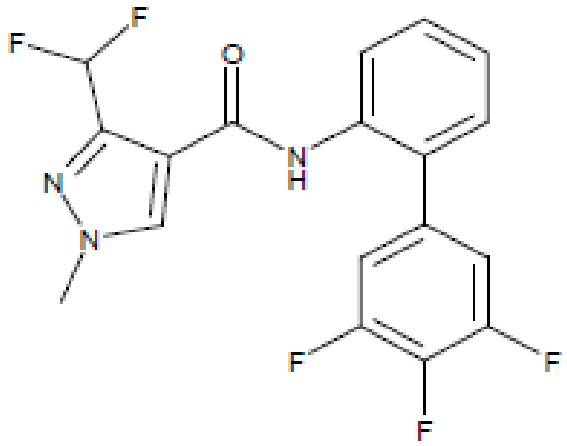
Environmental Fate and Ecological Risk Assessment for Proposed Foliar and Seed Treatment Uses of the Fungicide Fluxapyroxad (BAS 700F)



Fluxapyroxad
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1. Executive Summary

Fluxapyroxad, a second generation pyridine carboxamide fungicide, is an active ingredient currently registered for a number of pesticide products (see **Appendix A**) used as both a foliar and seed treatment on a range of agricultural crops. Fluxapyroxad has a moderate potential to reach aquatic environments for several months or more following foliar applications and seed treatments. The available fate data indicate that fluxapyroxad is likely to dissipate to some extent through various mechanisms, including runoff and erosion. Because fluxapyroxad degrades slowly in soil and aquatic systems (*e.g.*, half-lives greater than 1 year), the compound may persist in soil, in water, and in benthic sediment, once transported or partitioned to these environmental compartments. Fluxapyroxad is stable to some plant metabolism processes and has demonstrated at least limited systemic activity, based on plant residue studies submitted by the registrant.

Fluxapyroxad is moderately to very highly toxic to fish and moderately toxic to aquatic invertebrates, but is practically non-toxic to mammals, birds, and young adult honey bees following acute exposure. Chronic effects on reproduction and especially growth have been observed in both terrestrial and aquatic organisms exposed to fluxapyroxad, and toxic effects have been noted in aquatic and terrestrial plants. Ecotoxicity data gaps exist with respect to potential chronic effects on estuarine/marine organisms. The available avian toxicity data suggest that light conditions may influence the relative sensitivity of some bird species to fluxapyroxad, as does-response mortality was observed in studies with the bobwhite quail at normal light conditions (139 – 299 lux), but not lower light conditions (12 – 21 lux). Finally, two of the current formulated products (Merivon® [Reg. No. 7969-310] and Priaxor® [Reg. No. 7969-311]) proposed for new uses and two of the new use products (Lexicon [BAS 7969-GLN] and Xemium 703 [Reg. No. 7969-GLE]) proposed for registration are co-formulated with the fungicide pyraclostrobin and are similar in that respect to the registered fungicide product, Pristine® (25.2% boscalid and 12.8% pyraclostrobin). The registrant has conducted additional honey bee (*Apis mellifera*) larval toxicity tests with the fungicides boscalid and pyraclostrobin to address concerns that Pristine® may affect honey bee larval/pupal (brood) and queen cell development and these studies have not demonstrated any significant effect on queen development (DP Barcode 408124). A recently submitted semi-field study (bee brood tunnel test) was also conducted using the product Merivon® [Reg. No. 7969-310]. While a slight transient effect which was not statistically significant was noted on foraging activity of adult bees, no significant effects on bee brood development or viability were reported.

Based on estimated environmental concentrations (EECs) and the available ecotoxicity data, the proposed uses of fluxapyroxad may result in chronic risk to mammals, including mammals that consume treated seed. Exposure and risk to mammals from consumption of treated seeds may be reduced if seeds are incorporated at plant. Chronic risk to birds (and by extension to reptiles, and terrestrial-phase amphibians for which birds serve as surrogates) cannot be precluded because a statistically significant effect on growth, abeit slight, was observed at all treatment levels in an avian reproduction study. Risk quotient (RQ) values for foliar applications, estimated using the nondefintive endpoint (100 mg a.i./kg diet), exceed the chronic risk level of concern (LOC) for applications to berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries, and grapes (*Botrytis* disease) for short grass. RQs exceed the chronic risk LOC for

all seed treatment uses. Additional avian reproduction data have not been requested because the effect was not dose-responsive (100 – 1000 mg/kg diet), and it was unlikely that an additional study would establish a no observed adverse effects concentration (NOAEC) that would allow risk to be precluded at the screening level (NOAEC≥80 mg a.i./kg diet) for the proposed uses.

Based on estimated environmental concentrations (EECs) and the available ecotoxicity data, the likelihood of acute mortality to mammals, birds, reptiles and terrestrial-phase amphibians is considered low.

Fluxapyroxad exposure at the labeled treatment rates may also result in risk to federally-listed threatened and endangered (hereafter referred to as "listed") species of dicotyledonous (dicot) terrestrial and semi-aquatic plants. Risk to listed dicot plants exceeds the Agency's LOC for all foliar uses and for proposed seed treatment application rates above 0.05 lbs a.i./A (*e.g.*, bulb vegetables, leafy vegetables, and rice). For seed treatment uses, seed incorporation may reduce the likelihood of runoff and therefore reduce the potential for exposure and risk to listed dicot plants. The potential for adverse effects on monocotyledonous (monocot) plants and on nonlisted dicot plants is considered low.

Despite the absence of chronic ecotoxicity data for estuarine/marine organisms, a comparison of the available aquatic toxicity data with the relatively low EECs of fluxapyroxad in surface water demonstrates a low likelihood that the proposed uses will result in chronic risk to aquatic organisms. Similarly, the fluxapyroxad technical grade active ingredient (TGAI) does not pose an acute risk to either freshwater or estuarine/marine fish or aquatic invertebrates. However, potential spray drift of fluxapyroxad co-formulated with pyraclostrobin does result in a risk of acute mortality to fish and aquatic invertebrates. The increased toxicity of (and therefore risk from) the coformulated active ingredients for these taxa, when compared to fluxapyroxad TGAI and single a.i. formulations, is consistent with the toxicity profile for pyraclostrobin, which is evaluated in a separate risk assessment. The likelihood of adverse effects to aquatic sediment-dwelling (benthic) invertebrates and aquatic plants is considered low, as RQ values do not approach or exceed the Agency's LOC.

The proposed uses of fluxapyroxad co-occur with 2,231 unique listed species. The potential for direct and indirect effects to listed species as a result of the proposed uses of fluxapyroxad is summarized in **Table 1.1**. Although the total number (2,231) of co-occurring listed species includes both aquatic and terrestrial invertebrates, this screening-level assessment does not evaluate risk to terrestrial invertebrates.

Table 1.1. Potential effects to federally listed taxa associated with the proposed uses of fluxapyroxad.

Listed Taxon	Direct Effects		Indirect Effects from Risk to Other Taxa	
	Yes/No	Acute/Chronic	Yes/No	Through ...
Terrestrial and semi-aquatic plants – monocots and dicots	Yes (dicots only)	NA	Yes	Chronic effects on birds, terrestrial-phase amphibians, and mammals, when required for pollination or seed dispersal.
Birds	Yes	Chronic	Yes	Chronic effects on mammals that serve as prey; chronic effects on reptiles and amphibians that serve as prey.

Listed Taxon	Direct Effects		Indirect Effects from Risk to Other Taxa	
	Yes/No	Acute/Chronic	Yes/No	Through ...
Terrestrial-phase amphibians	Yes	Chronic	Yes	Chronic effects on mammals which provide habitat (*e.g.*, burrows) and serve as prey.
Reptiles	Yes	Chronic	Yes	Chronic effects on mammals that serve as prey; chronic effects on birds, reptiles, and amphibians that serve as prey.
Mammals	Yes	Chronic	Yes	Chronic effects on birds, reptiles, and amphibians that serve as prey; chronic effects on mammals that serve as prey.
Aquatic plants	No	NA	Yes	Effects on semi-aquatic dicot plants that serve as primary producers.
Freshwater fish	Yes	Acute (dual a.i. EPs only)	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Aquatic-phase amphibians	Yes	Acute (dual a.i. EPs only)	Yes	Chronic effects on terrestrial-phase amphibians; effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Freshwater invertebrates	Yes	Acute (dual a.i. EPs only)	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Molluscs	No	NA	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Marine/estuarine fish	Yes	Acute (dual a.i. EPs only)	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Marine/estuarine invertebrates	Yes	Acute (dual a.i. EPs only)	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.

[EP] End-use product. [NA] Not applicable.

2. Problem Formulation

2.1. Nature of Chemical Stressor

Fluxapyroxad (3-(difluoromethyl)-1-methyl-N-(3',4',5'-trifluoro[1,1'-biphenyl]-2-yl)-1H-pyrazole-4-carboxamide) was registered for use as as a fungicide in 2012. The chemical's mode of action in fungi is the inhibition of the enzyme succinate dehydrogenase, also known as complex II, in the mitochondrial electron transport chain (MRID 47923771).

2.2. Stressor Source and Distribution

Fluxapyroxad is an emulsifiable (EC) or suspension concentrate (SC) fungicide associated with six currently registered and three proposed end-use products (see **Appendix A**). Fluxapyroxad is being proposed for use on berries and small fruits, leafy vegetables, bulb vegetables, cucurbits,

grapes, rice, root vegetables, sorghum and millet, strawberries, sugarcane, and tree nuts. It is also being proposed for use on residential and commercial turf, golf courses, and sod farms.

The chemical is being proposed as a seed treatment for use on bulb vegetable, brassica, cucurbit, leafy vegetable, rapeseed, rice, and root vegetable seeds. For the current and proposed seed treatment products (Xemium® 2.78 [Reg No. 7969-307], Xemium® 2.72 [Reg No. 7969-308], and Xemium® 703 [Reg. No. 7969-GLE]), fluxapyroxad will be applied to seeds as a water-based slurry or mist. The seed treatment labels do not indicate how treated seeds will be planted or applied to the field. The proposed foliar application labels indicate that the best coverage of crops would be accomplished by ground application; however, aerial application and applications through sprinkler irrigation equipment are also proposed.

Two of the current products (Merivon® [Reg. No. 7969-310] and Priaxor® [Reg. No. 7969-311]) and two of the new use products (Lexicon® [BAS 7969-GLN] and Xemium® 703 [Reg. No. 7969-GLE]) also contain the active ingredient pyraclostrobin, which is being proposed at application rates equivalent to or higher than those of fluxapyroxad. This evaluation is limited to the exposure associated with fluxapyroxad specifically and not pyraclostrobin; however, risk based on exposure to the formulated product(s) is assessed, where data are sufficient to permit analysis, based on the content of fluxpyroxad in the relevant formulations. One major degradate was identified in the aerobic and anaerobic metabolism studies, M700F001 [3-(difluoro-methyl)-1-methyl-1H-pyrazole-4-carboxylic acid]. Based on discussions with the Health Effects Division's Residues of Concern Knowledgebase Subcommittee (ROCKS), only the parent compound is considered a residue of concern (D390225, 7/14/2011). The ecological risk assessment only evaluates exposure and risk to the parent compound, fluxapyroxad, as exposure to the parent below the levels of concern should be protective of any exposure to the degradates.

2.3. Receptors

The receptor is the biological entity that is exposed to the stressor (USEPA 1998). For this assessment, the receptor includes aquatic animals and terrestrial animals inhabiting fields where fluxapyroxad foliar applications occur or treated seeds are planted, and non-target areas to where fluxapyroxad is transported (via spray drift and runoff). Consistent with the process described in the Overview Document (USEPA 2004a), the risk assessment uses a surrogate species approach in its evaluation of fluxapyroxad. Toxicological data generated from surrogate test species, which are intended to be representative of broad taxonomic groups, are used to extrapolate to potential effects on a variety of species (receptors) included under these taxonomic groupings.

2.4. Assessment Endpoints

Assessment endpoints represent the actual environmental value that is to be protected, defined by an ecological entity (species, community, or other entity) and its attributes (EPA 1998). For fluxapyroxad, the ecological entities include terrestrial and aquatic plants and animals. The attributes evaluated for each of these entities include growth, reproduction, and survival.

2.5. Conceptual Model

For a pesticide to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations or doses. An exposure pathway is the means by which a pesticide moves in the environment from a source to an ecological receptor. For an ecological exposure pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure.

A conceptual model provides a written description and visual representation of the predicted relationships between fluxapyroxad, the potential routes of exposure, and the predicted effects for each assessment endpoint. A conceptual model consists of two major components: a risk hypothesis and a conceptual diagram (EPA 1998).

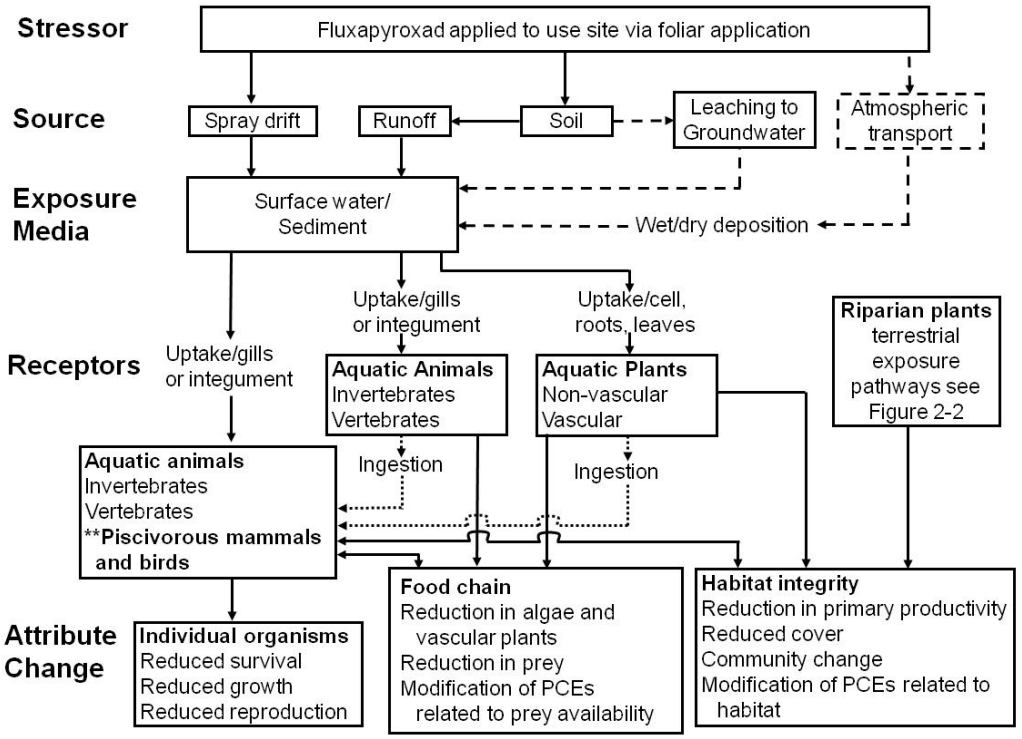
2.5.1. Risk Hypothesis

For fluxapyroxad, the following ecological risk hypothesis is employed for this risk assessment:

> *Fluxapyroxad has slight to moderate mobility in soil; it can move to surface water through spray drift, runoff, and erosion. Therefore, fluxapyroxad may produce adverse effects on survival, growth, and/or reproduction of aquatic animals. There is also the potential for risk to benthic invertebrates, given fluxapyroxad's persistence in water and sediment. Based on the compound's persistence, fluxapyroxad may pose a chronic risk to small birds, terrestrial-phase amphibians and reptiles and mammals. Based on previous assessments for fluxapyroxad, there is potential risk to terrestrial and semi-aquatic plants. Based on concerns raised regarding the potential effects of similar fungicide formulations to honey bees (Apis mellifera), there is uncertainty surrounding the potential effects of fluxapyroxad products, including those co-formulated with pyraclostrobin.*

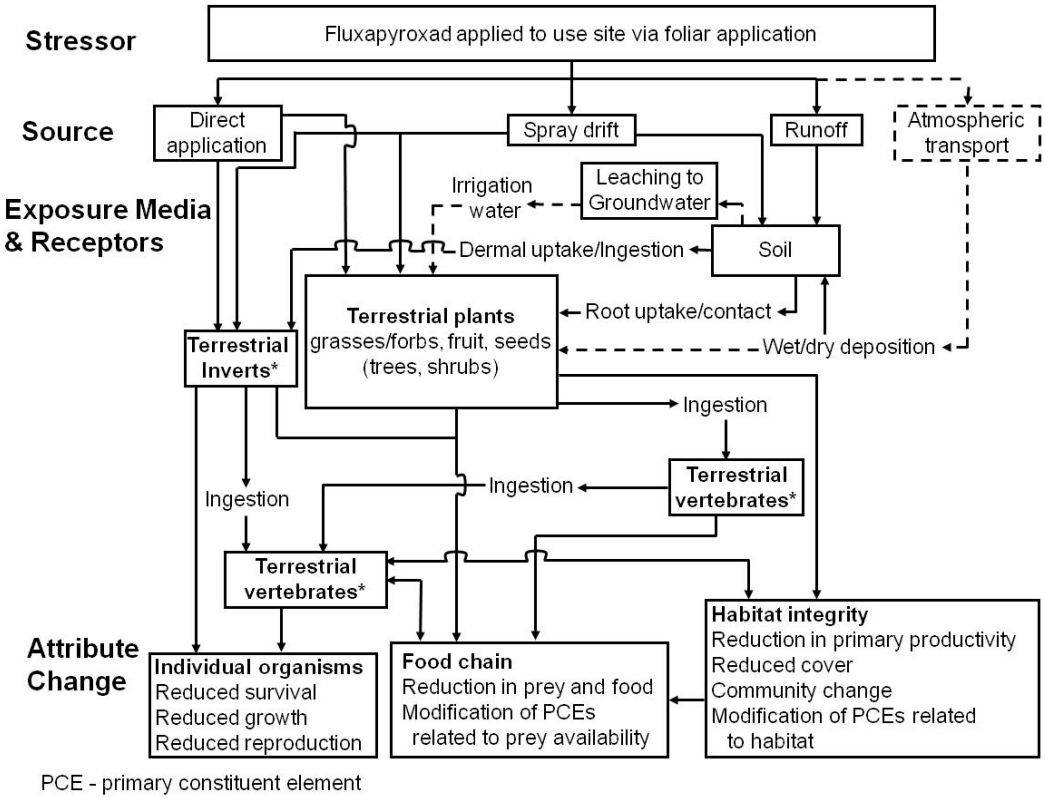
2.5.2. Conceptual Diagram

The environmental fate properties of fluxapyroxad indicate that for foliar applications, spray drift and runoff are potential transport mechanisms of fluxapyroxad to aquatic habitats where non-target organisms may be exposed. Non-target terrestrial organisms can be exposed to foliar applications of fluxapyroxad through consumption of exposed plants and invertebrates. With regards to the seed treatments, fluxapyroxad may reach aquatic habitats via leaching of the chemical from the seed coat into field runoff. Non-target terrestrial organisms can be exposed to fluxapyroxad through consumption of treated seeds. These transport mechanisms (*i.e.*, sources) are depicted in the conceptual models below (**Figures 2-1** and **2-2** are for terrestrial and aquatic exposure to foliar applications and **Figures 2-3** and **2-4** are for terrestrial and aquatic exposure to seed treatments) along with the receptors of concern and the potential attribute changes in the receptors due to exposures of fluxapyroxad. Dotted lines represent transport pathways that are assumed to have a low likelihood of occurring and/or of contributing to ecological risk.



** Route of exposure includes only ingestion of fish and aquatic invertebrates
PCE - primary constituent element

Figure 2-1. Conceptual model for potential fluxapyroxad foliar treatment effects on aquatic organisms.



PCE - primary constituent element

Figure 2-2. Conceptual model for potential fluxapyroxad foliar treatment effects on terrestrial organisms.

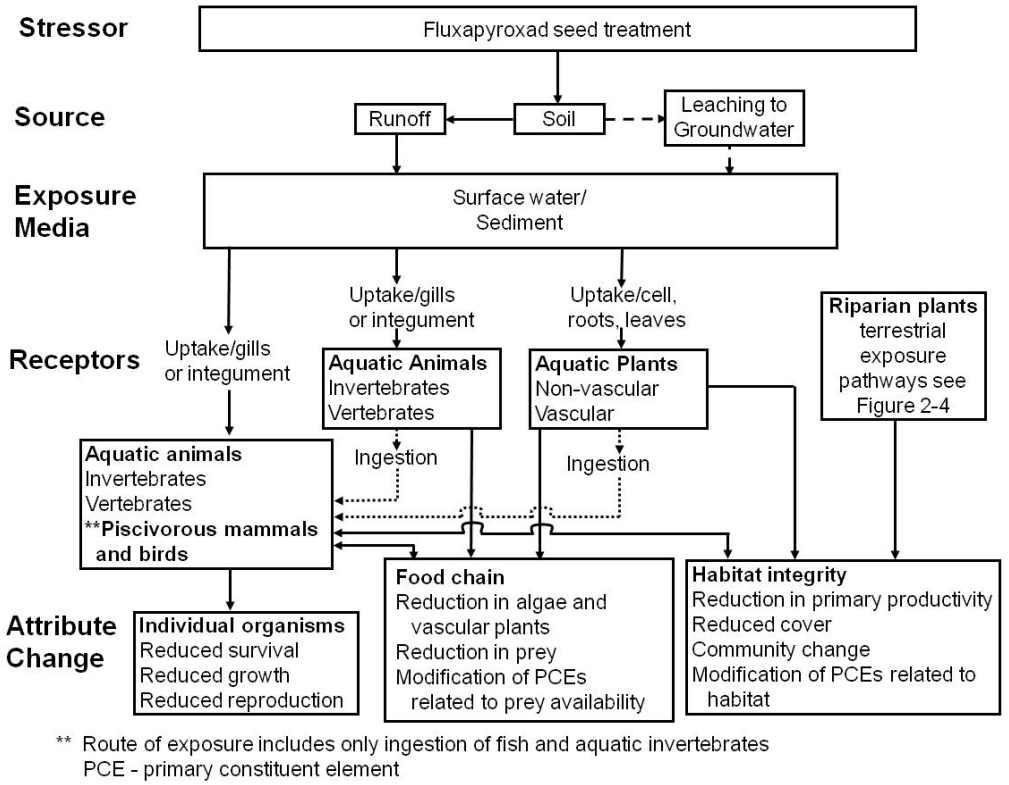


Figure 2-3. Conceptual model for potential fluxapyroxad seed treatment effects on aquatic organisms.

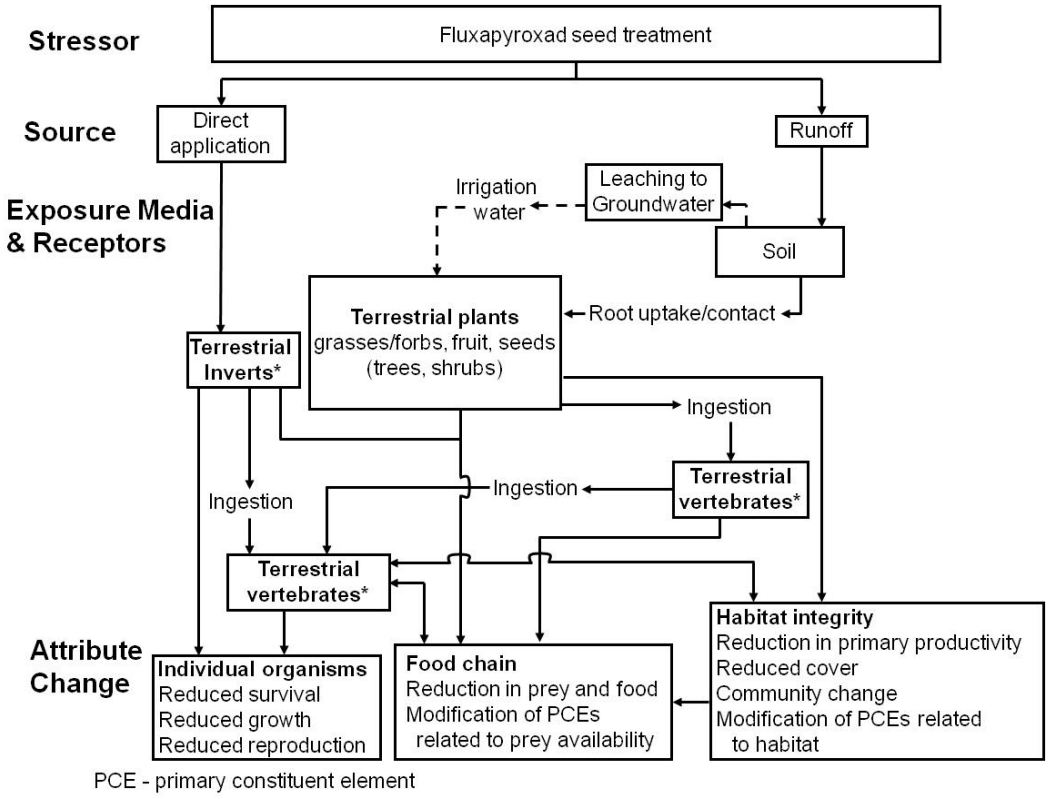


Figure 2-4. Conceptual model for potential fluxapyroxad seed treatment effects on terrestrial organisms.

2.6. Analysis Plan

The analysis plan is the final step in Problem Formulation. During this step, an assessment design is developed, the scope of the assessment is outlined, the methods for conducting the assessment are determined, measurements of effects and exposure to evaluate the risk hypothesis are delineated, and initial data gaps and assumptions required to address them are identified.

2.6.1. Conclusions from Previous Risk Assessments

Fluxapyroxad was first registered for use in the United States in 2012. An ecological risk assessment conducted in 2012 (DP Barcode 376883, March 2012) found that, based on EECs and the available ecotoxicity data, the proposed uses of fluxapyroxad resulted in chronic risk to mammals, including mammals that consume treated seed. Chronic risk to birds, reptiles, and terrestrial-phase amphibians could not be precluded with certainty because a statistically significant ($p<0.05$) effect on growth (albeit slight) was observed at all treatment levels in an avian reproduction study. Fluxapyroxad exposure based on maximum application rates could result in adverse effects to listed species of dicotyledonous (dicot) terrestrial and semi-aquatic plants. Risks to listed dicot plants exceeded the Agency's level of concern (LOC) for all foliar uses and for the highest seed treatment application rate (*i.e.*, wheat and triticale). The potential for adverse effects on monocotyledonous (monocot) plants and on nonlisted dicot plants was considered low. The likelihood of acute mortality to mammals, birds, reptiles and terrestrial-phase amphibians was considered low, as RQ values did not exceed the Agency's LOC.

A comparison of the available aquatic toxicity data with the relatively low EECs of fluxapyroxad in surface water demonstrated a low likelihood that the proposed uses would result in chronic effects in aquatic organisms. Similarly, the fluxapyroxad technical grade active ingredient (TGAI) was not expected to pose an acute risk to either freshwater or estuarine/marine fish or invertebrates. However, potential spray drift of fluxapyroxad co-formulated with pyraclostrobin did result in a risk of acute mortality to freshwater fish and aquatic invertebrates. In the absence of ecotoxicity data for estuarine/marine animals exposed to formulated fluxapyroxad, conclusions for freshwater species were assumed to apply. The increased toxicity of (and therefore risk from) the dual a.i. products for these taxa, when compared to fluxapyroxad TGAI and single a.i. formulations, was consistent with the increased toxicity of pyraclostrobin relative to fluxapyroxad. The likelihood of adverse effects to aquatic sediment-dwelling (benthic) invertebrates and aquatic plants was considered low as RQ values did not approach or exceed the Agency's LOC.

2.6.2. Identification of Data Gaps and Uncertainties

In terms of environmental fate studies required to support the proposed new uses and products of fluxapyroxad, there are no data gaps for fluxapyroxad.

With respect to data requirements to support the assessment of ecological effects, acceptable chronic toxicity data for estuarine/marine fish and invertebrates in the water column have not been submitted. There is uncertainty regarding avian toxicity a definitive NOAEC was not

established in the avian reproduction study with bobwhite quail (*Colinus virginianus*). However, given the flat concentration-response in this case, EFED considers it unlikely that an additional study would yield a NOAEC that would allow risk to be precluded at the screening level. With respect to terrestrial plant toxicity, apparent adjuvant interference in a seedling emergence study reduces confidence in these toxicity endpoints. An ecological risk assessment conducted in 2012 (DP Barcode 376883, March 2012) provides more detail on the guideline studies that were classified as either supplemental or invalid. Additional ecotoxicity data are not being requested at this time because such data would be unlikely to impact the screening level risk conclusions based on the currently proposed uses.

Two of the current fluxapyroxad end-use products (BAS 703 01 F [Merivon®] and BAS 703 02 F [Priaxor®]) and two proposed for registration (BAS 7969-GLN [Lexicon] and Xemium 703) are co-formulated with pyraclostrobin and are similar in that respect to the registered fungicide product, Pristine®. The Pristine® product, contains the similarly structured, pyridine carboxamide fungicide boscalid (25.2%) as well aspyraclostrobin (12.8%). Previous risk assessments for boscalid (DP Barcodes D363523, D379809, D385653) have described uncertainties regarding potential effects of Pristine® on development of honey bee brood, based on incident reports (BASF 2008) and communications with beekeepers (personal communication)[1]; however, studies have been submitted, for fluxapyroxad end-use products (MRID 48812702, under review) as well as Pristine® (DP Barcode 408124), and reviewed by EFED to address these uncertainties.

2.6.3. Measures of Exposure

Screening-level assessments are intended to be protective of wildlife on a national level, as opposed to being regionally- or locally-specific. Maximum application rates are used to model EECs. Measures of exposure are based on aquatic and terrestrial models that calculate EECs using labeled application rates and methods. Exposure modeling assumes that the seed treatment use will not result in spray drift. Particulate drift, which may occur from abrasion of treated seeds during field application, is not assessed in screening-level exposure models. There are currently no monitoring data for fluxapyroxad in the environment.

In the conduct of this screening-level assessment, Tier I models are employed unless exposure concentrations indicate an exceedence of ecological levels of concern. Surface water EECs are calculated using the Generic Estimated Environmental Concentration (GENEEC, v. 2.0, 8/1/2001) model. EECs for sediment-dwelling invertebrates and for drift only analyses are estimated using the Pesticide Root Zone Model (PRZM v. 3.12.2, 5/15/05) and Exposure Analysis Modeling System (EXAMS v. 2.98.04.06, 4/25/05), coupled with the input shell pe5v0 (11/15/06). The EFED Tier 1 Rice Model (v1.0, May 8, 2007) was used to estimate aquatic exposures for direct water applications that represent high exposure sites for rice use. The Terrestrial Residue Exposure Model (T-REX, version 1.4.1, 10/9/2008) is used to derive terrestrial EECs on food items (USEPA 2008) for terrestrial vertebrates. The TerrPlant model (v. 1.2.2, 12/26/2006) is used to derive runoff EECs for estimating exposures to terrestrial plants inhabiting dry and semi-aquatic areas (USEPA 2006b). As discussed in the ecological risk

[1] Personal communication in 2011: B. Brandi, L. Sundberg, R. Olivaris, D. Cox, K. Ward; commercial beekeepers in California.

assessment conducted in 2012, exposure estimates using the Screening Tool for Inhalation Risk (STIR, v. 1.0, 11/23/2010) and the Screening Imbibition Program (SIP, v. 1.0, 8/19/2010) indicated that inhalation and drinking water, respectively, were not expected to be significant routes of exposure for wildlife (DP Barcode 376883, March 2012). Exposure models are parameterized using relevant use and environmental fate data according to EFED input parameter guidance.

2.6.4. Measures of Effect

Measures of effect are obtained from a suite of registrant-submitted guideline studies which are 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. For example, toxicity testing reported in this risk assessment utilizes surrogate species to represent all freshwater fish (>2000 species) and birds (>680 species) identified in the U.S. Open literature searches are not conducted to identify data for potential use in this risk assessment because fluxapyroxad is a relatively new active ingredient.

The acute measures of effect used in this screening-level assessment include the median lethal dose (LD_{50}), median lethal concentration (LC_{50}), and the median effect concentration (EC_{50}). These are measures of acute toxicity which result in 50% of the respective effect in tested organisms. The endpoints for chronic measures of effect are the No Observed Adverse Effects Concentration (NOAEC) and the No Observed Adverse Effects Level (NOAEL). Toxicity studies are submitted for freshwater fish and invertebrates, estuarine/marine fish and invertebrates, aquatic and terrestrial plants, birds, mammals and honey bees (*Apis mellifera*). The measurement endpoints used for risk characterization are derived from studies which underwent review and are classified as "acceptable" (conducted under guideline conditions and considered to be scientifically sound) or "supplemental" (conditions deviated from guidelines but the results are scientifically sound).

2.6.5. Integration of Exposure and Effects

The exposure and toxicity effects data are integrated to evaluate the risks of adverse ecological effects on non-target species. For the screening-level assessment of fluxapyroxad, the deterministic, risk quotient (RQ) method is used to compare estimated exposure and measured toxicity values. The RQ method involves dividing EECs by acute and chronic toxicity values. The resulting RQs are then compared to the Agency's LOCs (USEPA 2004a). These criteria are used to indicate if applications of fluxapyroxad, as directed on the label, have the potential to cause adverse effects to non-target organisms.

Although risk is often described in terms of the likelihood and magnitude of adverse effects, the risk quotient-based approach does not provide a *quantitative* estimate of likelihood or magnitude of an adverse effect, but rather provides a "yes" or "no" answer depending upon whether or not LOCs are exceeded.

3. Analysis

3.1. Use Characterization

Fluxapyroxad is a registered fungicide active ingredient (a.i.) included in multiple, formulated end-use products, and is proposed for on berries and small fruits, leafy vegetables, bulb vegetables, cucurbits, grapes, rice, root vegetables, sorghum and millet, strawberries, sugarcane, and tree nuts. It is also being proposed for foliar use on residential and commercial turf, golf course, and sod farms. Foliar applications can be made via aerial, ground, or chemigation equipment. Proposed seed treatments include uses on bulb vegetable, brassica, cucurbit, leafy vegetable, rapeseed, rice, and root vegetable seeds. Application of the fungicide to seeds can be accomplished through water-based slurry, using standard slurry or mist-type seed treatment application equipment. A review of the labels indicates that many of the new foliar uses have similar application rates and retreatment intervals. As such, these uses have been grouped for ease of exposure modeling. Proposed application rates and retreatment intervals for the groups considered in the modeling runs are provided in **Table 3.1**. For seeding applications, the highest, mean, and lowest equivalent application rates were used to provide a range of potential exposure concentrations. Equivalent application rates for seed applications expressed in terms of pounds of active ingredient per acre (lbs a.i./A) were developed using label information, provided in units of lbs a.i./100 lbs of seed, and seeding rates provided by the Office of Pesticide Programs' Biological and Economic Analysis Division (Becker and Ratnayake 2011). Seeding rates are provided in **Appendix A, Table 2**.

Table 3.1. Fluxapyroxad application rates and retreatment intervals for proposed uses.

Use(s)	App. Method	Max. Single App. Rate (lbs a.i./A)	No. of Apps. Per year[1]	Retreatment Interval (days)	PHI (days)	Max. Annual App. Rate (lbs a.i./ A/year)
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries	Foliar	0.18	3[2]	7	0-14	0.54
Brassica leafy vegetables, cucurbits, root vegetable	Foliar	0.09	3[2]	7	0-7	0.27
Grapes (*Botrytis* disease) Grapes	Foliar	0.18 0.09	3[2] 6[2]	3[3] 10	14	0.54
Rice	Foliar	0.135	2	7	28	0.27
Sorghum and millet	Foliar	0.09	2	3[3]	21	0.18
Sugarcane	Foliar	0.11	2	14	14	0.22
Tree nuts	Foliar	0.11	3	7	14	0.33
Turf	Foliar	0.23	NS	14	NS	0.80
Bulb vegetable seed (high rate)	Seed	0.19	1	NA	NA	0.19
Leafy vegetable seed (medium rate)	Seed	0.08	1	NA	NA	0.08
Rapeseed (low rate)	Seed	0.002	1	NA	NA	0.002

App. - Application. Max. - Maximum. N/A - Not applicable. No. – Number. PHI – Pre-harvest interval.
[1] Maximum number of applications specified on label.
[2] Label specifies no more than 2 consecutive applications before alternating to a fungicide with a different mode of action.
[3] The retreatment interval was not specified on the labels, so a default value of 3 was assumed. This was estimated as the minimum amount of time necessary to apply the pesticide, evaluate the effects of the application, and determine if subsequent applications are required.

3.2. Exposure Characterization

3.2.1. Environmental Fate and Transport

Table 3.2 summarizes the physicochemical and fate properties of fluxapyroxad. Fluxapyroxad is stable to abiotic routes of degradations (hydrolysis and soil/aqueous photolysis). Relative to biotic routes of degradation, fluxapyroxad degrades slowly under aerobic and anaerobic conditions in soil, with half-lives ranging from 213 to 1,827 days; however, these half-lives may in part reflect sorption of parent compound to soil rather than, or in addition to, biotransformation. Fluxapyroxad also degrades slowly under aerobic and anaerobic conditions in aquatic systems, with whole-system half-lives ranging from 420 to 731 days. In aerobic aquatic studies, fluxapyroxad partitioned to sediment, reaching levels greater than 50% of applied radioactivity between 3 and 7 days after treatment. Fluxapyroxad is not expected to volatilize (vapor pressure approximately 6.1 x 10^{-11} Torr at 25˚ C).

Fluxapyroxad is classified as moderately to slightly mobile (FAO soil mobility classification) based on adsorption K_{OC} values in two U.S. soils ranging from 725 to 1,200 mL/g_{oc}. Adsorption K_{OC} values for six foreign soils were similar to these, ranging from 496 to 1,424 mL/g_{oc}. Freundlich soil partitioning coefficients (K_F) for adsorption for the two U.S. soils ranged from 2.5 to 8.6 mL/g (4.3 to 17.9 mL/g for foreign soils). Based on its mobility and persistence, fluxapyroxad has the potential, albeit low, to leach to ground water, particularly where high water tables are present, high rainfall/irrigation occurs, and where sandy soils with low organic matter exist.

In terrestrial field dissipation studies conducted on bare soil at six locations throughout North America (MRIDs 47923695, 47923696, and 47923697), fluxapyroxad dissipated with DT_{50}s ranging from 17 to 436 days, and was detected infrequently below the top 6 inches of soil. However, given fluxapyroxad's persistence and mobility, the terrestrial field dissipation studies, which only lasted a maximum of 472 days, may not have been long enough to capture leaching over time. Another terrestrial field dissipation study (MRID 48809901) was conducted using both bare-ground and turf plots at a site in Georgia. Fluxapyroxad was applied three times (14 day interval) to both plots at a target rate of 0.268 lb a.i/A/application. Dissipation DT_{50}s were 257 and 160 days for the bare soil and turf plots, respectively.

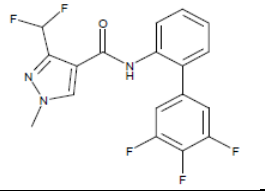
An aquatic field dissipation study was conducted on rice in St. Landry Parish, Louisiana (dry-seeded) and Tulare County, California (water-seeded) (MRID 48812602). Each test site consisted of two treated paddies, one non-cropped and one cropped. Fluxapyroxad was applied twice to each treated paddy (~7 day interval) at a target application rate of 0.089 lb a.i/A/application, which is less than the maximum rate specified on the proposed label of 0.135 lb a.i./A/application. During the study, the treated paddies at each test site were flooded on two

occasions. Two applications occurred during the first period of flooding (nominal flood period July – October 2010). Following flood water release in late October, the paddies were flooded the following year, simulating a second rice growing season (nominal flood period May – September 2011). The maximum concentration in the paddy water ranged from 29.2 to 157 µg/L after the second application and decreased to 5.5-26 µg/L seven days after the second application. The maximum concentration in the top 3 inches of the sediment ranged from 32.3 to 96.3 µg/kg and decreased to 5.3-31 µg/kg 365 days after the second application. Using the total mass measured in the soil/sediment and water (when flooded), total system DT_{50} values for fluxapyroxad ranged from 27 (CA) to 389 (LA) days in non-cropped plots and from 265 (LA) to 409 (CA) days in cropped plots. All of the test sites, except for the California non-cropped site, had observed DT_{90} values beyond the length of the study (373 days). At the California non-cropped site, the observed DT_{90} occurred approximately 180 days after the second application, the same day the paddy was flooded in 2011. These results indicate that fluxapyroxad is likely to carry over from one growing season to another in the sediments of rice paddies, irrespective of the release of flood waters.

A bioconcentration in fish (BCF) laboratory study involving bluegill sunfish (*Lepomis macrochirus*) (MRID 47923730) indicated that after 28 days of exposure to fluxapyroxad at 1.0 and 10.0 µg a.i./L, whole fish BCF values (based on total radioactivity) were 86 and 93 µg/kg-ww per µg/L, respectively. Depuration of fluxapyroxad was relatively rapid, i.e., 90% depuration was 2.5 days. Therefore, fluxapyroxad is not expected to bioaccumulate.

Based on discussions with the ROCKS, only the parent compound is of concern for drinking water purposes (D390225, 7/14/2011). The ecological risk assessment only evaluates exposure and risk to the parent compound, fluxapyroxad, as exposure to the parent below the levels of concern should be protective of any exposure to the degradates.

Table 3.2. Chemical properties and environmental fate parameters of fluxapyroxad.

Chemical Fate/Parameter	Value	Source (MRID)	Comments
IUPAC Name	3-(difluoromethyl)-1-methyl-N-(3',4',5'-trifluoro[1,1'-biphenyl]-2-yl)-1 H-pyrazole-4-carboxamide		
Chemical Formula	$C_{18}H_{12}F_5N_3O$		
Chemical Structure			
Molecular Mass (g/mol)	381.31		
Vapor Pressure (25°C) (Torr)	6.1×10^{-11}	47923505	Not expected to volatilize
Solubility (20°C) (ppm)	3.44 (pH 7)	47923509	
Octanol-water partition coefficient (K_{ow})	1,288 (log K_{ow} = 3.11)	47923511	
Dissociation constant (pK_a)	12.58	47923514	
Hydrolysis half-life (pHs 5,7,9; 25 °C)	No evidence of degradation at all three pHs	48409101	

Chemical Fate/Parameter	Value	Source (MRID)	Comments
Aqueous photolysis half-life	No evidence of degradation	47923513	
Soil photolysis half-life	No evidence of degradation	47923690	
Aerobic soil metabolism half-life; soil texture	213 days (NJ, loam)[1] 1,827 days (ID, sandy loam)[2] 676 days (IL, loam)[2] 387 days (WI, loamy sand)[2]	47923684	No observed correlation between half-lives and individual soil properties.
	729 days (CA, sandy loam)[2] 295 days (GA, sandy loam)[2,3] 345 days (IN, loam)[2,3] 238 days (NC, sandy loam)[2,3]	47923691	
Anaerobic soil metabolism half-life; soil texture	591 days (NJ, loam)[2]	47923688	
Aerobic aquatic metabolism half-life	420 days (silt loam)[2] 701 days (sand)[2]	47923713	Partitioned mainly to sediments
Anaerobic aquatic metabolism half-life	731 days	47923714	Supplemental
Range of Freundlich soil partition coefficients (K_F, mL/g) for adsorption;	8.6 (NJ, silt loam) 2.5 (CA, sandy loam) 6.8 (Germany, loamy sand) 4.2 (Germany, sand) 5.7 (Germany, loamy sand) 12.3 (Spain, silty clay) 18.3 (Germany, clay silt) 14.0 (Japan, sandy silt)	47923707	Six foreign soils found to be representative of agricultural areas where the pesticide will be used.
Range of organic carbon partition coefficients (K_{oc}, mL/g_{oc})	1,195 (NJ, silt loam) 725 (CA, sandy loam) 981 (Germany, loamy sand) 978 (Germany, sand) 827 (Germany, loamy sand) 496 (Spain, silty clay) 1,424 (Germany, clay silt) 819 (Japan, sandy silt)	47923707	Six foreign soils found to be representative of agricultural areas where the pesticide will be used.
Terrestrial field dissipation DT_{50}s	76 days (MB[4], clay loam) 16.7 days (TX, clay loam)[5] 120 days (IL, silt loam) 332 days (NY, sandy loam) 314 days (CA, sandy loam) 436 days (WI, sand) 257 days (GA, loamy sand) 160 days (GA, turf)	47923695 47923696 47923697 48809901	All applications were to bare ground, except 48809901, where bare ground and turf were assessed.
Aquatic field dissipation DT_{50}s	27 days (CA non-cropped) 409 days (CA cropped) 389 days (LA non-cropped) 265 days (LA cropped)	48812602	Not conducted at max label rate of 133 g a.i./ha/application
Bioconcentration factor	86-93(whole fish)	47923730	

[1] The half-life presented is from a SFO fit of the data.

[2] Half-lives extrapolated beyond length of studies (368 days for MRID 47923684, 120 days for MRID 47923691, 123 days for MRID 47923688, 100 days for MRID 47923713, and 365 days for MRID 47923714).

[3] These estimates are based on the SFO model. However using the interim EFED kinetics modeling guidance, SFO is not the best model of degradation in these studies. Representative half-lives based on alternative models are as high as 613 (GA), 2,580 (IN), and 1,561 (NC) days.

[4] MB – Manitoba, Canada

[5] Dissipation half-life was calculated using an nth order model (IORE). Using current EFED kinetics guidance, not available at the time of this estimation, suggests that a longer half-life of 117 days may be more appropriate.

3.2.2. Aquatic Exposure

In the conduct of this screening-level assessment, GENEEC was used to calculate aquatic estimated environmental concentrations (EECs) for fluxapyroxad. If aquatic EECs exceeded ecological levels of concern, as was the case for applications to turf, more refined Tier 2 modeling (PRZM/EXAMS) was employed. EECs for fluxapyroxad in surface water were generated based on maximum labeled use rates (**Table 3.1**) and fate input parameters (**Table 3.3**), developed using current EFED Input Parameter Guidance (USEPA, 2009). Although the labels specify that, for multiple applications of fluxapyroxad, no more than two applications should be made consecutively before alternating to a fungicide with a different mode of action, GENEEC does not have the capability to model multiple applications with varying retreatment intervals. For scenarios where three or four applications of fluxapyroxad could be made, the applications were conservatively modeled as consecutive applications. A soil incorporation depth of 0 inches was assumed, as fluxapyroxad can be applied on a variety of seeds, with varying planting depths, and no incorporation provides conservative exposure estimates for transport in runoff. For fluxapyroxad applications to turf, the PRZM/EXAMS Pennsylvania (PA) Turf scenario was used, as it provided the most conservative EECs. An application date of 4/15 was selected, based on logic discussed below for the drift-only assessment for formulated products. EECs derived using the Tier I Rice model are further described in EFED's drinking water assessment for this action (DP Barcode 403944, 3/15/2013).

Table 3.3. Input parameters used in surface water exposure modeling (GENEEC and PRZM/EXAMS).

Variable Name	Data Value	Data Source MRID(s)	Comment
Application Method	Aerial (foliar treatment), granular (seed treatment)	Proposed labels	
Application Rate (lbs. ai/acre)	See **Table 3.1**	Proposed labels	
Application Frequency	See **Table 3.1**	Proposed labels	
Application Interval (days)	See **Table 3.1**	Proposed labels	
Incorporation depth (in)	0	--	Assumed no incorporation
K_{oc}	931 mL/g_{oc}	47923707	Mean of eight values[1]
Aerobic Soil Metabolism	$t_{1/2}$ = 857 days	47923684, 47923691	90th percentile on mean (589 days) of 8 values[1]
Solubility	3.44 ppm	47923509	
Aerobic Aquatic Metabolism	$t_{1/2}$ = 993 days	47923713	90th percentile on mean (561 days) of 2 values[1]
Photolysis	$t_{1/2}$ = stable	47923513	

[1] EFED input parameter guidance is located at: http://www.epa.gov/oppefed1/models/water/input_parameter_guidance.htm

To estimate exposure to sediment-dwelling invertebrates and drift-only exposure to formulated products, EECs were developed using PRZM/EXAMS, as the GENEEC model does not estimate concentrations in pore water, or as the result of drift-only (*i.e.*, no runoff). The same fate parameters used in the above mentioned aquatic exposure modeling were used (**Table 3.3**). Drift-only estimates were derived for foliar applications alone, as seed applications do not result in spray drift issues. The application efficiency was set to zero and the spray drift fraction was set to 0.05, to simulate an aerial application resulting in drift-only contributions. The chemical application method (CAM) was set to 2, indicating interception by the crop canopy, though the pesticide application after harvest was treated as soil surface deposition. Use of PRZM and EXAMS requires specification of the first application date and the use of crop-specific scenarios. Relevant inputs are provided in **Table 3.4**. The date of the first application was determined considering a variety of factors. Initially the labels were consulted. For example, for grapes, the labels indicate to apply fluxapyroxad "during budbreak" or "before prebloom". However, in most instances, the labels indicate that one is to apply fluxapyroxad "prior to onset of disease development." In these cases, as fluxapyroxad is a fungicide designed to attack diseases which affect the leaf, dates when leaves begin to appear were then considered. For most crops this was assumed to occur approximately 14 days after emergence. However, if the date of emergence was listed as occurring on January 1st, the first day of the spring was then used, as most fungi thrive in moist, humid conditions. Although the new labels indicate that the fluxapyroxad products are not registered for use in California (CA), the CA PRZM/EXAMS scenarios were used to as surrogate scenarios for other parts of the country. For the CA scenarios, the first day of spring was used as the day of application, since the date of emergence for these scenarios occurred in early January. A list of the scenarios modeled is provided in **Table 3.4**. The scenarios with the maximum EECs in each category are highlighted in bold. The selected crop-specific scenarios are standard Agency-developed scenarios.

Table 3.4. Application scenarios and start dates for PRZM/EXAMS modeling.

Use(s)	PRZM/EXAMS Scenario	Emergence date	Date of first application
Berries and small fruits	**ORberriesOP**	**4/1**	**4/15**[1]
Brassica leafy vegetables	**CAcolecropRLF**	**1/1**	**3/21**[2]
Bulb vegetables	CAGarlicRLF **CAonion_WirrigSTD** GAOnion_WirrigSTD	10/30 **1/16** 9/15	11/13[1] **1/30**[1] 9/29[1]
Cucurbits	**CArowcropRLF** CAmelonsRLF FLcucumber MImelonSTD MOmelonSTD NJmelonSTD	**1/1** 5/16 10/16 4/30 4/10 5/1	**3/21**[2] 5/30[1] 10/30[1] 5/14[1] 4/24[1] 5/15[1]
Grapes (*Botrytis* disease) Grapes	**CAgrapes_WirrigSTD** CAWinegrapesRLF NYGrapesSTD	**2/1** 3/1 6/1	**2/1**[3] 3/1[3] 6/1[3]
Leafy vegetables (except Brassica)	**CAlettuceSTD** FLcabbageSTD	**2/16** 10/16	**3/2**[1] 10/30[1]

Use(s)	PRZM/EXAMS Scenario	Emergence date	Date of first application
Root vegetable	**CAPotatoRLF** FLcarrotSTD IDNpotato_WirrigSTD MEpotatoSTD NCSweetPotatoSTD	**2/16** 10/16 6/1 6/1 5/15	**3/2[1]** 10/30[1] 6/15[1] 6/15[1] 5/29[1]
Sorghum and millet	**KSsorghumSTD**	**5/20**	**6/3[1]**
Strawberries	**CAstrawberry-nplasticRLF** FLstrawberry_WirrigSTD	**1/1** 10/1	**3/21[2]** 10/15[1]
Sugarcane	**FLsugarcaneSTD** LAsugarcaneSTD	**1/1** 1/1	**3/21[2]** 3/21[2]
Tree nuts	CAalmond_WirrigSTD GApecansSTD **ORfilbertsSTD**	1/16 4/16 **3/1**	1/30[1] 4/30[1] **3/15[1]**
Turf	CATurfRLF FLturfSTD **PATurfSTD**	1/1 2/1 **4/1**	3/21[2] 2/15[1] **4/15[1]**

Bold values indicate scenarios which generated the highest surface water EECs.
[1]Assumed first application occurs 14 days after emergence.
[2]Assumed first application occurs on first day of spring.
[3]Based on label conditions.

The EECs in **Table 3.5** reflect the 1-in-10 year peak, 4-day, 21-day, 60-day, and 90-day surface water concentrations. Model runs using ground and airblast applications were also conducted, but resulted in EECs that were lower than those for aerial applications. The EECs in **Table 3.6** reflect the 1-in-10 year peak and 4-day surface water concentrations resulting from drift only. For estimates to sediment-dwelling invertebrates, the turf scenario was run, as it generated the highest peak surface water EECs in the GENEEC and PRZM/EXAMS (results not shown) runs. For rice applications, the Tier I model only provides estimates for the water column concentration. In lieu of using the water column concentration to estimate sediment concentrations, the maximum sediment concentration from the submitted aquatic field dissipation study (MRID 48812602) scaled to the maximum label application rate (96.3 µg/kg x (2x0.135)/(2x0.089) = 146 µg/kg) was used to estimate exposure to sediment-dwelling invertebrates in rice paddies. The sediment pore water acute EEC for the turf scenario was 12.8 µg/L. This estimate was converted to units of µg/kg dry sediment by using the pore water/water column concentrations, the sediment K_{oc} (931 L/kg$_{oc}$, **Table 3.3**), and the equilibrium partitioning model, depicted in Equation 1, to yield a concentration of 481 µg/kg dry sediment for turf (USEPA, 2008*a*). Default values and the equation for K_{biota} were obtained from supporting documents from the FIFRA SAP in 2004 for Refined (Level II) Terrestrial and Aquatic Models (USEPA, 2004*b*).

$$C_{sed-dw} = \frac{C_{pw}\ x\ 1000L/m^3\ x\ (m_{sed}\ x\ f_{oc}\ x\ K_{oc} + m_{biota}\ x\ K_{biota} + m_{DOC}\ x\ K_{DOC} + V_{pw})}{m_{sed}} \quad (1)$$

Where

$C_{sed\text{-}dw}$ concentration of pesticide in sediment on dry weight basis (mg ai/kg sediment, dry weight)
C_{pw} concentration of pesticide dissolved in pore water (mg ai/L)
m_{sed} mass of sediment (assumed to be 675,200 kg, USEPA, 2004*b*)
f_{oc} fraction of organic carbon in sediment (assumed to be 0.04, USEPA, 2004*b*)
K_{oc} organic carbon normalized solid water distribution coefficient (m^3/kg_{oc})
m_{biota} mass of biota in benthic compartment (assumed to be 0.06 kg, USEPA, 2004*b*)
K_{biota} biota-water partition coefficient ($0.436 \times [K_{oc}/0.35]^{0.907}$)($m^3/kg$)
m_{DOC} mass of dissolved organic carbon (DOC) in benthic compartment (assumed to be 1.249 kg)
K_{DOC} DOC-water partition coefficient (assumed equal to K_{oc}, m^3/kg_{oc})
V_{pw} volume of pore water (assumed equal to 249.8 m^3, USEPA, 2004*b*)

Table 3.5. Surface water EECs of fluxapyroxad (GENEEC, Tier I Rice model, and PRZM/EXAMS).

Use(s)	Application Rate (lbs a.i./A), Number of apps, RTI	EECs (µg/L)				
		Peak	4 day	21 day	60 day	90 day
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries	0.18 x 3, 7 days	15.2	15.1	14.7	13.9	13.4
Brassica leafy vegetables, cucurbits, root vegetable	0.09 x 3, 7 days	7.59	7.56	7.37	6.97	6.69
Grapes (*Botrytis* disease) Grapes	0.18 x 3, 3 days 0.09 x 6, 10 days	15.2 15.0	15.2 14.9	14.8 14.6	14.0 13.8	13.4 13.2
Rice[1]	0.135 x 2, 7 days	127	127	127	127	127
Sorghum and millet	0.09 x 2, 3 days	5.08	5.06	4.93	4.67	4.48
Sugarcane	0.11 x 2, 14 days	6.18	6.16	6.01	5.68	5.45
Tree nuts	0.11 x 3, 7 days	9.27	9.24	9.01	8.52	8.18
Turf[2]	0.23 x 4, 14 days	14.4	14.2	13.7	13.3	13.2
Bulb vegetable seed (high rate)	0.19 x 1	4.25	4.23	4.12	3.88	3.72
Leafy vegetable seed (medium rate)	0.08 x 1	1.79	1.78	1.73	1.64	1.57
Rapeseed (low rate)	0.002 x 1	0.04	0.04	0.04	0.04	0.04

RTI – retreatment interval
1. Values derived using Tier I rice model. Assumes 5% loss due to spray drift.
2. EECs estimated using PRZM/EXAMS. Fourth application conducted at 0.11 lbs a.i./A to meet annual label requirement of 0.8 lbs a.i./A/yr.

Table 3.6. EECs from spray drift only following fluxpyroxad applications (PRZM/EXAMS).

Use(s)	EECs (µg/L)	
	Peak	4 day
Berries and small fruits	3.75	3.70
Brassica leafy vegetables	1.70	1.68
Bulb vegetables	6.10	6.06
Cucurbits	2.40	2.38
Grapes (*Botrytis* disease) Grapes	6.50 6.16	6.45 6.13
Leafy vegetables (except Brassica)	4.01	3.97
Root vegetable	3.43	3.41
Sorghum and millet	0.87	0.85
Strawberries	3.29	3.25
Sugarcane	0.68	0.67
Tree nuts	2.16	2.14
Turf	8.71	8.65

3.2.3. Terrestrial Exposure

The proposed application of fluxapyroxad to crops has the potential to reach non-target terrestrial organisms via spray drift and runoff (for plants). Non-target terrestrial organisms may also be exposed to fluxapyroxad via treated seeds. For terrestrial animals, T-REX (Version 1.5.1) is used to calculate dietary- and dose-based EECs of fluxapyroxad for mammals and birds feeding on the site of application. Input values for T-REX include the maximum single application rates, number of applications, and retreatment interval for a given use and are located in **Table 3.1**. In this assessment, EFED uses a default foliar dissipation half-life of 35 days as an input for terrestrial exposure modeling in T-REX. The default value is generally consistent with information from residue decline studies submitted by the registrant and reviewed by HED [Global Joint Review Monograph B.7.6 Residues resulting from supervised trials (Annex IIA 6.3; Annex IIIA 8.3), 2011]. Although half-lives were not calculated, supervised field trials with legume vegetables, sunflower, canola, and sugar beets show that mean residues of fluxapyroxad declined by approximately half in the three-to-four weeks (21 to 28 days) following application. Fluxapyroxad was more persistent on cereal crops, including rice, barley, and wheat; residues in these matrices declined only slightly or remained the same for the duration of the trial (30 days). Therefore, the default foliar dissipation value of 35 days may underestimate persistence in some crops.

Upper-bound Kenega nomogram values based on Hoerger and Kenega (1972) as modified by Fletcher *et al*. (1994) are used to derive EECs for fluxapyroxad exposures to terrestrial mammals and birds based on dietary- and dose-based exposures from foliar applications of fluxapyroxad (**Table 3.7**). A one-year time period is simulated. Consideration is given to different types of feeding strategies for mammals and birds, including herbivores, insectivores and granivores. For

dose-based exposures, three weight classes of mammals (15, 35, and 1000 g) and birds (20, 100, and 1000 g) are considered (**Appendix C**). T-REX is also used to calculate dose-based EECs of fluxapyroxad for birds and mammals that consume treated seeds. Seeding rates (Becker and Ratnayake 2011) and the maximum application rate according to the proposed label are used to calculate dose-based EECs (USEPA 2008*b*) and the mass of fluxapyroxad per unit area (mg a.i./ft^2) available for consumption by birds and mammals (**Table 3.8)**.

Table 3.7. Terrestrial EECs as food residues for animals exposed to fluxapyroxad as a result of the proposed foliar uses.

Food Type	Dietary-based (mg/kg diet) (mammals and birds)	Dose-based (mg/kg bw) (birds)			Dose-based (mg/kg bw) (mammals)		
	All Size Classes	Small (20 g)	Medium (100 g)	Large (1000 g)	Small (15 g)	Medium (35 g)	Large (1000 g)
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries; 0.18 lbs a.i./A; 3 applications; 7-day interval							
Short grass	114	129	73.7	33.0	108	74.8	17.4
Tall grass	52.0	59.3	33.8	15.1	49.6	34.3	7.95
Broadleaf plants/small insects	63.9	72.7	41.5	18.6	60.9	42.1	9.76
Fruits/pods/large insects	7.10	8.08	4.61	2.06	6.77	4.68	1.08
Seeds (granivore)	N/A	1.80	1.02	0.46	1.50	1.04	0.24
Brassica leafy vegetables, cucurbits, root vegetable; 0.09 lbs a.i./A; 3 applications; 7-day interval							
Short grass	56.8	64.7	36.9	16.5	54.1	37.4	8.67
Tall grass	26.0	29.6	16.9	7.57	24.8	17.2	3.98
Broadleaf plants/small insects	31.9	36.4	20.7	9.29	30.5	21.0	4.88
Fruits/pods/large insects	3.55	4.04	2.30	1.03	3.38	2.34	0.54
Seeds (granivore)	N/A	0.9	0.51	0.23	0.75	0.52	0.12
Grapes (*Botrytis* disease); 0.18 lbs a.i./A; 3 applications; 3-day interval							
Short grass	122	139	79.4	35.6	116	80.6	18.7
Tall grass	56.0	63.8	36.4	16.3	53.4	36.9	8.56
Broadleaf plants/small insects	68.8	78.3	44.7	20.0	65.6	45.3	10.5
Fruits/pods/large insects	7.64	8.70	4.96	2.22	7.29	5.04	1.17
Seeds (granivore)	N/A	1.93	1.10	0.49	1.62	1.12	0.26
Grapes; 0.09 lbs a.i./A; 6 applications; 10-day interval							
Short grass	83.6	95.2	54.3	24.3	79.7	55.1	12.8
Tall grass	38.3	43.6	24.9	11.1	36.5	25.2	5.85
Broadleaf plants/small insects	47.0	53.6	30.5	13.7	44.8	31.0	7.18
Fruits/pods/large insects	5.22	5.95	3.39	1.52	4.98	3.44	0.80
Seeds (granivore)	N/A	1.32	0.75	0.34	1.11	0.76	0.18
Sorghum and millet; 0.09 lbs a.i./A; 2 applications; 3-day interval							
Short grass	42.0	47.8	27.3	12.2	40.0	27.7	6.41
Tall grass	19.2	21.9	12.5	5.59	18.3	12.7	2.94
Broadleaf plants/small insects	23.6	26.9	15.3	6.86	22.5	15.6	3.61
Fruits/pods/large insects	2.62	2.99	1.70	0.76	2.50	1.73	0.40
Seeds (granivore)	N/A	0.66	0.38	0.17	0.56	0.38	0.09
Sugarcane; 0.11 lbs a.i./A; 2 applications; 14-day interval							
Short grass	46.4	52.9	30.1	13.5	44.3	30.6	7.09
Tall grass	21.3	24.2	13.8	6.18	20.3	14.0	3.25

Food Type	Dietary-based (mg/kg diet) (mammals and birds)	Dose-based (mg/kg bw) (birds)			Dose-based (mg/kg bw) (mammals)		
	All Size Classes	Small (20 g)	Medium (100 g)	Large (1000 g)	Small (15 g)	Medium (35 g)	Large (1000 g)
Broadleaf plants/small insects	26.1	29.7	17.0	7.59	24.9	17.2	3.99
Fruits/pods/large insects	2.90	3.30	1.88	0.84	2.77	1.91	0.44
Seeds (granivore)	N/A	0.73	0.42	0.19	0.61	0.42	0.10
Tree nuts; 0.11 lbs a.i./A; 3 applications; 7-day interval							
Short grass	69.4	79.0	45.1	20.2	66.2	45.7	10.6
Tall grass	31.8	36.2	20.7	9.25	30.3	21.0	4.86
Broadleaf plants/small insects	39.0	44.5	25.4	11.4	37.2	25.7	5.96
Fruits/pods/large insects	4.34	4.94	2.82	1.26	4.13	2.86	0.66
Seeds (granivore)	N/A	1.10	0.63	0.28	0.92	0.64	0.15
Turf[1]; 0.23 lbs a.i./A; 4 applications; 14-day interval							
Short grass	97.0	111	63.0	28.2	92.5	63.9	14.8
Tall grass	44.5	50.7	28.9	12.9	42.4	29.3	6.79
Broadleaf plants/small insects	54.6	62.2	35.5	15.9	52.0	36.0	8.34
Fruits/pods/large insects	6.06	6.91	3.94	1.76	5.78	4.00	0.93
Seeds (granivore)	N/A	1.53	0.88	0.39	1.28	0.89	0.21

N/A Not applicable.

1. Fourth application made at 0.11 lbs a.i./A for a total annual application rate of 0.80 lbs a.i./A/year. TREX v 1.5.1 was used, using the varying rates mode.

Table 3.8. Terrestrial dose-based EECs for the range of seed treatment uses proposed for fluxapyroxad.

Use(s)	App Rate (lbs a.i./100 lbs seed)	Seeding Rate[1] (lbs seed/A)	App Rate (lbs a.i./A)	Seed App Rate (mg a.i./ kg seed)	Dose-Based EEC (mg a.i./kg-bw/day)		Spatial EEC (available a.i. per unit area) (mg a.i. /ft^2)
					Birds	Mammals	
Bulb vegetable seed (high rate)	0.25	75	0.19	2500	633	530	1.96
Leafy vegetable seed (medium rate)	0.2	40	0.08	2000	506	424	0.83
Rapeseed (low rate)	0.02	8.2	0.002	200	50.6	42.4	0.06

Abbreviations: App Application. cwt Hundred weight (100 lbs seed).

[1]Reference: Becker and Ratnayake (2011).

TerrPlant (**Appendix D**) is used to calculate EECs for non-target plants that inhabit dry and semi-aquatic areas. In this assessment, exposure to non-target plants is calculated based on the potential runoff and spray drift of foliar applications of fluxapyroxad, and potential runoff after seed treatment application (**Table 3.9**). Potential exposure resulting from spray drift is not calculated for seed treatment applications because any spray drift of fluxapyroxad associated with the seed treatment use is expected to be negligible. TerrPlant does not account for particulate drift that may result from the abrasion of treated seed coatings during planting.

Table 3.9. EECs for non-target terrestrial and semi-aquatic plants based on proposed uses of fluxapyroxad (TerrPlant).

Use(s)	Application Technique	Single Max. App. Rate (lbs a.i./A)	EECs (lbs a.i./A)		
			Semi-Aquatic Areas (Total)	Spray Drift	Dry Areas (Total)
Turf	Foliar	0.23	0.0345	0.0115	0.0138
Berries and small fruits	Foliar	0.18	0.027	0.009	0.0108
Bulb vegetables					
Grapes (*Botrytis* disease)					
Leafy vegetables (except Brassica)					
Strawberries					
Sugarcane	Foliar	0.11	0.0165	0.0055	0.0066
Tree nuts					
Brassica leafy vegetables	Foliar	0.09	0.0135	0.0045	0.0054
Cucurbits					
Grapes					
Root vegetable					
Sorghum and millet					
Bulb vegetable seed (high rate)	Seed	0.19	0.019	N/A	0.0019
Leafy vegetable seed (medium rate)	Seed	0.08	0.008	N/A	0.0008
Rapeseed (low rate)	Seed	0.002	0.0002	N/A	0.00002

App. - Application. Max. - Maximum. N/A - Not applicable.

3.3 Ecological Effects Characterization

3.3.1 Ecotoxicity Data

Toxicity endpoints used in risk estimation and characterization for the proposed new uses of fluxapyroxad are shown in **Table 3.10** through **Table 3.17**. In the current risk assessment, the most sensitive endpoints available from registrant-submitted toxicity studies classified as acceptable or supplemental are the endpoints selected for quantitative use in risk estimation. A complete discussion of the submitted toxicity data for fluxapyroxad is provided in USEPA 2012 (DP Barcode 376883, March 2012).

3.3.1.1. Aquatic Organisms

The following is a brief discussion of the selected toxicity endpoints that will be used for risk estimation.

Acute toxicity endpoints for fish and aquatic invertebrates are summarized in **Table 3.10**. Based on the available data, fluxapyroxad is highly toxic to freshwater fish on an acute exposure basis; the most sensitive species tested was the common (carp, *Cyprinus carpio*) on an acute exposure basis. Fluxapyroxad is moderatetely toxic to freshwater invertebrates and estuarine/marine fish on an acute exposure basis. While fluxapyroxad is moderately toxic to estuarine/marine crustaceans, it is highly toxic to estuarine/marine molluscs on an acute exposure basis.

Toxicity testing using formulated product on rainbow trout (*Oncorhynchus mykiss*) indicated that two of the formulations containing fluxapyroxad as the sole active ingredient (Imbrex and Sercadis) have toxicity values relatively similar to that of the TGAI (LC_{50}=0.61 mg ai/L). However, the Merivon (LC_{50}=0.0074 mg ai/L) and Priaxor (LC_{50}=0.0045 mg ai/L) formulations.which are both co-formulated with pyraclostrobin are two orders of magnitude more toxic and are classified as very highly toxic to freshwater fish on an acute exposure basis.

The fluxapyroxad TGAI is moderately toxic to freshwater invertebrates (water flea, *Daphnia magna*), and formulated fluxapyroxad ranges from slightly toxic (BAS 700 04 F [Sercadis]) to very highly toxic (BAS 703 02 F [Priaxor]) to freshwater invertebrates, on an acute exposure basis. The fluxapyroxad TGAI is at least moderately toxic to estuarine/marine fish (sheepshead minnow, *Cyprinidon variegatus*) and invertebrates (mysid shrimp, *Americamysis bahia*) based on acute mortality and is highly toxic to estuarine/marine molluscs (Eastern oyster, *Crassostrea virginica*), based on reductions in shell growth during acute exposure.

Chronic toxicity endpoints for fish and aquatic invertebrates exposed to fluxapyroxad are summarized in **Table 3.11**. Chronic toxicity has been demonstrated for freshwater fish based on reduced growth (body length) of juvenile fathead minnow (*Pimephales promelas*) in an early life stage toxicity test. An acute-to-chronic ratio (ACR=0.077), based on the submitted acute (LC_{50}=0.47 mg ai/L) and chronic toxicity data (NOAEC=0.036 mg ai/L) for fathead minnow, is used in this assessment to calculate a NOAEC value for use in risk estimation because chronic toxicity data were not submitted for the freshwater fish species (common carp) most sensitive to acute exposure to fluxapyroxad. The calculations for the ACR and the calculated NOAEC value

for carp are detailed in the footnotes to **Table 3.11**. Similar to the fathead minnow, chronic exposure of freshwater invertebrates (*D. magna*) to fluxapyroxad resulted in reduced growth (length) of parental daphnids and reduced reproduction in terms of the number of offspring per female daphnid. The chronic NOAEC values for freshwater fish and invertebrates were approximately an order of magnitude lower than the acute toxicity values (LC_{50} or EC_{50}) for the same species exposed to the TGAI. Acceptable chronic toxicity data for estuarine/marine fish and invertebrates in the water column have not been submitted.

Sediment toxicity data for fluxapyroxad are summarized in **Table 3.12**. Spiked sediment toxicity tests with the fluxapyroxad TGAI inhibited growth (reduced dry weight) and survival in separate 10-day studies with the freshwater amphipod (*Hyalella azteca* NOAEC=67 mg ai/L) and the estuarine/marine amphipod (*Leptocheirus plumulosus* NOAEC=27 mg ai/L), respectively.

Toxicity endpoints for aquatic plants exposed to fluxapyroxad and its formulations are shown in **Table 3.13**. Based on the submitted studies, nonvascular plants are slightly more sensitive to fluxapyroxad exposure than the vascular plant (duckweed, *Lemna gibba*). The green alga (*Pseudokirchneriella subcapitata*) was the most sensitive nonvascular plant species tested and was most sensitive to fluxapyroxad co-formulated with pyraclostrobin (BAS 703 02 F [Priaxor]), followed by the TGAI.

Table 3.10. Acute toxicity endpoints used in risk estimation and characterization for fish and aquatic invertebrates exposed to fluxapyroxad in the water column.

Study Type	Species	Test Material	Endpoints[1,2] (mg a.i./L)	Toxicity Classification (MRID) (Study Classification)
Acute toxicity to freshwater fish	Rainbow trout (*Oncorhynchus mykiss*)	EP (BAS 700 01 F) [Imbrex]	LC_{50} = **0.47** 95% CI = 0.39 – 0.58	Highly toxic (47923816) (Acceptable)
		EP (BAS 700 04 F) [Sercadis]	LC_{50} = **0.66** 95% CI = 0.28 –1.3	Highly toxic (47924113) (Acceptable)
		EP (BAS 703 01 F) [Merivon]	LC_{50} = **0.0074** 95% CI = 0.0051 – 0.011	Very highly toxic (47924212) (Acceptable)
		EP (BAS 703 02 F) [Priaxor]	LC_{50} = **0.0045** 95% CI = 0.0031 – 0.0064	Very highly toxic (47924314) (Acceptable)
	Carp (*Cyprinus carpio*)	TGAI	LC_{50} = **0.29** 95% CI = 0.27 – 0.33	Highly toxic (47923725) (Acceptable)
Acute toxicity to freshwater invertebrates	Water flea (*Daphnia magna*)	TGAI	EC_{50} = **5.1** 95% CI = 4.8 – 5.5	Moderately toxic (47923731) (Acceptable)
		EP (BAS 700 01 F) [Imbrex]	EC_{50} = **0.68** 95% CI = 0.48 – 0.96	Highly toxic (47923817) (Acceptable)
		EP (BAS 700 04 F) [Sercadis]	EC_{50} = **28** 95% CI = not determined	Slightly toxic (47924114) (Supplemental)
		EP (BAS 703 01 F) [Merivon]	EC_{50} = **0.016** 95% CI = 0.014 – 0.019	Very highly toxic (47924213) (Supplemental)
		EP (BAS 703 02 F) [Priaxor]	EC_{50} = **0.0083** 95% CI = 0.0075 – 0.0093 Probit slope = 9.1 (95% CI = 5.7 – 13)	Very highly toxic (47924315) (Supplemental)

Study Type	Species	Test Material	Endpoints[1,2] (mg a.i./L)	Toxicity Classification (MRID) (Study Classification)
Acute toxicity to estuarine/marine fish	Sheepshead minnow (*Cyprinidon variegatus*)	TGAI	LC_{50} = **1.3** 95% CI = 0.72 – 2.8	Moderately toxic (47923763) (Acceptable)
Acute toxicity to estuarine/marine crustaceans	Mysid shrimp (*Americamysis bahia*)	TGAI	EC_{50} = **3.6** 95% CI = 2.9 – 4.5	Moderately toxic (47923761) (Acceptable)
Toxicity to estuarine/marine molluscs – shell deposition	Eastern oyster (*Crassostrea virginica*)	TGAI	IC_{50} = **0.96** 95% CI = 0.08 – 1.13	Highly toxic (47923762) (Acceptable)

[1] **Bolded** values are used in risk estimation.

[2] For studies where concentration-response slope data are not available, the default value of 4.5 (with 95% confidence intervals (CI) of 2.0 and 9.0) is used to derive the probability of an individual effect (Urban and Cook 1986).

Table 3.11. Chronic toxicity endpoints used in risk estimation and characterization for fish and aquatic invertebrates exposed to fluxapyroxad in the water column.

Study Type	Species	Test Material	NOAEC & LOAEC[1] (mg a.i./L)	Effects (MRID) (Study Classification)
Early life stage toxicity to freshwater fish	Fathead minnow (*Pimephales promelas*)	TGAI	0.036 & 0.068	Reduced length (47923729) (Supplemental)
	Carp (*Cyprinus carpio*)	TGAI	**0.022** & 0.042[2]	ACR[2] based on fathead minnow (47923724 and 47923729) (N/A)
Chronic toxicity to freshwater invertebrates	Waterflea (*Daphnia magna*)	TGAI	**0.46** & 0.95	Reduced number of young, reduced parental length (47923736) (Acceptable)

[1] **Bolded** values are used in risk estimation.

[2] 0.036 mg a.i./L / LC50 = 0.47 mg a.i./L = acute to chronic ratio (ACR) 0.077 * 0.29 mg a.i./L = 0.022 mg a.i./L NOAEC
0.068 mg a.i./L / LC50 = 0.47 mg a.i./L = ACR 0.145 * 0.29 mg a.i./L = 0.042 mg a.i./L LOAEC

Table 3.12 Toxicity endpoints used in risk estimation and characterization for invertebrates exposed to fluxapyroxad in the sediment compartment.

Study Type	Species	Test Material	Endpoints[1,2] (mg a.i./kg dry sediment)	Effects (MRID) (Study Classification)
10-day sediment toxicity to freshwater invertebrates	Freshwater amphipod (*Hyalella azteca*)	TGAI	EC_{50} > 973 NOAEC = **67** LOAEC = 113	Dry weight (47923744) (Supplemental)
10-day sediment toxicity to estuarine/marine crustaceans	Estuarine/marine amphipod (*Leptocheirus plumulosus*)	TGAI	EC_{50} = 121 95% CI = 103 – 146 Probit slope = 2.03 (1.66 -- 2.40) NOAEC = **27** LOAEC = 57	Survival (47923745) (Supplemental)

[1] **Bolded** values are used in risk estimation.

[2] For studies where concentration-response slope data are not available, the default value of 4.5 (with 95% confidence intervals of 2.0 and 9.0) is used to derive the probability of an individual effect (Urban and Cook 1986).

Table 3.13 Toxicity endpoints used in risk estimation and characterization for aquatic plants exposed to fluxapyroxad in the water column.

Study Type	Species	Test Material	Endpoints[1] (mg a.i./L)	Effects (MRID) (Study Classification)
Toxicity to vascular aquatic plants	Duckweed (*Lemna gibba*)	TGAI	EC_{50} = **2.4** 95% CI = 2.2 – 2.5 NOAEC = **0.44**	Yield (frond number) (47923747) (Acceptable)
Toxicity to nonvascular aquatic plants	Green alga (*Pseudokirchneriella subcapitata*)	TGAI	EC_{50} = **0.37** 95% CI = 0.35 – 0.38 NOAEC = **0.15**	Yield (cell density) (47923737) (Supplemental)
		EP (BAS 703 02 F) [Priaxor]	EC_{50} = **0.12** 95% C.I. = 0.099-0.14 NOAEC = **0.014**	Cell density (47924316) (Supplemental)

[1] **Bolded** values are used in risk estimation.

3.3.1.2. Terrestrial Organisms

The following is a brief discussion of the selected toxicity endpoints that will be used for risk estimation.

Acute toxicity data for birds, mammals, honey bees, and earthworms exposed to fluxapyroxad are summarized in **Table 3.14**. Based on the available data, fluxapyroxad is practically non-toxic to birds (bobwhite quail, *Colinus virginianus*; mallard duck, *Anas platyrynchos*; and zebra finch, *Taeniopygia guttata*) on an acute oral exposure basis and ranges from slightly to practically nontoxic to birds on a subacute dietary exposure basis. A 10% reduction in feed consumption was observed in female zebra finches exposed to fluxapyroxad at 2000 mg/kg bw. Dose-responsive mortality was observed at all but the lowest test concentration (313 mg a.i./kg diet) in a subacute dietary exposure study with bobwhite quail, but the mortality was not observed when the study was repeated under lower light conditions (12 – 21 lux). This risk assessment conservatively uses the endpoints from the first bobwhite quail study, where up to 70% mortality was observed under normal laboratory light conditions (139 – 299 lux), for screening-level risk estimation.

The Health Effects Division has concluded that fluxapyroxad exhibits low acute toxicity to mammals by all exposure routes (EPA Toxicity Category III or IV). No mortality was observed at the limit dose (2000 mg/kg bw) in an acute oral toxicity study with the rat (*Rattus norvegicus*), which was the most sensitive mammalian species tested.

Fluxapyroxad and its formulated end-use products are practically non-toxic to the young adult honey bee on both an acute contact and acute oral exposure basis. The submitted data indicate that adult honey bees are most sensitive to contact exposure to the BAS 700 01 F formulation, although the LD_{50} value (15.7 μg a.i./bee) for BAS 700 01 F [Imbrex containing fluxapyroxad as the sole active ingredient] is still classified as practically nontoxic (LD_{50} > 11 μg a.i./bee). Likewise, submitted toxicity studies for the similarly structured carboxamide fungicide boscalid and its end-use product, Pristine®, are not acutely toxic to young adult honey bees (MRID 48470202).

Earthworms (*Eisenia foetida*) exposed to fluxapyroxad TGAI for 14 days exhibited a dose-responsive reduction in biomass but no statistically significant mortality. Earthworms were more sensitive to the BAS 700 01 F [Imbrex] formulation, which caused 28% mortality at 1000 mg a.i./kg dry soil; biomass was not affected.

Table 3.14 Acute toxicity endpoints used in risk estimation and characterization for terrestrial animals exposed to fluxapyroxad.

Study Type	Species	Test Material	Endpoints[1]	Toxicity Classification (MRID) (Study Classification)
Acute oral toxicity to birds	Zebra finch (*Taeniopygia guttata*)	TGAI	LD_{50} > **2000 mg/kg bw**[2]	Practically nontoxic (47923717) (Supplemental)
Subacute dietary toxicity to birds	Bobwhite quail (*Colinus virginianus*)	TGAI	LC_{50} = **2457 mg a.i./kg diet**[3]	Slightly toxic (48485301) (Acceptable)
Acute oral toxicity to mammals[4]	Norway rat (*Rattus norvegicus*)	TGAI	LD_{50} > **2000 mg/kg bw**	Practically nontoxic (47923558) (Acceptable)
Acute contact and oral toxicity to honey bees	Honey bee (*Apis mellifera*)	TGAI	LD_{50} **> 100 µg a.i./bee** (contact) LD_{50} > 111 µg a.i./bee (oral)	Practically non-toxic (47923748) (Acceptable)
		EP (BAS 700 01 F) [Imbrex]	LD_{50} = **15.7 µg a.i./bee** (contact) 95% CI = 12.4 – 19.9 µg a.i./bee LD_{50} = 62.8 µg a.i./bee (oral) 95% CI = not reported	Practically non-toxic (48565301) (Acceptable)
14-day toxicity to earthworms[5]	Earthworm (*Eisenia foetida*)	TGAI	LC_{50} > 1000 mg ai/kg soil NOAEC = 125 mg ai/kg soil LOAEC = 250 mg ai/kg soil	NA (47923750) (Supplemental)
		EP (BAS 700 01 F) [Imbrex]	LC_{50} > 60 mg ai/kg soil NOAEC = 40 mg ai/kg soil LOAEC = 60 mg ai/kg soil	NA (47923826) (Supplemental)

[1] Dose-response slope data were not available from the acute terrestrial toxicity studies. The default value of 4.5 (with 95% confidence intervals of 2.0 and 9.0) is used to derive the probability of an individual effect (Urban and Cook 1986).

[2] The LD_{50} values from all three avian acute oral toxicity studies are > 2000 mg/kg bw. The zebra finch is identified as the most sensitive among the acute oral toxicity studies because sublethal effects were observed in female zebra finch at the highest dose level.

[3] The endpoint identified for use in risk estimation is from the first experiment conducted under normal laboratory lighting conditions. No mortality was observed when the experiment was repeated under extremely low light.

[4] Mammalian toxicity data were reviewed by OPP Health Effects Division (USEPA) as part of the Global Joint Review for fluxapyroxad.

[5] The submitted 14-day earthworm toxicity studies were labeled as acute tests, although the duration is considerably longer than most acute toxicity tests.

Chronic toxicity data for birds, mammals, honey bees, and earthworms exposed to fluxapyroxad are shown in **Table 3.15**. An avian reproduction study with bobwhite quail exposed to fluxapyroxad in the diet demonstrated a slight (5 – 7%) but statistically significant ($p<0.05$) reduction in hatchling body weight at all treatment concentrations (NOAEC <100 mg/kg diet), when compared to the negative control, with full recovery by day 14 (*i.e.*, effects in fluxapyroxad-treated groups were transient and were no longer observed at day 14 post-hatch).

HED concluded that fluxapyroxad did not cause reproductive toxicity in rats. Developmental toxicity in rats included decreased body weight and body weight gain in offspring and was observed at the same dose levels at which the study authors reported thyroid dysregulation through hepatotoxicity in parental animals.

Submitted semi-field studies with a solo formulation of fluxapyroxad (BAS 700 00 F [Xemium], 5.9% a.i., not proposed for US registration; MRID 47923749) and with the boscalid product Pristine® (MRID 48470201) demonstrated no overall effects on honey bee brood, although EFED identified transient effects on eggs, larvae, and forage bee mortality in the study with Pristine®. The semi-field studies evaluated mortality, colony strength, brood compensation index, and brood termination rate, but did not evaluate effects on particular larval castes (*e.g.*, queen cells). The positive control, fenoxycarb (an insect growth regulator), demonstrated only weak effects in the study with BAS 700 00 F [Xemium] and there is uncertainty as to the ability (statistical power) of either study to detect treatment effects. Additional studies of Pristine examining honey bee queen cell development did not show any significant effects (DP Barcode 408124). In 2012, the registrant submitted a semi-field study (bee brood tunnel test) conducted in the summer of 2011 with the dual a.i. product BAS 703 01 F (Merivon®) (MRID 48812702). Bee brood in negative control, toxic reference item (fenoxycarb: 250 g/kg nominal), and Merivon® treatments were assessed at multiple time points and photographic records were maintained. The exposure period was 7 days, and the post-exposure observation period was 20 days. No significant effects on bee brood development or viability were reported at the nominal treatment rate of 0.60 L/ha (0.134 lbs ai/A). A slight and transient treatment-related effect on foraging of adult bees was noted, but was not identified as statistically significant by the study authors.

Exposure to BAS 700 01 F (Imbrex, a solo formulation of fluxapyroxad) for 56 days inhibited earthworm reproduction, based on an 18% reduction in the number of juveniles, and caused a 16% reduction in parental biomass at 21 mg a.i/kg dry soil, when compared to the negative control.

Additional non-guideline toxicity data for beneficial insects exposed to formulated fluxapyroxad are considered supplemental information in the current risk assessment and are summarized in **Table 3.16**. Tests with the predatory mite (*Typhlodromus pyri*), parasitoid wasp (*Aphidius rhopalosiphi*), green lacewing (*Chrysoperla carnea*), and rove beetle (*Aleochara bilineata*) were conducted at treatment rates lower than in the acute toxicity tests with the honey bee but approximately equal to the maximum application rate(s) on the proposed labels. The BAS 700 01 F [Imbrex] formulation caused mortality in the predatory mite, the parasitoid wasp, and the green lacewing and inhibited reproduction in the predatory mite, the parasitoid wasp, and the rove beetle at the maximum proposed application rate.

Terrestrial plant toxicity data were submitted for BAS 700 01 F [Imbrex], BAS 703 01 F [Merivon], BAS 703 02 F [Priaxor], and most recently for BAS 700 04 F [Sercadis]. Terrestrial plants were most sensitive to the BAS 703 02 F [Priaxor] formulation (**Table 3.17**), which inhibited dry weight in both monocot and dicot plants. Onion (*Allium cepa*) and cabbage (*Brassica oleracea*) were the most sensitive monocot and dicot species, respectively, in the seedling emergence study with BAS 703 02 F [Priaxor], whereas tomato (*Lycopersicon esculentum*) was the most sensitive dicot in the vegetative vigor study. No monocots were affected by foliar application of BAS 703 02 F [Priaxor]. Definitive IC_{25} values were not established for any endpoint-species study because effects either were not clearly dose-responsive or, more often, no effect greater than 25% was observed. Recent terrestrial plant toxicity studies (MRIDs 48958601 and 48958602) submitted for the fluxapyroxad formulation BAS 700 04 F [Sercadis] indicated no treatment effects; however, the studies were only conducted at approximately 50% of the proposed maximum application rate for this formulation.

Table 3.15 Chronic toxicity endpoints used in risk estimation and characterization for terrestrial animals exposed to fluxapyroxad.

Study Type	Species	Test Material	Endpoints	Effects (MRID) (Study Classification)
Avian reproduction	Bobwhite quail (*Colinus virginianus*)	TGAI	NOAEC **< 100 mg/kg diet** NOAEL < **7.8 mg/kg bw/day** LOAEC = 100 mg/kg diet	Reduction in hatchling body weight (47923720) (Supplemental)
Chronic toxicity to mammals[1] – two-generation reproduction	Norway rat (*Rattus norvegicus*)	TGAI	NOAEC = **112 mg/kg diet**[2] NOAEL = **10 mg/kg bw/day** LOAEL = 50 mg/kg bw/day	Reduction in F2 body weight and body weight gain (47923602) (Acceptable)
Toxicity to honey bee brood	Honey bee (*Apis mellifera*)	EP (BAS 700 00 F)[3] [Xemium]	NOAEC = 0.11 lbs a.i./A LOAEC > 0.11 lbs a.i./A	NA[4] (47923749) (Supplemental)
		EP (BAS 703 01 F) [Merivon]	NOAEC = 0.134 lbs a.i./A LOAEC > 0.134 lbs a.i./A	(48812702) (In Review)
56-day toxicity to earthworms	Earthworm (*Eisenia foetida*)	EP (BAS 700 01 F) [Imbrex]	NOAEC = 11 mg ai/kg soil LOAEC = 21 mg ai/kg soil	Reduced number of juveniles, biomass (47923827) (Supplemental)

[1] Mammalian toxicity data were reviewed by OPP Health Effects Division (USEPA) as part of the Global Joint Review for fluxapyroxad.
[2] The NOAEC value was calculated by the reviewer as the mean of measured concentrations of fluxapyroxad in the diet at the NOAEL (10 mg/kg bw/day).
[3] BAS 700 00 F is an emulsifiable concentrate formulation of fluxapyroxad (5.9% a.i.) that is not currently submitted for registration in the United States.
[4] No statistically signficant ($p<0.05$) adverse effects were observed. Parameters evaluated included mortality, colony strength, brood compensation index, and brood termination rate.

Table 3.16 Additional non-guideline toxicity data for hazard characterization of beneficial insects exposed to fluxapyroxad.

Study Type	Species	Test Material	Endpoints (lbs a.i./A)	Effects[1] (MRID) (Study Classification)
Toxicity to predatory mite	Predatory mite (*Typhlodromus pyri*)	EP (BAS 700 01 F) [Imbrex]	LD_{50} = **0.051** 95% CI = 0.008–0.156 NOAEL < **0.006** LOAEL = 0.006	Mortality, reduced number of eggs per female (47923820) (Supplemental)
Toxicity to parasitoid wasp	Parasitoid wasp (*Aphidius rhopalosiphi*)	EP (BAS 700 01 F) [Imbrex]	LD_{50} = **0.097** 95% CI = 0.088–0.107	Reduced number of parasitized aphids

Study Type	Species	Test Material	Endpoints (lbs a.i./A)	Effects[1] (MRID) (Study Classification)
			NOAEL < **0.017** LOAEL = 0.017	(47923821) (Supplemental)
Toxicity to green lacewing	Green lacewing (*Chrysoperla carnea*)	EP (BAS 700 01 F) [Imbrex]	LD_{50} > **0.804** NOAEL = **0.357** LOAEL = 0.536	Mortality (47923822) (Supplemental)
Toxicity to rove beetle	Rove beetle (*Aleochara bilineata*)	EP (BAS 700 01 F) [Imbrex]	LD_{50} > **0.809** NOAEL = **0.558** LOAEL = 0.809	Reduced number of emerged beetles (47923825) (Supplemental)

[1] Effects observed at LOAEL. Other effects may have been observed at higher treatment rates.

[2] BAS 700 00 F is an emulsifiable concentrate formulation of fluxapyroxad (5.9% a.i.) that is not currently submitted for registration in the United States. The predatory mite toxicity data for the BAS 700 00 F formulation are included for characterization to aid in comparison across end-use products (EPs), since the honey bee brood test submitted by the registrant used the BAS 700 00 F formulation.

Table 3.17 Toxicity endpoints used in risk estimation and characterization for terrestrial and semi-aquatic plants exposed to fluxapyroxad.

Study Type	Test Material	Most Sensitive Species	Endpoints (lbs a.i./A)	Effects (MRID) (Study Classification)
Terrestrial plant toxicity: Tier II seedling emergence	EP (BAS 703 02 F) [Priaxor]	Monocot: Onion (*Allium cepa*)	IC_{25} > **0.0894** NOAEL = **0.0446** LOAEL = 0.0894	Inhibition of dry weight (47924321) (Supplemental)
		Dicot: Cabbage (*Brassica oleracea*)	IC_{25} > **0.0894** NOAEL = **0.0055** LOAEL = 0.0111	Inhibition of dry weight (47924321) (Supplemental)
	EP (BAS 700 04 F) [Sercadis]	Monocot: NA	IC_{25} > 0.226 NOAEL = 0.226 LOAEL > 0.226	NA (48958601) (Acceptable)
		Dicot: NA	IC_{25} > 0.226 NOAEL = 0.226 LOAEL > 0.226	NA (48958601) (Acceptable)
Terrestrial plant toxicity: Tier II vegetative vigor	EP (BAS 703 02 F) [Priaxor]	Monocot: NA	IC_{25} > **0.0681** NOAEL= **0.0681** LOAEL > 0.0681	NA (47924320) (Acceptable)
		Dicot: Tomato (*Lycopersicon esculentum*)	IC_{25} > **0.0681** NOAEL = **0.0167** LOAEL = 0.0338	Inhibition of dry weight (47924320) (Acceptable)

Study Type	Test Material	Most Sensitive Species	Endpoints (lbs a.i./A)	Effects (MRID) (Study Classification)
	EP (BAS 700 04 F) [Sercadis]	Monocot: NA	IC_{25} > 0.226 NOAEL = 0.226 LOAEL > 0.226	NA (48958602) (Acceptable)
		Dicot: NA	IC_{25} > 0.226 NOAEL = 0.226 LOAEL > 0.226	NA (48958602) (Acceptable)

3.2.1. Incident Reports

Fluxapyroxad was recently registered in North America (2012). A search of the latest version of the most current version of the Ecological Incident Information System (version 2.1, dated 10/2012) did not produce any ecological incidents for fluxapyroxad. Previous risk assessments for the structurally similar (pyridine carboxamide) fungicide active ingredient, boscalid, and its associated end-use product Pristine® (25.2% boscalid and 12.8% pyraclostrobin), have identified reports of potential effects of boscalid and/or Pristine® exposure on honey bee brood (DP Barcodes D379809, D386068+). The registrant conducted higher tier larval toxicity tests with a solo formulation of boscalid and with the Pristine® formulation, respectively, to address these uncertainties and these studies did not indicate any significant effect. Semi-field studies conducted with BAS 700 00 F (5.9% a.i., MRID 47923749) and BAS 703 01 F (21.26% a.i., MRID 48812702) demonstrated no overall effects on honey bee brood development, but did not include endpoints specific to queen cell development. The registrant is not currently seeking U.S. registration for the BAS 700 00 F formulation.

4. Risk Characterization

Toxicity data and exposure estimates for fluxapyroxad are used to evaluate the potential for adverse ecological effects on non-target species. This screening-level assessment employs a deterministic risk estimation method, based on RQ values, to provide a metric of potential risks (**Section 4.1**). The potential for risk is characterized further in the Risk Description (**Section 4.2**) based on the risk estimation results and other relevant information about toxicity, incidents, ecosystems potentially at risk, and the environmental fate and transport characteristics of fluxapyroxad. In cases where an RQ value exceeds the listed species LOC, the potential for risk to listed species is characterized in greater detail in **Section 5**.

4.1. Risk Estimation

As discussed in the problem formulation, RQ values are compared to the Agency's LOCs to identify taxonomic groups potentially at risk of acute or chronic effects associated with the proposed new uses of fluxapyroxad.

4.1.1. Aquatic Organisms

RQ values are calculated for estimating acute and chronic risk to fish and aquatic invertebrates, including molluscs, where the submitted ecotoxicity data are sufficient to use in risk estimation. Toxicity data for aquatic animals and plants reported in Section 3.3.1.1 in terms of mg/L (ppm) are converted to µg/L (ppb) so that both exposure and toxicity are in similar units, *i.e.*, µg/L. As shown in **Table 4.1** through **Table 4.4**, most of the RQ values calculated for the fluxapyroxad TGAI are below the Agency's levels of concern (LOCs) for risk to listed or nonlisted species of aquatic organisms. For freshwater fish, acute and chronic RQ values (based upon EECs generated using the Tier I Rice model) exceed the listed species LOC for rice. RQ values are not calculated for chronic risk to estuarine/marine fish or invertebrates in the water column because acceptable chronic data for these taxa are not available.

As the endpoints for fluxapyroxad formulations are lower than those of the technical active ingredient, RQ values are calculated for freshwater acute and chronic risk to fish and aquatic invertebrates using spray drift-only EECs. As shown in **Table 4.5**, RQ values for the solo formulations of fluxapyroxad (BAS 700 01 F [Imbrex] and BAS 700 04 F [Sercadis]) do not exceed the LOCs for acute risk to listed and nonlisted fish and aquatic invertebrates. However, **Table 4.6** shows that RQ values calculated for all evaluated uses of the dual-a.i. formulations of fluxapyroxad (BAS 703 01 F [Merivon], BAS 703 02 F [Priaxor], and Lexicon) exceed the Agency's LOCs for acute risk to listed freshwater species of fish and aquatic invertebrates. RQ values for the uses of BAS 703 01 F [Merivon] on berries and small fruits, bulb vegetables, grapes, and leafy vegetables also exceed the Agency's LOC for acute risk to non-listed freshwater fish. RQ values for the uses of BAS 703 02 F [Priaxor] on bulb vegetables, cucurbits, grapes, and root vegetables also exceed the Agency's LOC for acute risk to non-listed freshwater fish. RQ values for the use of Lexicon on turf also exceed the Agency's LOC for acute risk to non-listed freshwater fish.

The submitted ecotoxicity data indicate that nonvascular aquatic plants are in some cases also more sensitive to formulated fluxapyroxad than to the TGAI. However, as shown in **Table 4.7,** RQ values based on the green alga EC_{50} and NOAEC values for BAS 703 02 F [Priaxor] do not exceed the listed or nonlisted species LOCs for any of the evaluated uses. RQ values for the other formulations (BAS 700 01 F [Imbrex], BAS 700 04 F [Sercadis], and BAS 703 01 F [Merivon]) are also not expected to exceed the LOCs for listed and nonlisted species LOCs because the alga was less sensitive to these formulations than to BAS 703 02 F [Priaxor].

Further characterization of the potential for adverse effects to aquatic organisms, based on the available data, is provided as part of the Risk Description in **Section 4.2.1**.

Table 4.1. Acute and chronic RQ values for freshwater fish and invertebrates exposed to fluxapyroxad TGAI in surface water.

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/L)			RQ Values[1]			
						Freshwater Fish LC_{50}=290 µg/L NOAEC=22 µg/L		Freshwater Invertebrate EC_{50}=5100 µg/L NOAEC=460 µg/L	
			Peak	21-d	60-d	Acute	Chronic	Acute	Chronic
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries	0.18 (3)	Aerial spray	15.2	14.7	13.9	0.05	0.63	< 0.01	0.03
Brassica leafy vegetables, cucurbits, root vegetable	0.09 (3)	Aerial spray	7.59	7.37	6.97	0.03	0.32	< 0.01	0.02
Grapes (*Botrytis* disease)	0.18 (3)	Aerial spray	15.2	14.8	14.0	0.05	0.64	< 0.01	0.03
Grapes	0.09 (6)	Aerial spray	15.0	14.6	13.8	0.05	0.63	< 0.01	0.03
Rice	0.135 (2)	Aerial spray	127	127	127	**0.44**	**5.77**	0.03	0.28
Sorghum and millet	0.09 (2)	Aerial spray	5.08	4.93	4.67	0.02	0.21	< 0.01	0.01
Sugarcane	0.11 (2)	Aerial spray	6.18	6.01	5.68	0.02	0.26	< 0.01	0.01
Tree nuts	0.11 (3)	Aerial spray	9.27	9.01	8.52	0.03	0.39	< 0.01	0.02
Turf[2]	0.23 (4)	Aerial spray	14.4	13.7	13.3	0.05	0.60	< 0.01	0.03
Bulb vegetable seed (high rate)	0.19 (1)	Seed Treatment	4.25	4.12	3.88	0.01	0.18	< 0.01	0.01
Leafy vegetable seed (medium rate)	0.08 (1)	Seed Treatment	1.79	1.73	1.64	0.01	0.07	< 0.01	< 0.01
Rapeseed (low rate)	0.002 (1)	Seed Treatment	0.04	0.04	0.04	< 0.01	< 0.01	< 0.01	< 0.01

[1] **Bold** values are RQs that exceed the Agency's acute risk LOC (RQ>0.05) for listed species or the chronic risk LOC (1) for listed/nonlisted species.

[2] Estimated using PRZM/EXAMS. Fourth application made at 0.11 lbs a.i./A for a total annual application rate of 0.80 lbs a.i./A/year.

Table 4.2. Acute RQ values for estuarine/marine fish and invertebrates exposed to fluxapyroxad TGAI in surface water.

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/L)	RQ Values		
				Estuarine/ Marine Fish LC_{50}=1300 µg/L	Estuarine/ Marine Crustacean EC_{50}=3600 µg/L	Estuarine/ Marine Mollusc IC_{50}=960 µg/L
			Peak	Acute	Acute	Acute
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries	0.18 (3)	Aerial spray	15.2	0.01	< 0.01	0.02
Brassica leafy vegetables, cucurbits, root vegetable	0.09 (3)	Aerial spray	7.59	0.01	< 0.01	0.01
Grapes (*Botrytis* disease)	0.18 (3)	Aerial spray	15.2	0.01	< 0.01	0.02
Grapes	0.09 (6)	Aerial spray	15.0	0.01	< 0.01	0.02
Rice	0.135 (2)	Aerial spray	127	0.10	0.04	0.13
Sorghum and millet	0.09 (2)	Aerial spray	5.08	< 0.01	< 0.01	0.01
Sugarcane	0.11 (2)	Aerial spray	6.18	< 0.01	< 0.01	0.01
Tree nuts	0.11 (3)	Aerial spray	9.27	0.01	< 0.01	0.01
Turf[1]	0.23 (4)	Aerial spray	14.4	0.01	< 0.01	0.02
Bulb vegetable seed (high rate)	0.19 (1)	Seed Treatment	4.25	< 0.01	< 0.01	< 0.01
Leafy vegetable seed (medium rate)	0.08 (1)	Seed Treatment	1.79	< 0.01	< 0.01	< 0.01
Rapeseed (low rate)	0.002 (1)	Seed Treatment	0.04	< 0.01	< 0.01	< 0.01

[1] Estimated using PRZM/EXAMS. Fourth application made at 0.11 lbs a.i./A for a total annual application rate of 0.80 lbs a.i./A/year.

Table 4.3. RQ values for sediment-dwelling invertebrates exposed to fluxapyroxad TGAI.

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/kg dry sediment)	RQ Values[1]	
				10-day Freshwater Invertebrate NOAEC=67000 µg/kg dry sediment	**10-day Estuarine/Marine Invertebrate** NOAEC=27000 µg/kg dry sediment
			Peak[2]		
Turf[3]	0.23 (4)	Aerial spray	481	0.01	0.02
Rice	0.135 (2)	Aerial spray	146	< 0.01	0.01

[1] This assessment compares the 10-day sediment toxicity endpoints to the peak sediment EEC associated with each use. The resulting RQ values are expected to be conservative. However, given the demonstrated persistence of fluxapyroxad in water and sediment time-weighted concentrations are expected to be similar to peak concentrations.

[2] Pore water concentration derived from PRZM/EXAMS (12.8 µg/L) was converted to µg/kg dry sediment using the sediment K_{oc} (931 L/kg_{oc}, **Table 3.3**) and the equation in Section 3.2.2, pg. 18 (USEPA, 2008).

[3] The fourth application was conducted at 0.11 lbs a.i./A, yielding an annual rate of 0.80 lbs a.i./A.

Table 4.4. RQ values for listed and nonlisted species of aquatic plants exposed to fluxapyroxad TGAI in surface water.

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/L)	RQ Values			
				Vascular Plants EC_{50}=2400 µg/L NOAEC=440 µg/L		**Nonvascular Plants** EC_{50}=370 µg/L NOAEC=150 µg/L	
			Peak	**Listed**	**Nonlisted**	**Listed**	**Nonlisted**
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries	0.18 (3)	Aerial spray	15.2	0.04	0.01	0.10	0.04
Brassica leafy vegetables, cucurbits, root vegetable	0.09 (3)	Aerial spray	7.59	0.02	< 0.01	0.05	0.02
Grapes (*Botrytis* disease)	0.18 (3)	Aerial spray	15.2	0.04	0.01	0.10	0.04
Grapes	0.09 (6)	Aerial spray	15.0	0.04	0.01	0.10	0.04
Rice	0.135 (2)	Aerial spray	127	0.32	0.05	0.85	0.34
Sorghum and millet	0.09 (2)	Aerial spray	5.08	0.01	< 0.01	0.03	0.01

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/L)	RQ Values			
				Vascular Plants EC_{50}=2400 µg/L NOAEC=440 µg/L		Nonvascular Plants EC_{50}=370 µg/L NOAEC=150 µg/L	
			Peak	Listed	Nonlisted	Listed	Nonlisted
Sugarcane	0.11 (2)	Aerial spray	6.18	0.01	< 0.01	0.04	0.02
Tree nuts	0.11 (3)	Aerial spray	9.27	0.02	< 0.01	0.06	0.03
Turf[1]	0.23 (4)	Aerial spray	14.4	0.04	0.01	0.10	0.04
Bulb vegetable seed (high rate)	0.19 (1)	Seed Treatment	4.25	0.01	0.01	0.03	0.01
Leafy vegetable seed (medium rate)	0.08 (1)	Seed Treatment	1.79	< 0.01	< 0.01	0.01	< 0.01
Rapeseed (low rate)	0.002 (1)	Seed Treatment	0.04	< 0.01	< 0.01	< 0.01	< 0.01

[1] Estimated using PRZM/EXAMS. Fourth application made at 0.11 lbs a.i./A for a total annual application rate of 0.80 lbs a.i./A/year.

Table 4.5. Acute RQ values for freshwater fish exposed to BAS 700 01 F [Imbrex] and BAS 700 04 F [Sercadis] in surface water as a result of spray drift only, based on maximum application rates for all fluxapyroxad uses.

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/L)	BAS 700 01 F [Imbrex][1]		BAS 700 04 F [Sercadis][1]	
				Fish LC_{50}=470 µg/L	Invertebrates LC_{50}=680 µg/L	Fish LC_{50}=660 µg/L	Invertebrates LC_{50}=28000 µg/L
			Peak	Acute	Acute	Acute	Acute
Berries and small fruits	0.18 (3)	Aerial	3.75	0.01	0.01	0.01	< 0.01
Brassica leafy vegetables	0.09 (3)	Aerial	1.70	< 0.01	< 0.01	< 0.01	< 0.01
Bulb vegetables	0.18 (3)	Aerial	6.10	0.01	0.01	0.01	< 0.01
Cucurbits	0.09 (3)	Aerial	2.40	0.01	< 0.01	< 0.01	< 0.01
Grapes (*Botrytis* disease)	0.18 (3)	Aerial	6.50	0.01	0.01	0.01	< 0.01
Grapes	0.09 (6)	Aerial	6.16	0.01	0.01	0.01	< 0.01

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/L)	BAS 700 01 F [Imbrex][1]		BAS 700 04 F [Sercadis][1]	
				Fish LC_{50}=470 µg/L	Invertebrates LC_{50}=680 µg/L	Fish LC_{50}=660 µg/L	Invertebrates LC_{50}=28000 µg/L
			Peak	Acute	Acute	Acute	Acute
Leafy vegetables (except Brassica)	0.18 (3)	Aerial	4.01	0.01	0.01	0.01	< 0.01
Root vegetable	0.09 (3)	Aerial	3.43	0.01	0.01	0.01	< 0.01
Sorghum and millet	0.09 (2)	Aerial	0.87	< 0.01	< 0.01	< 0.01	< 0.01
Strawberries	0.18 (3)	Aerial	3.29	0.01	< 0.01	< 0.01	< 0.01
Sugarcane	0.11 (2)	Aerial	0.68	< 0.01	< 0.01	< 0.01	< 0.01
Tree nuts	0.11 (3)	Aerial	2.16	< 0.01	< 0.01	< 0.01	< 0.01
Turf[2]	0.23 (4)	Aerial	8.71	NA	NA	0.01	< 0.01

NA Not applicable.

1 **Bold** values are RQs that exceed the Agency's acute risk LOC (RQ>0.05) for listed species.

2 Fourth application made at 0.11 lbs a.i./A for a total annual application rate of 0.80 lbs a.i./A/year. Turf is proposed for registration under the new product Xemplar, similar in formulation to BAS 700 04 F [Sercadis].

Table 4.6. Refined acute RQ values for freshwater fish and invertebrates exposed to BAS 703 01 F [Merivon] and BAS 703 02 F [Priaxor] in surface water as a result of spray drift only, based on proposed uses for each formulation.

Use	App Rate lbs a.i./A (#app)	BAS 703 01 F [Merivon][1]			BAS 703 02 F [Priaxor][1]		
		EECs (µg/L)	Fish LC_{50}= 7.4 µg/L	Invertebrates LC_{50}=16 µg/L	EECs (µg/L)	Fish LC_{50}=4.5 µg/L	Invertebrates LC_{50}=8.3 µg/L
		Peak	Acute	Acute	Peak	Acute	Acute
Berries and small fruits[3]	0.18 (3)	3.75	***0.51***	**0.23**	2.06	**0.46**	**0.25**
Brassica leafy vegetables	0.09 (3)	1.70	**0.23**	**0.11**	1.70	**0.38**	**0.20**
Bulb vegetables[3]	0.18 (3)	6.10	***0.82***	**0.38**	2.75	***0.61***	**0.33**
Cucurbits	0.09 (3)	2.40	**0.32**	**0.15**	2.40	***0.53***	**0.29**

Use	App Rate lbs a.i./A (#app)	BAS 703 01 F [Merivon][1]			BAS 703 02 F [Priaxor][1]		
		EECs (µg/L)	Fish LC_{50}= 7.4 µg/L	Invertebrates LC_{50}=16 µg/L	EECs (µg/L)	Fish LC_{50}=4.5 µg/L	Invertebrates LC_{50}=8.3 µg/L
		Peak	Acute	Acute	Peak	Acute	Acute
Grapes (*Botrytis* disease)[3]	0.18 (3)	6.50	***0.88***	**0.41**	2.60	***0.58***	**0.31**
Grapes[3]	0.09 (6)	6.16	***0.83***	**0.39**	2.60	***0.58***	**0.31**
Leafy vegetables (except Brassica)[3]	0.18 (3)	4.01	***0.54***	**0.25**	2.21	**0.49**	**0.27**
Root vegetable	0.09 (3)	3.43	**0.46**	**0.21**	3.43	***0.76***	**0.41**
Sorghum and millet[2]	0.09 (2)	NA	NA	NA	0.87	**0.19**	**0.10**
Strawberries[3]	0.18 (3)	3.29	**0.44**	**0.21**	1.81	**0.40**	**0.22**
Sugarcane[2,3]	0.11 (2)	NA	NA	NA	0.68	**0.15**	**0.08**
Tree nuts[3]	0.11 (3)	2.16	**0.29**	**0.14**	1.26	**0.28**	**0.15**
Turf[4]	0.23 (4)	NA	NA	NA	8.71	***1.94***	***1.05***

NA Not applicable.

1 **Bold** values are RQs that exceed the Agency's acute risk LOC (RQ>0.05) for listed species; ***bold italics*** values also exceed the Agency's acute risk LOC (RQ>0.5) for nonlisted species.

2 Sorghum and millet, and sugarcane are proposed uses for BAS 703 02 F but not for BAS 703 01 F.

3 The maximum proposed application rates for berries, bulb vegetables, grapes, leafy vegetables, strawberries, and tree nuts under BAS 703 02 F [Priaxor] are lower (in most cases, approximately half) than those specified on the BAS 703 01 F [Merivon] label, so separate model runs were conducted. However, the rates for sugarcane and strawberries, while lower under BAS 703 02 F [Priaxor] than BAS 703 01 F [Merivon], were not significantly different to result in new model runs.

4 The fourth application was conducted at 0.11 lbs a.i./A, yielding an annual rate of 0.80 lbs a.i./A. Turf is proposed for registration under the new product Lexicon, similar in formulation to BAS 703 02 F [Priaxor].

Table 4.7. RQ values for nonvascular aquatic plants exposed to BAS 703 02 F [Priaxor] in surface water from spray drift only, based on maximum application rates for all proposed uses of fluxapyroxad.

Use	App Rate lbs a.i./A (#app)	App Method	EECs (µg/L)	RQ Values[1]	
				Nonvascular Plants EC_{50}=120 µg/L NOAEC=14 µg/L	
			Peak	Listed	Nonlisted
Berries and small fruits	0.10 (3)	Aerial	2.06	0.15	0.02
Brassica leafy vegetables	0.09 (3)	Aerial	1.70	0.12	0.01
Bulb vegetables	0.08 (3)	Aerial	2.75	0.20	0.02
Cucurbits	0.09 (3)	Aerial	2.40	0.17	0.02
Grapes (*Botrytis* disease) /Grapes	0.07 (3)	Aerial	2.60	0.19	0.02
Leafy vegetables (except Brassica)	0.10 (3)	Aerial	2.21	0.16	0.02
Root vegetable	0.09 (3)	Aerial	3.43	0.25	0.03
Sorghum and millet	0.09 (2)	Aerial	0.87	0.06	0.01
Strawberries	0.10 (3)	Aerial	3.29	0.24	0.03
Sugarcane	0.11 (2)	Aerial	0.68	0.06	0.01
Tree nuts	0.06 (3)	Aerial	1.26	0.09	0.01
Turf[2]	0.23 (4)	Aerial	8.71	0.62	0.07

[1] As a screen for risk from the various formulations of fluxapyroxad, RQ values are calculated based on spray drift EECs from all evaluated fluxapyroxad uses and the most sensitive toxicity endpoints from all nonvascular plant toxicity tests with formulated fluxapyroxad, which were from the test with BAS 703 02 F [Priaxor].

4.1.2. Terrestrial Organisms

In this assessment, RQ values are calculated for subacute, dietary-based risk to birds (**Table 4.8**) and for chronic risk to mammals (**Table 4.9**). RQ values are not calculated for acute, dose-based risk to birds, chronic risk to birds, or acute risk to mammals because the toxicity endpoints needed for these calculations are nondefinitive. Specifically, the LD_{50} values for birds and mammals were greater than the highest dose tested in each study; whereas, the NOAEC value for chronic toxicity to birds was estimated to be less than the lowest treatment level tested in the avian reproduction study with bobwhite quail.

For all foliar uses of fluxpyroxad that were evaluated, the subacute dietary-based RQ values for birds are below the Agency's LOCs for acute risk to listed (RQ≥0.1) and nonlisted (RQ≥0.5) species. Chronic, dietary-based RQ values for mammals are also below the chronic risk LOC (RQ≥1) for all uses except for berries and small fruits, and grapes treated for the *Botrytis* disease. However, chronic dose-based RQ values for all uses exceed the chronic risk LOC for wild mammals (RQ ≥1) (**Table 4.9**). Chronic risk concerns are triggered by all uses for small (15 g) and medium sized (35 g) mammals that consume short grass. Chronic risk concerns for large (1000 g) mammals that consume short grass are triggered for all uses except for soghum and millet, and sugarcane. Chronic risk to small and medium mammal consumers of other dietary items, such as tall grass, broadleaf plants, and small insects, exceeds the LOC for most of the proposed uses.

Table 4.8. Acute dietary-based RQ values for birds exposed to fluxapyroxad as a result of the proposed foliar uses.

Food Type	Avian Dietary-Based RQs[1]			
	Short Grass	**Tall Grass**	**Broadleaf Plants/Small Insects**	**Fruits/Pods/ Large Insects**
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries	0.05	0.02	0.03	< 0.01
Brassica leafy vegetables, cucurbits, root vegetable	0.02	0.01	0.01	< 0.01
Grapes (*Botrytis* disease) Grapes	0.05 0.03	0.02 0.02	0.03 0.02	< 0.01 < 0.01
Sorghum and millet	0.02	0.01	0.01	< 0.01
Sugarcane	0.02	0.01	0.01	< 0.01
Tree nuts	0.03	0.01	0.02	< 0.01
Turf	0.04	0.02	0.02	< 0.01

N/A Not applicable.

[1] Dietary-based RQ values are based on the bobwhite quail LC_{50} value of 2457 mg a.i./kg diet (MRID 48485301).

Table 4.9. Chronic dietary and dose-based RQ values for mammals exposed to fluxapyroxad as a result of the proposed foliar uses.

Food Type	Dietary-based (mg/kg diet) (mammals and birds)	Dose-based (mg/kg bw) (mammals)		
	All Size Classes	Small (15 g)	Medium (35 g)	Large (1000 g)
Berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries				
Short grass	**1.01**	**4.93**	**4.21**	**2.26**
Tall grass	0.46	**2.26**	**1.93**	**1.03**
Broadleaf plants/small insects	0.57	**2.77**	**2.37**	**1.27**
Fruits/pods/large insects	0.06	0.31	0.26	0.14
Seeds (granivore)	N/A	0.07	0.06	0.03
Brassica leafy vegetables, cucurbits, root vegetable				
Short grass	0.51	**2.46**	**2.10**	**1.13**
Tall grass	0.23	**1.13**	0.96	0.52
Broadleaf plants/small insects	0.29	**1.39**	**1.18**	0.63
Fruits/pods/large insects	0.03	0.15	0.13	0.07
Seeds (granivore)	N/A	0.03	0.03	0.02
Grapes (*Botrytis* disease)				
Short grass	**1.09**	**5.30**	**4.53**	**2.43**
Tall grass	0.50	**2.43**	**2.08**	**1.11**
Broadleaf plants/small insects	0.61	**2.98**	**2.55**	**1.37**
Fruits/pods/large insects	0.07	0.33	0.28	0.15
Seeds (granivore)	N/A	0.07	0.06	0.03
Grapes				
Short grass	0.75	**3.63**	**3.10**	**1.66**
Tall grass	0.34	**1.66**	**1.42**	0.76
Broadleaf plants/small insects	0.42	**2.04**	**1.74**	0.93
Fruits/pods/large insects	0.05	0.23	0.19	0.10
Seeds (granivore)	N/A	0.05	0.04	0.02
Sorghum and millet				
Short grass	0.37	**1.82**	**1.55**	0.83
Tall grass	0.17	0.83	0.71	0.38
Broadleaf plants/small insects	0.21	**1.02**	0.87	0.47
Fruits/pods/large insects	0.02	0.11	0.10	0.05
Seeds (granivore)	N/A	0.03	0.02	0.01
Sugarcane				
Short grass	0.41	**2.01**	**1.72**	0.92
Tall grass	0.19	0.92	0.79	0.42
Broadleaf plants/small insects	0.23	**1.13**	0.97	0.52
Fruits/pods/large insects	0.03	0.13	0.11	0.06
Seeds (granivore)	N/A	0.03	0.02	0.01
Tree nuts				
Short grass	0.62	**3.01**	**2.57**	**1.38**
Tall grass	0.28	**1.38**	**1.18**	0.63
Broadleaf plants/small insects	0.35	**1.69**	**1.45**	0.78
Fruits/pods/large insects	0.04	0.19	0.16	0.09
Seeds (granivore)	N/A	0.04	0.04	0.02
Turf				
Short grass	0.87	**4.21**	**3.60**	**1.93**
Tall grass	0.40	**1.93**	**1.65**	0.88
Broadleaf plants/small insects	0.49	**2.37**	**2.02**	1.08

Food Type	Dietary-based (mg/kg diet) (mammals and birds)	Dose-based (mg/kg bw) (mammals)		
	All Size Classes	Small (15 g)	Medium (35 g)	Large (1000 g)
Fruits/pods/large insects	0.05	0.26	0.22	0.12
Seeds (granivore)	N/A	0.06	0.05	0.03

N/A Not applicable.

Bolded values exceed the Agency's Level of Concern (LOC) for chronic risk to wild mammals (RQ ≥ 1). RQ values of 0.99 in this assessment are conservatively rounded up and are considered to meet the chronic risk LOC.

RQ values for chronic risk to mammals, based on the range of proposed fluxapyroxad seed treatment uses, are calculated as follows:

RQ = Exposure (mg a.i./kg seed) / NOAEC (mg/kg diet)

The resulting RQ values for proposed seed treatment uses exceed the Agency's LOC for chronic risk to mammals (RQ ≥1, **Table 4.10**). This screening calculation indicates that a mammal that consumes 1 kg of treated seed over an unspecified time period will have been exposed to a dietary concentration of fluxapyroxad that is approximately 1.8 to 22 times the chronic NOAEC. The amount of time it would take a mammal to consume 1 kg of seed would depend upon the physiology, life history, and energy requirements of the individual.

It should be noted that the seed treatment uses presented in **Table 4.10** are a subset of those proposed on the fluxapyroxad labels, used to provide a range of RQs. For a seed treatment to be below the chronic risk LOC, it must be below 0.0112 lbs a.i./100 lbs seed. Based on the seed treatment uses on the proposed labels (see **Appendix A**), none of the proposed seed treatments would result in an RQ below the Agency's chronic risk LOC for mammals. Seed incorporation is not required on the label; therefore, the seed treatment EECs for terrestrial animals and associated RQ values are calculated using the assumption that seeds are not incorporated and are readily available for consumption and that treated seed represent 100% of the diet.

RQ values are not calculated for acute, dose-based risk to birds, chronic risk to birds, or acute risk to mammals based on the proposed seed treatment uses because the toxicity endpoints from these studies are nondefinitive (*i.e.*, outside the range of test concentrations).

Table 4.10. Chronic dietary RQ values for mammals exposed to fluxapyroxad following the proposed seed treatment uses.

Seed Treatment Use(s)	App Rate (lbs a.i./100 lbs seed)	Chronic EEC (mg a.i./kg seed)	Chronic RQs NOAEC=112 mg/kg diet
Bulb vegetable seed (high rate)	0.25	2500	**22.3**
Leafy vegetable seed (medium rate)	0.2	2000	**17.9**
Rapeseed (low rate)	0.02	200	**1.80**

Bolded values exceed the Agency's LOC for chronic risk to wild mammals (RQ ≥ 1).

For terrestrial plants, RQ values for the foliar and seed treatment uses are calculated based on the most sensitive toxicity endpoints from the submitted seedling emergence tests, but only the foliar

uses are evaluated against the vegetative vigor tests, as foliar exposure of non-target plants is considered unlikely to result from the proposed seed treatment uses (**Table 4.11**). RQ values for listed species of dicot plants exceed the Agency's LOC for all of the foliar uses evaluated for semi-aquatic areas and for the following foliar uses for dry areas and spray drift: turf, berries and small fruits, grapes (*Botrytis* disease), leafy vegetables (except Brassica), strawberries, sugarcane, and tree nuts. RQ values for listed species of monocot plants are below the LOC for all foliar uses. RQ values based on runoff from seed treatment uses exceed the Agency's LOC for listed species of dicot plants in semi-aquatic areas for proposed seed treatment rates greater than 0.05 lbs a.i./A (*e.g.*, bulb vegetables, leafy vegetables, and rice). The estimates for seed treatments are based on the assumptions that the seeds are not being incorporated and 100% of the seed treatment is available for leaching/runoff. These assumptions are especially conservative for seeds which may routinely be incorporated at depths greater than 1 inch. They are more representative of scenarios where seeds are broadcast applied or incorporated less than one inch (*e.g.*, onion may be incorporated at 0.5 inches; MBS Seed Chart [http://www.mbsseed.com/garden_seed_planting_chart.htm]). RQ values are not calculated for risk to non-listed species of terrestrial plants because the IC_{25} values exceeded the maximum application rate tested. Conclusions regarding potential risk to listed and nonlisted terrestrial plants, as they relate to RQ values based on the available NOAEC values, are discussed in **Section 4.2**.

Table 4.11. RQ values for listed species[1] of non-target terrestrial and semi-aquatic plants based on proposed uses of fluxapyroxad (TerrPlant).

Use(s)	Dry Area RQs		Semi-Aquatic Area RQs		Spray Drift Only RQs	
	Monocot	**Dicot**	**Monocot**	**Dicot**	**Monocot**	**Dicot**
Turf	0.31	**2.51**	0.77	**6.27**	0.26	**2.09**
Berries and small fruits	0.24	**1.96**	0.61	**4.91**	0.20	**1.64**
Bulb vegetables						
Grapes (*Botrytis* disease)						
Leafy vegetables (except Brassica)						
Strawberries						
Sugarcane	0.15	**1.20**	0.37	**3.00**	0.12	**1.00**
Tree nuts						
Brassica leafy vegetables	0.12	0.98	0.30	**2.45**	0.10	0.82
Cucurbits						
Grapes						
Root vegetable						
Sorghum and millet						

Bulb vegetable seed (high rate)	< 0.1	0.35	0.43	**3.45**	N/A	N/A
Leafy vegetable seed (medium rate)	< 0.1	0.15	0.18	**1.45**	N/A	N/A
Rapeseed (low rate)	< 0.1	< 0.1	< 0.1	< 0.1	N/A	N/A

N/A Not applicable.
Bolded values exceed the Agency's level of concern (LOC) for risk to listed species of terrestrial plants (RQ ≥ 1).
[1] RQ values are based on the seedling emergence NOAEL values of 0.0446 (monocot) and 0.0055 (dicot) lb ai/A (dry areas and semi-aquatic areas) and the vegetative vigor NOAEL values of 0.0681 (monocot) and 0.0167 (dicot) lb ai/A (drift only). RQ values are not calculated in this assessment for nonlisted species of terrestrial plants because the IC_{25} values were all greater than the highest treatment rate tested.

Although the Agency does not typically quantify risk to non-target terrestrial invertebrates using the RQ method, acute toxicity studies with the young adult honey bee demonstrate that fluxapyroxad is practically non-toxic to young adult honey bees on an acute oral and an acute contact exposure basis (LD_{50} >11 µg a.i./bee). Additionally, a semi-field study (bee brood tunnel test) conducted with the dual a.i. product BAS 703 01 F (MRID 48812702) indicated no significant effects on bee brood development or viability. Although a slight and transient treatment-related effect on foraging of adult bees was noted, it was not identified as statistically significant.

The potential for risk to non-target terrestrial organisms, associated with the proposed uses of fluxapyroxad, is discussed further in the Risk Description (**Section 4.2.2**).

4.2. Risk Description and Conclusions

This assessment evaluates the potential for ecological risks associated with the proposed uses of the fungicide fluxapyroxad as foliar applications and seed treatments. Fluxapyroxad is a synthetic carboxamide fungicide (FRAC Group 7) that inhibits mitochondrial respiration and the subsequent production of ATP in fungal cells. Fluxapyroxad is persistent, *i.e.*, is stable to most environmental degradation and some plant metabolism processes, and has demonstrated at least some systemic activity based on plant residue studies submitted by the registrant.

4.2.1. Aquatic Organisms

Acute RQ values are below the listed (RQ≥0.05) and non-listed (RQ≥0.1) species and chronic (RQ≥1.0) risk LOCs for all assessed aquatic organisms based on toxicity of the TGAI for all proposed uses, except for acute and chronic risk LOCs for listed species based on the proposed use on rice. The peak EEC is within an order of magnitude of concentrations observed in the aquatic field dissipation study meant to mimic rice applications. While culturing rice and freshwater fish and invertebrates together has been documented (LSU AgCenter, 2007), it is uncertain as to whether listed species would dwell in, and be exposed to water concentrations in, rice paddies. As a result, risk to listed and nonlisted aquatic organisms from fluxapyroxad TGAI is considered to be low.

Based on endpoints for the fluxapyroxad formulations that contain pyraclostrobin (BAS 703 01 F [Merivon®], BAS 703 02 F [Priaxor®], and Lexicon) and on spray drift-only EECs, there is potential acute risk to listed aquatic animals for all proposed uses. RQ values for the uses of

BAS 703 01 F [Merivon®] on berries and small fruits, bulb vegetables, grapes, and leafy vegetables exceed the Agency's LOC for acute risk to non-listed freshwater fish. RQ values for the uses of BAS 703 02 F [Priaxor®] on bulb vegetables, cucurbits, grapes, and root vegetables exceed the LOC for acute risk to non-listed freshwater fish. RQ values for the use of Lexicon on turf exceed the LOC for acute risk to non-listed freshwater fish. The enhanced toxicity of the dual-a.i. formulations appears to be driven by pyraclostrobin; when the toxicity endpoints for freshwater fish and invertebrates are adjusted for the percentage of pyraclstrobin in each product, they are similar to toxicity endpoints for the pyraclostrobin a.i. (*e.g.*, USEPA 2011, DP Barcode D380640), as illustrated in **Table 4.12**. In some cases, freshwater plants and animals are also more sensitive to formulations of fluxapyroxad alone (*e.g.*, BAS 700 01 F [Imbrex] and BAS 700 04 F [Sercadis]) than to the TGAI. However, none of the RQ values for formulations with fluxapyroxad alone approach or exceed LOCs.

Risk to listed and nonlisted vascular and nonvascular aquatic plants from fluxapyroxad TGAI and its formulated products is considered to be low since RQ values are below the Agency's LOC (RQ≥1).

Table 4.12. Comparison of aquatic ecotoxicity endpoints for BAS 703 01 F [Merivon®] and BAS 703 02 F [Priaxor®] with existing pyraclostrobin endpoints.

Study Type	Species	Endpoints (mg pyraclostrobin a.i./L)		
		BAS 703 01 F [Merivon®]	**BAS 703 02 F [Priaxor®]**	**Pyraclostrobin[1]**
Acute toxicity to freshwater fish	Rainbow trout (*Oncorhynchus mykiss*)	LC_{50} = 0.007	LC_{50} = 0.009	LC_{50} = 0.006
Acute toxicity to freshwater invertebrates	Water flea (*Daphnia magna*)	EC_{50} = 0.015	EC_{50} = 0.016	EC_{50} = 0.016
Acute toxicity to estuarine/marine fish	Sheepshead minnow (*Cyprinidon variegatus*)	LC_{50} = N/A	LC_{50} = N/A	LC_{50} = 0.077
Acute toxicity to estuarine/marine crustaceans	Mysid shrimp (*Americamysis bahia*)	EC_{50} = N/A	EC_{50} = N/A	EC_{50} = 0.004
Toxicity to estuarine/marine molluscs – shell deposition	Eastern oyster (*Crassostrea virginica*)	IC_{50} = N/A	IC_{50} = N/A	IC_{50} = 0.013

N/A Not applicable. Formulated product toxicity data using BAS 703 01 F and BAS 703 02 F were not provided for estuarine//marine fish, crustaceans, or molluscs.

[1] Pyraclostrobin endpoints obtained from USEPA 2011 (DP Barcode D380640 *et seq.*).

Figures 4.1 and **4.2** depict the time series peak EECs from the PRZM/EXAMS spray drift only analysis for the highest peak EEC (use on turf) and lowest peak EEC (use on sugarcane) for uses of BAS 703 02 F (Priaxor®). A review of the time series data indicates that, in general, the 90th percentile peak EEC for the modeled uses occurs as a result of accumulation from repeated annual application over 30 years. However, in most cases, exceedence of the listed species LOC can occur much sooner. For all uses, the LOCs for listed species at 0.225 µg/L (4.5 µg/L x 0.05)

and 0.415 µg/L (8.3 µg/L x 0.05) are exceeded in the first year of applications. For uses where the LOCs for nonlisted species at 2.25 µg/L (4.5 µg/L x 0.5) are exceeded, the LOC is usually exceeded after 2-12 repeated years of application. The LOC for nonlisted species at 4.15 µg/L (8.3 µg/L x 0.5) is only exceeded for use on turf, where the exceedence occurs after 5 years of consecutive use. In cases where the application rate is low, such as sugarcane, accumulation in the pond does not occur. It should be noted that EECs from the predicted accumulation reflect maximum usage of fluxapyroxad for 30 years and a pond that has no outlet, which may not necessarily be representative of real world conditions. However, given fluxapyroxad's high persistence in soil and aquatic environments, concentrations of fluxapyroxad over the long-term could potentially be a concern.

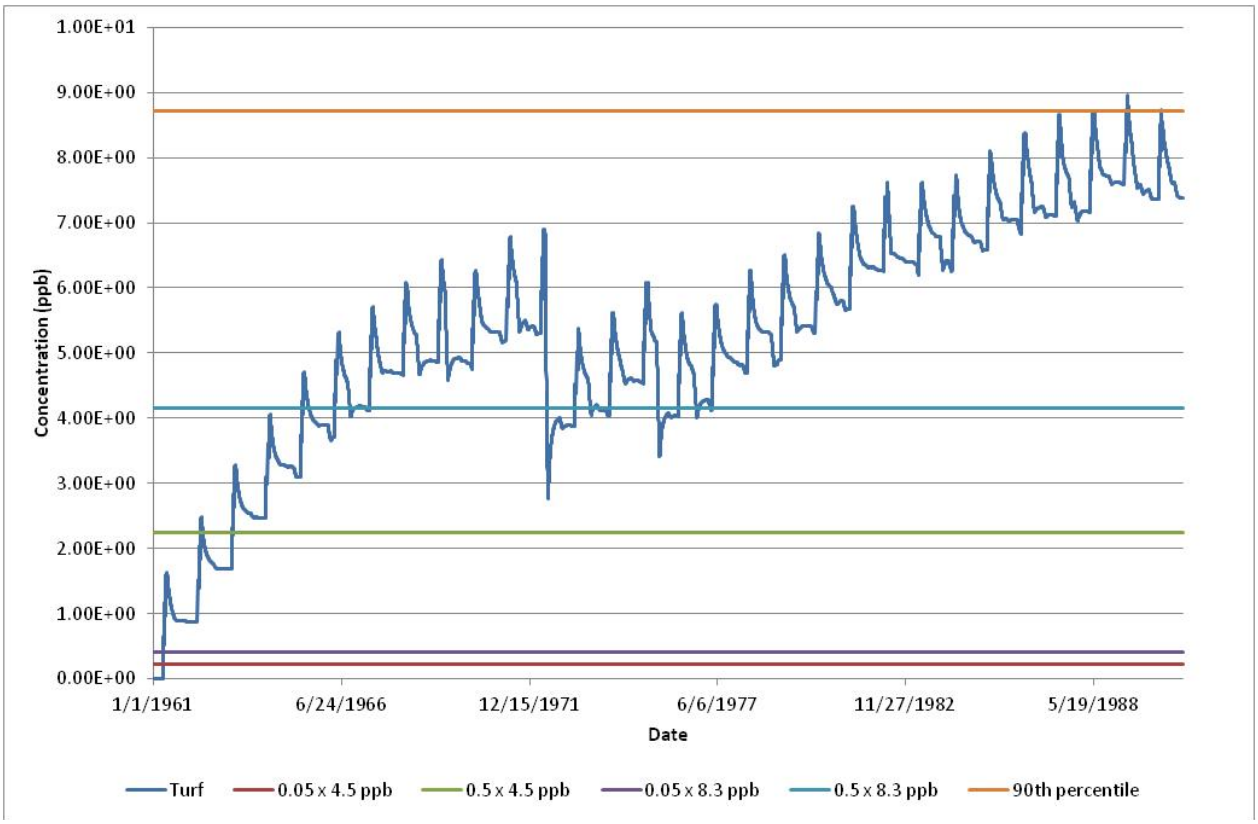


Figure 4-1. Turf peak EECs from spray drift only analysis.

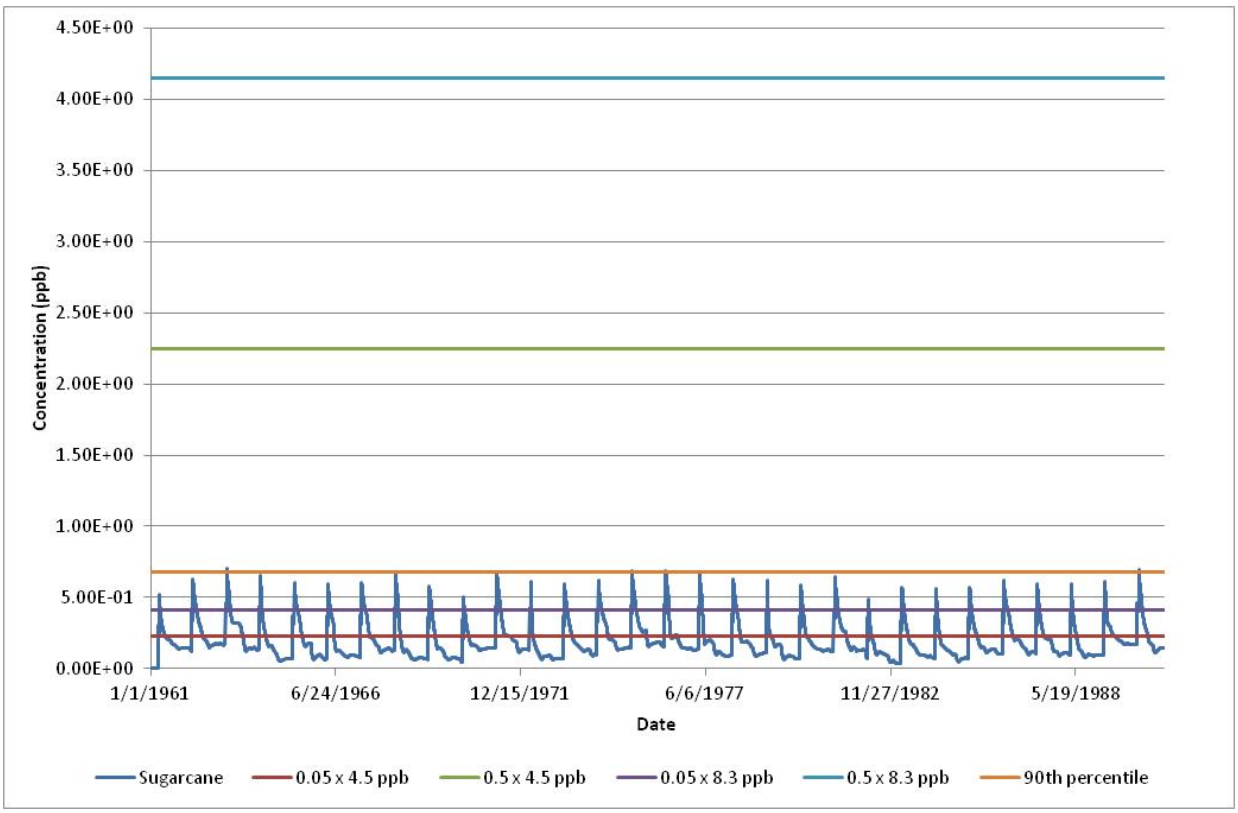


Figure 4-2. Sugarcane peak EECs from spray drift only analyses.

Depending on the percent organic matter content of benthic sediments, fluxapyroxad can partition to sediments. The potential for risk to benthic organisms exposed to sediment pore water is also considered, using the conservative assumption that the highest concentrations tested in the amphipod studies represent the toxicity thresholds (**Table 4.3)**. In this estimation, the acute RQ value for benthic invertebrates (RQ≤0.02) is similar to the RQ values for fish and invertebrates exposed to TGAI in the water column, and it does not exceed the acute risk to listed or non-listed species LOCs.

4.2.2. Terrestrial Organisms

Acute RQ values are not calculated in the Risk Estimation section for dose-based risk to birds or for dose- or dietary-based risk to mammals because the necessary toxicity endpoints (LD_{50}/LC_{50}) were determined to be greater than the limit dose in the submitted studies. Therefore, although fluxapyroxad is classified as practically non-toxic to birds and mammals on an acute oral and subacute dietary exposure basis, the nature and potential dose-response relationship of any effects of fluxapyroxad at exposure levels above the limit dose are unknown.

For the proposed foliar uses of fluxapyroxad, the potential for acute risk to birds and mammals is characterized using the conservative assumption that the limit dose or maximum dose tested in the submitted oral toxicity studies (*i.e.*, 2,000 mg/kg bw) represents the toxicity endpoint. Under these conditions, the foliar use of fluxapyroxad is not expected to result in acute risk of mortality to listed or non-listed species of birds (and reptiles and terrestrial-phase amphibians for which

birds serve as surrogates) or mammals because the resulting RQ values are all less than the acute risk LOC, *i.e.*, RQ<0.5 for nonlisted species and RQ<0.1 for listed species.

The RQ values in **Section 4.1** demonstrate that both foliar and seed treatment uses of fluxapyroxad may result in chronic risk to mammals (RQ≥1.0). RQ values are not calculated for chronic risk to birds because a statistically significant decrease in hatchling body weight was observed at all treatment levels in the submitted avian reproduction study with bobwhite quail. Therefore, the chronic toxicity endpoint for bobwhite quail is nondefinitive (*i.e.*, NOAEC<100 mg ai/kg diet). Assuming the NOAEC=100 mg ai/kg diet results in RQs=1.14 for foliar applications, based on maximum application rate to berries and small fruits, bulb vegetables, leafy vegetables (except Brassica), strawberries, and grapes (*Botrytis* disease) for short grass, exceeding the Agency's LOC for chronic risk to birds (LOC=1.0). Additionally, chronic risk to birds cannot be precluded with confidence because the submitted data do not establish whether adverse effects may occur at dietary concentrations less than 100 mg ai/kg diet. In order to preclude risk at the screening level, a NOAEC≥80 mg/kg-diet would need to be established, which is unlikely based on the flat concentration-response for the effect on body weight in the bobwhite quail study. The 5 – 7% decrease in hatchling body weight was transient during the study and was not observed in the study with mallard duck. As a result, it is uncertain whether and how this effect may impact the fitness of (and therefore risk to) different species and size classes of birds, reptiles, and terrestrial-phase amphibians exposed to fluxapyroxad in the wild.

For the proposed seed treatment uses of fluxapyroxad, the potential for acute risk to birds is characterized in **Table 4.14** by converting the subacute dietary toxicity endpoint for bobwhite quail (LC_{50}, from the first experiment conducted under normal laboratory lighting conditions) to a subacute oral LD_{50} value that represents the total a.i. consumed per kilogram body weight (kg bw) over the 5-day study. The calculation is performed based on information in the study report, as follows:

LC_{50} = 2457 mg a.i./kg diet, corresponds to 561 mg a.i./kg bw/day (reported by the study)
LD_{50} = 561 mg a.i./kg bw/day x 5 days exposure = 2805 mg a.i./kg bw

The calculated LD_{50} is then compared to the dose-based EEC (USEPA 2008*b*) values and the spatial EECs generated by T-REX to determine RQ values for risk characterization. Terrestrial exposure of mammals through consumption of treated seeds is characterized in **Table 4.13** using the conservative assumption for mammals that the maximum dose tested (2,000 mg/kg bw) represents the toxicity endpoint (LD_{50}). The toxicity endpoint is then adjusted for the body weight (bw) of the test specimens (default bw=178 g for bobwhite quail and 350 g for Norway rat) and compared to the estimated exposure per unit area (mg a.i./ft^2) and per daily dose of treated seed, *i.e.*, dose-based EEC in terms of mg a.i./kg bw/day (USEPA 2008*b*) .

Table 4.13. Characterization of potential risk to terrestrial birds and mammals from consumption of treated seeds, assuming that the limit dose tested in effects studies is the definitive toxicity endpoint.

Use	App Rate lbs a.i. /A (#app)	App Method	EECs		Toxicity Endpoints	Characterization Terrestrial RQ Values	
			Spatial (mg a.i./ft^2)	Dose-Based (mg a.i./kg-bw/d)	Animals	Acute Spatial	Acute Dose-Based
Bulb vegetable seed (high rate)	0.19 (1)	Seed	1.96	633	**Birds** LD_{50}=2,805 mg/kg-bw LC_{50}=2,457 mg/kg diet NOAEC<100 mg/kg diet NOAEL<7.8 mg/kg-bw	0.05	**0.31**
				530	**Mammals** LD_{50}>2,000 mg/kg-bw NOAEC=112 mg/kg diet NOAEL=10 mg/kg-bw	0.03	**0.12**
Leafy vegetable seed (medium rate)	0.08 (1)	Seed	0.83	506	**Birds** LD_{50}=2,805 mg/kg-bw LC_{50}=2,457 mg/kg diet NOAEC<100 mg/kg diet NOAEL<7.8 mg/kg-bw	0.02	**0.25**
				424	**Mammals** LD_{50}>2,000 mg/kg-bw NOAEC=112 mg/kg diet NOAEL=10 mg/kg-bw	0.01	**0.08**
Rapeseed (low rate)	0.002 (1)	Seed	0.06	50.6	**Birds** LD_{50}=2,805 mg/kg-bw LC_{50}=2,457 mg/kg diet NOAEC<100 mg/kg diet NOAEL<7.8 mg/kg-bw	<0.01	0.03
				42.4	**Mammals** LD_{50}>2,000 mg/kg-bw NOAEC=112 mg/kg diet NOAEL=10 mg/kg-bw	<0.01	0.01

Bold values are RQs that exceed the Agency's acute risk LOC (RQ>0.05) for listed species.

The available data indicate that acute mortality to listed mammals is possible, as RQ values exceed the Agency's acute risk LOC for bulb and leafy vegetable seeds. However, for mammals, as the LD_{50} exceeds the limit dose of the study, there was no mortality observed at this limit dose. While there is uncertainty surrounding risk to listed mammals based on sublethal effects, the sublethal effects observed in the toxicity study were not dose dependent and therefore it is expected that the potential for risk to listed species would be low.

While the available data indicate that acute mortality to listed birds is also possible, the potential for acute risk to listed species of birds can be further characterized by considering how foraging ecology affects the potential for exposure. The Nagy allometry food ingestion rate of a 20 g bird is approximately 5 g/day. To consume a mass of fluxapyroxad equivalent to the acute dietary toxicity endpoint in the submitted study with bobwhite quail, a 20-g bird would have to consume 40.4 mg a.i., equivalent to 16.2 g (0.035 lbs) of bulb vegetable seed treated at the maximum proposed application rate (0.25 lbs a.i./cwt). This is considered an unlikely, though not impossible, scenario for most species. Smaller, migrating birds that eat seeds are expected to be

at the highest risk of exposure, since they have higher surface area-to-body weight ratios and they must rapidly refuel energy reserves exhausted during migration (Klassen & Lindstrom 1996). In a short period of time (*e.g.*, one day or less), these birds may consume larger amounts of seeds, relative to body size, in magnitudes that approach or exceed their own body weight. Nonetheless, given that adult mortality was observed only in one subacute dietary toxicity experiment with bobwhite quail and at relatively high concentrations when compared to EECs, the likelihood of frank mortality is considered low even if a bird did consume the large amount of treated seed necessary to be exposed to the limit dose.

As the foraging efficiency of a granivore decreases, the area of exposure (*i.e.*, treated field) necessary to exceed the LOC increases. For example, assuming conservatively that the maximum dose tested in the submitted studies represents the LD_{50} value for birds, a 20-g, seed-eating bird with 100% foraging efficiency (*i.e.*, that all of the seeds are treated and that the bird eats all seeds within a given area) would consume enough fluxapyroxad in a 5-ft^2 area to exceed the LOC for acute risk to listed species of birds, reptiles and terrestrial-phase amphibians. Using the same assumption, a 20-g bird would consume enough fluxapyroxad to exceed the acute risk LOC for listed birds if it displayed 50% foraging efficiency in a 10-ft^2 foraging area, or if it displayed 10% foraging efficiency within a 50-ft^2 foraging area. The actual foraging area necessary to result in mortality to birds at a level equivalent to an LD_{50} (*i.e.*, mortality of 50% of exposed birds) is likely much greater given that no mortality was observed at the maximum dose tested. Additionally, seed incorporation would further reduce the likelihood of exposure to birds and mammals from the proposed seed treatment uses. As the acute spatial RQs for birds in **Table 4.19** are below the acute risk LOC, the potential for acute risk to birds is considered low. All risk conclusions for birds in this assessment are intended to apply to reptiles and terrestrial-phase amphibians as well.

As with birds and mammals, laboratory based acute toxicity tests with terrestrial invertebrates (*i.e.*, honey bee) have demonstrated that fluxapyroxad is practically non-toxic on an acute contact and acute oral exposure basis. However, two of the fluxapyroxad end-use products (BAS 703 01 F and BAS 703 02 F) proposed for registration are co-formulated with pyraclostrobin and are similar in that respect to the registered product, Pristine®, which is a dual-a.i. formulation from the same registrant that contains the similarly structured fungicide boscalid (25.2%) and pyraclostrobin (12.8%). Previous risk assessments for boscalid (DP Barcodes D363523, D379809, D385653), which – like fluxapyroxad – is a pyridine carboxamide, have described uncertainties regarding potential effects on development of honey bee brood, based on incident reports and communications with beekeepers. Submitted toxicity studies indicate that neither fluxapyroxad, any of its end-use products proposed for registration in the United States, nor boscalid or Pristine® are acutely toxic to young adult honey bees. In addition, submitted semi-field studies for fluxapyroxad (BAS 700 00 F, a formulation of fluxapyroxad not proposed for US registration, and BAS 703 01 F, a formulation with fluxapyroxad and pyraclostrobin) and with a similar fungicide formulation Pristine® demonstrated no overall effects on honey bee brood, although EFED identified transient effects on eggs, larvae, and forage bee mortality in the study with Pristine® (DP Barcode 390033). Although honey bee queen breeders have expressed concerns regarding the potential effects of Pristine® on queen development, studies conducted of the formulated product under semi-field condtions (DP Barcode D408124) have not demonstrated any significant effect on queen development.

Finally, the proposed new uses of fluxapyroxad are expected to result in risk to listed non-target terrestrial plants. RQ values for listed species of dicot plants exceed the Agency's LOC for all of the foliar uses evaluated except for curcurbits, grapes (not *Botrytis* disease), root vegetables, and sorghum and millet. Of the six dicot species tested in the vegetative vigor study with BAS 703 02 (Priaxor®), only the tomato, based on inhibition of dry weight, demonstrated a significant effect. However, the same formulation (BAS 703 02 F [Priaxor®]) significantly inhibited cabbage (dry weight), carrot (emergence), and lettuce (height) in the seedling emergence study. Thus, any effects on non-target dicot plants are likely to differ based on both species and route of exposure. RQ values for listed species of monocot plants are below the LOC for all foliar uses. RQ values are not calculated for nonlisted terrestrial plants because a 25% effect was not observed in any species exposed to fluxpayroxad at rates up to and including the maximum proposed application rate; therefore, the likelihood of adverse effects to nonlisted plants is considered to be low. RQ values based on seed treatment uses exceed the LOC at proposed use rates above 0.055 lbs a.i./A (*e.g.*, bulb vegetables, leafy vegetables, and rice) evaluated for listed species of dicot plants in semi-aquatic areas, but are below the LOC for all other nontarget plants. Risk estimates are sensitive to parameters such as incorporation depth of the seeds and seeding rate; in cases where seeds are incorporated greater than or equal to one inch, potential exposure via runoff is expected to be reduced, and risk would not exceed the LOC. It is uncertain to what extent exposure may occur via particulate drift from abrasion of treated seeds during planting and how this type of exposure may affect risk to non-target organisms.

4.2.3. Conclusions

The risk hypothesis and conceptual models articulated in the initial problem formulation of this assessment identified concerns that the proposed uses of fluxapyroxad may result in adverse effects on survival, growth and/or reproduction in aquatic organisms, and that the compound may pose a chronic risk to small birds, terrestrial-phase amphibians and reptiles, and to all size classes of mammals. Although fluxapyroxad was not expected to pose a risk to aquatic plants or to terrestrial monocots, the problem formulation indicated that there was uncertainty regarding the potential effects of the compound on terrestrial dicots through runoff and spray drift.

Based on this screening-level assessment, the physico-chemical properties of fluxapyroxad indicate that the fungicide is persistent and has a potential to reach aquatic environments for several months or more following foliar applications and seed treatments. Although available ecotoxicity data demonstrate that fluxapyroxad is acutely toxic to aquatic organisms and may cause chronic effects, including effects linked to reproduction and sublethal behavioral effects in some aquatic test species, the surface water EECs that result from the proposed foliar and seed treatment uses, except for rice, are relatively low and the resulting risk estimates for the TGAI are below LOCs. For rice, while the acute and chronic RQs exceed the listed LOCs, the probability that listed species inhabit rice paddies is considered low; hence, the risk to listed species is considered low. Therefore, based on the maximum proposed use rates, the potential for exposure to the fluxapyroxad TGAI in surface water at a level that is likely to cause direct acute or chronic effects on aquatic organisms, including fish, aquatic invertebrates, aquatic-phase amphibians, and aquatic plants, is considered low. Acceptable chronic toxicity data for estuarine/marine animals were not available. Additional studies were not requested because

estuarine/marine animals were similarly or less acutely sensitive to the TGAI than freshwater animals in the acute studies; when considered in the context of the relatively low EECs, new data would be unlikely to change the screening-level risk conclusions. Despite the persistence of fluxapyroxad, its propensity to partition to sediments, its K_{ow} and the available fish biocencentration data indicate that fluxapyroxad does not bioconcentrate but is instead readily metabolized and excreted in fish. There is greater uncertainty about the extent to which fluxapyroxad may persist and/or bioconcentrate in aquatic invertebrates, which may be more or less able to metabolize the parent compound. However, additional biococentration and bioaccumulation modeling is not triggered in this case because of the chemical's relatively low K_{ow}.

Formulated fluxapyroxad is in some cases more toxic than the TGAI to aquatic organisms. Exposure to dual-a.i. formulations of fluxapyroxad (BAS 703 01 F [Merivon®], BAS 703 02 F [Priaxor®], and Lexicon) as a result of spray drift may result in acute mortality of listed freshwater fish, aquatic-phase amphibians, and freshwater invertebrates. Certain proposed uses of BAS 703 01 F [Merivon®] (berries and small fruits, bulb vegetables, grapes, and leafy vegetables), BAS 703 02 F [Priaxor®] (bulb vegetables, cucurbits, grapes, and root vegetables), and the proposed use of Lexicon on turf also result in acute RQ values that exceed the LOC for nonlisted freshwater fish. Spray drift-based EECs for the proposed uses of co-formulated fluxapyroxad range from 0.87 to 8.71 μg/L. Although toxicity data for estuarine/marine animals exposed to formulated fluxapyroxad were not submitted, freshwater and estuarine/marine organisms generally exhibited similar responses to the TGAI; therefore, this assessment concludes that there is a potential for acute mortality of estuarine/marine animals when the proposed use of BAS 703 01 F [Merivon®], BAS 703 02 F [Priaxor®], or Lexicon results in spray drift to estuarine/marine habitat. The greater toxicity of the dual a.i. formulations to fish and invertebrates, when compared to the fluxapyroxad TGAI and formulations containing fluxapyroxad as the only active ingredient, appears to be driven by pyraclostrobin.

Terrestrial vertebrates may be exposed to fluxapyroxad by contact with or ingestion of treated plants and insects. Seed-eating (granivore) birds and mammals may also be exposed to fluxapyroxad as a result of the proposed seed treatment use. This assessment concludes that the proposed foliar and seed treatment uses of fluxapyroxad may result in chronic risk to mammals that exceed the Agency's LOC. Chronic risk to birds, reptiles, and terrestrial-phase amphibians cannot be precluded with certainty based on the available data, which demonstrated a slight (5-7%) and transient ($\leq$14 day), but statistically significant ($p<0.05$), effect on body weight in hatchling birds at all test concentrations. This effect was uniform across all test concentrations (100-1,000 mg/kg diet) and although it does not appear to be dose-responsive, it is consistent with effects on body weight and body weight gain in rat pups (NOAEC=112 mg/kg diet) in a two-generation reproduction study with mammals. In order to preclude chronic risk (*i.e.*, ensure RQ<1) to birds, reptiles, and terrestrial-phase amphibians, based on the proposed uses, an avian reproduction study would need to establish that no adverse effects, including effects on hatchling body weight, are observed at concentrations greater than or equal to 80 mg/kg diet. Given the flat concentration-response in this case, EFED considers it unlikely that an additional study would yield a NOAEC that would allow risk to be precluded at the screening level.

Based on EECs and the available ecotoxicity data, the likelihood of acute mortality to mammals, birds, reptiles and terrestrial-phase amphibians is considered low.

The proposed foliar use of fluxapyroxad may result in risk to listed species of terrestrial and semi-aquatic dicot plants, but risk to monocot plants and nonlisted dicot plants is not expected to exceed the LOC.

This assessment does not evaluate risk to terrestrial invertebrates. However, ecotoxicity data indicate that fluxpyroxad is practically non-toxic to young adult honey bees on an acute oral and contact exposure basis. While, non-guideline studies with beneficial insects (predatory mite, parasitoid wasp, green lacewing, rove beetle) and with earthworms demonstrated effects on reproduction and resulted in mortality in some cases, submitted semi-field studies for fluxapyroxad (BAS 700 00 F, a formulation of fluxapyroxad not proposed for US registration, and BAS 703 01 F, a formulation with fluxapyroxad and pyraclostrobin) demonstrated no overall effects on honey bee brood (MRIDs 47923749 and 48812702). Although honey bee queen breeders have expressed concerns regarding the potential effects of a similar fungicide formulation Pristine® on queen development, studies conducted of this formulated product under semi-field condtions have not demonstrated any significant effect on queen development (DP Barcode 408124).

5. Federally Threatened and Endangered (Listed) Species of Concern

Section 7 of the Endangered Species Act, 16 U.S.C. Section 1536(a)(2), requires all federal agencies to consult with the National Marine Fisheries Service (NMFS) for marine and anadromous listed species, and the United States Fish and Wildlife Service (USFWS) for listed wildlife and freshwater organisms, if the proposed "action" may affect listed species or their designated critical habitat. Each federal agency is required under the Act to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. To jeopardize the continued existence of a listed species means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of the species" (50 C.F.R. § 402.02).

To facilitate compliance with the requirements of the Endangered Species Act (subsection (a)(2)), the Office of Pesticide Programs has established procedures to evaluate whether a proposed registration action may directly or indirectly appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of any listed species (USEPA 2004a). After the Agency's screening-level risk assessment is conducted, if any of the Agency's listed species LOCs are exceeded for either direct or indirect effects, an analysis is conducted to determine if any listed or candidate species may co-occur in the area of the proposed pesticide use or areas downstream or downwind that could be contaminated from drift or runoff/erosion. If listed or candidate species may be present in the proposed action area, further biological assessment is undertaken. The extent to which

listed species may be at risk is considered, which then determines the need for the development of a more comprehensive consultation package, as required by the Endangered Species Act.

The federal action addressed herein is the proposed registration of new foliar and seed treatment uses for fluxapyroxad. It is expected that the new uses of fluxapyroxad could occur nationwide.

5.1. Action Area

For listed species assessment purposes, the action area is considered to be the area affected directly or indirectly by fluxapyroxad use and not merely the immediate area where fluxapyroxad is applied. At the initial screening-level, the risk assessment considers broadly described taxonomic groups and conservatively assumes that listed species within those broad groups are co-located with the pesticide treatment area. This means that terrestrial plants and wildlife are assumed to be located on or adjacent to the treated 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, which has the relatively highest potential exposure to the pesticide, and that exposures are likely to decrease with distance from the treatment area. **Section 5.2** of this risk assessment presents the proposed pesticide use sites that are used to establish initial co-location of species with treatment areas.

5.2. Taxonomic Groups Potentially at Risk

If the assumptions associated with the screening-level action area result in RQs 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, RQs below the listed species LOCs for a given taxonomic group indicate no concern for indirect effects on listed species that depend upon the taxonomic group for which the RQ was calculated. However, in situations where the screening assumptions lead to RQs 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 are considered to determine the extent to which screening assumptions regarding an action area apply to a particular listed organism. These subsequent refinement steps will consider how this information would impact the action area for a particular listed organism and potentially include areas of exposure that are downwind and downstream of the pesticide use site.

Assessment endpoints, exposure pathways, the conceptual models addressing the proposed new fluxapyroxad uses, and the associated exposure and effects analyses conducted for the fluxapyroxad screening-level risk assessment are in **Sections 2** to **3**. The assessment endpoints used in the screening-level risk assessment include those defined operationally as reduced survival and reproductive impairment for both aquatic and terrestrial animal species and survival, reproduction, and growth of non-target aquatic and terrestrial plant species from exposure via spray drift and runoff. These assessment endpoints address the standard set forth in the Endangered Species Act requiring federal agencies to ensure that any action it authorizes does

not appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of the species. Risk estimates (RQ values) integrating exposure and effects are calculated for broad-based taxonomic groups in the screening-level risk assessment and are presented in **Section 4.**

Both acute and chronic risk to listed species LOCs are considered in the screening-level risk assessment to identify direct and indirect effects to taxa of listed species. This section identifies direct and indirect effect concerns, by taxa, that are triggered by exceeding listed species LOCs in the screening-level risk assessment (**Table 5.1**). When applicable, probit dose response analysis is used to evaluate the probability of individual acute effects for exposures that occur at the established listed species LOC (**Section 5.2.1**). Data on exposure and effects collected under field (when available) and laboratory conditions are evaluated to make determinations on the predictive utility of the direct effect screening assessment findings to listed species.

Table 5.1 Potential effects to federally listed taxa associated with the proposed uses of fluxapyroxad.

Listed Taxon	Direct Effects		Indirect Effects from Risk to Other Taxa	
	Yes/No	Acute/Chronic	Yes/No	Through ...
Terrestrial and semi-aquatic plants – monocots and dicots	Yes (dicots only)	NA	Yes	Chronic effects on birds, terrestrial-phase amphibians, and mammals, when required for pollination or seed dispersal.
Birds	Yes	Chronic	Yes	Chronic effects on mammals that serve as prey; chronic effects on reptiles and amphibians that serve as prey.
Terrestrial-phase amphibians	Yes	Chronic	Yes	Chronic effects on mammals which provide habitat (*e.g.*, burrows) and serve as prey.
Reptiles	Yes	Chronic	Yes	Chronic effects on mammals that serve as prey; chronic effects on birds, reptiles, and amphibians that serve as prey.
Mammals	Yes	Chronic	Yes	Chronic effects on birds, reptiles, and amphibians that serve as prey; chronic effects on mammals that serve as prey.
Aquatic plants	No	NA	Yes	Effects on semi-aquatic dicot plants that serve as primary producers.
Freshwater fish	Yes	Acute (dual a.i. EPs only)	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Aquatic-phase amphibians	Yes	Acute (dual a.i. EPs only)	Yes	Chronic effects on terrestrial-phase amphibians; effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Freshwater invertebrates	Yes	Acute (dual a.i. EPs only)	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Molluscs	No	NA	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.
Marine/estuarine fish	Yes	Acute	Yes	Effects on semi-aquatic dicot plants that

Listed Taxon	Direct Effects		Indirect Effects from Risk to Other Taxa	
	Yes/No	Acute/Chronic	Yes/No	Through ...
		(dual a.i. EPs only)		provide habitat and serve as primary producers.
Marine/estuarine invertebrates	Yes	Acute (dual a.i. EPs only)	Yes	Effects on semi-aquatic dicot plants that provide habitat and serve as primary producers.

[EP] End-use product. [NA] Not applicable.

5.2.1. Probit Dose-Response Analysis

The Agency uses the probit dose-response relationship as a tool for providing additional information on the potential for acute direct effects to individual listed species and to terrestrial and aquatic animals that may indirectly affect the listed species of concern (USEPA 2004a). Based on the available acute toxicity data and RQ values for fluxapyroxad, a summary of the probit dose-response analysis is provided in **Table 5.2**. If no dose-response information is available to estimate a slope for this analysis, a default slope assumption of 4.5 (with lower and upper bounds of 2 to 9) is used (Urban and Cook 1986). Individual effect probabilities are calculated based on a Microsoft® Excel spreadsheet tool IECV1.1 (Individual Effect Chance Model Version 1.1) developed by the U.S. EPA, OPP, Environmental Fate and Effects Division (June 22, 2004). The model allows for such calculations by entering the mean slope estimate (and the 95% confidence bounds of that estimate) as the slope parameter for the spreadsheet. The desired threshold for the probability of an individual effect is entered as the listed species LOC. In addition, the probability of an individual effect is also derived based on the calculated acute RQ, if available.

As shown in **Table 5.2**, the chance of acute direct effects (*i.e.*, mortality) to individual listed fish at the listed species LOC is 1 in 4.18×10^{8} (95% CI: 216 to 1.75×10^{31}). However, at the highest derived RQ value (1.94; **Table 4.6**) for the proposed uses of dual a.i. formulations of fluxapyroxad, the chances of an individual effect increase for fish to approximately 1 in 1. For freshwater invertebrates, the chance of acute direct effects (*i.e.*, mortality) at the listed species LOC is 1 in 8.19×10^{31} (95% CI: 1.66×10^{13} to 5.58×10^{61}). At the highest derived RQ value (1.05; **Table 4.6**) for dual a.i. formulations of fluxapyroxad, the chances increase to 1 in 2. These probabilities are based on exposure to formulated fluxapyroxad (BAS 703 02 F [Priaxor®]) in surface water from spray drift only. In the absence of ecotoxicity data for estuarine/marine animals exposed to formulated fluxapyroxad, this assessment assumes that the likelihood of an individual effect for these taxa is similar to that for freshwater fish and invertebrates. The likelihood of an individual acute effect is not calculated for acute oral exposure to birds and mammals because an effect is considered unlikely.

Table 5.2. Summary of fluxapyroxad probit dose response analysis for listed species.

Taxa (study type)	Acute Effect Slope (95% C.I.)	Chance of Individual Effect at Listed Species LOC (95% C.I.)	Chance of Individual Effect at Derived Acute RQ[1] (95% C.I.)
Bird oral dose	No mortality observed	Not calculated; no mortality observed	Not calculated; no mortality observed
Bird dietary	Mortality[1] Slope NA = 4.5 (2 – 9)	1 in 2.94 x 10^{5} (1 in 44 to 1 in 8.86 x 10^{18})	1 in 2.76 x 10^{11} (1 in 862 to 1 in 2.14 x 10^{42})
Mammal oral dose	No mortality observed	Not calculated; no mortality observed	Not calculated; no mortality observed
Freshwater fish	Mortality[2] Slope NA = 4.5 (2 – 9)	1 in 4.18 x 10^{8} (1 in 216 to 1 in 1.75 x 10^{31})	1 in 2.76 x 10^{11} (1 in 862 to 1 in 2.14 x 10^{42})
	Mortality (dual a.i. EPs)[3] Slope NA = 4.5 (2 – 9)	1 in 4.18 x 10^{8} (1 in 216 to 1 in 1.75 x 10^{31})	1 in 2.07 (1 in 2.03 to 1 in 2.13)
Freshwater invertebrate	Mortality[4] Slope NA = 4.5 (2 – 9)	1 in 4.18 x 10^{8} (1 in 216 to 1 in 1.75 x 10^{31})	1 in 8.86 x 10^{18} (1 in 31.6 x 10^{4} to 1 in 1.03 x 10^{72})
	Mortality (dual a.i. EPs)[5] Slope 9.1 (5.7 – 13)	1 in 8.19 x 10^{31} (1 in 1.66 x 10^{13} to 1 in 5.58 x 10^{63})	1 in 165 (1 in 17.2 to 1 in 5,920)
Estuarine/marine fish	Mortality[6] Slope NA = 4.5 (2 – 9)	1 in 4.18 x 10^{8} (1 in 216 to 1 in 1.75 x 10^{31})	1 in 8.86 x 10^{18} (1 in 3.16 x 10^{4} to 1 in 1.03 x 10^{72})
Estuarine/marine crustacean	Mortality[6] Slope NA = 4.5 (2 – 9)	1 in 4.18 x 10^{8} (1 in 216 to 1 in 1.75 x 10^{31})	1 in 8.86 x 10^{18} (1 in 3.16 x 10^{4} to 1 in 1.03 x 10^{72}
Estuarine/marine mollusc	Mortality[6] Slope NA = 4.5 (2 – 9)	1 in 4.18 x 10^{8} (1 in 216 to 1 in 1.75 x 10^{31})	1 in 8.86 x 10^{18} (1 in 3.16 x 10^{4} to 1 in 1.03 x 10^{72}

[1] Maximum acute dietary RQ = 0.03 (birds).
[2] Based on exposure to the TGAI. Maximum acute RQ (0.03) did not exceed the LOC.
[3] Based on exposure to the fluxpyroxad EP (BAS 703 02 F). Maximum acute RQ used in calculation (0.98) is based on spray drift from application to stone fruit.
[4] Based on exposure to the TGAI. Maximum acute RQ (<0.01) did not exceed the LOC.
[5] Based on exposure to the fluxpyroxad EP (BAS 703 02 F). Maximum acute RQ used in calculation (0.53) is based on spray drift from application to stone fruit.
[6] Based on exposure to the TGAI. Maximum acute RQ (0.01) did not exceed the LOC.
EP End-use product. NA Not available.

5.2.2. Listed Species Occurrence with Proposed New Use of Fluxapyroxad

A preliminary analysis of the co-occurrence of listed species and the proposed new uses of fluxapyroxad was conducted using OPP's LOCATES database (v. 2.2.5). 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. The objective is to provide insight into the potential for exposure of listed species and to identify those areas, crop uses, and listed species that warrant further attention. The LOCATES database uses location information for listed species at the county level and compares it to agricultural census data 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 is proposed for use.

Appendix E provides a species listing by state for those listed species that may potentially be impacted by the proposed new uses of fluxapyroxad.

A tabulation of the number of unique listed species in each state that may co-occur with the proposed new use of fluxapyroxad as a seed treatment on rapeseed is provided in **Table 5.3**. Although this assessment does not evaluate risk to terrestrial invertebrates, terrestrial invertebrates are included in the tabulation of species that may co-occur with areas of fluxapyroxad use. Secondary effects may occur in predatory birds, reptiles, amphibians, and mammals that rely on mammals, birds, reptiles, or terrestrial amphibians as prey. LOCATES does not currently differentiate between different feeding guilds or identify those plant species that require particular interactions for pollination or seed dispersal. Therefore, the number of potentially affected listed mammals, birds (also reptiles and terrestrial-phase amphibians), and terrestrial plants may be overestimated and include species that are not likely to be indirectly affected if they do not (1) rely on mammals, birds, amphibians, reptiles, or seeds as prey or (2) require mammals or birds for pollination or seed dispersal.

Based on the results of the LOCATES database query, there are a total of 2,231 unique listed species of terrestrial plants, birds, reptiles, terrestrial and aquatic-phase amphibians, mammals, and terrestrial invertebrates associated with counties where fluxapyroxad may be used nationwide based on the proposed uses. A total of 53 states and territories have listed species that are potentially affected by direct or secondary effects of fluxapyroxad exposure and are associated with crops where fluxapyroxad is proposed for use. Hawaii has the highest number (400) of listed species in the identified taxa that may co-occur with the proposed fluxapyroxad uses, followed by California (294), Alabama (111), and Florida (109). It should be noted that the labels for the proposed uses indicate that the products are not registered for use in California.

This preliminary analysis indicates that there is potential for fluxapyroxad 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 fluxapyroxad and the 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 screening level assessment.

Table 5.3. Tabulation by state and taxonomic group of listed species at potential risk of direct or secondary effects of proposed fluxapyroxad uses.

State	Amphibians	Birds	Conifer	Corals	Crustaceans and Bivalves	Dicot Plants	Ferns and Lichens	Fish	Other Invertebrates	Mammals	Monocot Plants	Reptiles	Total per State
Alabama	2	4			47	13	3	15	14	5	4	4	**111**
Alaska		2								5			**7**
Arizona	2	6				16		19	3	8	2	2	**58**
Arkansas	1	4			12	6		7	2	4	1		**37**
California	6	15	2		8	161		21	26	30	18	7	**294**
Colorado		5				13		6	2	3	1		**30**
Connecticut		2			1	2			1	1	1	1	**9**
Delaware		1			1	1				1	1		**5**
Florida	2	12	1	2	15	48	1	4	4	11	3	6	**109**
Georgia	2	6	1		17	15	3	8	2	5	6	2	**67**
Guam		5				1				2		4	**12**
Hawaii		29			1	271	16		61	2	20		**400**
Idaho						4		5	4	4	1		**18**
Illinois		2			9	7		2	3	2	2		**27**
Indiana		1			9	4			2	2	1	1	**20**
Iowa		2			4	3		3	1	1	2		**16**
Kansas		3			1	1		5	1	2	1		**14**
Kentucky		6			24	9		6	1	4			**50**
Louisiana		3			3	2	1	3		3		2	**17**
Maine		2				1		2		2	2		**9**
Maryland		1			1	5		1	2	2	2	1	**15**
Massachusetts		2			1	1		1	3	1	2	2	**13**
Michigan		2			4	4	1		4	3	3	1	**22**
Minnesota		1			4	2		1	1	1	2		**12**

State	Amphibians	Birds	Conifer	Corals	Crustaceans and Bivalves	Dicot Plants	Ferns and Lichens	Fish	Other Invertebrates	Mammals	Monocot Plants	Reptiles	Total per State
Mississippi	1	4			10	2	1	4		5		5	**32**
Missouri	1	1			9	7		6	2	3	1		**30**
Montana		3				2		3		3	1		**12**
Nebraska		4				2		3	2	2	2		**15**
Nevada		2				9		22	2	1	1	1	**38**
New Hampshire		1			1	1			1	1	2		**7**
New Jersey		2			1	3			1	1	3	1	**12**
New Mexico	1	5			2	13		13	6	5		1	**46**
New York		2			3	5	1	1	2	1	2	1	**18**
North Carolina		4			8	21	1	5	3	7	5	2	**56**
North Dakota		3						2		2	1		**8**
Northern		5								1			**6**
Ohio		1			8	4		1	3	1	2	1	**21**
Oklahoma		6			3			4	1	3	2	1	**20**
Oregon		4			1	14		14	2	3	2		**40**
Pennsylvania		1			6					1	2	1	**11**
Puerto Rico	3	8		2		33	7			1	6	6	**66**
Rhode Island		2				1		1	1	1	1		**7**
South Carolina	1	6			1	13	2	1		1	6	1	**32**
South Dakota		4			2			3	1	1	1		**12**
Tennessee		3			42	15	2	20	4	3	2		**91**
Texas	4	12			1	26		9	20	6	3		**81**
Utah		3				23		8	1	3	2	1	**41**
Vermont					1	1				2	2		**6**

State	Amphibians	Birds	Conifer	Corals	Crustaceans and Bivalves	Dicot Plants	Ferns and Lichens	Fish	Other Invertebrates	Mammals	Monocot Plants	Reptiles	Total per State
Virgin Islands				2		2						1	**5**
Virginia	1	3			25	13		8	4	5	4	1	**64**
Washington		4				9		6	1	8	1		**29**
West Virginia		1			7	4			1	2	2		**17**
Wisconsin		2			5	5			2	2	2		**18**
Wyoming	1	3				3		6		3	2		**18**

6. Additional Description of Assumptions, Limitations, Uncertainties, Strengths and Data Gaps

Aquatic Exposure

The labels specify that, for multiple applications of fluxapyroxad, no more than two applications should be made consecutively before alternating to a fungicide with a different mode of action. For several of the use scenarios, three and four applications of fluxapyroxad were modeled as consecutive applications without consideration of using a second fungicide. The Tier I model used for estimating aquatic exposure, GENEEC, does not have the capability to model multiple applications with varying retreatment intervals. While higher tier modeling such as with PRZM and EXAMS does allow for varying retreatment intervals, as the labels do not specify a particular alternative to be used for multiple applications, it is uncertain how long the retreatment interval between applications 2 and 3 should be. The employed approach is expected to overestimate chronic aquatic concentrations, but given fluxapyroxad's persistence, the potential overestimation is expected to be slight.

The GENEEC model was used to generate EECs for seed treatments. These EECs are probably very conservative, particularly when assuming a depth of incorporation of 0 cm. Larger seeds would likely be planted at soil depths where pesticide transport to the surface for entrainment into runoff or for consumption by terrestrial species would presumably be lessened. To the extent that this is the case, GENEEC EECs for seed treatments may overestimate aquatic cocnentrations.

Risk to aquatic organisms from exposure to fluxapyroxad was estimated using GENEEC-based EECs. GENEEC does not account for year-to-year accumulation of pesticides in aquatic ecosystems with repeated annual applications, such as might occur in static or slowly-moving water bodies, particularly given fluxapyroxad's persistence. GENEEC is a single-event model that assumes a large rainfall/runoff event occurs, which transports a large quantity of pesticide from a field to an adjacent water body. Longer-term, multiple-day average concentrations are calculated based on the peak concentration, and considering any subsequent degradation. As a consequence, GENEEC may underestimate concentrations in relatively static water bodies where fluxapyroxad is applied to the contributing drainage area over many consecutive years. In lotic ecosystems this is not an issue.

Risk to aquatic organisms from exposure to fluxapyroxad end-products was estimated using PRZM/EXAMS EECs, considering only spray drift. The standard pond simulated with EXAMS is a static water body of fixed volume and no outlet (*i.e.*, no discharge). The linked PRZM and EXAMS models are ordinarily used to simulate daily weather-driven runoff and spray drift from a treated agricultural field over a thirty year time span. Each new additional load of pesticide to the water-body contributes to the total mass present, which includes pesticide remaining after having been delivered by previous previous runoff and/or spray-drift events. Especially persistent pesticides may thus accumulate essentially without bound. Fluxapyroxad is sufficiently persistent in aquatic environments that accumulation occurs essentially continuously over the 30 simulated years. The "1-in-10 year" EECs obtained from the model runs thus do not

reflect randomly varying meteorological conditions and an associated one-in-ten year return frequency, since annual maximum concentrations are not independent of each other, but rather are serially correlated. For this reason, PRZM/EXAMS results potentially overestimate aquatic EECs for all static water bodies. Even for static waters the model results are conservative, since over the course of thirty years some loss of fluxapyroxad would be expected due to burial of sediment and other dissipation processes not simulated by the models. Fluxapyroxad concentrations in flowing (*e.g.*, lotic) waters are not expected to substantially accumulate from year to year because of advective and dispersive removal processes. Thus risks to freshwater fish and invertebrates from accumulation of fluxapyroxad due to multiple years of application are not expected in flowing systems.

The Tier I Rice model was used to estimate EECs for aquatic organisms that may use rice paddies as habitat. While this screening-level model is designed to conservatively estimate EECs, the acute EEC is within an order of magnitude of concentrations observed in the aquatic field dissipation study designed to mimic rice applications. Cultural practices including rice and freshwater fish and invertebrates together have been documented (LSU AgCenter, 2007), but it is uncertain whether any listed species would be found in, and therefore exposed to water concentrations in, rice paddies. While the Tier I Rice model does not account for pesticide degradation, given fluxapyroxad's persistence in soil and aquatic environments, the chronic concentration is expected to be similar in magnitude to the acute concentration.

Terrestrial Exposure

Supervised field trials with legume vegetables, sunflower, canola, and sugar beet indicate that mean residues of fluxapyroxad declined by approximately half in the three-to-four weeks (21 to 28 days) following application, while field trials indicate that fluxapyroxad was more persistent on cereal crops (*e.g.*, rice, barley, bulb vegetables, fruiting vegetables, grapes, root vegetables, strawberries, and wheat), with residues in these matrices declining only slightly or remaining the same for the duration of the trial (30 days). Field trials for brassica, berries, and cucumbers had mixed results, with some trials indicating a more rapid decline in fluxapyroxad, with a decline to half of the residue in 3-7 days, while some trials indicated no decline over a 7-day period. Therefore, the default foliar dissipation value of 35 days used in estimating terrestrial exposure may underestimate or overestimate persistence depeneding on the crop. It is uncertain whether fluxapyroxad residues will accumulate in the terrestrial environment following repeated use over multiple seasons or years. However, even based upon the default foliar dissipation value, at the maximum proposed application rate, even a single application of fluxpyroxad would result in an RQ value that exceeds the Agency's LOC for chronic risk to mammals.

The potential effects of the formulated product BAS 703 02 F [Priaxor] on seedling emergence of terrestrial plants are uncertain because of potential adjuvant interference in results for onion (the most sensitive monocot species), cabbage (the most sensitive dicot species), and tomato. Although no effects greater than 25% were observed in that study, the NOAEL values from that study were the most sensitive endpoints for terrestrial plant seedling emergence from any of the submitted studies and were used in risk estimation for fluxapyroxad. However, the uncertainty regarding potential adjuvant effects on these species and endpoints reduces confidence in the risk conclusions that are based upon these endpoints.

Acute risk to birds from seed treatment uses may potentially be overestimated. In order to reach the equivalent to the acute dietary toxicity endpoint, the amount of seed needed to be consumed by birds feeding exclusively on treated seed is equivalent to 16.2 g, or more than three times the normal amount of seed ingested by a 20 g bird (the Nagy allometry food ingestion rate is approximately 5 g/day). While smaller, migrating birds may consume large amounts of seeds, in magnitudes that approach or exceed their own body weight, in a short period of time (*e.g.*, one day or less), the likelihood of frank mortality is considered low given the acute endpoint is much higher than the EECs.

Exposure from seed treatment uses is likely to be overestimated for scenarios where seeds are incorporated. Seed incorporation would reduce the transport via runoff to non-target plants and surface water and would further reduce the likelihood of seed consumption by birds and mammals.

Data Gaps

There are no fate data gaps for fluxapyroxad. It should be noted that low carbon dioxide (CO_2) levels were observed in the aerobic soil metabolism studies, along with a lack of transformation product formation (MRID 47923684). These observations, coupled with the fact that fluxapyroxad is moderately to slightly mobile, indicate that the estimated aerobic soil half-life values may be more representative of sorption rather than of biotransformation. If this is the case, then over time, repeated use of fluxapyroxad could result in saturation of soil sorption sites, resulting in greater potential for runoff of fluxapyroxad than is accounted for in EFED's models.

There are no acceptable chronic toxicity data for estuarine/marine fish or aquatic invertebrates. The submitted life cycle study with mysid shrimp was classified as invalid, and no other chronic studies have been submitted. An ecological risk assessment conducted in 2012 (DP Barcode 376883, March 2012) lists numerous other studies that are classified as supplemental based on meaningful guideline deviations and/or uncertainty regarding the study results. Specifically, the early life stage test with freshwater fish, three spiked sediment toxicity tests with benthic invertebrates, three toxicity tests with nonvascular aquatic plants, the acute oral toxicity test with zebra finch, the avian reproduction study with bobwhite quail, and the seedling emergence test with BAS 703 02 F [Priaxor] are each classified as supplemental. However, additional data are not being requested for these studies at this time because such data would be unlikely to impact the screening level risk conclusions based on the currently proposed uses.

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Appendix A. Current and Proposed New Uses, Fluxapyroxad

Current and proposed products for registration containing fluxapyroxad

End-Use Product Name	Summary Formulation Details: Formulation Type lb fluxapyroxad/gal of product (lb ai pyraclostrobin/gal of product)	Application Type	Crops
Currently Registered Products			
Imbrex BAS 700 01 F Fungicide **Reg No. 7969-306**	Emulsifiable Concentrate 0.52	Foliar Aerial and ground	**Existing**: Wheat, barley, corn, bean and pea legumes, peanuts, pome and stone fruits, fruiting vegetables, oil seed, root and tuberous vegetable crops. **Proposed**: Berries and small fruits, bulb vegetables, cucurbits, grapes, leafy vegetables, rice, root vegetables, sorghum and millet, strawberries, sugarcane, and tree nuts
Xemium 2.78 BAS 700 02 F Fungicide Seed Treatment **Reg No. 7969-307**	Suspension Concentrate 0.78	Seed Treatment	**Existing**: Barley, corn, cotton, dried shelled peas and beans, edible podded legume vegetables, oat, peanut, rye, sorghum, soybean, sunflower, wheat and triticale seed **Proposed**: Brassica vegetable, bulb vegetable, cucurbit, leafy vegetable, rapeseed, rice, and root and tuber vegetable seed
Xemium 2.72 BAS 700 03 F Fungicide Seed Treatment **Reg No. 7969-308**	Suspension Concentrate 2.72	Seed Treatment	**Existing**: Barley, corn, cotton, dried shelled peas and beans, edible podded legume vegetables, oat, peanut, rye, sorghum, soybean, sunflower, wheat and triticale seed **Proposed**: Brassica vegetable, bulb vegetable, cucurbit, leafy vegetable, rapeseed, rice, and root and tuber vegetable seed
Sercadis BAS 700 04 F Fungicide **Reg No. 7969-309**	Suspension Concentrate 2.47	Foliar Aerial and ground	**Existing**: Cereals, bean and pea legumes, peanuts, pome and stone fruits, fruiting vegetables, oil seed, root and root and tuberous vegetable crops **Proposed**: Berries and small fruits, bulb vegetables, cucurbits, grapes, leafy vegetables, rice, root vegetables, sorghum and millet, strawberries, sugarcane, and tree nuts

End-Use Product Name	Summary Formulation Details: Formulation Type lb fluxapyroxad/gal of product (lb ai pyraclostrobin/gal of product)	Application Type	Crops
Currently Registered Products			
Merivon BAS 703 01 F Fungicide **Reg No. 7969-310**	Suspension Concentrate 2.09 (2.09 Pyraclostrobin)	Foliar Aerial and ground	**Existing**: Pome and stone fruits, fruiting vegetables, oil seed, soybean, and root and tuberous vegetable crops. **Proposed**: Berries and small fruits, bulb vegetables, cucurbits, grapes, leafy vegetables, root vegetables, strawberries, and tree nuts
Priaxor BAS 703 02 F Fungicide **Reg No. 7969-311**	Suspension Concentrate 1.39 (2.78 Pyraclostrobin)	Foliar Aerial and ground	**Existing**: Cereals, fruiting vegetables, oilseed crops, peanut, soybean, and root and tuber vegetables crops. **Proposed**: Berries and small fruits, bulb vegetables, cucurbits, grapes, leafy vegetables, root vegetables, sorghum and millet, strawberries, sugarcane, and tree nuts
New Product for Registration			
Lexicon Fungicide **Reg No. 7969-GLN**	Suspension Concentrate 1.39 (2.78 Pyraclostrobin)	Foliar Aerial and ground	**Proposed:** Turf (residential, commercial, golf courses, sod farms)
Xzemplar Fungicide **Reg No. 7969-GUO**	Suspension Concentrate 2.47	Foliar Aerial and ground	**Proposed:** Turf (residential, commercial, golf courses, sod farms)
Xemium 703 Fungicide **Reg No. 7969-GLE**	Suspension Concentrate 2.09 (2.09 Pyraclostrobin)	Seed Treatment	**Proposed**: Brassica vegetable, bulb vegetable, corn, cotton, cucurbit, leafy vegetable, rapeseed, root and tuber vegetable, and soybean seed

Proposed Use Information for Fluxapyroxad Products

EUP	Crop	Max Single App Rate (lbs a.i./A)	Number of Applications	Minimum Retreatment Interval	Max Annual App Rate (lbs a.i./A)	Notes
Imbrex (BAS 700 01F) Sercadis (BAS 700 04F) Merivon (BAS 703 01F)	Berries and small fruits	0.18	3	7	0.54	1
	Brassica leafy vegetables	0.09	3	7	0.27	1
	Bulb vegetables	0.18	3	7	0.54	1
	Cucurbits	0.09	3	7	0.27	1
	Grapes (*Botrytis* disease)	0.18	3	NS	0.54	1
	Grapes	0.09	6	10	0.54	1
	Leafy vegetables (except Brassica)	0.18	3	7	0.54	1
	Rice	0.135	2	7	0.27	1,2
	Root vegetables (except sugarbeet)	0.09	3	7	0.27	1
	Sorghum and millet	0.09	2	NS	0.18	1, 2
	Strawberries	0.18	3	7	0.54	1
	Sugarcane	0.11	2	14	0.22	1, 2
	Tree nuts	0.11	3	7	0.33	1
Priaxor (BAS 703 02F)	Berries and small fruits	0.10	3	7	0.29	1
	Brassica leafy vegetables	0.09	3	7	0.27	1
	Bulb vegetables	0.08	3	7	0.24	1
	Cucurbits	0.09	3	7	0.27	1
	Grapes (*Botrytis* disease)	0.07	3	NS	0.22	1
	Grapes	0.07	3	10	0.22	1
	Leafy vegetables (except Brassica)	0.10	3	7	0.30	1
	Root vegetables (except sugarbeet)	0.09	3	7	0.27	1
	Sorghum and millet	0.09	1	NA	0.09	1
	Strawberries	0.10	3	7	0.29	1
	Sugarcane	0.10	2	14	0.17	1
	Tree nuts	0.06	3	7	0.18	1
Xemium 2.78 (BAS 700 02F) and Xemium 2.72 (BAS 700 03F)	Bulb vegetable seed	0.19	1	NA	0.19	Based on 75 lbs seed/acre (onion)
	Brassica seed	0.003	1	NA	0.003	Based on 8.2 lbs seed/acre (rape)
	Cucurbit seed	0.005	1	NA	0.005	Based on 11.6 lbs seed/acre (cucumber)
	Leafy vegetable seed	0.08	1	NA	0.08	Based on 40 lbs seed/acre (parsely)
	Rapeseed	0.002	1	NA	0.002	Based on 8.2 lbs seed/acre (rape)

EUP	Crop	Max Single App Rate (lbs a.i./A)	Number of Applications	Minimum Retreatment Interval	Max Annual App Rate (lbs a.i./A)	Notes
	Rice seed	0.065	1	NA	0.065	Based on 129 lbs seed/acre (rice)
	Root and tuber seed	0.04	1	NA	0.04	Based on 100 lbs seed/acre (ginseng)
Xemium 703	Bulb vegetable seed	0.06	1	NA	0.06	Based on 75 lbs seed/acre (onion)
	Brassica seed	0.007	1	NA	0.007	Based on 8.2 lbs seed/acre (rape)
	Corn seed	0.007	1	NA	0.007	Based on 33.2 lbs seed/acre (corn)
	Cotton seed[3]	0.008	1	NA	0.008	Based on 18.9 lbs seed/acre (cotton)
	Cucurbit seed	0.007	1	NA	0.007	Based on 11.6 lbs seed/acre (cucumber)
	Leafy vegetable seed	0.024	1	NA	0.024	Based on 40 lbs seed/acre (parsely)
	Rapeseed	0.002	1	NA	0.002	Based on 8.2 lbs seed/acre (rape)
	Root and tuber seed	0.06	1	NA	0.06	Based on 100 lbs seed/acre (ginseng)
	Soybean[3]	0.033	1	NA	0.033	Based on 166.7 lbs seed/acre (soybean)
Lexicon	Turf	0.23	NS	14	0.80	1
Xzemplar	Turf	0.22	NS	14	0.79	1

NS - not specified. NA - not applicable

Notes

1. Only 2 consecutive applications before alternating to a labeled fungicide w/ different mode of action.
2. Merivon not proposed for registration on rice, sorghum and millet, or sugarcane.
3. Rates are twice as high as currently registered rates for cotton and soybean on Xemium 2.78 and Xemium 2.72
4. Seeding rates obtained from USEPA model TREX Version 1.5.1 (http://www.epa.gov/oppefed1/models/terrestrial/index.htm#trex).

Appendix B. GENEEC Results

Foliar Applications

RUN No. 1 FOR fluxapyroxad ON berries * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.180(.537)	3 7	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
15.17	15.11	14.74	13.94	13.38

RUN No. 2 FOR fluxapyroxad ON brassica * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.090(.268)	3 7	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
7.59	7.56	7.37	6.97	6.69

RUN No. 3 FOR fluxapyroxad ON grape botr * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)

.180(	.539)	3	3	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
15.22	15.16	14.78	13.98	13.42

RUN No. 4 FOR fluxapyroxad ON grapes * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.090(.529)	6 10	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
14.98	14.92	14.56	13.77	13.21

RUN No. 5 FOR fluxapyroxad ON sorghum * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.090(.180)	2 3	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)

857.00	2	N/A	.00-	.00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
5.08	5.06	4.93	4.67	4.48

RUN No. 6 FOR fluxapyroxad ON sugarcane * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.110(.219)	2 14	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00-	.00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
6.18	6.16	6.01	5.68	5.45

RUN No. 7 FOR fluxapyroxad ON tree nuts * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.110(.328)	3 7	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00-	.00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
9.27	9.24	9.01	8.52	8.18

RUN No. 8 FOR fluxapyroxad ON turf * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.230(.682)	3 14	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
19.30	19.22	18.74	17.73	17.01

RUN No. 9 FOR fluxapyroxad ON turf * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.230(.905)	4 14	931.0	3.4	AERL_B(13.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
25.60	25.50	24.87	23.52	22.58

Seed Treatments

RUN No. 1 FOR fluxapyroxad ON bulb veg s * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)

.190(.190) 1 1 931.0 3.4 GRANUL(.0) .0 .0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
4.25	4.23	4.12	3.88	3.72

RUN No. 2 FOR fluxapyroxad ON leafy veg * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.080(.080)	1 1	931.0	3.4	GRANUL(.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
1.79	1.78	1.73	1.64	1.57

RUN No. 3 FOR fluxapyroxad ON rapeseed s * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.002(.002)	1 1	931.0	3.4	GRANUL(.0)	.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN NANOGRAMS/LITER (PPTr)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
44.74	44.53	43.37	40.89	39.15

RUN No. 4 FOR fluxapyroxad ON bulb veg s * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.190(.190)	1 1	931.0	3.4	GRANUL(.0)	.0	1.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
4.25	4.23	4.12	3.88	3.72

RUN No. 5 FOR fluxapyroxad ON bulb veg s * INPUT VALUES *

RATE (#/AC) ONE(MULT)	No.APPS & INTERVAL	SOIL Koc	SOLUBIL (PPM)	APPL TYPE (%DRIFT)	NO-SPRAY (FT)	INCORP (IN)
.190(.190)	1 1	931.0	3.4	GRANUL(.0)	.0	2.0

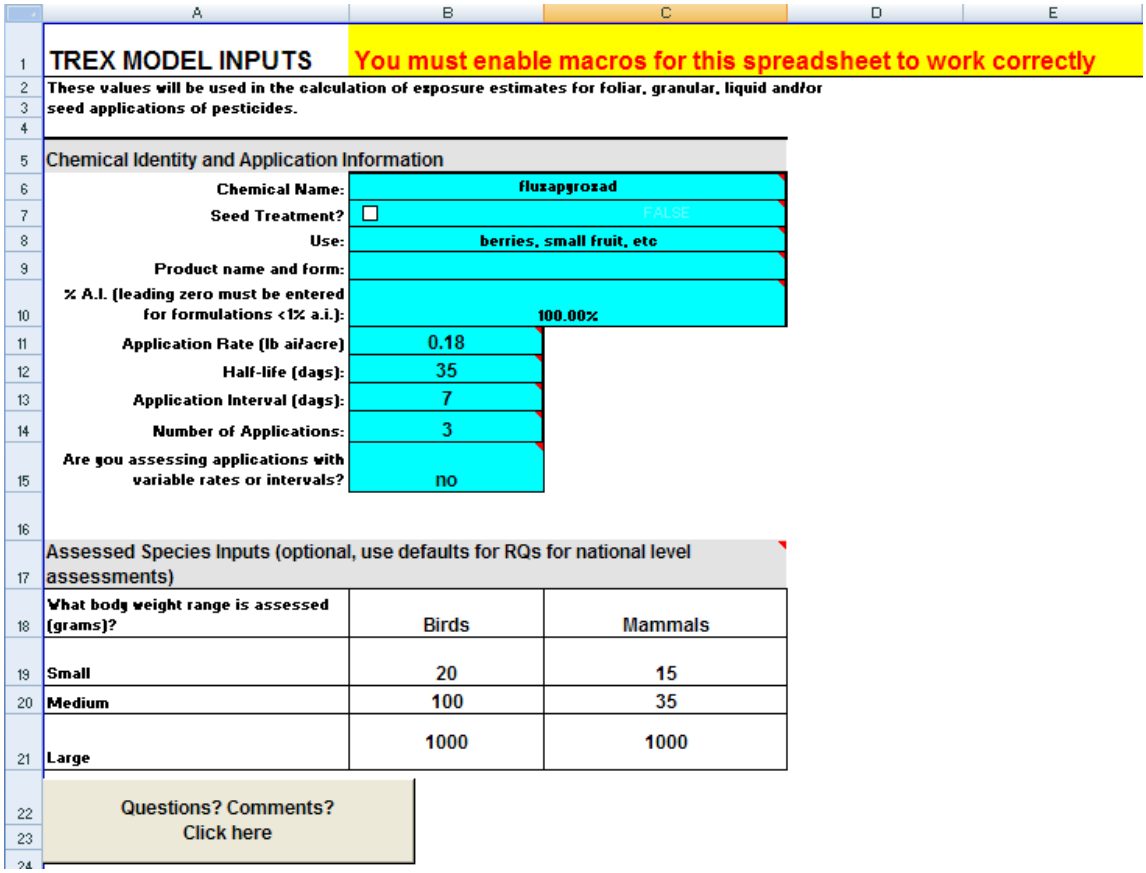
FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
857.00	2	N/A	.00- .00	993.00	993.00

GENERIC EECs (IN MICROGRAMS/LITER (PPB)) Version 2.0 Aug 1, 2001

PEAK GEEC	MAX 4 DAY AVG GEEC	MAX 21 DAY AVG GEEC	MAX 60 DAY AVG GEEC	MAX 90 DAY AVG GEEC
2.13	2.12	2.06	1.94	1.86

Appendix C. Example T-REX (v. 1.5.1) input and output data



TREX MODEL INPUTS — You must enable macros for this spreadsheet to work correctly

These values will be used in the calculation of exposure estimates for foliar, granular, liquid and/or seed applications of pesticides.

Chemical Identity and Application Information

Chemical Name:	fluxapyroxad
Seed Treatment?	☐ FALSE
Use:	berries, small fruit, etc
Product name and form:	
% A.I. (leading zero must be entered for formulations <1% a.i.):	100.00%
Application Rate (lb ai/acre)	0.18
Half-life (days):	35
Application Interval (days):	7
Number of Applications:	3
Are you assessing applications with variable rates or intervals?	no

Assessed Species Inputs (optional, use defaults for RQs for national level assessments)

What body weight range is assessed (grams)?	Birds	Mammals
Small	20	15
Medium	100	35
Large	1000	1000

Questions? Comments? Click here

Avian

Endpoint	Toxicity value	Indicate test species
LD50 (mg/kg-bw)		Bobwhite quail
LC50 (mg/kg-diet)	2457.00	Bobwhite quail
NOAEL (mg/kg-bw)	7.80	Mallard duck
NOAEC (mg/kg-diet)	100.00	Bobwhite quail
Enter the Mineau et al. Scaling Factor	1.15	

Mammalian

	Acute Study	Chronic Study
Size (g) of mammal used in toxicity study	350	350
Endpoint / **Toxicity value**		**Reference (MRID)**
LD50 (mg/kg-bw)	2000.00	
LC50 (mg/kg-diet)		
Reported Chronic Endpoint	10.00 mg/kg-bw	
Is dietary concentration (mg/kg-diet) reported from the available chronic	yes	
Enter dietary concentration (mg/kg-	112.00	

Summary of Risk Quotient Calculations Based on Upper Bound Kenaga EECs

Table X. 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	129.32	#DIV/0!	59.27	#DIV/0!	72.74	#####	8.08	#DIV/0!	50.65	#####	1.80	#####
100	0.00	73.74	#DIV/0!	33.80	#DIV/0!	41.48	#####	4.61	#DIV/0!	28.88	#####	1.02	#####
1000	0.00	33.02	#DIV/0!	15.13	#DIV/0!	18.57	#####	2.06	#DIV/0!	12.93	#####	0.46	#####

Table X. 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
2457	113.55	0.05	52.04	0.02	63.87	0.03	7.10	0.00	44.47	0.02

Size class not used for dietary risk quotients

Table X. 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
100	113.55	1.14	52.04	0.52	63.87	0.64	7.10	0.07	44.47	0.44

Size class not used for dietary risk quotients

Table X. 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	4395.66	108.26	0.02	49.62	0.01	60.90	0.01	6.77	0.00	42.4013	0.0096	1.5036	0.0003
35	3556.56	74.82	0.02	34.29	0.01	42.09	0.01	4.68	0.00	29.305	0.0082	1.0392	0.0003
1000	1538.32	17.35	0.01	7.95	0.01	9.76	0.01	1.08	0.00	6.79446	0.0044	0.2409	0.0002

Table X. 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	113.55	#DIV/0!	52.04	#DIV/0!	63.87	#DIV/0!	7.10	#####	44.47	#DIV/0!

Size class not used for dietary risk quotients

Table X. Upper Bound Kenaga, Chronic Mammalian Dietary Based Risk Quotients

NOAEC (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Se		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
112	113.55	1.01	52.04	0.46	63.87	0.57	7.10	0.06	44.47	0.40

Size class not used for dietary risk quotients

Table X. 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	21.98	108.26	4.93	49.62	2.26	60.90	2.77	6.77	0.31	42.40	1.93	1.50	0.07
35	17.78	74.82	4.21	34.29	1.93	42.09	2.37	4.68	0.26	29.30	1.65	1.04	0.06
1000	7.69	17.35	2.26	7.95	1.03	9.76	1.27	1.08	0.14	6.79	0.88	0.24	0.03

Appendix D. Example TerrPlant (v. 1.2.2) input and output data

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	fluxapyroxad
PC code	
Use	turf
Application Method	aerial (sod farms0
Application Form	
Solubility in Water (ppm)	3.44

Table 2. Input parameters used to derive EECs.			
Input Parameter	Symbol	Value	Units
Application Rate	A	0.23	
Incorporation	I	1	none
Runoff Fraction	R	0.01	none
Drift Fraction	D	0.05	none

Table 3. EECs for fluxapyroxad. Units in .		
Description	Equation	EEC
Runoff to dry areas	(A/I)*R	0.0023
Runoff to semi-aquatic areas	(A/I)*R*10	0.023
Spray drift	**A*D**	**0.0115**
Total for dry areas	**((A/I)*R)+(A*D)**	**0.0138**
Total for semi-aquatic areas	**((A/I)*R*10)+(A*D)**	**0.0345**

Table 4. Plant survival and growth data used for RQ derivation. Units are in .				
	Seedling Emergence		Vegetative Vigor	
Plant type	EC_{25}	NOAEC	EC_{25}	NOAEC
Monocot	x	0.0446	x	0.0681
Dicot	x	0.0055	x	0.0167

Table 5. RQ values for plants in dry and semi-aquatic areas exposed to fluxapyroxad through runoff and/or spray drift.*				
Plant Type	Listed Status	Dry	Semi-Aquatic	Spray Drift
Monocot	non-listed	#VALUE!	#VALUE!	#DIV/0!
Monocot	listed	0.31	0.77	0.26
Dicot	non-listed	#VALUE!	#VALUE!	#DIV/0!
Dicot	listed	2.51	6.27	2.09
*If RQ > 1.0, the LOC is exceeded, resulting in potential for risk to that plant group.				

Appendix E. LOCATES (v. 2.2.5) output of listed species

Species Listing by State with Use Criteria

No species were excluded
Minimum of 1 Acre.
All Medium Types Reported

Generic taxon {Amphibian, Arachnid, Bird, Bivalve, Conf/cycds, Coral, Crustacean, Dicot, Ferns, Fish, Gastropod, Insect, Lichen, Mammal, Monocot, Reptile}

blackberries and dewberries, blueberries-tame, blueberries-wild, currants, raspberries-all, raspberries-black, raspberries-red, cranberries, kiwifruit, broccoli, brussels sprouts, cabbage-chinese, cabbage-head, cabbage-mustard, cauliflower, collards, kale, mustard greens, garlic, onions-dry, onions-green, citron, cucumbers and pickles, pumpkins, watermelons, cantaloupes, honeydew melons, squash-all, squash-summer, squash-winter, grapes, celery, lettuce-all, lettuce-head, lettuce-leaf, lettuce-romaine, parsley, spinach, rice, rice-wild, beets, carrots, ginseng, horseradish, radishes, turnips, sorghum for grain, sorghum for silage or greenchop, sorghum for syrup, strawberries, sugarcane for seed, sugarcane for sugar, sugarcane not harvested, almonds, chestnuts, hazelnuts (filberts), macadamia nuts, pecans-all, pecans-improved, pecans-native and seedling, pistachios, walnuts-english

Alabama	(111) species:	**E/T**	**Medium**	**Taxon**
Salamander, Frosted	*Ambystoma cingulatum*	T	Terrestrial,	Amphibian
Salamander, Red Hills	*Phaeognathus hubrichti*	T	Terrestrial,	Amphibian
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Stork, Wood	*Mycteria americana*	E	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Alabama pearlshell	*Margaritifera marrianae*	E	Freshwater	Bivalve
Bankclimber, Purple	*Elliptoideus sloatianus*	T	Freshwater	Bivalve
Choctaw Bean	*Villosa choctawensis*	E	Freshwater	Bivalve
Combshell, Southern	*Epioblasma penita*	E	Freshwater	Bivalve
Combshell, Upland	*Epioblasma metastriata*	E	Freshwater	Bivalve
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
fuzzy pigtoe	*Pleurobema strodeanum*	T	Freshwater	Bivalve
Kidneyshell, Triangular	*Ptychobranchus greenii*	E	Freshwater	Bivalve
Mucket, Orange-nacre	*Lampsilis perovalis*	T	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Acornshell	*Epioblasma othcaloogensis*	E	Freshwater	Bivalve
Mussel, Alabama	*Medionidus acutissimus*	T	Freshwater	Bivalve
Mussel, Coosa	*Medionidus parvulus*	E	Freshwater	Bivalve
Mussel, Cumberland	*Epioblasma brevidens*	E	Freshwater	Bivalve
Mussel, Dark Pigtoe	*Pleurobema furvum*	E	Freshwater	Bivalve
Mussel, Fine-lined	*Lampsilis altilis*	T	Freshwater	Bivalve
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	E	Freshwater	Bivalve
Mussel, Flat Pigtoe	*Pleurobema marshalli*	E	Freshwater	Bivalve
Mussel, Georgia pigtoe	*Pleurobema hanleyianum*	E	Freshwater	Bivalve
Mussel, Gulf	*Medionidus penicillatus*	E	Freshwater	Bivalve

Mussel, Heavy Pigtoe	*Pleurobema taitianum*	E	Freshwater	Bivalve
Mussel, Heelsplitter	*Potamilus inflatus*	T	Freshwater	Bivalve
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	E	Freshwater	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Freshwater	Bivalve
Mussel, Ring Pink (=Golf	*Obovaria retusa*	E	Freshwater	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Freshwater	Bivalve
Mussel, Shiny Pigtoe	*Fusconaia cor*	E	Freshwater	Bivalve
Mussel, Shiny-rayed	*Lampsilis subangulata*	E	Freshwater	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Freshwater	Bivalve
Mussel, Southern Clubshell	*Pleurobema decisum*	E	Freshwater	Bivalve
Mussel, Southern Pigtoe	*Pleurobema georgianum*	E	Freshwater	Bivalve
Narrow Pigtoe	*Fusconaia escambia*	T	Freshwater	Bivalve
Pearlymussel, Alabama	*Lampsilis virescens*	E	Freshwater	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Freshwater	Bivalve
Pearlymussel,	*Quadrula intermedia*	E	Freshwater	Bivalve
Pearlymussel, Orange-	*Plethobasus cooperianus*	E	Freshwater	Bivalve
Pearlymussel, Pale Lilliput	*Toxolasma cylindrellus*	E	Freshwater	Bivalve
Pearlymussel, Turgid-	*Epioblasma turgidula*	E	Freshwater	Bivalve
Pearlymussel, White	*Plethobasus cicatricosus*	E	Freshwater	Bivalve
Round Ebonyshell	*Fusconaia rotulata*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Southern Kidneyshell	*Ptychobranchus jonesi*	E	Freshwater	Bivalve
Southern Sandshell	*Hamiota australis*	T	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Stirrupshell	*Quadrula stapes*	E	Freshwater	Bivalve
Tapered Pigtoe	*Fusconaia burkei*	T	Freshwater	Bivalve
Shrimp, Alabama Cave	*Palaemonias alabamae*	E	Freshwater	Crustacean
Amphianthus, Little	*Amphianthus pusillus*	T	Wetland	Dicot
Barbara Buttons, Mohr's	*Marshallia mohrii*	T	Wetland	Dicot
Bladderpod, Lyrate	*Lesquerella lyrata*	T	Unattributed	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Clover, Leafy Prairie	*Dalea foliosa*	E	Unattributed	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Leather-flower, Alabama	*Clematis socialis*	E	Unattributed	Dicot
Leather-flower, Morefield's	*Clematis morefieldii*	E	Unattributed	Dicot
Pinkroot, Gentian	*Spigelia gentianoides*	E	Unattributed	Dicot
Pitcher-plant, Alabama	*Sarracenia rubra alabamensis*	E	Unattributed	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	Wetland	Dicot
Pondberry	*Lindera melissifolia*	E	Wetland	Dicot
Potato-bean, Price's	*Apios priceana*	T	Unattributed	Dicot
Fern, Alabama Streak-sorus	*Thelypteris pilosa var. alabamensis*	T	Unattributed	Ferns
Fern, American hart's-	*Asplenium scolopendrium var.*	T	Unattributed	Ferns
Quillwort, Louisiana	*Isoetes louisianensis*	E	Wetland	Ferns
Cavefish, Alabama	*Speoplatyrhinus poulsoni*	E	Freshwater	Fish
Chub, Spotfin	*Erimonax monachus*	T	Freshwater	Fish
Darter, Boulder	*Etheostoma wapiti*	E	Freshwater	Fish
Darter, Goldline	*Percina aurolineata*	T	Freshwater	Fish
Darter, Slackwater	*Etheostoma boschungi*	T	Freshwater	Fish
Darter, Snail	*Percina tanasi*	T	Freshwater	Fish

Darter, Vermilion	*Etheostoma chermocki*	E	Freshwater	Fish
Darter, Watercress	*Etheostoma nuchale*	E	Freshwater	Fish
Rush darter	*Etheostoma phytophilum*	E	Freshwater	Fish
Sculpin, Pygmy	*Cottus paulus (pygmaeus)*	T	Freshwater	Fish
Shiner, Blue	*Cyprinella caerulea*	T	Freshwater	Fish
Shiner, Cahaba	*Notropis cahabae*	E	Freshwater	Fish
Shiner, Palezone	*Notropis albizonatus*	E	Freshwater	Fish
Sturgeon, Alabama	*Scaphirhynchus suttkusi*	E	Freshwater	Fish
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Freshwater,	Fish
Campeloma, Slender	*Campeloma decampi*	E	Freshwater	Gastropod
Elimia, Lacy	*Elimia crenatella*	T	Freshwater	Gastropod
Hornsnail, rough	*Pleurocera foremani*	E	Freshwater	Gastropod
Pebblesnail, Flat	*Lepyrium showalteri*	E	Freshwater	Gastropod
Riversnail, Anthony's	*Athearnia anthonyi*	E	Freshwater	Gastropod
Rocksnail, interrupted	*Leptoxis foremani*	E	Freshwater	Gastropod
Rocksnail, Painted	*Leptoxis taeniata*	T	Freshwater	Gastropod
Rocksnail, Plicate	*Leptoxis plicata*	E	Freshwater	Gastropod
Rocksnail, Round	*Leptoxis ampla*	T	Freshwater	Gastropod
Snail, Armored	*Pyrgulopsis (Marstonia) pachyta*	E	Freshwater	Gastropod
Snail, Lioplax Cylindrical	*Lioplax cyclostomaformis*	E	Freshwater	Gastropod
Snail, Tulotoma	*Tulotoma magnifica*	T	Terrestrial	Gastropod
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Terrestrial,	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Terrestrial,	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Mouse, Alabama Beach	*Peromyscus polionotus ammobates*	E	Terrestrial,	Mammal
Mouse, Perdido Key Beach	*Peromyscus polionotus trissyllepsis*	E	Terrestrial,	Mammal
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot
Grass, Tennessee Yellow-	*Xyris tennesseensis*	E	Wetland	Monocot
Trillium, Relict	*Trillium reliquum*	E	Unattributed	Monocot
Water-plantain, Kral's	*Sagittaria secundifolia*	T	Wetland	Monocot
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Terrestrial	Reptile
Tortoise, Gopher	*Gopherus polyphemus*	T	Terrestrial	Reptile
Turtle, Alabama Red-bellied	*Pseudemys alabamensis*	E	Terrestrial,	Reptile
Turtle, Flattened Musk	*Sternotherus depressus*	T	Terrestrial,	Reptile

Alaska	(7) species:	**E/T**	**Medium**	**Taxon**
Albatross, Short-tailed	*Phoebastria (Diomedea) albatrus*	E	Terrestrial,	Bird
Eider, Steller's	*Polysticta stelleri*	T	Terrestrial,	Bird
Bison, Wood	*Bison bison athabascae*	E	Terrestrial	Mammal
Otter, Northern Sea	*Enhydra lutris kenyoni*	T	Saltwater	Mammal
Seal, spotted	*Phoca largha*	T	Saltwater,	Mammal
Whale, beluga	*Delphinapterus leucas*	E	Saltwater	Mammal
Whale, Gray	*Eschrichtius robustus*	E	Saltwater	Mammal

Arizona	(58) species:	**E/T**	**Medium**	**Taxon**
Frog, Chiricahua Leopard	*Rana chiricahuensis*	T	Terrestrial,	Amphibian
Salamander, Sonora Tiger	*Ambystoma tigrinum stebbinsi*	E	Terrestrial,	Amphibian
Bobwhite, Masked	*Colinus virginianus ridgwayi*	E	Terrestrial	Bird

Condor, California	*Gymnogyps californianus*	E	Terrestrial	Bird
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	E	Terrestrial	Bird
Flycatcher, Southwestern	*Empidonax traillii extimus*	E	Terrestrial	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Terrestrial	Bird
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	E	Terrestrial	Bird
Blue-star, Kearney's	*Amsonia kearneyana*	E	Unattributed	Dicot
Cactus, Arizona Hedgehog	*Echinocereus triglochidiatus var.*	E	Unattributed	Dicot
Cactus, Brady Pincushion	*Pediocactus bradyi*	E	Unattributed	Dicot
Cactus, Cochise Pincushion	*Coryphantha robbinsorum*	T	Unattributed	Dicot
Cactus, Nichol's Turk's	*Echinocactus horizonthalonius var.*	E	Unattributed	Dicot
Cactus, Peebles Navajo	*Pediocactus peeblesianus*	E	Unattributed	Dicot
Cactus, Pima Pineapple	*Coryphantha scheeri var.*	E	Unattributed	Dicot
Cactus, Siler Pincushion	*Pediocactus*	T	Unattributed	Dicot
Cliffrose, Arizona	*Purshia (cowania) subintegra*	E	Unattributed	Dicot
Cycladenia, Jones	*Cycladenia jonesii (humilis)*	T	Unattributed	Dicot
Fleabane, Zuni	*Erigeron rhizomatus*	T	Unattributed	Dicot
Groundsel, San Francisco	*Senecio franciscanus*	T	Unattributed	Dicot
Milk-vetch, Holmgren	*Astragalus holmgreniorum*	E	Unattributed	Dicot
Milk-vetch, Sentry	*Astragalus cremnophylax var.*	E	Unattributed	Dicot
Milkweed, Welsh's	*Asclepias welshii*	T	Unattributed	Dicot
Umbel, Huachuca Water	*Lilaeopsis schaffneriana var. recurva*	E	Wetland	Dicot
Catfish, Yaqui	*Ictalurus pricei*	T	Freshwater	Fish
Chub, Bonytail	*Gila elegans*	E	Freshwater	Fish
Chub, Gila	*Gila intermedia*	E	Freshwater	Fish
Chub, Humpback	*Gila cypha*	E	Freshwater	Fish
Chub, Sonora	*Gila ditaenia*	T	Freshwater	Fish
Chub, Virgin River	*Gila seminuda (robusta)*	E	Freshwater	Fish
Chub, Yaqui	*Gila purpurea*	E	Freshwater	Fish
Minnow, Loach	*Tiaroga cobitis*	E	Freshwater	Fish
Pupfish, Desert	*Cyprinodon macularius*	E	Freshwater	Fish
Shiner, Beautiful	*Cyprinella formosa*	T	Freshwater	Fish
Spikedace	*Meda fulgida*	E	Freshwater	Fish
Spinedace, Little Colorado	*Lepidomeda vittata*	T	Freshwater	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Freshwater	Fish
Steelhead	*Oncorhynchus (Salmo) mykiss*	E/T	Freshwater,	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Freshwater	Fish
Topminnow, Gila (Yaqui)	*Poeciliopsis occidentalis*	E	Freshwater	Fish
Trout, Apache	*Oncorhynchus apache*	T	Freshwater	Fish
Trout, Gila	*Oncorhynchus gilae*	E	Freshwater	Fish
Woundfin	*Plagopterus argentissimus*	E	Freshwater	Fish
Ambersnail, Kanab	*Oxyloma haydeni kanabensis*	E	Terrestrial,	Gastropod
Springsnail, San	*Pyrgulopsis bernardina*	E	Terrestrial,	Gastropod
Springsnail, Three Forks	*Pyrgulopsis trivialis*	E	Freshwater	Gastropod
Bat, Lesser (Sanborn's)	*Leptonycteris curasoae*	E	Terrestrial,	Mammal
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Jaguar	*Panthera onca*	E	Terrestrial	Mammal
Jaguarundi, Sinaloan	*Herpailurus (Felis) yagouaroundi*	E	Terrestrial	Mammal
Ocelot	*Leopardus (Felis) pardalis*	E	Terrestrial	Mammal
Pronghorn, Sonoran	*Antilocapra americana sonoriensis*	E	Terrestrial	Mammal

Squirrel, Mount Graham	*Tamiasciurus hudsonicus*	E	Terrestrial	Mammal
Vole, Hualapai Mexican	*Microtus mexicanus hualpaiensis*	E	Terrestrial	Mammal
Ladies'-tresses, Canelo	*Spiranthes delitescens*	E	Wetland	Monocot
Sedge, Navajo	*Carex specuicola*	T	Wetland	Monocot
Rattlesnake, New Mexican	*Crotalus willardi obscurus*	T	Terrestrial	Reptile
Tortoise, Desert	*Gopherus agassizii*	T	Terrestrial	Reptile

Arkansas	(37) species:	**E/T**	**Medium**	**Taxon**
Ozark Hellbender	*Cryptobranchus alleganiensis*	E	Freshwater	Amphibian
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Terrestrial	Bird
Woodpecker, Ivory-billed	*Campephilus principalis*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Fatmucket, Arkansas	*Lampsilis powelli*	T	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Scaleshell	*Leptodea leptodon*	E	Freshwater	Bivalve
Mussel, Speckled	*Lampsilis streckeri*	E	Freshwater	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Freshwater	Bivalve
Pearlymussel, Curtis'	*Epioblasma florentina curtisii*	E	Freshwater	Bivalve
Pearlymussel, Fat	*Potamilus capax*	E	Freshwater	Bivalve
Pearlymussel, Turgid-	*Epioblasma turgidula*	E	Freshwater	Bivalve
Rock-pocketbook,	*Arkansia wheeleri*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Crayfish, Cave (Cambarus	*Cambarus aculabrum*	E	Freshwater	Crustacean
Crayfish, Cave (Cambarus	*Cambarus zophonastes*	E	Freshwater	Crustacean
Bladderpod, Missouri	*Lesquerella filiformis*	T	Unattributed	Dicot
Catchfly, Spalding's	*Silene spaldingii*	T	Unattributed	Dicot
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Unattributed	Dicot
Fruit, Earth (geocarpon)	*Geocarpon minimum*	T	Unattributed	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Pondberry	*Lindera melissifolia*	E	Wetland	Dicot
Cavefish, Ozark	*Amblyopsis rosae*	T	Freshwater	Fish
Darter, Leopard	*Percina pantherina*	T	Freshwater	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Trout, Bull	*Salvelinus confluentus*	T	Freshwater	Fish
Yellowcheek darter	*Etheostoma moorei*	E	Freshwater	Fish
Shagreen, Magazine	*Mesodon magazinensis*	T	Terrestrial	Gastropod
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bat, Ozark Big-eared	*Corynorhinus (Plecotus)*	E	Terrestrial,	Mammal
Panther, Florida	*Puma (Felis) concolor coryi*	E	Terrestrial	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot

California	(294) species:	**E/T**	**Medium**	**Taxon**
Frog, California Red-legged	*Rana aurora draytonii*	T	Terrestrial,	Amphibian
Frog, Mountain Yellow-	*Rana muscosa*	E	Terrestrial,	Amphibian
Salamander, California	*Ambystoma californiense*	E	Terrestrial,	Amphibian

Salamander, Desert Slender	*Batrachoseps aridus*	E	Terrestrial,	Amphibian
Salamander, Santa Cruz	*Ambystoma macrodactylum*	E	Terrestrial,	Amphibian
Toad, Arroyo Southwestern	*Bufo californicus (microscaphus)*	E	Terrestrial,	Amphibian
Albatross, Short-tailed	*Phoebastria (Diomedea) albatrus*	E	Terrestrial,	Bird
Condor, California	*Gymnogyps californianus*	E	Terrestrial	Bird
Flycatcher, Southwestern	*Empidonax traillii extimus*	E	Terrestrial	Bird
Gnatcatcher, Coastal	*Polioptila californica californica*	T	Terrestrial	Bird
Murrelet, Marbled	*Brachyramphus marmoratus*	T	Terrestrial,	Bird
Owl, Northern Spotted	*Strix occidentalis caurina*	T	Terrestrial	Bird
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	T	Terrestrial	Bird
Rail, California Clapper	*Rallus longirostris obsoletus*	E	Terrestrial	Bird
Rail, Light-footed Clapper	*Rallus longirostris levipes*	E	Terrestrial	Bird
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	E	Terrestrial	Bird
Shrike, San Clemente	*Lanius ludovicianus mearnsi*	E	Terrestrial	Bird
Sparrow, San Clemente	*Amphispiza belli clementeae*	T	Terrestrial	Bird
Tern, California Least	*Sterna antillarum browni*	E	Terrestrial	Bird
Towhee, Inyo Brown	*Pipilo crissalis eremophilus*	T	Terrestrial	Bird
Vireo, Least Bell's	*Vireo bellii pusillus*	E	Terrestrial	Bird
Cypress, Gowen	*Cupressus goveniana ssp.*	T	Unattributed	Conf/cycds
Cypress, Santa Cruz	*Cupressus abramsiana*	E	Unattributed	Conf/cycds
Crayfish, Shasta	*Pacifastacus fortis*	E	Freshwater	Crustacean
Fairy Shrimp, Conservancy	*Branchinecta conservatio*	E	Vernal pool	Crustacean
Fairy Shrimp, Longhorn	*Branchinecta longiantenna*	E	Vernal pool	Crustacean
Fairy Shrimp, Riverside	*Streptocephalus woottoni*	E	Vernal pool	Crustacean
Fairy Shrimp, San Diego	*Branchinecta sandiegonensis*	E	Vernal pool	Crustacean
Fairy Shrimp, Vernal Pool	*Branchinecta lynchi*	T	Vernal pool	Crustacean
Shrimp, California	*Syncaris pacifica*	E	Freshwater	Crustacean
Tadpole Shrimp, Vernal	*Lepidurus packardi*	E	Vernal pool	Crustacean
Adobe Sunburst, San	*Pseudobahia peirsonii*	T	Unattributed	Dicot
Allocarya, Calistoga	*Plagiobothrys strictus*	E	Wetland	Dicot
Ambrosia, San Diego	*Ambrosia pumila*	E	Wetland	Dicot
Baccharis, Encinitas	*Baccharis vanessae*	T	Unattributed	Dicot
Barberry, Island	*Berberis pinnata ssp. insularis*	E	Unattributed	Dicot
Barberry, Nevin's	*Berberis nevinii*	E	Unattributed	Dicot
Bedstraw, El Dorado	*Galium californicum ssp. sierrae*	E	Unattributed	Dicot
Bedstraw, Island	*Galium buxifolium*	E	Unattributed	Dicot
Bird's-beak, Palmate-	*Cordylanthus palmatus*	E	Wetland	Dicot
Bird's-beak, Pennell's	*Cordylanthus tenuis ssp. capillaris*	E	Unattributed	Dicot
Bird's-beak, salt marsh	*Cordylanthus maritimus ssp.*	E	Unattributed	Dicot
Bird's-beak, Soft	*Cordylanthus mollis ssp. mollis*	E	Unattributed	Dicot
Bladderpod, San	*Lesquerella kingii ssp. bernardina*	E	Unattributed	Dicot
Bluecurls, Hidden Lake	*Trichostema austromontanum ssp.*	T	Unattributed	Dicot
Broom, San Clemente Island	*Lotus dendroideus ssp. traskiae*	E	Unattributed	Dicot
Buckwheat, Cushenbury	*Eriogonum ovalifolium var. vineum*	E	Unattributed	Dicot
Buckwheat, Ione	*Eriogonum apricum*	E	Unattributed	Dicot
Buckwheat, Southern	*Eriogonum kennedyi var.*	T	Unattributed	Dicot
Bush-mallow, San	*Malacothamnus clementinus*	E	Unattributed	Dicot
Bush-mallow, Santa Cruz	*Malacothamnus fasciculatus var.*	E	Unattributed	Dicot
Butterweed, Layne's	*Senecio layneae*	T	Unattributed	Dicot

Button-celery, San Diego	*Eryngium aristulatum var. parishii*	E	Unattributed	Dicot
Cactus, Bakersfield	*Opuntia treleasei*	E	Unattributed	Dicot
Ceanothus, Coyote	*Ceanothus ferrisae*	E	Unattributed	Dicot
Ceanothus, Pine Hill	*Ceanothus roderickii*	E	Unattributed	Dicot
Ceanothus, Vail Lake	*Ceanothus ophiochilus*	T	Unattributed	Dicot
Centaury, Spring-loving	*Centaurium namophilum*	T	Wetland	Dicot
Checker-mallow, Keck's	*Sidalcea keckii*	E	Unattributed	Dicot
Checker-mallow, Kenwood	*Sidalcea oregana ssp. valida*	E	Unattributed	Dicot
Checker-mallow, Pedate	*Sidalcea pedata*	E	Wetland	Dicot
Clarkia, Pismo	*Clarkia speciosa ssp. immaculata*	E	Unattributed	Dicot
Clarkia, Presidio	*Clarkia franciscana*	E	Unattributed	Dicot
Clarkia, Springville	*Clarkia springvillensis*	T	Unattributed	Dicot
Clarkia, Vine Hill	*Clarkia imbricata*	E	Unattributed	Dicot
Clover, Fleshy Owl's	*Castilleja campestris ssp. succulenta*	T	Wetland	Dicot
Clover, Monterey	*Trifolium trichocalyx*	E	Unattributed	Dicot
Clover, Showy Indian	*Trifolium amoenum*	E	Wetland	Dicot
Coyote-thistle, Loch Lomond	*Eryngium constancei*	E	Wetland	Dicot
Crownbeard, Big-leaved	*Verbesina dissita*	T	Unattributed	Dicot
Crownscale, San Jacinto	*Atriplex coronata var. notatior*	E	Unattributed	Dicot
Daisy, Parish's	*Erigeron parishii*	T	Unattributed	Dicot
Dudleya, Conejo	*Dudleya abramsii ssp. parva*	T	Unattributed	Dicot
Dudleya, Marcescent	*Dudleya cymosa ssp. marcescens*	T	Unattributed	Dicot
Dudleya, Santa Clara Valley	*Dudleya setchellii*	E	Unattributed	Dicot
Dudleya, Santa Cruz Island	*Dudleya nesiotica*	T	Unattributed	Dicot
Dudleya, Santa Monica	*Dudleya cymosa ssp. ovatifolia*	T	Unattributed	Dicot
Dudleya, Verity's	*Dudleya verityi*	T	Unattributed	Dicot
Dwarf-flax, Marin	*Hesperolinon congestum*	T	Unattributed	Dicot
Evening-primrose, Antioch	*Oenothera deltoides ssp. howellii*	E	Unattributed	Dicot
Evening-primrose, Eureka	*Oenothera avita ssp. eurekensis*	E	Unattributed	Dicot
Evening-primrose, San	*Camissonia benitensis*	T	Unattributed	Dicot
Fiddleneck, Large-flowered	*Amsinckia grandiflora*	E	Unattributed	Dicot
Flannelbush, Mexican	*Fremontodendron mexicanum*	E	Unattributed	Dicot
Flannelbush, Pine Hill	*Fremontodendron californicum*	E	Unattributed	Dicot
Fringepod, Santa Cruz	*Thysanocarpus conchuliferus*	E	Unattributed	Dicot
Gilia, Hoffmann's Slender-	*Gilia tenuiflora ssp. hoffmannii*	E	Unattributed	Dicot
Gilia, Monterey	*Gilia tenuiflora ssp. arenaria*	E	Unattributed	Dicot
Golden Sunburst, Hartweg's	*Pseudobahia bahiifolia*	E	Unattributed	Dicot
Goldfields, Burke's	*Lasthenia burkei*	E	Wetland	Dicot
Goldfields, Contra Costa	*Lasthenia conjugens*	E	Wetland	Dicot
Grass, Hairy Orcutt	*Orcuttia pilosa*	E	Wetland	Dicot
Grass, Sacramento Orcutt	*Orcuttia viscida*	E	Wetland	Dicot
Grass, Slender Orcutt	*Orcuttia tenuis*	T	Wetland	Dicot
Gumplant, Ash Meadows	*Grindelia fraxino-pratensis*	T	Wetland	Dicot
Howellia, Water	*Howellia aquatilis*	T	Wetland	Dicot
Jewelflower, California	*Caulanthus californicus*	E	Unattributed	Dicot
Jewelflower, Metcalf	*Streptanthus albidus ssp. albidus*	E	Unattributed	Dicot
Jewelflower, Tiburon	*Streptanthus niger*	E	Unattributed	Dicot
Larkspur, Baker's	*Delphinium bakeri*	E	Unattributed	Dicot
Larkspur, San Clemente	*Delphinium variegatum ssp.*	E	Unattributed	Dicot

Larkspur, Yellow	*Delphinium luteum*	E	Unattributed	Dicot
Layia, Beach	*Layia carnosa*	E	Unattributed	Dicot
Lessingia, San Francisco	*Lessingia germanorum*	E	Unattributed	Dicot
Liveforever, Laguna Beach	*Dudleya stolonifera*	T	Unattributed	Dicot
Liveforever, Santa Barbara	*Dudleya traskiae*	E	Unattributed	Dicot
Lupine, Clover	*Lupinus tidestromii*	E	Unattributed	Dicot
Lupine, Nipomo Mesa	*Lupinus nipomensis*	E	Unattributed	Dicot
Malacothrix, Island	*Malacothrix squalida*	E	Unattributed	Dicot
Malacothrix, Santa Cruz	*Malacothrix indecora*	E	Unattributed	Dicot
Mallow, Kern	*Eremalche kernensis*	E	Unattributed	Dicot
Manzanita, Del Mar	*Arctostaphylos glandulosa ssp.*	E	Unattributed	Dicot
Manzanita, Ione	*Arctostaphylos myrtifolia*	T	Unattributed	Dicot
Manzanita, Morro	*Arctostaphylos morroensis*	T	Unattributed	Dicot
Manzanita, Pallid	*Arctostaphylos pallida*	T	Unattributed	Dicot
Manzanita, Santa Rosa	*Arctostaphylos confertiflora*	E	Unattributed	Dicot
Meadowfoam, Butte County	*Limnanthes floccosa ssp. californica*	E	Unattributed	Dicot
Meadowfoam, Sebastopol	*Limnanthes vinculans*	E	Wetland	Dicot
Milk-vetch, Applegate's	*Astragalus applegatei*	E	Unattributed	Dicot
Milk-vetch, Braunton's	*Astragalus brauntonii*	E	Unattributed	Dicot
Milk-vetch, Clara Hunt's	*Astragalus clarianus*	E	Unattributed	Dicot
Milk-vetch, Coachella	*Astragalus lentiginosus var.*	E	Unattributed	Dicot
Milk-vetch, Coastal Dunes	*Astragalus tener var. titi*	E	Unattributed	Dicot
Milk-vetch, Cushenbury	*Astragalus albens*	E	Unattributed	Dicot
Milk-vetch, Fish Slough	*Astragalus lentiginosus var.*	T	Wetland	Dicot
Milk-vetch, Lane Mountain	*Astragalus jaegerianus*	E	Unattributed	Dicot
Milk-vetch, Pierson's	*Astragalus magdalenae var.*	T	Unattributed	Dicot
Milk-vetch, Triple-ribbed	*Astragalus tricarinatus*	E	Unattributed	Dicot
Milk-vetch, Ventura Marsh	*Astragalus pycnostachyus var.*	E	Unattributed	Dicot
Mint, Otay Mesa	*Pogogyne nudiuscula*	E	Wetland	Dicot
Mint, San Diego Mesa	*Pogogyne abramsii*	E	Wetland	Dicot
Monardella, Willowy	*Monardella linoides ssp. viminea*	E	Upland	Dicot
Morning-glory, Stebbins	*Calystegia stebbinsii*	E	Unattributed	Dicot
Mountainbalm, Indian	*Eriodictyon altissimum*	E	Unattributed	Dicot
Mountain-mahogany,	*Cercocarpus traskiae*	E	Unattributed	Dicot
Mustard, Slender-petaled	*Thelypodium stenopetalum*	E	Wetland	Dicot
Navarretia, Few-flowered	*Navarretia leucocephala ssp.*	E	Unattributed	Dicot
Navarretia, Many-flowered	*Navarretia leucocephala ssp.*	E	Unattributed	Dicot
Navarretia, Spreading	*Navarretia fossalis*	T	Wetland	Dicot
Niterwort, Amargosa	*Nitrophila mohavensis*	E	Wetland	Dicot
Oxytheca, Cushenbury	*Oxytheca parishii var.*	E	Unattributed	Dicot
Paintbrush, Ash-grey Indian	*Castilleja cinerea*	T	Unattributed	Dicot
Paintbrush, San Clemente	*Castilleja grisea*	E	Unattributed	Dicot
Paintbrush, Soft-leaved	*Castilleja mollis*	E	Unattributed	Dicot
Paintbrush, Tiburon	*Castilleja affinis ssp. neglecta*	E	Unattributed	Dicot
Penny-cress, Kneeland	*Thlaspi californicum*	E	Unattributed	Dicot
Pentachaeta, Lyon's	*Pentachaeta lyonii*	E	Unattributed	Dicot
Pentachaeta, White-rayed	*Pentachaeta bellidiflora*	E	Unattributed	Dicot
Phacelia, Island	*Phacelia insularis ssp. insularis*	E	Unattributed	Dicot
Phlox, Yreka	*Phlox hirsuta*	E	Unattributed	Dicot

Polygonum, Scott's Valley	*Polygonum hickmanii*	E	Unattributed	Dicot
Potentilla, Hickman's	*Potentilla hickmanii*	E	Wetland	Dicot
Pussypaws, Mariposa	*Calyptridium pulchellum*	T	Unattributed	Dicot
Rock-cress, Hoffmann's	*Arabis hoffmannii*	E	Unattributed	Dicot
Rock-cress, McDonald's	*Arabis mcdonaldiana*	E	Unattributed	Dicot
Rock-cress, Santa Cruz	*Sibara filifolia*	E	Unattributed	Dicot
Rush-rose, Island	*Helianthemum greenei*	T	Unattributed	Dicot
Sandwort, Bear Valley	*Arenaria ursina*	T	Unattributed	Dicot
Sandwort, Marsh	*Arenaria paludicola*	E	Wetland	Dicot
Sea-blite, California	*Suaeda californica*	E	Wetland	Dicot
Spineflower, Ben Lomond	*Chorizanthe pungens var.*	E	Unattributed	Dicot
Spineflower, Howell's	*Chorizanthe howellii*	E	Unattributed	Dicot
Spineflower, Monterey	*Chorizanthe pungens var. pungens*	T	Unattributed	Dicot
Spineflower, Orcutt's	*Chorizanthe orcuttiana*	E	Unattributed	Dicot
Spineflower, Robust	*Chorizanthe robusta va r. robusta*	E	Unattributed	Dicot
Spineflower, Scotts Valley	*Chorizanthe robusta var. hartwegii*	E	Unattributed	Dicot
Spineflower, Slender-	*Dodecahema leptoceras*	E	Unattributed	Dicot
Spineflower, Sonoma	*Chorizanthe valida*	E	Unattributed	Dicot
Spurge, Hoover's	*Chamaesyce hooveri*	T	Wetland	Dicot
Stickyseed, Baker's	*Blennosperma bakeri*	E	Wetland	Dicot
Stonecrop, Lake County	*Parvisedum leiocarpum*	E	Unattributed	Dicot
Sunflower, San Mateo	*Eriophyllum latilobum*	E	Unattributed	Dicot
Taraxacum, California	*Taraxacum californicum*	E	Wetland	Dicot
Tarplant, Gaviota	*Deinandra increscens ssp. villosa*	E	Unattributed	Dicot
Tarplant, Otay	*Deinandra (Hemizonia) conjugens*	T	Unattributed	Dicot
Tarplant, Santa Cruz	*Holocarpha macradenia*	T	Unattributed	Dicot
Thistle, Chorro creek Bog	*Cirsium fontinale var. obispoense*	E	Unattributed	Dicot
Thistle, Fountain	*Cirsium fontinale var. fontinale*	E	Unattributed	Dicot
Thistle, La Graciosa	*Cirsium loncholepis*	E	Unattributed	Dicot
Thistle, Suisun	*Cirsium hydrophilum var.*	E	Unattributed	Dicot
Thornmint, San Diego	*Acanthomintha ilicifolia*	T	Wetland	Dicot
Thornmint, San Mateo	*Acanthomintha obovata ssp.*	E	Unattributed	Dicot
Tuctoria, Green's	*Tuctoria greenei*	E	Wetland	Dicot
Vervain, California	*Verbena californica*	T	Wetland	Dicot
Wallflower, Ben Lomond	*Erysimum teretifolium*	E	Unattributed	Dicot
Wallflower, Contra Costa	*Erysimum capitatum var.*	E	Unattributed	Dicot
Wallflower, Menzie's	*Erysimum menziesii*	E	Unattributed	Dicot
Watercress, Gambel's	*Rorippa gambellii*	E	Unattributed	Dicot
Woodland-star, San	*Lithophragma maximum*	E	Unattributed	Dicot
Woolly-star, Santa Ana	*Eriastrum densifolium ssp.*	E	Unattributed	Dicot
Woolly-threads, San	*Monolopia (Lembertia) congdonii*	E	Unattributed	Dicot
Yerba Santa, Lompoc	*Eriodictyon capitatum*	E	Unattributed	Dicot
Chub, Bonytail	*Gila elegans*	E	Freshwater	Fish
Chub, Mohave Tui	*Gila bicolor mohavensis*	E	Freshwater	Fish
Chub, Owens Tui	*Gila bicolor snyderi*	E	Freshwater	Fish
Goby, Tidewater	*Eucyclogobius newberryi*	E	Freshwater	Fish
Pupfish, Desert	*Cyprinodon macularius*	E	Freshwater	Fish
Pupfish, Owens	*Cyprinodon radiosus*	E	Freshwater	Fish
Salmon, Chinook	*Oncorhynchus (Salmo)*	E/T	Freshwater,	Fish
Salmon, Coho	*Oncorhynchus (Salmo) kisutch*	E/T	Freshwater,	Fish

Smelt, Delta	*Hypomesus transpacificus*	T	Freshwater,	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Freshwater	Fish
Steelhead	*Oncorhynchus (Salmo) mykiss*	E/T	Freshwater,	Fish
Stickleback, Unarmored	*Gasterosteus aculeatus williamsoni*	E	Freshwater	Fish
Sturgeon, North American	*Acipenser medirostris*	T	Freshwater,	Fish
Sucker, Lost River	*Deltistes luxatus*	E	Freshwater	Fish
Sucker, Modoc	*Catostomus microps*	E	Freshwater	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Freshwater	Fish
Sucker, Santa Ana	*Catostomus santaanae*	T	Freshwater	Fish
Sucker, Shortnose	*Chasmistes brevirostris*	E	Freshwater	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	Freshwater	Fish
Trout, Little Kern Golden	*Oncorhynchus aguabonita whitei*	T	Freshwater	Fish
Trout, Paiute Cutthroat	*Oncorhynchus clarki seleniris*	T	Freshwater	Fish
Abalone, Black	*Haliotis cracherodii*	E	Saltwater	Gastropod
Abalone, White	*Haliotis sorenseni*	E	Saltwater	Gastropod
Snail, Morro Shoulderband	*Helminthoglypta walkeriana*	E	Terrestrial	Gastropod
Beetle, Casey's June	*Dinacoma caseyi*	E	Terrestrial	Insect
Beetle, Delta Green Ground	*Elaphrus viridis*	T	Terrestrial,	Insect
Beetle, Mount Hermon June	*Polyphylla barbata*	E	Terrestrial,	Insect
Beetle, Ohlone Tiger	*Cicindela ohlone*	E	Terrestrial	Insect
Beetle, Valley Elderberry	*Desmocerus californicus dimorphus*	T	Terrestrial	Insect
Butterfly, Bay Checkerspot	*Euphydryas editha bayensis*	T	Terrestrial	Insect
Butterfly, Behren's	*Speyeria zerene behrensii*	E	Terrestrial	Insect
Butterfly, Callippe	*Speyeria callippe callippe*	E	Terrestrial	Insect
Butterfly, El Segundo Blue	*Euphilotes battoides allyni*	E	Terrestrial	Insect
Butterfly, Lange's	*Apodemia mormo langei*	E	Terrestrial	Insect
Butterfly, Lotis Blue	*Lycaeides argyrognomon lotis*	E	Terrestrial	Insect
Butterfly, Mission Blue	*Icaricia icarioides missionensis*	E	Terrestrial	Insect
Butterfly, Myrtle's	*Speyeria zerene myrtleae*	E	Terrestrial	Insect
Butterfly, Oregon	*Speyeria zerene hippolyta*	T	Terrestrial	Insect
Butterfly, Palos Verdes Blue	*Glaucopsyche lygdamus*	E	Terrestrial	Insect
Butterfly, Quino	*Euphydryas editha quino .*	E	Terrestrial	Insect
Butterfly, San Bruno Elfin	*Callophrys mossii bayensis*	E	Terrestrial	Insect
Butterfly, Smith's Blue	*Euphilotes enoptes smithi*	E	Terrestrial	Insect
Fly, Delhi Sands Flower-	*Rhaphiomidas terminatus*	E	Terrestrial	Insect
Grasshopper, Zayante	*Trimerotropis infantilis*	E	Terrestrial	Insect
Moth, Kern Primrose	*Euproserpinus euterpe*	T	Terrestrial	Insect
Skipper, Carson Wandering	*Pseudocopaeodes eunus obscurus*	E	Terrestrial	Insect
Skipper, Laguna Mountain	*Pyrgus ruralis lagunae*	E	Terrestrial	Insect
Fox, San Joaquin Kit	*Vulpes macrotis mutica*	E	Terrestrial	Mammal
Fox, San Miguel Island	*Urocyon littoralis littoralis*	E	Terrestrial	Mammal
Fox, Santa Catalina Island	*Urocyon littoralis catalinae*	E	Terrestrial	Mammal
Fox, Santa Cruz Island	*Urocyon littoralis santacruzae*	E	Terrestrial	Mammal
Fox, Santa Rosa Island	*Urocyon littoralis santarosae*	E	Terrestrial	Mammal
Jaguar	*Panthera onca*	E	Terrestrial	Mammal
Kangaroo Rat, Fresno	*Dipodomys nitratoides exilis*	E	Terrestrial	Mammal
Kangaroo Rat, Giant	*Dipodomys ingens*	E	Terrestrial	Mammal
Kangaroo Rat, Morro Bay	*Dipodomys heermanni morroensis*	E	Terrestrial	Mammal
Kangaroo Rat, San	*Dipodomys merriami parvus*	E	Terrestrial	Mammal

Kangaroo Rat, Stephens'	*Dipodomys stephensi*	E	Terrestrial	Mammal
Kangaroo Rat, Tipton	*Dipodomys nitratoides nitratoides*	E	Terrestrial	Mammal
Mountain Beaver, Point	*Aplodontia rufa nigra*	E	Terrestrial,	Mammal
Mouse, Pacific Pocket	*Perognathus longimembris*	E	Terrestrial	Mammal
Mouse, Salt Marsh Harvest	*Reithrodontomys raviventris*	E	Terrestrial	Mammal
Otter, Southern Sea	*Enhydra lutris nereis*	T	Saltwater	Mammal
Rabbit, Riparian Brush	*Sylvilagus bachmani riparius*	E	Terrestrial	Mammal
Seal, Guadalupe Fur	*Arctocephalus townsendi*	T	Saltwater,	Mammal
Sea-lion, Steller	*Eumetopias jubatus*	E/T	Saltwater,	Mammal
Sheep, Peninsular Bighorn	*Ovis canadensis nelsoni*	E	Terrestrial	Mammal
Sheep, Sierra Nevada	*Ovis canadensis sierrae*	E	Terrestrial	Mammal
Shrew, Buena Vista Lake	*Sorex ornatus relictus*	E	Terrestrial	Mammal
Vole, Amargosa	*Microtus californicus scirpensis*	E	Terrestrial	Mammal
Whale, Finback	*Balaenoptera physalus*	E	Saltwater	Mammal
Whale, Gray	*Eschrichtius robustus*	E	Saltwater	Mammal
Whale, Humpback	*Megaptera novaeangliae*	E	Saltwater	Mammal
Whale, North Atlantic right	*Eubalaena glacialis (incl. australis)*	E	Saltwater	Mammal
Whale, Sei	*Balaenoptera borealis*	E	Saltwater	Mammal
Whale, Sperm	*Physeter catodon (macrocephalus)*	E	Saltwater	Mammal
Woodrat, Riparian	*Neotoma fuscipes riparia*	E	Terrestrial	Mammal
Alopecurus, Sonoma	*Alopecurus aequalis var.*	E	Unattributed	Monocot
Amole, Cammatta Canyon	*Chlorogalum purpureum var.*	T	Unattributed	Monocot
Amole, Purple	*Chlorogalum purpureum var.*	T	Unattributed	Monocot
Bluegrass, Napa	*Poa napensis*	E	Wetland	Monocot
Bluegrass, San Bernardino	*Poa atropurpurea*	E	Wetland	Monocot
Brodiaea, Chinese Camp	*Brodiaea pallida*	T	Wetland	Monocot
Brodiaea, Thread-leaved	*Brodiaea filifolia*	T	Wetland	Monocot
Grass, California Orcutt	*Orcuttia californica*	E	Wetland	Monocot
Grass, Colusa	*Neostapfia colusana*	T	Wetland	Monocot
Grass, Eureka Dune	*Swallenia alexandrae*	E	Unattributed	Monocot
Grass, San Joaquin Valley	*Orcuttia inaequalis*	T	Wetland	Monocot
Grass, Solano	*Tuctoria mucronata*	E	Wetland	Monocot
Lily, Pitkin Marsh	*Lilium pardalinum ssp. pitkinense*	E	Unattributed	Monocot
Lily, Tiburon Mariposa	*Calochortus tiburonensis*	T	Unattributed	Monocot
Lily, Western	*Lilium occidentale*	E	Wetland	Monocot
Onion, Munz's	*Allium munzii*	E	Unattributed	Monocot
Piperia, Yadon's	*Piperia yadonii*	E	Unattributed	Monocot
Sedge, White	*Carex albida*	E	Wetland	Monocot
Lizard, Blunt-nosed Leopard	*Gambelia silus*	E	Terrestrial	Reptile
Lizard, Coachella Valley	*Uma inornata*	T	Terrestrial	Reptile
Lizard, Island Night	*Xantusia riversiana*	T	Terrestrial	Reptile
Snake, Giant Garter	*Thamnophis gigas*	T	Terrestrial,	Reptile
Snake, San Francisco	*Thamnophis sirtalis tetrataenia*	E	Terrestrial,	Reptile
Tortoise, Desert	*Gopherus agassizii*	T	Terrestrial	Reptile
Whipsnake	*Masticophis lateralis euryxanthus*	T	Terrestrial	Reptile

Colorado	(30) species:	**E/T**	**Medium**	**Taxon**
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Flycatcher, Southwestern	*Empidonax traillii extimus*	E	Terrestrial	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Terrestrial	Bird

Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Beardtongue, Penland	*Penstemon penlandii*	E	Unattributed	Dicot
Butterfly Plant, Colorado	*Gaura neomexicana var.*	T	Unattributed	Dicot
Cactus, Colorado hookless	*Sclerocactus glaucus*	T	Unattributed	Dicot
Cactus, Knowlton	*Pediocactus knowltonii*	E	Unattributed	Dicot
Cactus, Mesa Verde	*Sclerocactus mesae-verdae*	T	Unattributed	Dicot
DeBeque phacelia	*Phacelia submutica*	T	Terrestrial	Dicot
Milk-vetch, Mancos	*Astragalus humillimus*	E	Unattributed	Dicot
Milk-vetch, Osterhout	*Astragalus osterhoutii*	E	Unattributed	Dicot
Mustard, Penland Alpine	*Eutrema penlandii*	T	Wetland	Dicot
Pagosa Skyrocket	*Ipomopsis polyantha*	E	Terrestrial	Dicot
Parachute Beardtongue	*Penstemon debilis*	T	Terrestrial	Dicot
Phacelia, North Park	*Phacelia formosula*	E	Unattributed	Dicot
Wild-buckwheat, Clay-	*Eriogonum pelinophilum*	E	Unattributed	Dicot
Chub, Bonytail	*Gila elegans*	E	Freshwater	Fish
Chub, Humpback	*Gila cypha*	E	Freshwater	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Freshwater	Fish
Trout, Greenback Cutthroat	*Oncorhynchus clarki stomias*	T	Freshwater	Fish
Butterfly, Uncompahgre	*Boloria acrocnema*	E	Terrestrial	Insect
Skipper, Pawnee Montane	*Hesperia leonardus montana*	T	Terrestrial	Insect
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Mouse, Preble's Meadow	*Zapus hudsonius preblei*	T	Terrestrial	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot

Connecticut	(29) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Gerardia, Sandplain	*Agalinis acuta*	E	Unattributed	Dicot
Beetle, Puritan Tiger	*Cicindela puritana*	T	Terrestrial,	Insect
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

Delaware	(5) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Amaranth, Seabeach	*Amaranthus pumilus*	T	Wetland	Dicot
Squirrel, Delmarva	*Sciurus niger cinereus*	E	Terrestrial	Mammal
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

Florida	(109) species:	**E/T**	**Medium**	**Taxon**
Salamander, Frosted	*Ambystoma cingulatum*	T	Terrestrial,	Amphibian
Salamander, Reticulated	*Ambystoma bishopi*	E	Terrestrial,	Amphibian
Caracara, Audubon's	*Polyborus plancus audubonii*	T	Terrestrial	Bird
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird

Kite, Everglades Snail	*Rostrhamus sociabilis plumbeus*	E	Terrestrial	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Scrub-Jay, Florida	*Aphelocoma coerulescens*	T	Terrestrial	Bird
Sparrow, Cape Sable	*Ammodramus maritimus mirabilis*	E	Terrestrial	Bird
Sparrow, Florida	*Ammodramus savannarum*	E	Terrestrial	Bird
Stork, Wood	*Mycteria americana*	E	Terrestrial	Bird
Warbler (=Wood),	*Dendroica kirtlandii*	E	Terrestrial	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Terrestrial	Bird
Woodpecker, Ivory-billed	*Campephilus principalis*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Bankclimber, Purple	*Elliptoideus sloatianus*	T	Freshwater	Bivalve
Choctaw Bean	*Villosa choctawensis*	E	Freshwater	Bivalve
fuzzy pigtoe	*Pleurobema strodeanum*	T	Freshwater	Bivalve
Mussel, Fat Threeridge	*Amblema neislerii*	E	Freshwater	Bivalve
Mussel, Gulf	*Medionidus penicillatus*	E	Freshwater	Bivalve
Mussel, Ochlockonee	*Medionidus simpsonianus*	E	Freshwater	Bivalve
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	E	Freshwater	Bivalve
Mussel, Shiny-rayed	*Lampsilis subangulata*	E	Freshwater	Bivalve
Narrow Pigtoe	*Fusconaia escambia*	T	Freshwater	Bivalve
Round Ebonyshell	*Fusconaia rotulata*	E	Freshwater	Bivalve
Slabshell, Chipola	*Elliptio chipolaensis*	T	Freshwater	Bivalve
Southern Kidneyshell	*Ptychobranchus jonesi*	E	Freshwater	Bivalve
Southern Sandshell	*Hamiota australis*	T	Freshwater	Bivalve
Tapered Pigtoe	*Fusconaia burkei*	T	Freshwater	Bivalve
Torreya, Florida	*Torreya taxifolia*	E	Unattributed	Conf/cycds
Coral, Elkhorn	*Acropora palmata*	T	Saltwater	Coral
Coral, Staghorn	*Acropora cervicornis*	T	Saltwater	Coral
Shrimp, Squirrel Chimney	*Palaemonetes cummingi*	T	Freshwater,	Crustacean
Aster, Florida Golden	*Chrysopsis floridana*	E	Unattributed	Dicot
Bellflower, Brooksville	*Campanula robinsiae*	E	Wetland	Dicot
Birds-in-a-nest, White	*Macbridea alba*	T	Wetland	Dicot
Blazing Star, Scrub	*Liatris ohlingerae*	E	Unattributed	Dicot
Bonamia, Florida	*Bonamia grandiflora*	T	Unattributed	Dicot
Buckwheat, Scrub	*Eriogonum longifolium var.*	T	Unattributed	Dicot
Butterwort, Godfrey's	*Pinguicula ionantha*	T	Wetland	Dicot
Campion, Fringed	*Silene polypetala*	E	Unattributed	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Fringe Tree, Pygmy	*Chionanthus pygmaeus*	E	Unattributed	Dicot
Gooseberry, Miccosukee	*Ribes echinellum*	T	Wetland	Dicot
Gourd, Okeechobee	*Cucurbita okeechobeensis ssp.*	E	Unattributed	Dicot
Harebells, Avon Park	*Crotalaria avonensis*	E	Unattributed	Dicot
Hypericum, Highlands	*Hypericum cumulicola*	E	Unattributed	Dicot
Jacquemontia, Beach	*Jacquemontia reclinata*	E	Unattributed	Dicot
Lead-plant, Crenulate	*Amorpha crenulata*	E	Unattributed	Dicot
Lupine, Scrub	*Lupinus aridorum*	E	Unattributed	Dicot
Meadowrue, Cooley's	*Thalictrum cooleyi*	E	Wetland	Dicot
Milkpea, Small's	*Galactia smallii*	E	Unattributed	Dicot
Mint, Garrett's	*Dicerandra christmanii*	E	Unattributed	Dicot
Mint, Lakela's	*Dicerandra immaculata*	E	Unattributed	Dicot

Mint, Longspurred	*Dicerandra cornutissima*	E	Unattributed	Dicot
Mint, Scrub	*Dicerandra frutescens*	E	Unattributed	Dicot
Mustard, Carter's	*Warea carteri*	E	Unattributed	Dicot
Pawpaw, Beautiful	*Deeringothamnus pulchellus*	E	Wetland	Dicot
Pawpaw, Four-petal	*Asimina tetramera*	E	Unattributed	Dicot
Pawpaw, Rugel's	*Deeringothamnus rugelii*	E	Wetland	Dicot
Pinkroot, Gentian	*Spigelia gentianoides*	E	Unattributed	Dicot
Plum, Scrub	*Prunus geniculata*	E	Unattributed	Dicot
Polygala, Lewton's	*Polygala lewtonii*	E	Unattributed	Dicot
Polygala, Tiny	*Polygala smallii*	E	Wetland	Dicot
Prickly-apple, Fragrant	*Cereus eriophorus var. fragrans*	E	Unattributed	Dicot
Rhododendron, Chapman	*Rhododendron chapmanii*	E	Wetland	Dicot
Rosemary, Apalachicola	*Conradina glabra*	E	Unattributed	Dicot
Rosemary, Etonia	*Conradina etonia*	E	Unattributed	Dicot
Rosemary, Short-leaved	*Conradina brevifolia*	E	Unattributed	Dicot
Sandlace	*Polygonella myriophylla*	E	Unattributed	Dicot
Skullcap, Florida	*Scutellaria floridana*	T	Wetland	Dicot
Snakeroot	*Eryngium cuneifolium*	E	Unattributed	Dicot
Spurge, Deltoid	*Chamaesyce deltoidea ssp.*	E	Unattributed	Dicot
Spurge, Garber's	*Chamaesyce garberi*	T	Unattributed	Dicot
Spurge, Telephus	*Euphorbia telephioides*	T	Unattributed	Dicot
Warea, Wide-leaf	*Warea amplexifolia*	E	Unattributed	Dicot
Water-willow, Cooley's	*Justicia cooleyi*	E	Wetland	Dicot
Whitlow-wort, Papery	*Paronychia chartacea*	T	Unattributed	Dicot
Wings, Pigeon	*Clitoria fragrans*	T	Unattributed	Dicot
Wireweed	*Polygonella basiramia*	E	Unattributed	Dicot
Ziziphus, Florida	*Ziziphus celata*	E	Unattributed	Dicot
Darter, Okaloosa	*Etheostoma okaloosae*	E	Freshwater	Fish
Sawfish, Smalltooth	*Pristis pectinata*	E	Freshwater,	Fish
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Freshwater,	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Butterfly [Cassius Blue,	*Leptotes and Hemiargus and*	SAT	Terrestrial	Insect
Butterfly, Ceranus Blue	*Hemiargus ceraunus antibubastus*	SAT	Terrestrial	Insect
Butterfly, Miami Blue	*Cyclargus thomasi bethunebakeri*	E	Terrestrial	Insect
Butterfly, Nickerbean Blue	*Cyclargus ammon*	SAT	Terrestrial	Insect
Cladonia, Florida Perforate	*Cladonia perforata*	E	Unattributed	Lichen
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Mouse, Anastasia Island	*Peromyscus polionotus phasma*	E	Terrestrial,	Mammal
Mouse, Choctawhatchee	*Peromyscus polionotus allophrys*	E	Terrestrial,	Mammal
Mouse, Perdido Key Beach	*Peromyscus polionotus trissyllepsis*	E	Terrestrial,	Mammal
Mouse, Southeastern Beach	*Peromyscus polionotus niveiventris*	T	Terrestrial,	Mammal
Mouse, St. Andrew Beach	*Peromyscus polionotus peninsularis*	E	Terrestrial,	Mammal
Panther, Florida	*Puma (Felis) concolor coryi*	E	Terrestrial	Mammal
Puma (Cougar), Eastern	*Puma (Felis) concolor (all subsp.*	E	Terrestrial	Mammal
Vole, Florida Salt Marsh	*Microtus pennsylvanicus*	E	Terrestrial,	Mammal
Beargrass, Britton's	*Nolina brittoniana*	E	Unattributed	Monocot
Beauty, Harper's	*Harperocallis flava*	E	Wetland	Monocot

Seagrass, Johnson's	*Halophila johnsonii*	T	Wetland	Monocot
Alligator, American	*Alligator mississippiensis*	T	Terrestrial,	Reptile
Crocodile, American	*Crocodylus acutus*	T	Terrestrial,	Reptile
Skink, Blue-tailed Mole	*Eumeces egregius lividus*	T	Terrestrial	Reptile
Skink, Sand	*Neoseps reynoldsi*	T	Terrestrial	Reptile
Snake, Atlantic Salt Marsh	*Nerodia clarkii taeniata*	T	Terrestrial,	Reptile
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Terrestrial	Reptile

Georgia	(67) species:	**E/T**	**Medium**	**Taxon**
Salamander, Frosted	*Ambystoma cingulatum*	T	Terrestrial,	Amphibian
Salamander, Reticulated	*Ambystoma bishopi*	E	Terrestrial,	Amphibian
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Stork, Wood	*Mycteria americana*	E	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Warbler (=Wood),	*Dendroica kirtlandii*	E	Terrestrial	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Bankclimber, Purple	*Elliptoideus sloatianus*	T	Freshwater	Bivalve
Combshell, Upland	*Epioblasma metastriata*	E	Freshwater	Bivalve
Kidneyshell, Triangular	*Ptychobranchus greenii*	E	Freshwater	Bivalve
Mussel, Acornshell	*Epioblasma othcaloogensis*	E	Freshwater	Bivalve
Mussel, Alabama	*Medionidus acutissimus*	T	Freshwater	Bivalve
Mussel, Coosa	*Medionidus parvulus*	E	Freshwater	Bivalve
Mussel, Fat Threeridge	*Amblema neislerii*	E	Freshwater	Bivalve
Mussel, Fine-lined	*Lampsilis altilis*	T	Freshwater	Bivalve
Mussel, Georgia pigtoe	*Pleurobema hanleyianum*	E	Freshwater	Bivalve
Mussel, Gulf	*Medionidus penicillatus*	E	Freshwater	Bivalve
Mussel, Ochlockonee	*Medionidus simpsonianus*	E	Freshwater	Bivalve
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	E	Freshwater	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Freshwater	Bivalve
Mussel, Shiny-rayed	*Lampsilis subangulata*	E	Freshwater	Bivalve
Mussel, Southern Clubshell	*Pleurobema decisum*	E	Freshwater	Bivalve
Mussel, Southern Pigtoe	*Pleurobema georgianum*	E	Freshwater	Bivalve
Spinymussel, Altamaha	*Elliptio spinosa*	E	Freshwater	Bivalve
Torreya, Florida	*Torreya taxifolia*	E	Unattributed	Conf/cycds
Amphianthus, Little	*Amphianthus pusillus*	T	Wetland	Dicot
Barbara Buttons, Mohr's	*Marshallia mohrii*	T	Wetland	Dicot
Campion, Fringed	*Silene polypetala*	E	Unattributed	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	Unattributed	Dicot
Dropwort, Canby's	*Oxypolis canbyi*	E	Wetland	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Leather-flower, Alabama	*Clematis socialis*	E	Unattributed	Dicot
Meadowrue, Cooley's	*Thalictrum cooleyi*	E	Wetland	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	Wetland	Dicot
Pondberry	*Lindera melissifolia*	E	Wetland	Dicot
Rattleweed, Hairy	*Baptisia arachnifera*	E	Unattributed	Dicot
Skullcap, Large-flowered	*Scutellaria montana*	T	Unattributed	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Wetland	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	Unattributed	Dicot

Quillwort, Black-spored	*Isoetes melanospora*	E	Wetland	Ferns
Quillwort, Mat-forming	*Isoetes tegetiformans*	E	Wetland	Ferns
Darter, Amber	*Percina antesella*	E	Freshwater	Fish
Darter, Cherokee	*Etheostoma scotti*	T	Freshwater	Fish
Darter, Etowah	*Etheostoma etowahae*	E	Freshwater	Fish
Darter, Goldline	*Percina aurolineata*	T	Freshwater	Fish
Darter, Snail	*Percina tanasi*	T	Freshwater	Fish
Logperch, Conasauga	*Percina jenkinsi*	E	Freshwater	Fish
Shiner, Blue	*Cyprinella caerulea*	T	Freshwater	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Rocksnail, interrupted	*Leptoxis foremani*	E	Freshwater	Gastropod
Snail, Lioplax Cylindrical	*Lioplax cyclostomaformis*	E	Freshwater	Gastropod
Lichen, Rock Gnome	*Gymnoderma lineare*	E	Unattributed	Lichen
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Whale, Humpback	*Megaptera novaeangliae*	E	Saltwater	Mammal
Whale, North Atlantic right	*Eubalaena glacialis (incl. australis)*	E	Saltwater	Mammal
Grass, Tennessee Yellow-	*Xyris tennesseensis*	E	Wetland	Monocot
Pink, Swamp	*Helonias bullata*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Trillium, Persistent	*Trillium persistens*	E	Unattributed	Monocot
Trillium, Relict	*Trillium reliquum*	E	Unattributed	Monocot
Water-plantain, Kral's	*Sagittaria secundifolia*	T	Wetland	Monocot
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Terrestrial	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

Guam	(12) species:	**E/T**	**Medium**	**Taxon**
Crow, Mariana	*Corvus kubaryi*	E	Terrestrial	Bird
Kingfisher, Guam	*Halcyon cinnamomina*	E	Terrestrial	Bird
Moorhen, Mariana	*Gallinula chloropus guami*	E	Terrestrial	Bird
Rail, Guam	*Rallus owstoni*	E	Terrestrial	Bird
White-eye, Bridled (Nossa)	*Zosterops conspicillatus*	E	Terrestrial	Bird
Hayun Lagu (Tronkon	*Serianthes nelsonii*	E	Unattributed	Dicot
Bat, Little Mariana Fruit	*Pteropus tokudae*	E	Terrestrial,	Mammal
Bat, Mariana Fruit	*Pteropus mariannus mariannus*	T	Terrestrial,	Mammal
Sea turtle, green	*Chelonia mydas*	E/T	Saltwater	Reptile
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Saltwater,	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Saltwater,	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Saltwater,	Reptile

Hawaii	(353) species:	**E/T**	**Medium**	**Taxon**
Spider, Kauai Cave Wolf	*Adelocosa anops*	E	Terrestrial,	Arachnid
Akekee	*Loxops caeruleirostris*	E	Terrestrial	Bird
'Akepa, Hawaii	*Loxops coccineus coccineus*	E	Terrestrial	Bird
'Akepa, Maui	*Loxops coccineus ochraceus*	E	Terrestrial	Bird
'Akia Loa, Kauai	*Hemignathus procerus*	E	Terrestrial	Bird
'Akia Pola'au	*Hemignathus munroi*	E	Terrestrial	Bird
Coot, Hawaiian (=Alae keo	*Fulica americana alai*	E	Terrestrial	Bird
Creeper, Hawaii	*Oreomystis mana*	E	Terrestrial	Bird

Creeper, Oahu (Alauwahio)	*Paroreomyza maculata*	E	Terrestrial	Bird
Crow, Hawaiian ('Alala)	*Corvus hawaiiensis*	E	Terrestrial	Bird
Duck, Hawaiian (Koloa)	*Anas wyvilliana*	E	Terrestrial,	Bird
Elepaio, Oahu	*Chasiempis sandwichensis ibidis*	E	Terrestrial	Bird
Goose, Hawaiian (Nene)	*Branta (Nesochen) sandvicensis*	E	Terrestrial,	Bird
Hawk, Hawaiian (Io)	*Buteo solitarius*	E	Terrestrial	Bird
Honeycreeper, Crested	*Palmeria dolei*	E	Terrestrial	Bird
Kauai creeper	*Oreomystis bairdi*	E	Terrestrial	Bird
Moorhen, Hawaiian	*Gallinula chloropus sandvicensis*	E	Terrestrial	Bird
Nuku Pu'u, Kauai	*Hemignathus lucidus hanapepe*	E	Terrestrial	Bird
Nuku Pu'u, Maui	*Hemignathus lucidus affinus*	E	Terrestrial	Bird
'O'o, Kauai (='A'a)	*Moho braccatus*	E	Terrestrial	Bird
'O'u (Honeycreeper)	*Psittirostra psittacea*	E	Terrestrial	Bird
Palila	*Loxioides bailleui*	E	Terrestrial	Bird
Parrotbill, Maui	*Pseudonestor xanthophrys*	E	Terrestrial	Bird
Petrel, Hawaiian Dark-	*Pterodroma phaeopygia*	E	Terrestrial	Bird
Po'ouli	*Melamprosops phaeosoma*	E	Terrestrial	Bird
Shearwater, Newell's	*Puffinus auricularis newelli*	T	Terrestrial,	Bird
Stilt, Hawaiian (=Ae'o)	*Himantopus mexicanus knudseni*	E	Terrestrial	Bird
Swiftlet, Mariana Gray	*Aerodramus vanikorensis bartschi*	E	Terrestrial	Bird
Thrush, Large Kauai	*Myadestes myadestinus*	E	Terrestrial	Bird
Thrush, Small Kauai	*Myadestes palmeri*	E	Terrestrial	Bird
Amphipod, Kauai Cave	*Spelaeorchestia koloana*	E	Freshwater,	Crustacean
(ncn)	*Tetraplasandra bisattenuata*	E	Unattributed	Dicot
Abutilon sandwicense	*Abutilon sandwicense*	E	Unattributed	Dicot
Achyranthes mutica (ncn)	*Achyranthes mutica*	E	Unattributed	Dicot
Achyranthes splendens	*Achyranthes splendens var.*	E	Unattributed	Dicot
a'e	*Zanthoxylum oahuense*	E	Wetland	Dicot
A'e (Zanthoxylum	*Zanthoxylum dipetalum var.*	E	Unattributed	Dicot
A'e (Zanthoxylum	*Zanthoxylum hawaiiense*	E	Unattributed	Dicot
'Aiea (Nothocestrum	*Nothocestrum breviflorum*	E	Unattributed	Dicot
'Aiea (Nothocestrum	*Nothocestrum peltatum*	E	Unattributed	Dicot
Akoko	*Chamaesyce remyi var. kauaiensis*	E	Unattributed	Dicot
'akoko	*Chamaesyce eleanoriae*	E	Unattributed	Dicot
'Akoko (Chamaesyce	*Chamaesyce celastroides var.*	E	Unattributed	Dicot
'Akoko (Chamaesyce	*Chamaesyce deppeana*	E	Unattributed	Dicot
'Akoko (Chamaesyce	*Chamaesyce herbstii*	E	Unattributed	Dicot
'Akoko (Chamaesyce	*Chamaesyce kuwaleana*	E	Unattributed	Dicot
'Akoko (Chamaesyce rockii)	*Chamaesyce rockii*	E	Wetland	Dicot
'Akoko (Chamaesyce	*Chamaesyce skottsbergii var.*	E	Unattributed	Dicot
'Akoko (Euphorbia	*Euphorbia haeleeleana*	E	Unattributed	Dicot
alani	*Melicope christophersenii*	E	Wetland	Dicot
Alani (Melicope	*Melicope adscendens*	E	Unattributed	Dicot
Alani (Melicope balloui)	*Melicope balloui*	E	Unattributed	Dicot
Alani (Melicope	*Melicope haupuensis*	E	Unattributed	Dicot
Alani (Melicope knudsenii)	*Melicope knudsenii*	E	Unattributed	Dicot
Alani (Melicope lydgatei)	*Melicope lydgatei*	E	Wetland	Dicot
Alani (Melicope	*Melicope mucronulata*	E	Unattributed	Dicot
Alani (Melicope ovalis)	*Melicope ovalis*	E	Unattributed	Dicot

Alani (Melicope pallida)	*Melicope pallida*	E	Unattributed	Dicot
Alani (Melicope	*Melicope quadrangularis*	E	Wetland	Dicot
Alani (Melicope saint-	*Melicope saint-johnii*	E	Unattributed	Dicot
Alani (Melicope	*Melicope zahlbruckneri*	E	Unattributed	Dicot
Alsinidendron obovatum	*Alsinidendron obovatum*	E	Unattributed	Dicot
Alsinidendron trinerve	*Alsinidendron trinerve*	E	Unattributed	Dicot
Alsinidendron viscosum	*Alsinidendron viscosum*	E	Wetland	Dicot
'Anaunau (Lepidium	*Lepidium arbuscula*	E	Unattributed	Dicot
'Anunu (Sicyos alba)	*Sicyos alba*	E	Unattributed	Dicot
Aupaka (Isodendrion	*Isodendrion hosakae*	E	Unattributed	Dicot
Aupaka (Isodendrion	*Isodendrion laurifolium*	E	Unattributed	Dicot
Aupaka (Isodendrion	*Isodendrion longifolium*	T	Unattributed	Dicot
awikiwiki	*Canavalia napaliensis*	E	Unattributed	Dicot
'Awiwi (Centaurium	*Centaurium sebaeoides*	E	Unattributed	Dicot
'Awiwi (Hedyotis cookiana)	*Hedyotis cookiana*	E	Unattributed	Dicot
Bonamia menziesii (ncn)	*Bonamia menziesii*	E	Unattributed	Dicot
Chamaesyce Halemanui	*Chamaesyce halemanui*	E	Unattributed	Dicot
Cyanea undulata (ncn)	*Cyanea undulata*	E	Unattributed	Dicot
Delissea rhytodisperma	*Delissea rhytidosperma*	E	Unattributed	Dicot
Dubautia latifolia (ncn)	*Dubautia latifolia*	E	Unattributed	Dicot
Dubautia pauciflorula	*Dubautia pauciflorula*	E	Wetland	Dicot
Geranium, Hawaiian Red-	*Geranium arboreum*	E	Unattributed	Dicot
Gouania hillebrandii (ncn)	*Gouania hillebrandii*	E	Unattributed	Dicot
Gouania meyenii (ncn)	*Gouania meyenii*	E	Unattributed	Dicot
Gouania vitifolia (ncn)	*Gouania vitifolia*	E	Unattributed	Dicot
ha`iwale	*Cyrtandra kaulantha*	E	Wetland	Dicot
Haha	*Cyanea lanceolata*	E	Wetland	Dicot
Haha (Cyanea acuminata)	*Cyanea acuminata*	E	Wetland	Dicot
Haha (Cyanea asarifolia)	*Cyanea asarifolia*	E	Unattributed	Dicot
Haha (Cyanea copelandii	*Cyanea copelandii ssp. copelandii*	E	Unattributed	Dicot
Haha (Cyanea copelandii	*Cyanea copelandii ssp.*	E	Unattributed	Dicot
Haha (Cyanea Crispa)	*Cyanea (Rollandia) crispa*	E	Unattributed	Dicot
Haha (Cyanea glabra)	*Cyanea glabra*	E	Unattributed	Dicot
Haha (Cyanea grimesiana	*Cyanea grimesiana ssp. grimesiana*	E	Unattributed	Dicot
Haha (Cyanea grimesiana	*Cyanea grimesiana ssp. obatae*	E	Unattributed	Dicot
Haha (Cyanea hamatiflora	*Cyanea hamatiflora ssp. Carlsonii*	E	Unattributed	Dicot
Haha (Cyanea hamatiflora	*Cyanea hamatiflora ssp.*	E	Unattributed	Dicot
Haha (Cyanea	*Cyanea humboldtiana*	E	Wetland	Dicot
Haha (Cyanea koolauensis)	*Cyanea koolauensis*	E	Wetland	Dicot
Haha (Cyanea lobata)	*Cyanea lobata*	E	Unattributed	Dicot
Haha (Cyanea longiflora)	*Cyanea longiflora*	E	Unattributed	Dicot
Haha (Cyanea	*Cyanea mceldowneyi*	E	Wetland	Dicot
Haha (Cyanea pinnatifida)	*Cyanea pinnatifida*	E	Unattributed	Dicot
Haha (Cyanea platyphylla)	*Cyanea platyphylla*	E	Unattributed	Dicot
Haha (Cyanea recta)	*Cyanea recta*	T	Unattributed	Dicot
Haha (Cyanea remyi)	*Cyanea remyi*	E	Wetland	Dicot
Haha (Cyanea shipmanii)	*Cyanea shipmannii*	E	Unattributed	Dicot
Haha (Cyanea stictophylla)	*Cyanea stictophylla*	E	Unattributed	Dicot
Haha (Cyanea St-Johnii)	*Cyanea st-johnii*	E	Wetland	Dicot

Haha (Cyanea superba)	*Cyanea superba*	E	Unattributed	Dicot
Haha (Cyanea truncata)	*Cyanea truncata*	E	Unattributed	Dicot
haiwale	*Cyrtandra waiolani*	E	Wetland	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra crenata*	E	Unattributed	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra dentata*	E	Unattributed	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra giffardii*	E	Unattributed	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra limahuliensis*	T	Unattributed	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra munroi*	E	Unattributed	Dicot
Ha'iwale (Cyrtandra	*Cyrtandra oenobarba*	E	Wetland	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra polyantha*	E	Unattributed	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra subumbellata*	E	Unattributed	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra tintinnabula*	E	Unattributed	Dicot
Ha'Iwale (Cyrtandra	*Cyrtandra viridiflora*	E	Wetland	Dicot
Haplostachys	*Haplostachys haplostachya*	E	Unattributed	Dicot
Hau Kauhiwi	*Hibiscadelphus woodii*	E	Unattributed	Dicot
Hau Kuahiwi	*Hibiscadelphus distans*	E	Unattributed	Dicot
Hau Kuahiwi	*Hibiscadelphus giffardianus*	E	Unattributed	Dicot
Hau Kuahiwi	*Hibiscadelphus hualalaiensis*	E	Unattributed	Dicot
Heau (Exocarpos luteolus)	*Exocarpos luteolus*	E	Wetland	Dicot
Hedyotis degeneri (ncn)	*Hedyotis degeneri*	E	Unattributed	Dicot
Hedyotis parvula (ncn)	*Hedyotis parvula*	E	Unattributed	Dicot
Hedyotis St.-Johnii (ncn)	*Hedyotis st.-johnii*	E	Unattributed	Dicot
Hesperomannia	*Hesperomannia arborescens*	E	Unattributed	Dicot
Hesperomannia arbuscula	*Hesperomannia arbuscula*	E	Unattributed	Dicot
Hesperomannia lydgatei	*Hesperomannia lydgatei*	E	Wetland	Dicot
Hibiscus, Clay's	*Hibiscus clayi*	E	Unattributed	Dicot
ho'awa	*Pittosporum napaliense*	E	Unattributed	Dicot
Holei (Ochrosia	*Ochrosia kilaueaensis*	E	Unattributed	Dicot
Iliau (Wilkesia hobdyi)	*Wilkesia hobdyi*	E	Unattributed	Dicot
kamakahala	*Labordia helleri*	E	Unattributed	Dicot
Kamakahala (Labordia	*Labordia cyrtandrae*	E	Wetland	Dicot
Kamakahala (Labordia	*Labordia lydgatei*	E	Wetland	Dicot
Kamakahala (Labordia	*Labordia tinifolia var.*	E	Unattributed	Dicot
Kauila (Colubrina	*Colubrina oppositifolia*	E	Unattributed	Dicot
kaulu	*Pteralyxia macrocarpa*	E	Wetland	Dicot
Kaulu (Pteralyxia	*Pteralyxia kauaiensis*	E	Unattributed	Dicot
Kio'Ele (Hedyotis coriacea)	*Hedyotis coriacea*	E	Unattributed	Dicot
Kiponapona (Phyllostegia	*Phyllostegia racemosa*	E	Unattributed	Dicot
ko`oko`olau	*Bidens amplectens*	E	Wetland	Dicot
Koki'o (Kokia drynarioides)	*Kokia drynarioides*	E	Unattributed	Dicot
Koki'o (Kokia kauaiensis)	*Kokia kauaiensis*	E	Unattributed	Dicot
Koki'o Ke'oke'o (Hibiscus	*Hibiscus waimeae ssp. hannerae*	E	Unattributed	Dicot
kolea	*Myrsine mezii*	E	Unattributed	Dicot
Kolea (Myrsine juddii)	*Myrsine juddii*	E	Wetland	Dicot
Kolea (Myrsine	*Myrsine linearifolia*	T	Wetland	Dicot
Ko'oko'olau (Bidens	*Bidens micrantha ssp. kalealaha*	E	Unattributed	Dicot
Ko'oloa'ula (Abutilon	*Abutilon menziesii*	E	Unattributed	Dicot
kopiko	*Psychotria grandiflora*	E	Wetland	Dicot
Kuawawaenohu	*Alsinidendron lychnoides*	E	Wetland	Dicot

Kulu'I (Nototrichium	*Nototrichium humile*	E	Unattributed	Dicot
Laukahi Kuahiwi	*Plantago hawaiensis*	E	Unattributed	Dicot
Laukahi Kuahiwi	*Plantago princeps*	E	Wetland	Dicot
Laulihilihi (Schiedea	*Schiedea stellarioides*	E	Unattributed	Dicot
lehua makanoe	*Lysimachia daphnoides*	E	Wetland	Dicot
Liliwai (Acaena exigua)	*Acaena exigua*	E	Wetland	Dicot
Lipochaeta venosa (ncn)	*Lipochaeta venosa*	E	Unattributed	Dicot
Lobelia monostachya (ncn)	*Lobelia monostachya*	E	Unattributed	Dicot
Lobelia niihauensis (ncn)	*Lobelia niihauensis*	E	Terrestrial	Dicot
Lobelia oahuensis (ncn)	*Lobelia oahuensis*	E	Wetland	Dicot
Lysimachia filifolia (ncn)	*Lysimachia filifolia*	E	Wetland	Dicot
Lysimachia lydgatei (ncn)	*Lysimachia lydgatei*	E	Unattributed	Dicot
Mahoe (Alectryon	*Alectryon macrococcus*	E	Unattributed	Dicot
Makou (Peucedanum	*Peucedanum sandwicense*	T	Unattributed	Dicot
Ma'o Hau Hele (Hibiscus	*Hibiscus brackenridgei*	E	Unattributed	Dicot
Ma'oli'oli (Schiedea	*Schiedea apokremnos*	E	Unattributed	Dicot
Ma'oli'oli (Schiedea	*Schiedea kealiae*	E	Unattributed	Dicot
Mapele (Cyrtandra	*Cyrtandra cyaneoides*	E	Wetland	Dicot
Mehamehame (Flueggea	*Flueggea neowawraea*	E	Unattributed	Dicot
Munroidendron	*Munroidendron racemosum*	E	Unattributed	Dicot
Na`ena`e	*Dubautia waialealae*	E	Wetland	Dicot
Naenae	*Dubautia kalalauensis*	E	Unattributed	Dicot
Na'ena'e (Dubautia	*Dubautia herbstobatae*	E	Unattributed	Dicot
Na'ena'e (Dubautia	*Dubautia plantaginea ssp. humilis*	E	Unattributed	Dicot
Nani Wai'ale'ale (Viola	*Viola kauaiensis var. wahiawaensis*	E	Unattributed	Dicot
Nanu (Gardenia mannii)	*Gardenia mannii*	E	Unattributed	Dicot
Na'u (Gardenia brighamii)	*Gardenia brighamii*	E	Unattributed	Dicot
Naupaka, Dwarf (Scaevola	*Scaevola coriacea*	E	Unattributed	Dicot
Nehe (Lipochaeta fauriei)	*Lipochaeta fauriei*	E	Unattributed	Dicot
Nehe (Lipochaeta	*Lipochaeta kamolensis*	E	Unattributed	Dicot
Nehe (Lipochaeta lobata	*Lipochaeta lobata var. leptophylla*	E	Unattributed	Dicot
Nehe (Lipochaeta	*Lipochaeta micrantha*	E	Unattributed	Dicot
Nehe (Lipochaeta	*Lipochaeta tenuifolia*	E	Unattributed	Dicot
Nehe (Lipochaeta	*Lipochaeta waimeaensis*	E	Unattributed	Dicot
Neraudia angulata (ncn)	*Neraudia angulata*	E	Unattributed	Dicot
Neraudia ovata (ncn)	*Neraudia ovata*	E	Unattributed	Dicot
Neraudia sericea (ncn)	*Neraudia sericea*	E	Unattributed	Dicot
Nioi (Eugenia koolauensis)	*Eugenia koolauensis*	E	Unattributed	Dicot
nohoanu	*Geranium kauaiense*	E	Wetland	Dicot
Nohoanu (Geranium	*Geranium multiflorum*	E	Wetland	Dicot
Oahu wild coffee	*Psychotria hexandra ssp.*	E	Upland	Dicot
'Oha (Delissea rivularis)	*Delissea rivularis*	E	Unattributed	Dicot
'Oha (Delissea subcordata)	*Delissea subcordata*	E	Unattributed	Dicot
'Oha (Delissea undulata)	*Delissea undulata*	E	Unattributed	Dicot
'Oha (Lobelia	*Lobelia gaudichaudii ssp.*	E	Unattributed	Dicot
'Oha Wai (Clermontia	*Clermontia drepanomorpha*	E	Wetland	Dicot
'Oha Wai (Clermontia	*Clermontia lindseyana*	E	Unattributed	Dicot
'Oha Wai (Clermontia	*Clermontia oblongifolia ssp.*	E	Unattributed	Dicot
'Oha Wai (Clermontia	*Clermontia peleana*	E	Unattributed	Dicot

'Oha Wai (Clermontia	*Clermontia pyrularia*	E	Unattributed	Dicot
'Oha Wai (Clermontia	*Clermontia samuelii*	E	Wetland	Dicot
'Ohai (Sesbania	*Sesbania tomentosa*	E	Upland	Dicot
'Ohe'ohe (Tetraplasandra	*Tetraplasandra gymnocarpa*	E	Wetland	Dicot
'Olulu (Brighamia insignis)	*Brighamia insignis*	E	Unattributed	Dicot
Opuhe (Urera kaalae)	*Urera kaalae*	E	Unattributed	Dicot
Pamakani (Viola	*Viola chamissoniana ssp.*	E	Upland	Dicot
Papala	*Charpentiera densiflora*	E	Unattributed	Dicot
Phyllostegia hirsuta (ncn)	*Phyllostegia hirsuta*	E	Wetland	Dicot
Phyllostegia kaalaensis	*Phyllostegia kaalaensis*	E	Unattributed	Dicot
Phyllostegia knudsenii	*Phyllostegia knudsenii*	E	Unattributed	Dicot
Phyllostegia mannii (ncn)	*Phyllostegia mannii*	E	Wetland	Dicot
Phyllostegia mollis (ncn)	*Phyllostegia mollis*	E	Unattributed	Dicot
Phyllostegia parviflora	*Phyllostegia parviflora*	E	Unattributed	Dicot
Phyllostegia velutina (ncn)	*Phyllostegia velutina*	E	Unattributed	Dicot
Phyllostegia waimeae	*Phyllostegia waimeae*	E	Unattributed	Dicot
Phyllostegia warshaueri	*Phyllostegia warshaueri*	E	Wetland	Dicot
Phyllostegia wawrana	*Phyllostegia wawrana*	E	Wetland	Dicot
Pilo (Hedyotis mannii)	*Hedyotis mannii*	E	Unattributed	Dicot
pilo kea lau li`i	*Platydesma rostrata*	E	Unattributed	Dicot
Po'e (Portulaca	*Portulaca sclerocarpa*	E	Wetland	Dicot
Popolo 'Aiakeakua	*Solanum sandwicense*	E	Unattributed	Dicot
Popolo Ku Mai (Solanum	*Solanum incompletum*	E	Unattributed	Dicot
Pua'ala (Brighamia rockii)	*Brighamia rockii*	E	Unattributed	Dicot
Remya kauaiensis (ncn)	*Remya kauaiensis*	E	Unattributed	Dicot
Remya montgomeryi (ncn)	*Remya montgomeryi*	E	Unattributed	Dicot
Remya, Maui	*Remya mauiensis*	E	Unattributed	Dicot
Sandalwood, Lanai	*Santalum freycinetianum var.*	E	Unattributed	Dicot
Sanicula mariversa (ncn)	*Sanicula mariversa*	E	Unattributed	Dicot
Sanicula purpurea (ncn)	*Sanicula purpurea*	E	Wetland	Dicot
Schiedea haleakalensis	*Schiedea haleakalensis*	E	Unattributed	Dicot
Schiedea helleri (ncn)	*Schiedea helleri*	E	Unattributed	Dicot
Schiedea hookeri (ncn)	*Schiedea hookeri*	E	Unattributed	Dicot
Schiedea kaalae (ncn)	*Schiedea kaalae*	E	Unattributed	Dicot
Schiedea kauaiensis (ncn)	*Schiedea kauaiensis*	E	Unattributed	Dicot
Schiedea membranacea	*Schiedea membranacea*	E	Unattributed	Dicot
Schiedea nuttallii (ncn)	*Schiedea nuttallii*	E	Unattributed	Dicot
Schiedea spergulina var.	*Schiedea spergulina var. leiopoda*	E	Unattributed	Dicot
Schiedea spergulina var.	*Schiedea spergulina var. spergulina*	T	Unattributed	Dicot
Schiedea, Diamond Head	*Schiedea adamantis*	E	Unattributed	Dicot
Silene hawaiiensis (ncn)	*Silene hawaiiensis*	T	Unattributed	Dicot
Silene lanceolata (ncn)	*Silene lanceolata*	E	Unattributed	Dicot
Silene perlmanii (ncn)	*Silene perlmanii*	E	Unattributed	Dicot
Silversword, Haleakala	*Argyroxiphium sandwicense ssp.*	T	Unattributed	Dicot
Silversword, Ka'u	*Argyroxiphium kauense*	E	Wetland	Dicot
Silversword, Mauna Kea	*Argyroxiphium sandwicense ssp.*	E	Unattributed	Dicot
Spermolepis hawaiiensis	*Spermolepis hawaiiensis*	E	Unattributed	Dicot
Stenogyne angustifolia	*Stenogyne angustifolia var.*	E	Unattributed	Dicot
Stenogyne campanulata	*Stenogyne campanulata*	E	Unattributed	Dicot
Stenogyne kanehoana (ncn)	*Stenogyne kanehoana*	E	Unattributed	Dicot

Tetramolopium arenarium	*Tetramolopium arenarium*	E	Unattributed	Dicot
Tetramolopium capillare	*Tetramolopium capillare*	E	Unattributed	Dicot
Tetramolopium filiforme	*Tetramolopium filiforme*	E	Unattributed	Dicot
Tetramolopium lepidotum	*Tetramolopium lepidotum ssp.*	E	Unattributed	Dicot
Tetramolopium remyi (ncn)	*Tetramolopium remyi*	E	Unattributed	Dicot
Tetramolopium rockii (ncn)	*Tetramolopium rockii*	T	Unattributed	Dicot
Trematolobelia singularis	*Trematolobelia singularis*	E	Wetland	Dicot
Uhiuhi (Caesalpinia	*Caesalpinia kavaiense*	E	Unattributed	Dicot
Vetch, Hawaiian (Vicia	*Vicia menziesii*	E	Unattributed	Dicot
Vigna o-wahuensis (ncn)	*Vigna o-wahuensis*	E	Unattributed	Dicot
Viola helenae (ncn)	*Viola helenae*	E	Wetland	Dicot
Viola oahuensis (ncn)	*Viola oahuensis*	E	Wetland	Dicot
Wahine Noho Kula	*Isodendrion pyrifolium*	E	Unattributed	Dicot
Xylosma crenatum (ncn)	*Xylosma crenatum*	E	Wetland	Dicot
Asplenium fragile var.	*Asplenium fragile var. insulare*	E	Unattributed	Ferns
aumakua, Palapalai	*Dryopteris crinalis podosorus*	E	Unattributed	Ferns
Diellia erecta (ncn)	*Diellia erecta*	E	Unattributed	Ferns
Diellia falcata (ncn)	*Diellia falcata*	E	Unattributed	Ferns
Diellia pallida (ncn)	*Diellia pallida*	E	Unattributed	Ferns
Diellia unisora (ncn)	*Diellia unisora*	E	Unattributed	Ferns
Diplazium molokaiense	*Diplazium molokaiense*	E	Unattributed	Ferns
Fern, Pendant Kihi	*Adenophorus periens*	E	Unattributed	Ferns
'Ihi'Ihi (Marsilea villosa)	*Marsilea villosa*	E	Wetland	Ferns
Pauoa (Ctenitis	*Ctenitis squamigera*	E	Unattributed	Ferns
Pteris lidgatei (ncn)	*Pteris lidgatei*	E	Wetland	Ferns
Wawae'Iole	*Huperzia mannii*	E	Unattributed	Ferns
Wawae'Iole	*Lycopodium (Phlegmariurus)*	E	Unattributed	Ferns
Snail, Newcomb's	*Erinna newcombi*	T	Freshwater	Gastropod
Snail, O'ahu Tree	*Achatinella abbreviata*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella apexfulva*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella bellula*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella buddii*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella bulimoides*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella byronii*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella caesia*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella casta*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella cestus*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella concavospira*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella curta*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella decipiens*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella decora*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella dimorpha*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella elegans*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella fulgens*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella fuscobasis*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella juddii*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella juncea*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella lehuiensis*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella leucorraphe*	E	Terrestrial	Gastropod

Snail, O'ahu Tree	*Achatinella lila*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella livida*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella lorata*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella mustelina*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella papyracea*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella phaeozona*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella pulcherrima*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella pupukanioe*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella rosea*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella sowerbyana*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella spaldingi*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella stewartii*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella swiftii*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella taeniolata*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella thaahumi*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella turgida*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella valida*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella viridans*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella vittata*	E	Terrestrial	Gastropod
Snail, O'ahu Tree	*Achatinella vulpina*	E	Terrestrial	Gastropod
blackline Hawaiian	*Megalagrion nigrohamatum*	E	Terrestrial	Insect
Crimson Hawaiian	*Megalagrion leptodemas*	E	Terrestrial	Insect
Damselfly, Flying Earwig	*Megalagrion nesiotes*	E	Terrestrial	Insect
Damselfly, Pacific	*Megalagrion pacificum*	E	Terrestrial	Insect
Fly, Hawaiian picture-wing	*Drosophila aglaia*	E	Terrestrial	Insect
Hawaiian picture-wing Fly	*Drosophila sharpi*	E	Terrestrial	Insect
Moth, Blackburn's Sphinx	*Manduca blackburni*	E	Terrestrial	Insect
Oceanic Hawaiian	*Megalagrion oceanicum*	E	Terrestrial	Insect
Bat, Hawaiian Hoary	*Lasiurus cinereus semotus*	E	Terrestrial,	Mammal
Seal, Hawaiian Monk	*Monachus schauinslandi*	E	Saltwater,	Mammal
Bluegrass, Hawaiian	*Poa sandvicensis*	E	Wetland	Monocot
Bluegrass, Mann's (Poa	*Poa mannii*	E	Wetland	Monocot
Grass, Fosberg's Love	*Eragrostis fosbergii*	E	Unattributed	Monocot
Hala Pepe (Pleomele	*Pleomele hawaiiensis*	E	Unattributed	Monocot
Hilo Ischaemum	*Ischaemum byrone*	E	Wetland	Monocot
Kamanomano (Cenchrus	*Cenchrus agrimonioides*	E	Unattributed	Monocot
Lau'ehu (Panicum	*Panicum niihauense*	E	Unattributed	Monocot
lo`ulu	*Pritchardia hardyi*	E	Wetland	Monocot
Lo`ulu (Pritchardia affinis)	*Pritchardia affinis*	E	Wetland	Monocot
Lo`ulu (Pritchardia kaalae)	*Pritchardia kaalae*	E	Wetland	Monocot
Lo`ulu (Pritchardia	*Pritchardia napaliensis*	E	Unattributed	Monocot
Lo`ulu (Pritchardia	*Pritchardia schattaueri*	E	Unattributed	Monocot
Lo`ulu (Pritchardia	*Pritchardia viscosa*	E	Wetland	Monocot
Mariscus fauriei (ncn)	*Mariscus fauriei*	E	Unattributed	Monocot
Mariscus pennatiformis	*Mariscus pennatiformis*	E	Unattributed	Monocot
Pa'iniu	*Astelia waialealae*	E	Wetland	Monocot
Panicgrass, Carter's	*Panicum fauriei var. carteri*	E	Unattributed	Monocot
Platanthera holochila	*Platanthera holochila*	E	Wetland	Monocot
Poa siphonoglossa (ncn)	*Poa siphonoglossa*	E	Wetland	Monocot

Pu'uka'a (Cyperus	*Cyperus trachysanthos*	E	Wetland	Monocot

Idaho	(18) species:	**E/T**	**Medium**	**Taxon**
Catchfly, Spalding's	*Silene spaldingii*	T	Unattributed	Dicot
Four-o'clock, Macfarlane's	*Mirabilis macfarlanei*	T	Unattributed	Dicot
Howellia, Water	*Howellia aquatilis*	T	Wetland	Dicot
Peppergrass, Slick Spot	*Lepidium papilliferum*	T	Unattributed	Dicot
Salmon, Chinook	*Oncorhynchus (Salmo)*	E/T	Freshwater,	Fish
Salmon, Sockeye	*Oncorhynchus (Salmo) nerka*	E	Freshwater,	Fish
Steelhead	*Oncorhynchus (Salmo) mykiss*	E/T	Freshwater,	Fish
Sturgeon, White	*Acipenser transmontanus*	E	Freshwater,	Fish
Trout, Bull	*Salvelinus confluentus*	T	Freshwater	Fish
Limpet, Banbury Springs	*Lanx sp.*	E	Freshwater	Gastropod
Snail, Bliss Rapids	*Taylorconcha serpenticola*	T	Freshwater	Gastropod
Snail, Snake River Physa	*Physa natricina*	E	Terrestrial	Gastropod
Springsnail, Bruneau Hot	*Pyrgulopsis bruneauensis*	E	Freshwater	Gastropod
Bear, Grizzly	*Ursus arctos horribilis*	T	Terrestrial	Mammal
Caribou, Woodland	*Rangifer tarandus caribou*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Squirrel, Northern Idaho	*Spermophilus brunneus brunneus*	T	Terrestrial	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot

Illinois	(27) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Pearlymussel, Fat	*Potamilus capax*	E	Freshwater	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Freshwater	Bivalve
Pearlymussel, Orange-	*Plethobasus cooperianus*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Amphipod, Illinois Cave	*Gammarus acherondytes*	E	Freshwater,	Crustacean
Aster, Decurrent False	*Boltonia decurrens*	T	Unattributed	Dicot
Clover, Leafy Prairie	*Dalea foliosa*	E	Unattributed	Dicot
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Unattributed	Dicot
Daisy, Lakeside	*Hymenoxys herbacea*	T	Unattributed	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Unattributed	Dicot
Potato-bean, Price's	*Apios priceana*	T	Unattributed	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Unattributed	Dicot
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Snail, Iowa Pleistocene	*Discus macclintocki*	E	Terrestrial	Gastropod
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Terrestrial,	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot

Indiana	(20) species:	**E/T**	**Medium**	**Taxon**
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Freshwater	Bivalve
Pearlymussel, Fat	*Potamilus capax*	E	Freshwater	Bivalve
Pearlymussel, White Cat's	*Epioblasma obliquata perobliqua*	E	Freshwater	Bivalve
Rayed Bean	*Villosa fabalis*	E	Freshwater	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Unattributed	Dicot
Goldenrod, Short's	*Solidago shortii*	E	Unattributed	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Unattributed	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Unattributed	Dicot
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Terrestrial,	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Snake, Northern	*Nerodia erythrogaster neglecta*	T	Terrestrial,	Reptile

Iowa	(16) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Unattributed	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Unattributed	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	Unattributed	Dicot
Shiner, Topeka	*Notropis topeka (tristis)*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Snail, Iowa Pleistocene	*Discus macclintocki*	E	Terrestrial	Gastropod
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot

Kansas	(14) species:	**E/T**	**Medium**	**Taxon**
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Milkweed, Mead's	*Asclepias meadii*	T	Unattributed	Dicot
Madtom, Neosho	*Noturus placidus*	T	Freshwater	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Freshwater	Fish
Shiner, Topeka	*Notropis topeka (tristis)*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish

Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot

Kentucky	(50) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Warbler (=Wood),	*Dendroica kirtlandii*	E	Terrestrial	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Terrestrial	Bird
Woodpecker, Ivory-billed	*Campephilus principalis*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Mussel, Cumberland	*Epioblasma brevidens*	E	Freshwater	Bivalve
Mussel, Cumberland Elktoe	*Alasmidonta atropurpurea*	E	Freshwater	Bivalve
Mussel, Oyster	*Epioblasma capsaeformis*	E	Freshwater	Bivalve
Mussel, Ring Pink (=Golf	*Obovaria retusa*	E	Freshwater	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Freshwater	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Freshwater	Bivalve
Pearlymussel,	*Quadrula sparsa*	E	Freshwater	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Freshwater	Bivalve
Pearlymussel,	*Villosa trabalis*	E	Freshwater	Bivalve
Pearlymussel, Dromedary	*Dromus dromas*	E	Freshwater	Bivalve
Pearlymussel, Fat	*Potamilus capax*	E	Freshwater	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	Freshwater	Bivalve
Pearlymussel, Orange-	*Plethobasus cooperianus*	E	Freshwater	Bivalve
Pearlymussel, Purple Cat's	*Epioblasma obliquata obliquata*	E	Freshwater	Bivalve
Pearlymussel, Tubercled-	*Epioblasma torulosa torulosa*	E	Freshwater	Bivalve
Pearlymussel, White	*Plethobasus cicatricosus*	E	Freshwater	Bivalve
Pearlymussel, Yellow-	*Epioblasma florentina florentina*	E	Freshwater	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Freshwater	Bivalve
Riffleshell, Tan	*Epioblasma florentina walkeri*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Shrimp, Kentucky Cave	*Palaemonias ganteri*	E	Freshwater	Crustacean
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Unattributed	Dicot
Goldenrod, Short's	*Solidago shortii*	E	Unattributed	Dicot
Goldenrod, White-haired	*Solidago albopilosa*	T	Unattributed	Dicot
Potato-bean, Price's	*Apios priceana*	T	Unattributed	Dicot
Rock-cress, Small	*Arabis perstellata E. L. Braun var.*	E	Unattributed	Dicot
Rosemary, Cumberland	*Conradina verticillata*	T	Wetland	Dicot
Sandwort, Cumberland	*Arenaria cumberlandensis*	E	Unattributed	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Wetland	Dicot
Cumberland darter	*Etheostoma susanae*	E	Freshwater	Fish
Dace, Blackside	*Phoxinus cumberlandensis*	T	Freshwater	Fish
Darter, Relict	*Etheostoma chienense*	E	Freshwater	Fish
Shiner, Palezone	*Notropis albizonatus*	E	Freshwater	Fish

Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bat, Virginia Big-eared	*Corynorhinus (Plecotus)*	E	Terrestrial,	Mammal
Wolf, Red	*Canis rufus*	E	Terrestrial	Mammal

Louisiana	(17) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Heelsplitter	*Potamilus inflatus*	T	Freshwater	Bivalve
Pearlshell, Louisiana	*Margaritifera hembeli*	T	Freshwater	Bivalve
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Fruit, Earth (geocarpon)	*Geocarpon minimum*	T	Unattributed	Dicot
Quillwort, Louisiana	*Isoetes louisianensis*	E	Wetland	Ferns
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Freshwater,	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Bear, American Black	*Ursus americanus*	SAT	Terrestrial	Mammal
Bear, Louisiana Black	*Ursus americanus luteolus*	T	Terrestrial	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Tortoise, Gopher	*Gopherus polyphemus*	T	Terrestrial	Reptile
Turtle, Ringed Map	*Graptemys oculifera*	T	Terrestrial,	Reptile

Maine	(9) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Lousewort, Furbish	*Pedicularis furbishiae*	E	Wetland	Dicot
Salmon, Atlantic	*Salmo salar*	E	Freshwater,	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Bear, American Black	*Ursus americanus*	SAT	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot

Maryland	(15) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Amaranth, Seabeach	*Amaranthus pumilus*	T	Wetland	Dicot
Dropwort, Canby's	*Oxypolis canbyi*	E	Wetland	Dicot
Gerardia, Sandplain	*Agalinis acuta*	E	Unattributed	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	Wetland	Dicot
Darter, Maryland	*Etheostoma sellare*	E	Freshwater	Fish
Beetle, Northeastern	*Cicindela dorsalis dorsalis*	T	Terrestrial	Insect
Beetle, Puritan Tiger	*Cicindela puritana*	T	Terrestrial,	Insect
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Squirrel, Delmarva	*Sciurus niger cinereus*	E	Terrestrial	Mammal

Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot
Pink, Swamp	*Helonias bullata*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

Massachusetts	(13) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Gerardia, Sandplain	*Agalinis acuta*	E	Unattributed	Dicot
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Beetle, Northeastern	*Cicindela dorsalis dorsalis*	T	Terrestrial	Insect
Beetle, Puritan Tiger	*Cicindela puritana*	T	Terrestrial,	Insect
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile
Turtle, Plymouth Red-	*Pseudemys rubriventris bangsi*	E	Terrestrial,	Reptile

Michigan	(22) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Warbler (=Wood),	*Dendroica kirtlandii*	E	Terrestrial	Bird
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Freshwater	Bivalve
Rayed Bean	*Villosa fabalis*	E	Freshwater	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Freshwater	Bivalve
Daisy, Lakeside	*Hymenoxys herbacea*	T	Unattributed	Dicot
Goldenrod, Houghton's	*Solidago houghtonii*	T	Wetland	Dicot
Monkey-flower, Michigan	*Mimulus glabratus var.*	E	Unattributed	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Unattributed	Dicot
Fern, American hart's-	*Asplenium scolopendrium var.*	T	Unattributed	Ferns
Beetle, Hungerford's	*Brychius hungerfordi*	E	Freshwater	Insect
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Terrestrial,	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Terrestrial,	Insect
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Gray Wolf	*Canis lupus*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Iris, Dwarf Lake	*Iris lacustris*	T	Wetland	Monocot
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Snake, Northern	*Nerodia erythrogaster neglecta*	T	Terrestrial,	Reptile

Minnesota	(12) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Freshwater	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Unattributed	Dicot
Roseroot, Leedy's	*Sedum integrifolium ssp. leedyi*	T	Unattributed	Dicot

Shiner, Topeka	*Notropis topeka (tristis)*	E	Freshwater	Fish
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Lily, Minnesota Trout	*Erythronium propullans*	E	Unattributed	Monocot
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot

Mississippi	(32) species:	**E/T**	**Medium**	**Taxon**
Frog, Dusky Gopher	*Rana capito sevosa*	E	Terrestrial,	Amphibian
Crane, Mississippi	*Grus canadensis pulla*	E	Terrestrial,	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Combshell, Southern	*Epioblasma penita*	E	Freshwater	Bivalve
Mucket, Orange-nacre	*Lampsilis perovalis*	T	Freshwater	Bivalve
Mussel, Alabama	*Medionidus acutissimus*	T	Freshwater	Bivalve
Mussel, Black (=Curtus'	*Pleurobema curtum*	E	Freshwater	Bivalve
Mussel, Cumberland	*Epioblasma brevidens*	E	Freshwater	Bivalve
Mussel, Heavy Pigtoe	*Pleurobema taitianum*	E	Freshwater	Bivalve
Mussel, Heelsplitter	*Potamilus inflatus*	T	Freshwater	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Freshwater	Bivalve
Mussel, Southern Clubshell	*Pleurobema decisum*	E	Freshwater	Bivalve
Pearlymussel, Fat	*Potamilus capax*	E	Freshwater	Bivalve
Pondberry	*Lindera melissifolia*	E	Wetland	Dicot
Potato-bean, Price's	*Apios priceana*	T	Unattributed	Dicot
Quillwort, Louisiana	*Isoetes louisianensis*	E	Wetland	Ferns
Darter, Bayou	*Etheostoma rubrum*	T	Freshwater	Fish
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	T	Freshwater,	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bear, American Black	*Ursus americanus*	SAT	Terrestrial	Mammal
Bear, Louisiana Black	*Ursus americanus luteolus*	T	Terrestrial	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Snake, Eastern Indigo	*Drymarchon corais couperi*	T	Terrestrial	Reptile
Tortoise, Gopher	*Gopherus polyphemus*	T	Terrestrial	Reptile
Turtle, Alabama Red-bellied	*Pseudemys alabamensis*	E	Terrestrial,	Reptile
Turtle, Ringed Map	*Graptemys oculifera*	T	Terrestrial,	Reptile
Turtle, Yellow-blotched	*Graptemys flavimaculata*	T	Terrestrial,	Reptile

Missouri	(30) species:	**E/T**	**Medium**	**Taxon**
Ozark Hellbender	*Cryptobranchus alleganiensis*	E	Freshwater	Amphibian
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Scaleshell	*Leptodea leptodon*	E	Freshwater	Bivalve
Mussel, snuffbox	*Epioblasma triquetra*	E	Freshwater	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Freshwater	Bivalve
Pearlymussel, Curtis'	*Epioblasma florentina curtisii*	E	Freshwater	Bivalve
Pearlymussel, Fat	*Potamilus capax*	E	Freshwater	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Freshwater	Bivalve

Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Aster, Decurrent False	*Boltonia decurrens*	T	Unattributed	Dicot
Bladderpod, Missouri	*Lesquerella filiformis*	T	Unattributed	Dicot
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Unattributed	Dicot
Fruit, Earth (geocarpon)	*Geocarpon minimum*	T	Unattributed	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Unattributed	Dicot
Pondberry	*Lindera melissifolia*	E	Wetland	Dicot
Sneezeweed, Virginia	*Helenium virginicum*	T	Wetland	Dicot
Cavefish, Ozark	*Amblyopsis rosae*	T	Freshwater	Fish
Darter, Niangua	*Etheostoma nianguae*	T	Freshwater	Fish
Madtom, Neosho	*Noturus placidus*	T	Freshwater	Fish
Shiner, Topeka	*Notropis topeka (tristis)*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Cavesnail, Tumbling Creek	*Antrobia culveri*	E	Freshwater,	Gastropod
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Terrestrial,	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bear, American Black	*Ursus americanus*	SAT	Terrestrial	Mammal
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot

Montana	(12) species:	**E/T**	**Medium**	**Taxon**
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Catchfly, Spalding's	*Silene spaldingii*	T	Unattributed	Dicot
Howellia, Water	*Howellia aquatilis*	T	Wetland	Dicot
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Trout, Bull	*Salvelinus confluentus*	T	Freshwater	Fish
Bear, Grizzly	*Ursus arctos horribilis*	T	Terrestrial	Mammal
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot

Nebraska	(15) species:	**E/T**	**Medium**	**Taxon**
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Curlew, Eskimo	*Numenius borealis*	E	Terrestrial	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Butterfly Plant, Colorado	*Gaura neomexicana var.*	T	Unattributed	Dicot
Penstemon, Blowout	*Penstemon haydenii*	E	Unattributed	Dicot
Shiner, Topeka	*Notropis topeka (tristis)*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Beetle, Salt Creek Tiger	*Cicindela nevadica lincolniana*	E	Terrestrial	Insect
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Gray Wolf	*Canis lupus*	E	Terrestrial	Mammal

Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot

Nevada	(38) species:	**E/T**	**Medium**	**Taxon**
Flycatcher, Southwestern	*Empidonax traillii extimus*	E	Terrestrial	Bird
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	E	Terrestrial	Bird
Blazing Star, Ash Meadows	*Mentzelia leucophylla*	T	Wetland	Dicot
Buckwheat, Steamboat	*Eriogonum ovalifolium var.*	E	Unattributed	Dicot
Centaury, Spring-loving	*Centaurium namophilum*	T	Wetland	Dicot
Gumplant, Ash Meadows	*Grindelia fraxino-pratensis*	T	Wetland	Dicot
Ivesia, Ash Meadows	*Ivesia kingii var. eremica*	T	Unattributed	Dicot
Milk-vetch, Ash Meadows	*Astragalus phoenix*	T	Wetland	Dicot
Niterwort, Amargosa	*Nitrophila mohavensis*	E	Wetland	Dicot
Poolfish, Pahrump (=	*Empetrichthys latos*	E	Freshwater	Dicot
Sunray, Ash Meadows	*Enceliopsis nudicaulis var. corrugata*	T	Unattributed	Dicot
Chub, Humpback	*Gila cypha*	E	Freshwater	Fish
Chub, Pahranagat	*Gila robusta jordani*	E	Freshwater	Fish
Chub, Virgin River	*Gila seminuda (robusta)*	E	Freshwater	Fish
Cui-ui	*Chasmistes cujus*	E	Freshwater	Fish
Dace, Ash Meadows	*Rhinichthys osculus nevadensis*	E	Freshwater	Fish
Dace, Clover Valley	*Rhinichthys osculus oligoporus*	E	Freshwater	Fish
Dace, Desert	*Eremichthys acros*	T	Freshwater	Fish
Dace, Independence Valley	*Rhinichthys osculus lethoporus*	E	Freshwater	Fish
Dace, Moapa	*Moapa coriacea*	E	Freshwater	Fish
Pupfish, Ash Meadows	*Cyprinodon nevadensis mionectes*	E	Freshwater	Fish
Pupfish, Devils Hole	*Cyprinodon diabolis*	E	Freshwater	Fish
Pupfish, Warm Springs	*Cyprinodon nevadensis pectoralis*	E	Freshwater	Fish
Spinedace, Big Spring	*Lepidomeda mollispinis pratensis*	T	Freshwater	Fish
Spinedace, White River	*Lepidomeda albivallis*	E	Freshwater	Fish
Springfish, Hiko White	*Crenichthys baileyi grandis*	E	Freshwater	Fish
Springfish, Railroad Valley	*Crenichthys nevadae*	T	Freshwater	Fish
Springfish, White River	*Crenichthys baileyi baileyi*	E	Freshwater	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Freshwater	Fish
Sucker, Warner	*Catostomus warnerensis*	T	Freshwater	Fish
Trout, Bull	*Salvelinus confluentus*	T	Freshwater	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	Freshwater	Fish
Woundfin	*Plagopterus argentissimus*	E	Freshwater	Fish
Naucorid, Ash Meadows	*Ambrysus amargosus*	T	Terrestrial	Insect
Skipper, Carson Wandering	*Pseudocopaeodes eunus obscurus*	E	Terrestrial	Insect
Gray Wolf	*Canis lupus*	E	Terrestrial	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot
Tortoise, Desert	*Gopherus agassizii*	T	Terrestrial	Reptile

New Hampshire	(7) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Milk-vetch, Jesup's	*Astragalus robbinsii var. jesupi*	E	Unattributed	Dicot
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot

Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
New Jersey	(12) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Amaranth, Seabeach	*Amaranthus pumilus*	T	Wetland	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	Wetland	Dicot
Beetle, Northeastern	*Cicindela dorsalis dorsalis*	T	Terrestrial	Insect
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Beaked-rush, Knieskern's	*Rhynchospora knieskernii*	T	Wetland	Monocot
Pink, Swamp	*Helonias bullata*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile
New Mexico	(46) species:	**E/T**	**Medium**	**Taxon**
Frog, Chiricahua Leopard	*Rana chiricahuensis*	T	Terrestrial,	Amphibian
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	E	Terrestrial	Bird
Flycatcher, Southwestern	*Empidonax traillii extimus*	E	Terrestrial	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Terrestrial	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Amphipod, Noel's	*Gammarus desperatus*	E	Freshwater	Crustacean
Isopod, Socorro	*Thermosphaeroma thermophilus*	E	Freshwater	Crustacean
Cactus, Knowlton	*Pediocactus knowltonii*	E	Unattributed	Dicot
Cactus, Kuenzler Hedgehog	*Echinocereus fendleri var. kuenzleri*	E	Unattributed	Dicot
Cactus, Lee Pincushion	*Coryphantha sneedii var. leei*	T	Unattributed	Dicot
Cactus, Mesa Verde	*Sclerocactus mesae-verdae*	T	Unattributed	Dicot
Cactus, Sneed Pincushion	*Coryphantha sneedii var. sneedii*	E	Unattributed	Dicot
Fleabane, Zuni	*Erigeron rhizomatus*	T	Unattributed	Dicot
Ipomopsis, Holy Ghost	*Ipomopsis sancti-spiritus*	E	Unattributed	Dicot
Milk-vetch, Mancos	*Astragalus humillimus*	E	Unattributed	Dicot
Pennyroyal, Todsen's	*Hedeoma todsenii*	E	Unattributed	Dicot
Poppy, Sacramento Prickly	*Argemone pleiacantha ssp.*	E	Unattributed	Dicot
Sunflower, Pecos	*Helianthus paradoxus*	T	Wetland	Dicot
Thistle, Sacramento	*Cirsium vinaceum*	T	Wetland	Dicot
Wild-buckwheat, Gypsum	*Eriogonum gypsophilum*	T	Unattributed	Dicot
Chub, Chihuahua	*Gila nigrescens*	T	Freshwater	Fish
Chub, Gila	*Gila intermedia*	E	Freshwater	Fish
Gambusia, Pecos	*Gambusia nobilis*	E	Freshwater	Fish
Minnow, Loach	*Tiaroga cobitis*	E	Freshwater	Fish
Minnow, Rio Grande Silvery	*Hybognathus amarus*	E	Freshwater	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Freshwater	Fish
Shiner, Beautiful	*Cyprinella formosa*	T	Freshwater	Fish
Shiner, Pecos Bluntnose	*Notropis simus pecosensis*	T	Freshwater	Fish
Spikedace	*Meda fulgida*	E	Freshwater	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Freshwater	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Freshwater	Fish
Topminnow, Gila (Yaqui)	*Poeciliopsis occidentalis*	E	Freshwater	Fish

Trout, Gila	*Oncorhynchus gilae*	E	Freshwater	Fish
Snail, Pecos Assiminea	*Assiminea pecos*	E	Freshwater	Gastropod
Springsnail, Alamosa	*Tryonia alamosae*	E	Freshwater	Gastropod
Springsnail, Chupadera	*Pyrgulopsis chupaderae*	E	Terrestrial,	Gastropod
Springsnail, Koster's	*Juturnia kosteri*	E	Terrestrial	Gastropod
Springsnail, Roswell	*Pyrgulopsis roswellensis*	E	Freshwater	Gastropod
Springsnail, Socorro	*Pyrgulopsis neomexicana*	E	Freshwater	Gastropod
Bat, Lesser (=Sanborn's)	*Leptonycteris curasoae*	E	Terrestrial,	Mammal
Bat, Mexican Long-nosed	*Leptonycteris nivalis*	E	Terrestrial,	Mammal
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Gray Wolf	*Canis lupus*	E	Terrestrial	Mammal
Jaguar	*Panthera onca*	E	Terrestrial	Mammal
Rattlesnake, New Mexican	*Crotalus willardi obscurus*	T	Terrestrial	Reptile

New York	(18) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Rayed Bean	*Villosa fabalis*	E	Freshwater	Bivalve
Amaranth, Seabeach	*Amaranthus pumilus*	T	Wetland	Dicot
Gerardia, Sandplain	*Agalinis acuta*	E	Unattributed	Dicot
Goldenrod, Houghton's	*Solidago houghtonii*	T	Wetland	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	Unattributed	Dicot
Roseroot, Leedy's	*Sedum integrifolium ssp. leedyi*	T	Unattributed	Dicot
Fern, American hart's-	*Asplenium scolopendrium var.*	T	Unattributed	Ferns
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Snail, Chittenango Ovate	*Succinea chittenangoensis*	T	Terrestrial,	Gastropod
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

North Carolina	(56) species:	**E/T**	**Medium**	**Taxon**
Spider, Spruce-fir Moss	*Microhexura montivaga*	E	Terrestrial	Arachnid
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Stork, Wood	*Mycteria americana*	E	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Elktoe, Appalachian	*Alasmidonta raveneliana*	E	Freshwater	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Mussel, Heelsplitter	*Lasmigona decorata*	E	Freshwater	Bivalve
Pearlymussel,	*Villosa trabalis*	E	Freshwater	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	Freshwater	Bivalve
Riffleshell, Tan	*Epioblasma florentina walkeri*	E	Freshwater	Bivalve
Spinymussel, James River	*Pleurobema collina*	E	Freshwater	Bivalve
Spinymussel, Tar River	*Elliptio steinstansana*	E	Freshwater	Bivalve
Amaranth, Seabeach	*Amaranthus pumilus*	T	Wetland	Dicot
Avens, Spreading	*Geum radiatum*	E	Unattributed	Dicot

Bittercress, Small-anthered	*Cardamine micranthera*	E	Wetland	Dicot
Blazing Star, Heller's	*Liatris helleri*	T	Unattributed	Dicot
Bluet, Roan Mountain	*Hedyotis purpurea var. montana*	E	Unattributed	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	Unattributed	Dicot
Dropwort, Canby's	*Oxypolis canbyi*	E	Wetland	Dicot
Goldenrod, Blue Ridge	*Solidago spithamaea*	T	Unattributed	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Heartleaf, Dwarf-flowered	*Hexastylis naniflora*	T	Unattributed	Dicot
Heather, Mountain Golden	*Hudsonia montana*	T	Unattributed	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	Wetland	Dicot
Loosestrife, Rough-leaved	*Lysimachia asperulaefolia*	E	Wetland	Dicot
Meadowrue, Cooley's	*Thalictrum cooleyi*	E	Wetland	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	Wetland	Dicot
Pitcher-plant, Mountain	*Sarracenia rubra ssp. jonesii*	E	Unattributed	Dicot
Pondberry	*Lindera melissifolia*	E	Wetland	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Wetland	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	Unattributed	Dicot
Sunflower, Schweinitz's	*Helianthus schweinitzii*	E	Unattributed	Dicot
Chub, Spotfin	*Erimonax monachus*	T	Freshwater	Fish
Logperch, Roanoke	*Percina rex*	E	Freshwater	Fish
Shiner, Cape Fear	*Notropis mekistocholas*	E	Freshwater	Fish
Silverside, Waccamaw	*Menidia extensa*	T	Freshwater	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Snail, Noonday	*Mesodon clarki nantahala*	T	Terrestrial	Gastropod
Butterfly, Saint Francis'	*Neonympha mitchellii francisci*	E	Terrestrial	Insect
Lichen, Rock Gnome	*Gymnoderma lineare*	E	Unattributed	Lichen
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bat, Virginia Big-eared	*Corynorhinus (Plecotus)*	E	Terrestrial,	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Puma (Cougar), Eastern	*Puma (Felis) concolor*	E	Terrestrial	Mammal
Squirrel, Carolina	*Glaucomys sabrinus coloratus*	E	Terrestrial	Mammal
Wolf, Red	*Canis rufus*	E	Terrestrial	Mammal
Arrowhead, Bunched	*Sagittaria fasciculata*	E	Wetland	Monocot
Irisette, White	*Sisyrinchium dichotomum*	E	Unattributed	Monocot
Pink, Swamp	*Helonias bullata*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Sedge, Golden	*Carex lutea*	E	Unattributed	Monocot
Alligator, American	*Alligator mississippiensis*	T	Terrestrial,	Reptile
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

North Dakota	(8) species:	**E/T**	**Medium**	**Taxon**
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Gray Wolf	*Canis lupus*	E	Terrestrial	Mammal

Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot
Northern Mariana Islands	(6) species:	**E/T**	**Medium**	**Taxon**
Crow, Mariana	*Corvus kubaryi*	E	Terrestrial	Bird
Megapode, Micronesian	*Megapodius laperouse*	E	Terrestrial	Bird
Moorhen, Mariana	*Gallinula chloropus guami*	E	Terrestrial	Bird
Warbler, nightingale reed	*Acrocephalus luscinia*	E	Terrestrial	Bird
White-eye, Rota Bridled	*Zosterops rotensis*	E	Terrestrial	Bird
Bat, Mariana Fruit	*Pteropus mariannus mariannus*	T	Terrestrial,	Mammal
Ohio	(21) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Pearlymussel, Purple Cat's	*Epioblasma obliquata obliquata*	E	Freshwater	Bivalve
Pearlymussel, White Cat's	*Epioblasma obliquata perobliqua*	E	Freshwater	Bivalve
Rayed Bean	*Villosa fabalis*	E	Freshwater	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Unattributed	Dicot
Daisy, Lakeside	*Hymenoxys herbacea*	T	Unattributed	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	Unattributed	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Wetland	Dicot
Madtom, Scioto	*Noturus trautmani*	E	Freshwater	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Terrestrial,	Insect
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Snake, Northern	*Nerodia erythrogaster neglecta*	T	Terrestrial,	Reptile
Oklahoma	(20) species:	**E/T**	**Medium**	**Taxon**
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Curlew, Eskimo	*Numenius borealis*	E	Terrestrial	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Vireo, Black-capped	*Vireo atricapilla*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Mussel, Scaleshell	*Leptodea leptodon*	E	Freshwater	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Freshwater	Bivalve
Rock-pocketbook,	*Arkansia wheeleri*	E	Freshwater	Bivalve
Cavefish, Ozark	*Amblyopsis rosae*	T	Freshwater	Fish
Darter, Leopard	*Percina pantherina*	T	Freshwater	Fish
Madtom, Neosho	*Noturus placidus*	T	Freshwater	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Freshwater	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bat, Ozark Big-eared	*Corynorhinus (Plecotus)*	E	Terrestrial,	Mammal

Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot
Alligator, American	*Alligator mississippiensis*	T	Terrestrial,	Reptile
Oregon	(40) species:	**E/T**	**Medium**	**Taxon**
Albatross, Short-tailed	*Phoebastria (Diomedea) albatrus*	E	Terrestrial,	Bird
Murrelet, Marbled	*Brachyramphus marmoratus*	T	Terrestrial,	Bird
Owl, Northern Spotted	*Strix occidentalis caurina*	T	Terrestrial	Bird
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	T	Terrestrial	Bird
Fairy Shrimp, Vernal Pool	*Branchinecta lynchi*	T	Vernal pool	Crustacean
Catchfly, Spalding's	*Silene spaldingii*	T	Unattributed	Dicot
Checker-mallow, Nelson's	*Sidalcea nelsoniana*	T	Wetland	Dicot
Daisy, Willamette	*Erigeron decumbens var.*	E	Unattributed	Dicot
Four-o'clock, Macfarlane's	*Mirabilis macfarlanei*	T	Unattributed	Dicot
Howellia, Water	*Howellia aquatilis*	T	Wetland	Dicot
Lomatium, Bradshaw's	*Lomatium bradshawii*	E	Wetland	Dicot
Lomatium, Cook's	*Lomatium cookii*	E	Wetland	Dicot
Lupine, Kincaid's	*Lupinus sulphureus (oreganus)*	T	Unattributed	Dicot
Meadowfoam, Large-	*Limnanthes floccosa ssp.*	E	Unattributed	Dicot
Milk-vetch, Applegate's	*Astragalus applegatei*	E	Unattributed	Dicot
Paintbrush, Golden	*Castilleja levisecta*	T	Unattributed	Dicot
Popcornflower, Rough	*Plagiobothrys hirtus*	E	Wetland	Dicot
Rock-cress, McDonald's	*Arabis mcdonaldiana*	E	Unattributed	Dicot
Thelypody, Howell's	*Thelypodium howellii spectabilis*	T	Unattributed	Dicot
Chub, Hutton Tui	*Gila bicolor ssp.*	T	Freshwater	Fish
Chub, Oregon	*Oregonichthys crameri*	E	Freshwater	Fish
Dace, Foskett Speckled	*Rhinichthys osculus ssp.*	T	Freshwater	Fish
Salmon, Chinook	*Oncorhynchus (Salmo)*	E/T	Freshwater,	Fish
Salmon, Chum	*Oncorhynchus (Salmo) keta*	T	Freshwater,	Fish
Salmon, Coho	*Oncorhynchus (Salmo) kisutch*	E/T	Freshwater,	Fish
Salmon, Sockeye	*Oncorhynchus (Salmo) nerka*	E	Freshwater,	Fish
Steelhead	*Oncorhynchus (Salmo) mykiss*	E/T	Freshwater,	Fish
Sucker, Lost River	*Deltistes luxatus*	E	Freshwater	Fish
Sucker, Modoc	*Catostomus microps*	E	Freshwater	Fish
Sucker, Shortnose	*Chasmistes brevirostris*	E	Freshwater	Fish
Sucker, Warner	*Catostomus warnerensis*	T	Freshwater	Fish
Trout, Bull	*Salvelinus confluentus*	T	Freshwater	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	Freshwater	Fish
Butterfly, Fender's Blue	*Icaricia icarioides fenderi*	E	Terrestrial	Insect
Butterfly, Oregon	*Speyeria zerene hippolyta*	T	Terrestrial	Insect
Deer, Columbian White-	*Odocoileus virginianus leucurus*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Whale, Gray	*Eschrichtius robustus*	E	Saltwater	Mammal
Fritillary, Gentner's	*Fritillaria gentneri*	E	Unattributed	Monocot
Lily, Western	*Lilium occidentale*	E	Wetland	Monocot
Pennsylvania	(11) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve

Mussel, snuffbox	*Epioblasma triquetra*	E	Freshwater	Bivalve
Rayed Bean	*Villosa fabalis*	E	Freshwater	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile
Puerto Rico	(66) species:	**E/T**	**Medium**	**Taxon**
Coqui, Golden	*Eleutherodactylus jasperi*	T	Terrestrial,	Amphibian
Guajon	*Eleutherodactylus cooki*	T	Terrestrial,	Amphibian
Toad, Puerto Rican Crested	*Peltophryne lemur*	T	Terrestrial,	Amphibian
Blackbird, Yellow-	*Agelaius xanthomus*	E	Terrestrial	Bird
Hawk, Puerto Rican Broad-	*Buteo platypterus brunnescens*	E	Terrestrial	Bird
Hawk, Puerto Rican Sharp-	*Accipiter striatus venator*	E	Terrestrial	Bird
Nightjar, Puerto Rico	*Caprimulgus noctitherus*	E	Terrestrial	Bird
Parrot, Puerto Rican	*Amazona vittata*	E	Terrestrial	Bird
Pigeon, Puerto Rican Plain	*Columba inornata wetmorei*	E	Terrestrial	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Coral, Elkhorn	*Acropora palmata*	T	Saltwater	Coral
Coral, Staghorn	*Acropora cervicornis*	T	Saltwater	Coral
Auerodendron	*Auerodendron pauciflorum*	E	Unattributed	Dicot
Bariaco	*Trichilia triacantha*	E	Unattributed	Dicot
Boxwood, Vahl's	*Buxus vahlii*	E	Unattributed	Dicot
Capa Rosa	*Callicarpa ampla*	E	Wetland	Dicot
Catesbaea Melanocarpa	*Catesbaea melanocarpa*	E	Unattributed	Dicot
Chamaecrista glandulosa	*Chamaecrista glandulosa var.*	E	Unattributed	Dicot
Chumbo, Higo	*Harrisia portoricensis*	T	Unattributed	Dicot
Chupacallos	*Pleodendron macranthum*	E	Wetland	Dicot
Cobana Negra	*Stahlia monosperma*	T	Wetland	Dicot
Cordia bellonis (ncn)	*Cordia bellonis*	E	Wetland	Dicot
Daphnopsis hellerana	*Daphnopsis hellerana*	E	Unattributed	Dicot
Erubia	*Solanum drymophilum*	E	Unattributed	Dicot
Eugenia Woodburyana	*Eugenia woodburyana*	E	Unattributed	Dicot
Gesneria pauciflora (ncn)	*Gesneria pauciflora*	T	Wetland	Dicot
Goetzea, Beautiful	*Goetzea elegans*	E	Unattributed	Dicot
Higuero De Sierra	*Crescentia portoricensis*	E	Wetland	Dicot
Holly, Cook's	*Ilex cookii*	E	Wetland	Dicot
Ilex sintenisii (ncn)	*Ilex sintenisii*	E	Wetland	Dicot
Lyonia truncata var.	*Lyonia truncata var. proctorii*	E	Unattributed	Dicot
Mitracarpus Maxwelliae	*Mitracarpus maxwelliae*	E	Unattributed	Dicot
Mitracarpus Polycladus	*Mitracarpus polycladus*	E	Unattributed	Dicot
Myrcia Paganii	*Myrcia paganii*	E	Unattributed	Dicot
Palo Colorado	*Ternstroemia luquillensis*	E	Wetland	Dicot
Palo de Jazmin	*Styrax portoricensis*	E	Wetland	Dicot
Palo de Nigua	*Cornutia obovata*	E	Wetland	Dicot
Palo de Ramon	*Banara vanderbiltii*	E	Unattributed	Dicot
Palo de Rosa	*Ottoschulzia rhodoxylon*	E	Unattributed	Dicot

Peperomia, Wheeler's	*Peperomia wheeleri*	E	Unattributed	Dicot
Prickly-ash, St. Thomas	*Zanthoxylum thomasianum*	E	Unattributed	Dicot
Schoepfia arenaria (ncn)	*Schoepfia arenaria*	T	Unattributed	Dicot
Ternstroemia subsessilis	*Ternstroemia subsessilis*	E	Wetland	Dicot
Uvillo	*Eugenia haematocarpa*	E	Wetland	Dicot
Vernonia Proctorii (ncn)	*Vernonia proctorii*	E	Unattributed	Dicot
Fern, Elaphoglossum	*Elaphoglossum serpens*	E	Unattributed	Ferns
Fern, Thelypteris	*Thelypteris inabonensis*	E	Unattributed	Ferns
Fern, Thelypteris verecunda	*Thelypteris verecunda*	E	Unattributed	Ferns
Fern, Thelypteris	*Thelypteris yaucoensis*	E	Unattributed	Ferns
Polystichum calderonense	*Polystichum calderonense*	E	Unattributed	Ferns
Tectaria Estremerana	*Tectaria estremerana*	E	Unattributed	Ferns
Tree Fern, Elfin	*Cyathea dryopteroides*	E	Unattributed	Ferns
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Aristida chaseae (ncn)	*Aristida chaseae*	E	Unattributed	Monocot
Cranichis Ricartii	*Cranichis ricartii*	E	Unattributed	Monocot
Lepanthes eltorensis (ncn)	*Lepanthes eltoroensis*	E	Unattributed	Monocot
Manaca, palma de	*Calyptronoma rivalis*	T	Wetland	Monocot
Pelos del Diablo	*Aristida portoricensis*	E	Unattributed	Monocot
Walnut, Nogal	*Juglans jamaicensis*	E	Unattributed	Monocot
Boa, Puerto Rican	*Epicrates inornatus*	E	Terrestrial	Reptile
Boa, Virgin Islands Tree	*Epicrates monensis granti*	E	Terrestrial	Reptile
Sea turtle, green	*Chelonia mydas*	E/T	Saltwater	Reptile
Sea turtle, hawksbill	*Eretmochelys imbricata*	E	Saltwater,	Reptile
Sea turtle, leatherback	*Dermochelys coriacea*	E	Saltwater,	Reptile
Sea turtle, loggerhead	*Caretta caretta*	E/T	Saltwater,	Reptile

Rhode Island	(7) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Gerardia, Sandplain	*Agalinis acuta*	E	Unattributed	Dicot
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Puma (Cougar), Eastern	*Puma (Felis) concolor (all subsp.*	E	Terrestrial	Mammal
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot

South Carolina	(32) species:	**E/T**	**Medium**	**Taxon**
Salamander, Frosted	*Ambystoma cingulatum*	T	Terrestrial,	Amphibian
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Stork, Wood	*Mycteria americana*	E	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Warbler (=Wood),	*Dendroica kirtlandii*	E	Terrestrial	Bird
Warbler, Bachman's	*Vermivora bachmanii*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Mussel, Heelsplitter	*Lasmigona decorata*	E	Freshwater	Bivalve
Amaranth, Seabeach	*Amaranthus pumilus*	T	Wetland	Dicot
Amphianthus, Little	*Amphianthus pusillus*	T	Wetland	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	Unattributed	Dicot
Dropwort, Canby's	*Oxypolis canbyi*	E	Wetland	Dicot

Gooseberry, Miccosukee	*Ribes echinellum*	T	Wetland	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Heartleaf, Dwarf-flowered	*Hexastylis naniflora*	T	Unattributed	Dicot
Loosestrife, Rough-leaved	*Lysimachia asperulaefolia*	E	Wetland	Dicot
Pitcher-plant, Mountain	*Sarracenia rubra ssp. jonesii*	E	Unattributed	Dicot
Pondberry	*Lindera melissifolia*	E	Wetland	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	Unattributed	Dicot
Sunflower, Schweinitz's	*Helianthus schweinitzii*	E	Unattributed	Dicot
Quillwort, Black-spored	*Isoetes melanospora*	E	Wetland	Ferns
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Lichen, Rock Gnome	*Gymnoderma lineare*	E	Unattributed	Lichen
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Arrowhead, Bunched	*Sagittaria fasciculata*	E	Wetland	Monocot
Irisette, White	*Sisyrinchium dichotomum*	E	Unattributed	Monocot
Pink, Swamp	*Helonias bullata*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Trillium, Persistent	*Trillium persistens*	E	Unattributed	Monocot
Trillium, Relict	*Trillium reliquum*	E	Unattributed	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

South Dakota	(12) species:	**E/T**	**Medium**	**Taxon**
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Curlew, Eskimo	*Numenius borealis*	E	Terrestrial	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Mussel, Scaleshell	*Leptodea leptodon*	E	Freshwater	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Freshwater	Bivalve
Shiner, Topeka	*Notropis topeka (tristis)*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot

Tennessee	(91) species:	**E/T**	**Medium**	**Taxon**
Spider, Spruce-fir Moss	*Microhexura montivaga*	E	Terrestrial	Arachnid
Stork, Wood	*Mycteria americana*	E	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Combshell, Upland	*Epioblasma metastriata*	E	Freshwater	Bivalve
Elktoe, Appalachian	*Alasmidonta raveneliana*	E	Freshwater	Bivalve
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
Kidneyshell, Triangular	*Ptychobranchus greenii*	E	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Alabama	*Medionidus acutissimus*	T	Freshwater	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Mussel, Coosa	*Medionidus parvulus*	E	Freshwater	Bivalve
Mussel, Cumberland	*Epioblasma brevidens*	E	Freshwater	Bivalve
Mussel, Cumberland Elktoe	*Alasmidonta atropurpurea*	E	Freshwater	Bivalve
Mussel, Cumberland Pigtoe	*Pleurobema gibberum*	E	Freshwater	Bivalve

Mussel, Fine-lined	*Lampsilis altilis*	T	Freshwater	Bivalve
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	E	Freshwater	Bivalve
Mussel, Georgia pigtoe	*Pleurobema hanleyianum*	E	Freshwater	Bivalve
Mussel, Ovate Clubshell	*Pleurobema perovatum*	E	Freshwater	Bivalve
Mussel, Oyster	*Epioblasma capsaeformis*	E	Freshwater	Bivalve
Mussel, Ring Pink	*Obovaria retusa*	E	Freshwater	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Freshwater	Bivalve
Mussel, Shiny Pigtoe	*Fusconaia cor*	E	Freshwater	Bivalve
Mussel, Southern Pigtoe	*Pleurobema georgianum*	E	Freshwater	Bivalve
Pearlymussel, Alabama	*Lampsilis virescens*	E	Freshwater	Bivalve
Pearlymussel,	*Quadrula sparsa*	E	Freshwater	Bivalve
Pearlymussel, Birdwing	*Lemiox rimosus*	E	Freshwater	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Freshwater	Bivalve
Pearlymussel,	*Villosa trabalis*	E	Freshwater	Bivalve
Pearlymussel,	*Quadrula intermedia*	E	Freshwater	Bivalve
Pearlymussel, Dromedary	*Dromus dromas*	E	Freshwater	Bivalve
Pearlymussel, Green-	*Epioblasma torulosa gubernaculum*	E	Freshwater	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	Freshwater	Bivalve
Pearlymussel, Orange-	*Plethobasus cooperianus*	E	Freshwater	Bivalve
Pearlymussel, Pale Lilliput	*Toxolasma cylindrellus*	E	Freshwater	Bivalve
Pearlymussel, Purple Cat's	*Epioblasma obliquata obliquata*	E	Freshwater	Bivalve
Pearlymussel, Tubercled-	*Epioblasma torulosa torulosa*	E	Freshwater	Bivalve
Pearlymussel, Turgid-	*Epioblasma turgidula*	E	Freshwater	Bivalve
Pearlymussel, White	*Plethobasus cicatricosus*	E	Freshwater	Bivalve
Pearlymussel, Yellow-	*Epioblasma florentina florentina*	E	Freshwater	Bivalve
Purple Bean	*Villosa perpurpurea*	E	Freshwater	Bivalve
Rabbitsfoot, Rough	*Quadrula cylindrica strigillata*	E	Freshwater	Bivalve
Riffleshell, Tan	*Epioblasma florentina walkeri*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Crayfish, Nashville	*Orconectes shoupi*	E	Freshwater	Crustacean
Aster, Ruth's Golden	*Pityopsis ruthii*	E	Unattributed	Dicot
Avens, Spreading	*Geum radiatum*	E	Unattributed	Dicot
Bladderpod, Spring Creek	*Lesquerella perforata*	E	Unattributed	Dicot
Bluet, Roan Mountain	*Hedyotis purpurea var. montana*	E	Unattributed	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Clover, Leafy Prairie	*Dalea foliosa*	E	Unattributed	Dicot
Goldenrod, Blue Ridge	*Solidago spithamaea*	T	Unattributed	Dicot
Ground-plum, Guthrie's	*Astragalus bibullatus*	E	Unattributed	Dicot
Pitcher-plant, Green	*Sarracenia oreophila*	E	Wetland	Dicot
Potato-bean, Price's	*Apios priceana*	T	Unattributed	Dicot
Rock-cress, Braun's	*Arabis perstellata E. L. Braun var.*	E	Unattributed	Dicot
Rosemary, Cumberland	*Conradina verticillata*	T	Wetland	Dicot
Sandwort, Cumberland	*Arenaria cumberlandensis*	E	Unattributed	Dicot
Skullcap, Large-flowered	*Scutellaria montana*	T	Unattributed	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Wetland	Dicot
Fern, American hart's-	*Asplenium scolopendrium var.*	T	Unattributed	Ferns
Chub, Slender	*Erimystax cahni*	T	Freshwater	Fish
Chub, Spotfin	*Erimonax monachus*	T	Freshwater	Fish

Chucky Madtom	*Noturus crypticus*	E	Freshwater	Fish
Cumberland darter	*Etheostoma susanae*	E	Freshwater	Fish
Dace, Blackside	*Phoxinus cumberlandensis*	T	Freshwater	Fish
Darter, Amber	*Percina antesella*	E	Freshwater	Fish
Darter, Bluemask (jewel)	*Etheostoma sp.*	E	Freshwater	Fish
Darter, Boulder	*Etheostoma wapiti*	E	Freshwater	Fish
Darter, Duskytail	*Etheostoma percnurum*	E	Freshwater	Fish
Darter, Slackwater	*Etheostoma boschungi*	T	Freshwater	Fish
Darter, Snail	*Percina tanasi*	T	Freshwater	Fish
Laurel dace	*Chrosomus aylori*	E	Freshwater	Fish
Logperch, Conasauga	*Percina jenkinsi*	E	Freshwater	Fish
Madtom, Pygmy	*Noturus stanauli*	E	Freshwater	Fish
Madtom, Smoky	*Noturus baileyi*	E	Freshwater	Fish
Madtom, Yellowfin	*Noturus flavipinnis*	T	Freshwater	Fish
Shiner, Blue	*Cyprinella caerulea*	T	Freshwater	Fish
Shiner, Palezone	*Notropis albizonatus*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Marstonia, Royal l	*Pyrgulopsis ogmorhaphe*	E	Terrestrial	Gastropod
Riversnail, Anthony's	*Athearnia anthonyi*	E	Freshwater	Gastropod
Snail, Painted Snake	*Anguispira picta*	T	Terrestrial	Gastropod
Lichen, Rock Gnome	*Gymnoderma lineare*	E	Unattributed	Lichen
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Squirrel, Carolina	*Glaucomys sabrinus coloratus*	E	Terrestrial	Mammal
Grass, Tennessee Yellow-	*Xyris tennesseensis*	E	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot

Texas	(81) species:	**E/T**	**Medium**	**Taxon**
Salamander, Barton	*Eurycea sosorum*	E	Terrestrial,	Amphibian
Salamander, San Marcos	*Eurycea nana*	T	Terrestrial,	Amphibian
Salamander, Texas Blind	*Typhlomolge rathbuni*	E	Freshwater,	Amphibian
Toad, Houston	*Bufo houstonensis*	E	Terrestrial,	Amphibian
Harvestman, Bee Creek	*Texella reddelli*	E	Terrestrial,	Arachnid
Harvestman, Bone Cave	*Texella reyesi*	E	Terrestrial,	Arachnid
Harvestman,	*Texella cokendolpheri*	E	Terrestrial,	Arachnid
Meshweaver, Braken Bat	*Cicurina venii*	E	Terrestrial,	Arachnid
Meshweaver, Government	*Cicurina vespera*	E	Terrestrial,	Arachnid
Meshweaver, Madla's Cave	*Cicurina madla*	E	Terrestrial,	Arachnid
Meshweaver, Robber	*Cicurina baronia*	E	Terrestrial,	Arachnid
Pseudoscorpion, Tooth	*Tartarocreagris texana*	E	Terrestrial,	Arachnid
Spider, Government	*Neoleptoneta microps*	E	Terrestrial,	Arachnid
Spider, Tooth Cave	*Leptoneta myopica*	E	Terrestrial,	Arachnid
Crane, Mississippi	*Grus canadensis pulla*	E	Terrestrial,	Bird
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Curlew, Eskimo	*Numenius borealis*	E	Terrestrial	Bird
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	E	Terrestrial	Bird
Flycatcher, Southwestern	*Empidonax traillii extimus*	E	Terrestrial	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Terrestrial	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird

Prairie-chicken, Attwater's	*Tympanuchus cupido attwateri*	E	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Vireo, Black-capped	*Vireo atricapilla*	E	Terrestrial	Bird
Warbler (=Wood), Golden-	*Dendroica chrysoparia*	E	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Amphipod, Peck's Cave	*Stygobromus (Stygonectes) pecki*	E	Freshwater,	Crustacean
Ambrosia, South Texas	*Ambrosia cheiranthifolia*	E	Unattributed	Dicot
Ayenia, Texas	*Ayenia limitaris*	E	Unattributed	Dicot
Bladderpod, White	*Lesquerella pallida*	E	Wetland	Dicot
Bladderpod, Zapata	*Lesquerella thamnophila*	E	Unattributed	Dicot
Cactus, Black Lace	*Echinocereus reichenbachii var.*	E	Unattributed	Dicot
Cactus, Bunched Cory	*Coryphantha ramillosa*	T	Unattributed	Dicot
Cactus, Chisos Mountain	*Echinocereus chisoensis var.*	T	Unattributed	Dicot
Cactus, Lloyd's Mariposa	*Echinomastus mariposensis*	T	Unattributed	Dicot
Cactus, Nellie Cory	*Coryphantha minima*	E	Unattributed	Dicot
Cactus, Sneed Pincushion	*Coryphantha sneedii var. sneedii*	E	Unattributed	Dicot
Cactus, Star	*Astrophytum asterias*	E	Unattributed	Dicot
Cactus, Tobusch Fishhook	*Ancistrocactus tobuschii*	E	Unattributed	Dicot
Cat's-eye, Terlingua Creek	*Cryptantha crassipes*	E	Unattributed	Dicot
Dawn-flower, Texas	*Hymenoxys texana*	E	Wetland	Dicot
Dogweed, Ashy	*Thymophylla tephroleuca*	E	Unattributed	Dicot
Frankenia, Johnston's	*Frankenia johnstonii*	E	Unattributed	Dicot
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	T	Unattributed	Dicot
Manioc, Walker's	*Manihot walkerae*	E	Unattributed	Dicot
Oak, Hinckley	*Quercus hinckleyi*	T	Unattributed	Dicot
Phlox, Texas Trailing	*Phlox nivalis ssp. texensis*	E	Unattributed	Dicot
Pitaya, Davis' Green	*Echinocereus viridiflorus var. davisii*	E	Unattributed	Dicot
Poppy-mallow, Texas	*Callirhoe scabriuscula*	E	Unattributed	Dicot
Rush-pea, Slender	*Hoffmannseggia tenella*	E	Unattributed	Dicot
Sand-verbena, Large-fruited	*Abronia macrocarpa*	E	Unattributed	Dicot
Snowbells, Texas	*Styrax texanus*	E	Unattributed	Dicot
Sunflower, Pecos	*Helianthus paradoxus*	T	Wetland	Dicot
Darter, Fountain	*Etheostoma fonticola*	E	Freshwater	Fish
Gambusia, Big Bend	*Gambusia gaigei*	E	Freshwater	Fish
Gambusia, Clear Creek	*Gambusia heterochir*	E	Freshwater	Fish
Gambusia, Pecos	*Gambusia nobilis*	E	Freshwater	Fish
Gambusia, San Marcos	*Gambusia georgei*	E	Freshwater	Fish
Minnow, Devils River	*Dionda diaboli*	T	Freshwater	Fish
Pupfish, Comanche Springs	*Cyprinodon elegans*	E	Freshwater	Fish
Pupfish, Leon Springs	*Cyprinodon bovinus*	E	Freshwater	Fish
Shiner, Arkansas River	*Notropis girardi*	T	Freshwater	Fish
Snail, Pecos Assiminea	*Assiminea pecos*	E	Freshwater	Gastropod
Beetle, American Burying	*Nicrophorus americanus*	E	Terrestrial	Insect
Beetle, Coffin Cave Mold	*Batrisodes texanus*	E	Subterraneous	Insect
Beetle, Comal Springs	*Stygoparnus comalensis*	E	Freshwater,	Insect
Beetle, Comal Springs Riffle	*Heterelmis comalensis*	E	Freshwater,	Insect
Beetle, Helotes Mold	*Batrisodes venyivi*	E	Subterraneous	Insect
Beetle, Kretschmarr Cave	*Texamaurops reddelli*	E	Subterraneous	Insect
Beetle, Tooth Cave Ground	*Rhadine persephone*	E	Subterraneous	Insect

Rhadine exilis (ncn)	*Rhadine exilis*	E	Terrestrial,	Insect
Rhadine infernalis (ncn)	*Rhadine infernalis*	E	Terrestrial,	Insect
Bat, Mexican Long-nosed	*Leptonycteris nivalis*	E	Terrestrial,	Mammal
Bear, American Black	*Ursus americanus*	SAT	Terrestrial	Mammal
Bear, Louisiana Black	*Ursus americanus luteolus*	T	Terrestrial	Mammal
Jaguarundi, Gulf Coast	*Herpailurus (Felis) yagouaroundi*	E	Terrestrial	Mammal
Manatee, West Indian	*Trichechus manatus*	E	Saltwater	Mammal
Ocelot	*Leopardus (Felis) pardalis*	E	Terrestrial	Mammal
Ladies'-tresses, Navasota	*Spiranthes parksii*	E	Unattributed	Monocot
Pondweed, Little Aguja	*Potamogeton clystocarpus*	E	Wetland	Monocot
Wild-rice, Texas	*Zizania texana*	E	Wetland	Monocot

Utah	(41) species:	**E/T**	**Medium**	**Taxon**
Condor, California	*Gymnogyps californianus*	E	Terrestrial	Bird
Flycatcher, Southwestern	*Empidonax traillii extimus*	E	Terrestrial	Bird
Owl, Mexican Spotted	*Strix occidentalis lucida*	T	Terrestrial	Bird
Bearclaw poppy, Dwarf	*Arctomecon humilis*	E	Unattributed	Dicot
Bladderpod, Kodachrome	*Lesquerella tumulosa*	E	Unattributed	Dicot
Buttercup, Autumn	*Ranunculus aestivalis (acriformis)*	E	Wetland	Dicot
Cactus, Colorado hookless	*Sclerocactus glaucus*	T	Unattributed	Dicot
Cactus, Pariette	*Sclerocactus brevispinus*	T	Unattributed	Dicot
Cactus, San Rafael	*Pediocactus despainii*	E	Unattributed	Dicot
Cactus, Siler Pincushion	*Pediocactus*	T	Unattributed	Dicot
Cactus, Uinta Basin	*Sclerocactus wetlandicus*	T	Unattributed	Dicot
Cactus, Winkler	*Pediocactus winkleri*	T	Unattributed	Dicot
Cactus, Wright Fishhook	*Sclerocactus wrightiae*	E	Unattributed	Dicot
Cycladenia, Jones	*Cycladenia jonesii (=humilis)*	T	Unattributed	Dicot
Milk-vetch, Deseret	*Astragalus desereticus*	T	Unattributed	Dicot
Milk-vetch, Heliotrope	*Astragalus montii*	T	Unattributed	Dicot
Milk-vetch, Holmgren	*Astragalus holmgreniorum*	E	Unattributed	Dicot
Milk-vetch, Shivwits	*Astragalus ampullarioides*	E	Unattributed	Dicot
Milkweed, Welsh's	*Asclepias welshii*	T	Unattributed	Dicot
Phacelia, Clay	*Phacelia argillacea*	E	Unattributed	Dicot
Primrose, Maguire	*Primula maguirei*	T	Upland	Dicot
Reed-mustard, Barneby	*Schoenocrambe barnebyi*	E	Unattributed	Dicot
Reed-mustard, Clay	*Schoenocrambe argillacea*	T	Unattributed	Dicot
Reed-mustard, Shrubby	*Schoenocrambe suffrutescens*	E	Unattributed	Dicot
Ridge-cress (=Pepper-	*Lepidium barnebyanum*	E	Unattributed	Dicot
Townsendia, Last Chance	*Townsendia aprica*	T	Unattributed	Dicot
Chub, Bonytail	*Gila elegans*	E	Freshwater	Fish
Chub, Humpback	*Gila cypha*	E	Freshwater	Fish
Chub, Virgin River	*Gila seminuda (robusta)*	E	Freshwater	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Freshwater	Fish
Sucker, June	*Chasmistes liorus*	E	Freshwater	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Freshwater	Fish
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	T	Freshwater	Fish
Woundfin	*Plagopterus argentissimus*	E	Freshwater	Fish
Ambersnail, Kanab	*Oxyloma haydeni kanabensis*	E	Terrestrial,	Gastropod
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal

Prairie Dog, Utah	*Cynomys parvidens*	T	Terrestrial,	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot
Sedge, Navajo	*Carex specuicola*	T	Wetland	Monocot
Tortoise, Desert	*Gopherus agassizii*	T	Terrestrial	Reptile
Vermont	(6) species:	**E/T**	**Medium**	**Taxon**
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Milk-vetch, Jesup's	*Astragalus robbinsii var. jesupi*	E	Unattributed	Dicot
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Virgin Islands	(5) species:	**E/T**	**Medium**	**Taxon**
Coral, Elkhorn	*Acropora palmata*	T	Saltwater	Coral
Coral, Staghorn	*Acropora cervicornis*	T	Saltwater	Coral
Boxwood, Vahl's	*Buxus vahlii*	E	Unattributed	Dicot
Catesbaea Melanocarpa	*Catesbaea melanocarpa*	E	Unattributed	Dicot
Lizard, St. Croix Ground	*Ameiva polops*	E	Terrestrial	Reptile
Virginia	(64) species:	**E/T**	**Medium**	**Taxon**
Salamander, Shenandoah	*Plethodon shenandoah*	E	Terrestrial,	Amphibian
Spider, Spruce-fir Moss	*Microhexura montivaga*	E	Terrestrial	Arachnid
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Roseate	*Sterna dougallii dougallii*	E/T	Terrestrial	Bird
Woodpecker, Red-cockaded	*Picoides borealis*	E	Terrestrial	Bird
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Cumberland	*Epioblasma brevidens*	E	Freshwater	Bivalve
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	E	Freshwater	Bivalve
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	E	Freshwater	Bivalve
Mussel, Oyster	*Epioblasma capsaeformis*	E	Freshwater	Bivalve
Mussel, Rough Pigtoe	*Pleurobema plenum*	E	Freshwater	Bivalve
Mussel, Shiny Pigtoe	*Fusconaia cor*	E	Freshwater	Bivalve
Pearlymussel,	*Quadrula sparsa*	E	Freshwater	Bivalve
Pearlymussel, Birdwing	*Lemiox rimosus*	E	Freshwater	Bivalve
Pearlymussel, Cracking	*Hemistena lata*	E	Freshwater	Bivalve
Pearlymussel,	*Villosa trabalis*	E	Freshwater	Bivalve
Pearlymussel,	*Quadrula intermedia*	E	Freshwater	Bivalve
Pearlymussel, Dromedary	*Dromus dromas*	E	Freshwater	Bivalve
Pearlymussel, Green-	*Epioblasma torulosa gubernaculum*	E	Freshwater	Bivalve
Pearlymussel, Little-wing	*Pegias fabula*	E	Freshwater	Bivalve
Purple Bean	*Villosa perpurpurea*	E	Freshwater	Bivalve
Rabbitsfoot, Rough	*Quadrula cylindrica strigillata*	E	Freshwater	Bivalve
Rayed Bean	*Villosa fabalis*	E	Freshwater	Bivalve
Riffleshell, Tan	*Epioblasma florentina walkeri*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Spinymussel, James River	*Pleurobema collina*	E	Freshwater	Bivalve
Isopod, Lee County Cave	*Lirceus usdagalun*	E	Freshwater	Crustacean
Isopod, Madison Cave	*Antrolana lira*	T	Freshwater	Crustacean

Amaranth, Seabeach	*Amaranthus pumilus*	T	Wetland	Dicot
Birch, Virginia Round-leaf	*Betula uber*	T	Unattributed	Dicot
Bittercress, Small-anthered	*Cardamine micranthera*	E	Wetland	Dicot
Chaffseed, American	*Schwalbea americana*	E	Wetland	Dicot
Coneflower, Smooth	*Echinacea laevigata*	E	Unattributed	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Joint-vetch, Sensitive	*Aeschynomene virginica*	T	Wetland	Dicot
Mallow, Peter's Mountain	*Iliamna corei*	E	Unattributed	Dicot
Rock-cress, Shale Barren	*Arabis serotina*	E	Unattributed	Dicot
Sneezeweed, Virginia	*Helenium virginicum*	T	Wetland	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Wetland	Dicot
Sumac, Michaux's	*Rhus michauxii*	E	Unattributed	Dicot
Sunflower, Schweinitz's	*Helianthus schweinitzii*	E	Unattributed	Dicot
Chub, Slender	*Erimystax cahni*	T	Freshwater	Fish
Chub, Spotfin	*Erimonax monachus*	T	Freshwater	Fish
Dace, Blackside	*Phoxinus cumberlandensis*	T	Freshwater	Fish
Darter, Duskytail	*Etheostoma percnurum*	E	Freshwater	Fish
Logperch, Conasauga	*Percina jenkinsi*	E	Freshwater	Fish
Logperch, Roanoke	*Percina rex*	E	Freshwater	Fish
Madtom, Yellowfin	*Noturus flavipinnis*	T	Freshwater	Fish
Sturgeon, Shortnose	*Acipenser brevirostrum*	E	Freshwater,	Fish
Snail, Virginia Fringed	*Polygyriscus virginianus*	E	Terrestrial	Gastropod
Beetle, Northeastern	*Cicindela dorsalis dorsalis*	T	Terrestrial	Insect
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	E	Terrestrial,	Insect
Bat, Gray	*Myotis grisescens*	E	Terrestrial,	Mammal
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bat, Ozark Big-eared	*Corynorhinus (Plecotus)*	E	Terrestrial,	Mammal
Squirrel, Carolina	*Glaucomys sabrinus coloratus*	E	Terrestrial	Mammal
Squirrel, Delmarva	*Sciurus niger cinereus*	E	Terrestrial	Mammal
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot
Pink, Swamp	*Helonias bullata*	T	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot
Turtle, Bog	*Clemmys muhlenbergii*	T	Terrestrial,	Reptile

Washington	(29) species:	**E/T**	**Medium**	**Taxon**
Albatross, Short-tailed	*Phoebastria (Diomedea) albatrus*	E	Terrestrial,	Bird
Murrelet, Marbled	*Brachyramphus marmoratus*	T	Terrestrial,	Bird
Owl, Northern Spotted	*Strix occidentalis caurina*	T	Terrestrial	Bird
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	T	Terrestrial	Bird
Catchfly, Spalding's	*Silene spaldingii*	T	Unattributed	Dicot
Checker-mallow, Nelson's	*Sidalcea nelsoniana*	T	Wetland	Dicot
Checker-mallow,	*Sidalcea oregana var. calva*	E	Unattributed	Dicot
Howellia, Water	*Howellia aquatilis*	T	Wetland	Dicot
Lomatium, Bradshaw's	*Lomatium bradshawii*	E	Wetland	Dicot
Lupine, Kincaid's	*Lupinus sulphureus (=oreganus)*	T	Unattributed	Dicot
Paintbrush, Golden	*Castilleja levisecta*	T	Unattributed	Dicot
Sandwort, Marsh	*Arenaria paludicola*	E	Wetland	Dicot
Stickseed, Showy	*Hackelia venusta*	E	Unattributed	Dicot
Rockfish, Bocaccio	*Sebastes paucispinis*	E	Saltwater	Fish

Salmon, Chinook	*Oncorhynchus (Salmo)*	E/T	Freshwater,	Fish
Salmon, Sockeye	*Oncorhynchus (Salmo) nerka*	E	Freshwater,	Fish
Steelhead	*Oncorhynchus (Salmo) mykiss*	E/T	Freshwater,	Fish
Trout, Apache	*Oncorhynchus apache*	T	Freshwater	Fish
Trout, Bull	*Salvelinus confluentus*	T	Freshwater	Fish
Butterfly, Oregon	*Speyeria zerene hippolyta*	T	Terrestrial	Insect
Bear, Grizzly	*Ursus arctos horribilis*	T	Terrestrial	Mammal
Caribou, Woodland	*Rangifer tarandus caribou*	E	Terrestrial	Mammal
Deer, Columbian White-	*Odocoileus virginianus leucurus*	E	Terrestrial	Mammal
Gray Wolf	*Canis lupus*	E	Terrestrial	Mammal
Killer whale, Southern	*Orcinus orca*	E	Saltwater	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Rabbit, Pygmy	*Brachylagus idahoensis*	E	Terrestrial	Mammal
Whale, Gray	*Eschrichtius robustus*	E	Saltwater	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot

West Virginia	(17) species:	**E/T**	**Medium**	**Taxon**
Salamander, Cheat	*Plethodon nettingi*	T	Terrestrial,	Amphibian
Fanshell	*Cyprogenia stegaria*	E	Freshwater	Bivalve
Mucket, Pink	*Lampsilis abrupta*	E	Freshwater	Bivalve
Mussel, Clubshell	*Pleurobema clava*	E	Freshwater	Bivalve
Pearlymussel, Tubercled-	*Epioblasma torulosa torulosa*	E	Freshwater	Bivalve
Riffleshell, Northern	*Epioblasma torulosa rangiana*	E	Freshwater	Bivalve
Spinymussel, James River	*Pleurobema collina*	E	Freshwater	Bivalve
Isopod, Madison Cave	*Antrolana lira*	T	Freshwater	Crustacean
Clover, Running Buffalo	*Trifolium stoloniferum*	E	Unattributed	Dicot
Harperella	*Ptilimnium nodosum*	E	Wetland	Dicot
Rock-cress, Shale Barren	*Arabis serotina*	E	Unattributed	Dicot
Spiraea, Virginia	*Spiraea virginiana*	T	Wetland	Dicot
Snail, Flat-spired Three-	*Triodopsis platysayoides*	T	Terrestrial	Gastropod
Bat, Indiana	*Myotis sodalis*	E	Terrestrial,	Mammal
Bat, Virginia Big-eared	*Corynorhinus (Plecotus)*	E	Terrestrial,	Mammal
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	Wetland	Monocot
Pogonia, Small Whorled	*Isotria medeoloides*	T	Wetland	Monocot

Wisconsin	(18) species:	**E/T**	**Medium**	**Taxon**
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Warbler (Wood),	*Dendroica kirtlandii*	E	Terrestrial	Bird
Mussel, snuffbox	*Epioblasma triquetra*	E	Freshwater	Bivalve
Mussel, Winged Mapleleaf	*Quadrula fragosa*	E	Freshwater	Bivalve
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	E	Freshwater	Bivalve
Sheepnose mussel	*Plethobasus cyphyus*	E	Freshwater	Bivalve
Spectaclecase mussel	*Cumberlandia monodonta*	E	Freshwater	Bivalve
Clover, Prairie Bush	*Lespedeza leptostachya*	T	Unattributed	Dicot
Locoweed, Fassett's	*Oxytropis campestris var. chartacea*	T	Unattributed	Dicot
Milkweed, Mead's	*Asclepias meadii*	T	Unattributed	Dicot
Monkshood, Northern Wild	*Aconitum noveboracense*	T	Unattributed	Dicot
Thistle, Pitcher's	*Cirsium pitcheri*	T	Unattributed	Dicot
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	E	Terrestrial	Insect
Dragonfly, Hine's Emerald	*Somatochlora hineana*	E	Terrestrial,	Insect

Gray Wolf	*Canis lupus*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Iris, Dwarf Lake	*Iris lacustris*	T	Wetland	Monocot
Orchid, Eastern Prairie	*Platanthera leucophaea*	T	Wetland	Monocot

Wyoming	(18) species:	**E/T**	**Medium**	**Taxon**
Toad, Wyoming	*Bufo baxteri (hemiophrys)*	E	Terrestrial,	Amphibian
Crane, Whooping	*Grus americana*	E	Terrestrial,	Bird
Plover, Piping	*Charadrius melodus*	E/T	Terrestrial	Bird
Tern, Interior (population)	*Sterna antillarum*	E	Terrestrial	Bird
Butterfly Plant, Colorado	*Gaura neomexicana var.*	T	Unattributed	Dicot
Penstemon, Blowout	*Penstemon haydenii*	E	Unattributed	Dicot
Yellowhead, Desert	*Yermo xanthocephalus*	T	Unattributed	Dicot
Chub, Bonytail	*Gila elegans*	E	Freshwater	Fish
Chub, Humpback	*Gila cypha*	E	Freshwater	Fish
Squawfish, Colorado	*Ptychocheilus lucius*	E	Freshwater	Fish
Sturgeon, Pallid	*Scaphirhynchus albus*	E	Freshwater	Fish
Sturgeon, Shovelnose	*Scaphirhynchus platorynchus*	SAT	Saltwater	Fish
Sucker, Razorback	*Xyrauchen texanus*	E	Freshwater	Fish
Ferret, Black-footed	*Mustela nigripes*	E	Terrestrial	Mammal
Lynx, Canada	*Lynx canadensis*	T	Terrestrial	Mammal
Mouse, Preble's Meadow	*Zapus hudsonius preblei*	T	Terrestrial	Mammal
Ladies'-tresses, Ute	*Spiranthes diluvialis*	T	Wetland	Monocot
Orchid, Western Prairie	*Platanthera praeclara*	T	Unattributed	Monocot

Marine Species

Coral (Anthozoa)

Common name	Scientific name	Family	Order
Coral, Elkhorn	*Acropora palmata*	Acroporidae	Scleractinia
Coral, Staghorn	*Acropora cervicornis*	Acroporidae	Scleractinia

Fish (Actinopterygii)

Common name	Scientific name	Family	Order
Rockfish, Bocaccio	*Sebastes paucispinis*	Scorpaenidae	Perciformes
Rockfish, Canary	*Sebastes pinniger*	Scorpaenidae	Perciformes
Salmon, Atlantic	*Salmo salar*	Salmonidae	Salmoniformes
Salmon, Chinook	*Oncorhynchus (=Salmo) tshawytscha*	Salmonidae	Salmoniformes
Salmon, Chum	*Oncorhynchus (=Salmo) keta*	Salmonidae	Salmoniformes
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	Salmonidae	Salmoniformes
Salmon, Sockeye	*Oncorhynchus (=Salmo) nerka*	Salmonidae	Salmoniformes
Sawfish, Smalltooth	*Pristis pectinata*	Pristidae	Pristiformes
Steelhead	*Oncorhynchus (=Salmo) mykiss*	Salmonidae	Salmoniformes
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	Acipenseridae	Acipenseriformes
Sturgeon, North American green	*Acipenser medirostris*	Acipenseridae	Acipenseriformes
Sturgeon, Shortnose	*Acipenser brevirostrum*	Acipenseridae	Acipenseriformes
Sturgeon, White	*Acipenser transmontanus*	Acipenseridae	Acipenseriformes

Gastropod (Gastropoda)

Common name	Scientific name	Family	Order
Abalone, Black	*Haliotis cracherodii*	Haliotidae	Vetigastropoda
Abalone, White	*Haliotis sorenseni*	Haliotidae	Vetigastropoda

Mammal (Mammalia)

Common name	Scientific name	Family	Order
Bear, polar	*Ursus maritimus*	Ursidae	Carnivora
Dugong	*Dugong dugon*	Dugongidae	Sirenia
Killer whale, Southern Resident DPS	*Orcinus orca*	Cervidae	Artiodactyla
Manatee, West Indian	*Trichechus manatus*	Trichechidae	Sirenia
Otter, Northern Sea	*Enhydra lutris kenyoni*	Mustelidae	Carnivora
Otter, Southern Sea	*Enhydra lutris nereis*	Mustelidae	Carnivora
Seal, bearded (Atlantic)	*Erignathus barbatus barbatus*	Phocidae	Carnivora
Seal, bearded (Pacific)	*Erignathus barbatus nauticus*	Phocidae	Carnivora
Seal, Guadalupe Fur	*Arctocephalus townsendi*	Phocidae	Carnivora
Seal, Hawaiian Monk	*Monachus schauinslandi*	Phocidae	Carnivora
Seal, ringed (Arctic)	*Phoca hispida hispida*	Phocidae	Carnivora
Seal, ringed (Baltic)	*Phoca hispida botnica*	Phocidae	Carnivora
Seal, ringed (Ladoga)	*Phoca hispida ladogensis*	Phocidae	Carnivora
Seal, ringed (Okhotsk)	*Phoca hispida ochotensis*	Phocidae	Carnivora
Seal, spotted	*Phoca largha*	Phocidae	Carnivora
Sea-lion, Steller	*Eumetopias jubatus*	Otariidae	Carnivora

Mammal (Mammalia)

Common name	Scientific name	Family	Order
Whale, beluga	*Delphinapterus leucas*	Monodontidae	Cetacea
Whale, Blue	*Balaenoptera musculus*	Balaenopteridae	Cetacea
Whale, Bowhead	*Balaena mysticetus*	Balaenidae	Cetacea
Whale, Finback	*Balaenoptera physalus*	Balaenopteridae	Cetacea
Whale, Gray	*Eschrichtius robustus*	Eschrichtiidae	Cetacea
Whale, Humpback	*Megaptera novaeangliae*	Balaenopteridae	Cetacea
Whale, North Atlantic right	*Eubalaena glacialis (incl. australis)*	Balaenidae	Cetacea
Whale, North Pacific right	*Eubalaena japonica*	Balaenidae	Cetacea
Whale, Sei	*Balaenoptera borealis*	Balaenopteridae	Cetacea
Whale, Sperm	*Physeter catodon (=macrocephalus)*	Physeteridae	Cetacea

Monocot (Liliopsida)

Common name	Scientific name	Family	Order
Seagrass, Johnson's	*Halophila johnsonii*	Hydrocharitaceae	Alismatales

Reptile (Reptilia)

Common name	Scientific name	Family	Order
Sea turtle, green	*Chelonia mydas*	Cheloniidae	Testudines
Sea turtle, hawksbill	*Eretmochelys imbricata*	Cheloniidae	Testudines
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Cheloniidae	Testudines
Sea turtle, leatherback	*Dermochelys coriacea*	Dermochelyidae	Testudines
Sea turtle, loggerhead	*Caretta caretta*	Cheloniidae	Testudines
Sea turtle, olive ridley	*Lepidochelys olivacea*	Cheloniidae	Testudines
Snake, Atlantic Salt Marsh	*Nerodia clarkii taeniata*	Colubridae	Squamata