, 20051145/01/BLEU, 15854. Unpublished study prepared by GAB Biotechnologie Gmbh.

48120091 - Samel, A. (2006); DPX-HGW86 technical: 21-day chronic static-renewal toxicity test to *Daphnia magna*. Project number: DuPont/17002/OCR, 15854, 254. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120092 - Krueger, H.O., Thomas, S., Kendall, T.Z. (2007b); ^{14}C-DPX-HGW86: A prolonged sediment toxicity test with *Chironomus riparius* using spiked sediment. Project number: DuPont/17463/OCR, 112A/195, 15985. Unpublished study prepared by Wildlife International, Ltd.

48120093 - Krueger, H.O., Thomas, S., Kendall, T.Z. (2007a); ^{14}C-DPX-HGW86: A prolonged sediment toxicity test with *Chironomus riparius* using spiked water. Project number: DuPont/17464/OCR, 112A/196, 15985. Unpublished study prepared by Wildlife International, Ltd.

48120094 - Samel, A. (2006b); DPX-HGW86 technical: Static, acute, 48-hour toxicity test to *Chironomus riparius*. Project number: DuPont/17465/OCR, 15854, 1381. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120095 - Blankinship, A.S., Kendall, T.Z., Krueger, H.O. (2006); DPX-HGW86: A 96-hour shell deposition test with the eastern oyster (*Crassostrea virginica*). Project number: DuPont/17466/OCR, 112A/198, 15978. Unpublished study prepared by Wildlife International, Ltd.

48120096 - Blankinship, A.S., Kendall, T.Z., Krueger, H.O. (2006); DPX-HGW86 technical: A 96-hour flow-through toxicity test with the saltwater mysid (*Americamysis bahia*). Project number: DuPont/17467/OCR, 112A/199A, 15978. Unpublished study prepared by Wildlife International, Ltd.

48120098 - Samel, A. (2006b); DPX-HGW86 technical: Static, acute, 48-hour toxicity test to *Gammarus pseudolimnaeus*. Project number: DuPont/18433, 16255, 1384. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120099 - Samel, A. (2006b); DPX-HGW86 technical: Static, acute, 48-hour toxicity test to the mayfly, *Centroptilium triangulifer*. Project number: DuPont/18434/OCR, 16255, 1487. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120101 - Samel, A. (2006a); DPX-HGW86 technical: Static, acute, 48-hour toxicity test to the aquatic oligochaete, *Lumbriculus variegatus.* Project number: DuPont/18435, 16255, 1492. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120102 - Samel, A. (2006a); DPX-HGW86 technical: Static, acute, 48-hour toxicity test to *Hyalella azteca.* Project number: DuPont/18436, 16255, 1380. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120103 - Samel, A. (2006a); DPX-HGW86 technical: Static, acute, 48-hour toxicity test to *Soyedina carolinensis.* Project number: DuPont/18889, 16373, 1532. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120104 - Turner, J.T. (2006); DPX-HGW86 technical: Static-renewal, acute, 96-hour toxicity test to bluegill sunfish, *Lepomis macrochirus.* Project number: DuPont/19164, 16497, 226. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120105 - Gallagher, S.P., Kendall, T.Z., Krueger, H.O. (2009b); Cyantraniliprole technical: A 96-hour flow-through acute toxicity test with the sheepshead minnow (*Cyprinodon variegatus*). Project number: DuPont/19165, 112A/256. Unpublished study prepared by Wildlife International Ltd.

48120106 - Gallagher, S.P., Kendall, T.Z., Krueger, H.O. (2009a); Cyantraniliprole (DPX-HGW86) technical: A 96-hour flow-through acute toxicity test with the channel catfish (*Ictalurus punctatus*). Project number: DuPont/19167, 112A/260 17718. Unpublished study prepared by Wildlife International Ltd.

48120107 - Porch, J.R., Kendall, T.Z., Krueger, H.O. (2009b); Cyantraniliprole (DPX-HGW86) technical: A 72-hour toxicity test with the freshwater alga (*Pseudokirchneriella subcapitata*). Project number: DuPont/19190, 112A/247, 17718. Unpublished study prepared by Wildlife International Ltd.

48120108 - Bouchelle, L.D. (2006); DPX-HGW86 technical: Static, acute, 96-hour toxicity test with rainbow trout, *Oncorhynchus mykiss*. Project number: DuPont/19191, 16497, 228. Unpublished study prepared by E.I. DuPont de Nemours and Company.

48120109 - Samel, A. (2007); DPX-HGW86 technical: Early life-stage toxicity to rainbow trout, *Oncorhynchus mykiss*. Project number: DuPont/19192, 16948, 217. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120110 - Gallagher, S.P., Kendall, T.Z., Krueger, H.O. (2009); Cyantraniliprole (DPX-HGW86) technical: An early life-stage toxicity test with the sheepshead minnow (*Cyprinodon variegatus*). Project number: DuPont/19193, 112A/275, 17718. Unpublished study prepared by Wildlife International Ltd.

48120113 - Muther-Paul, J. (2007); DPX-HGW86 100 g/L OD: Acute oral and contact toxicity to the honey bee, *Apis mellifera* L. Project number: DuPont/19229, 20061214/01/BLEU,WR/16513. Unpublished study prepared by Eurofins – GAB GmbH.

48120114 - Samel, A. (2006); DPX-HGW86 technical: Static, acute, 48-hour toxicity test with *Daphnia magna*. Project number: DuPont/20148, 16667, 241. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120115 - Temple, D.L., Beavers, J.B., Jaber, M. (2008a); DPX-HGW86 technical: A reproduction study with the mallard. Project number: DuPont/20917, 112/586, 16888. Unpublished study prepared by Wildlife International Ltd.

48120116 - Temple, D.L., Beavers, J.B., Jaber, M. (2008b); DPX-HGW86 technical: A reproduction study with the northern bobwhite. Project number: DuPont/20918, 112/585, 16888. Unpublished study prepared by Wildlife International Ltd.

48120117 - Samel, A. (2007); DPX-HGW86 technical: Static, acute, 48-hour toxicity test with *Lepidostoma ontario*. Project number: DuPont/20941, 16995, 1531. Unpublished study prepared by E.I. du Pont de Nemours and Company.

48120120 - Yeom, D-H. (2008a); Static, acute 48-hour limit test of IN-J9Z38 to the cladoceran, *Daphnia magna*. Project number: DuPont/21321, KIT/EG07147, 17606. Unpublished study prepared by Korea Institute of Toxicology.

48120122 - Lührs, U. (2007a); IN-J9Z38: Acute toxicity to the earthworm, *Eisenia fetida* in artificial soil. Project number: DuPont/21324, 33141021, 17031. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120121 - Gopi, R.A. (2008a); Static-renewal, acute 48 hour toxicity test of IN-JCZ38 to the cladoceran, *Daphnia magna*. Project number: DuPont/21322, 08161, 21322. Unpublished study prepared by International Institute of Biotechnology and Toxicology.

48120123 - Lührs, U. (2007b); IN-JCZ38: Acute toxicity to the earthworm, *Eisenia fetida* in artificial soil. Project number: DuPont/21325, 33151021, 17032. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120125 - Yeom, D-H. (2008b); Static, acute 48-hour limit test of IN-K5A77 to the cladoceran, *Daphnia magna*. Project number: DuPont/21392, KIT/EG07149, 17602. Unpublished study prepared by Korea Institute of Toxicology.

48120126 - Lührs, U. (2007c); IN-K5A77: Acute toxicity to the earthworm, *Eisenia fetida* in artificial soil. Project number: DuPont/21393, 33131021, 17029. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120127 - Hubbard, P.M., Martin, K.H., Beavers, J.B. (2008); DPX-HGW86 technical: A dietary LC_{50} study with the mallard. Project number: DuPont/21469, 112/613, 17619. Unpublished study prepared by Wildlife International Ltd.
48120128 - Hubbard, P.M., Martin, K.H., Beavers, J.B. (2008); DPX-HGW86 technical: A dietary LC_{50} study with the northern bobwhite. Project number: DuPont/21470, 112/612, 17619. Unpublished study prepared by Wildlife International Ltd.
48120129 - Adelberger, I. (2008a); Cyantraniliprole (DPX-HGW86) 100 g/L OD: A laboratory test to evaluate the effects on the predatory mite *Typhlodromus pyri* (Acari, Phytoseiidae). Project number: DuPont/21471, S08/02309/L1/NLTP, 17617. Unpublished study prepared by Eurofins – GAB GmbH.
48120130 - Adelberger, I. (2008b); Cyantraniliprole (DPX-HGW86) 100 g/L OD: A laboratory test to study the effects on the parasitoid *Aphidius rhopalosiphi* (Hymenoptera, Braconidae). Project number: DuPont/21472, S08/02310/L1/NLAP, 17617. Unpublished study prepared by Eurofins – GAB GmbH.
48120132 - Porch, J.R., Krueger, H.O. (2008); DPX-HGW86 100 g/L OD: Foliage residue toxicity study to the honeybee, *Apis mellifera* L. Project number: DuPont/21474. Unpublished study prepared by Wildlife International Ltd.
48120133 - Yeom, D-H. (2009a); IN-J9Z38: 21-day chronic static-renewal toxicity test to *Daphnia magna*. Project number: DuPont/21479, KIT/EG07148, 17606. Unpublished study prepared by Korea Institute of Toxicology.
48120135 - Mamet, O. (2008a); DPX-HGW86 100 g/L OD: A semi field study to evaluate effects on the honey bee (*Apis mellifera mellifera*; Hymenoptera, Apidae) on wheat treated with artificial honeydew in France 2008. Project number: DuPont/21705, 127/2008. Unpublished study prepared by Testapi.
48120136 - Mamet, O. (2008b); DPX-HGW86 100 G/L OD: A semi field study to evaluate effects on the honey bee (*Apis mellifera*; Hymenoptera, Apidae) on phacelia in France 2008. Project number: DuPont/21706, 128/2008. Unpublished study prepared by Testapi.
48120137 - Jeyalakshmi, T. (2008); DPX-HGW86 200 g/L SC: Acute oral and contact toxicity to the honeybee, *Apis mellifera* L. Project number: DuPont/21860, 08029, 17616. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120138 - Kleinhenz, M. (2009); DPX-HGW86 100 g/L OD: A semi-field study to evaluate effects on the honey bee (*Apis mellifera carnica*; Hymenoptera, Apidae) in *Phacelia tanacetifolia* in Germany 2008. Project number: DuPont/21984, S08/01287. Unpublished study prepared by Eurofins – GAB GmbH.
48120141 - Dutt, M.S. (2008a); IN-K5A78: Acute toxicity to the earthworm, *Eisenia fetida*, in artificial soil. Project number: DuPont/24236, 07369, 17611. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120142 - Gopi, R.A. (2008c); Static-renewal, acute 48 hour limit test of IN-K5A78 to the cladoceran, *Daphnia magna*. Project number: DuPont/24237, 07368, 17611. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120144 - Shanmugasundaram, R. (2008b); IN-JSE76: Acute toxicity to the earthworm, *Eisenia fetida* in artificial soil. Project number: DuPont/24239, 07367, 17562. Unpublished study prepared by International Institute of Biotechnology and Toxicology.

48120145 - Chittibabu, R.A. (2008a); Static, acute 48-hour toxicity of IN-JSE76 to the cladoceran, *Daphnia magna*. Project number: DuPont/24240, 07366, 17562. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120149 - Shanmugasundaram, R. (2008a); IN-PLT97: Acute toxicity to the earthworm, *Eisenia fetida* in artificial soil. Project number: DuPont/24244, 07365, 17599. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120150 - Dutt, M.S. (2008b); IN-K5A79: Acute toxicity to the earthworm, *Eisenia fetida* in artificial soil. Project number: DuPont/24245, 07371, 17614. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120151 - Chittibabu, R.A. (2008b); Static-renewal, acute 48 hour toxicity test of IN-PLT97 to the cladoceran, *Daphnia magna*. Project number: DuPont/24246, 07364, 17599. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120152 - Gopi, R.A. (2008b); Static, acute 48 hour toxicity test of IN-K5A79 to the cladoceran, *Daphnia magna*. Project number: DuPont/24247, 07370, 17614. Unpublished study prepared by International Institute of Biotechnology and Toxicology.
48120153 - Hubbard, P.M., Beavers, J.B. (2008); DPX-HGW86 technical: An acute oral toxicity study with the northern bobwhite. Project number: DuPont/24248, 112/614, 17169. Unpublished study prepared by Wildlife International Ltd.
48120154 - Adelberger, I. (2008b); DPX-HGW86 200 g/L SC: A laboratory rate response test to evaluate the effects on the predatory mite *Typhlodromus pyri* (Acari, Phytoseiidae). Project number: DuPont/24249, S08/01342/L1/NLTP, 17616. Unpublished study prepared by Eurofins – GAB GmbH.
48120155 - Adelberger, I. (2008a); Cyantraniliprole (DPX-HGW86) 200 g/L SC: A laboratory rate response test to evaluate the effects on the parasitoid *Aphidius rhopalosiphi* (Hymenoptera, Braconidae). Project number: DuPont/24250, S08/01341/L1/NLAP, 17616. Unpublished study prepared by Eurofins – GAB GmbH.
48120157 - Porch, J.R., Kendall, T.Z., Krueger, H.O. (2009d); Cyantraniliprole (DPX-HGW86) technical: A 96-hour toxicity test with the freshwater, diatom, *Navicula pelliculosa*. Project number: DuPont/24877, 112ª/245, 17718. Unpublished study prepared by Wildlife International Ltd.
48120158 - Lührs, U. (2008); DPX-HGW86 technical: Acute toxicity to the earthworm, *Eisenia fetida* in artificial soil with 5% peat. DuPont/24880, 42041021, WR/17718. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.
48120159 - Moll, M. (2009b); Cyantraniliprole (DPX-HGW86) 100 g/L OD: An extended laboratory rate response test to study the effects on the green lacewing, Chrysoperla carnea Steph. (Chrysopidae, Neuroptera). Project number: DuPont/25525, 47422047, 17617. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.
48120160 - Moll, M. (2009a); Cyantraniliprole (DPX-HGW86) 100 g/L OD: An extended laboratory rate response test to study the effects on the lady bird beetle, Coccinella septempunctata (Coleoptera, Coccinellidae). Project number: DuPont/25526, 47423012, 17617. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.
48120161 - Moll, M. (2009b); Cyantraniliprole (DPX-HGW86) 100 g/L OD: An extended laboratory rate response test to study the effects on the parasitoid *Aphidius rhopalosiphi* (Hymenoptera, Braconidae). Project number: DuPont/25528, 47421002, 17617.

Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120162 - Adelberger, I. (2009); Cyantraniliprole (DPX-HGW86) 100 g/L SE: A laboratory rate response test to evaluate the effects on the predatory mite *Typhlodromus pyri* (Acari, Phytoseiidae). Project number: DuPont/25993, S08/02392/NLTP, 17883. Unpublished study prepared by Eurofins – GAB GmbH.

48120163 - Adelberger, I. (2009); DPX-HGW86 100 g/L SE: A laboratory rate response test to evaluate the effects on the parasitoid *Aphidius rhopalosiphi* (Hymenoptera, Braconidae). Project number: DuPont/25994, S08/02393/L1/NLAP, 17883. Unpublished study prepared by Eurofins – GAB GmbH.

48120164 - Kling, A. (2009a); Cyantraniliprole (DPX-HGW86) 100 g/L SE: Acute oral and contact toxicity to the honey bee, *Apis mellifera* L. Project number: DuPont/25995, S08/02394, 17883. Unpublished study prepared by Eurofins.

48120165 - Bruhnke, C. (2010); Cyantraniliprole (DPX-HGW86) 200 g/L SC: An extended laboratory test to study the effects on the rove beetle Aleochara bilineata (Coleoptera, Staphylinidae). Project number: DuPont/26172, IKE12670, 17616. Unpublished study prepared by Dr. U. Noack-Laboratorien.

48120166 - Bruhnke, C. (2010); Cyantraniliprole (DPX-HGW86) 200 g/L SC: Extended laboratory test (dose-response-test) on Pardosa spp. (Araneae, Lycosidae). Project number: DuPont/26173, IPE13423, 17616. Unpublished study prepared by Dr. U. Noack-Laboratorien.

48120167 - Lührs, U. (2009a); Cyantraniliprole (DPX-HGW86) technical: Effects on reproduction and growth of the earthworm, *Eisenia fetida*, in artificial soil with 5% peat. Project number: DuPont/26883, 42044022, WR/17718. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120168 - Moll, M. (2009a); Cyantraniliprole (DPX-HGW86) 100 g/L SE + Codacide oil: An extended laboratory test to evaluate the effects on the parasitoid, *Aphidius rhopalosiphi* (Hymenoptera, Braconidae). Project number: DuPont/26915, 47431002, 17883. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120169 - Moll, M. (2009c); Cyantraniliprole (DPX-HGW86) 100 g/L SE: An extended laboratory test to evaluate the effects on the lacewing, *Chrysoperla carnea* (Neuroptera: Chrysopidae). Project number: DuPont/26927, 47432047, 17883. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120170 - Moll, M. (2009d); Cyantraniliprole (DPX-HGW86) 100 g/L SE: An extended laboratory test to evaluate the effects on the ladybird beetle, Coccinella septempunctata (Coleoptera, Coccinellidae). Project number: DuPont/26928, 47433012, 17883. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120171 - Hubbard, P.M., Beavers, J.B. (2009); Cyantraniliprole technical: An acute oral toxicity study with the Zebra finch (Poephila guttata). Project number: DuPont/27316, 112/636, 18218. Unpublished study prepared by Wildlife International Ltd.

48120173 - Porch, J.R., Martin, K.H. (2009a); Cyantraniliprole (DPX-HGW86) 100 g/L OD: A greenhouse study to investigate the effects on vegetative vigor of ten terrestrial plants following foliar exposure. Project number: DuPont/21475, 112/618,17617. Unpublished study prepared by Wildlife International Ltd.

48120176 - Lührs, U. (2009g); IN-J9Z38: Effects on reproduction and growth of the earthworm, Eisenia fetida, in artificial soil with 5% peat. Project number: DuPont/27347, 48321022, 18139. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120177 - Lührs, U. (2009h); IN-PLT97: Effects on reproduction and growth of the earthworm, Eisenia fetida, in artificial soil with 5% peat. Project number: DuPont/27348, 48291022, 17599. Unpublished study prepared by Institute fuer Biologische Analytik und Consulting IBACON.

48120178 - Lührs, U. (2009f); IN-K5A79: Effects on reproduction and growth of the earthworm, Eisenia fetida, in artificial soil with 5% peat. Project number: DuPont/27349, 48341022, 17614. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120179 - Lührs, U. (2009e); IN-K5A78: Effects on reproduction and growth of the earthworm, Eisenia fetida, in artificial soil with 5% peat. Project number: DuPont/27350, 48331022, 18142. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120180 - Lührs, U. (2009d); IN-JCZ38: Effects on reproduction and growth of the earthworm, Eisenia fetida, in artificial soil with 5% peat. Project number: DuPont/27351, 48312022, 18143. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120181 - Lührs, U. (2009c); IN-JSE76: Effects on reproduction and growth of the earthworm, Eisenia fetida, in artificial soil with 5% peat. Project number: DuPont/27352, 48281022, WR/17562. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120182 - Lührs, U. (2009b); IN-K5A77: Effects on reproduction and growth of the earthworm, Eisenia fetida, in artificial soil with 5% peat. Project number: DuPont/27353, 48301022, WR/18141. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120183 - Lührs, U. (2009c); Cyantraniliprole (DPX-HGW86) technical: Effects on reproduction of the predatory mite Hypoaspis aculeifer in artificial soil with 5% peat. Project number: DuPont/27445, 49151089, 18218. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120184 - Kling, A. (2009d); IN-HGW87: Acute oral toxicity to the honey bee, *Apis mellifera* L. Project number: DuPont/27448, S09/00176, 18219. Unpublished study prepared by Eurofins – GAB GmbH.

48120185 - Kling, A. (2009c); IN-J9Z38: Acute oral toxicity to the honey bee, *Apis mellifera* L. Project number: DuPont/27449, S09/00177, 17606. Unpublished study prepared by Eurofins – GAB GmbH.

48120186 - Porch, J.R., Kendall, T.Z. (2010b); Cyantraniliprole (DPX-HGW86) 100 g/L OD + Codacide oil: A greenhouse study to investigate the effects on vegetative vigor of ten terresterial plants following foliar exposure. Project number: DuPont/29050, 112/655, 18509. Unpublished study prepared by Wildlife International Ltd.

48120188 - Moll, M. (2009e); Cyantraniliprole (DPX-HGW86) 100 g/L OD + Codacide oil: An extended laboratory test to evaluate the effects on the parasitoid, *Aphidius rhopalosiphi* (Hymenoptera, Braconidae) - aged residue test. Project number: DuPont/27694, 50071003, 18315. Unpublished study prepared by Institut fuer Biologische Analytik und Consulting IBACON.

48120189 - Müther-Paul, J. (2010a); DPX-HGW86 100 g/L SE plus Codacide oil: A field study to evaluate effects on predatory mites (acari: phytoseiidae) in apple orchards in Germany, 2009. Project Number: DuPont/27849, S09/02129/01. Unpublished study prepared by Eurofins – GAB GmbH.

48120190 - Müther-Paul, J. (2010b); DPX-HGW86 100 g/L SE plus Codacide oil: A field study to evaluate effects on predatory mites (Acari: Phytoseiidae) in grape vineyards in Italy, 2009. Project number: DuPont/27850, S09/02128/01. Unpublished study prepared by Eurofins – GAB GmbH.

48120191 - Höhn, P. (2009a); Cyantraniliprole (DPX-HGW86) 100 g/L SE plus Codacide oil: An extended laboratory test with field-aged spray deposits to study the effects on the green lacewing *Chrysoperla carnea* steph. (neuroptera, chrysopidae). Project number: DuPont/27851, S09/02357, 18383. Unpublished study prepared by Eurofins – GAB GmbH.

48120192 - Höhn, P. (2009b); Cyantraniliprole (DPX-HGW86) 100 g/L SE plus Codacide oil: An extended laboratory test with field-aged spray deposits to study the effects on the ladybird beetle, Coccinella septempunctata L. (Coleoptera, Coccinellidae). Project number: DuPont/27852, S09/02358, 18383. Unpublished study prepared by Eurofins – GAB GmbH.

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Appendix A Screening Imbibition Program (SIP v. 1.0) Inputs and Outputs for the Proposed Uses of Cyantraniliprole

Table 1. Inputs

Parameter	**Value**
Chemical name	Cyantraniliprole
Solubility (in water at 25°C; mg/L)	14.2
Mammalian LD_{50} (mg/kg-bw)	5000
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Mammalian NOAEL (mg/kg-bw)	20
Mammalian test species	laboratory rat
Body weight (g) of "other" mammalian species	
Avian LD_{50} (mg/kg-bw)	2250
Avian test species	northern bobwhite quail
Body weight (g) of "other" avian species	
Mineau scaling factor	1.15
Mallard NOAEC (mg/kg-diet)	1000
Bobwhite quail NOAEC (mg/kg-diet)	1000
NOAEC (mg/kg-diet) for other bird species	
Body weight (g) of other avian species	
NOAEC (mg/kg-diet) for 2nd other bird species	
Body weight (g) of 2nd other avian species	

Table 2. Mammalian Results

Parameter	**Acute**	**Chronic**
Upper bound exposure (mg/kg-bw)	2.4424	2.4424
Adjusted toxicity value (mg/kg-bw)	3845.8028	15.3832
Ratio of exposure to toxicity	0.0006	0.1588
Conclusion*	**Drinking water exposure alone is NOT a potential concern for mammals**	**Drinking water exposure alone is NOT a potential concern for mammals**

Table 3. Avian Results

Parameter	Acute	Chronic
Upper bound exposure (mg/kg-bw)	11.5020	11.5020
Adjusted toxicity value (mg/kg-bw)	1620.9664	49.6126
Ratio of exposure to acute toxicity	0.0071	0.2318
Conclusion*	**Drinking water exposure alone is NOT a potential concern for birds**	**Drinking water exposure alone is NOT a potential concern for birds**

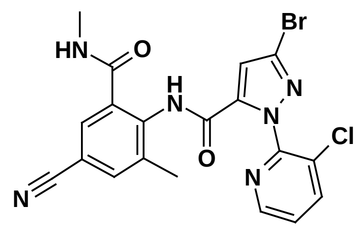
*Conclusion is for drinking water exposure alone. This does not combine all routes of exposure. Therefore, when aggregated with other routes (*i.e.*, diet, inhalation, dermal), pesticide exposure through drinking water may contribute to a total exposure that has potential for effects to non-target animals.

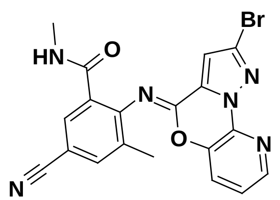
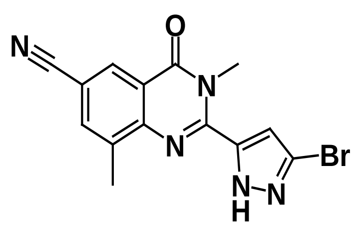
Appendix B Sample Screening Tool for Inhalation Risk (STIR v. 1.0) Inputs and Outputs for the Proposed Uses of Cyantraniliprole

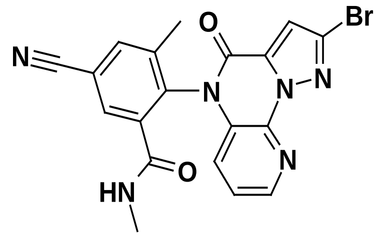
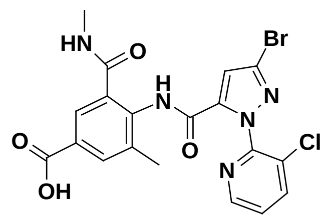
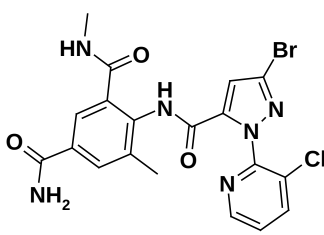
Input		
Application and Chemical Information		
Enter Chemical Name	Cyantraniliprole	
Enter Chemical Use	Agriculture and Residential	
Is the Application a Spray? (enter y or n)	y	
If Spray What Type (enter ground or air)	air	
Enter Chemical Molecular Weight (g/mole)	473.72	
Enter Chemical Vapor Pressure (mmHg)	3.85E-17	
Enter Application Rate (lb a.i./acre)	0.69	
Toxicity Properties		
Bird		
Enter Lowest Bird Oral LD_{50} (mg/kg bw)	2250	
Enter Mineau Scaling Factor	1.15	
Enter Tested Bird Weight (kg)	0.178	
Mammal		
Enter Lowest Rat Oral LD_{50} (mg/kg bw)	5000	
Enter Lowest Rat Inhalation LC_{50} (mg/L)	5.2	
Duration of Rat Inhalation Study (hrs)	4	
Enter Rat Weight (kg)	0.35	
Output		
Results Avian (0.020 kg)		
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	9.81E-13	
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	1.23E-13	
Adjusted Inhalation LD_{50}	1.30E+01	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	9.46E-15	**Exposure not Likely Significant**
Maximum Post-treatment Spray Inhalation Dose (mg/kg)	6.63E-02	
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	5.08E-03	**Exposure not Likely Significant**
Results Mammalian (0.015 kg)		
Maximum Vapor Concentration in Air at Saturation (mg/m^3)	9.81E-13	
Maximum 1-hour Vapor Inhalation Dose (mg/kg)	1.55E-13	
Adjusted Inhalation LD_{50}	3.10E+02	
Ratio of Vapor Dose to Adjusted Inhalation LD_{50}	5.01E-16	**Exposure not Likely Significant**
Maximum Post-treatment Spray Inhalation Dose	8.33E-02	

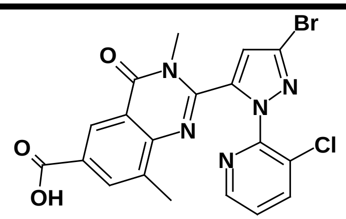
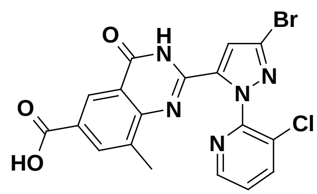
(mg/kg)		
Ratio of Droplet Inhalation Dose to Adjusted Inhalation LD_{50}	2.69E-04	**Exposure not Likely Significant**

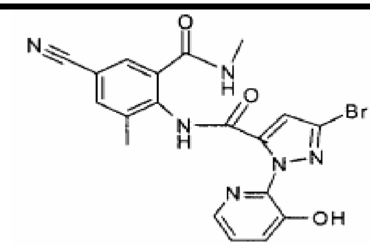
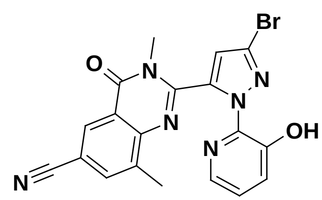
Appendix C Cyantraniliprole and Its Major and Minor Environmental Degradates

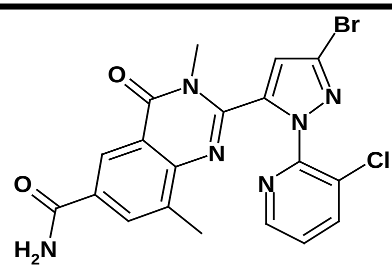
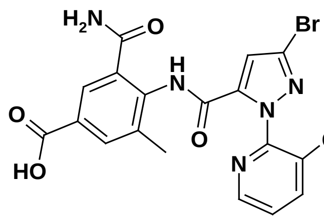
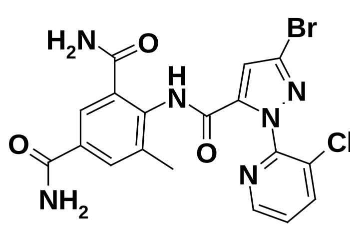
Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	MRID	Maximum %AR (day)	Final %AR (study length)
PARENT						
Cyantraniliprole **DPX-HGW86**	**CAS Name:** 3-Bromo-1-(3-chloro-2-pyridinyl)-N-[4-cyano-2-methyl-6 [(methylamino)carbonyl]phenyl]-1*H*-pyrazole-5-carboxamide **CAS Number:** 736994-63-1 **Formula**: $C_{19}H_{14}BrClN_6O_2$ **MW:** 472 g/mol **SMILES:** Not Available		Hydrolysis pH 4 at 25ºC	48119905		92.86 (30 days)
			Hydrolysis pH 7 at 25ºC			52.79 (30 days)
			Hydrolysis pH 9 at 25ºC			2.21 (30 days)
			Aqueous Photolysis	48119906 48122540		ND (15 days) [LD 5.47 (1 days)]
			Soil Photolysis (moist-soil)	48120082		ND (30 days) [LD 12.40 (20 days)]
			Soil Photolysis (air-dry soil)	48120046		84.11 (30 days)
			Aerobic Soil Metabolism	48120045		57.70 (120 days)
				48120043		12.02 (358 days)
			Anaerobic Soil Metabolism	48120047		1.20 (120 days)
			Aerobic Aquatic Metabolism	48120049		8.26 (100 days)
			Anaerobic Aquatic Metabolism	48120071		0.15 (353 days)
				48120081		4.00 (100 days)
	MAJOR (>10%) TRANSFORMATION PRODUCTS					
	CAS Name: 2-[3-Bromo-1-(3-		Hydrolysis pH 7 at 25ºC	48119905	**48.87** (30 days)	48.87 (30 days)

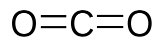
Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	MRID	Maximum %AR (day)	Final %AR (study length)
			Hydrolysis pH 9 at 25ºC		**97.84** (10 days)	95.40 (30 days)
			Soil Photolysis (moist-soil)	48120082	**54.82** (10 days)	30.08 (30 days)
			Aerobic Soil Metabolism	48120045	**19.39** (120 days)	19.39 (120 days)
				48120043	**15.98** (16 days)	5.05 (358 days)
			Anaerobic Soil Metabolism	48120047	**71.88** (30 days)	68.35 (120 days)
			Aerobic Aquatic Metabolism	48120049	**71.74** (56 days)	68.64 (100 days)
			Anaerobic Aquatic Metabolism	48120071	**77.20** (28 days)	58.03 (353 days)
				48120081	**82.03** (100 days)	81.14 (100 days)
			Hydrolysis pH 4 at 25ºC	48119905	7.79 (30 days)	7.79 (30 days)
			Soil Photolysis (air-dry soil)	48120046	8.86 (15 days)	8.86 (15 days)
IN-NXX69	**CAS Name:** 2-[[(4Z)-2-bromo-4H-pyrazolo[1,5-d]pyrido[3,2-b][1,4]oxazin-4-ylidene]amino]-5-cyano-N,3-dimethylbenzamide **CAS Number:** Not Assigned **Formula**: $C_{19}H_{13}BrN_6O_2$ **MW:** 437 g/mol **SMILES:** Not Available		Aqueous Photolysis	48119906 48122540	**100.67** (2 days)	79.23 (15 days)
IN-QKV54	**CAS Name:** 2-(3-Bromo-1H-pyrazol-5-yl)-1,4-dihydro-3,8-dimethyl-4-oxo-6-quinazolinecarbonitrile **CAS Number:** Not Assigned **Formula**: $C_{14}H_{10}BrN_5O$ **MW:** 344 g/mol **SMILES:** Not Available		Soil Photolysis (moist-soil)	48120082	**17.18** (15 days)	5.83 (30 days)
	CAS Name: 2-(2-Bromo-4-		Soil Photolysis (moist-soil)	48120082	**14.12** (30 days)	14.12 (30 days)

Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	MRID	Maximum %AR (day)	Final %AR (study length)
IN-RNU71	oxopyrazolo[1,5-a]pyrido[3,2-e]pyrazin-5(4H)-yl)-5-cyano-N,3-dimethylbenzamide **CAS Number:** Not Assigned **Formula**: $C_{19}H_{13}BrN_6O_2$ **MW:** 437 g/mol **SMILES:** Not Available		Aqueous Photolysis	48119906 48122540	7.46 (15 days)	7.46 (15 days)
IN-JSE76	**CAS Name**: 4-[[[3-Bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazol-5-yl]carbonyl]amino]-3-methyl-5-[(methylamino)carbonyl]benzoic acid **CAS Number:** Not Assigned **Formula**: $C_{19}H_{15}BrClN_5O_4$ **MW:** 491 g/mol **SMILES:** Not Available		Aerobic Soil Metabolism	48120045	**33.28** (120 days)	33.28 (120 days)
				48120043	**42.90** (358 days)	42.90 (358 days)
			Soil Photolysis (moist-soil)	48120082	4.19 (30 days)	4.19 (30 days)
			Anaerobic Soil Metabolism	48120047	5.82 (14 days)	ND (120 days) [LD 4.65 (30 days)]
			Aerobic Aquatic Metabolism	48120049	0.79 (56 days)	ND (100 days) [LD 0.79 (56 days)]
IN-JCZ38	**CAS Name**: 4-[[[3-Bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazol-5-yl]carbonyl]amino]-N'3',5-dimethyl-1,3-benzenedicarboxamide **CAS Number:** Not Assigned **Formula**: $C_{19}H_{16}BrClN_6O_3$ **MW:** 490 g/mol **SMILES:** Not Available		Aerobic Soil Metabolism	48120045	**39.60** (120 days)	39.60 (120 days)
				48120043	**16.58** (7 days)	ND (358 days) [LD 0.20 (238 days)]
			Soil Photolysis (moist-soil)	48120082	3.35 (20 days)	2.63 (30 days)
			Anaerobic Soil Metabolism	48120047	3.62 (7 days)	ND (120 days) [LD 1.62 (30 days)]

Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	MRID	Maximum %AR (day)	Final %AR (study length)
IN-K5A78	**CAS Name**: 2-[3-Bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazol-5-yl]-3,4-dihydro-3,8-dimethyl-4-oxo-6-quinazolinecarboxylic acid **CAS Number:** Not Assigned **Formula**: $C_{19}H_{13}BrClN_5O_3$ **MW:** 473 g/mol **SMILES:** Not Available		Aerobic Soil Metabolism	48120045	**10.53** (120 days)	10.53 (120 days)
				48120043	**28.78** (358 days)	28.78 (358 days)
			Anaerobic Soil Metabolism	48120047	**16.17** (120 days)	16.17 (120 days)
			Aerobic Aquatic Metabolism	48120049	0.61 (84 days)	ND (100 days) [LD 0.61 (84 days)]
			Anaerobic Aquatic Metabolism	48120071	9.18 (353 days)	9.18 (353 days)
IN-PLT97	**CAS Name**: 2-[3-Bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazol-5-yl]-1,4-dihydro-8-methyl-4-oxo-6-quinazolinecarboxylic acid **CAS Number:** Not Assigned **Formula**: $C_{18}H_{11}BrClN_5O_3$ **MW:** 460 g/mol **SMILES:** Not Available		Aerobic Soil Metabolism	48120043	**26.27** (358 days)	26.27 (358 days)
Unidentified Radioactivity			Soil Photolysis (moist-soil)	48120082	**10.34** (30 days)	10.34 (30 days)
			Anaerobic Aquatic Metabolism	48120071	**31.74** (260 days)	29.22 (353 days)
			Aqueous Photolysis	48119906 48122540	3.83 (15 days)	3.83 (15 days)
			Soil Photolysis (air-dry soil)	48120046	4.50 (1 days)	--
			Aerobic Soil Metabolism	48120045	3.57 (120 days)	3.57 (120 days)
			Anaerobic Soil Metabolism	48120047	1.73 (7 days)	ND (120 days) [LD 1.59 (90 days)]

Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	MRID	Maximum %AR (day)	Final %AR (study length)
			Aerobic Aquatic Metabolism	48120049	1.72 (56 days)	0.99 (100 days)
			Anaerobic Aquatic Metabolism	48120081	6.43 (45 days)	5.33 (100 days)
Non-Extractable Radioactivity			Soil Photolysis (moist-soil)	48120082	**28.83** (30 days)	28.83 (30 days)
			Aerobic Soil Metabolism	48120045	**18.72** (30 days)	18.72 (120 days)
			Aerobic Aquatic Metabolism	48120049	**12.70** (100 days)	12.70 (100 days)
			Soil Photolysis (air-dry soil)	48120046	6.65 (15 days)	6.65 (15 days)
			Anaerobic Soil Metabolism	48120047	6.15 (120 days)	6.15 (120 days)
			Anaerobic Aquatic Metabolism	48120081	5.84 (100 days)	5.84 (100 days)
MINOR (<10%) TRANSFORMATION PRODUCTS						
IN-QKV55	**CAS Name:** Not Assigned **CAS Number:** Not Assigned **Formula**: $C_{19}H_{16}BrN_6O$ **MW:** Not Available **SMILES:** Not Available		Aqueous Photolysis	48119906 48122540	6.26 (15 days)	6.26 (15 days)
IN-NXX70	**CAS Name**: 2-[3-Bromo-1-(3-hydroxy-2-pyridinyl)-1H-pyrazol-5-yl]-3,4-dihydro-3,8-dimethyl-4-oxo-6-quinazolinecarbonitrile **CAS Number:** Not Assigned **Formula**: $C_{19}H_{13}BrN_6O_2$ **MW:** 437 g/mol **SMILES:** Not Available		Aqueous Photolysis	48119906 48122540	5.38 (15 days)	5.38 (15 days)
			Soil Photolysis (moist-soil)	48120082	4.79 (6 days)	ND (30 days) [LD 1.42 (20 days)]
	CAS Name: 2-[3-Bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazol-5-		Soil Photolysis (moist-soil)	48120082	1.95 (20 days)	ND (30 days) [LD 1.95 (20 days)]

Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	MRID	Maximum %AR (day)	Final %AR (study length)
IN-K5A77	yl]-3,4-dihydro-3,8-dimethyl-4-oxo-6-quinazolinecarboxamide **CAS Number:** Not Assigned **Formula**: $C_{19}H_{14}BrClN_6O_2$ **MW:** 473 g/mol **SMILES:** Not Available		Aerobic Soil Metabolism	48120045	6.24 (30 days)	5.54 (120 days)
				48120043	8.93 (100 days)	4.83 (358 days)
			Anaerobic Soil Metabolism	48120047	9.97 (60 days)	7.46 (120 days)
			Aerobic Aquatic Metabolism	48120049	2.00 (100 days)	2.00 (100 days)
			Anaerobic Aquatic Metabolism	48120071	7.24 (353 days)	7.24 (353 days)
				48120081	2.48 (100 days)	2.48 (100 days)
IN-K5A79	**CAS Name**: 3-(Aminocarbonyl)-4-[[[3-bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazol-5-yl]carbonyl]amino]-5-methylbenzoic acid **CAS Number:** Not Assigned **Formula**: $C_{18}H_{13}BrClN_5O_4$ **MW:** 478 g/mol **SMILES:** Not Available		Soil Photolysis (moist-soil)	48120082	2.97 (30 days)	2.97 (30 days)
			Aerobic Soil Metabolism	48120045	2.99 (120 days)	2.99 (120 days)
				48120043	9.34 (41 days)	2.18 (358 days)
IN-K7H19	**CAS Name**: 4-[[[3-Bromo-1-(3-chloro-2-pyridinyl)-1H-pyrazol-5-yl]carbonyl]amino]-5-methyl-1,3-benzenedicarboxamide **CAS Number:** Not Assigned **Formula**: $C_{18}H_{14}BrClN_6O_3$ **MW:** 477 g/mol **SMILES:** Not Available		Soil Photolysis (moist-soil)	48120082	5.93 (30 days)	5.93 (30 days)
			Aerobic Soil Metabolism	48120045	1.58 (120 days)	1.58 (120 days)
			Aqueous Photolysis	48119906 48122540	0.25 (15 days)	0.25 (15 days)

Code Name/ Synonym	Chemical Name	Chemical Structure	Study Type	MRID	Maximum %AR (day)	Final %AR (study length)
Carbon Dioxide	**CAS Number**: 124-38-9 **Formula:** CO_2 **MW:** 44.1 g/mol		Soil Photolysis (air-dry soil)	48120046	< LOQ	< LOQ (15 days)
			Aerobic Soil Metabolism	48120045	1.58 (30 days)	1.58 (120 days)
			Anaerobic Soil Metabolism	48120047	< LOQ	< LOQ (120 days)
			Aerobic Aquatic Metabolism	48120049	0.20 (70 days)	<LOQ (100 days)

ND = Not Detected
LD = Last Detected
-- = No result applicable
LOQ = Limit of Quantitation
Major degradates that continued to increase by study termination include IN-J9Z38, IN-RNU71, IN-JSE76, IN-JCZ38, IN-K5A78, IN-PLT97.

Appendix D: Example Surface Water PRZM/EXAMS Output for Aerial Use on NC Cotton

stored as Cotton3A.out						
Chemical: Cyantraniliprole						
PRZM environment: NCcottonSTD.txt	modified Tueday, 29 May 2007 at 12:58:38					
EXAMS environment: pond298.exv	modified Tueday, 26 August 2008 at 05:14:07					
Metfile: w13722.dvf	modified Tueday, 26 August 2008 at 05:14:27					
Water segment concentrations (ppb)						
Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	2.585	2.582	2.571	2.073	1.567	0.3863
1962	10.16	10.15	10.1	9.704	7.328	3.563
1963	16.4	16.37	16.28	15.78	13.35	10.11
1964	15.95	15.94	15.88	15.76	15.66	14.53
1965	14.71	14.7	14.66	14.56	14.48	13.39
1966	16.24	16.22	16.14	16.05	14.66	12.77
1967	15.99	15.98	15.93	15.76	15.59	14.75
1968	24.83	24.81	24.7	24.46	22.65	16.54
1969	24.24	24.23	24.15	23.99	23.85	21.93
1970	26.91	26.88	26.78	26.54	24.02	20.42
1971	26.16	26.14	26.07	25.89	25.74	24.28
1972	26.25	26.22	26.18	25.82	25.04	23.74
1973	25.7	25.68	25.61	25.44	25.28	23.19
1974	22.76	22.74	22.65	22.47	22.32	20.74
1975	29.06	29.02	28.87	26.85	23.66	20.21
1976	31.89	31.86	31.79	31.58	29.85	26.83
1977	36.56	36.51	36.34	35.98	33.57	30.08
1978	35.61	35.59	35.49	35.29	35.11	32.34
1979	34.63	34.59	34.43	34.11	31.46	29.86
1980	33.82	33.79	33.69	33.46	33.29	30.51
1981	36.57	36.52	36.34	35.97	33	28.72
1982	38.12	38.08	37.94	37.58	35.59	33.28
1983	38.91	38.87	38.74	38.43	36.63	34.78
1984	38.21	38.19	38.08	37.82	37.6	34.31
1985	31.42	31.41	31.33	31.15	30.97	29
1986	30.81	30.79	30.7	30.49	30.3	27.59
1987	26.12	26.1	26.03	25.87	25.73	23.71
1988	27.87	27.84	27.72	27.44	25.21	22.27
1989	27.44	27.41	27.31	27.14	26.56	25.07
1990	30.63	30.58	30.42	30.12	28.28	25.42
Sorted results						
Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	38.91	38.87	38.74	38.43	37.60	34.78
0.06	38.21	38.19	38.08	37.82	36.63	34.31
0.10	38.12	38.08	37.94	37.58	35.59	33.28
0.13	36.57	36.52	36.34	35.98	35.11	32.34
0.16	36.56	36.51	36.34	35.97	33.57	30.51
0.19	35.61	35.59	35.49	35.29	33.29	30.08
0.23	34.63	34.59	34.43	34.11	33.00	29.86
0.26	33.82	33.79	33.69	33.46	31.46	29.00
0.29	31.89	31.86	31.79	31.58	30.97	28.72
0.32	31.42	31.41	31.33	31.15	30.30	27.59
0.35	30.81	30.79	30.70	30.49	29.85	26.83
0.39	30.63	30.58	30.42	30.12	28.28	25.42
0.42	29.06	29.02	28.87	27.44	26.56	25.07
0.45	27.87	27.84	27.72	27.14	25.74	24.28
0.48	27.44	27.41	27.31	26.85	25.73	23.74
0.52	26.91	26.88	26.78	26.54	25.28	23.71
0.55	26.25	26.22	26.18	25.89	25.21	23.19
0.58	26.16	26.14	26.07	25.87	25.04	22.27
0.61	26.12	26.10	26.03	25.82	24.02	21.93
0.65	25.70	25.68	25.61	25.44	23.85	20.74
0.68	24.83	24.81	24.70	24.46	23.66	20.42
0.71	24.24	24.23	24.15	23.99	22.65	20.21
0.74	22.76	22.74	22.65	22.47	22.32	16.54
0.77	16.40	16.37	16.28	16.05	15.66	14.75
0.81	16.24	16.22	16.14	15.78	15.59	14.53
0.84	15.99	15.98	15.93	15.76	14.66	13.39
0.87	15.95	15.94	15.88	15.76	14.48	12.77
0.90	14.71	14.70	14.66	14.56	13.35	10.11
0.94	10.16	10.15	10.10	9.70	7.33	3.56
0.97	2.59	2.58	2.57	2.07	1.57	0.39
0.10	**37.97**	37.92	**37.78**	**37.42**	35.54	33.19
					Average	22.48
Inputs generated by pe5.pl - Novemeber 2006						
Data used for this run:						
Output File: Cotton3A						
Metfile:	w13722.dvf					
PRZM scenario:	NCcottonSTD.txt					
EXAMS environment file:	pond298.exv					
Chemical Name:	Cyantraniliprole					
Description	Variable N	Value	Units	Comments		
Molecular weight	mwt	473.72	g/mol			
Henry's Law Const.	henry	1.70E-18	atm-m^3/mol			
Vapor Pressure	vapr	3.85E-17	torr			
Solubility	sol	14.2	mg/L			
Kd	Kd		mg/L			
Koc	Koc	14	mg/L			
Photolysis half-life	kdp	88	days	Half-life		
Aerobic Aquatic Metabolism	kbacw	589	days	Halfife		
Anaerobic Aquatic Metabolism	kbacs	961	days	Halfife		
Aerobic Soil Metabolism	asm	1327	days	Halfife		
Hydrolysis:	pH 7	0	days	Half-life		
Method:	CAM	2	integer	See PRZM manual		
Incorporation Depth:	DEPI		cm			
Application Rate:	TAPP	0.149	kg/ha			
Application Efficiency:	APPEFF	0.95	fraction			
Spray Drift	DRFT	0.05	fraction of application rate applied to pond			
Application Date	Date	10-Nov	dd/mm or dd/mmm or dd-mm or dd-mmm			
Interval 1	interval	7	days	Set to 0 or delete line for single app.		
app. rate 1	apprate	0.149	kg/ha			
Interval 2	interval	7	days	Set to 0 or delete line for single app.		
app. rate 2	apprate	0.149	kg/ha			
Record 17:	FILTRA					
	IPSCND	1				
	UPTKF					
Record 18:	PLVKRT					
	PLDKRT					
	FEXTRC	0.5				
Flag for Index Res. Run	IR	EPA Pond				
Flag for runoff calc.	RUNOFF	none	none, monthly or total(average of entire run)			

Appendix E Sample T-REX Input and Output for the Proposed Uses of Cyantraniliprole

Brassica Leafy Vegetables (3 apps at 0.133 lb ai/A – 5-day interval)

Summary of Risk Quotient Calculations Based on Upper Bound Kenaga EECs

Upper Bound Kenaga, Acute Avian Dose-Based Risk Quotients													
Size Class (grams)	Adjusted LD50	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/ Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
20	0.00	99.10	N/A	45.42	N/A	55.75	N/A	6.19	N/A	38.82	N/A	1.38	N/A
100	0.00	56.51	N/A	25.90	N/A	31.79	N/A	3.53	N/A	22.13	N/A	0.78	N/A
1000	0.00	25.30	N/A	11.60	N/A	14.23	N/A	1.58	N/A	9.91	N/A	0.35	N/A

Upper Bound Kenaga, Subacute Avian Dietary Based Risk Quotients										
	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
LC50	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
0	87.02	N/A	39.88	N/A	48.95	N/A	5.44	N/A	34.08	N/A

Size class not used for dietary risk quotients

Upper Bound Kenaga, Chronic Avian Dietary Based Risk Quotients										
	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
NOAEC (ppm)	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
1000	87.02	0.09	39.88	0.04	48.95	0.05	5.44	0.01	34.08	0.03

Upper Bound Kenaga, Acute Mammalian Dose-Based Risk Quotients

Size Class (grams)	Adjusted LD50	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/ Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	0.00	82.96	N/A	38.02	N/A	46.67	N/A	5.19	N/A	32.4938	N/A	1.1523	N/A
35	0.00	57.34	N/A	26.28	N/A	32.25	N/A	3.58	N/A	22.4576	N/A	0.7964	N/A
1000	0.00	13.29	N/A	6.09	N/A	7.48	N/A	0.83	N/A	5.20687	N/A	0.1846	N/A

Upper Bound Kenaga, Acute Mammalian Dietary Based Risk Quotients										
LC50 (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
0	87.02	N/A	39.88	N/A	48.95	N/A	5.44	N/A	34.08	N/A

Size class not used for dietary risk quotients

Upper Bound Kenaga, Chronic Mammalian Dietary Based Risk Quotients										
NOAEC (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds/Large Insects		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
20	87.02	4.35	39.88	1.99	48.95	2.45	5.44	0.27	34.08	1.70

Size class not used for dietary risk quotients

Upper Bound Kenaga, Chronic Mammalian Dose-Based Risk Quotients													
Size Class (grams)	Adjusted NOAEL	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/ Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	0.00	82.96	N/A	38.02	N/A	46.67	N/A	5.19	N/A	32.49	N/A	1.15	N/A
35	0.00	57.34	N/A	26.28	N/A	32.25	N/A	3.58	N/A	22.46	N/A	0.80	N/A
1000	0.00	13.29	N/A	6.09	N/A	7.48	N/A	0.83	N/A	5.21	N/A	0.18	N/A

Appendix F EEC Calculations for Soil Drench/Injection, Drip Chemigation, and Pot Drench Applications

Soil Injection/Soil Drench/Drip Irrigation and Woody Potted Ornamental Drench Leaf Biomass Estimates

General hardwood equation for dry weight (Sollins et al., 1973)

ln leaf biomass (kg) = -3.862 + 1.74*(ln(dbh[1]))

For the soil injection/soil drench scenarios, a diameter at breast height (DBH) of 6 inches (15.24 cm) is used. This DBH was selected based on the Biological and Economic Analysis Division's (BEAD) assumption that the average sized tree in an acre of urban trees has a DBH of 6 inches (USEPA 2011a).

ln leaf biomass (kg) = -3.862 + 0*15.24 + 1.74*(ln(15.24[1]))
ln leaf biomass (kg) = -3.862 + 0 + 4.74
ln leaf biomass (kg) = 0.878
Leaf biomass = $e^{0.878}$ = 2.4 kg

The correction for bias when converting from ln to arithmetic units = 1.34 (Sollins *et al.*, 1973). Therefore:
Leaf biomass = 2.4*1.34 = 3.216 kg dry weight

For leaves, 85 percent (mean) of the wet weight is water (USEPA, 1993); therefore, the general equation to convert leaf dry weight into wet weight is:

Leaf wet weight = (100% total leaf weight) *(kg of leaf dry weight) / (% leaf dry weight)

Hardwood leaf wet weight = (100%)*(3.216 kg) / (15%)
Hardwood (6-inch DBH) leaf wet weight = **21.44 kg wet weight**

A similar calculation is performed for the woody potted ornamental drench scenario; however, a DBH of 1 inch (2.54 cm) is assumed because woody potted ornamentals are small.

ln leaf biomass (kg) = -3.862 + 0*2.54 + 1.74*(ln(2.54[1]))
ln leaf biomass (kg) = -3.862 + 0 + 1.621
ln leaf biomass (kg) = -2.241
Leaf biomass = $e^{-2.241}$ = 0.106 kg

The correction for bias when converting from ln to arithmetic units = 1.34 (Sollins et al., 1973). Therefore:
Leaf biomass = 0.106*1.34 = 0.142 kg dry weight

For leaves, 85 percent of the wet weight is water (USEPA, 1993); therefore, the general equation to convert leaf dry weight into wet weight is:

Wet weight = (100% total weight) *(kg of dry weight) / (% dry weight)

Hardwood leaf wet weight = (100%)*(0.142 kg) / (15%)
Hardwood (1-inch DBH) leaf wet weight = **0.95 kg wet weight**

General softwood equation for dry weight (Sollins et al., 1973)

ln leaf biomass (kg) = -2.907 + 0*dbh + 1.674*(ln(dbh^1))

For the soil injection and soil drench scenarios, a DBH of 6 inches (15.24 cm) is used. This DBH was selected based on BEAD's assumption that the average sized tree in an acre of trees has a DBH of 6 inches (USEPA 2011a).

ln leaf biomass (kg) = -2.907 + 0*15.24 + 1.674*(ln(15.24^1))
ln leaf biomass (kg) = -2.907 + 0 + 4.56
ln leaf biomass (kg) = 1.653
Leaf biomass = $e^{1.653}$ = 5.222 kg

The correction for bias when converting from ln to arithmetic units = 1.34 (Sollins *et al.*, 1973). Therefore:
Leaf biomass = 5.222*1.34 = 7 kg dry weight

For leaves, 85 percent of the wet weight is water (USEPA, 1993); therefore, the general equation to convert leaf dry weight into wet weight is:

Wet weight = (100% total weight) *(kg of dry weight) / (% dry weight)

Softwood leaf wet weight = (100%)*(7 kg) / (15%)
Softwood (6-inch DBH) leaf wet weight = **47 kg wet weight**

A similar calculation is performed for the woody potted ornamental drench scenario; however, a DBH of 1 inch (2.54 cm) is assumed because woody potted ornamentals are small.

ln leaf biomass (kg) = -2.907 + 0*2.54 + 1.674*(ln(2.54^1))
ln leaf biomass (kg) = -2.907 + 0 + 1.56
ln leaf biomass (kg) = -1.347
Leaf biomass = $e^{-1.347}$ = 0.26 kg

The correction for bias when converting from ln to arithmetic units = 1.34 (Sollins et al., 1973). Therefore:
Leaf biomass = 0.26*1.34 = 0.35 kg dry weight

For leaves, 85 percent of the wet weight is water (USEPA, 1993); therefore, the general equation to convert leaf dry weight into wet weight is:

Wet weight = (100% total weight) *(kg of dry weight) / (% dry weight)

Softwood leaf wet weight = (100%)*(0.35 kg) / (15%)
Softwood (1-inch DBH) leaf wet weight = **2.3 kg wet weight**

Soil Injection and Drench for Ornamental Trees and Citrus
The seasonal maximum application rates for ornamental trees range from 0.26 to 0.42 lb ai/A; the seasonal maximum application rate for citrus is 0.391 lb ai/A. Seasonal maximums were chosen because multiple applications of cyantraniliprole are expected to accumulate in the plants. USEPA 2011a established that on average, there are 36 trees per acre in urban settings. Thus:

Ornamental trees = (0.26 lb ai/A) / (36 trees/A) = 0.007 lb ai/tree
Ornamental trees = (0.42 lb ai/A) / (36 trees/A) = 0.012 lb ai/tree
Citrus = (0.391 lb ai/A) / (36 trees/A) = 0.011 lb ai/tree

Conversion to mg (ornamental trees) = (0.007 lb ai)*(453592 mg ai/lb) = 3175 mg ai/tree
Conversion to mg (ornamental trees) = (0.012 lb ai)*(453592 mg ai/lb) = 5443 mg ai/tree
Conversion to mg (citrus) = (0.011 lb ai)*(453592 mg ai/lb) = 4990 mg ai/tree

It is assumed that the entire application of cyantraniliprole will accumulate in the leaves (a surrogate for other non-woody food items such as seeds) of the tree. To determine the dietary concentration (EEC) of cyantraniliprole in the leaves of hardwoods and softwoods, the cyantraniliprole application per tree is divided by the leaf biomass (Table 13).

Hardwoods ornamentals = (3175 mg ai/tree) / 21.44 kg = **148 mg ai/kg-leaves**
Hardwoods ornamentals = (5443 mg ai/tree) / 21.44 kg = **254 mg ai/kg-leaves**
Citrus = (4990 mg ai/tree) / 21.44 kg = **233 mg ai/kg-leaves**
Softwoods ornamentals = (3175 mg ai/tree) / 47 kg = **68 mg ai/kg-leaves**
Softwoods ornamentals = (5443 mg ai/tree) / 47 kg = **116 mg ai/kg-leaves**

The EECs must be adjusted for mammal body weight. The T-REX analysis uses three size classes for mammals: 15, 35, and 1000 g. According to the T-REX User's Manual, a 15 g mammal consumes 95 percent of its body weight daily, a 35 g mammal consumes 66 percent of its body weight daily, and a 1000 g mammal consumes 15 percent of its body weight daily. Consequently, the general equation for determining the dose of cyantraniliprole received per day is:

EEC mg ai/kg-bw = (dietary concentration mg ai/kg-diet)*(body weight consumption kg-diet/kg-bw)

Hardwoods ornamentals

15 g mammal EEC = (148 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **141 mg ai/kg-bw**
35 g mammal EEC = (148 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **100 mg ai/kg-bw**
1000 g mammal EEC = (148 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **22 mg ai/kg-bw**

Hardwoods ornamentals
15 g mammal EEC = (254 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **241 mg ai/kg-bw**
35 g mammal EEC = (254 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **168 mg ai/kg-bw**
1000 g mammal EEC = (254 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **38 mg ai/kg-bw**

Citrus
15 g mammal EEC = (233 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **221 mg ai/kg-bw**
35 g mammal EEC = (233 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **154 mg ai/kg-bw**
1000 g mammal EEC = (233 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **35 mg ai/kg-bw**

Softwoods ornamentals
15 g mammal EEC = (68 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **65 mg ai/kg-bw**
35 g mammal EEC = (68 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **45 mg ai/kg-bw**
1000 g mammal EEC = (68 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **10 mg ai/kg-bw**

Softwoods ornamentals
15 g mammal EEC = (116 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **110 mg ai/kg-bw**
35 g mammal EEC = (116 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **77 mg ai/kg-bw**
1000 g mammal EEC = (116 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **17 mg ai/kg-bw**

Non-Woody Potted Ornamental Drench and Agricultural Drip Irrigation
Leaf biomass equations were not available for non-woody plants. Therefore, the assumption was made that the entire application of cyantraniliprole would concentrate in the plant.

The seasonal maximum application rates for potted ornamentals are 0.26 and 0.5 lb ai/A. The seasonal maximum application rates for agricultural crops are 0.4 (brassica vegetables, cucurbits, fruiting vegetables, leafy vegetables, and corm and tuberous vegetables). The seasonal maximum application rate was chosen because it is assumed that cyantraniliprole will accumulate in the plant as multiple applications occur (application intervals are usually 7 to 10 days).

For the potted ornamental scenario, 49,000 8-inch pots are expected to fit into an acre of storage area at a typical nursery. Thus,

(0.26 lb ai/A) / 49,000 = 0.000005 lb ai/plant
(0.5 lb ai/A) / 49,000 = 0.00001 lb ai/plant

Conversion to mg = (0.000005 lb ai)*(453592 mg ai/lb) = 2.3 mg ai/plant
Conversion to mg = (0.00001 lb ai)*(453592 mg ai/lb) = 4.5 mg ai/plant

For the agricultural crop scenarios, transplant rates per acre (or seed rates if transplants were not available) were used to estimate the number of plants in a field (USEPA 2011b). Lower estimates were used because this provided the most protective scenario (fewer plants = higher concentration of cyantraniliprole per plant).

Rates were as follows (seeds or transplants per acre):
Brassica vegetables = 5445 (cauliflower)
Cucurbits = 589 (pumpkin)
Fruiting vegetables = 2178 (eggplant and tomato)
Leafy vegetables = 6223 (collards)
Corm and tuberous vegetables = 5445 (sweet potato, and cassava)

Thus,

Brassica vegetables = (0.4 lb ai/A) / 5445 = 0.00007 lb ai/plant
Cucurbits = (0.4 lb ai/A) / 589 = 0.0007 lb ai/plant
Fruiting vegetables = (0.4 lb ai/A) / 2178 = 0.0002 lb ai/plant
Leafy vegetables = (0.4 lb ai/A) / 6223 = 0.00006 lb ai/plant
Corm and tuberous vegetables = (0.4 lb ai/A) / 5445 = 0.00007 lb ai/plant

Conversion to mg

Brassica vegetables = (0.00007 lb ai)*(453592 mg ai/lb) = 32 mg ai/plant
Cucurbits = (0.0007 lb ai)*(453592 mg ai/lb) = 318 mg ai/plant
Fruiting vegetables = (0.0002 lb ai)*(453592 mg ai/lb) = 91 mg ai/plant
Leafy vegetables = (0.00006 lb ai)*(453592 mg ai/lb) = 27 mg ai/plant
Corm and tuberous vegetables = (0.00007 lb ai)*(453592 mg ai/lb) = 32 mg ai/plant

It is assumed that the entire application of cyantraniliprole will accumulate in the plant and that the average weight of a plant is 0.5 kg. Thus, to calculate the dietary concentration (EEC) of cyantraniliprole in a plant, the cyantraniliprole application per plant is divided by its weight (0.5 kg).

Potted ornamental = (2.3 mg ai/plant) / 0.5 kg = **4.6 mg ai/kg-plant**
Potted ornamental = (4.5 mg ai/plant) / 0.5 kg = **9 mg ai/kg-plant**
Brassica vegetables = (32 mg ai/plant) / 0.5 kg = **64 mg ai/kg-plant**
Cucurbits = (318 mg ai/plant) / 0.5 kg = **636 mg ai/kg-plant**
Fruiting vegetables = (91 mg ai/plant) / 0.5 kg = **182 mg ai/kg-plant**
Leafy vegetables = (27 mg ai/plant) / 0.5 kg = **54 mg ai/kg-plant**
Corm and tuberous vegetables = (32 mg ai/plant) / 0.5 kg = **64 mg ai/kg-plant**

The EECs must be adjusted for mammal body weight. The T-REX analysis uses three size classes for mammals: 15, 35, and 1000 g. According to the T-REX User's Manual, a 15 g mammal consumes 95 percent of its body weight daily, a 35 g mammal consumes 66 percent of its body weight daily, and a 1000 g mammal consumes 15 percent of its body weight daily. Consequently, the general equation for determining the dose of cyantraniliprole received per day is:

EEC mg ai/kg-bw = (dietary concentration mg ai/kg-diet)*(body weight consumption kg-diet/kg-bw)

Potted ornamental
15 g mammal EEC = (4.6 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **4 mg ai/kg-bw**
35 g mammal EEC = (4.6 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **3 mg ai/kg-bw**
1000 g mammal EEC = (4.6 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **0.7 mg ai/kg-bw**

Potted ornamental
15 g mammal EEC = (9 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **9 mg ai/kg-bw**
35 g mammal EEC = (9 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **6 mg ai/kg-bw**
1000 g mammal EEC = (9 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **1 mg ai/kg-bw**

Brassica vegetables
15 g mammal EEC = (64 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **61 mg ai/kg-bw**
35 g mammal EEC = (64 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **42 mg ai/kg-bw**
1000 g mammal EEC = (64 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **10 mg ai/kg-bw**

Cucurbits
15 g mammal EEC = (636 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **604 mg ai/kg-bw**
35 g mammal EEC = (636 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **420 mg ai/kg-bw**
1000 g mammal EEC = (636 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **95 mg ai/kg-bw**

Fruiting vegetables
15 g mammal EEC = (182 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **173 mg ai/kg-bw**
35 g mammal EEC = (182 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **120 mg ai/kg-bw**
1000 g mammal EEC = (182 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **27 mg ai/kg-bw**

Leafy vegetables
15 g mammal EEC = (54 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **51 mg ai/kg-bw**
35 g mammal EEC = (54 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **36 mg ai/kg-bw**
1000 g mammal EEC = (54 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **8 mg ai/kg-bw**

Corm and tuberous vegetables
15 g mammal EEC = (64 mg ai/kg-diet)*(0.95 kg-diet/kg-bw) = **61 mg ai/kg-bw**
35 g mammal EEC = (64 mg ai/kg-diet)*(0.66 kg-diet/kg-bw) = **42 mg ai/kg-bw**
1000 g mammal EEC = (64 mg ai/kg-diet)*(0.15 kg-diet/kg-bw) = **10 mg ai/kg-bw**

Appendix G SAMPLE TerrPlant Input and Output for the Proposed Cyantraniliprole

TerrPlant v. 1.2.2

Green values signify user inputs (Tables 1, 2 and 4).

Input and output guidance is in popups indicated by red arrows.

Table 1. Chemical Identity.	
Chemical Name	**Cyantraniliprole**
PC code	**90098**
Use	
Application Method	
Application Form	**Liquid**
Solubility in Water (ppm)	**14.2**

Table 2. Input parameters used to derive EECs.

Input Parameter	Symbol	Value	Units
Application Rate	A	**0.13**	**y**
Incorporation	I	**1**	none
Runoff Fraction	R	**0.02**	none
Drift Fraction	D	**0.01**	none

Table 3. EECs for Cyantraniliprole. Units in y.

Description	Equation	EEC
Runoff to dry areas	(A/I)*R	0.0026
Runoff to semi-aquatic areas	(A/I)*R*10	0.026
Spray drift	**A*D**	**0.0013**
Total for dry areas	**((A/I)*R)+(A*D)**	**0.0039**
Total for semi-aquatic areas	**((A/I)*R*10)+(A*D)**	**0.0273**

TerrPlant v. 1.2.2

Green values signify user inputs (Tables 1, 2 and 4).

Input and output guidance is in popups indicated by red arrows.

Table 1. Chemical Identity.	
Chemical Name	**Cyantraniliprole**
PC code	**90098**
Use	
Application Method	
Application Form	**Liquid**
Solubility in Water (ppm)	**14.2**

Table 2. Input parameters used to derive EECs.

Input Parameter	Symbol	Value	Units
Application Rate	A	**0.13**	**y**
Incorporation	I	**1**	none
Runoff Fraction	R	**0.02**	none

Drift Fraction	D	0.01	none

Table 3. EECs for Cyantraniliprole. Units in y.		
Description	**Equation**	**EEC**
Runoff to dry areas	(A/I)*R	0.0026
Runoff to semi-aquatic areas	(A/I)*R*10	0.026
Spray drift	**A*D**	**0.0013**
Total for dry areas	**((A/I)*R)+(A*D)**	**0.0039**
Total for semi-aquatic areas	**((A/I)*R*10)+(A*D)**	**0.0273**

Table 4. Plant survival and growth data used for RQ derivation. Units are in y.				
	Seedling Emergence		**Vegetative Vigor**	
Plant type	**EC25**	**NOAEC**	**EC25**	**NOAEC**
Monocot	**x**	**0.134**	**x**	**0.067**
Dicot	**x**	**0.134**	**x**	**0.134**

Table 5. RQ values for plants in dry and semi-aquatic areas exposed to Cyantraniliprole through runoff and/or spray drift.*				
Plant Type	**Listed Status**	**Dry**	**Semi-Aquatic**	**Spray Drift**
Monocot	non-listed	N/A	N/A	N/A
Monocot	listed	<0.1	0.20	<0.1
Dicot	non-listed	N/A	N/A	N/A
Dicot	listed	<0.1	0.20	<0.1
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

Appendix H Agency Levels of Concern (LOC)

Risk	Description	RQ	Taxa
Acute	Potential for acute risk to non-target organisms which may warrant regulatory action in addition to restricted use classification	acute RQ > 0.5	aquatic animals, mammals, birds
Acute Restricted Use	Potential for acute risk to non-target organisms, but may be mitigated through restricted use classification	acute RQ > 0.1	aquatic animals
		acute RQ > 0.2	mammals and birds
Acute Listed Species	Listed species may be potentially affected by use	acute RQ > 0.05	aquatic animals
		acute RQ > 0.1	mammals and birds
Chronic	Potential for chronic risk may warrant regulatory action, listed species may potentially be affected through chronic exposure	chronic RQ > 1	all animals
Non-Listed and Listed Plant	Potential for effects in non-listed and listed plants	RQ > 1	all plants

Appendix I LOCATES Endangered Species List

Based on the following crops: almonds, apples, apricots, artichokes, beets, bittermelon, blueberries, broccoli, Brussels sprouts, Chinese cabbage, head cabbage, mustard cabbage, cantaloupe, canola, cassava, cauliflower, celery, cherries, chestnut, Christmas trees, citron, citrus, collards, cotton, crambe, cucumbers and pickles, currants, eggplant, endive and escarole, garlic, grapefruit, hazelnuts, honeydew melon, jojoba harvest, kale, kumquats, lemons, lemons and limes, lettuce, limes, macadamia nuts, muskmelons and pepinos, mustard greens, mustard seed, nectarines, nuts, okra, onions, oranges, orchards, peaches, pears, pecans, peppers, persimmons, pistachios, plums and prunes, pluots, potatoes, pumpkins, rapeseed, rhubarb, sesame, sod harvested, spinach, squash, sunflower seed, sweet potatoes, tangelos, tangerines, tomatoes, walnuts, watermelons, woodlands, and yams.

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Salamander, Frosted Flatwoods	*Ambystoma cingulatum*	T	Alabama	Amphibian
Salamander, Red Hills	*Phaeognathus hubrichti*	T	Alabama	Amphibian
Stork, Wood	*Mycteria americana*	E	Alabama	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Alabama	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Alabama	Bird
Plover, Piping	*Charadrius melodus*	E/T	Alabama	Bird
Alabama pearlshell	*Margaritifera marrianae*	E	Alabama	Bivalve
Choctaw Bean	*Villosa choctawensis*	E	Alabama	Bivalve
Combshell, Southern (=Penitent mussel)	*Epioblasma penita*	E	Alabama	Bivalve
Combshell, Upland	*Epioblasma metastriata*	E	Alabama	Bivalve
Fanshell	*Cyprogenia stegaria*	E	Alabama	Bivalve
Kidneyshell, Triangular	*Ptychobranchus greenii*	E	Alabama	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Alabama	Bivalve
Mussel, Acornshell Southern	*Epioblasma othcaloogensis*	E	Alabama	Bivalve
Mussel, Coosa Moccasinshell	*Medionidus parvulus*	E	Alabama	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Mussel, Cumberland Combshell	*Epioblasma brevidens*	E	Alabama	Bivalve
Mussel, Dark Pigtoe	*Pleurobema furvum*	E	Alabama	Bivalve
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	E	Alabama	Bivalve
Mussel, Flat Pigtoe (=Marshall's Mussel)	*Pleurobema marshalli*	E	Alabama	Bivalve
Mussel, Georgia pigtoe	*Pleurobema hanleyianum*	E	Alabama	Bivalve
Mussel, Gulf Moccasinshell	*Medionidus penicillatus*	E	Alabama	Bivalve
Mussel, Heavy Pigtoe (=Judge Tait's Mussel)	*Pleurobema taitianum*	E	Alabama	Bivalve
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	E	Alabama	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Alabama	Bivalve
Mussel, Ring Pink (=Golf Stick Pearly)	*Obovaria retusa*	E	Alabama	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Alabama	Bivalve
Mussel, Shiny Pigtoe	*Fusconaia cor*	E	Alabama	Bivalve
Mussel, Shiny-rayed Pocketbook	*Lampsilis subangulata*	E	Alabama	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Alabama	Bivalve
Mussel, Southern Clubshell	*Pleurobema decisum*	E	Alabama	Bivalve
Mussel, Southern Pigtoe	*Pleurobema georgianum*	E	Alabama	Bivalve
Pearlymussel, Alabama Lamp	*Lampsilis virescens*	E	Alabama	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Alabama	Bivalve
Pearlymussel, Cumberland Monkeyface	*Quadrula intermedia*	E	Alabama	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	E	Alabama	Bivalve
Pearlymussel, Pale Lilliput	*Toxolasma cylindrellus*	E	Alabama	Bivalve
Pearlymussel, Turgid-blossom	*Epioblasma turgidula*	E	Alabama	Bivalve
Pearlymussel, White Wartyback	*Plethobasus cicatricosus*	E	Alabama	Bivalve
Round Ebonyshell	*Fusconaia rotulata*	E	Alabama	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Alabama	Bivalve
Southern Kidneyshell	*Ptychobranchus jonesi*	E	Alabama	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Alabama	Bivalve
Stirrupshell	*Quadrula stapes*	E	Alabama	Bivalve
Bankclimber, Purple	*Elliptoideus sloatianus*	T	Alabama	Bivalve
fuzzy pigtoe	*Pleurobema strodeanum*	T	Alabama	Bivalve
Mucket, Orange-nacre	*Lampsilis perovalis*	T	Alabama	Bivalve
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	T	Alabama	Bivalve
Mussel, Fine-lined Pocketbook	*Lampsilis altilis*	T	Alabama	Bivalve
Mussel, Heelsplitter Inflated	*Potamilus inflatus*	T	Alabama	Bivalve
Narrow Pigtoe	*Fusconaia escambia*	T	Alabama	Bivalve
Southern Sandshell	*Hamiota australis*	T	Alabama	Bivalve
Tapered Pigtoe	*Fusconaia burkei*	T	Alabama	Bivalve
Shrimp, Alabama Cave	*Palaemonias alabamae*	E	Alabama	Crustacean
Chaffseed, American	*Schwalbea americana*	E	Alabama	Dicot
Clover, Leafy Prairie	*Dalea foliosa*	E	Alabama	Dicot
Harperella	*Ptilimnium nodosum*	E	Alabama	Dicot
Leather-flower, Alabama	*Clematis socialis*	E	Alabama	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Leather-flower, Morefield's	*Clematis morefieldii*	E	Alabama	Dicot
Pinkroot, Gentian	*Spigelia gentianoides*	E	Alabama	Dicot
Pitcher-plant, Alabama Canebrake	*Sarracenia rubra alabamensis*	E	Alabama	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	Alabama	Dicot
Pondberry	*Lindera melissifolia*	E	Alabama	Dicot
Amphianthus, Little	*Amphianthus pusillus*	T	Alabama	Dicot
Barbara Buttons, Mohr's	*Marshallia mohrii*	T	Alabama	Dicot
Bladderpod, Lyrate	*Lesquerella lyrata*	T	Alabama	Dicot
Potato-bean, Price's	*Apios priceana*	T	Alabama	Dicot
Quillwort, Louisiana	*Isoetes louisianensis*	E	Alabama	Ferns
Fern, Alabama Streak-sorus	*Thelypteris pilosa var. alabamensis*	T	Alabama	Ferns
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	T	Alabama	Ferns
Cavefish, Alabama	*Speoplatyrhinus poulsoni*	E	Alabama	Fish
Darter, Boulder	*Etheostoma wapiti*	E	Alabama	Fish
Darter, Vermilion	*Etheostoma chermocki*	E	Alabama	Fish
Darter, Watercress	*Etheostoma nuchale*	E	Alabama	Fish
Rush darter	*Etheostoma phytophilum*	E	Alabama	Fish
Shiner, Cahaba	*Notropis cahabae*	E	Alabama	Fish
Shiner, Palezone	*Notropis albizonatus*	E	Alabama	Fish
Sturgeon, Alabama	*Scaphirhynchus suttkusi*	E	Alabama	Fish
Chub, Spotfin	*Erimonax monachus*	T	Alabama	Fish
Darter, Goldline	*Percina aurolineata*	T	Alabama	Fish
Darter, Slackwater	*Etheostoma boschungi*	T	Alabama	Fish
Darter, Snail	*Percina tanasi*	T	Alabama	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Sculpin, Pygmy	*Cottus paulus (=pygmaeus)*	T	Alabama	Fish
Shiner, Blue	*Cyprinella caerulea*	T	Alabama	Fish
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Alabama	Fish
Campeloma, Slender	*Campeloma decampi*	E	Alabama	Gastropod
Hornsnail, rough	*Pleurocera foremani*	E	Alabama	Gastropod
Pebblesnail, Flat	*Lepyrium showalteri*	E	Alabama	Gastropod
Riversnail, Anthony's	*Athearnia anthonyi*	E	Alabama	Gastropod
Rocksnail, interrupted	*Leptoxis foremani*	E	Alabama	Gastropod
Rocksnail, Plicate	*Leptoxis plicata*	E	Alabama	Gastropod
Snail, Armored	*Pyrgulopsis (=Marstonia) pachyta*	E	Alabama	Gastropod
Snail, Lioplax Cylindrical	*Lioplax cyclostomaformis*	E	Alabama	Gastropod
Elimia, Lacy	*Elimia crenatella*	T	Alabama	Gastropod
Rocksnail, Painted	*Leptoxis taeniata*	T	Alabama	Gastropod
Rocksnail, Round	*Leptoxis ampla*	T	Alabama	Gastropod
Snail, Tulotoma	*Tulotoma magnifica*	T	Alabama	Gastropod
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Alabama	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Alabama	Insect
Bat, Gray	*Myotis grisescens*	E	Alabama	Mammal
Bat, Indiana	*Myotis sodalis*	E	Alabama	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Alabama	Mammal
Mouse, Alabama Beach	*Peromyscus polionotus ammobates*	E	Alabama	Mammal
Mouse, Perdido Key Beach	*Peromyscus polionotus trissyllepsis*	E	Alabama	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Alabama	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	Alabama	Monocot
Grass, Tennessee Yellow-eyed	*Xyris tennesseensis*	E	Alabama	Monocot
Trillium, Relict	*Trillium reliquum*	E	Alabama	Monocot
Water-plantain, Kral's	*Sagittaria secundifolia*	T	Alabama	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Alabama	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Alabama	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Alabama	Reptile
Turtle, Alabama Red-bellied	*Pseudemys alabamensis*	E	Alabama	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Alabama	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Alabama	Reptile
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Alabama	Reptile
Tortoise, Gopher	*Gopherus polyphemus*	T	Alabama	Reptile
Turtle, Flattened Musk	*Sternotherus depressus*	T	Alabama	Reptile
Albatross, Short-tailed	*Phoebastria (=Diomedea) albatrus*	E	Alaska	Bird
Curlew, Eskimo	*Numenius borealis*	E	Alaska	Bird
Eider, Steller's	*Polysticta stelleri*	T	Alaska	Bird
Bison, Wood	*Bison bison athabascae*	E	Alaska	Mammal
Whale, beluga	*Delphinapterus leucas*	E	Alaska	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Alaska	Mammal
Whale, Bowhead	*Balaena mysticetus*	E	Alaska	Mammal
Whale, Finback	*Balaenoptera physalus*	E	Alaska	Mammal
Whale, Gray	*Eschrichtius robustus*	E	Alaska	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Whale, Humpback	*Megaptera novaeangliae*	E	Alaska	Mammal
Whale, North Pacific right	*Eubalaena japonica*	E	Alaska	Mammal
Whale, Sei	*Balaenoptera borealis*	E	Alaska	Mammal
Whale, Sperm	*Physeter catodon (=macrocephalus)*	E	Alaska	Mammal
Sea-lion, Steller	*Eumetopias jubatus*	E/T	Alaska	Mammal
Otter, Northern Sea	*Enhydra lutris kenyoni*	T	Alaska	Mammal
Seal, spotted	*Phoca largha*	T	Alaska	Mammal
Sea turtle, leatherback	*Dermochelys coriacea*	E	Alaska	Reptile
Salamander, Sonora Tiger	*Ambystoma tigrinum stebbinsi*	E	Arizona	Amphibian
Frog, Chiricahua Leopard	*Rana chiricahuensis*	T	Arizona	Amphibian
Bobwhite, Masked	*Colinus virginianus ridgwayi*	E	Arizona	Bird
Condor, California	*Gymnogyps californianus*	E	Arizona	Bird
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	E	Arizona	Bird
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	E	Arizona	Bird
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	E	Arizona	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Arizona	Bird
Blue-star, Kearney's	*Amsonia kearneyana*	E	Arizona	Dicot
Cactus, Arizona Hedgehog	*Echinocereus triglochidiatus var. arizonicus*	E	Arizona	Dicot
Cactus, Brady Pincushion	*Pediocactus bradyi*	E	Arizona	Dicot
Cactus, Nichol's Turk's Head	*Echinocactus horizonthalonius var. nicholii*	E	Arizona	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Cactus, Peebles Navajo	*Pediocactus peeblesianus peeblesianus*	E	Arizona	Dicot
Cactus, Pima Pineapple	*Coryphantha scheeri var. robustispina*	E	Arizona	Dicot
Cliffrose, Arizona	*Purshia (=cowania) subintegra*	E	Arizona	Dicot
Milk-vetch, Holmgren	*Astragalus holmgreniorum*	E	Arizona	Dicot
Milk-vetch, Sentry	*Astragalus cremnophylax var. cremnophylax*	E	Arizona	Dicot
Umbel, Huachuca Water	*Lilaeopsis schaffneriana var. recurva*	E	Arizona	Dicot
Cactus, Cochise Pincushion	*Coryphantha robbinsorum*	T	Arizona	Dicot
Cactus, Siler Pincushion	*Pediocactus (=Echinocactus,=Utahia) sileri*	T	Arizona	Dicot
Cycladenia, Jones	*Cycladenia jonesii (=humilis)*	T	Arizona	Dicot
Fleabane, Zuni	*Erigeron rhizomatus*	T	Arizona	Dicot
Groundsel, San Francisco Peaks	*Senecio franciscanus*	T	Arizona	Dicot
Milkweed, Welsh's	*Asclepias welshii*	T	Arizona	Dicot
Chub, Bonytail	*Gila elegans*	E	Arizona	Fish
Chub, Gila	*Gila intermedia*	E	Arizona	Fish
Chub, Humpback	*Gila cypha*	E	Arizona	Fish
Chub, Virgin River	*Gila seminuda (=robusta)*	E	Arizona	Fish
Chub, Yaqui	*Gila purpurea*	E	Arizona	Fish
Minnow, Loach	*Tiaroga cobitis*	E	Arizona	Fish
Pupfish, Desert	*Cyprinodon macularius*	E	Arizona	Fish
Spikedace	*Meda fulgida*	E	Arizona	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Arizona	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Arizona	Fish

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Topminnow, Gila (Yaqui)	*Poeciliopsis occidentalis*	E	Arizona	Fish
Trout, Gila	*Oncorhynchus gilae*	E	Arizona	Fish
Woundfin	*Plagopterus argentissimus*	E	Arizona	Fish
Steelhead	*Oncorhynchus (=Salmo) mykiss*	E/T	Arizona	Fish
Catfish, Yaqui	*Ictalurus pricei*	T	Arizona	Fish
Chub, Sonora	*Gila ditaenia*	T	Arizona	Fish
Shiner, Beautiful	*Cyprinella formosa*	T	Arizona	Fish
Spinedace, Little Colorado	*Lepidomeda vittata*	T	Arizona	Fish
Trout, Apache	*Oncorhynchus apache*	T	Arizona	Fish
Ambersnail, Kanab	*Oxyloma haydeni kanabensis*	E	Arizona	Gastropod
Springsnail, San Bernardino	*Pyrgulopsis bernardina*	E	Arizona	Gastropod
Springsnail, Three Forks	*Pyrgulopsis trivialis*	E	Arizona	Gastropod
Bat, Lesser (=Sanborn's) Long-nosed	*Leptonycteris curasoae yerbabuenae*	E	Arizona	Mammal
Ferret, Black-footed	*Mustela nigripes*	E	Arizona	Mammal
Jaguar	*Panthera onca*	E	Arizona	Mammal
Jaguarundi, Sinaloan	*Herpailurus (=Felis) yagouaroundi tolteca*	E	Arizona	Mammal
Ocelot	*Leopardus (=Felis) pardalis*	E	Arizona	Mammal
Pronghorn, Sonoran	*Antilocapra americana sonoriensis*	E	Arizona	Mammal
Squirrel, Mount Graham Red	*Tamiasciurus hudsonicus grahamensis*	E	Arizona	Mammal
Vole, Hualapai Mexican	*Microtus mexicanus hualpaiensis*	E	Arizona	Mammal
Ladies'-tresses, Canelo Hills	*Spiranthes delitescens*	E	Arizona	Monocot

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Sedge, Navajo	*Carex specuicola*	T	Arizona	Monocot
Rattlesnake, New Mexican Ridge-nosed	*Crotalus willardi obscurus*	T	Arizona	Reptile
Tortoise, Desert	*Gopherus agassizii*	T	Arizona	Reptile
Ozark Hellbender	*Cryptobranchus alleganiensis bishopi*	E	Arkansas	Amphibian
Tern, Interior (population) Least	*Sterna antillarum*	E	Arkansas	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Arkansas	Bird
Woodpecker, Ivory-billed	*Campephilus principalis*	E	Arkansas	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Arkansas	Bird
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Arkansas	Bivalve
Mussel, Scaleshell	*Leptodea leptodon*	E	Arkansas	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Arkansas	Bivalve
Mussel, Speckled Pocketbook	*Lampsilis streckeri*	E	Arkansas	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Arkansas	Bivalve
Pearlymussel, Curtis'	*Epioblasma florentina curtisii*	E	Arkansas	Bivalve
Pearlymussel, Fat Pocketbook	*Potamilus capax*	E	Arkansas	Bivalve
Pearlymussel, Turgid-blossom	*Epioblasma turgidula*	E	Arkansas	Bivalve
Rock-pocketbook, Ouachita (=Wheeler's pm)	*Arkansia wheeleri*	E	Arkansas	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Arkansas	Bivalve
Fatmucket, Arkansas	*Lampsilis powelli*	T	Arkansas	Bivalve
Crayfish, Cave (Cambarus aculabrum)	*Cambarus aculabrum*	E	Arkansas	Crustacean

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Crayfish, Cave (Cambarus zophonastes)	*Cambarus zophonastes*	E	Arkansas	Crustacean
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Arkansas	Dicot
Harperella	*Ptilimnium nodosum*	E	Arkansas	Dicot
Pondberry	*Lindera melissifolia*	E	Arkansas	Dicot
Bladderpod, Missouri	*Lesquerella filiformis*	T	Arkansas	Dicot
Catchfly, Spalding's	*Silene spaldingii*	T	Arkansas	Dicot
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	T	Arkansas	Dicot
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Arkansas	Fish
Yellowcheek darter	*Etheostoma moorei*	E	Arkansas	Fish
Cavefish, Ozark	*Amblyopsis rosae*	T	Arkansas	Fish
Darter, Leopard	*Percina pantherina*	T	Arkansas	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Arkansas	Fish
Trout, Bull	*Salvelinus confluentus*	T	Arkansas	Fish
Shagreen, Magazine Mountain	*Mesodon magazinensis*	T	Arkansas	Gastropod
Beetle, American Burying	*Nicrophorus americanus*	E	Arkansas	Insect
Bat, Gray	*Myotis grisescens*	E	Arkansas	Mammal
Bat, Indiana	*Myotis sodalis*	E	Arkansas	Mammal
Bat, Ozark Big-eared	*Corynorhinus (=Plecotus) townsendii ingens*	E	Arkansas	Mammal
Panther, Florida	*Puma (=Felis) concolor coryi*	E	Arkansas	Mammal
Rabbit, Pygmy	*Brachylagus idahoensis*	E	Arkansas	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Arkansas	Monocot
Frog, Mountain Yellow-legged	*Rana muscosa*	E	California	Amphibian
Salamander, California Tiger	*Ambystoma californiense*	E	California	Amphibian

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Salamander, Desert Slender	*Batrachoseps aridus*	E	California	Amphibian
Salamander, Santa Cruz Long-toed	*Ambystoma macrodactylum croceum*	E	California	Amphibian
Toad, Arroyo Southwestern	*Bufo californicus (=microscaphus)*	E	California	Amphibian
Frog, California Red-legged	*Rana aurora draytonii*	T	California	Amphibian
Albatross, Short-tailed	*Phoebastria (=Diomedea) albatrus*	E	California	Bird
Condor, California	*Gymnogyps californianus*	E	California	Bird
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	E	California	Bird
Rail, California Clapper	*Rallus longirostris obsoletus*	E	California	Bird
Rail, Light-footed Clapper	*Rallus longirostris levipes*	E	California	Bird
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	E	California	Bird
Shrike, San Clemente Loggerhead	*Lanius ludovicianus mearnsi*	E	California	Bird
Tern, California Least	*Sterna antillarum browni*	E	California	Bird
Vireo, Least Bell's	*Vireo bellii pusillus*	E	California	Bird
Gnatcatcher, Coastal California	*Polioptila californica californica*	T	California	Bird
Murrelet, Marbled	*Brachyramphus marmoratus*	T	California	Bird
Owl, Northern Spotted	*Strix occidentalis caurina*	T	California	Bird
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	T	California	Bird
Sparrow, San Clemente Sage	*Amphispiza belli clementeae*	T	California	Bird

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Towhee, Inyo Brown	*Pipilo crissalis eremophilus*	T	California	Bird
Cypress, Santa Cruz	*Cupressus abramsiana*	E	California	Conf/cycds
Cypress, Gowen	*Cupressus goveniana ssp. goveniana*	T	California	Conf/cycds
Crayfish, Shasta	*Pacifastacus fortis*	E	California	Crustacean
Fairy Shrimp, Conservancy Fairy	*Branchinecta conservatio*	E	California	Crustacean
Fairy Shrimp, Longhorn	*Branchinecta longiantenna*	E	California	Crustacean
Fairy Shrimp, Riverside	*Streptocephalus woottoni*	E	California	Crustacean
Fairy Shrimp, San Diego	*Branchinecta sandiegonensis*	E	California	Crustacean
Shrimp, California Freshwater	*Syncaris pacifica*	E	California	Crustacean
Tadpole Shrimp, Vernal Pool	*Lepidurus packardi*	E	California	Crustacean
Fairy Shrimp, Vernal Pool	*Branchinecta lynchi*	T	California	Crustacean
Allocarya, Calistoga	*Plagiobothrys strictus*	E	California	Dicot
Ambrosia, San Diego	*Ambrosia pumila*	E	California	Dicot
Barberry, Island	*Berberis pinnata ssp. insularis*	E	California	Dicot
Barberry, Nevin's	*Berberis nevinii*	E	California	Dicot
Bedstraw, El Dorado	*Galium californicum ssp. sierrae*	E	California	Dicot
Bedstraw, Island	*Galium buxifolium*	E	California	Dicot
Bird's-beak, Palmate-bracted	*Cordylanthus palmatus*	E	California	Dicot
Bird's-beak, Pennell's	*Cordylanthus tenuis ssp. capillaris*	E	California	Dicot
Bird's-beak, salt marsh	*Cordylanthus maritimus ssp. maritimus*	E	California	Dicot
Bird's-beak, Soft	*Cordylanthus mollis ssp. mollis*	E	California	Dicot

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Bladderpod, San Bernardino Mountains	*Lesquerella kingii ssp. bernardina*	E	California	Dicot
Broom, San Clemente Island	*Lotus dendroideus ssp. traskiae*	E	California	Dicot
Buckwheat, Cushenbury	*Eriogonum ovalifolium var. vineum*	E	California	Dicot
Buckwheat, Ione (incl. Irish Hill)	*Eriogonum apricum (incl. var. prostratum)*	E	California	Dicot
Bush-mallow, San Clemente Island	*Malacothamnus clementinus*	E	California	Dicot
Bush-mallow, Santa Cruz Island	*Malacothamnus fasciculatus var. nesioticus*	E	California	Dicot
Button-celery, San Diego	*Eryngium aristulatum var. parishii*	E	California	Dicot
Cactus, Bakersfield	*Opuntia treleasei*	E	California	Dicot
Ceanothus, Coyote	*Ceanothus ferrisae*	E	California	Dicot
Ceanothus, Pine Hill	*Ceanothus roderickii*	E	California	Dicot
Checker-mallow, Keck's	*Sidalcea keckii*	E	California	Dicot
Checker-mallow, Kenwood Marsh	*Sidalcea oregana ssp. valida*	E	California	Dicot
Checker-mallow, Pedate	*Sidalcea pedata*	E	California	Dicot
Clarkia, Pismo	*Clarkia speciosa ssp. immaculata*	E	California	Dicot
Clarkia, Presidio	*Clarkia franciscana*	E	California	Dicot
Clarkia, Vine Hill	*Clarkia imbricata*	E	California	Dicot
Clover, Monterey	*Trifolium trichocalyx*	E	California	Dicot
Clover, Showy Indian	*Trifolium amoenum*	E	California	Dicot
Coyote-thistle, Loch Lomond	*Eryngium constancei*	E	California	Dicot
Crownscale, San Jacinto Valley	*Atriplex coronata var. notatior*	E	California	Dicot

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Dudleya, Santa Clara Valley	*Dudleya setchellii*	E	California	Dicot
Evening-primrose, Antioch Dunes	*Oenothera deltoides ssp. howellii*	E	California	Dicot
Evening-primrose, Eureka Valley	*Oenothera avita ssp. eurekensis*	E	California	Dicot
Fiddleneck, Large-flowered	*Amsinckia grandiflora*	E	California	Dicot
Flannelbush, Mexican	*Fremontodendron mexicanum*	E	California	Dicot
Flannelbush, Pine Hill	*Fremontodendron californicum ssp. decumbens*	E	California	Dicot
Fringepod, Santa Cruz Island	*Thysanocarpus conchuliferus*	E	California	Dicot
Gilia, Hoffmann's Slender-flowered	*Gilia tenuiflora ssp. hoffmannii*	E	California	Dicot
Gilia, Monterey	*Gilia tenuiflora ssp. arenaria*	E	California	Dicot
Golden Sunburst, Hartweg's	*Pseudobahia bahiifolia*	E	California	Dicot
Goldfields, Burke's	*Lasthenia burkei*	E	California	Dicot
Goldfields, Contra Costa	*Lasthenia conjugens*	E	California	Dicot
Grass, Hairy Orcutt	*Orcuttia pilosa*	E	California	Dicot
Grass, Sacramento Orcutt	*Orcuttia viscida*	E	California	Dicot
Jewelflower, California	*Caulanthus californicus*	E	California	Dicot
Jewelflower, Metcalf Canyon	*Streptanthus albidus ssp. albidus*	E	California	Dicot
Jewelflower, Tiburon	*Streptanthus niger*	E	California	Dicot
Larkspur, Baker's	*Delphinium bakeri*	E	California	Dicot
Larkspur, San Clemente Island	*Delphinium variegatum ssp. kinkiense*	E	California	Dicot
Larkspur, Yellow	*Delphinium luteum*	E	California	Dicot
Layia, Beach	*Layia carnosa*	E	California	Dicot

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Lessingia, San Francisco	*Lessingia germanorum (=L.g. var. germanorum)*	E	California	Dicot
Liveforever, Santa Barbara Island	*Dudleya traskiae*	E	California	Dicot
Lupine, Clover	*Lupinus tidestromii*	E	California	Dicot
Lupine, Nipomo Mesa	*Lupinus nipomensis*	E	California	Dicot
Malacothrix, Island	*Malacothrix squalida*	E	California	Dicot
Malacothrix, Santa Cruz Island	*Malacothrix indecora*	E	California	Dicot
Mallow, Kern	*Eremalche kernensis*	E	California	Dicot
Manzanita, Del Mar	*Arctostaphylos glandulosa ssp. crassifolia*	E	California	Dicot
Manzanita, Santa Rosa Island	*Arctostaphylos confertiflora*	E	California	Dicot
Meadowfoam, Butte County	*Limnanthes floccosa ssp. californica*	E	California	Dicot
Meadowfoam, Sebastopol	*Limnanthes vinculans*	E	California	Dicot
Milk-vetch, Applegate's	*Astragalus applegatei*	E	California	Dicot
Milk-vetch, Braunton's	*Astragalus brauntonii*	E	California	Dicot
Milk-vetch, Clara Hunt's	*Astragalus clarianus*	E	California	Dicot
Milk-vetch, Coachella Valley	*Astragalus lentiginosus var. coachellae*	E	California	Dicot
Milk-vetch, Coastal Dunes	*Astragalus tener var. titi*	E	California	Dicot
Milk-vetch, Cushenbury	*Astragalus albens*	E	California	Dicot
Milk-vetch, Lane Mountain	*Astragalus jaegerianus*	E	California	Dicot
Milk-vetch, Triple-ribbed	*Astragalus tricarinatus*	E	California	Dicot

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Milk-vetch, Ventura Marsh	*Astragalus pycnostachyus var. lanosissimus*	E	California	Dicot
Mint, Otay Mesa	*Pogogyne nudiuscula*	E	California	Dicot
Mint, San Diego Mesa	*Pogogyne abramsii*	E	California	Dicot
Monardella, Willowy	*Monardella linoides ssp. viminea*	E	California	Dicot
Morning-glory, Stebbins	*Calystegia stebbinsii*	E	California	Dicot
Mountainbalm, Indian Knob	*Eriodictyon altissimum*	E	California	Dicot
Mountain-mahogany, Catalina Island	*Cercocarpus traskiae*	E	California	Dicot
Mustard, Slender-petaled	*Thelypodium stenopetalum*	E	California	Dicot
Navarretia, Few-flowered	*Navarretia leucocephala ssp. Pauciflora*	E	California	Dicot
Navarretia, Many-flowered	*Navarretia leucocephala ssp. plieantha*	E	California	Dicot
Niterwort, Amargosa	*Nitrophila mohavensis*	E	California	Dicot
Oxytheca, Cushenbury	*Oxytheca parishii var. goodmaniana*	E	California	Dicot
Paintbrush, San Clemente Island Indian	*Castilleja grisea*	E	California	Dicot
Paintbrush, Soft-leaved	*Castilleja mollis*	E	California	Dicot
Paintbrush, Tiburon	*Castilleja affinis ssp. neglecta*	E	California	Dicot
Penny-cress, Kneeland Prairie	*Thlaspi californicum*	E	California	Dicot
Pentachaeta, Lyon's	*Pentachaeta lyonii*	E	California	Dicot
Pentachaeta, White-rayed	*Pentachaeta bellidiflora*	E	California	Dicot

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Phacelia, Island	*Phacelia insularis ssp. insularis*	E	California	Dicot
Phlox, Yreka	*Phlox hirsuta*	E	California	Dicot
Polygonum, Scott's Valley	*Polygonum hickmanii*	E	California	Dicot
Potentilla, Hickman's	*Potentilla hickmanii*	E	California	Dicot
Rock-cress, Hoffmann's	*Arabis hoffmannii*	E	California	Dicot
Rock-cress, McDonald's	*Arabis mcdonaldiana*	E	California	Dicot
Rock-cress, Santa Cruz Island	*Sibara filifolia*	E	California	Dicot
San Francisco manzanita	*Arctostaphylos franciscana*	E	California	Dicot
Sandwort, Marsh	*Arenaria paludicola*	E	California	Dicot
Sea-blite, California	*Suaeda californica*	E	California	Dicot
Spineflower, Ben Lomond	*Chorizanthe pungens var. hartwegiana*	E	California	Dicot
Spineflower, Howell's	*Chorizanthe howellii*	E	California	Dicot
Spineflower, Orcutt's	*Chorizanthe orcuttiana*	E	California	Dicot
Spineflower, Robust	*Chorizanthe robusta va r. robusta*	E	California	Dicot
Spineflower, Scotts Valley	*Chorizanthe robusta var. hartwegii*	E	California	Dicot
Spineflower, Slender-horned	*Dodecahema leptoceras*	E	California	Dicot
Spineflower, Sonoma	*Chorizanthe valida*	E	California	Dicot
Stickyseed, Baker's	*Blennosperma bakeri*	E	California	Dicot
Stonecrop, Lake County	*Parvisedum leiocarpum*	E	California	Dicot
Sunflower, San Mateo Woolly	*Eriophyllum latilobum*	E	California	Dicot
Taraxacum, California	*Taraxacum californicum*	E	California	Dicot

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Tarplant, Gaviota	*Deinandra increscens ssp. villosa*	E	California	Dicot
Thistle, Chorro creek Bog	*Cirsium fontinale var. obispoense*	E	California	Dicot
Thistle, Fountain	*Cirsium fontinale var. fontinale*	E	California	Dicot
Thistle, La Graciosa	*Cirsium loncholepis*	E	California	Dicot
Thistle, Suisun	*Cirsium hydrophilum var. hydrophilum*	E	California	Dicot
Thornmint, San Mateo	*Acanthomintha obovata ssp. duttonii*	E	California	Dicot
Tuctoria, Green's	*Tuctoria greenei*	E	California	Dicot
Wallflower, Ben Lomond	*Erysimum teretifolium*	E	California	Dicot
Wallflower, Contra Costa	*Erysimum capitatum var. angustatum*	E	California	Dicot
Wallflower, Menzie's	*Erysimum menziesii*	E	California	Dicot
Watercress, Gambel's	*Rorippa gambellii*	E	California	Dicot
Woodland-star, San Clemente Island	*Lithophragma maximum*	E	California	Dicot
Woolly-star, Santa Ana River	*Eriastrum densifolium ssp. sanctorum*	E	California	Dicot
Woolly-threads, San Joaquin	*Monolopia (=Lembertia) congdonii*	E	California	Dicot
Yerba Santa, Lompoc	*Eriodictyon capitatum*	E	California	Dicot
Adobe Sunburst, San Joaquin	*Pseudobahia peirsonii*	T	California	Dicot
Baccharis, Encinitas	*Baccharis vanessae*	T	California	Dicot
Bluecurls, Hidden Lake	*Trichostema austromontanum ssp. compactum*	T	California	Dicot
Buckwheat, Southern Mountain Wild	*Eriogonum kennedyi var. austromontanum*	T	California	Dicot

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Butterweed, Layne's	*Senecio layneae*	T	California	Dicot
Ceanothus, Vail Lake	*Ceanothus ophiochilus*	T	California	Dicot
Centaury, Spring-loving	*Centaurium namophilum*	T	California	Dicot
Clarkia, Springville	*Clarkia springvillensis*	T	California	Dicot
Clover, Fleshy Owl's	*Castilleja campestris ssp. succulenta*	T	California	Dicot
Crownbeard, Big-leaved	*Verbesina dissita*	T	California	Dicot
Daisy, Parish's	*Erigeron parishii*	T	California	Dicot
Dudleya, Conejo	*Dudleya abramsii ssp. parva*	T	California	Dicot
Dudleya, Marcescent	*Dudleya cymosa ssp. marcescens*	T	California	Dicot
Dudleya, Santa Cruz Island	*Dudleya nesiotica*	T	California	Dicot
Dudleya, Santa Monica Mountains	*Dudleya cymosa ssp. ovatifolia*	T	California	Dicot
Dudleya, Verity's	*Dudleya verityi*	T	California	Dicot
Dwarf-flax, Marin	*Hesperolinon congestum*	T	California	Dicot
Evening-primrose, San Benito	*Camissonia benitensis*	T	California	Dicot
Grass, Slender Orcutt	*Orcuttia tenuis*	T	California	Dicot
Gumplant, Ash Meadows	*Grindelia fraxino-pratensis*	T	California	Dicot
Howellia, Water	*Howellia aquatilis*	T	California	Dicot
Liveforever, Laguna Beach	*Dudleya stolonifera*	T	California	Dicot
Manzanita, Ione	*Arctostaphylos myrtifolia*	T	California	Dicot
Manzanita, Morro	*Arctostaphylos morroensis*	T	California	Dicot
Manzanita, Pallid	*Arctostaphylos pallida*	T	California	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Milk-vetch, Fish Slough	*Astragalus lentiginosus var. piscinensis*	T	California	Dicot
Milk-vetch, Pierson's	*Astragalus magdalenae var. peirsonii*	T	California	Dicot
Navarretia, Spreading	*Navarretia fossalis*	T	California	Dicot
Paintbrush, Ash-grey Indian	*Castilleja cinerea*	T	California	Dicot
Pussypaws, Mariposa	*Calyptridium pulchellum*	T	California	Dicot
Rush-rose, Island	*Helianthemum greenei*	T	California	Dicot
Sandwort, Bear Valley	*Arenaria ursina*	T	California	Dicot
Spineflower, Monterey	*Chorizanthe pungens var. pungens*	T	California	Dicot
Spurge, Hoover's	*Chamaesyce hooveri*	T	California	Dicot
Tarplant, Otay	*Deinandra (=Hemizonia) conjugens*	T	California	Dicot
Tarplant, Santa Cruz	*Holocarpha macradenia*	T	California	Dicot
Thornmint, San Diego	*Acanthomintha ilicifolia*	T	California	Dicot
Vervain, California	*Verbena californica*	T	California	Dicot
Chub, Bonytail	*Gila elegans*	E	California	Fish
Chub, Mohave Tui	*Gila bicolor mohavensis*	E	California	Fish
Chub, Owens Tui	*Gila bicolor snyderi*	E	California	Fish
Goby, Tidewater	*Eucyclogobius newberryi*	E	California	Fish
Pupfish, Desert	*Cyprinodon macularius*	E	California	Fish
Pupfish, Owens	*Cyprinodon radiosus*	E	California	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	California	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Stickleback, Unarmored Threespine	*Gasterosteus aculeatus williamsoni*	E	California	Fish
Sucker, Lost River	*Deltistes luxatus*	E	California	Fish
Sucker, Modoc	*Catostomus microps*	E	California	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	California	Fish
Sucker, Shortnose	*Chasmistes brevirostris*	E	California	Fish
Salmon, Chinook	*Oncorhynchus (=Salmo) tshawytscha*	E/T	California	Fish
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	E/T	California	Fish
Steelhead	*Oncorhynchus (=Salmo) mykiss*	E/T	California	Fish
Smelt, Delta	*Hypomesus transpacificus*	T	California	Fish
Sturgeon, North American green	*Acipenser medirostris*	T	California	Fish
Sucker, Santa Ana	*Catostomus santaanae*	T	California	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	California	Fish
Trout, Little Kern Golden	*Oncorhynchus aguabonita whitei*	T	California	Fish
Trout, Paiute Cutthroat	*Oncorhynchus clarki seleniris*	T	California	Fish
Abalone, Black	*Haliotis cracherodii*	E	California	Gastropod
Abalone, White	*Haliotis sorenseni*	E	California	Gastropod
Snail, Morro Shoulderband	*Helminthoglypta walkeriana*	E	California	Gastropod
Beetle, Casey's June	*Dinacoma caseyi*	E	California	Insect
Beetle, Mount Hermon June	*Polyphylla barbata*	E	California	Insect
Beetle, Ohlone Tiger	*Cicindela ohlone*	E	California	Insect
Butterfly, Behren's Silverspot	*Speyeria zerene behrensii*	E	California	Insect
Butterfly, Callippe Silverspot	*Speyeria callippe callippe*	E	California	Insect

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Butterfly, El Segundo Blue	*Euphilotes battoides allyni*	E	California	Insect
Butterfly, Lange's Metalmark	*Apodemia mormo langei*	E	California	Insect
Butterfly, Lotis Blue	*Lycaeides argyrognomon lotis*	E	California	Insect
Butterfly, Mission Blue	*Icaricia icarioides missionensis*	E	California	Insect
Butterfly, Myrtle's Silverspot	*Speyeria zerene myrtleae*	E	California	Insect
Butterfly, Palos Verdes Blue	*Glaucopsyche lygdamus palosverdesensis*	E	California	Insect
Butterfly, Quino Checkerspot	*Euphydryas editha quino (=E. e. wrighti)*	E	California	Insect
Butterfly, San Bruno Elfin	*Callophrys mossii bayensis*	E	California	Insect
Butterfly, Smith's Blue	*Euphilotes enoptes smithi*	E	California	Insect
Fly, Delhi Sands Flower-loving	*Rhaphiomidas terminatus abdominalis*	E	California	Insect
Grasshopper, Zayante Band-winged	*Trimerotropis infantilis*	E	California	Insect
Skipper, Carson Wandering	*Pseudocopaeodes eunus obscurus*	E	California	Insect
Skipper, Laguna Mountain	*Pyrgus ruralis lagunae*	E	California	Insect
Beetle, Delta Green Ground	*Elaphrus viridis*	T	California	Insect
Beetle, Valley Elderberry Longhorn	*Desmocerus californicus dimorphus*	T	California	Insect
Butterfly, Bay Checkerspot (Wright's euphydryas)	*Euphydryas editha bayensis*	T	California	Insect
Butterfly, Oregon Silverspot	*Speyeria zerene hippolyta*	T	California	Insect

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Moth, Kern Primrose Sphinx	*Euproserpinus euterpe*	T	California	Insect
Fox, San Joaquin Kit	*Vulpes macrotis mutica*	E	California	Mammal
Fox, San Miguel Island	*Urocyon littoralis littoralis*	E	California	Mammal
Fox, Santa Catalina Island	*Urocyon littoralis catalinae*	E	California	Mammal
Fox, Santa Cruz Island	*Urocyon littoralis santacruzae*	E	California	Mammal
Fox, Santa Rosa Island	*Urocyon littoralis santarosae*	E	California	Mammal
Jaguar	*Panthera onca*	E	California	Mammal
Kangaroo Rat, Fresno	*Dipodomys nitratoides exilis*	E	California	Mammal
Kangaroo Rat, Giant	*Dipodomys ingens*	E	California	Mammal
Kangaroo Rat, Morro Bay	*Dipodomys heermanni morroensis*	E	California	Mammal
Kangaroo Rat, San Bernardino Merriam's	*Dipodomys merriami parvus*	E	California	Mammal
Kangaroo Rat, Stephens'	*Dipodomys stephensi (incl. D. cascus)*	E	California	Mammal
Kangaroo Rat, Tipton	*Dipodomys nitratoides nitratoides*	E	California	Mammal
Mountain Beaver, Point Arena	*Aplodontia rufa nigra*	E	California	Mammal
Mouse, Pacific Pocket	*Perognathus longimembris pacificus*	E	California	Mammal
Mouse, Salt Marsh Harvest	*Reithrodontomys raviventris*	E	California	Mammal
Rabbit, Riparian Brush	*Sylvilagus bachmani riparius*	E	California	Mammal
Sheep, Peninsular Bighorn	*Ovis canadensis nelsoni*	E	California	Mammal
Sheep, Sierra Nevada Bighorn	*Ovis canadensis sierrae*	E	California	Mammal

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Shrew, Buena Vista Lake Ornate	*Sorex ornatus relictus*	E	California	Mammal
Vole, Amargosa	*Microtus californicus scirpensis*	E	California	Mammal
Whale, Blue	*Balaenoptera musculus*	E	California	Mammal
Whale, Finback	*Balaenoptera physalus*	E	California	Mammal
Whale, Gray	*Eschrichtius robustus*	E	California	Mammal
Whale, Humpback	*Megaptera novaeangliae*	E	California	Mammal
Whale, North Atlantic right	*Eubalaena glacialis (incl. australis)*	E	California	Mammal
Whale, Sei	*Balaenoptera borealis*	E	California	Mammal
Whale, Sperm	*Physeter catodon (=macrocephalus)*	E	California	Mammal
Woodrat, Riparian	*Neotoma fuscipes riparia*	E	California	Mammal
Sea-lion, Steller	*Eumetopias jubatus*	E/T	California	Mammal
Otter, Southern Sea	*Enhydra lutris nereis*	T	California	Mammal
Seal, Guadalupe Fur	*Arctocephalus townsendi*	T	California	Mammal
Alopecurus, Sonoma	*Alopecurus aequalis var. sonomensis*	E	California	Monocot
Bluegrass, Napa	*Poa napensis*	E	California	Monocot
Bluegrass, San Bernardino	*Poa atropurpurea*	E	California	Monocot
Grass, California Orcutt	*Orcuttia californica*	E	California	Monocot
Grass, Eureka Dune	*Swallenia alexandrae*	E	California	Monocot
Grass, Solano	*Tuctoria mucronata*	E	California	Monocot
Lily, Pitkin Marsh	*Lilium pardalinum ssp. pitkinense*	E	California	Monocot
Lily, Western	*Lilium occidentale*	E	California	Monocot
Onion, Munz's	*Allium munzii*	E	California	Monocot
Piperia, Yadon's	*Piperia yadonii*	E	California	Monocot

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Sedge, White	*Carex albida*	E	California	Monocot
Amole, Cammatta Canyon	*Chlorogalum purpureum var. reductum*	T	California	Monocot
Amole, Purple	*Chlorogalum purpureum var. purpureum*	T	California	Monocot
Brodiaea, Chinese Camp	*Brodiaea pallida*	T	California	Monocot
Brodiaea, Thread-leaved	*Brodiaea filifolia*	T	California	Monocot
Grass, Colusa	*Neostapfia colusana*	T	California	Monocot
Grass, San Joaquin Valley Orcutt	*Orcuttia inaequalis*	T	California	Monocot
Lily, Tiburon Mariposa	*Calochortus tiburonensis*	T	California	Monocot
Lizard, Blunt-nosed Leopard	*Gambelia silus*	E	California	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	California	Reptile
Snake, San Francisco Garter	*Thamnophis sirtalis tetrataenia*	E	California	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	California	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	California	Reptile
Lizard, Coachella Valley Fringe-toed	*Uma inornata*	T	California	Reptile
Lizard, Island Night	*Xantusia riversiana*	T	California	Reptile
Sea turtle, olive ridley	*Lepidochelys olivacea*	T	California	Reptile
Snake, Giant Garter	*Thamnophis gigas*	T	California	Reptile
Tortoise, Desert	*Gopherus agassizii*	T	California	Reptile
Whipsnake (=Striped Racer), Alameda	*Masticophis lateralis euryxanthus*	T	California	Reptile
Crane, Whooping	*Grus americana*	E	Colorado	Bird
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	E	Colorado	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Colorado	Bird

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Plover, Piping	*Charadrius melodus*	E/T	Colorado	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Colorado	Bird
Beardtongue, Penland	*Penstemon penlandii*	E	Colorado	Dicot
Cactus, Knowlton	*Pediocactus knowltonii*	E	Colorado	Dicot
Milk-vetch, Mancos	*Astragalus humillimus*	E	Colorado	Dicot
Milk-vetch, Osterhout	*Astragalus osterhoutii*	E	Colorado	Dicot
Pagosa Skyrocket	*Ipomopsis polyantha*	E	Colorado	Dicot
Phacelia, North Park	*Phacelia formosula*	E	Colorado	Dicot
Wild-buckwheat, Clay-loving	*Eriogonum pelinophilum*	E	Colorado	Dicot
Bladderpod, Dudley Bluffs	*Lesquerella congesta*	T	Colorado	Dicot
Butterfly Plant, Colorado	*Gaura neomexicana var. coloradensis*	T	Colorado	Dicot
Cactus, Colorado hookless	*Sclerocactus glaucus*	T	Colorado	Dicot
Cactus, Mesa Verde	*Sclerocactus mesae-verdae*	T	Colorado	Dicot
DeBeque phacelia	*Phacelia submutica*	T	Colorado	Dicot
Mustard, Penland Alpine Fen	*Eutrema penlandii*	T	Colorado	Dicot
Parachute Beardtongue	*Penstemon debilis*	T	Colorado	Dicot
Twinpod, Dudley Bluffs	*Physaria obcordata*	T	Colorado	Dicot
Chub, Bonytail	*Gila elegans*	E	Colorado	Fish
Chub, Humpback	*Gila cypha*	E	Colorado	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Colorado	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Colorado	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Colorado	Fish
Trout, Greenback Cutthroat	*Oncorhynchus clarki stomias*	T	Colorado	Fish

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Butterfly, Uncompahgre Fritillary	*Boloria acrocnema*	E	Colorado	Insect
Skipper, Pawnee Montane	*Hesperia leonardus montana*	T	Colorado	Insect
Ferret, Black-footed	*Mustela nigripes*	E	Colorado	Mammal
Gray Wolf	*Canis lupus*	E	Colorado	Mammal
Lynx, Canada	*Lynx canadensis*	T	Colorado	Mammal
Mouse, Preble's Meadow Jumping	*Zapus hudsonius preblei*	T	Colorado	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Colorado	Monocot
Plover, Piping	*Charadrius melodus*	E/T	Connecticut	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Connecticut	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Connecticut	Bivalve
Chaffseed, American	*Schwalbea americana*	E	Connecticut	Dicot
Gerardia, Sandplain	*Agalinis acuta*	E	Connecticut	Dicot
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Connecticut	Fish
Beetle, Puritan Tiger	*Cicindela puritana*	T	Connecticut	Insect
Bat, Indiana	*Myotis sodalis*	E	Connecticut	Mammal
Pogonia, Small Whorled	*Isotria medeoloides*	T	Connecticut	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Connecticut	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Connecticut	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Connecticut	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Connecticut	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Connecticut	Reptile

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Turtle, Bog	*Clemmys muhlenbergii*	T	Connecticut	Reptile
Plover, Piping	*Charadrius melodus*	E/T	Delaware	Bird
Dropwort, Canby's	*Oxypolis canbyi*	E	Delaware	Dicot
Amaranth, Seabeach	*Amaranthus pumilus*	T	Delaware	Dicot
Sucker, Shortnose	*Chasmistes brevirostris*	E	Delaware	Fish
Squirrel, Delmarva Peninsula Fox	*Sciurus niger cinereus*	E	Delaware	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Delaware	Mammal
Whale, Finback	*Balaenoptera physalus*	E	Delaware	Mammal
Whale, Humpback	*Megaptera novaeangliae*	E	Delaware	Mammal
Whale, North Atlantic right	*Eubalaena glacialis (incl. australis)*	E	Delaware	Mammal
Beaked-rush, Knieskern's	*Rhynchospora knieskernii*	T	Delaware	Monocot
Pink, Swamp	*Helonias bullata*	T	Delaware	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Delaware	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Delaware	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Delaware	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Delaware	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Delaware	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Delaware	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	Delaware	Reptile
Salamander, Reticulated flatwoods	*Ambystoma bishopi*	E	Florida	Amphibian

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Salamander, Frosted Flatwoods	*Ambystoma cingulatum*	T	Florida	Amphibian
Crane, Whooping	*Grus americana*	E	Florida	Bird
Kite, Everglades Snail	*Rostrhamus sociabilis plumbeus*	E	Florida	Bird
Sparrow, Cape Sable Seaside	*Ammodramus maritimus mirabilis*	E	Florida	Bird
Sparrow, Florida Grasshopper	*Ammodramus savannarum floridanus*	E	Florida	Bird
Stork, Wood	*Mycteria americana*	E	Florida	Bird
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	E	Florida	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Florida	Bird
Woodpecker, Ivory-billed	*Campephilus principalis*	E	Florida	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Florida	Bird
Plover, Piping	*Charadrius melodus*	E/T	Florida	Bird
Caracara, Audubon's Crested	*Polyborus plancus audubonii*	T	Florida	Bird
Scrub-Jay, Florida	*Aphelocoma coerulescens*	T	Florida	Bird
Choctaw Bean	*Villosa choctawensis*	E	Florida	Bivalve
Mussel, Fat Threeridge	*Amblema neislerii*	E	Florida	Bivalve
Mussel, Gulf Moccasinshell	*Medionidus penicillatus*	E	Florida	Bivalve
Mussel, Ochlockonee Moccasinshell	*Medionidus simpsonianus*	E	Florida	Bivalve
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	E	Florida	Bivalve
Mussel, Shiny-rayed Pocketbook	*Lampsilis subangulata*	E	Florida	Bivalve
Round Ebonyshell	*Fusconaia rotulata*	E	Florida	Bivalve
Southern Kidneyshell	*Ptychobranchus jonesi*	E	Florida	Bivalve
Bankclimber, Purple	*Elliptoideus sloatianus*	T	Florida	Bivalve

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fuzzy pigtoe	*Pleurobema strodeanum*	T	Florida	Bivalve
Narrow Pigtoe	*Fusconaia escambia*	T	Florida	Bivalve
Slabshell, Chipola	*Elliptio chipolaensis*	T	Florida	Bivalve
Southern Sandshell	*Hamiota australis*	T	Florida	Bivalve
Tapered Pigtoe	*Fusconaia burkei*	T	Florida	Bivalve
Torreya, Florida	*Torreya taxifolia*	E	Florida	Conf/cycds
Coral, Elkhorn	*Acropora palmata*	T	Florida	Coral
Coral, Staghorn	*Acropora cervicornis*	T	Florida	Coral
Shrimp, Squirrel Chimney Cave	*Palaemonetes cummingi*	T	Florida	Crustacean
Aster, Florida Golden	*Chrysopsis floridana*	E	Florida	Dicot
Bellflower, Brooksville	*Campanula robinsiae*	E	Florida	Dicot
Blazing Star, Scrub	*Liatris ohlingerae*	E	Florida	Dicot
Campion, Fringed	*Silene polypetala*	E	Florida	Dicot
Chaffseed, American	*Schwalbea americana*	E	Florida	Dicot
Fringe Tree, Pygmy	*Chionanthus pygmaeus*	E	Florida	Dicot
Gourd, Okeechobee	*Cucurbita okeechobeensis ssp. okeechobeensis*	E	Florida	Dicot
Harebells, Avon Park	*Crotalaria avonensis*	E	Florida	Dicot
Hypericum, Highlands Scrub	*Hypericum cumulicola*	E	Florida	Dicot
Jacquemontia, Beach	*Jacquemontia reclinata*	E	Florida	Dicot
Lead-plant, Crenulate	*Amorpha crenulata*	E	Florida	Dicot
Lupine, Scrub	*Lupinus aridorum*	E	Florida	Dicot
Meadowrue, Cooley's	*Thalictrum cooleyi*	E	Florida	Dicot
Milkpea, Small's	*Galactia smallii*	E	Florida	Dicot
Mint, Garrett's	*Dicerandra christmanii*	E	Florida	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Mint, Lakela's	*Dicerandra immaculata*	E	Florida	Dicot
Mint, Longspurred	*Dicerandra cornutissima*	E	Florida	Dicot
Mint, Scrub	*Dicerandra frutescens*	E	Florida	Dicot
Mustard, Carter's	*Warea carteri*	E	Florida	Dicot
Pawpaw, Beautiful	*Deeringothamnus pulchellus*	E	Florida	Dicot
Pawpaw, Four-petal	*Asimina tetramera*	E	Florida	Dicot
Pawpaw, Rugel's	*Deeringothamnus rugelii*	E	Florida	Dicot
Pinkroot, Gentian	*Spigelia gentianoides*	E	Florida	Dicot
Plum, Scrub	*Prunus geniculata*	E	Florida	Dicot
Polygala, Lewton's	*Polygala lewtonii*	E	Florida	Dicot
Polygala, Tiny	*Polygala smallii*	E	Florida	Dicot
Prickly-apple, Fragrant	*Cereus eriophorus var. fragrans*	E	Florida	Dicot
Rhododendron, Chapman	*Rhododendron chapmanii*	E	Florida	Dicot
Rosemary, Apalachicola	*Conradina glabra*	E	Florida	Dicot
Rosemary, Etonia	*Conradina etonia*	E	Florida	Dicot
Rosemary, Short-leaved	*Conradina brevifolia*	E	Florida	Dicot
Sandlace	*Polygonella myriophylla*	E	Florida	Dicot
Snakeroot	*Eryngium cuneifolium*	E	Florida	Dicot
Spurge, Deltoid	*Chamaesyce deltoidea ssp. deltoidea*	E	Florida	Dicot
Warea, Wide-leaf	*Warea amplexifolia*	E	Florida	Dicot
Water-willow, Cooley's	*Justicia cooleyi*	E	Florida	Dicot
Wireweed	*Polygonella basiramia*	E	Florida	Dicot
Ziziphus, Florida	*Ziziphus celata*	E	Florida	Dicot

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Birds-in-a-nest, White	*Macbridea alba*	T	Florida	Dicot
Bonamia, Florida	*Bonamia grandiflora*	T	Florida	Dicot
Buckwheat, Scrub	*Eriogonum longifolium var. gnaphalifolium*	T	Florida	Dicot
Butterwort, Godfrey's	*Pinguicula ionantha*	T	Florida	Dicot
Gooseberry, Miccosukee	*Ribes echinellum*	T	Florida	Dicot
Skullcap, Florida	*Scutellaria floridana*	T	Florida	Dicot
Spurge, Garber's	*Chamaesyce garberi*	T	Florida	Dicot
Spurge, Telephus	*Euphorbia telephioides*	T	Florida	Dicot
Whitlow-wort, Papery	*Paronychia chartacea*	T	Florida	Dicot
Wings, Pigeon	*Clitoria fragrans*	T	Florida	Dicot
Darter, Okaloosa	*Etheostoma okaloosae*	E	Florida	Fish
Sawfish, Smalltooth	*Pristis pectinata*	E	Florida	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Florida	Fish
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Florida	Fish
Butterfly, Miami Blue	*Cyclargus thomasi bethunebakeri*	E	Florida	Insect
Cladonia, Florida Perforate	*Cladonia perforata*	E	Florida	Lichen
Bat, Gray	*Myotis grisescens*	E	Florida	Mammal
Bat, Indiana	*Myotis sodalis*	E	Florida	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Florida	Mammal
Mouse, Anastasia Island Beach	*Peromyscus polionotus phasma*	E	Florida	Mammal
Mouse, Choctawhatchee Beach	*Peromyscus polionotus allophrys*	E	Florida	Mammal
Mouse, Perdido Key Beach	*Peromyscus polionotus trissyllepsis*	E	Florida	Mammal

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Mouse, St. Andrew Beach	*Peromyscus polionotus peninsularis*	E	Florida	Mammal
Panther, Florida	*Puma (=Felis) concolor coryi*	E	Florida	Mammal
Puma (=Cougar), Eastern	*Puma (=Felis) concolor (all subsp. except coryi)*	E	Florida	Mammal
Vole, Florida Salt Marsh	*Microtus pennsylvanicus dukecampbelli*	E	Florida	Mammal
Mouse, Southeastern Beach	*Peromyscus polionotus niveiventris*	T	Florida	Mammal
Beargrass, Britton's	*Nolina brittoniana*	E	Florida	Monocot
Beauty, Harper's	*Harperocallis flava*	E	Florida	Monocot
Seagrass, Johnson's	*Halophila johnsonii*	T	Florida	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Florida	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Florida	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Florida	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Florida	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Florida	Reptile
Alligator, American	*Alligator mississippiensis*	T	Florida	Reptile
Crocodile, American	*Crocodylus acutus*	T	Florida	Reptile
Skink, Blue-tailed Mole	*Eumeces egregius lividus*	T	Florida	Reptile
Skink, Sand	*Neoseps reynoldsi*	T	Florida	Reptile
Snake, Atlantic Salt Marsh	*Nerodia clarkii taeniata*	T	Florida	Reptile
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Florida	Reptile
Salamander, Reticulated flatwoods	*Ambystoma bishopi*	E	Georgia	Amphibian

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Salamander, Frosted Flatwoods	*Ambystoma cingulatum*	T	Georgia	Amphibian
Stork, Wood	*Mycteria americana*	E	Georgia	Bird
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	E	Georgia	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Georgia	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Georgia	Bird
Plover, Piping	*Charadrius melodus*	E/T	Georgia	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Georgia	Bird
Combshell, Upland	*Epioblasma metastriata*	E	Georgia	Bivalve
Kidneyshell, Triangular	*Ptychobranchus greenii*	E	Georgia	Bivalve
Mussel, Acornshell Southern	*Epioblasma othcaloogensis*	E	Georgia	Bivalve
Mussel, Coosa Moccasinshell	*Medionidus parvulus*	E	Georgia	Bivalve
Mussel, Fat Threeridge	*Amblema neislerii*	E	Georgia	Bivalve
Mussel, Georgia pigtoe	*Pleurobema hanleyianum*	E	Georgia	Bivalve
Mussel, Gulf Moccasinshell	*Medionidus penicillatus*	E	Georgia	Bivalve
Mussel, Ochlockonee Moccasinshell	*Medionidus simpsonianus*	E	Georgia	Bivalve
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	E	Georgia	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Georgia	Bivalve
Mussel, Shiny-rayed Pocketbook	*Lampsilis subangulata*	E	Georgia	Bivalve
Mussel, Southern Clubshell	*Pleurobema decisum*	E	Georgia	Bivalve
Mussel, Southern Pigtoe	*Pleurobema georgianum*	E	Georgia	Bivalve
Spinymussel, Altamaha	*Elliptio spinosa*	E	Georgia	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Bankclimber, Purple	*Elliptoideus sloatianus*	T	Georgia	Bivalve
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	T	Georgia	Bivalve
Mussel, Fine-lined Pocketbook	*Lampsilis altilis*	T	Georgia	Bivalve
Torreya, Florida	*Torreya taxifolia*	E	Georgia	Conf/cycds
Campion, Fringed	*Silene polypetala*	E	Georgia	Dicot
Chaffseed, American	*Schwalbea americana*	E	Georgia	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	Georgia	Dicot
Dropwort, Canby's	*Oxypolis canbyi*	E	Georgia	Dicot
Harperella	*Ptilimnium nodosum*	E	Georgia	Dicot
Leather-flower, Alabama	*Clematis socialis*	E	Georgia	Dicot
Meadowrue, Cooley's	*Thalictrum cooleyi*	E	Georgia	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	Georgia	Dicot
Pondberry	*Lindera melissifolia*	E	Georgia	Dicot
Rattleweed, Hairy	*Baptisia arachnifera*	E	Georgia	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	Georgia	Dicot
Amphianthus, Little	*Amphianthus pusillus*	T	Georgia	Dicot
Barbara Buttons, Mohr's	*Marshallia mohrii*	T	Georgia	Dicot
Skullcap, Large-flowered	*Scutellaria montana*	T	Georgia	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Georgia	Dicot
Quillwort, Black-spored	*Isoetes melanospora*	E	Georgia	Ferns
Quillwort, Mat-forming	*Isoetes tegetiformans*	E	Georgia	Ferns
Darter, Amber	*Percina antesella*	E	Georgia	Fish
Darter, Etowah	*Etheostoma etowahae*	E	Georgia	Fish
Logperch, Conasauga	*Percina jenkinsi*	E	Georgia	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Georgia	Fish
Darter, Cherokee	*Etheostoma scotti*	T	Georgia	Fish
Darter, Goldline	*Percina aurolineata*	T	Georgia	Fish
Darter, Snail	*Percina tanasi*	T	Georgia	Fish
Shiner, Blue	*Cyprinella caerulea*	T	Georgia	Fish
Hornsnail, rough	*Pleurocera foremani*	E	Georgia	Gastropod
Rocksnail, interrupted	*Leptoxis foremani*	E	Georgia	Gastropod
Snail, Lioplax Cylindrical	*Lioplax cyclostomaformis*	E	Georgia	Gastropod
Lichen, Rock Gnome	*Gymnoderma lineare*	E	Georgia	Lichen
Bat, Gray	*Myotis grisescens*	E	Georgia	Mammal
Bat, Indiana	*Myotis sodalis*	E	Georgia	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Georgia	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Georgia	Mammal
Whale, Humpback	*Megaptera novaeangliae*	E	Georgia	Mammal
Whale, North Atlantic right	*Eubalaena glacialis (incl. australis)*	E	Georgia	Mammal
Grass, Tennessee Yellow-eyed	*Xyris tennesseensis*	E	Georgia	Monocot
Trillium, Persistent	*Trillium persistens*	E	Georgia	Monocot
Trillium, Relict	*Trillium reliquum*	E	Georgia	Monocot
Pink, Swamp	*Helonias bullata*	T	Georgia	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Georgia	Monocot
Water-plantain, Kral's	*Sagittaria secundifolia*	T	Georgia	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Georgia	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Georgia	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Georgia	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Georgia	Reptile

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Sea turtle, loggerhead	*Caretta caretta*	E/T	Georgia	Reptile
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Georgia	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	Georgia	Reptile
Crow, Mariana	*Corvus kubaryi*	E	Guam	Bird
Kingfisher, Guam Micronesian	*Halcyon cinnamomina cinnamomina*	E	Guam	Bird
Moorhen, Mariana Common	*Gallinula chloropus guami*	E	Guam	Bird
Rail, Guam	*Rallus owstoni*	E	Guam	Bird
White-eye, Bridled (Nossa)	*Zosterops conspicillatus conspicillatus*	E	Guam	Bird
Hayun Lagu (Tronkon Guafi)	*Serianthes nelsonii*	E	Guam	Dicot
Bat, Little Mariana Fruit	*Pteropus tokudae*	E	Guam	Mammal
Bat, Mariana Fruit (=Mariana Flying Fox)	*Pteropus mariannus mariannus*	T	Guam	Mammal
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Guam	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Guam	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Guam	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Guam	Reptile
Spider, Kauai Cave Wolf	*Adelocosa anops*	E	Hawaii	Arachnid
Akekee	*Loxops caeruleirostris*	E	Hawaii	Bird
'Akepa, Hawaii	*Loxops coccineus coccineus*	E	Hawaii	Bird
'Akepa, Maui	*Loxops coccineus ochraceus*	E	Hawaii	Bird
'Akia Loa, Kauai (Hemignathus procerus)	*Hemignathus procerus*	E	Hawaii	Bird

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
'Akia Pola'au (Hemignathus munroi)	*Hemignathus munroi*	E	Hawaii	Bird
Coot, Hawaiian (=Alae keo keo)	*Fulica americana alai*	E	Hawaii	Bird
Creeper, Hawaii	*Oreomystis mana*	E	Hawaii	Bird
Creeper, Oahu (Alauwahio)	*Paroreomyza maculata*	E	Hawaii	Bird
Crow, Hawaiian ('Alala)	*Corvus hawaiiensis*	E	Hawaii	Bird
Duck, Hawaiian (Koloa)	*Anas wyvilliana*	E	Hawaii	Bird
Elepaio, Oahu	*Chasiempis sandwichensis ibidis*	E	Hawaii	Bird
Goose, Hawaiian (Nene)	*Branta (=Nesochen) sandvicensis*	E	Hawaii	Bird
Hawk, Hawaiian (Io)	*Buteo solitarius*	E	Hawaii	Bird
Honeycreeper, Crested ('Akohekohe)	*Palmeria dolei*	E	Hawaii	Bird
Kauai creeper	*Oreomystis bairdi*	E	Hawaii	Bird
Moorhen, Hawaiian Common	*Gallinula chloropus sandvicensis*	E	Hawaii	Bird
Nuku Pu'u, Kauai	*Hemignathus lucidus hanapepe*	E	Hawaii	Bird
Nuku Pu'u, Maui	*Hemignathus lucidus affinus*	E	Hawaii	Bird
'O'o, Kauai (='A'a)	*Moho braccatus*	E	Hawaii	Bird
'O'u (Honeycreeper)	*Psittirostra psittacea*	E	Hawaii	Bird
Palila	*Loxioides bailleui*	E	Hawaii	Bird
Parrotbill, Maui	*Pseudonestor xanthophrys*	E	Hawaii	Bird
Petrel, Hawaiian Dark-rumped	*Pterodroma phaeopygia sandwichensis*	E	Hawaii	Bird
Po'ouli	*Melamprosops phaeosoma*	E	Hawaii	Bird
Stilt, Hawaiian (=Ae'o)	*Himantopus mexicanus knudseni*	E	Hawaii	Bird

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Swiftlet, Mariana Gray (=Vanikoro)	*Aerodramus vanikorensis bartschi*	E	Hawaii	Bird
Thrush, Large Kauai	*Myadestes myadestinus*	E	Hawaii	Bird
Thrush, Small Kauai (Puaiohi)	*Myadestes palmeri*	E	Hawaii	Bird
Shearwater, Newell's Townsend's	*Puffinus auricularis newelli*	T	Hawaii	Bird
Amphipod, Kauai Cave	*Spelaeorchestia koloana*	E	Hawaii	Crustacean
(ncn)	*Cyanea kolekoleensis*	E	Hawaii	Dicot
(ncn)	*Keysseria (=Lagenifera) erici*	E	Hawaii	Dicot
(ncn)	*Keysseria (=Lagenifera) helenae*	E	Hawaii	Dicot
(ncn)	*Lysimachia iniki*	E	Hawaii	Dicot
(ncn)	*Lysimachia pendens*	E	Hawaii	Dicot
(ncn)	*Lysimachia scopulensis*	E	Hawaii	Dicot
(ncn)	*Lysimachia venosa*	E	Hawaii	Dicot
(ncn)	*Phyllostegia hispida*	E	Hawaii	Dicot
(ncn)	*Phyllostegia renovans*	E	Hawaii	Dicot
(ncn)	*Platydesma cornuta var. cornuta*	E	Hawaii	Dicot
(ncn)	*Platydesma cornuta var. decurrens*	E	Hawaii	Dicot
(ncn)	*Schiedea attenuata*	E	Hawaii	Dicot
(ncn)	*Stenogyne kealiae*	E	Hawaii	Dicot
(ncn)	*Tetraplasandra bisattenuata*	E	Hawaii	Dicot
(ncn)	*Tetraplasandra flynnii*	E	Hawaii	Dicot
(ncn)	*Tetraplasandra lydgatei*	E	Hawaii	Dicot
Abutilon sandwicense (ncn)	*Abutilon sandwicense*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Achyranthes mutica (ncn)	*Achyranthes mutica*	E	Hawaii	Dicot
Achyranthes splendens var. rotundata (ncn)	*Achyranthes splendens var. rotundata*	E	Hawaii	Dicot
a'e	*Zanthoxylum oahuense*	E	Hawaii	Dicot
A'e (Zanthoxylum dipetalum var. tomentosum)	*Zanthoxylum dipetalum var. tomentosum*	E	Hawaii	Dicot
A'e (Zanthoxylum hawaiiense)	*Zanthoxylum hawaiiense*	E	Hawaii	Dicot
'Aiea (Nothocestrum breviflorum)	*Nothocestrum breviflorum*	E	Hawaii	Dicot
'Aiea (Nothocestrum peltatum)	*Nothocestrum peltatum*	E	Hawaii	Dicot
Akoko	*Chamaesyce remyi var. kauaiensis*	E	Hawaii	Dicot
'akoko	*Chamaesyce eleanoriae*	E	Hawaii	Dicot
'Akoko (Chamaesyce celastroides var. kaenana)	*Chamaesyce celastroides var. kaenana*	E	Hawaii	Dicot
'Akoko (Chamaesyce deppeana)	*Chamaesyce deppeana*	E	Hawaii	Dicot
'Akoko (Chamaesyce herbstii)	*Chamaesyce herbstii*	E	Hawaii	Dicot
'Akoko (Chamaesyce kuwaleana)	*Chamaesyce kuwaleana*	E	Hawaii	Dicot
'Akoko (Chamaesyce rockii)	*Chamaesyce rockii*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
'Akoko (Chamaesyce skottsbergii var. skottsbe	*Chamaesyce skottsbergii var. kalaeloana*	E	Hawaii	Dicot
'Akoko (Euphorbia haeleeleana)	*Euphorbia haeleeleana*	E	Hawaii	Dicot
alani	*Melicope christophersenii*	E	Hawaii	Dicot
alani	*Melicope degeneri*	E	Hawaii	Dicot
alani	*Melicope hiiakae*	E	Hawaii	Dicot
alani	*Melicope makahae*	E	Hawaii	Dicot
alani	*Melicope paniculata*	E	Hawaii	Dicot
alani	*Melicope puberula*	E	Hawaii	Dicot
Alani (Melicope adscendens)	*Melicope adscendens*	E	Hawaii	Dicot
Alani (Melicope balloui)	*Melicope balloui*	E	Hawaii	Dicot
Alani (Melicope haupuensis)	*Melicope haupuensis*	E	Hawaii	Dicot
Alani (Melicope knudsenii)	*Melicope knudsenii*	E	Hawaii	Dicot
Alani (Melicope lydgatei)	*Melicope lydgatei*	E	Hawaii	Dicot
Alani (Melicope mucronulata)	*Melicope mucronulata*	E	Hawaii	Dicot
Alani (Melicope ovalis)	*Melicope ovalis*	E	Hawaii	Dicot
Alani (Melicope pallida)	*Melicope pallida*	E	Hawaii	Dicot
Alani (Melicope quadrangularis)	*Melicope quadrangularis*	E	Hawaii	Dicot
Alani (Melicope saint-johnii)	*Melicope saint-johnii*	E	Hawaii	Dicot
Alani (Melicope zahlbruckneri)	*Melicope zahlbruckneri*	E	Hawaii	Dicot
Alsinidendron obovatum (ncn)	*Alsinidendron obovatum*	E	Hawaii	Dicot
Alsinidendron trinerve (ncn)	*Alsinidendron trinerve*	E	Hawaii	Dicot
Alsinidendron viscosum (ncn)	*Alsinidendron viscosum*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
'Anaunau (Lepidium arbuscula)	*Lepidium arbuscula*	E	Hawaii	Dicot
'Anunu (Sicyos alba)	*Sicyos alba*	E	Hawaii	Dicot
Aupaka (Isodendrion hosakae)	*Isodendrion hosakae*	E	Hawaii	Dicot
Aupaka (Isodendrion laurifolium)	*Isodendrion laurifolium*	E	Hawaii	Dicot
awikiwiki	*Canavalia napaliensis*	E	Hawaii	Dicot
'Awiwi (Centaurium sebaeoides)	*Centaurium sebaeoides*	E	Hawaii	Dicot
'Awiwi (Hedyotis cookiana)	*Hedyotis cookiana*	E	Hawaii	Dicot
Bonamia menziesii (ncn)	*Bonamia menziesii*	E	Hawaii	Dicot
Chamaesyce Halemanui (ncn)	*Chamaesyce halemanui*	E	Hawaii	Dicot
Cyanea undulata (ncn)	*Cyanea undulata*	E	Hawaii	Dicot
Delissea rhytodisperma (ncn)	*Delissea rhytidosperma*	E	Hawaii	Dicot
Dubautia latifolia (ncn)	*Dubautia latifolia*	E	Hawaii	Dicot
Dubautia pauciflorula (ncn)	*Dubautia pauciflorula*	E	Hawaii	Dicot
Geranium, Hawaiian Red-flowered	*Geranium arboreum*	E	Hawaii	Dicot
Gouania hillebrandii (ncn)	*Gouania hillebrandii*	E	Hawaii	Dicot
Gouania meyenii (ncn)	*Gouania meyenii*	E	Hawaii	Dicot
Gouania vitifolia (ncn)	*Gouania vitifolia*	E	Hawaii	Dicot
ha`iwale	*Cyrtandra kaulantha*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
ha`iwale	*Cyrtandra sessilis*	E	Hawaii	Dicot
Haha	*Cyanea calycina*	E	Hawaii	Dicot
Haha	*Cyanea dolichopoda*	E	Hawaii	Dicot
haha	*Cyanea eleeleensis*	E	Hawaii	Dicot
Haha	*Cyanea kuhihewa*	E	Hawaii	Dicot
Haha	*Cyanea lanceolata*	E	Hawaii	Dicot
haha	*Cyanea purpurellifolia*	E	Hawaii	Dicot
Haha (Cyanea acuminata)	*Cyanea acuminata*	E	Hawaii	Dicot
Haha (Cyanea asarifolia)	*Cyanea asarifolia*	E	Hawaii	Dicot
Haha (Cyanea copelandii ssp. copelandii)	*Cyanea copelandii ssp. copelandii*	E	Hawaii	Dicot
Haha (Cyanea copelandii ssp. haleakalaensis)	*Cyanea copelandii ssp. haleakalaensis*	E	Hawaii	Dicot
Haha (Cyanea Crispa) (=Rollandia crispa)	*Cyanea (=Rollandia) crispa*	E	Hawaii	Dicot
Haha (Cyanea glabra)	*Cyanea glabra*	E	Hawaii	Dicot
Haha (Cyanea grimesiana ssp. grimesiana)	*Cyanea grimesiana ssp. grimesiana*	E	Hawaii	Dicot
Haha (Cyanea grimesiana ssp. obatae)	*Cyanea grimesiana ssp. obatae*	E	Hawaii	Dicot
Haha (Cyanea hamatiflora ssp. carlsonii)	*Cyanea hamatiflora ssp. Carlsonii*	E	Hawaii	Dicot
Haha (Cyanea hamatiflora ssp. hamatiflora)	*Cyanea hamatiflora ssp. hamatiflora*	E	Hawaii	Dicot
Haha (Cyanea humboldtiana)	*Cyanea humboldtiana*	E	Hawaii	Dicot
Haha (Cyanea koolauensis)	*Cyanea koolauensis*	E	Hawaii	Dicot
Haha (Cyanea lobata)	*Cyanea lobata*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Haha (Cyanea longiflora)	*Cyanea longiflora*	E	Hawaii	Dicot
Haha (Cyanea mceldowneyi)	*Cyanea mceldowneyi*	E	Hawaii	Dicot
Haha (Cyanea pinnatifida)	*Cyanea pinnatifida*	E	Hawaii	Dicot
Haha (Cyanea platyphylla)	*Cyanea platyphylla*	E	Hawaii	Dicot
Haha (Cyanea remyi)	*Cyanea remyi*	E	Hawaii	Dicot
Haha (Cyanea shipmanii)	*Cyanea shipmannii*	E	Hawaii	Dicot
Haha (Cyanea stictophylla)	*Cyanea stictophylla*	E	Hawaii	Dicot
Haha (Cyanea St-Johnii) (=Rollandia St-Johnii)	*Cyanea st-johnii*	E	Hawaii	Dicot
Haha (Cyanea superba)	*Cyanea superba*	E	Hawaii	Dicot
Haha (Cyanea truncata)	*Cyanea truncata*	E	Hawaii	Dicot
haiwale	*Cyrtandra gracilis*	E	Hawaii	Dicot
haiwale	*Cyrtandra paliku*	E	Hawaii	Dicot
haiwale	*Cyrtandra waiolani*	E	Hawaii	Dicot
Ha'Iwale (Cyrtandra crenata)	*Cyrtandra crenata*	E	Hawaii	Dicot
Ha'Iwale (Cyrtandra dentata)	*Cyrtandra dentata*	E	Hawaii	Dicot
Ha'Iwale (Cyrtandra giffardii)	*Cyrtandra giffardii*	E	Hawaii	Dicot
Ha'Iwale (Cyrtandra munroi)	*Cyrtandra munroi*	E	Hawaii	Dicot
Ha'iwale (Cyrtandra oenobarba)	*Cyrtandra oenobarba*	E	Hawaii	Dicot
Ha'Iwale (Cyrtandra polyantha)	*Cyrtandra polyantha*	E	Hawaii	Dicot
Ha'Iwale (Cyrtandra subumbellata)	*Cyrtandra subumbellata*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Ha'Iwale (Cyrtandra tintinnabula)	*Cyrtandra tintinnabula*	E	Hawaii	Dicot
Ha'Iwale (Cyrtandra viridiflora)	*Cyrtandra viridiflora*	E	Hawaii	Dicot
Haplostachys Haplostachya (ncn)	*Haplostachys haplostachya*	E	Hawaii	Dicot
Hau Kauhiwi (Hibiscadelphus woodi)	*Hibiscadelphus woodii*	E	Hawaii	Dicot
Hau Kuahiwi (Hibiscadelphus distans)	*Hibiscadelphus distans*	E	Hawaii	Dicot
Hau Kuahiwi (Hibiscadelphus giffardianus)	*Hibiscadelphus giffardianus*	E	Hawaii	Dicot
Hau Kuahiwi (Hibiscadelphus hualalaiensis)	*Hibiscadelphus hualalaiensis*	E	Hawaii	Dicot
Heau (Exocarpos luteolus)	*Exocarpos luteolus*	E	Hawaii	Dicot
Hedyotis degeneri (ncn)	*Hedyotis degeneri*	E	Hawaii	Dicot
Hedyotis parvula (ncn)	*Hedyotis parvula*	E	Hawaii	Dicot
Hedyotis St.-Johnii (ncn)	*Hedyotis st.-johnii*	E	Hawaii	Dicot
Hesperomannia arborescens (ncn)	*Hesperomannia arborescens*	E	Hawaii	Dicot
Hesperomannia arbuscula (ncn)	*Hesperomannia arbuscula*	E	Hawaii	Dicot
Hesperomannia lydgatei (ncn)	*Hesperomannia lydgatei*	E	Hawaii	Dicot
Hibiscus, Clay's	*Hibiscus clayi*	E	Hawaii	Dicot
ho'awa	*Pittosporum napaliense*	E	Hawaii	Dicot
Holei (Ochrosia kilaueaensis)	*Ochrosia kilaueaensis*	E	Hawaii	Dicot
Iliau (Wilkesia hobdyi)	*Wilkesia hobdyi*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
kamakahala	*Labordia helleri*	E	Hawaii	Dicot
kamakahala	*Labordia pumila*	E	Hawaii	Dicot
Kamakahala (Labordia cyrtandrae)	*Labordia cyrtandrae*	E	Hawaii	Dicot
Kamakahala (Labordia lydgatei)	*Labordia lydgatei*	E	Hawaii	Dicot
Kamakahala (Labordia tinifolia var. wahiawaen)	*Labordia tinifolia var. wahiawaensis*	E	Hawaii	Dicot
Kauila (Colubrina oppositifolia)	*Colubrina oppositifolia*	E	Hawaii	Dicot
kaulu	*Pteralyxia macrocarpa*	E	Hawaii	Dicot
Kaulu (Pteralyxia kauaiensis)	*Pteralyxia kauaiensis*	E	Hawaii	Dicot
Kio'Ele (Hedyotis coriacea)	*Hedyotis coriacea*	E	Hawaii	Dicot
Kiponapona (Phyllostegia racemosa)	*Phyllostegia racemosa*	E	Hawaii	Dicot
ko`oko`olau	*Bidens amplectens*	E	Hawaii	Dicot
Koki'o (Kokia drynarioides)	*Kokia drynarioides*	E	Hawaii	Dicot
Koki'o (Kokia kauaiensis)	*Kokia kauaiensis*	E	Hawaii	Dicot
Koki'o Ke'oke'o (Hibiscus waimeae ssp. hannerae)	*Hibiscus waimeae ssp. hannerae*	E	Hawaii	Dicot
Kolea	*Myrsine knudsenii*	E	Hawaii	Dicot
kolea	*Myrsine mezii*	E	Hawaii	Dicot
Kolea (Myrsine juddii)	*Myrsine juddii*	E	Hawaii	Dicot
Ko'oko'olau (Bidens micrantha ssp. kalealaha)	*Bidens micrantha ssp. kalealaha*	E	Hawaii	Dicot
Ko'oloa'ula (Abutilon menziesii)	*Abutilon menziesii*	E	Hawaii	Dicot
kopiko	*Psychotria grandiflora*	E	Hawaii	Dicot
kopiko	*Psychotria hobdyi*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Kuawawaenohu (Alsinidendron lychnoides)	*Alsinidendron lychnoides*	E	Hawaii	Dicot
Kulu'I (Nototrichium humile)	*Nototrichium humile*	E	Hawaii	Dicot
Laukahi Kuahiwi (Plantago hawaiensis)	*Plantago hawaiensis*	E	Hawaii	Dicot
Laukahi Kuahiwi (Plantago princeps)	*Plantago princeps*	E	Hawaii	Dicot
Laulihilihi (Schiedea stellarioides)	*Schiedea stellarioides*	E	Hawaii	Dicot
lehua makanoe	*Lysimachia daphnoides*	E	Hawaii	Dicot
Liliwai (Acaena exigua)	*Acaena exigua*	E	Hawaii	Dicot
Lipochaeta venosa (ncn)	*Lipochaeta venosa*	E	Hawaii	Dicot
Lobelia monostachya (ncn)	*Lobelia monostachya*	E	Hawaii	Dicot
Lobelia niihauensis (ncn)	*Lobelia niihauensis*	E	Hawaii	Dicot
Lobelia oahuensis (ncn)	*Lobelia oahuensis*	E	Hawaii	Dicot
Lysimachia filifolia (ncn)	*Lysimachia filifolia*	E	Hawaii	Dicot
Lysimachia lydgatei (ncn)	*Lysimachia lydgatei*	E	Hawaii	Dicot
Mahoe (Alectryon macrococcus)	*Alectryon macrococcus*	E	Hawaii	Dicot
Ma'o Hau Hele (Hibiscus brackenridgei)	*Hibiscus brackenridgei*	E	Hawaii	Dicot
Ma'oli'oli (Schiedea apokremnos)	*Schiedea apokremnos*	E	Hawaii	Dicot
Ma'oli'oli (Schiedea kealiae)	*Schiedea kealiae*	E	Hawaii	Dicot
Mapele (Cyrtandra cyaneoides)	*Cyrtandra cyaneoides*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Mehamehame (Flueggea neowawraea)	*Flueggea neowawraea*	E	Hawaii	Dicot
Munroidendron racemosum (ncn)	*Munroidendron racemosum*	E	Hawaii	Dicot
na`ena`e	*Dubautia imbricata imbricata*	E	Hawaii	Dicot
na`ena`e	*Dubautia plantaginea magnifolia*	E	Hawaii	Dicot
Na`ena`e	*Dubautia waialealae*	E	Hawaii	Dicot
Naenae	*Dubautia kalalauensis*	E	Hawaii	Dicot
Naenae	*Dubautia kenwoodii*	E	Hawaii	Dicot
Na'ena'e (Dubautia herbstobatae)	*Dubautia herbstobatae*	E	Hawaii	Dicot
Na'ena'e (Dubautia plantaginea ssp. humilis)	*Dubautia plantaginea ssp. humilis*	E	Hawaii	Dicot
Nani Wai'ale'ale (Viola kauaensis var. wahiawaensis)	*Viola kauaiensis var. wahiawaensis*	E	Hawaii	Dicot
Nanu (Gardenia mannii)	*Gardenia mannii*	E	Hawaii	Dicot
Na'u (Gardenia brighamii)	*Gardenia brighamii*	E	Hawaii	Dicot
Naupaka, Dwarf (Scaevola coriacea)	*Scaevola coriacea*	E	Hawaii	Dicot
Nehe (Lipochaeta fauriei)	*Lipochaeta fauriei*	E	Hawaii	Dicot
Nehe (Lipochaeta kamolensis)	*Lipochaeta kamolensis*	E	Hawaii	Dicot
Nehe (Lipochaeta lobata var. leptophylla)	*Lipochaeta lobata var. leptophylla*	E	Hawaii	Dicot
Nehe (Lipochaeta micrantha)	*Lipochaeta micrantha*	E	Hawaii	Dicot
Nehe (Lipochaeta tenuifolia)	*Lipochaeta tenuifolia*	E	Hawaii	Dicot
Nehe (Lipochaeta waimeaensis)	*Lipochaeta waimeaensis*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Neraudia angulata (ncn)	*Neraudia angulata*	E	Hawaii	Dicot
Neraudia ovata (ncn)	*Neraudia ovata*	E	Hawaii	Dicot
Neraudia sericea (ncn)	*Neraudia sericea*	E	Hawaii	Dicot
Nioi (Eugenia koolauensis)	*Eugenia koolauensis*	E	Hawaii	Dicot
nohoanu	*Geranium kauaiense*	E	Hawaii	Dicot
Nohoanu (Geranium multiflorum)	*Geranium multiflorum*	E	Hawaii	Dicot
Oahu wild coffee	*Psychotria hexandra ssp. Oahuensis*	E	Hawaii	Dicot
'Oha (Delissea rivularis)	*Delissea rivularis*	E	Hawaii	Dicot
'Oha (Delissea subcordata)	*Delissea subcordata*	E	Hawaii	Dicot
'Oha (Delissea undulata)	*Delissea undulata*	E	Hawaii	Dicot
'Oha (Lobelia gaudichaudii koolauensis)	*Lobelia gaudichaudii ssp. koolauensis*	E	Hawaii	Dicot
'Oha Wai (Clermontia drepanomorpha)	*Clermontia drepanomorpha*	E	Hawaii	Dicot
'Oha Wai (Clermontia lindseyana)	*Clermontia lindseyana*	E	Hawaii	Dicot
'Oha Wai (Clermontia oblongifolia ssp. mauiensis)	*Clermontia oblongifolia ssp. mauiensis*	E	Hawaii	Dicot
'Oha Wai (Clermontia peleana)	*Clermontia peleana*	E	Hawaii	Dicot
'Oha Wai (Clermontia pyrularia)	*Clermontia pyrularia*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
'Oha Wai (Clermontia samuelii)	*Clermontia samuelii*	E	Hawaii	Dicot
'Ohai (Sesbania tomentosa)	*Sesbania tomentosa*	E	Hawaii	Dicot
'Ohe'ohe (Tetraplasandra gymnocarpa)	*Tetraplasandra gymnocarpa*	E	Hawaii	Dicot
'Olulu (Brighamia insignis)	*Brighamia insignis*	E	Hawaii	Dicot
Opuhe (Urera kaalae)	*Urera kaalae*	E	Hawaii	Dicot
Pamakani (Viola chamissoniana ssp. chamissoniana)	*Viola chamissoniana ssp. chamissoniana*	E	Hawaii	Dicot
Papala	*Charpentiera densiflora*	E	Hawaii	Dicot
Phyllostegia hirsuta (ncn)	*Phyllostegia hirsuta*	E	Hawaii	Dicot
Phyllostegia kaalaensis (ncn)	*Phyllostegia kaalaensis*	E	Hawaii	Dicot
Phyllostegia knudsenii (ncn)	*Phyllostegia knudsenii*	E	Hawaii	Dicot
Phyllostegia mannii (ncn)	*Phyllostegia mannii*	E	Hawaii	Dicot
Phyllostegia mollis (ncn)	*Phyllostegia mollis*	E	Hawaii	Dicot
Phyllostegia parviflora (ncn)	*Phyllostegia parviflora*	E	Hawaii	Dicot
Phyllostegia velutina (ncn)	*Phyllostegia velutina*	E	Hawaii	Dicot
Phyllostegia waimeae (ncn)	*Phyllostegia waimeae*	E	Hawaii	Dicot
Phyllostegia warshaueri (ncn)	*Phyllostegia warshaueri*	E	Hawaii	Dicot
Phyllostegia wawrana (ncn)	*Phyllostegia wawrana*	E	Hawaii	Dicot
Pilo (Hedyotis mannii)	*Hedyotis mannii*	E	Hawaii	Dicot
pilo kea lau li`i	*Platydesma rostrata*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Po'e (Portulaca sclerocarpa)	*Portulaca sclerocarpa*	E	Hawaii	Dicot
Popolo 'Aiakeakua (Solanum sandwicense)	*Solanum sandwicense*	E	Hawaii	Dicot
Popolo Ku Mai (Solanum incompletum)	*Solanum incompletum*	E	Hawaii	Dicot
Pua'ala (Brighamia rockii)	*Brighamia rockii*	E	Hawaii	Dicot
Remya kauaiensis (ncn)	*Remya kauaiensis*	E	Hawaii	Dicot
Remya montgomeryi (ncn)	*Remya montgomeryi*	E	Hawaii	Dicot
Remya, Maui	*Remya mauiensis*	E	Hawaii	Dicot
Sandalwood, Lanai (='Iliahi)	*Santalum freycinetianum var. lanaiense*	E	Hawaii	Dicot
Sanicula mariversa (ncn)	*Sanicula mariversa*	E	Hawaii	Dicot
Sanicula purpurea (ncn)	*Sanicula purpurea*	E	Hawaii	Dicot
Schiedea haleakalensis (ncn)	*Schiedea haleakalensis*	E	Hawaii	Dicot
Schiedea helleri (ncn)	*Schiedea helleri*	E	Hawaii	Dicot
Schiedea hookeri (ncn)	*Schiedea hookeri*	E	Hawaii	Dicot
Schiedea kaalae (ncn)	*Schiedea kaalae*	E	Hawaii	Dicot
Schiedea kauaiensis (ncn)	*Schiedea kauaiensis*	E	Hawaii	Dicot
Schiedea membranacea (ncn)	*Schiedea membranacea*	E	Hawaii	Dicot
Schiedea nuttallii (ncn)	*Schiedea nuttallii*	E	Hawaii	Dicot
Schiedea spergulina var. leiopoda (ncn)	*Schiedea spergulina var. leiopoda*	E	Hawaii	Dicot
Schiedea, Diamond Head (Schiedea adamantis)	*Schiedea adamantis*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Silene lanceolata (ncn)	*Silene lanceolata*	E	Hawaii	Dicot
Silene perlmanii (ncn)	*Silene perlmanii*	E	Hawaii	Dicot
Silversword, Ka'u (Argyroxiphium kauense)	*Argyroxiphium kauense*	E	Hawaii	Dicot
Silversword, Mauna Kea ('Ahinahina)	*Argyroxiphium sandwicense ssp. sandwicense*	E	Hawaii	Dicot
Spermolepis hawaiiensis (ncn)	*Spermolepis hawaiiensis*	E	Hawaii	Dicot
Stenogyne angustifolia (ncn)	*Stenogyne angustifolia var. angustifolia*	E	Hawaii	Dicot
Stenogyne campanulata (ncn)	*Stenogyne campanulata*	E	Hawaii	Dicot
Stenogyne kanehoana (ncn)	*Stenogyne kanehoana*	E	Hawaii	Dicot
Tetramolopium arenarium (ncn)	*Tetramolopium arenarium*	E	Hawaii	Dicot
Tetramolopium capillare (ncn)	*Tetramolopium capillare*	E	Hawaii	Dicot
Tetramolopium filiforme (ncn)	*Tetramolopium filiforme*	E	Hawaii	Dicot
Tetramolopium lepidotum ssp. lepidotum (ncn)	*Tetramolopium lepidotum ssp. lepidotum*	E	Hawaii	Dicot
Tetramolopium remyi (ncn)	*Tetramolopium remyi*	E	Hawaii	Dicot
Trematolobelia singularis (ncn)	*Trematolobelia singularis*	E	Hawaii	Dicot
Uhiuhi (Caesalpinia kavaiensis)	*Caesalpinia kavaiense*	E	Hawaii	Dicot
Vetch, Hawaiian (Vicia menziesii)	*Vicia menziesii*	E	Hawaii	Dicot
Vigna o-wahuensis (ncn)	*Vigna o-wahuensis*	E	Hawaii	Dicot
Viola helenae (ncn)	*Viola helenae*	E	Hawaii	Dicot
Viola oahuensis (ncn)	*Viola oahuensis*	E	Hawaii	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Wahine Noho Kula (Isodendrion pyrifolium)	*Isodendrion pyrifolium*	E	Hawaii	Dicot
Xylosma crenatum (ncn)	*Xylosma crenatum*	E	Hawaii	Dicot
Aupaka (Isodendrion longifolium)	*Isodendrion longifolium*	T	Hawaii	Dicot
Haha (Cyanea recta)	*Cyanea recta*	T	Hawaii	Dicot
Ha'Iwale (Cyrtandra limahuliensis)	*Cyrtandra limahuliensis*	T	Hawaii	Dicot
Kolea (Myrsine linearifolia)	*Myrsine linearifolia*	T	Hawaii	Dicot
Makou (Peucedanum sandwicense)	*Peucedanum sandwicense*	T	Hawaii	Dicot
Schiedea spergulina var. spergulina (ncn)	*Schiedea spergulina var. spergulina*	T	Hawaii	Dicot
Silene hawaiiensis (ncn)	*Silene hawaiiensis*	T	Hawaii	Dicot
Silversword, Haleakala ('Ahinahina)	*Argyroxiphium sandwicense ssp. macrocephalum*	T	Hawaii	Dicot
Tetramolopium rockii (ncn)	*Tetramolopium rockii*	T	Hawaii	Dicot
(ncn)	*Diellia mannii*	E	Hawaii	Ferns
(ncn)	*Doryopteris angelica*	E	Hawaii	Ferns
(ncn)	*Doryopteris takeuchii*	E	Hawaii	Ferns
Asplenium fragile var. insulare (ncn)	*Asplenium fragile var. insulare*	E	Hawaii	Ferns
aumakua, Palapalai	*Dryopteris crinalis podosorus*	E	Hawaii	Ferns
Diellia erecta (ncn)	*Diellia erecta*	E	Hawaii	Ferns
Diellia falcata (ncn)	*Diellia falcata*	E	Hawaii	Ferns
Diellia pallida (ncn)	*Diellia pallida*	E	Hawaii	Ferns
Diellia unisora (ncn)	*Diellia unisora*	E	Hawaii	Ferns

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Diplazium molokaiense (ncn)	*Diplazium molokaiense*	E	Hawaii	Ferns
Fern, Pendant Kihi (Adenophorus periens)	*Adenophorus periens*	E	Hawaii	Ferns
'Ihi'Ihi (Marsilea villosa)	*Marsilea villosa*	E	Hawaii	Ferns
Pauoa (Ctenitis squamigera)	*Ctenitis squamigera*	E	Hawaii	Ferns
Pteris lidgatei (ncn)	*Pteris lidgatei*	E	Hawaii	Ferns
Wawae'Iole (Phlegmariurus (=Huperzia) mannii)	*Huperzia mannii*	E	Hawaii	Ferns
Wawae'Iole (Phlegmariurus (=Lycopodium) nutans)	*Lycopodium (=Phlegmariurus) nutans*	E	Hawaii	Ferns
Snail, O'ahu Tree (Achatinella abbreviata)	*Achatinella abbreviata*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella apexfulva)	*Achatinella apexfulva*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella bellula)	*Achatinella bellula*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella buddii)	*Achatinella buddii*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella bulimoides)	*Achatinella bulimoides*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella byronii)	*Achatinella byronii*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella caesia)	*Achatinella caesia*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella casta)	*Achatinella casta*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella cestus)	*Achatinella cestus*	E	Hawaii	Gastropod

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Snail, O'ahu Tree (Achatinella concavospira)	*Achatinella concavospira*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella curta)	*Achatinella curta*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella decipiens)	*Achatinella decipiens*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella decora)	*Achatinella decora*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella dimorpha)	*Achatinella dimorpha*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella elegans)	*Achatinella elegans*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella fulgens)	*Achatinella fulgens*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella fuscobasis)	*Achatinella fuscobasis*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella juddii)	*Achatinella juddii*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella juncea)	*Achatinella juncea*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella lehuiensis)	*Achatinella lehuiensis*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella leucorraphe)	*Achatinella leucorraphe*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella lila)	*Achatinella lila*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella livida)	*Achatinella livida*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella lorata)	*Achatinella lorata*	E	Hawaii	Gastropod

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Snail, O'ahu Tree (Achatinella mustelina)	*Achatinella mustelina*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella papyracea)	*Achatinella papyracea*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella phaeozona)	*Achatinella phaeozona*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella pulcherrima)	*Achatinella pulcherrima*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella pupukanioe)	*Achatinella pupukanioe*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella rosea)	*Achatinella rosea*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella sowerbyana)	*Achatinella sowerbyana*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella spaldingi)	*Achatinella spaldingi*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella stewartii)	*Achatinella stewartii*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella swiftii)	*Achatinella swiftii*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella taeniolata)	*Achatinella taeniolata*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella thaanumi)	*Achatinella thaahumi*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella turgida)	*Achatinella turgida*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella valida)	*Achatinella valida*	E	Hawaii	Gastropod

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Snail, O'ahu Tree (Achatinella viridans)	*Achatinella viridans*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella vittata)	*Achatinella vittata*	E	Hawaii	Gastropod
Snail, O'ahu Tree (Achatinella vulpina)	*Achatinella vulpina*	E	Hawaii	Gastropod
Snail, Newcomb's	*Erinna newcombi*	T	Hawaii	Gastropod
blackline Hawaiian damselfly	*Megalagrion nigrohamatum nigrolineatum*	E	Hawaii	Insect
Crimson Hawaiian damselfly	*Megalagrion leptodemas*	E	Hawaii	Insect
Damselfly, Flying Earwig Hawaiian	*Megalagrion nesiotes*	E	Hawaii	Insect
Damselfly, Pacific Hawaiian	*Megalagrion pacificum*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila aglaia*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila hemipeza*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila heteroneura*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila montgomeryi*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila musaphilia*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila neoclavisetae*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila obatai*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila ochrobasis*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila substenoptera*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila tarphytrichia*	E	Hawaii	Insect
Hawaiian picture-wing Fly	*Drosophila sharpi*	E	Hawaii	Insect

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Moth, Blackburn's Sphinx	*Manduca blackburni*	E	Hawaii	Insect
Oceanic Hawaiian damselfly	*Megalagrion oceanicum*	E	Hawaii	Insect
Fly, Hawaiian picture-wing	*Drosophila mulli*	T	Hawaii	Insect
Bat, Hawaiian Hoary	*Lasiurus cinereus semotus*	E	Hawaii	Mammal
Seal, Hawaiian Monk	*Monachus schauinslandi*	E	Hawaii	Mammal
Whale, Humpback	*Megaptera novaeangliae*	E	Hawaii	Mammal
Whale, Sperm	*Physeter catodon (=macrocephalus)*	E	Hawaii	Mammal
Bluegrass, Hawaiian	*Poa sandvicensis*	E	Hawaii	Monocot
Bluegrass, Mann's (Poa mannii)	*Poa mannii*	E	Hawaii	Monocot
Grass, Fosberg's Love	*Eragrostis fosbergii*	E	Hawaii	Monocot
Hala Pepe (Pleomele hawaiiensis)	*Pleomele hawaiiensis*	E	Hawaii	Monocot
Hilo Ischaemum (Ischaemum byrone)	*Ischaemum byrone*	E	Hawaii	Monocot
Kamanomano (Cenchrus agrimonioides)	*Cenchrus agrimonioides*	E	Hawaii	Monocot
Lau'ehu (Panicum niihauense)	*Panicum niihauense*	E	Hawaii	Monocot
lo`ulu	*Pritchardia hardyi*	E	Hawaii	Monocot
Lo`ulu (Pritchardia affinis)	*Pritchardia affinis*	E	Hawaii	Monocot
Lo`ulu (Pritchardia kaalae)	*Pritchardia kaalae*	E	Hawaii	Monocot
Lo`ulu (Pritchardia napaliensis)	*Pritchardia napaliensis*	E	Hawaii	Monocot
Lo`ulu (Pritchardia schattaueri)	*Pritchardia schattaueri*	E	Hawaii	Monocot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Lo`ulu (Pritchardia viscosa)	*Pritchardia viscosa*	E	Hawaii	Monocot
Mariscus fauriei (ncn)	*Mariscus fauriei*	E	Hawaii	Monocot
Mariscus pennatiformis (ncn)	*Mariscus pennatiformis*	E	Hawaii	Monocot
Pa'iniu	*Astelia waialealae*	E	Hawaii	Monocot
Panicgrass, Carter's (Panicum fauriei var.carteri)	*Panicum fauriei var. carteri*	E	Hawaii	Monocot
Platanthera holochila (ncn)	*Platanthera holochila*	E	Hawaii	Monocot
Poa siphonoglossa (ncn)	*Poa siphonoglossa*	E	Hawaii	Monocot
Pu'uka'a (Cyperus trachysanthos)	*Cyperus trachysanthos*	E	Hawaii	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Hawaii	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Hawaii	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Hawaii	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Hawaii	Reptile
Sea turtle, olive ridley	*Lepidochelys olivacea*	T	Hawaii	Reptile
Catchfly, Spalding's	*Silene spaldingii*	T	Idaho	Dicot
Four-o'clock, Macfarlane's	*Mirabilis macfarlanei*	T	Idaho	Dicot
Howellia, Water	*Howellia aquatilis*	T	Idaho	Dicot
Peppergrass, Slick Spot	*Lepidium papilliferum*	T	Idaho	Dicot
Salmon, Sockeye	*Oncorhynchus (=Salmo) nerka*	E	Idaho	Fish
Sturgeon, White	*Acipenser transmontanus*	E	Idaho	Fish
Salmon, Chinook	*Oncorhynchus (=Salmo) tshawytscha*	E/T	Idaho	Fish
Steelhead	*Oncorhynchus (=Salmo) mykiss*	E/T	Idaho	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Trout, Bull	*Salvelinus confluentus*	T	Idaho	Fish
Limpet, Banbury Springs	*Lanx sp.*	E	Idaho	Gastropod
Snail, Snake River Physa	*Physa natricina*	E	Idaho	Gastropod
Springsnail, Bruneau Hot	*Pyrgulopsis bruneauensis*	E	Idaho	Gastropod
Snail, Bliss Rapids	*Taylorconcha serpenticola*	T	Idaho	Gastropod
Caribou, Woodland	*Rangifer tarandus caribou*	E	Idaho	Mammal
Bear, Grizzly	*Ursus arctos horribilis*	T	Idaho	Mammal
Lynx, Canada	*Lynx canadensis*	T	Idaho	Mammal
Squirrel, Northern Idaho Ground	*Spermophilus brunneus brunneus*	T	Idaho	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Idaho	Monocot
Tern, Interior (population) Least	*Sterna antillarum*	E	Illinois	Bird
Plover, Piping	*Charadrius melodus*	E/T	Illinois	Bird
Fanshell	*Cyprogenia stegaria*	E	Illinois	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Illinois	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Illinois	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Illinois	Bivalve
Pearlymussel, Fat Pocketbook	*Potamilus capax*	E	Illinois	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Illinois	Bivalve
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	E	Illinois	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Illinois	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Illinois	Bivalve
Amphipod, Illinois Cave	*Gammarus acherondytes*	E	Illinois	Crustacean
Clover, Leafy Prairie	*Dalea foliosa*	E	Illinois	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Aster, Decurrent False	*Boltonia decurrens*	T	Illinois	Dicot
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Illinois	Dicot
Daisy, Lakeside	*Hymenoxys herbacea*	T	Illinois	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Illinois	Dicot
Potato-bean, Price's	*Apios priceana*	T	Illinois	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Illinois	Dicot
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Illinois	Fish
Snail, Iowa Pleistocene	*Discus macclintocki*	E	Illinois	Gastropod
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Illinois	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Illinois	Insect
Bat, Gray	*Myotis grisescens*	E	Illinois	Mammal
Bat, Indiana	*Myotis sodalis*	E	Illinois	Mammal
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Illinois	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Illinois	Monocot
Tern, Interior (population) Least	*Sterna antillarum*	E	Indiana	Bird
Fanshell	*Cyprogenia stegaria*	E	Indiana	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Indiana	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Indiana	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Indiana	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Indiana	Bivalve
Pearlymussel, Fat Pocketbook	*Potamilus capax*	E	Indiana	Bivalve
Pearlymussel, White Cat's Paw	*Epioblasma obliquata perobliqua*	E	Indiana	Bivalve
Rayed Bean	*Villosa fabalis*	E	Indiana	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Indiana	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Sheepnose mussel	*Plethobasus cyphyus*	E	Indiana	Bivalve
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Indiana	Dicot
Goldenrod, Short's	*Solidago shortii*	E	Indiana	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Indiana	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Indiana	Dicot
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Indiana	Insect
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Indiana	Insect
Bat, Gray	*Myotis grisescens*	E	Indiana	Mammal
Bat, Indiana	*Myotis sodalis*	E	Indiana	Mammal
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Indiana	Monocot
Snake, Northern Copperbelly Water	*Nerodia erythrogaster neglecta*	T	Indiana	Reptile
Tern, Interior (population) Least	*Sterna antillarum*	E	Iowa	Bird
Plover, Piping	*Charadrius melodus*	E/T	Iowa	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Iowa	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Iowa	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Iowa	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Iowa	Bivalve
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Iowa	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Iowa	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	Iowa	Dicot
Shiner, Topeka	*Notropis topeka (=tristis)*	E	Iowa	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Iowa	Fish
Snail, Iowa Pleistocene	*Discus macclintocki*	E	Iowa	Gastropod
Bat, Indiana	*Myotis sodalis*	E	Iowa	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Iowa	Monocot
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	Iowa	Monocot
Crane, Whooping	*Grus americana*	E	Kansas	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Kansas	Bird
Plover, Piping	*Charadrius melodus*	E/T	Kansas	Bird
Spectaclecase mussel	*Cumberlandia monodonta*	E	Kansas	Bivalve
Milkweed, Mead's	*Asclepias meadii*	T	Kansas	Dicot
Shiner, Topeka	*Notropis topeka (=tristis)*	E	Kansas	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Kansas	Fish
Madtom, Neosho	*Noturus placidus*	T	Kansas	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Kansas	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Kansas	Insect
Bat, Gray	*Myotis grisescens*	E	Kansas	Mammal
Ferret, Black-footed	*Mustela nigripes*	E	Kansas	Mammal
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	Kansas	Monocot
Tern, Interior (population) Least	*Sterna antillarum*	E	Kentucky	Bird
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	E	Kentucky	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Kentucky	Bird
Woodpecker, Ivory-billed	*Campephilus principalis*	E	Kentucky	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Kentucky	Bird
Plover, Piping	*Charadrius melodus*	E/T	Kentucky	Bird
Fanshell	*Cyprogenia stegaria*	E	Kentucky	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Kentucky	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Kentucky	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Mussel, Cumberland Combshell	*Epioblasma brevidens*	E	Kentucky	Bivalve
Mussel, Cumberland Elktoe	*Alasmidonta atropurpurea*	E	Kentucky	Bivalve
Mussel, Oyster	*Epioblasma capsaeformis*	E	Kentucky	Bivalve
Mussel, Ring Pink (=Golf Stick Pearly)	*Obovaria retusa*	E	Kentucky	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Kentucky	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Kentucky	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Kentucky	Bivalve
Pearlymussel, Appalachian Monkeyface	*Quadrula sparsa*	E	Kentucky	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Kentucky	Bivalve
Pearlymussel, Cumberland Bean	*Villosa trabalis*	E	Kentucky	Bivalve
Pearlymussel, Dromedary	*Dromus dromas*	E	Kentucky	Bivalve
Pearlymussel, Fat Pocketbook	*Potamilus capax*	E	Kentucky	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	Kentucky	Bivalve
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	E	Kentucky	Bivalve
Pearlymussel, Purple Cat's Paw	*Epioblasma obliquata obliquata*	E	Kentucky	Bivalve
Pearlymussel, Tubercled-blossom	*Epioblasma torulosa torulosa*	E	Kentucky	Bivalve
Pearlymussel, White Wartyback	*Plethobasus cicatricosus*	E	Kentucky	Bivalve
Pearlymussel, Yellow-blossom	*Epioblasma florentina florentina*	E	Kentucky	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Kentucky	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Riffleshell, Tan	*Epioblasma florentina walkeri (=E. walkeri)*	E	Kentucky	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Kentucky	Bivalve
Shrimp, Kentucky Cave	*Palaemonias ganteri*	E	Kentucky	Crustacean
Chaffseed, American	*Schwalbea americana*	E	Kentucky	Dicot
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Kentucky	Dicot
Goldenrod, Short's	*Solidago shortii*	E	Kentucky	Dicot
Rock-cress, Small	*Arabis perstellata E. L. Braun var. perstellata Fernald*	E	Kentucky	Dicot
Sandwort, Cumberland	*Arenaria cumberlandensis*	E	Kentucky	Dicot
Goldenrod, White-haired	*Solidago albopilosa*	T	Kentucky	Dicot
Potato-bean, Price's	*Apios priceana*	T	Kentucky	Dicot
Rosemary, Cumberland	*Conradina verticillata*	T	Kentucky	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Kentucky	Dicot
Cumberland darter	*Etheostoma susanae*	E	Kentucky	Fish
Darter, Relict	*Etheostoma chienense*	E	Kentucky	Fish
Shiner, Palezone	*Notropis albizonatus*	E	Kentucky	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Kentucky	Fish
Dace, Blackside	*Phoxinus cumberlandensis*	T	Kentucky	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Kentucky	Insect
Bat, Gray	*Myotis grisescens*	E	Kentucky	Mammal
Bat, Indiana	*Myotis sodalis*	E	Kentucky	Mammal
Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	E	Kentucky	Mammal
Wolf, Red	*Canis rufus*	E	Kentucky	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Tern, Interior (population) Least	*Sterna antillarum*	E	Louisiana	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Louisiana	Bird
Plover, Piping	*Charadrius melodus*	E/T	Louisiana	Bird
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Louisiana	Bivalve
Mussel, Heelsplitter Inflated	*Potamilus inflatus*	T	Louisiana	Bivalve
Pearlshell, Louisiana	*Margaritifera hembeli*	T	Louisiana	Bivalve
Chaffseed, American	*Schwalbea americana*	E	Louisiana	Dicot
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	T	Louisiana	Dicot
Quillwort, Louisiana	*Isoetes louisianensis*	E	Louisiana	Ferns
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Louisiana	Fish
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Louisiana	Fish
Manatee, West Indian	*Trichechus manatus*	E	Louisiana	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Louisiana	Mammal
Bear, Louisiana Black	*Ursus americanus luteolus*	T	Louisiana	Mammal
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Louisiana	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Louisiana	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Louisiana	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Louisiana	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Louisiana	Reptile
Tortoise, Gopher	*Gopherus polyphemus*	T	Louisiana	Reptile
Turtle, Ringed Map	*Graptemys oculifera*	T	Louisiana	Reptile
Plover, Piping	*Charadrius melodus*	E/T	Maine	Bird

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Maine	Bird
Lousewort, Furbish	*Pedicularis furbishiae*	E	Maine	Dicot
Salmon, Atlantic	*Salmo salar*	E	Maine	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Maine	Fish
Whale, Blue	*Balaenoptera musculus*	E	Maine	Mammal
Lynx, Canada	*Lynx canadensis*	T	Maine	Mammal
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Maine	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Maine	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Maine	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Maine	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Maine	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Maine	Reptile
Plover, Piping	*Charadrius melodus*	E/T	Maryland	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Maryland	Bivalve
Dropwort, Canby's	*Oxypolis canbyi*	E	Maryland	Dicot
Gerardia, Sandplain	*Agalinis acuta*	E	Maryland	Dicot
Harperella	*Ptilimnium nodosum*	E	Maryland	Dicot
Amaranth, Seabeach	*Amaranthus pumilus*	T	Maryland	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	Maryland	Dicot
Darter, Maryland	*Etheostoma sellare*	E	Maryland	Fish
Beetle, Northeastern Beach Tiger	*Cicindela dorsalis dorsalis*	T	Maryland	Insect
Beetle, Puritan Tiger	*Cicindela puritana*	T	Maryland	Insect
Bat, Indiana	*Myotis sodalis*	E	Maryland	Mammal
Squirrel, Delmarva Peninsula Fox	*Sciurus niger cinereus*	E	Maryland	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Whale, Blue	*Balaenoptera musculus*	E	Maryland	Mammal
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	Maryland	Monocot
Pink, Swamp	*Helonias bullata*	T	Maryland	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Maryland	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Maryland	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Maryland	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Maryland	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Maryland	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	Maryland	Reptile
Plover, Piping	*Charadrius melodus*	E/T	Massachusetts	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Massachusetts	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Massachusetts	Bivalve
Gerardia, Sandplain	*Agalinis acuta*	E	Massachusetts	Dicot
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Massachusetts	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Massachusetts	Insect
Beetle, Northeastern Beach Tiger	*Cicindela dorsalis dorsalis*	T	Massachusetts	Insect
Beetle, Puritan Tiger	*Cicindela puritana*	T	Massachusetts	Insect
Bat, Indiana	*Myotis sodalis*	E	Massachusetts	Mammal
Puma (=Cougar), Eastern	*Puma (=Felis) concolor (all subsp. except coryi)*	E	Massachusetts	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Massachusetts	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	Massachusetts	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Massachusetts	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Massachusetts	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Massachusetts	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Massachusetts	Reptile
Turtle, Plymouth Red-bellied	*Pseudemys rubriventris bangsi*	E	Massachusetts	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Massachusetts	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Massachusetts	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	Massachusetts	Reptile
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	E	Michigan	Bird
Plover, Piping	*Charadrius melodus*	E/T	Michigan	Bird
Mussel, Clubshell	*Pleurobema clava*	E	Michigan	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Michigan	Bivalve
Rayed Bean	*Villosa fabalis*	E	Michigan	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Michigan	Bivalve
Monkey-flower, Michigan	*Mimulus glabratus var. michiganensis*	E	Michigan	Dicot
Daisy, Lakeside	*Hymenoxys herbacea*	T	Michigan	Dicot
Goldenrod, Houghton's	*Solidago houghtonii*	T	Michigan	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Michigan	Dicot
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	T	Michigan	Ferns
Beetle, Hungerford's Crawling Water	*Brychius hungerfordi*	E	Michigan	Insect

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Michigan	Insect
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Michigan	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Michigan	Insect
Bat, Indiana	*Myotis sodalis*	E	Michigan	Mammal
Gray Wolf	*Canis lupus*	E	Michigan	Mammal
Lynx, Canada	*Lynx canadensis*	T	Michigan	Mammal
Iris, Dwarf Lake	*Iris lacustris*	T	Michigan	Monocot
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Michigan	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Michigan	Monocot
Snake, Northern Copperbelly Water	*Nerodia erythrogaster neglecta*	T	Michigan	Reptile
Plover, Piping	*Charadrius melodus*	E/T	Minnesota	Bird
Mussel, snuffbox	*Epioblasma triquetra*	E	Minnesota	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Minnesota	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Minnesota	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Minnesota	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Minnesota	Bivalve
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Minnesota	Dicot
Roseroot, Leedy's	*Sedum integrifolium ssp. leedyi*	T	Minnesota	Dicot
Shiner, Topeka	*Notropis topeka (=tristis)*	E	Minnesota	Fish
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Minnesota	Insect
Lynx, Canada	*Lynx canadensis*	T	Minnesota	Mammal
Lily, Minnesota Trout	*Erythronium propullans*	E	Minnesota	Monocot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	Minnesota	Monocot
Frog, Dusky Gopher (Mississippi DPS)	*Rana capito sevosa*	E	Mississippi	Amphibian
Crane, Mississippi Sandhill	*Grus canadensis pulla*	E	Mississippi	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Mississippi	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Mississippi	Bird
Plover, Piping	*Charadrius melodus*	E/T	Mississippi	Bird
Combshell, Southern (=Penitent mussel)	*Epioblasma penita*	E	Mississippi	Bivalve
Mussel, Black (=Curtus' Mussel) Clubshell	*Pleurobema curtum*	E	Mississippi	Bivalve
Mussel, Cumberland Combshell	*Epioblasma brevidens*	E	Mississippi	Bivalve
Mussel, Heavy Pigtoe (=Judge Tait's Mussel)	*Pleurobema taitianum*	E	Mississippi	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Mississippi	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Mississippi	Bivalve
Mussel, Southern Clubshell	*Pleurobema decisum*	E	Mississippi	Bivalve
Pearlymussel, Fat Pocketbook	*Potamilus capax*	E	Mississippi	Bivalve
Mucket, Orange-nacre	*Lampsilis perovalis*	T	Mississippi	Bivalve
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	T	Mississippi	Bivalve
Mussel, Heelsplitter Inflated	*Potamilus inflatus*	T	Mississippi	Bivalve
Pondberry	*Lindera melissifolia*	E	Mississippi	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Potato-bean, Price's	*Apios priceana*	T	Mississippi	Dicot
Quillwort, Louisiana	*Isoetes louisianensis*	E	Mississippi	Ferns
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Mississippi	Fish
Darter, Bayou	*Etheostoma rubrum*	T	Mississippi	Fish
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Mississippi	Fish
Bat, Gray	*Myotis grisescens*	E	Mississippi	Mammal
Bat, Indiana	*Myotis sodalis*	E	Mississippi	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Mississippi	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Mississippi	Mammal
Bear, Louisiana Black	*Ursus americanus luteolus*	T	Mississippi	Mammal
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Mississippi	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Mississippi	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Mississippi	Reptile
Turtle, Alabama Red-bellied	*Pseudemys alabamensis*	E	Mississippi	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Mississippi	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Mississippi	Reptile
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Mississippi	Reptile
Tortoise, Gopher	*Gopherus polyphemus*	T	Mississippi	Reptile
Turtle, Ringed Map	*Graptemys oculifera*	T	Mississippi	Reptile
Turtle, Yellow-blotched Map	*Graptemys flavimaculata*	T	Mississippi	Reptile

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Ozark Hellbender	*Cryptobranchus alleganiensis bishopi*	E	Missouri	Amphibian
Tern, Interior (population) Least	*Sterna antillarum*	E	Missouri	Bird
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Missouri	Bivalve
Mussel, Scaleshell	*Leptodea leptodon*	E	Missouri	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Missouri	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Missouri	Bivalve
Pearlymussel, Curtis'	*Epioblasma florentina curtisii*	E	Missouri	Bivalve
Pearlymussel, Fat Pocketbook	*Potamilus capax*	E	Missouri	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Missouri	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Missouri	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Missouri	Bivalve
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Missouri	Dicot
Pondberry	*Lindera melissifolia*	E	Missouri	Dicot
Aster, Decurrent False	*Boltonia decurrens*	T	Missouri	Dicot
Bladderpod, Missouri	*Lesquerella filiformis*	T	Missouri	Dicot
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	T	Missouri	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Missouri	Dicot
Sneezeweed, Virginia	*Helenium virginicum*	T	Missouri	Dicot
Shiner, Topeka	*Notropis topeka (=tristis)*	E	Missouri	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Missouri	Fish
Cavefish, Ozark	*Amblyopsis rosae*	T	Missouri	Fish
Darter, Niangua	*Etheostoma nianguae*	T	Missouri	Fish
Madtom, Neosho	*Noturus placidus*	T	Missouri	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Cavesnail, Tumbling Creek	*Antrobia culveri*	E	Missouri	Gastropod
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Missouri	Insect
Bat, Gray	*Myotis grisescens*	E	Missouri	Mammal
Bat, Indiana	*Myotis sodalis*	E	Missouri	Mammal
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	Missouri	Monocot
Crane, Whooping	*Grus americana*	E	Montana	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Montana	Bird
Plover, Piping	*Charadrius melodus*	E/T	Montana	Bird
Catchfly, Spalding's	*Silene spaldingii*	T	Montana	Dicot
Howellia, Water	*Howellia aquatilis*	T	Montana	Dicot
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Montana	Fish
Sturgeon, White	*Acipenser transmontanus*	E	Montana	Fish
Trout, Bull	*Salvelinus confluentus*	T	Montana	Fish
Ferret, Black-footed	*Mustela nigripes*	E	Montana	Mammal
Bear, Grizzly	*Ursus arctos horribilis*	T	Montana	Mammal
Lynx, Canada	*Lynx canadensis*	T	Montana	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Montana	Monocot
Crane, Whooping	*Grus americana*	E	Nebraska	Bird
Curlew, Eskimo	*Numenius borealis*	E	Nebraska	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Nebraska	Bird
Plover, Piping	*Charadrius melodus*	E/T	Nebraska	Bird
Penstemon, Blowout	*Penstemon haydenii*	E	Nebraska	Dicot
Butterfly Plant, Colorado	*Gaura neomexicana var. coloradensis*	T	Nebraska	Dicot
Shiner, Topeka	*Notropis topeka (=tristis)*	E	Nebraska	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Nebraska	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Beetle, American Burying	*Nicrophorus americanus*	E	Nebraska	Insect
Beetle, Salt Creek Tiger	*Cicindela nevadica lincolniana*	E	Nebraska	Insect
Ferret, Black-footed	*Mustela nigripes*	E	Nebraska	Mammal
Gray Wolf	*Canis lupus*	E	Nebraska	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Nebraska	Monocot
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	Nebraska	Monocot
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	E	Nevada	Bird
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	E	Nevada	Bird
Buckwheat, Steamboat	*Eriogonum ovalifolium var. williamsiae*	E	Nevada	Dicot
Niterwort, Amargosa	*Nitrophila mohavensis*	E	Nevada	Dicot
Poolfish, Pahrump (= Pahrump Killifish)	*Empetrichthys latos*	E	Nevada	Dicot
Blazing Star, Ash Meadows	*Mentzelia leucophylla*	T	Nevada	Dicot
Centaury, Spring-loving	*Centaurium namophilum*	T	Nevada	Dicot
Gumplant, Ash Meadows	*Grindelia fraxino-pratensis*	T	Nevada	Dicot
Ivesia, Ash Meadows	*Ivesia kingii var. eremica*	T	Nevada	Dicot
Milk-vetch, Ash Meadows	*Astragalus phoenix*	T	Nevada	Dicot
Sunray, Ash Meadows	*Enceliopsis nudicaulis var. corrugata*	T	Nevada	Dicot
Chub, Humpback	*Gila cypha*	E	Nevada	Fish
Chub, Pahranagat Roundtail	*Gila robusta jordani*	E	Nevada	Fish
Chub, Virgin River	*Gila seminuda (=robusta)*	E	Nevada	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Cui-ui	*Chasmistes cujus*	E	Nevada	Fish
Dace, Ash Meadows Speckled	*Rhinichthys osculus nevadensis*	E	Nevada	Fish
Dace, Clover Valley Speckled	*Rhinichthys osculus oligoporus*	E	Nevada	Fish
Dace, Independence Valley Speckled	*Rhinichthys osculus lethoporus*	E	Nevada	Fish
Dace, Moapa	*Moapa coriacea*	E	Nevada	Fish
Pupfish, Ash Meadows Amargosa	*Cyprinodon nevadensis mionectes*	E	Nevada	Fish
Pupfish, Devils Hole	*Cyprinodon diabolis*	E	Nevada	Fish
Pupfish, Warm Springs	*Cyprinodon nevadensis pectoralis*	E	Nevada	Fish
Spinedace, White River	*Lepidomeda albivallis*	E	Nevada	Fish
Springfish, Hiko White River	*Crenichthys baileyi grandis*	E	Nevada	Fish
Springfish, White River	*Crenichthys baileyi baileyi*	E	Nevada	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Nevada	Fish
Woundfin	*Plagopterus argentissimus*	E	Nevada	Fish
Dace, Desert	*Eremichthys acros*	T	Nevada	Fish
Spinedace, Big Spring	*Lepidomeda mollispinis pratensis*	T	Nevada	Fish
Springfish, Railroad Valley	*Crenichthys nevadae*	T	Nevada	Fish
Sucker, Warner	*Catostomus warnerensis*	T	Nevada	Fish
Trout, Bull	*Salvelinus confluentus*	T	Nevada	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	Nevada	Fish
Skipper, Carson Wandering	*Pseudocopaeodes eunus obscurus*	E	Nevada	Insect
Naucorid, Ash Meadows	*Ambrysus amargosus*	T	Nevada	Insect

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Gray Wolf	*Canis lupus*	E	Nevada	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Nevada	Monocot
Tortoise, Desert	*Gopherus agassizii*	T	Nevada	Reptile
Plover, Piping	*Charadrius melodus*	E/T	New Hampshire	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	New Hampshire	Bivalve
Milk-vetch, Jesup's	*Astragalus robbinsii var. jesupi*	E	New Hampshire	Dicot
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	New Hampshire	Insect
Whale, Blue	*Balaenoptera musculus*	E	New Hampshire	Mammal
Lynx, Canada	*Lynx canadensis*	T	New Hampshire	Mammal
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	New Hampshire	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	New Hampshire	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	New Hampshire	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	New Hampshire	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	New Hampshire	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	New Hampshire	Reptile
Plover, Piping	*Charadrius melodus*	E/T	New Jersey	Bird

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Tern, Roseate	*Sterna dougallii dougallii*	E/T	New Jersey	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	New Jersey	Bivalve
Chaffseed, American	*Schwalbea americana*	E	New Jersey	Dicot
Amaranth, Seabeach	*Amaranthus pumilus*	T	New Jersey	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	New Jersey	Dicot
Beetle, Northeastern Beach Tiger	*Cicindela dorsalis dorsalis*	T	New Jersey	Insect
Bat, Indiana	*Myotis sodalis*	E	New Jersey	Mammal
Whale, Blue	*Balaenoptera musculus*	E	New Jersey	Mammal
Beaked-rush, Knieskern's	*Rhynchospora knieskernii*	T	New Jersey	Monocot
Pink, Swamp	*Helonias bullata*	T	New Jersey	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	New Jersey	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	New Jersey	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	New Jersey	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	New Jersey	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	New Jersey	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	New Jersey	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	New Jersey	Reptile
Frog, Chiricahua Leopard	*Rana chiricahuensis*	T	New Mexico	Amphibian
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	E	New Mexico	Bird

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	E	New Mexico	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	New Mexico	Bird
Plover, Piping	*Charadrius melodus*	E/T	New Mexico	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	New Mexico	Bird
Amphipod, Noel's	*Gammarus desperatus*	E	New Mexico	Crustacean
Isopod, Socorro	*Thermosphaeroma thermophilus*	E	New Mexico	Crustacean
Cactus, Knowlton	*Pediocactus knowltonii*	E	New Mexico	Dicot
Cactus, Kuenzler Hedgehog	*Echinocereus fendleri var. kuenzleri*	E	New Mexico	Dicot
Cactus, Sneed Pincushion	*Coryphantha sneedii var. sneedii*	E	New Mexico	Dicot
Ipomopsis, Holy Ghost	*Ipomopsis sancti-spiritus*	E	New Mexico	Dicot
Milk-vetch, Mancos	*Astragalus humillimus*	E	New Mexico	Dicot
Pennyroyal, Todsen's	*Hedeoma todsenii*	E	New Mexico	Dicot
Poppy, Sacramento Prickly	*Argemone pleiacantha ssp. pinnatisecta*	E	New Mexico	Dicot
Cactus, Lee Pincushion	*Coryphantha sneedii var. leei*	T	New Mexico	Dicot
Cactus, Mesa Verde	*Sclerocactus mesae-verdae*	T	New Mexico	Dicot
Fleabane, Zuni	*Erigeron rhizomatus*	T	New Mexico	Dicot
Sunflower, Pecos	*Helianthus paradoxus*	T	New Mexico	Dicot
Thistle, Sacramento Mountains	*Cirsium vinaceum*	T	New Mexico	Dicot
Wild-buckwheat, Gypsum	*Eriogonum gypsophilum*	T	New Mexico	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Chub, Gila	*Gila intermedia*	E	New Mexico	Fish
Gambusia, Pecos	*Gambusia nobilis*	E	New Mexico	Fish
Minnow, Loach	*Tiaroga cobitis*	E	New Mexico	Fish
Minnow, Rio Grande Silvery	*Hybognathus amarus*	E	New Mexico	Fish
Spikedace	*Meda fulgida*	E	New Mexico	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	New Mexico	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	New Mexico	Fish
Topminnow, Gila (Yaqui)	*Poeciliopsis occidentalis*	E	New Mexico	Fish
Trout, Gila	*Oncorhynchus gilae*	E	New Mexico	Fish
Chub, Chihuahua	*Gila nigrescens*	T	New Mexico	Fish
Shiner, Arkansas River	*Notropis girardi*	T	New Mexico	Fish
Shiner, Beautiful	*Cyprinella formosa*	T	New Mexico	Fish
Shiner, Pecos Bluntnose	*Notropis simus pecosensis*	T	New Mexico	Fish
Snail, Pecos Assiminea	*Assiminea pecos*	E	New Mexico	Gastropod
Springsnail, Alamosa	*Tryonia alamosae*	E	New Mexico	Gastropod
Springsnail, Chupadera	*Pyrgulopsis chupaderae*	E	New Mexico	Gastropod
Springsnail, Koster's	*Juturnia kosteri*	E	New Mexico	Gastropod
Springsnail, Roswell	*Pyrgulopsis roswellensis*	E	New Mexico	Gastropod
Springsnail, Socorro	*Pyrgulopsis neomexicana*	E	New Mexico	Gastropod
Bat, Lesser (=Sanborn's) Long-nosed	*Leptonycteris curasoae yerbabuenae*	E	New Mexico	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Bat, Mexican Long-nosed	*Leptonycteris nivalis*	E	New Mexico	Mammal
Ferret, Black-footed	*Mustela nigripes*	E	New Mexico	Mammal
Gray Wolf	*Canis lupus*	E	New Mexico	Mammal
Jaguar	*Panthera onca*	E	New Mexico	Mammal
Rattlesnake, New Mexican Ridge-nosed	*Crotalus willardi obscurus*	T	New Mexico	Reptile
Plover, Piping	*Charadrius melodus*	E/T	New York	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	New York	Bird
Mussel, Clubshell	*Pleurobema clava*	E	New York	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	New York	Bivalve
Rayed Bean	*Villosa fabalis*	E	New York	Bivalve
Gerardia, Sandplain	*Agalinis acuta*	E	New York	Dicot
Amaranth, Seabeach	*Amaranthus pumilus*	T	New York	Dicot
Goldenrod, Houghton's	*Solidago houghtonii*	T	New York	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	New York	Dicot
Roseroot, Leedy's	*Sedum integrifolium ssp. leedyi*	T	New York	Dicot
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	T	New York	Ferns
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	New York	Fish
Snail, Chittenango Ovate Amber	*Succinea chittenangoensis*	T	New York	Gastropod
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	New York	Insect

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Bat, Indiana	*Myotis sodalis*	E	New York	Mammal
Whale, Blue	*Balaenoptera musculus*	E	New York	Mammal
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	New York	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	New York	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	New York	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	New York	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	New York	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	New York	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	New York	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	New York	Reptile
Spider, Spruce-fir Moss	*Microhexura montivaga*	E	North Carolina	Arachnid
Stork, Wood	*Mycteria americana*	E	North Carolina	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	North Carolina	Bird
Plover, Piping	*Charadrius melodus*	E/T	North Carolina	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	North Carolina	Bird
Elktoe, Appalachian	*Alasmidonta raveneliana*	E	North Carolina	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	North Carolina	Bivalve
Mussel, Heelsplitter Carolina	*Lasmigona decorata*	E	North Carolina	Bivalve
Pearlymussel, Cumberland Bean	*Villosa trabalis*	E	North Carolina	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	North Carolina	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Riffleshell, Tan	*Epioblasma florentina walkeri (=E. walkeri)*	E	North Carolina	Bivalve
Spinymussel, James River	*Pleurobema collina*	E	North Carolina	Bivalve
Spinymussel, Tar River	*Elliptio steinstansana*	E	North Carolina	Bivalve
Avens, Spreading	*Geum radiatum*	E	North Carolina	Dicot
Bittercress, Small-anthered	*Cardamine micranthera*	E	North Carolina	Dicot
Bluet, Roan Mountain	*Hedyotis purpurea var. montana*	E	North Carolina	Dicot
Chaffseed, American	*Schwalbea americana*	E	North Carolina	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	North Carolina	Dicot
Dropwort, Canby's	*Oxypolis canbyi*	E	North Carolina	Dicot
Harperella	*Ptilimnium nodosum*	E	North Carolina	Dicot
Loosestrife, Rough-leaved	*Lysimachia asperulaefolia*	E	North Carolina	Dicot
Meadowrue, Cooley's	*Thalictrum cooleyi*	E	North Carolina	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	North Carolina	Dicot
Pitcher-plant, Mountain Sweet	*Sarracenia rubra ssp. jonesii*	E	North Carolina	Dicot
Pondberry	*Lindera melissifolia*	E	North Carolina	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	North Carolina	Dicot
Sunflower, Schweinitz's	*Helianthus schweinitzii*	E	North Carolina	Dicot
Amaranth, Seabeach	*Amaranthus pumilus*	T	North Carolina	Dicot
Blazing Star, Heller's	*Liatris helleri*	T	North Carolina	Dicot
Goldenrod, Blue Ridge	*Solidago spithamaea*	T	North Carolina	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Heartleaf, Dwarf-flowered	*Hexastylis naniflora*	T	North Carolina	Dicot
Heather, Mountain Golden	*Hudsonia montana*	T	North Carolina	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	North Carolina	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	North Carolina	Dicot
Logperch, Roanoke	*Percina rex*	E	North Carolina	Fish
Shiner, Cape Fear	*Notropis mekistocholas*	E	North Carolina	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	North Carolina	Fish
Chub, Spotfin	*Erimonax monachus*	T	North Carolina	Fish
Silverside, Waccamaw	*Menidia extensa*	T	North Carolina	Fish
Snail, Noonday	*Mesodon clarki nantahala*	T	North Carolina	Gastropod
Butterfly, Saint Francis' Satyr	*Neonympha mitchellii francisci*	E	North Carolina	Insect
Lichen, Rock Gnome	*Gymnoderma lineare*	E	North Carolina	Lichen
Bat, Gray	*Myotis grisescens*	E	North Carolina	Mammal
Bat, Indiana	*Myotis sodalis*	E	North Carolina	Mammal
Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	E	North Carolina	Mammal
Manatee, West Indian	*Trichechus manatus*	E	North Carolina	Mammal
Puma (=Cougar), Eastern	*Puma (=Felis) concolor (all subsp. except coryi)*	E	North Carolina	Mammal
Squirrel, Carolina Northern Flying	*Glaucomys sabrinus coloratus*	E	North Carolina	Mammal
Whale, Blue	*Balaenoptera musculus*	E	North Carolina	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Wolf, Red	*Canis rufus*	E	North Carolina	Mammal
Arrowhead, Bunched	*Sagittaria fasciculata*	E	North Carolina	Monocot
Irisette, White	*Sisyrinchium dichotomum*	E	North Carolina	Monocot
Sedge, Golden	*Carex lutea*	E	North Carolina	Monocot
Pink, Swamp	*Helonias bullata*	T	North Carolina	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	North Carolina	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	North Carolina	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	North Carolina	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	North Carolina	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	North Carolina	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	North Carolina	Reptile
Alligator, American	*Alligator mississippiensis*	T	North Carolina	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	North Carolina	Reptile
Crane, Whooping	*Grus americana*	E	North Dakota	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	North Dakota	Bird
Plover, Piping	*Charadrius melodus*	E/T	North Dakota	Bird
Sturgeon, Pallid	*Scaphirhynchus albus*	E	North Dakota	Fish
Ferret, Black-footed	*Mustela nigripes*	E	North Dakota	Mammal
Gray Wolf	*Canis lupus*	E	North Dakota	Mammal
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	North Dakota	Monocot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Crow, Mariana	*Corvus kubaryi*	E	Northern Mariana Islands	Bird
Megapode, Micronesian (La Perouse's)	*Megapodius laperouse*	E	Northern Mariana Islands	Bird
Moorhen, Mariana Common	*Gallinula chloropus guami*	E	Northern Mariana Islands	Bird
Warbler, nightingale reed (old world warbler)	*Acrocephalus luscinia*	E	Northern Mariana Islands	Bird
White-eye, Rota Bridled	*Zosterops rotensis*	E	Northern Mariana Islands	Bird
Bat, Mariana Fruit (=Mariana Flying Fox)	*Pteropus mariannus mariannus*	T	Northern Mariana Islands	Mammal
Plover, Piping	*Charadrius melodus*	E/T	Ohio	Bird
Fanshell	*Cyprogenia stegaria*	E	Ohio	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Ohio	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Ohio	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Ohio	Bivalve
Pearlymussel, Purple Cat's Paw	*Epioblasma obliquata obliquata*	E	Ohio	Bivalve
Pearlymussel, White Cat's Paw	*Epioblasma obliquata perobliqua*	E	Ohio	Bivalve
Rayed Bean	*Villosa fabalis*	E	Ohio	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Ohio	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Ohio	Bivalve
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Ohio	Dicot
Daisy, Lakeside	*Hymenoxys herbacea*	T	Ohio	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	Ohio	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Ohio	Dicot
Madtom, Scioto	*Noturus trautmani*	E	Ohio	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Beetle, American Burying	*Nicrophorus americanus*	E	Ohio	Insect
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Ohio	Insect
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Ohio	Insect
Bat, Indiana	*Myotis sodalis*	E	Ohio	Mammal
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Ohio	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Ohio	Monocot
Snake, Northern Copperbelly Water	*Nerodia erythrogaster neglecta*	T	Ohio	Reptile
Crane, Whooping	*Grus americana*	E	Oklahoma	Bird
Curlew, Eskimo	*Numenius borealis*	E	Oklahoma	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Oklahoma	Bird
Vireo, Black-capped	*Vireo atricapilla*	E	Oklahoma	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Oklahoma	Bird
Plover, Piping	*Charadrius melodus*	E/T	Oklahoma	Bird
Mussel, Scaleshell	*Leptodea leptodon*	E	Oklahoma	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Oklahoma	Bivalve
Rock-pocketbook, Ouachita (=Wheeler's pm)	*Arkansia wheeleri*	E	Oklahoma	Bivalve
Cavefish, Ozark	*Amblyopsis rosae*	T	Oklahoma	Fish
Darter, Leopard	*Percina pantherina*	T	Oklahoma	Fish
Madtom, Neosho	*Noturus placidus*	T	Oklahoma	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Oklahoma	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Beetle, American Burying	*Nicrophorus americanus*	E	Oklahoma	Insect
Bat, Gray	*Myotis grisescens*	E	Oklahoma	Mammal
Bat, Indiana	*Myotis sodalis*	E	Oklahoma	Mammal
Bat, Ozark Big-eared	*Corynorhinus (=Plecotus) townsendii ingens*	E	Oklahoma	Mammal
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Oklahoma	Monocot
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	Oklahoma	Monocot
Alligator, American	*Alligator mississippiensis*	T	Oklahoma	Reptile
Albatross, Short-tailed	*Phoebastria (=Diomedea) albatrus*	E	Oregon	Bird
Murrelet, Marbled	*Brachyramphus marmoratus*	T	Oregon	Bird
Owl, Northern Spotted	*Strix occidentalis caurina*	T	Oregon	Bird
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	T	Oregon	Bird
Fairy Shrimp, Vernal Pool	*Branchinecta lynchi*	T	Oregon	Crustacean
Daisy, Willamette	*Erigeron decumbens var. decumbens*	E	Oregon	Dicot
Lomatium, Bradshaw's	*Lomatium bradshawii*	E	Oregon	Dicot
Lomatium, Cook's	*Lomatium cookii*	E	Oregon	Dicot
Meadowfoam, Large-flowered Woolly	*Limnanthes floccosa ssp. Grandiflora*	E	Oregon	Dicot
Milk-vetch, Applegate's	*Astragalus applegatei*	E	Oregon	Dicot
Popcornflower, Rough	*Plagiobothrys hirtus*	E	Oregon	Dicot
Rock-cress, McDonald's	*Arabis mcdonaldiana*	E	Oregon	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Catchfly, Spalding's	*Silene spaldingii*	T	Oregon	Dicot
Checker-mallow, Nelson's	*Sidalcea nelsoniana*	T	Oregon	Dicot
Four-o'clock, Macfarlane's	*Mirabilis macfarlanei*	T	Oregon	Dicot
Howellia, Water	*Howellia aquatilis*	T	Oregon	Dicot
Lupine, Kincaid's	*Lupinus sulphureus (=oreganus) ssp. kincaidii (=var. kincaidii)*	T	Oregon	Dicot
Paintbrush, Golden	*Castilleja levisecta*	T	Oregon	Dicot
Thelypody, Howell's Spectacular	*Thelypodium howellii spectabilis*	T	Oregon	Dicot
Chub, Oregon	*Oregonichthys crameri*	E	Oregon	Fish
Salmon, Sockeye	*Oncorhynchus (=Salmo) nerka*	E	Oregon	Fish
Sucker, Lost River	*Deltistes luxatus*	E	Oregon	Fish
Sucker, Modoc	*Catostomus microps*	E	Oregon	Fish
Sucker, Shortnose	*Chasmistes brevirostris*	E	Oregon	Fish
Salmon, Chinook	*Oncorhynchus (=Salmo) tshawytscha*	E/T	Oregon	Fish
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	E/T	Oregon	Fish
Steelhead	*Oncorhynchus (=Salmo) mykiss*	E/T	Oregon	Fish
Chub, Hutton Tui	*Gila bicolor ssp.*	T	Oregon	Fish
Dace, Foskett Speckled	*Rhinichthys osculus ssp.*	T	Oregon	Fish
Salmon, Chum	*Oncorhynchus (=Salmo) keta*	T	Oregon	Fish
Sucker, Warner	*Catostomus warnerensis*	T	Oregon	Fish
Trout, Bull	*Salvelinus confluentus*	T	Oregon	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	Oregon	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Butterfly, Fender's Blue	*Icaricia icarioides fenderi*	E	Oregon	Insect
Butterfly, Oregon Silverspot	*Speyeria zerene hippolyta*	T	Oregon	Insect
Deer, Columbian White-tailed	*Odocoileus virginianus leucurus*	E	Oregon	Mammal
Gray Wolf	*Canis lupus*	E	Oregon	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Oregon	Mammal
Whale, Gray	*Eschrichtius robustus*	E	Oregon	Mammal
Lynx, Canada	*Lynx canadensis*	T	Oregon	Mammal
Fritillary, Gentner's	*Fritillaria gentneri*	E	Oregon	Monocot
Lily, Western	*Lilium occidentale*	E	Oregon	Monocot
Sea turtle, leatherback	*Dermochelys coriacea*	E	Oregon	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Oregon	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Oregon	Reptile
Plover, Piping	*Charadrius melodus*	E/T	Pennsylvania	Bird
Mussel, Clubshell	*Pleurobema clava*	E	Pennsylvania	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Pennsylvania	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Pennsylvania	Bivalve
Rayed Bean	*Villosa fabalis*	E	Pennsylvania	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Pennsylvania	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Pennsylvania	Bivalve
Bat, Indiana	*Myotis sodalis*	E	Pennsylvania	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Pennsylvania	Mammal
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	Pennsylvania	Monocot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Pogonia, Small Whorled	*Isotria medeoloides*	T	Pennsylvania	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Pennsylvania	Reptile
Coqui, Golden	*Eleutherodactylus jasperi*	T	Puerto Rico	Amphibian
Guajon	*Eleutherodactylus cooki*	T	Puerto Rico	Amphibian
Toad, Puerto Rican Crested	*Peltophryne lemur*	T	Puerto Rico	Amphibian
Blackbird, Yellow-shouldered	*Agelaius xanthomus*	E	Puerto Rico	Bird
Hawk, Puerto Rican Broad-winged	*Buteo platypterus brunnescens*	E	Puerto Rico	Bird
Hawk, Puerto Rican Sharp-shinned	*Accipiter striatus venator*	E	Puerto Rico	Bird
Nightjar, Puerto Rico	*Caprimulgus noctitherus*	E	Puerto Rico	Bird
Parrot, Puerto Rican	*Amazona vittata*	E	Puerto Rico	Bird
Pigeon, Puerto Rican Plain	*Columba inornata wetmorei*	E	Puerto Rico	Bird
Plover, Piping	*Charadrius melodus*	E/T	Puerto Rico	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Puerto Rico	Bird
Coral, Elkhorn	*Acropora palmata*	T	Puerto Rico	Coral
Coral, Staghorn	*Acropora cervicornis*	T	Puerto Rico	Coral
Auerodendron pauciflorum (ncn)	*Auerodendron pauciflorum*	E	Puerto Rico	Dicot
Bariaco	*Trichilia triacantha*	E	Puerto Rico	Dicot
Boxwood, Vahl's	*Buxus vahlii*	E	Puerto Rico	Dicot
Calyptranthes Thomasiana (ncn)	*Calyptranthes thomasiana*	E	Puerto Rico	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Capa Rosa	*Callicarpa ampla*	E	Puerto Rico	Dicot
Catesbaea Melanocarpa (ncn)	*Catesbaea melanocarpa*	E	Puerto Rico	Dicot
Chamaecrista glandulosa (ncn)	*Chamaecrista glandulosa var. mirabilis*	E	Puerto Rico	Dicot
Chupacallos	*Pleodendron macranthum*	E	Puerto Rico	Dicot
Cordia bellonis (ncn)	*Cordia bellonis*	E	Puerto Rico	Dicot
Daphnopsis hellerana (ncn)	*Daphnopsis hellerana*	E	Puerto Rico	Dicot
Erubia	*Solanum drymophilum*	E	Puerto Rico	Dicot
Eugenia Woodburyana	*Eugenia woodburyana*	E	Puerto Rico	Dicot
Goetzea, Beautiful (Matabuey)	*Goetzea elegans*	E	Puerto Rico	Dicot
Higuero De Sierra	*Crescentia portoricensis*	E	Puerto Rico	Dicot
Holly, Cook's	*Ilex cookii*	E	Puerto Rico	Dicot
Ilex sintenisii (ncn)	*Ilex sintenisii*	E	Puerto Rico	Dicot
Leptocereus grantianus (ncn)	*Leptocereus grantianus*	E	Puerto Rico	Dicot
Lyonia truncata var. proctorii (ncn)	*Lyonia truncata var. proctorii*	E	Puerto Rico	Dicot
Mitracarpus Maxwelliae	*Mitracarpus maxwelliae*	E	Puerto Rico	Dicot
Mitracarpus Polycladus	*Mitracarpus polycladus*	E	Puerto Rico	Dicot
Myrcia Paganii	*Myrcia paganii*	E	Puerto Rico	Dicot
Palo Colorado (Ternstroemia luquillensis)	*Ternstroemia luquillensis*	E	Puerto Rico	Dicot
Palo de Jazmin	*Styrax portoricensis*	E	Puerto Rico	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Palo de Nigua	*Cornutia obovata*	E	Puerto Rico	Dicot
Palo de Ramon	*Banara vanderbiltii*	E	Puerto Rico	Dicot
Palo de Rosa	*Ottoschulzia rhodoxylon*	E	Puerto Rico	Dicot
Peperomia, Wheeler's	*Peperomia wheeleri*	E	Puerto Rico	Dicot
Prickly-ash, St. Thomas	*Zanthoxylum thomasianum*	E	Puerto Rico	Dicot
Ternstroemia subsessilis (ncn)	*Ternstroemia subsessilis*	E	Puerto Rico	Dicot
Uvillo	*Eugenia haematocarpa*	E	Puerto Rico	Dicot
Vernonia Proctorii (ncn)	*Vernonia proctorii*	E	Puerto Rico	Dicot
Chumbo, Higo	*Harrisia portoricensis*	T	Puerto Rico	Dicot
Cobana Negra	*Stahlia monosperma*	T	Puerto Rico	Dicot
Gesneria pauciflora (ncn)	*Gesneria pauciflora*	T	Puerto Rico	Dicot
Schoepfia arenaria (ncn)	*Schoepfia arenaria*	T	Puerto Rico	Dicot
Fern, Adiantum vivesii	*Adiantum vivesii*	E	Puerto Rico	Ferns
Fern, Elaphoglossum serpens	*Elaphoglossum serpens*	E	Puerto Rico	Ferns
Fern, Thelypteris inabonensis	*Thelypteris inabonensis*	E	Puerto Rico	Ferns
Fern, Thelypteris verecunda	*Thelypteris verecunda*	E	Puerto Rico	Ferns
Fern, Thelypteris yaucoensis	*Thelypteris yaucoensis*	E	Puerto Rico	Ferns
Polystichum calderonense (ncn)	*Polystichum calderonense*	E	Puerto Rico	Ferns
Tectaria Estremerana	*Tectaria estremerana*	E	Puerto Rico	Ferns
Tree Fern, Elfin	*Cyathea dryopteroides*	E	Puerto Rico	Ferns

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Manatee, West Indian	*Trichechus manatus*	E	Puerto Rico	Mammal
Aristida chaseae (ncn)	*Aristida chaseae*	E	Puerto Rico	Monocot
Cranichis Ricartii	*Cranichis ricartii*	E	Puerto Rico	Monocot
Lepanthes eltorensis (ncn)	*Lepanthes eltoroensis*	E	Puerto Rico	Monocot
Pelos del Diablo	*Aristida portoricensis*	E	Puerto Rico	Monocot
Walnut, Nogal	*Juglans jamaicensis*	E	Puerto Rico	Monocot
Manaca, palma de	*Calyptronoma rivalis*	T	Puerto Rico	Monocot
Anole, Culebra Island Giant	*Anolis roosevelti*	E	Puerto Rico	Reptile
Boa, Puerto Rican	*Epicrates inornatus*	E	Puerto Rico	Reptile
Boa, Virgin Islands Tree	*Epicrates monensis granti*	E	Puerto Rico	Reptile
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Puerto Rico	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Puerto Rico	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Puerto Rico	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Puerto Rico	Reptile
Plover, Piping	*Charadrius melodus*	E/T	Rhode Island	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Rhode Island	Bird
Gerardia, Sandplain	*Agalinis acuta*	E	Rhode Island	Dicot
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Rhode Island	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Rhode Island	Insect
Puma (=Cougar), Eastern	*Puma (=Felis) concolor (all subsp. except coryi)*	E	Rhode Island	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Whale, Blue	*Balaenoptera musculus*	E	Rhode Island	Mammal
Pogonia, Small Whorled	*Isotria medeoloides*	T	Rhode Island	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Rhode Island	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Rhode Island	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Rhode Island	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Rhode Island	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Rhode Island	Reptile
Salamander, Frosted Flatwoods	*Ambystoma cingulatum*	T	South Carolina	Amphibian
Stork, Wood	*Mycteria americana*	E	South Carolina	Bird
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	E	South Carolina	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	South Carolina	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	South Carolina	Bird
Plover, Piping	*Charadrius melodus*	E/T	South Carolina	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	South Carolina	Bird
Mussel, Heelsplitter Carolina	*Lasmigona decorata*	E	South Carolina	Bivalve
Chaffseed, American	*Schwalbea americana*	E	South Carolina	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	South Carolina	Dicot
Dropwort, Canby's	*Oxypolis canbyi*	E	South Carolina	Dicot
Harperella	*Ptilimnium nodosum*	E	South Carolina	Dicot
Loosestrife, Rough-leaved	*Lysimachia asperulaefolia*	E	South Carolina	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Pitcher-plant, Mountain Sweet	*Sarracenia rubra ssp. jonesii*	E	South Carolina	Dicot
Pondberry	*Lindera melissifolia*	E	South Carolina	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	South Carolina	Dicot
Sunflower, Schweinitz's	*Helianthus schweinitzii*	E	South Carolina	Dicot
Amaranth, Seabeach	*Amaranthus pumilus*	T	South Carolina	Dicot
Amphianthus, Little	*Amphianthus pusillus*	T	South Carolina	Dicot
Gooseberry, Miccosukee	*Ribes echinellum*	T	South Carolina	Dicot
Heartleaf, Dwarf-flowered	*Hexastylis naniflora*	T	South Carolina	Dicot
Quillwort, Black-spored	*Isoetes melanospora*	E	South Carolina	Ferns
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	South Carolina	Fish
Lichen, Rock Gnome	*Gymnoderma lineare*	E	South Carolina	Lichen
Manatee, West Indian	*Trichechus manatus*	E	South Carolina	Mammal
Whale, Blue	*Balaenoptera musculus*	E	South Carolina	Mammal
Arrowhead, Bunched	*Sagittaria fasciculata*	E	South Carolina	Monocot
Irisette, White	*Sisyrinchium dichotomum*	E	South Carolina	Monocot
Trillium, Persistent	*Trillium persistens*	E	South Carolina	Monocot
Trillium, Relict	*Trillium reliquum*	E	South Carolina	Monocot
Pink, Swamp	*Helonias bullata*	T	South Carolina	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	South Carolina	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	South Carolina	Reptile

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	South Carolina	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	South Carolina	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	South Carolina	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	South Carolina	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	South Carolina	Reptile
Crane, Whooping	*Grus americana*	E	South Dakota	Bird
Curlew, Eskimo	*Numenius borealis*	E	South Dakota	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	South Dakota	Bird
Plover, Piping	*Charadrius melodus*	E/T	South Dakota	Bird
Mussel, Scaleshell	*Leptodea leptodon*	E	South Dakota	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	South Dakota	Bivalve
Shiner, Topeka	*Notropis topeka (=tristis)*	E	South Dakota	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	South Dakota	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	South Dakota	Insect
Gray Wolf	*Canis lupus*	E	South Dakota	Mammal
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	South Dakota	Monocot
Spider, Spruce-fir Moss	*Microhexura montivaga*	E	Tennessee	Arachnid
Stork, Wood	*Mycteria americana*	E	Tennessee	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Tennessee	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Tennessee	Bird

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Combshell, Upland	*Epioblasma metastriata*	E	Tennessee	Bivalve
Elktoe, Appalachian	*Alasmidonta raveneliana*	E	Tennessee	Bivalve
Fanshell	*Cyprogenia stegaria*	E	Tennessee	Bivalve
Kidneyshell, Triangular	*Ptychobranchus greenii*	E	Tennessee	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Tennessee	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Tennessee	Bivalve
Mussel, Coosa Moccasinshell	*Medionidus parvulus*	E	Tennessee	Bivalve
Mussel, Cumberland Combshell	*Epioblasma brevidens*	E	Tennessee	Bivalve
Mussel, Cumberland Elktoe	*Alasmidonta atropurpurea*	E	Tennessee	Bivalve
Mussel, Cumberland Pigtoe	*Pleurobema gibberum*	E	Tennessee	Bivalve
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	E	Tennessee	Bivalve
Mussel, Georgia pigtoe	*Pleurobema hanleyianum*	E	Tennessee	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Tennessee	Bivalve
Mussel, Oyster	*Epioblasma capsaeformis*	E	Tennessee	Bivalve
Mussel, Ring Pink (=Golf Stick Pearly)	*Obovaria retusa*	E	Tennessee	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Tennessee	Bivalve
Mussel, Shiny Pigtoe	*Fusconaia cor*	E	Tennessee	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Tennessee	Bivalve
Mussel, Southern Pigtoe	*Pleurobema georgianum*	E	Tennessee	Bivalve
Pearlymussel, Alabama Lamp	*Lampsilis virescens*	E	Tennessee	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Pearlymussel, Appalachian Monkeyface	*Quadrula sparsa*	E	Tennessee	Bivalve
Pearlymussel, Birdwing	*Lemiox rimosus*	E	Tennessee	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Tennessee	Bivalve
Pearlymussel, Cumberland Bean	*Villosa trabalis*	E	Tennessee	Bivalve
Pearlymussel, Cumberland Monkeyface	*Quadrula intermedia*	E	Tennessee	Bivalve
Pearlymussel, Dromedary	*Dromus dromas*	E	Tennessee	Bivalve
Pearlymussel, Green-blossom	*Epioblasma torulosa gubernaculum*	E	Tennessee	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	Tennessee	Bivalve
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	E	Tennessee	Bivalve
Pearlymussel, Pale Lilliput	*Toxolasma cylindrellus*	E	Tennessee	Bivalve
Pearlymussel, Purple Cat's Paw	*Epioblasma obliquata obliquata*	E	Tennessee	Bivalve
Pearlymussel, Tubercled-blossom	*Epioblasma torulosa torulosa*	E	Tennessee	Bivalve
Pearlymussel, Turgid-blossom	*Epioblasma turgidula*	E	Tennessee	Bivalve
Pearlymussel, White Wartyback	*Plethobasus cicatricosus*	E	Tennessee	Bivalve
Pearlymussel, Yellow-blossom	*Epioblasma florentina florentina*	E	Tennessee	Bivalve
Purple Bean	*Villosa perpurpurea*	E	Tennessee	Bivalve
Rabbitsfoot, Rough	*Quadrula cylindrica strigillata*	E	Tennessee	Bivalve
Riffleshell, Tan	*Epioblasma florentina walkeri (=E. walkeri)*	E	Tennessee	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Tennessee	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Spectaclecase mussel	*Cumberlandia monodonta*	E	Tennessee	Bivalve
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	T	Tennessee	Bivalve
Mussel, Fine-lined Pocketbook	*Lampsilis altilis*	T	Tennessee	Bivalve
Crayfish, Nashville	*Orconectes shoupi*	E	Tennessee	Crustacean
Aster, Ruth's Golden	*Pityopsis ruthii*	E	Tennessee	Dicot
Avens, Spreading	*Geum radiatum*	E	Tennessee	Dicot
Bladderpod, Spring Creek	*Lesquerella perforata*	E	Tennessee	Dicot
Bluet, Roan Mountain	*Hedyotis purpurea var. montana*	E	Tennessee	Dicot
Chaffseed, American	*Schwalbea americana*	E	Tennessee	Dicot
Clover, Leafy Prairie	*Dalea foliosa*	E	Tennessee	Dicot
Ground-plum, Guthrie's	*Astragalus bibullatus*	E	Tennessee	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	Tennessee	Dicot
Rock-cress, Braun's	*Arabis perstellata E. L. Braun var. ampla Rollins*	E	Tennessee	Dicot
Sandwort, Cumberland	*Arenaria cumberlandensis*	E	Tennessee	Dicot
Goldenrod, Blue Ridge	*Solidago spithamaea*	T	Tennessee	Dicot
Potato-bean, Price's	*Apios priceana*	T	Tennessee	Dicot
Rosemary, Cumberland	*Conradina verticillata*	T	Tennessee	Dicot
Skullcap, Large-flowered	*Scutellaria montana*	T	Tennessee	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Tennessee	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	T	Tennessee	Ferns
Chucky Madtom	*Noturus crypticus*	E	Tennessee	Fish
Cumberland darter	*Etheostoma susanae*	E	Tennessee	Fish
Darter, Amber	*Percina antesella*	E	Tennessee	Fish
Darter, Bluemask (=jewel)	*Etheostoma sp.*	E	Tennessee	Fish
Darter, Boulder	*Etheostoma wapiti*	E	Tennessee	Fish
Darter, Duskytail	*Etheostoma percnurum*	E	Tennessee	Fish
Laurel dace	*Chrosomus aylori*	E	Tennessee	Fish
Logperch, Conasauga	*Percina jenkinsi*	E	Tennessee	Fish
Madtom, Pygmy	*Noturus stanauli*	E	Tennessee	Fish
Madtom, Smoky	*Noturus baileyi*	E	Tennessee	Fish
Shiner, Palezone	*Notropis albizonatus*	E	Tennessee	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Tennessee	Fish
Chub, Slender	*Erimystax cahni*	T	Tennessee	Fish
Chub, Spotfin	*Erimonax monachus*	T	Tennessee	Fish
Dace, Blackside	*Phoxinus cumberlandensis*	T	Tennessee	Fish
Darter, Slackwater	*Etheostoma boschungi*	T	Tennessee	Fish
Darter, Snail	*Percina tanasi*	T	Tennessee	Fish
Madtom, Yellowfin	*Noturus flavipinnis*	T	Tennessee	Fish
Shiner, Blue	*Cyprinella caerulea*	T	Tennessee	Fish

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Marstonia, Royal (=Royal Snail)	*Pyrgulopsis ogmorhaphe*	E	Tennessee	Gastropod
Riversnail, Anthony's	*Athearnia anthonyi*	E	Tennessee	Gastropod
Snail, Painted Snake Coiled Forest	*Anguispira picta*	T	Tennessee	Gastropod
Lichen, Rock Gnome	*Gymnoderma lineare*	E	Tennessee	Lichen
Bat, Gray	*Myotis grisescens*	E	Tennessee	Mammal
Bat, Indiana	*Myotis sodalis*	E	Tennessee	Mammal
Squirrel, Carolina Northern Flying	*Glaucomys sabrinus coloratus*	E	Tennessee	Mammal
Grass, Tennessee Yellow-eyed	*Xyris tennesseensis*	E	Tennessee	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Tennessee	Monocot
Salamander, Barton Springs	*Eurycea sosorum*	E	Texas	Amphibian
Salamander, Texas Blind	*Typhlomolge rathbuni*	E	Texas	Amphibian
Toad, Houston	*Bufo houstonensis*	E	Texas	Amphibian
Salamander, San Marcos	*Eurycea nana*	T	Texas	Amphibian
Harvestman, Bee Creek Cave	*Texella reddelli*	E	Texas	Arachnid
Harvestman, Bone Cave	*Texella reyesi*	E	Texas	Arachnid
Harvestman, Cokendolpher Cave	*Texella cokendolpheri*	E	Texas	Arachnid
Meshweaver, Braken Bat Cave	*Cicurina venii*	E	Texas	Arachnid
Meshweaver, Government Canyon Bat Cave	*Cicurina vespera*	E	Texas	Arachnid
Meshweaver, Madla's Cave	*Cicurina madla*	E	Texas	Arachnid
Meshweaver, Robber Baron Cave	*Cicurina baronia*	E	Texas	Arachnid

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Pseudoscorpion, Tooth Cave	*Tartarocreagris texana*	E	Texas	Arachnid
Spider, Government Canyon Bat Cave	*Neoleptoneta microps*	E	Texas	Arachnid
Spider, Tooth Cave	*Leptoneta myopica*	E	Texas	Arachnid
Crane, Mississippi Sandhill	*Grus canadensis pulla*	E	Texas	Bird
Crane, Whooping	*Grus americana*	E	Texas	Bird
Curlew, Eskimo	*Numenius borealis*	E	Texas	Bird
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	E	Texas	Bird
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	E	Texas	Bird
Prairie-chicken, Attwater's Greater	*Tympanuchus cupido attwateri*	E	Texas	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Texas	Bird
Vireo, Black-capped	*Vireo atricapilla*	E	Texas	Bird
Warbler (=Wood), Golden-cheeked	*Dendroica chrysoparia*	E	Texas	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Texas	Bird
Plover, Piping	*Charadrius melodus*	E/T	Texas	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Texas	Bird
Amphipod, Peck's Cave	*Stygobromus (=Stygonectes) pecki*	E	Texas	Crustacean
Ambrosia, South Texas	*Ambrosia cheiranthifolia*	E	Texas	Dicot
Ayenia, Texas	*Ayenia limitaris*	E	Texas	Dicot
Bladderpod, White	*Lesquerella pallida*	E	Texas	Dicot
Bladderpod, Zapata	*Lesquerella thamnophila*	E	Texas	Dicot
Cactus, Black Lace	*Echinocereus reichenbachii var. albertii*	E	Texas	Dicot
Cactus, Nellie Cory	*Coryphantha minima*	E	Texas	Dicot

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Cactus, Sneed Pincushion	*Coryphantha sneedii var. sneedii*	E	Texas	Dicot
Cactus, Star	*Astrophytum asterias*	E	Texas	Dicot
Cactus, Tobusch Fishhook	*Ancistrocactus tobuschii*	E	Texas	Dicot
Cat's-eye, Terlingua Creek	*Cryptantha crassipes*	E	Texas	Dicot
Dawn-flower, Texas Prairie (=Texas Bitterweed)	*Hymenoxys texana*	E	Texas	Dicot
Dogweed, Ashy	*Thymophylla tephroleuca*	E	Texas	Dicot
Frankenia, Johnston's	*Frankenia johnstonii*	E	Texas	Dicot
Manioc, Walker's	*Manihot walkerae*	E	Texas	Dicot
Phlox, Texas Trailing	*Phlox nivalis ssp. texensis*	E	Texas	Dicot
Pitaya, Davis' Green	*Echinocereus viridiflorus var. davisii*	E	Texas	Dicot
Poppy-mallow, Texas	*Callirhoe scabriuscula*	E	Texas	Dicot
Rush-pea, Slender	*Hoffmannseggia tenella*	E	Texas	Dicot
Sand-verbena, Large-fruited	*Abronia macrocarpa*	E	Texas	Dicot
Snowbells, Texas	*Styrax texanus*	E	Texas	Dicot
Cactus, Bunched Cory	*Coryphantha ramillosa*	T	Texas	Dicot
Cactus, Chisos Mountain Hedgehog	*Echinocereus chisoensis var. chisoensis*	T	Texas	Dicot
Cactus, Lloyd's Mariposa	*Echinomastus mariposensis*	T	Texas	Dicot
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	T	Texas	Dicot
Oak, Hinckley	*Quercus hinckleyi*	T	Texas	Dicot
Sunflower, Pecos	*Helianthus paradoxus*	T	Texas	Dicot
Darter, Fountain	*Etheostoma fonticola*	E	Texas	Fish

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Gambusia, Big Bend	*Gambusia gaigei*	E	Texas	Fish
Gambusia, Clear Creek	*Gambusia heterochir*	E	Texas	Fish
Gambusia, Pecos	*Gambusia nobilis*	E	Texas	Fish
Gambusia, San Marcos	*Gambusia georgei*	E	Texas	Fish
Pupfish, Comanche Springs	*Cyprinodon elegans*	E	Texas	Fish
Pupfish, Leon Springs	*Cyprinodon bovinus*	E	Texas	Fish
Minnow, Devils River	*Dionda diaboli*	T	Texas	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Texas	Fish
Snail, Pecos Assiminea	*Assiminea pecos*	E	Texas	Gastropod
Beetle, American Burying	*Nicrophorus americanus*	E	Texas	Insect
Beetle, Coffin Cave Mold	*Batrisodes texanus*	E	Texas	Insect
Beetle, Comal Springs Dryopid	*Stygoparnus comalensis*	E	Texas	Insect
Beetle, Comal Springs Riffle	*Heterelmis comalensis*	E	Texas	Insect
Beetle, Helotes Mold	*Batrisodes venyivi*	E	Texas	Insect
Beetle, Kretschmarr Cave Mold	*Texamaurops reddelli*	E	Texas	Insect
Beetle, Tooth Cave Ground	*Rhadine persephone*	E	Texas	Insect
Rhadine exilis (ncn)	*Rhadine exilis*	E	Texas	Insect
Rhadine infernalis (ncn)	*Rhadine infernalis*	E	Texas	Insect
Bat, Mexican Long-nosed	*Leptonycteris nivalis*	E	Texas	Mammal
Jaguarundi, Gulf Coast	*Herpailurus (=Felis) yagouaroundi cacomitli*	E	Texas	Mammal

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Manatee, West Indian	*Trichechus manatus*	E	Texas	Mammal
Ocelot	*Leopardus (=Felis) pardalis*	E	Texas	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Texas	Mammal
Bear, Louisiana Black	*Ursus americanus luteolus*	T	Texas	Mammal
Ladies'-tresses, Navasota	*Spiranthes parksii*	E	Texas	Monocot
Pondweed, Little Aguja Creek	*Potamogeton clystocarpus*	E	Texas	Monocot
Wild-rice, Texas	*Zizania texana*	E	Texas	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Texas	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Texas	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Texas	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Texas	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Texas	Reptile
Condor, California	*Gymnogyps californianus*	E	Utah	Bird
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	E	Utah	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Utah	Bird
Bearclaw poppy, Dwarf	*Arctomecon humilis*	E	Utah	Dicot
Bladderpod, Kodachrome	*Lesquerella tumulosa*	E	Utah	Dicot
Buttercup, Autumn	*Ranunculus aestivalis (=acriformis)*	E	Utah	Dicot
Cactus, San Rafael	*Pediocactus despainii*	E	Utah	Dicot
Cactus, Wright Fishhook	*Sclerocactus wrightiae*	E	Utah	Dicot

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Milk-vetch, Holmgren	*Astragalus holmgreniorum*	E	Utah	Dicot
Milk-vetch, Shivwits	*Astragalus ampullarioides*	E	Utah	Dicot
Phacelia, Clay	*Phacelia argillacea*	E	Utah	Dicot
Reed-mustard, Barneby	*Schoenocrambe barnebyi*	E	Utah	Dicot
Reed-mustard, Shrubby	*Schoenocrambe suffrutescens*	E	Utah	Dicot
Ridge-cress (=Pepper-cress), Barneby	*Lepidium barnebyanum*	E	Utah	Dicot
Cactus, Colorado hookless	*Sclerocactus glaucus*	T	Utah	Dicot
Cactus, Pariette	*Sclerocactus brevispinus*	T	Utah	Dicot
Cactus, Siler Pincushion	*Pediocactus (=Echinocactus,=Utahia) sileri*	T	Utah	Dicot
Cactus, Uinta Basin hookless	*Sclerocactus wetlandicus*	T	Utah	Dicot
Cactus, Winkler	*Pediocactus winkleri*	T	Utah	Dicot
Cycladenia, Jones	*Cycladenia jonesii (=humilis)*	T	Utah	Dicot
Milk-vetch, Deseret	*Astragalus desereticus*	T	Utah	Dicot
Milk-vetch, Heliotrope	*Astragalus montii*	T	Utah	Dicot
Milkweed, Welsh's	*Asclepias welshii*	T	Utah	Dicot
Primrose, Maguire	*Primula maguirei*	T	Utah	Dicot
Reed-mustard, Clay	*Schoenocrambe argillacea*	T	Utah	Dicot
Townsendia, Last Chance	*Townsendia aprica*	T	Utah	Dicot
Chub, Bonytail	*Gila elegans*	E	Utah	Fish
Chub, Humpback	*Gila cypha*	E	Utah	Fish
Chub, Virgin River	*Gila seminuda (=robusta)*	E	Utah	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Utah	Fish

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Sucker, June	*Chasmistes liorus*	E	Utah	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Utah	Fish
Woundfin	*Plagopterus argentissimus*	E	Utah	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	Utah	Fish
Ambersnail, Kanab	*Oxyloma haydeni kanabensis*	E	Utah	Gastropod
Ferret, Black-footed	*Mustela nigripes*	E	Utah	Mammal
Gray Wolf	*Canis lupus*	E	Utah	Mammal
Lynx, Canada	*Lynx canadensis*	T	Utah	Mammal
Prairie Dog, Utah	*Cynomys parvidens*	T	Utah	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Utah	Monocot
Sedge, Navajo	*Carex specuicola*	T	Utah	Monocot
Tortoise, Desert	*Gopherus agassizii*	T	Utah	Reptile
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Vermont	Bivalve
Milk-vetch, Jesup's	*Astragalus robbinsii var. jesupi*	E	Vermont	Dicot
Bat, Indiana	*Myotis sodalis*	E	Vermont	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Vermont	Mammal
Lynx, Canada	*Lynx canadensis*	T	Vermont	Mammal
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	Vermont	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Vermont	Monocot
Coral, Elkhorn	*Acropora palmata*	T	Virgin Islands	Coral
Coral, Staghorn	*Acropora cervicornis*	T	Virgin Islands	Coral
Boxwood, Vahl's	*Buxus vahlii*	E	Virgin Islands	Dicot
Catesbaea Melanocarpa (ncn)	*Catesbaea melanocarpa*	E	Virgin Islands	Dicot
Lizard, St. Croix Ground	*Ameiva polops*	E	Virgin Islands	Reptile

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Salamander, Shenandoah	*Plethodon shenandoah*	E	Virginia	Amphibian
Spider, Spruce-fir Moss	*Microhexura montivaga*	E	Virginia	Arachnid
Woodpecker, Red-cockaded	*Picoides borealis*	E	Virginia	Bird
Plover, Piping	*Charadrius melodus*	E/T	Virginia	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Virginia	Bird
Fanshell	*Cyprogenia stegaria*	E	Virginia	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	Virginia	Bivalve
Mussel, Cumberland Combshell	*Epioblasma brevidens*	E	Virginia	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Virginia	Bivalve
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	E	Virginia	Bivalve
Mussel, Oyster	*Epioblasma capsaeformis*	E	Virginia	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Virginia	Bivalve
Mussel, Shiny Pigtoe	*Fusconaia cor*	E	Virginia	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Virginia	Bivalve
Pearlymussel, Appalachian Monkeyface	*Quadrula sparsa*	E	Virginia	Bivalve
Pearlymussel, Birdwing	*Lemiox rimosus*	E	Virginia	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Virginia	Bivalve
Pearlymussel, Cumberland Bean	*Villosa trabalis*	E	Virginia	Bivalve
Pearlymussel, Cumberland Monkeyface	*Quadrula intermedia*	E	Virginia	Bivalve
Pearlymussel, Dromedary	*Dromus dromas*	E	Virginia	Bivalve

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Pearlymussel, Green-blossom	*Epioblasma torulosa gubernaculum*	E	Virginia	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	Virginia	Bivalve
Purple Bean	*Villosa perpurpurea*	E	Virginia	Bivalve
Rabbitsfoot, Rough	*Quadrula cylindrica strigillata*	E	Virginia	Bivalve
Rayed Bean	*Villosa fabalis*	E	Virginia	Bivalve
Riffleshell, Tan	*Epioblasma florentina walkeri (=E. walkeri)*	E	Virginia	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Virginia	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Virginia	Bivalve
Spinymussel, James River	*Pleurobema collina*	E	Virginia	Bivalve
Isopod, Lee County Cave	*Lirceus usdagalun*	E	Virginia	Crustacean
Isopod, Madison Cave	*Antrolana lira*	T	Virginia	Crustacean
Bittercress, Small-anthered	*Cardamine micranthera*	E	Virginia	Dicot
Chaffseed, American	*Schwalbea americana*	E	Virginia	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	Virginia	Dicot
Harperella	*Ptilimnium nodosum*	E	Virginia	Dicot
Mallow, Peter's Mountain	*Iliamna corei*	E	Virginia	Dicot
Rock-cress, Shale Barren	*Arabis serotina*	E	Virginia	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	Virginia	Dicot
Sunflower, Schweinitz's	*Helianthus schweinitzii*	E	Virginia	Dicot
Amaranth, Seabeach	*Amaranthus pumilus*	T	Virginia	Dicot
Birch, Virginia Round-leaf	*Betula uber*	T	Virginia	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	Virginia	Dicot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Sneezeweed, Virginia	*Helenium virginicum*	T	Virginia	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Virginia	Dicot
Darter, Duskytail	*Etheostoma percnurum*	E	Virginia	Fish
Logperch, Conasauga	*Percina jenkinsi*	E	Virginia	Fish
Logperch, Roanoke	*Percina rex*	E	Virginia	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Virginia	Fish
Chub, Slender	*Erimystax cahni*	T	Virginia	Fish
Chub, Spotfin	*Erimonax monachus*	T	Virginia	Fish
Dace, Blackside	*Phoxinus cumberlandensis*	T	Virginia	Fish
Madtom, Yellowfin	*Noturus flavipinnis*	T	Virginia	Fish
Snail, Virginia Fringed Mountain	*Polygyriscus virginianus*	E	Virginia	Gastropod
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Virginia	Insect
Beetle, Northeastern Beach Tiger	*Cicindela dorsalis dorsalis*	T	Virginia	Insect
Bat, Gray	*Myotis grisescens*	E	Virginia	Mammal
Bat, Indiana	*Myotis sodalis*	E	Virginia	Mammal
Bat, Ozark Big-eared	*Corynorhinus (=Plecotus) townsendii ingens*	E	Virginia	Mammal
Squirrel, Carolina Northern Flying	*Glaucomys sabrinus coloratus*	E	Virginia	Mammal
Squirrel, Delmarva Peninsula Fox	*Sciurus niger cinereus*	E	Virginia	Mammal
Squirrel, Virginia Northern Flying	*Glaucomys sabrinus fuscus*	E	Virginia	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Virginia	Mammal
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	Virginia	Monocot
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Virginia	Monocot

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Pink, Swamp	*Helonias bullata*	T	Virginia	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Virginia	Monocot
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Virginia	Reptile
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	E	Virginia	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Virginia	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Virginia	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Virginia	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	Virginia	Reptile
Albatross, Short-tailed	*Phoebastria (=Diomedea) albatrus*	E	Washington	Bird
Murrelet, Marbled	*Brachyramphus marmoratus*	T	Washington	Bird
Owl, Northern Spotted	*Strix occidentalis caurina*	T	Washington	Bird
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	T	Washington	Bird
Checker-mallow, Wenatchee Mountains	*Sidalcea oregana var. calva*	E	Washington	Dicot
Lomatium, Bradshaw's	*Lomatium bradshawii*	E	Washington	Dicot
Sandwort, Marsh	*Arenaria paludicola*	E	Washington	Dicot
Stickseed, Showy	*Hackelia venusta*	E	Washington	Dicot
Catchfly, Spalding's	*Silene spaldingii*	T	Washington	Dicot
Checker-mallow, Nelson's	*Sidalcea nelsoniana*	T	Washington	Dicot
Howellia, Water	*Howellia aquatilis*	T	Washington	Dicot

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Lupine, Kincaid's	*Lupinus sulphureus (=oreganus) ssp. kincaidii (=var. kincaidii)*	T	Washington	Dicot
Paintbrush, Golden	*Castilleja levisecta*	T	Washington	Dicot
Rockfish, Bocaccio	*Sebastes paucispinis*	E	Washington	Fish
Salmon, Sockeye	*Oncorhynchus (=Salmo) nerka*	E	Washington	Fish
Salmon, Chinook	*Oncorhynchus (=Salmo) tshawytscha*	E/T	Washington	Fish
Steelhead	*Oncorhynchus (=Salmo) mykiss*	E/T	Washington	Fish
Trout, Apache	*Oncorhynchus apache*	T	Washington	Fish
Trout, Bull	*Salvelinus confluentus*	T	Washington	Fish
Butterfly, Oregon Silverspot	*Speyeria zerene hippolyta*	T	Washington	Insect
Caribou, Woodland	*Rangifer tarandus caribou*	E	Washington	Mammal
Deer, Columbian White-tailed	*Odocoileus virginianus leucurus*	E	Washington	Mammal
Gray Wolf	*Canis lupus*	E	Washington	Mammal
Killer whale, Southern Resident DPS	*Orcinus orca*	E	Washington	Mammal
Rabbit, Pygmy	*Brachylagus idahoensis*	E	Washington	Mammal
Whale, Blue	*Balaenoptera musculus*	E	Washington	Mammal
Whale, Gray	*Eschrichtius robustus*	E	Washington	Mammal
Bear, Grizzly	*Ursus arctos horribilis*	T	Washington	Mammal
Lynx, Canada	*Lynx canadensis*	T	Washington	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Washington	Monocot
Sea turtle, leatherback	*Dermochelys coriacea*	E	Washington	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Washington	Reptile
Salamander, Cheat Mountain	*Plethodon nettingi*	T	West Virginia	Amphibian
Fanshell	*Cyprogenia stegaria*	E	West Virginia	Bivalve
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	E	West Virginia	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	West Virginia	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	West Virginia	Bivalve
Pearlymussel, Tubercled-blossom	*Epioblasma torulosa torulosa*	E	West Virginia	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	West Virginia	Bivalve
Spinymussel, James River	*Pleurobema collina*	E	West Virginia	Bivalve
Isopod, Madison Cave	*Antrolana lira*	T	West Virginia	Crustacean
Clover, Running Buffalo	*Trifolium stoloniferum*	E	West Virginia	Dicot
Harperella	*Ptilimnium nodosum*	E	West Virginia	Dicot
Rock-cress, Shale Barren	*Arabis serotina*	E	West Virginia	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	West Virginia	Dicot
Snail, Flat-spired Three-toothed	*Triodopsis platysayoides*	T	West Virginia	Gastropod
Bat, Indiana	*Myotis sodalis*	E	West Virginia	Mammal
Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	E	West Virginia	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Puma (=Cougar), Eastern	*Puma (=Felis) concolor (all subsp. except coryi)*	E	West Virginia	Mammal
Squirrel, Virginia Northern Flying	*Glaucomys sabrinus fuscus*	E	West Virginia	Mammal
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	E	West Virginia	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	West Virginia	Monocot
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	E	Wisconsin	Bird
Plover, Piping	*Charadrius melodus*	E/T	Wisconsin	Bird
Mussel, snuffbox	*Epioblasma triquetra*	E	Wisconsin	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Wisconsin	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Wisconsin	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Wisconsin	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Wisconsin	Bivalve
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Wisconsin	Dicot
Locoweed, Fassett's	*Oxytropis campestris var. chartacea*	T	Wisconsin	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Wisconsin	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	Wisconsin	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Wisconsin	Dicot
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Wisconsin	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Wisconsin	Insect
Gray Wolf	*Canis lupus*	E	Wisconsin	Mammal

INVNAME	*SCINAME*	Status	STATE NAME	Taxon
Lynx, Canada	*Lynx canadensis*	T	Wisconsin	Mammal
Iris, Dwarf Lake	*Iris lacustris*	T	Wisconsin	Monocot
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	T	Wisconsin	Monocot
Toad, Wyoming	*Bufo baxteri (=hemiophrys)*	E	Wyoming	Amphibian
Crane, Whooping	*Grus americana*	E	Wyoming	Bird
Tern, Interior (population) Least	*Sterna antillarum*	E	Wyoming	Bird
Plover, Piping	*Charadrius melodus*	E/T	Wyoming	Bird
Penstemon, Blowout	*Penstemon haydenii*	E	Wyoming	Dicot
Butterfly Plant, Colorado	*Gaura neomexicana var. coloradensis*	T	Wyoming	Dicot
Yellowhead, Desert	*Yermo xanthocephalus*	T	Wyoming	Dicot
Chub, Bonytail	*Gila elegans*	E	Wyoming	Fish
Chub, Humpback	*Gila cypha*	E	Wyoming	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Wyoming	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Wyoming	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Wyoming	Fish
Ferret, Black-footed	*Mustela nigripes*	E	Wyoming	Mammal
Lynx, Canada	*Lynx canadensis*	T	Wyoming	Mammal
Mouse, Preble's Meadow Jumping	*Zapus hudsonius preblei*	T	Wyoming	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wyoming	Monocot
Orchid, Western Prairie Fringed	*Platanthera praeclara*	T	Wyoming	Monocot