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OFFICE OF
PREVENTION, PESTICIDES, AND
TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Revised Environmental Fate and Ecological Risk Assessment for Dazomet

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Attached is the revised EFED Environmental Fate and Ecological Risk Assessment for the Reregistration of Dazomet. The assessment has been revised to account for 1) removal of the Florida aquatic exposure scenarios for tomatoes and strawberries (these crops are currently registered only in California), 2) addition of a California strawberry aquatic exposure scenario (including irrigation), and 3) corrections to the Pennsylvania turf aquatic exposure scenario. The revisions thus include some new EECs and risk quotients, as well as revisions to the risk description and endangered species sections, based on the above changes.

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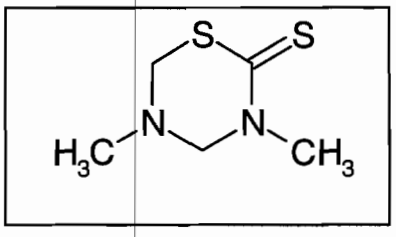
Office of Prevention, Pesticides,
and Toxic Substances

Revised Environmental Fate and Ecological Risk Assessment for the Reregistration of Dazomet



DAZOMET
IUPAC name: 3,5-Dimethyl-1,3,5-thiadiazinane-2-thione
CAS name: Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione

CAS No: 533-74-4, PC Code: 035602

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I. EXECUTIVE SUMMARY

A. Nature of Chemical Stressor

Dazomet is a granular formulation product, which is registered as a preplant fumigant for agriculture and non-agriculture uses. Agricultural uses included in this review include California strawberry and tomato uses. Non-agricultural uses include turf and ornamentals. Antimicrobial or other industrial uses are not covered by this risk assessment. Dazomet and its primary degradation product methyl isothiocyanate (MITC) are the potential stressors that would result from the application of dazomet to soil in controlling weeds, nematodes and various soil-borne pathogens. MITC is highly toxic and results in the disruption of biological functions of soil organisms. MITC accounts for most of the fumigant activity by diffusing, either as a gas or volatile liquid, upward through the interstitial spaces in the soil and killing living organisms with which it comes in contact.

B. Conclusions - Exposure Characterization

Dazomet, a granular pre-plant soil fumigant, is used in controlling a broad range of soil pathogens. It is unstable in the environment and hydrolyzes rapidly to form methyl isothiocyanate (MITC), which acts as a preplant fumigant to control nematodes, soil-borne diseases, insects and weeds. The high vapor pressure and low affinity for sorption on soil of MITC suggest that volatilization is the most important environmental route of dissipation and to a lesser extent leaching and degradation. Rapid photolytic decomposition of gaseous MITC is the primary route of dissipation from the atmosphere. Repeated application of dazomet at the same site may cause microbial induced fast degradation of MITC resulting in the compromise of biocidal activities of dazomet. Dazomet does not contain halogens, a property which is considered to be advantageous with regard to impact on ozone layer depletion.

C. Potential Risks to Non-target Organisms

This is a Level I screening assessment. EFED has a strong presumption of acute risk to all exposed plants and animals, since dazomet is a broad-spectrum fumigant. It is assumed that all living organisms in the treated soil (including beneficial insects and burrowing mammals, for example) are at high risk of mortality. Based on an LD_{50}/sq. ft. analysis, acute RQ values for dazomet granules exceed Levels-of-Concern for birds and mammals that potentially could be exposed (via oral and other routes) to that portion of the granules that may be left on the soil surface. There is a potential for avian reproductive effects from dazomet, but additional data are needed for quantitative risk assessment.

The second portion of the terrestrial risk assessment is of the MITC gas. Based on available modeling of MITC air residues, it does not appear that residues downwind from a single 40-acre field would be sufficient to exceed equivalent acute LOCs for inhalation for mammals. However, multiple fields may be treated at one time and over time, possibly posing a greater acute and/or longer-term risk from air residues. Monitoring data could reduce uncertainty. Birds may be at greater risk than mammals, due to physiological differences in the avian lung, but avian inhalation toxicity data are not available for MITC. Other terrestrial wildlife (e.g., reptiles and terrestrial

phase amphibians) may also be at a similar risk as mammals and/or birds, if exposed to dazomet granules or MITC air residues.

Based on PRZM/EXAMS modeling, no aquatic LOCs are exceeded, based on exposure to MITC in the modeled pond. Additional acute and chronic aquatic data on MITC, needed for a more complete risk assessment, are described. Modeling indicates no aquatic exposure to parent dazomet. There are uncertainties in estimating aquatic ecological effects of dazomet/MITC due to the limitations of current exposure models and crop scenarios. The PRZM model has a limited capability of capturing the partitioning of volatile chemicals in air, water and sediment. Thus, estimated MITC surface water concentrations may be upper bound. However, other degradates are not addressed and thus the overall aquatic and terrestrial risk estimates are potentially underestimated.

No LOCs are exceeded for aquatic plant exposure to MITC, based in part on supplemental data. Terrestrial plant data are needed for risk assessment of MITC.

D. Conclusions - Effects Characterization

Dazomet is considered moderately toxic on an acute oral basis to both birds (LD_{50} = 424 mg/kg) and mammals (LD_{50} = 415 mg/kg). MITC is considered highly toxic on an acute oral basis to mammals (LD_{50} = 55 mg/kg). Acute oral toxicity data with MITC are needed for birds. The acute mammal inhalation LC_{50} for MITC is 54 mg/l. The rat 28-day inhalation NOAEL for MITC is 20 µg/l. Inhalation toxicity data with MITC are needed for birds.

MITC is considered very highly toxic to both fish (lowest LC_{50} = 51.2 ppb) and aquatic invertebrates (lowest LC_{50} = 55 ppb). The available NOAEC for freshwater invertebrates is 25 ppb. The lowest EC_{50} for aquatic plants is 0.254 ppm, for the alga *Scenedesmus subspicatus*.

E. Data Gaps and Uncertainties

1. Environmental Fate and Exposure

a. Environmental Fate Data Gaps: Dazomet

The environmental fate data base for the parent compound is largely complete. The following environmental fate studies were not submitted and no further actions will be needed. (Appendix A. Table A1-B).

162-4 Aerobic aquatic metabolism of dazomet. Dazomet is very unstable and hydrolyzed rapidly in soil and water to generate MITC, which volatilizes into the atmosphere. Aerobic aquatic metabolism study will not provide additional information.

165-4 Bioaccumulation in fish of dazomet The octanol/water partition coefficient (log K_{ow}) for dazomet is less than 0.15, indicating a low potential for dazomet to bioaccumulate in aquatic

organisms. Therefore, bioaccumulation in fish study is not required under the above circumstances according to the Subdivision N guidelines.

b. Environmental Fate data Gaps: MITC

The laboratory studies successfully characterize the degradation of dazomet, however, several key environmental fate studies of the major metabolite MITC were not provided.

161-4 Photodegradation in Air This study was not provided by the registrant. However, a study done by Geddes et al. (1995) provided pertinent information required by this study. Therefore, a new study will not be required at this time. (Geddes, J.D., G.C. Miller, and G. E. Taylor Jr. 1995. Gas phase photolysis of methyl isothiocyanate. Environ. Sci. Technol. 29:2590-2594.)

162-1 Aerobic Soil Metabolism This aerobic soil metabolism study of MITC has been deemed supplemental, but the bodies of evidence suggest that there is no need of additional studies under the present guideline. A study done by Gerstl et al. (1977) provided pertinent information. (Gerstl, Z., U. Mingelgrin, B. Yaron. 1977. Behavior of Vapam and Methylisothiocyanate in soils. Soil Sci. Soc. Am. J. 41: 545-548)

163-1 Adsorption/Desorption of MITC The study MRID# 42569201 provides marginally acceptable data on the soil-water partitioning of MITC. However, a study done by Gerstl et al. (1977) provided pertinent information required by this study. (Gerstl, Z., U. Mingelgrin, B. Yaron. 1977. Behavior of Vapam and Methylisothiocyanate in soils. Soil Sci. Soc. Am. J. 41: 545-548)

164-1 Terrestrial Field Dissipation Terrestrial field dissipation of dazomet studies essentially captured the dissipation of MITC as well. Therefore, no additional study is required.

c. Uncertainties- Fate and Environmental Exposure

The laboratory studies successfully characterize the degradation of dazomet, however, several key environmental fate studies of the major metabolite MITC were not provided. Many essential fate data were obtained from open literature to complete the environmental fate and exposure assessment for MITC. However, these studies provided very limited information related to the formation and decline of metabolites of MITC in soil and water. The Agency is not requiring additional fate data for MITC at this time. However, the true extent of this compound's ultimate fate can only be gauged through a review of additional environmental fate of MITC in soil and water studies capable of addressing the above concerns.

There are also uncertainties in estimating dazomet and MITC exposure in surface water from post-application due to tarping and/or water sealing of the treated area. If tarping is used to minimize the volatilization of MITC, the loading of dazomet and MITC through runoff will be limited until the tarp is sliced or removed from the field. The present version of the PRZM model and the selected crop scenarios used in modeling have limited capabilities in discounting the load from runoff of applied chemical under a post-application tarp scenario. PRZM also has limited

capabilities in capturing the partitions of a volatile chemical in air, water and sediment. Since the load of dazomet and MITC from runoff is considered in the PRZM/EXAMS simulation, the estimated concentrations of these chemicals in surface water bodies may be upper bound.

There are uncertainties with existing modeling of air residues for the purpose of estimating exposure to terrestrial wildlife. Since field emission data of MITC were collected greater than 1 meter above the ground surface, actual concentrations at ground level may differ from estimated air concentrations using Industrial Source Complex Short Term (ISCST3) modeling and ambient air monitoring. Air monitoring at ground-level of MITC in the dazomet fumigated fields may reduce the uncertainty related to terrestrial exposure for wildlife.

2. Ecological Effects

a. Ecological Effects Data Gaps

The following data are needed on dazomet and/or MITC for ecological risk assessment. These data needs are similar to those available or previously specified as needed for risk assessment for methyl bromide, for chloropicrin, and for the degradate MITC as part of the metam-sodium risk assessment. Appendix E lists the status of the ecological effects data requirements for dazomet and MITC specifically for the present risk assessment.

Note: MITC is the common degradate of both dazomet and metam sodium. Data on MITC have also been requested for risk assessment of metam sodium via the re-registration review process. It is not the intent to request duplicate testing. An acceptable MITC study can be used for risk assessment of both dazomet and metam sodium.

71-1 Avian Acute Oral, MITC. The current estimate of avian risk is based largely on the mammal assessment. This basic study will contribute to a risk assessment specific to birds, including enabling a comparison to the mammal acute oral data.

----- Avian acute inhalation, MITC. The current estimate of avian risk is based largely on the mammal assessment. This study will enable an inhalation risk assessment specific to birds. This is critical, since avian exposure to MITC is expected to be largely via inhalation.

-----Avian sub-chronic/chronic inhalation, MITC. This study is needed for risk assessment, due to the potential for repeat and/or continuous exposure to birds resulting from the use of dazomet on multiple fields over multiple days in any given geographic area. This study is reserved, pending submission and review of avian acute inhalation data (above) and chronic mammalian inhalation data (by HED).

71-4 (a) and (b) Avian Reproduction (bobwhite quail and mallard duck), Dazomet. These studies are needed to assess potential reproductive effects in birds from exposure to the parent dazomet in the granular formulation. Neither of the existing studies is able to provide an overall NOAEL/LOAEL needed for risk assessment. There were problems with mixing of the diet in both studies and the mallard study had unacceptably high embryo mortality in the controls

between day 21 and hatch. The studies are considered Supplemental but indicate the possibility of severe reproductive effects, particularly in the mallard study (which included effects prior to control problems, enabling study to be Supplemental).

72-3 (a) Acute Marine/Estuarine Fish, MITC. The aquatic risk assessment of dazomet use is based on exposure to MITC. Given the use patterns evaluated, marine/estuarine species could also be exposed. This study will enable a risk assessment for marine/estuarine species exposure.

72-3(b) Acute Marine/Estuarine Mollusk, MITC. The aquatic risk assessment of dazomet use is based on exposure to MITC. Given the use patterns evaluated, marine/estuarine species could also be exposed. This study will enable a risk assessment for marine/estuarine species exposure. It will also improve certainty with the endangered species risk assessment, as this test species may be more representative of endangered freshwater mussels than the freshwater *Daphnia*.

72-3 (c) Acute Marine/Estuarine Shrimp, MITC. The aquatic risk assessment of dazomet use is based on exposure to MITC. Given the use patterns evaluated, marine/estuarine species could also be exposed. This study will enable a risk assessment for marine/estuarine species exposure.

72-4(a) Early Life-stage Fish – Freshwater, MITC. Current aquatic modeling indicates the potential for chronic aquatic exposure to MITC. This study will enable a chronic risk assessment for freshwater fish.

72-4(a) Early Life-stage Fish – Marine/Estuarine, MITC. Current aquatic modeling indicates the potential for chronic aquatic exposure to MITC. This study is reserved pending the submission and review of the above early life-stage study with a freshwater fish species.

72-4(b) Life-Cycle Aquatic Invertebrate, MITC. The current chronic risk assessment for aquatic invertebrates is based on a supplemental study (MRID #4563400). This study was classified as supplemental because mean measured concentrations were not determined, the stability of the test substance was not assessed under actual use conditions, and terminal growth measurements were not obtained. Submission of an Acceptable (Core) study will reduce uncertainty.

72-5 Life-Cycle Fish, MITC. This study is reserved, pending submission and review of early life-stage fish testing.

123-1(a) Seedling Emergence – Tier II, MITC. Dazomet is used in part due to the phytotoxicity of MITC at the application site. This study will enable the assessment of risk to non-target terrestrial plants off-site.

123-1(b) Vegetative Vigor – Tier II, MITC. Dazomet is used in part due to the phytotoxicity of MITC at the application site. This study will enable the assessment of risk to non-target terrestrial plants off-site.

123-2 Aquatic Plant Growth – Tier II, MITC. Only one of four tests currently available (on duckweed) is considered to be Acceptable (Core) (MRID #45919422). The submission of data for remaining test species under this guideline will reduce uncertainty and improve the assessment

of risk to aquatic plants. For example, the blue-green alga and green alga studies are 72-hour OECD studies that are only accepted as Tier I screening studies.

b. Uncertainties: *Ecological Effects*

The uncertainties associated with the risk to terrestrial organisms from dazomet use are focused on the extent and effect of terrestrial animal exposure to parent dazomet via the granules themselves and exposure via inhalation to MITC gas resulting from dazomet conversion to MITC. Additional avian reproduction data with dazomet are needed for risk assessment. Avian inhalation toxicity data on MITC are not available, as indicated above. Terrestrial plant data on MITC are needed to conduct an assessment of risk to non-target terrestrial plants off-site.

Because of the potential for repeat exposures from applications to different fields on different days in a given geographic area, there is the added potential for sub-chronic/chronic exposure to MITC. HED has indicated previously for metam sodium that a chronic mammal inhalation study (two-generation reproduction study) with MITC is needed. A sub-chronic/chronic avian inhalation study is reserved, pending the submission and review of chronic mammalian data.

The uncertainties associated with the risk to aquatic organisms from dazomet use are mainly focused on the effects of aquatic exposure to MITC that may be very brief due to high volatility. However, chronic exposure is possible, in part due to repeat or continuous input to the aquatic environment. Acute toxicity data on MITC are not available for marine/estuarine organisms. Chronic toxicity data are not available for freshwater fish. The risk assessment relies on Supplemental data for aquatic invertebrate chronic toxicity and non-vascular aquatic plant growth.

Table I a. Listed species risks associated with direct or indirect effects due to applications of dazomet to one or more use sites (based on dazomet and/or MITC exposure), if organisms in listed taxa are exposed (direct effects) or are dependent on other organisms that are exposed (indirect effects). Risks are based on available data (and/or assumptions based on target organisms of dazomet). Aquatic assessment is based on MITC. See text for additional details. Requested data may result in additional potential direct effects.

Listed Taxon	Direct Effects	Indirect Effects[6]
Terrestrial and semi-aquatic plants - monocots	**Yes**[1]	**Yes**
Terrestrial and semi-aquatic plants – dicots	**Yes**[1]	**Yes**
Terrestrial Invertebrates	**Yes**[1]	**Yes**
Birds	**Acute (Additional chronic data needed)**	**Yes**
Terrestrial-phase amphibians[2]	**Acute (Additional chronic data needed)**	**Yes**

Table I a. Listed species risks associated with direct or indirect effects due to applications of dazomet to one or more use sites (based on dazomet and/or MITC exposure), if organisms in listed taxa are exposed (direct effects) or are dependent on other organisms that are exposed (indirect effects). Risks are based on available data (and/or assumptions based on target organisms of dazomet). Aquatic assessment is based on MITC. See text for additional details. Requested data may result in additional potential direct effects.

Reptiles[2]	**Acute (Additional chronic data needed)**	**Yes**
Mammals	**Acute (Additional chronic data needed)**	**Yes**
Aquatic non-vascular plants*	**Yes[1,3]**	**Yes**
Aquatic vascular plants	**Yes[1,3]**	**Yes**
Freshwater fish	**(No chronic data)**	**Yes**
Aquatic-phase amphibians[4]	**(No chronic data)**	**Yes**
Freshwater crustaceans	**(Additional chronic data needed[5])**	**Yes**
Mollusks	**(No acute or chronic data)**	**Yes**
Marine/estuarine fish	**(No acute or chronic data)**	**Yes**
Marine/estuarine crustaceans	**(No acute or chronic data)**	**Yes**

* At the present time no aquatic non-vascular plants are included in Federal listings of threatened and endangered species. The taxonomic group is included here for the purposes of evaluating potential contributions to indirect effects to other taxa and as a record of exceedances should future listings of non-vascular aquatic plants warrant additional evaluation of Federal actions.

[1]Acute toxicity to nontarget plants and insects is assumed, based on target organisms of dazomet.

[2]Risk assessment is based on avian assessment.

[3]Based on available data, LOC not exceeded; however, additional data are needed for risk assessment.

[4]Risk assessment is based on freshwater fish assessment.

[5]Based on available data, the chronic LOC is not exceeded; however, additional data are needed for risk assessment.

[6]Indirect effects are considered possible for every taxonomic group when one or more direct effect LOCs are met/exceeded. Listed species could be affected by the loss of other species that they depend on for food, cover, and/or reproduction (e.g., pollination, seed dispersal). This is only a screening assessment. A refined assessment will consider the specifics of the food, cover, and reproduction needs of each listed species.

II. PROBLEM FORMULATION

A. Stressor Source and Distribution

1. Source and Intensity

Dazomet (tetrahydro-3,5-dimethyl-2*H*-1,3,5-thiadiazine-2-thione) and its primary degradation product methyl isothiocyanate (MITC) are the potential stressors that would result from application of dazomet to soil to control weeds, nematodes and various soil-borne pathogens. Following application of formulated dazomet products to soils, rapid hydrolysis and biodegradation are expected to result in the formation of its major degradation product MITC. The high vapor pressure and low affinity for sorption on soil of MITC suggest that volatilization is the most important environmental route of dissipation. Additional transport mechanisms include runoff from pre-plant fumigated fields, and drift of volatilized MITC and redeposition through precipitation in adjacent areas. Thus, the major concern is the exposure of non-target terrestrial and aquatic organisms to MITC as well as exposure of non-target terrestrial organisms to granular dazomet.

2. Physicochemical, Fate, and Transport Properties

The environmental fate of dazomet in aquatic and terrestrial environments is dependent on rapid hydrolytic degradation to form MITC. MITC is the major degradation product and active ingredient of dazomet. The dissipation of MITC appears to be predominantly dependent on volatilization, followed by photolytic degradation in the atmosphere. Although MITC is volatile, it is also highly soluble in water and its low adsorption in soil indicates that leaching to groundwater may be a potential problem under flooded or saturated soil moisture conditions. However, dazomet label suggests that for optimum effect soil moisture should be maintained at 50% of field capacity. Under the unsaturated field condition, the potential for groundwater contamination of MITC is unlikely due to its volatilization and rapid degradation characteristics in soil.

3. Pesticide Type, Class, and Mode of Action

Soil fumigants, such as dazomet, are used to kill weed seeds and underground plant parts as well as nematodes and disease-causing organisms before planting in areas where high-value crops are to be grown. Dazomet also exhibits nematicidal, fungicidal, insecticidal, and slimicidal activity. Dazomet is a dithiocarbamate that converts readily to the isothiocyanate (MITC) upon application to soil. The rate of decomposition depends on the type of soil, soil moisture and temperature. Low temperatures and higher alkalinity slow degradation, while higher temperatures, moisture, and sandy soil increase degradation. MITC accounts for most of the fumigant activity by diffusing, either as a gas or volatile liquid, upward through the interstitial spaces in the soil and killing living organisms with which it comes in contact. MITC is highly toxic and results in the disruption of biological functions of soil organisms. For example, MITC is highly reactive with the nucleophilic centers such as thiol groups in vital enzymes of nematodes, and thus appears to kill these organisms (Cremlyn, 1991). Dazomet is assumed to be toxic to all growing plants.

Current label precautions prohibit application within 3 - 4 feet of growing plants or closer than the drip line of trees and large shrubs and during weather conditions that favor drift to non-target plants.

4. Overview of Pesticide Usage

Dazomet is registered as a soil fumigant with fungicidal, herbicidal and nematicidal properties. Currently registered end-use products are applied to compost piles, soil heaps or piles, golf course greens/tees, potting soils, seed and propagating beds, renovating turf sites, ornamental sites, field nurseries and soils of nonbearing crops. One dazomet label (EPA Reg. No. 70051-101) includes a time-limited use in California as a soil fumigant for preplant soil treatment for strawberries and tomatoes. Dazomet can be applied to soil at rates of 222 to 530 lb ai/acre in a granular formulation containing 99% active ingredient, at an 8-inch incorporated depth (Basamid®G Granular, EPA Reg. No. 70051-101). Application of dazomet can be made either as a preplant treatment or as fall preplant treatment for spring sowing and transplanting. In general, the application method consists of applying dazomet to the surface of the field, incorporating the granules into the soil with rototiller or spading machine, and then applying a water seal. The water seal is also a means of activating the chemical and providing a surface seal during irrigation. The soil treatment is more effective when soil moisture is kept at 50% of field capacity (e.g. 30-40% for clay). Surface sealing can also be maintained with polyethylene sheeting (tarping).

Typical applications are made prior to planting but dazomet may also be applied in a variety of industries and contexts such as paper mills, oilfield drilling muds and work over or completion fluids and recirculating cooling water systems to control slime-forming and/or spoilage bacteria. There are a total of 20 active end-use products currently registered.

B. Receptors

For the screening-level risk assessment on dazomet and MITC, toxicological data generated on representative test species belonging to broad taxonomic groups are summarized, then utilized in an assessment of risk for each group. These data are obtained from registrant-submitted studies. Table II.a gives examples of taxonomic groups and test species evaluated for ecological effects in screening-level risk assessments for dazomet and MITC. Within each of these very broad taxonomic groups, an acute and/or chronic measure of effect is selected from the available test data. A discussion of toxicity data available for this risk assessment and the resulting measures of effect selected for each taxonomic group are included in Appendix E.

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

Taxonomic group	*Chemical*	*Example(s) of representative species*

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

Birds [a]	Dazomet	Mallard duck (*Anas platyrhynchos*) Bobwhite quail (*Colinus virginianus*)
	MITC	No study available
Mammals	Dazomet	Rat (*Rattus norvegicus*) Rabbit Dog
	MITC	Rat (*Rattus norvegicus*) Rabbit Dog
Insects	Dazomet	Honey bee (*Apis mellifera L.*)
	MITC	No study available
Freshwater fish [b]	MITC	Bluegill sunfish (*Lepomis macrochirus*) Rainbow trout (*Oncorhynchus mykiss*)
Freshwater invertebrates	MITC	Water flea (*Daphnia magna*)
Estuarine/marine fish	MITC	No study available
Estuarine/marine invertebrates	MITC	No study available
Terrestrial plants [c]	Dazomet	No study available
	MITC	No study available
Aquatic plants and algae	MITC	Duckweed (*Lemna gibba*) Green algae (*Selenastrum capricornutum*) Blue-green algae (*Anabaena flos-aquae*) Algae (*Scenedesmus subspicatus*)

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

1. Ecological Effects

a. Aquatic Effects

For dazomet and MITC, effects on aquatic organisms are estimated from acute and chronic laboratory studies submitted to the Agency. Since dazomet rapidly hydrolyzes to MITC, potential exposure to aquatic receptors would be primarily via surface runoff; consequently, the toxicity data for MITC will be used to assess risk to fish, aquatic invertebrates, and aquatic plants. MITC acute toxicity data are available for freshwater fish [rainbow trout (*Oncorhynchus mykiss)* and bluegill sunfish (*Lepomis macrochirus)]*, and freshwater invertebrates [water flea (*Daphnia magna*)]. No MITC studies are available for marine/estuarine organisms.

Reproductive or growth effects from chronic exposure are estimated from studies conducted with freshwater fish and freshwater invertebrates. For MITC, the only data available to evaluate chronic effects on aquatic organisms is an early life-stage toxicity test conducted with the freshwater invertebrate, *Daphnia magna*. No MITC data are available to evaluate the chronic effects on freshwater fish (early life stage), estuarine/marine fish, or estuarine/marine invertebrates.

For MITC, toxicity data are available for aquatic vascular plants (duckweed, *Lemna gibba*) and non-vascular algae (green algae, *Selenastrum capricornutum*; blue-green algae, *Anabaena flos-aquae;* algae, *Scenedesmus subspicatus*).

b. Terrestrial Effects

Terrestrial exposure to birds, mammals and invertebrates can occur orally as dazomet granules and/or by inhalation of MITC. Available dazomet toxicity studies allow the assessment of acute oral exposure of birds and mammals. Inhalation toxicity studies for MITC are only available for mammals. Avian inhalation risk will be evaluated using the mammal assessment; however, the sensitivities of birds and mammals may not be equivalent due to physiological differences that could result in higher exposures to birds. Studies conducted to assess reproductive toxicity of dazomet are considered Supplemental for both bobwhite quail and mallard, and neither provides an overall NOAEL/LOAEL needed for quantitative risk assessment. Effects on mammals are estimated from acute and chronic laboratory studies reviewed by the Health Effects Division (HED). Dazomet effects data for mammals are available for acute, subchronic and development/reproductive toxicity for oral exposure (rat and dog). MITC effects data for mammals are available for acute and subchronic inhalation exposure (rat) and for chronic developmental effects (rat).

No studies (seedling emergence and vegetative vigor) were submitted to evaluate the effects of dazomet or MITC to terrestrial monocots or dicots.

2. Ecosystems at Risk

Ecosystems potentially at risk are expressed in terms of the selected assessment endpoints. The typical assessment endpoints for screening-level pesticide ecological risk assessments are reduced survival and reproductive and growth impairment for both terrestrial and aquatic animal species.

The terrestrial ecosystems potentially at risk include the treated area and areas immediately adjacent to the treated area that might receive drift (wind dispersion) or runoff, and might include other cultivated fields, fence rows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats and other uncultivated areas. For Tier 1 assessment purposes, risk will be assessed to terrestrial animals assumed to exclusively occur in the treated area. Terrestrial animal species of potential concern include birds, mammals, beneficial invertebrates, and earthworms. Although there is likely a risk to terrestrial plants in areas immediately adjacent to and in wetlands receiving runoff from treated areas, these endpoints cannot be assessed due to the lack of toxicity data.

The proposed uses of dazomet and properties of the degradation product, MITC, could result in exposure to aquatic and terrestrial organisms inhabiting flowing, non-flowing or transient freshwater or marine waterbodies, wetlands and transitional areas, and wildlands (forests and ecotones, such as edge and riparian habitats). For uses in coastal areas, aquatic habitat also includes marine ecosystems including estuaries. For Tier 1 assessment purposes, risk will be assessed to aquatic animals and plants assumed to occur in small, static ponds receiving runoff and drift from treated areas. Aquatic animal species of potential concern include freshwater fish and invertebrates, estuarine/marine fish and invertebrates, and amphibians. Aquatic plant species of potential concern include vascular and non-vascular plants. MITC is readily absorbed through the roots of plants; consequently, it could be injurious to non-target plant species by drift, runoff, or leaching to roots.

The ecological relevance of selecting the above-mentioned assessment endpoints is as follows: 1) complete exposure pathways exist for these receptors; 2) the receptors may be potentially sensitive to pesticides in affected media and in residues on plants, seeds, and insects; and 3) the receptors could potentially inhabit areas where pesticides are applied, or areas where runoff and/or drift may impact the sites.

C. Assessment Endpoints

Assessment endpoints are defined as "explicit expressions of the actual environmental value that is to be protected." Defining an assessment endpoint involves two steps: 1) identifying the valued attributes of the environment that are considered to be at risk; and 2) operationally defining the assessment endpoint in terms of an ecological entity (i.e., a community of fish and aquatic invertebrates) and its attributes (i.e., survival and reproduction). Therefore, selection of the assessment endpoints is based on valued entities (i.e., ecological receptors), the ecosystems potentially at risk, the migration pathways of pesticides, and the routes by which ecological receptors are exposed to pesticide-related contamination. The selection of clearly defined assessment endpoints is important because they provide direction and boundaries in the risk assessment for addressing risk management issues of concern. Assessment endpoints are ultimately selected from the available toxicity studies, and are used as the measures of effects to characterize potential ecological risks associated with exposure to dazomet.

To estimate exposure concentrations, this ecological risk assessment considers a single application at the maximum dazomet application rate to fields that have vulnerable soils. In addition, this assessment is not intended to represent a site- or time-specific analysis. Instead, this

assessment is intended to represent high-end exposures at a national level. Likewise, the most sensitive toxicity endpoints are used from surrogate test species to estimate treatment-related direct effects on acute mortality and chronic reproductive, growth and survival assessment endpoints. Toxicity tests are intended to determine effects of pesticide exposure on birds, mammals, fish, terrestrial and aquatic invertebrates, and plants. These tests include short-term acute, subacute, and reproduction studies and are typically arranged in a hierarchical or tiered system that progresses from basic laboratory tests to applied field studies. The toxicity studies are used to evaluate the potential of a pesticide to cause adverse effects, to determine whether further testing is required, and to determine the need for precautionary label statements to minimize the potential adverse effects to non-target animals and plants (CFR 40 §158.202, 2002). A summary of measures of effect selected to characterize potential ecological risks associated with exposure to dazomet and MITC are provided in Tables II.b. and II.c., respectively.

Table II.b. Summary of Possible Assessment Endpoints and Measures of Effect for Dazomet (TGAI)

Assessment Endpoint	*Measures of Effect*
1. Abundance (i.e., survival, reproduction, and growth) of individuals and populations of birds.	1a. Bobwhite quail acute oral 21-day LD_{50}. 1b. Mallard duck subacute dietary 5-day LC_{50} 1c. Bobwhite quail and mallard duck chronic reproduction NOAEC and LOAEC
2. Abundance (i.e., survival, reproduction, and growth) of individuals and populations of mammals.	2a. Laboratory rat acute oral LD_{50}. 2b. Laboratory rat and dog subacute oral NOAEL and LOAEL. 2c. Laboratory rat and dog oral development/reproduction chronic NOAEL and LOAEL.
3. Survival of beneficial insect populations.	3a. Honeybee acute contact LD_{50}.
4. Perpetuation of individuals and populations of non-target terrestrial and semi-aquatic species (crops and non-crop plant species).	4a. Monocot and dicot seedling emergence and vegetative vigor EC_{25} values. (No studies)

LD_{50} = Lethal dose to 50% of the test population.
NOAEC = No-observed-adverse-effect concentration.
LOAEC = Lowest-observed-adverse-effect concentration
LC_{50} (EC_{50}) = Lethal (effective) concentration to 50% of the test population.
LC_{25} (EC_{25}) = Lethal (effective) concentration to 25% of the test population

Table II.c. Summary of Possible Assessment Endpoints and Measures of Effect for MITC

Assessment Endpoint	*Measures of Effect*
1. Abundance (i.e., survival, reproduction, and growth) of individuals and populations of birds.	1a. Bobwhite quail/mallard acute oral 21-day LD_{50}. (No studies) 1b. Avian acute inhalation (No studies). 1c. Avian subchronic/chronic inhalation (No studies) .
2. Abundance (i.e., survival, reproduction, and growth) of individuals and populations of mammals.	2a. Laboratory rat acute inhalation LD_{50}. 2b. Laboratory rat subchronic inhalation LOAEL and NOAEL. 2c. Laboratory rat development/reproduction chronic NOAEL and LOAEL.
3. Survival and reproduction of individuals and communities of freshwater fish and invertebrates.	3a. Rainbow trout and bluegill acute LC_{50}. 3b. Fathead minnow chronic (early-life) NOAEC and LOAEC.(No studies). 3c. Water flea acute EC_{50}. 3d. Water flea chronic (life-cycle) LOAEC
4. Survival and reproduction of individuals and communities of estuarine/marine fish and invertebrates.	4a. Sheepshead minnow acute LC_{50} (No studies). 4b. Eastern oyster and mysid shrimp acute LC_{50} (No studies). 4c. Mysid shrimp chronic (life-cycle) NOAEC and LOAEC (No studies)
5. Survival of beneficial insect populations.	5a. Honeybee acute contact LD_{50} (No studies) 5b. Honeybee acute oral LD_{50} (No studies)
6. Perpetuation of individuals and populations of non-target terrestrial and semi-aquatic species (crops and non-crop plant species).	6a. Monocot and dicot seedling emergence and vegetative vigor EC_{25} values (No studies).
7. Maintenance and growth of individuals and populations of aquatic plants from standing crop or biomass.	7a. Algal and vascular plant (i.e., duckweed) EC_{50} values for growth rate and biomass measurements.

LD_{50} = Lethal dose to 50% of the test population.
NOAEC = No-observed-adverse-effect concentration.
LOAEC = Lowest-observed-adverse-effect concentration.
LC_{50} (EC_{50}) = Lethal (effective) concentration to 50% of the test population.
LC_{25} (EC_{25}) = Lethal (effective) concentration to 25% of the test population

D. Conceptual Model

1. Risk Hypotheses

Dazomet is applied in a granular form and is rapidly hydrolyzed to MITC, which is dissipated by volatilization and leaching/surface runoff. Terrestrial exposure to birds, mammals and terrestrial invertebrates could occur orally as dazomet granules and/or by inhalation of MITC. Potential exposure to aquatic receptors would occur from surface runoff/leaching and drift (wind dispersion) of MITC. MITC is not expected to bioaccumulate in aquatic organisms. The initial emphasis of the risk assessment primarily addresses possible risk to aquatic vascular and non-vascular plants, fish and invertebrates and to terrestrial non-target plants, invertebrates, birds and mammals. Risk was evaluated for direct effects to these organisms from dazomet and/or MITC through ground deposition, volatilization and/or wind dispersion, redeposition, and leaching/surface runoff following granular application and for indirect effects to forests, wetlands, edge and riparian habitats. Therefore, the following risk hypothesis is presumed for this screening-level assessment:

The use of dazomet as a soil fumigant for preplant soil treatment will likely involve situations where terrestrial and aquatic animals and plants will be exposed to the chemical and/or its degradation product MITC. Based on information on environmental fate, mode of action, direct toxicity and potential indirect effects, EFED assumes that dazomet and MITC have the potential to cause reduced survival, growth, and reproduction to terrestrial and/or aquatic animals and plants as a result of the proposed uses of the pesticide.

2. Diagram

In order for a chemical to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. 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. In addition, the potential mechanisms of degradation/transformation (i.e., which degradation/transformation products may form in the environment, in which media, and how much) must be understood, especially for a chemical whose metabolites/transformation products are of greater toxicological concern than the parent compound. The assessment of ecological exposure pathways, therefore, includes an examination of the source and potential migration pathways for constituents, and the determination of potential exposure routes.

Based on an examination of the physical/chemical properties of dazomet and MITC, the fate and disposition in the environment, and mode of application (granular application), a conceptual model (Figure II.a) was developed that represents the possible relationships between the stressor, ecological receptors, and the assessment endpoints.

E. Analysis Plan

The analysis plan is the final step in Problem Formulation. The plan describes the three measures used to evaluate the risk hypotheses developed in the conceptual model for dazomet usage. First, the measures of exposure are derived as estimated environmental concentrations (EECs) based on model predictions and environmental fate data. Second, the measures of effect characterize the assessment endpoints and are based on toxicity data that describe the effects of dazomet and MITC on individuals, species, populations, and communities in aquatic and terrestrial ecosystems. Third, the measures of ecosystem and receptor characteristics describe the attributes of the receptors and/or ecosystems that may be affected by exposure to the stressor (i.e. behavior and life history characteristics). The analysis plan also identifies the data gaps and uncertainties for conducting the risk assessment and suggests recommendations for new data collection (if needed).

Analysis is a process that examines the two primary components of risk (exposure and effects) and their relationships between each other and site characteristics. The objective is to provide the information necessary for predicting ecological responses to pesticide uses under exposure

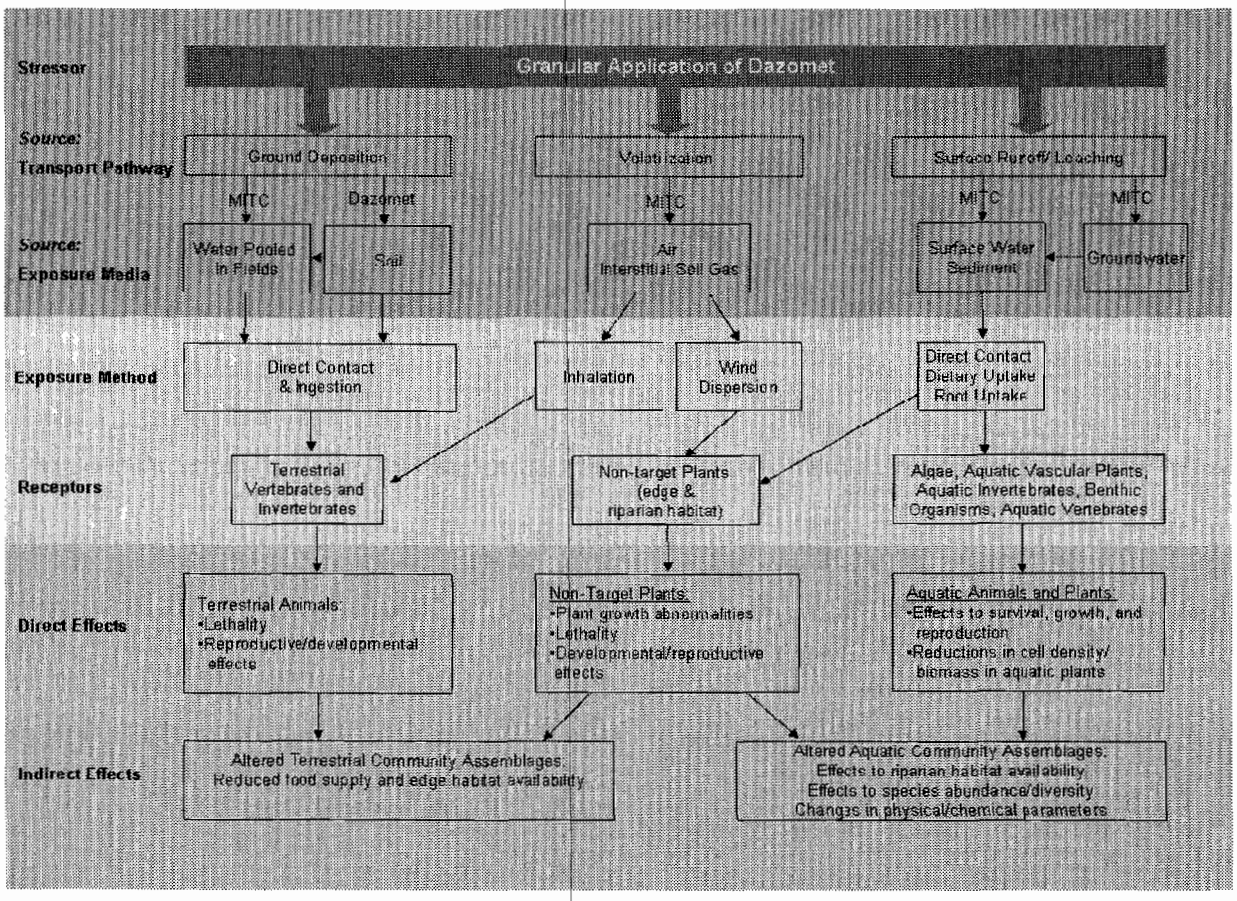


Figure II.a. Ecological Risk Assessment Conceptual Model for Dazomet and MITC.

conditions of interest. The analysis provides the basis for estimating and describing risks and identifying uncertainties in the risk characterization.

In the analysis stage (Section III) data to be used in the risk assessment are summarized and discussed. Levels of environmental exposure are predicted using computer models, based on findings from scientifically sound environmental fate studies required under FIFRA to support registration for the requested uses.

Estimated environmental concentrations are then compared (in the risk characterization) to experimentally-determined acute or chronic toxicity parameters for surrogate aquatic and terrestrial organisms. Surrogate species are used to predict potential risks for species with no data (*i.e.* reptiles, amphibians). For terrestrial organisms, there is a two-phase assessment. First, dazomet (via the granules themselves) is assessed via an LD_{50}/sq. ft. analysis. LD_{50}/sq. ft. analyses are considered to cover oral and other routes of exposure. Then, inhalation risk to mammals and avian species from MITC gas will be estimated using mammalian inhalation toxicity data. It is assumed that use of surrogate effects data is sufficiently conservative to apply to the broad range of species within taxonomic groups. If other species are more or less sensitive to dazomet and its degradation products than the surrogate species, risks may be under- or overestimated, respectively.

1. Preliminary Identification of Data Gaps

While acceptable studies are available to assess the acute toxicity of MITC to freshwater fish and invertebrates, toxicity data are not available to determine the potential chronic toxicity of MITC to freshwater fish (rainbow trout subchronic study, MRID 45634002, invalid). In addition, no acute or chronic toxicity data are available to determine the risk of MITC to marine/estuarine fish and invertebrates. Risk to these organisms will be estimated based on the assumption that freshwater and marine/estuarine organisms are of equal sensitivity. Since MITC is not expected to persist in soil/sediment or to bioaccumulate, exposure to sediment-dwelling benthic organisms is not expected.

While acceptable studies are available to assess the acute oral and dietary toxicity of dazomet to avian species (upland game and waterfowl), reproduction studies are not adequate for quantitative risk assessment. The majority of data gaps for this risk assessment are likely to be on MITC. The inhalation portion of the terrestrial wildlife risk assessment and the entire aquatic organism risk assessment are on MITC. MITC data gaps are likely to be similar to those previously identified in relation to metam sodium, another MITC generator. The MITC gaps will likely include avian oral and inhalation data, a range of acute and chronic aquatic data, and plant data.

2. Measures to Evaluate Risk Hypotheses and Conceptual Model

a. Measures of Exposure

Aquatic exposure concentrations for this assessment were modeled using the Tier II linked, Pesticide Root Zone Model (Carsel et al., 1998) version 3.1.2 beta and Exposure Analysis Modeling System (Burns, 2002) version 2.98.04; referred to as PRZM/EXAMS in this document.

The linkage program shell PE4V0 (US EPA, 2004a) for PRZM and EXAMS models is typically used by EFED in estimating pesticide concentrations in aquatic systems. PRZM is employed to evaluate run-off loading from a ten-hectare agricultural field to a receiving surface water body (one-hectare-by-two-meter-deep "standard" pond). As soon as the pesticide residues reach the surface water, EXAMS uses algorithms to estimate the pesticides concentrations by taking into account different dissipation mechanisms in the aqueous and sediment phases. Additional input parameters DAIR (vapor phase diffusion coefficient) and ENPY (enthalpy of vaporization) of PRZM were used to capture the dissipation of MITC due to volatilization. Several crop scenarios were used in the TIER II models to capture dazomet's use pattern.

Direct exposure to dazomet granules by mammals and birds was estimated using the LD_{50}/square foot risk screening method given in the model T-REX, Version 1.2.3 (T-REX, 2005). In addition, exposure of terrestrial animals to the volatile degradation product MITC was evaluated using a preliminary LD_{50}/square foot risk screening method. This method is considered to cover all routes of exposure, although it uses an acute inhalation or oral toxicity value. It is typically used for granular and similar products, but it is considered acceptable for use as a preliminary risk screen for MITC, simply to determine/confirm the need for further analysis on the inhalation route of exposure. Likewise, the Industrial Source Complex Short Term (ISCST3) model together with information about MITC emissions from a treated field was used to evaluate the range of MITC concentrations which might be found under different conditions of application rate, weather, source size and shape (e.g., field size in acres) and distance from the treated field.

b. Measures of Effect

Measures of ecological effects are obtained from a suite of registrant-submitted guideline studies conducted with a limited number of surrogate species. Surrogate test species of birds, mammals, fish, aquatic and terrestrial invertebrates and plants are used to estimate treatment-related direct effects on acute mortality and chronic reproduction, growth, and survival of non-target species. The test species are not intended to be representative of the most sensitive species but rather were selected based on their ability to thrive under laboratory conditions. Toxicity testing does not represent all species of birds, mammals, or aquatic organisms. Only a few surrogate species for both freshwater fish and birds are used to represent all freshwater fish (2000+) and bird (680+) species in the United States. Surrogate mammalian species include laboratory rats, rabbits and dogs. For this risk assessment of MITC, avian inhalation risk will be evaluated using the mammal assessment. In addition, reptile and amphibian toxicity data are not available; consequently, this risk assessment assumes that avian and reptilian toxicities are similar and fish and amphibian toxicities are similar. Consistent with EPA test guidelines, a variety of ecological effects data appropriate for this assessment on technical grade dazomet and MITC that complies with good laboratory testing requirements has been submitted. In addition, the Ecological Incident Information System (EIIS) is searched to further refine the characterization of potential ecological effects associated with exposure to dazomet. Toxicity tests include short-term acute, subacute, and reproduction/chronic studies. These data are summarized in Section III.C and additional details are in Appendix E.

c. Measures of Ecosystem and Receptor Characteristics

Field studies are not available to determine the indirect effects to plant and animal communities in wetland and riparian habitats along freshwater/marine waterbodies near target fields or to forest and edge habitats adjacent to target fields. An evaluation of modeled EECs and calculated RQs will determine if direct effects to receptor species could result in effects at the higher levels of organization (i.e. population, trophic level, community, ecosystem). In terrestrial and shallow-water aquatic communities, plants are the primary producers upon which the succeeding trophic levels depend. If the available plant material is impacted due to the effects of dazomet and MITC, this may have negative effects not only on the herbivores, but throughout the food chain. Also, depending on the severity of impacts to the plant communities in the adjacent forests, wetlands, and ecotones (edge and riparian edge habitats), community assemblages and ecosystem stability may be altered (i.e. reduced production of fruits and seeds as a food source for bird and mammal populations in forest and edge habitats, reduced riparian vegetation resulting in increased light penetration and temperature in aquatic habitats, loss of cover and food sources for fish; reduced productivity/biomass in wetlands). In addition, riparian vegetation is not only a significant component of the food supply for aquatic herbivores and detritivores but also provides habitat (i.e. leaf packs, materials for case-building for invertebrates).

The ecosystems that are modeled are intended to be generally representative of any aquatic or terrestrial ecosystem associated with areas where dazomet is used. Selected models are: Tier II PRZM/EXAMS (for aquatic exposure assessment), Tier I T-REX (for LD_{50}/square foot risk analyses) and ISCST3 model (for terrestrial animal inhalation exposure assessment to MITC). The receptors addressed by the aquatic and terrestrial risk assessments are summarized in Figure II.a. For aquatic assessments, generally fish and aquatic invertebrates in both freshwater and estuarine/marine environments are represented. For terrestrial assessments, three different size classes of small mammals and three size classes of birds are represented. Detailed information regarding the toxicity data available for these various classes of aquatic and terrestrial receptors is provided in Appendix E.

III. ANALYSIS

A. Use Characterization

Dazomet is registered as a soil fumigant with fungicidal, herbicidal and nematicidal properties. When dazomet is applied and tilled into moist soil, it is quickly broken down into several strong irritant products (91% MITC and small percentages of other degradates). MITC accounts for most of the fumigant activity but formaldehyde, monomethylamine, hydrogen sulfide and in acid soils carbon disulfide are also formed. Currently registered end-use products are applied to compost piles, soil heaps or piles, golf course greens/tees, potting soils, seed and propagating beds, renovating turf sites, ornamental sites, field nurseries and soils of nonbearing crops. The typical application for existing uses is prior to planting but dazomet may also be applied in a variety of industries and contexts such as paper mills, oilfield drilling muds and work over or completion fluids and recirculation cooling water systems to control slime-forming and/or spoilage bacteria. There are a total of 20 active end-use products currently registered.

In 2005, dazomet was approved to use as a non-selective soil fumigant for preplant soil treatment for strawberries and tomatoes in California. Application of dazomet can be made either as a preplant treatment or as fall preplant treatment for spring sowing and transplanting. Dazomet can be applied to soil at rates of 222 to 530 lb ai/acre in a granular formulation containing 99% active ingredient, at an 8-inch incorporated depth (Basamid®G Granular, EPA Reg. No. 70051-101). Dazomet is typically applied once per growing season for annual crops. The incorporated application method consists of applying dazomet to the surface of the field, incorporating the granules into the soil with rototiller or spading machine, and then applying water, which activates the chemical and providing a surface seal during irrigation. The soil treatment is more effective when is kept at 50% field capacity of soil. Surface sealing can also be maintained with polyethylene sheeting (tarping).The registrant also recommends a waiting period between treatment and replanting dependent upon the type of application and soil temperature. Waiting periods of 10 to 30 days are outlined in the Basamid®G Granular label.

Currently, dazomet has a limited number of registered use sites (see above). Nevertheless, most of these (other than strawberries and tomatoes) could potentially be found in virtually any county in the United States. The Office of Pesticide Programs has insufficient survey data for dazomet to display its usage geographically (U.S. EPA, 2005). Since dazomet has been approved to use on strawberries and tomatoes in California, its use can be anticipated to occur in agricultural areas where these crops are grown (Figures III.a and III.b).

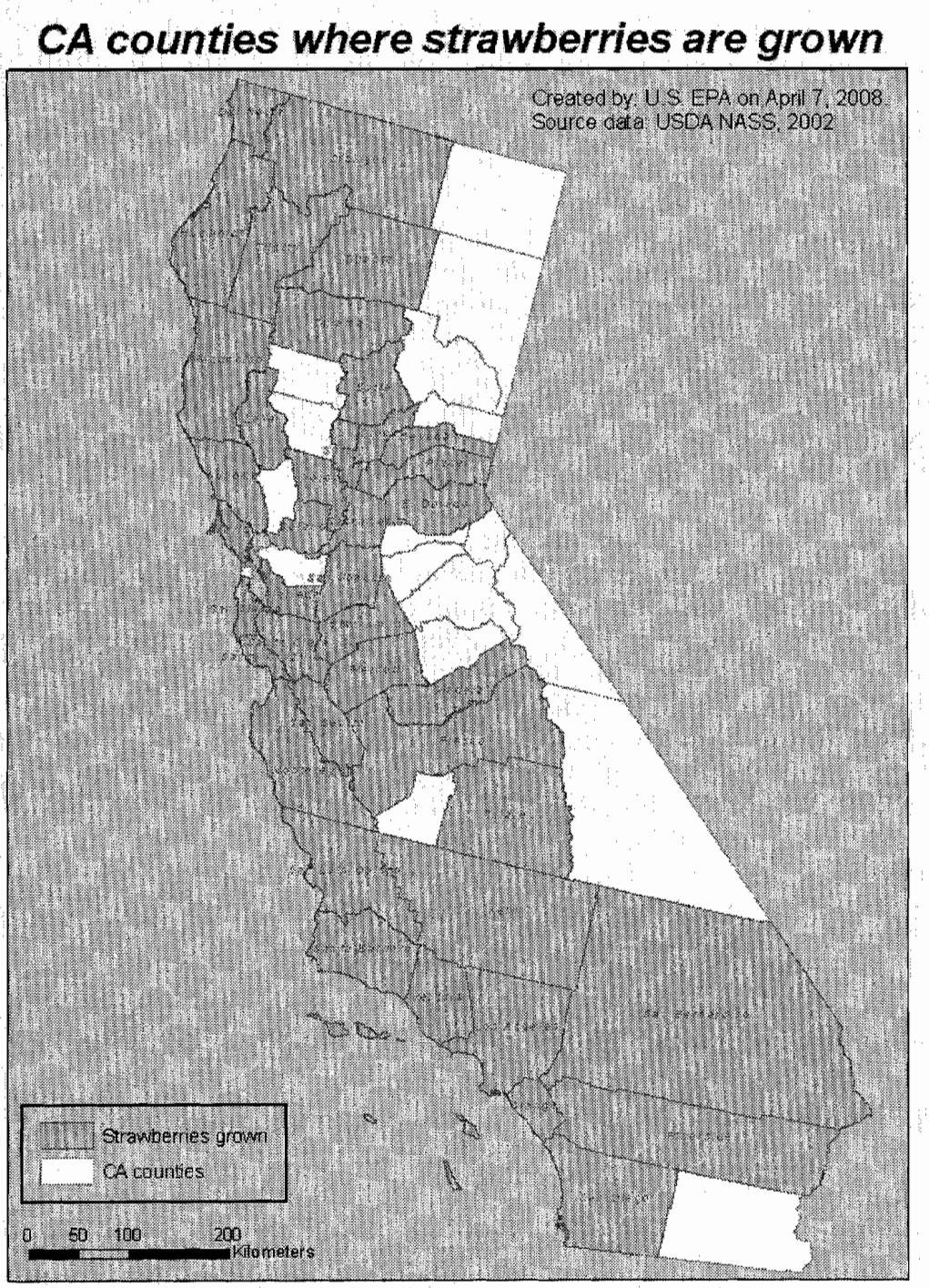


Figure III a. Potential dazomet use area for strawberries (http://www.nass.usda.gov)

Figure III b. Potential dazomet use area for tomatoes (http://www.nass.usda.gov)

B. Exposure Characterization

1. Environmental Fate and Transport Characterization

Selected physical and chemical properties of technical grade active ingredient (TGAI) of dazomet are listed in Table III.a. Dazomet is non-volatile and readily soluble (3 g/L at 25^0C) in water and degrades very rapidly to MITC in soil. MITC has high vapor pressure (19 mm Hg at 25^0C) and the Henry's Law Constant of 1.79 x 10^{-4} atm-m^3/mol, which suggests that it will be volatilized from dazomet treated fields. It has a distinct pungent horse-radish like odor. The important physicochemical and environmental fate properties of dazomet and its primary degradate MITC are provided in Table III.a.

Table III.a. Physicochemical and Fate Properties of Dazomet and its Major Degradation Product Methyl isothiocyanate (MITC).

Property	*Value*	*Reference (MRID)*
I. Physicochemical Properties of Parent Dazomet		
Chemical Name	Tetrahydro-3,5-dimethyl-2*H*-1,3,5-thiadiazine-2-thione	Tomlin, 1997 (ed.)
Chemical Group	Dithiocarbamate	Tomlin, 1997 (ed.)
CAS Number	533-74-4	Tomlin, 1997 (ed.)
SMILES String	S=C1N(CN(CS1)C)C	
Molecular Weight (g $Mole^{-1}$)	162.3	Tomlin, 1997 (ed.)
Molecular Formula	$C_5H_{10}N_2S_2$	Tomlin, 1997 (ed.)
Water solubility at 25°C	3000 mg L^{-1}	Tomlin, 1997 (ed.)
Melting point	104 - 105°C	Tomlin, 1997 (ed.)
Octanol/water partition coefficient (log K_{ow})	0.15	Tomlin, 1997 (ed.)
Vapor Pressure	2.8 x 10^{-6} mm Hg at 20°C	Tomlin, 1997 (ed.)
II. Fate Properties of Parent Dazomet		
Hydrolysis half-lives	6.8 hrs. at pH 4, 4.4 hours at pH 7, and 2.4 hours at pH 9 6.6 hrs. at pH 3, 5.8 hrs. at pH 5, 4.0 hrs. at pH 7, and 5.4 hrs. at pH 9 Major Degradation products: MITC and carbon disulfide	459083-01, 414790-03 and 421114-01
Aqueous photolysis half-lives	4.0 hours pH 7 buffer Major Degradation product: MITC	414799-01 and 421114-02
Soil photolysis half-life	9-10 days Major Degradation product: MITC	431725-01

Table III.a. Physicochemical and Fate Properties of Dazomet and its Major Degradation Product Methyl isothiocyanate (MITC).

Property	*Value*	*Reference (MRID)*
Aerobic soil metabolism half-life	17.2 hours Major Degradation product: MITC	402119-01 and 421114-03
Anaerobic aquatic half-life (water/ sediment system)	3 hours Major Degradation product: MITC and methyl S-[N-formyl-N-methylaminomethyl-(N-methyl)aminomethyl] dithiocarbamate (MAM-DCT)	435965-01
Terrestrial Field half-lives	1.5 days (Germany, silt loam soil) 1.8 days (Spain, loamy sand soil) 1.9 days (Spain, loamy sand soil) Major Degradation product: MITC	460847-02
	9.65 days for dazomet residue (dazomet and MITC) (CA loamy sand soil) Major Degradation product: MITC	418748-01 and 418748-02
III. Physicochemical Properties of Major Degradation Product MITC		
Chemical Name	Methyl isothiocyanate	
Chemical Group	Isothiocyanate	
CAS Number	556-61-6	
Molecular Weight	73.1g $Mole^{-1}$	MRID 423656-03
Molecular Formula	C_2H_3NS	
Water solubility	7.6 g/L at 20°C	Hartly (ed.) 1992
Melting point	35 - 36°C	Hartly (ed.) 1992
Vapor pressure (VP)	19 mm of Hg at 25°C	Hartly (eds.) 1992
Octanol/water partition coefficient (log K_{ow})	0.98	MRID 435409-03
Henry's law constant	1.79 x 10^{-4} (atm-m^3/mol)	Estimated
IV. Fate Properties of Major Degradation Product MITC		
Hydrolysis half-life	3.5 days at pH 5, 20.4 days at pH 7, and 4.6 days at pH 9	MRID 00158162
Photodegradation half-life in water	51.6 days	CDPR, 2002
Photodegradation half-life in air	1.21 to 1.60 days	Geddes, et al., 1995

Table III.a. Physicochemical and Fate Properties of Dazomet and its Major Degradation Product Methyl isothiocyanate (MITC).

Property	*Value*	*Reference (MRID)*
Aerobic soil metabolism half-life	5.4 and 7.0 days for loamy sand, and 20.2 for sandy loam	MRID 460847-01
	3.3 days for Har Barquan, 4.1 days for Golan, 4.6 days for Belt Nir, 5.0 days for Gilat and Mivatachim, and 9.9 days for Malkiya.	Gerstl et al., 1977
Anaerobic aquatic metabolism half-life	21 days	MRID 435965-01
Soil water partition coefficient (K_d)	0.26 L Kg^{-1}	Gerstl et al., 1977

a. Summary of Empirical Data

The environmental fate of dazomet in aquatic and terrestrial environments is dependent on rapid hydrolytic degradation to form methyl isothiocyanate (MITC). The dissipation of MITC is predominately dependent on volatilization and to a lesser extent leaching and degradation. Once MITC is volatilized into the atmosphere, it undergoes direct photolysis. MITC is also highly soluble in water and has a low adsorption in soil. Geddes et al. (1995) estimated the half-live of MITC in the atmosphere ranged from 29 to 39 hours. Alvarez and Moore (1994) calculated a photolysis half-life of 39 hours for noontime condition under mid summer at 40° N latitude.

b. Degradation and Metabolism

Dazomet rapidly hydrolyzed ($t_{1/2}$ < 7 hours) in sterile, buffer solutions at 25°C (MRIDs 459083-01, 41479003 and 42111401). The major hydrolytic degradation product was MITC. Similar dazomet degradation patterns and rates were observed in photodegradation in water studies (MRIDs 41479901 and 42111402). In an aerobic soil metabolism study (MRID 40211901, 42111403, and 46084701), dazomet degrades in soil with a half-life of less than 18 hours (Table III.a.). The majority of the residues had been volatilized: 92% of the applied as MITC; 3.02% as other volatiles (CO_2, COS and CS_2). The chemical structures of dazomet and its primary degradation products (including MITC) are shown in Appendix B. Supplemental data from field dissipation studies indicate dazomet residues (dazomet and MITC) were rapidly dissipated ($t_{1/2}$ < 10 days) from a loamy sand soil in California (MRIDs 41874801 and 41874802). The reported data indicate dazomet is not persistent in terrestrial and aquatic environments.

The major degradation product and active ingredient of dazomet, MITC, has a vapor pressure of 19 mm Hg and water solubility of 7.6 g/L at 25°C (Table III.a). The calculated Henry's Law constant of MITC is 1.79 x 10^{-4} atm-m^3/mol. A Henry's Law constant in the range of 10^{-5} to 10^{-3} atm-m^3/mol indicates volatilization from water can be a significant route of dissipation for the compound; however, transport resistance in liquid and gas phases is expected to reduce the rate of volatilization for the compound (Lyman et al., 1990). Volatilization of MITC was a major route of dissipation in environmental fate laboratory studies. Laboratory soil volatility data ranged from

a maximum concentration of 1.02 x 10^5 µg/m^3 and volatility rate of 16.9 µg/cm^2/hr at 50% FC and 100 ml/minute air flow to a concentration of 2.8 x 10^5 µg/m^3 and volatility of 24.9 µg/cm^2/hr at 75% FC and 300 ml/minute air flow (MRID 42569202). There are no field studies available to quantify the volatilization of MITC under actual dazomet use conditions.

Once MITC is volatilized into the atmosphere, it undergoes direct photolysis. Geddes et al. (1995) estimated the half-live of MITC in atmosphere ranged from 29 to 39 hours. Alvarez and Moore (1994) calculated a photolysis half-life of 39 hours for noontime under mid summer conditions at 40° N latitude. Several metabolites were identified that included methyl isocyanate (MIC), methyl isocyanide, sulfur dioxide, hydrogen sulfide, carbonyl sulfur, N-methylthioformamide, and methylamine (Geddes et al.,1995). They also reported that 7% of MITC can potentially degrade to MIC. MIC is known to be very reactive and can be acutely toxic to terrestrial animals.

The degradation rates of MITC in soils have been reported in a number of studies (MRID 46084701 and Gerstl et al, 1977). These studies generally found that MITC degradation in soil was dominated by microbial processes and followed first-order degradation kinetics. The calculated half-lives were 5.4 and 7.0 days for loamy sand and 20.2 days for sandy loam soil were reported in MRID 46084701. Gerstl et al. (1977) calculated MITC degradation with half-lives ranging from 3.3 to 9.9 days depending on soil composition. Since MITC is a volatile compound, very little information is available on the metabolites of MITC degradation in soil. Dungan and Yates (2003) reported that the microorganisms responsible for enhanced degradation of MITC specifically target the isothiocyanate functional group, which may compromise the pesticidal efficacy of MITC containing active ingredients like metam sodium and dazomet in soil.

Methyl isothiocyanate degradation in soil and water appears to be also dependent on hydrolysis and microbial-mediated degradation. A hydrolysis study indicates radiolabeled MITC hydrolyzes [$t_{1/2}$ < 21 days in buffer solutions (Accession No. 257305)]. The only hydrolytic product at pH 5 and pH 7 was CH_3NH_3OH. Hydrolytic products in pH 9 buffer solution were $S=C(CH_3NH)_2$ (dimethylthiourea) and CH_3NH^2 (methylamine). MITC had a half-life of 27 days in a non-sterile, anaerobic soil-water test system under a static incubation system (MRID 43596501). A major degradation product was methyl S-[N-formyl-N-methylaminomethyl-(N-methyl) aminomethyl]dithiocarbamate (MAM-DCT). Minor degradation products were 1,3-dimethyl-2-thiourea and 1-methyl-2-thiourea (DMTU-MMTU). The above data suggest that MITC should not persist in terrestrial environments and surface water because of volatilization and degradation.

c. Transport and Mobility

Fate data indicate that MITC could potentially be transported via atmospheric, groundwater, and surface water pathways; however, data suggest that MITC should not persist in terrestrial environments because of volatilization and degradation. Volatilization of MITC is likely the primary mechanism for transport as indicated in environmental fate laboratory studies. In addition, its high solubility in water and low adsorption in soil (K_d of 0.26 L Kg^{-1}) suggest that leaching to groundwater may be a potential transport pathway under flooded and saturated conditions. However, under most field conditions, the potential for groundwater contamination of MITC is unlikely due to unsaturated soil conditions and its volatilization and degradation characteristics in soil (aerobic soil half-lives of 3.3 to 20.2 days). Based on the available non-

targeted monitoring data, no MITC was detected in the ground- water samples within the U.S.A. MITC can also potentially move to surface water through runoff under a possible worst-case scenario, that is, if an intense rainfall and/or continuous irrigation occurs right after dazomet application. However, the Henry's Law Constant of MITC suggests that it will volatilize rapidly from surface water. No monitoring data of MITC in surface water are available at the present time.

d. Field Studies

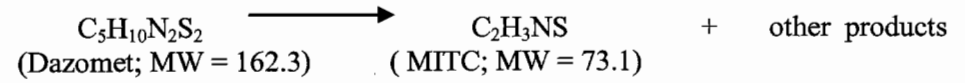
Field dissipation studies (MRID 41874801) conducted on dazomet in California. Dazomet residues (dazomet and MITC) had a field dissipation half-life of 9.65 days (DT_{50} < 3 days) in a California loamy sand. Dazomet residues were predominately detected in the surface 6 inch soil layer; however, residues (dazomet or MITC) were detected at depths of 12 to 18 inches at 3, 5, 10, 12, and 21 days. No residues were detected in deeper soil samples except immediately post-treatment.

2. Measures of Aquatic Exposure

a. Aquatic Exposure Modeling

Aquatic EECs for the ecological exposure to dazomet and MITC were estimated using PRZM /EXAMS employing the standard field pond scenario. PRZM/EXAMS is a Tier II screening model designed to estimate pesticide concentrations found in water at the edge of a treated field. As such, it provides high-end values of the pesticide concentrations that might be found in ecologically sensitive environments following pesticide application. PRZM/EXAMS is a multi-year runoff model that also accounts for spray drift from single and multiple applications. In the ecological exposure assessment, PRZM/EXAMS simulates a 10 hectare (ha) field immediately adjacent to a 1 ha pond, 2 meters deep with no outlet. The location of the field is specific to the crop being simulated using site specific information on the soils, weather, cropping, and management factors associated with the scenario. The crop/location scenario in a specific state is intended to represent a high-end vulnerable site on which the crop is normally grown. Based on historical rainfall patterns, the pond receives multiple runoff events during the years simulated.

Stoichiometry of MITC formation from dazomet



The maximum application rates and relevant environmental fate parameters for dazomet and MITC were used in the screening model PRZM/EXAMS in estimating concentrations in surface water. Tables III.b for dazomet and III.c for MITC present the input parameters used in the Tier II PRZM/EXAMS modeling. The application rate of MITC was calculated using the following approach. From the equation shown above, one mole or 162.3 mass unit of dazomet degrades to produce one mole or 73.1 mass units of MITC. Thus, the mass conversion ratio or molecular weight (MW) ratio of MITC to dazomet is 0.45. The aerobic soil metabolism study suggests that

the maximum conversion rate of dazomet to MITC was 92%. Therefore, the maximum application rate of MITC would be (0.92)(0.45)(530) = 219.4 lbs/Acre at 530 lbs/Acre application rate for dazomet.

To simulate field application of dazomet, multiple scenarios were selected representing proposed dazomet usage areas based on geography and weather. PRZM and EXAMS models and relevant scenarios were used to estimate dazomet EECs in surface water based on label information for dazomet application to tomatoes, strawberries, turf and ornamental trees. PRZM/EXAMS modeling indicates no surface water exposure of dazomet for various scenarios (Appendix C). The modeled surface water EECs for these scenarios are presented in Table III.d for MITC.

The important output parameters for the modeling exercises are the peak, 96 hour, 21 day, 60 day, 90 day and yearly MITC levels estimated in the model reservoir and pond. The higher EECs were observed for Florida tomato and Pennsylvania turf scenarios as compared to the other scenarios. The variations of MITC levels estimated in surface waters can be traced to chemical loadings into either the environmental pond from the PRZM output. Since the chemical input parameters are identical in each PRZM run, the different outputs are entirely dependent upon the different soil parameters used in the corresponding crop scenarios during the PRZM portion of the modeling exercise, as well as the scenario-specific meteorological data. A much higher percentage of pesticide was dissipated in the environment and /or leached below the root zone level for Florida tomato and Pennsylvania turf scenario as compared to other scenarios due to a number of factors such as slope, soil type, moisture content, and the runoff curve numbers used for the different fields. This resulted in runoff and erosion flux vectors for Florida tomato, and Pennsylvania turf scenarios that were considerably higher than those estimated from other scenarios. As a consequence, the MITC loadings into the EXAMS model environment were much higher, resulting in the larger EECs. Also, there are few infrequent occurrences of very high EECs that were observed in these scenarios, which can be traced to relate with high rainfall events. Therefore, EFED has suggested adding a cautionary statement in the present dazomet label to avoid its application if rain is expected within 48 hours.

Acute risk assessments are performed using peak EEC values for a single application. Chronic risk assessments for aquatic invertebrates and fish are performed using the average 21-day and 60-day EECs, respectively. For a given crop, only the highest EECs are presented in the table; however, results from all modeled scenarios are provided in Appendix B. For each PRZM/EXAMS scenario, a granular application to soil was evaluated following the proposed uses for dazomet. The PRZM/EXAMS input and output files from the aquatic ecological exposure assessment are presented in Appendix C.

Table III.b. PRZM/EXAMS Input Parameters for Dazomet

Parameters	Values & Units	Sources

Table III.b. PRZM/EXAMS Input Parameters for Dazomet

Parameters	Values & Units	Sources
Molecular Weight	162.3 g $Mole^{-1}$	
Vapor Pressure 20°C	2.8 X 10^{-6} mm Hg	
Water Solubility @ pH 7.0 and 25°C	3000 mg L^{-1}	
Hydrolysis Half-Life (pH 7)	0.18 Days (0.17 and 0.18 days)	(Calculated 90th Percentile) MRID#s 4211140-01 and 459083-01
Aerobic Soil Metabolism $t_{½}$,	0.71 x 3 Days*	MRID#s 40211901, 42111403
Aerobic Aquatic metabolism:	2.13 x 2 Days**	EFED Guideline
Anaerobic Aquatic metabolism: for entire sediment/water system	0.13 x 3 Days*	MRID 43596501
Aqueous Photolysis	0.17 Day	MRID#s 41479901, 42111402
Soil Water Partition Coefficient (K_{oc})	13.64 L Kg^{-1} ***	EPISUITE
Pesticide is Wetted-In	No	Product Label
Crop Management		
Application rates (lb a.i./A)	530	Basamid®G Granular Proposed Certis Label (EPA Reg. No. 70051-101)
Pesticide Application Frequency	1	Basamid®G Granular Proposed Certis Label (EPA Reg. No. 70051-101)
Application Date-CA tomato	October 15	USDA Crop Profiles‡
Application Date- CA strawberry	November 15	USDA Crop Profiles‡
Application Date-FL Turf	October 15	USDA Crop Profiles‡
Application Date- PA Turf	May 15	USDA Crop Profiles‡
Application Date- OR Christmas Tree	April 15	USDA Crop Profiles‡
Application Method	Ground and 8 inches incorporation	Basamid®G Granular Proposed Certis Label (EPA Reg. No. 70051-101)
Spray Efficiency	Not applicable	EFED

Table III.b. PRZM/EXAMS Input Parameters for Dazomet

Parameters	Values & Units	Sources

* = Due to one reported half-life, input half-life was multiplied by 3 according to Guidance for selecting input parameters in modeling for environmental fate and transport of pesticides. Version II. December 4, 2001.
**= In the absence of an aerobic aquatic metabolism half-life, the reported half-lives of aerobic soil metabolism were multiplied by 2 according to Guidance for selecting input parameters in modeling for environmental fate and transport of pesticides. Version II. December 4, 2001.
*** = The EPI (Estimation Program Interface) SuiteTM is a Windows® based suite of physical/chemical property and environmental fate estimation models developed by the EPA's Office of Pollution Prevention Toxics and Syracuse Research Corporation SRC. http://www.epa.gov/opptintr/exposure/docs/updates_episuite_v3.11.htm
‡ www.pestdata.ncsu.edu/cropprofiles/cropprofiles.cfm

Table III.c. PRZM/EXAMS Input Parameters for MITC, a Dazomet Metabolite

Parameters	Values & Units	Sources
Molecular Weight	73.12g $Mole^{-1}$	Product Chemistry
Vapor Pressure @ 25°C	19 mm Hg	CDPR, 2002
Water Solubility @ pH 7.0 and 25°C	7600 mg L^{-1}	Product Chemistry
Vapor Phase Diffusion Coefficient (DAIR)	8227 cm^2 day^{-1}	Fuller et al., 1966
Enthalpy of Vaporization	8.91 kcal $mole^{-1}$	Chickos and Acree, 2003
Hydrolysis Half-Life (pH 7)	20.4	MRID 001581-62
Aerobic Soil Metabolism $t_{½}$,	9.61 Days	(Calculated 90th Percentile)
	(5.4 - 20.2 days) (3.3-9.9 days)	MRID 460847-01 Gerstl et al, 1977
Aerobic Aquatic metabolism: for entire sediment/water system	19.2†	EFED Guideline
Anaerobic aquatic metabolism	Stable	MRID 439084-26
Aqueous Photolysis	51.6 Day	CDPR, 2002
Soil Water Partition Coefficient	0.26 L Kg^{-1} (Mean K_d)	Gerstl et al., 1977
Crop Management		
Pesticide application frequency and rate	219.4 (lb a.i./A)‡	Estimated
Application Date- CA tomato	October 15	USDA Crop Profiles
Application Date-CA strawberry	November 15	USDA Crop Profiles
Application Date-FL Turf	October 15	USDA Crop Profiles‡
Application Date- PA Turf	May 15	USDA Crop Profiles‡

Table III.c. PRZM/EXAMS Input Parameters for MITC, a Dazomet Metabolite

Parameters	Values & Units	Sources
Application Date- OR Christmas Tree	April 15	USDA Crop Profiles‡
Application Method	MITC generates from ground application of dazomet	MRID#s 40211901, 42111403
Spray Efficiency	Not applicable	EFED Guideline

† = In the absence of an aerobic aquatic half-life, the reported half-life of aerobic soil metabolism is multiplied by 2 according to Guidance for selecting input parameters in modeling for environmental fate and transport of pesticides. Version II. December 4, 2001.

‡ = Dazomet application rate x [(0.92, (the maximum conversion of dazomet to MITC in the aerobic soil metabolism) x (0.45, the molecular weight ratio of MITC to dazomet]

Table III.d. Tier II Concentration of MITC in Surface Water Using PRZM/EXAMS Scenarios [a]

Crop Scenario (location)	Application Rate (lbs ai/acre)	Peak Conc. (µg ai/L)	21- Day Average Conc. (µg ai/L)	60-Day Average Conc. (µg ai/L)
Tomato (CA)	219.4[b]	0.03	0.01	0.00
Strawberry (CA)	219.4[b]	1.08	0.29	0.10
Turf (FL)	219.4[b]	0.78	0.22	0.10
Turf (PA)	219.4[b]	0.02	0.00	0.00
Ornamental (OR)	219.4[b]	0.33	0.08	0.03

[a] Granular application with soil incorporation modeled using PRZM 3.12/EXAMS 2.98. Surface water EECs for all crop scenarios and PRZM/EXAMS model outputs are presented in Appendix C.
[b] MITC application rate estimated from the dazomet application rate (see Table III.c.).

b. Aquatic Exposure Monitoring (Field Data)

No data were identified to provide information on surface water or groundwater monitoring of dazomet or MITC.

3. Measures of Terrestrial Exposure

a. Modeling of Granular Exposure for Terrestrial Animal Exposure

The EFED terrestrial exposure model, T-REX (Version 1.2.3, 8/8/05), is used to estimate exposures and risks to avian and mammalian species. Input values on avian and mammalian toxicity as well as chemical application are required to run the model. The model generates LD_{50}/square foot values, which can be compared to OPP Levels-of-Concern (LOCs). A more detailed discussion of the methodology implemented by T-REX is presented in Appendix F. T-REX was run for tomato and strawberry crops (also applicable to turf, ornamental and other pre-plant incorporated uses) for a single application of dazomet applied at the maximum rate of 530 lb a.i./A.

b. Inhalation Exposure Modeling of MITC for Terrestrial Animals

The potential for inhalation of MITC to be a toxicologically significant route of exposure to birds and mammals within the use area was evaluated with the Agency's Industrial Source Complex Short Term (ISCST3) model (US EPA, 1995). The ISCST3 model with information about emissions from a treated field (i.e., known as flux) estimates the range of concentrations which might be found under different conditions of application rate, weather, source size and shape (e.g., field size in acres), and distance from the treated field, building or structure. Before a modeling analysis can be done, one of the most important parameters for ISCST3, the flux rate must be determined. The flux rate is the quantity of pesticide that is emitted from the treated fields, buildings or structures per unit area per unit time. As an example, for field applications it is usually expressed in units of micrograms per square meter per second ($\mu g/m^2/sec$). In essence, flux represents how quickly the pesticide moves or volatilizes into the surrounding atmosphere. Numerous factors can influence flux rates such as application rate, depth of soil injection, type of application (e.g., drip vs. soil injection vs. granule application), techniques used to control emissions (e.g., tarps), temperature, wind and weather conditions, soil type, and others. Flux is difficult to determine. Three general methods are used to calculate flux are discussed briefly below. The first two measure flux from sampling directly in treated fields, and the third is indirect in that it calculates flux using samples from downwind locations (back calculations). For dazomet, the flux estimates were completed using the back calculation method (US EPA, 2004b and 2005).

> Method 1, Flux Chamber: The first direct method for estimating flux uses field fumigant emission data measured in a flux chamber. A flux chamber is basically a box which encloses a small defined area of a treated field, from which air samples are obtained representing defined durations (e.g., air is pulled through a charcoal trap collecting emitted pesticide over a continuous length of time such as 4 hours). Since the surface area is defined by the area of the chamber, and the quantity of pesticide emitted per unit time is defined by the air concentration, this method directly measures flux. A possible issue with flux chambers is that the conditions within the chamber (e.g., temperature, wind, air stability) are not generally identical to those outside the chamber in the treated field; since flux rates can be significantly affected by these factors, flux rates measured in these

chambers may not always represent actual flux rates in the field. Flux chambers are not often used for estimating flux rates.

Method 2, Aerodynamic Method: The second direct method used is the aerodynamic flux method. In this method, air samplers are set up in the treated field at various heights on a mast (e.g., 15, 30, 90, and 150 cm from the ground). Using measured air concentrations at these various heights, a vertical gradient of concentrations can be estimated for different time points, which can be integrated across all heights to estimate the flux rate at each time point after application. Some studies are available using this method to determine flux rates.

Method 3, Back-Calculation: The method most often used to determine flux rates is an indirect method known as the back-calculation method. This method uses measured air concentrations taken in a typical field fumigation study in which air samplers are located at various positions around the field. The measured air concentrations, together with information about weather conditions that occurred when the samples were obtained, are used as inputs into the ISCST3 model. The model assumes that these air concentrations result from a Gaussian plume, the plume being distributed around the treated field as a result of the wind and weather conditions measured. The model then calculates the flux rate which would be required to emit the plume in that manner and to obtain the air concentrations measured.

Determination of the flux rate for all situations to be considered in an assessment is necessary before ISCST3 can be run. After these are defined, other key inputs must be defined such as the size and shape of a treated field, wind direction, wind speed, and atmospheric stability. ISCST3 calculates downwind air concentrations using hourly meteorological conditions,that include wind speed and atmospheric stability. The lower the wind speed and the more stable the environment, the higher the air concentrations are going to be close to a treated field. Conversely, if wind speed increases or the atmosphere is less stable, then air concentrations are lower in proximity to the treated field. Atmospheric stability is essentially a measure of how turbulent the atmosphere is at any given time. Stability is affected by solar radiation, wind speed, cloud cover, and temperature, among other factors. If the atmosphere is unstable, then more off-field movement of airborne residues is possible because they are pushed up into the atmosphere and moved away from the field, thereby lowering the air concentration in proximity to the field. To simplify modeling the transport of soil fumigant vapors from a treated field, a single wind direction, wind speed, and stability category are used for a given 1-hour period. The Agency has not determined if a particular set of meteorological conditions should be used for regulatory purposes, so risk assessments generally present exposures and risks representing a variety of conditions.

Modeling with ISCST3 produced high-end estimates of air concentration and resulting risks for a number of reasons. First, only the downwind direction is considered. Secondly, the model runs are based on constant wind speed, wind direction, and atmospheric stability for a 1-hour period. This will rarely occur resulting in overestimates of air concentrations and risks. The Agency believes that using ISCST3 to predict exposures over more extended periods is inappropriate because constant meteorological conditions over such periods will not occur. Therefore, use of the model for extended periods would yield highly conservative, physically unlikely results.

However, the model is useful because it allows air concentrations reflecting different conditions based on changing factors such as application rates, field sizes, downwind distances, wind and weather conditions, and other factors, which cannot be done using the monitoring data method described above. Therefore, results using the ISCST3 model should be considered to be potential exposures to the most highly exposed, upper percentile of the population, but are not representative of exposures to most of the population around a treated field.

The specific inputs for the ISCST3 model calculations dominated the associated uncertainties in the results. For example, the key input factors for pre-plant agricultural uses were field size, flux/emission rates, atmospheric stability, and windspeed. Wind direction is another factor which also should be considered. The field sizes used by EFED in this assessment were 1 to 40 acres which is well within the range of what could be treated on a daily basis. There are uncertainties associated with point estimates of flux/emission rates for specific application techniques which is another varying factor. The flux rates used have been calculated by HED (US EPA, 2005) and they compare reasonably well with those calculated by the study investigators. The reality is that there is a large distribution of flux rates which is a phenomenon inherent in the nature of these types of data. The values used for this assessment yield conservative air concentration estimates because considering a constant flux rate does not allow for diurnal/nocturnal changes that may occur, which can result in lower concentrations when coupled with the appropriate wind speed and stability category. Additionally, the range of application rates, 222 and 530 lbs ai/acre, was considered coupled with the median emission rate which also provided a conservative estimate for flux. The meteorological inputs also will provide a conservative estimate of exposure because the wind direction is considered to be perpendicular (pointed downwind) to the treated field for the entire 24 hours represented in the calculation. This is not a normal situation in the atmosphere for most locations. There is normally a prevailing wind with directional changes over the course of a typical day, especially when diurnal and nocturnal differences are noted. EFED did not recommend a specific set of meteorological conditions for this assessment but instead provided a range of results for different conditions. Different meteorological databases were evaluated (e.g., SAMSON & CIMIS) using data from various locations for comparative purposes. The lower 10^{th} percentile windspeeds for a 24 hour period in that analysis ranged from approximately 2 to 5.5 mph depending upon the location. The windspeeds used by EFED ranged from approximately 2 to 10 mph. The estimated air concentrations were listed in Table III.e. Overall, EFED believes that the approach used to evaluate potential exposures from a known area source can be considered conservative. However, it is believed, however, that the range of selected input values and outputs represent what could reasonably occur in agriculture fields given proper field and climatological conditions. The basic approaches to estimate air concentrations using ISCST3 model are outlined in the Health Effects Division's Draft Standard Operating Procedures (SOPs) for Estimating Bystander Risk from Inhalation Exposure to Soil Fumigant (USEPA,2004b). ISCST3 estimated downwind air concentrations using hourly meteorological conditions that include the wind speed and atmospheric stability.

Table III.e. MITC EECs in Air after Dazomet Application[a]

Distance from treated field	MITC concentration ($\mu g/m^3$) for various sizes of treated fields

(m)	1acre	5 acre	10 acre	20 acre	40 acre
0	1350	1704	1874	2045	2230
25	514	803	952	1110	1283
50	355	599	732	880	1044
100	227	418	529	658	805

[a] Based on dazomet maximum application rate of 530 lbs a.i./A, wind speed of 1.0 m/s , wind stability category D and flux rate of 0.01 g/m^2-s. Output from the ISCST3 model is provided in Appendix D.

c. Exposure Modeling for Non-Target Terrestrial Plants

Nontarget plants off-site have the potential to be exposed when the degradate MITC off-gasses from treated fields. Terrestrial plant toxicity data have not been submitted. However, it is known that dazomet and MITC are toxic to plants as evidenced by the precautionary language on the label for Basamid G.

d. Terrestrial Exposure Monitoring (Field Data)

No data were identified to provide information on terrestrial monitoring.

C. Ecological Effects Characterization

In screening-level ecological risk assessments, effects characterization describes the types of effects a pesticide has on aquatic or terrestrial organisms. This characterization is based on registrant-submitted studies that describe information regarding acute and chronic effects toxicity for various aquatic and terrestrial animals and plants. Appendix E summarizes the results of the registrant-submitted toxicity studies used to characterize effects for this risk assessment. Surrogate test species of birds, mammals, fish, aquatic and terrestrial invertebrates and plants are used to estimate treatment-related direct effects on acute mortality and chronic reproduction, growth, and survival of non-target species. Toxicity tests include short-term acute, subacute, and reproduction/chronic studies that progress from basic laboratory tests to applied field studies. In addition, avian species are used as surrogates for reptiles, and fish species are used as surrogates for amphibians.

On application, granular dazomet rapidly hydrolyzes to MITC, which is dissipated by volatilization and leaching; consequently, terrestrial exposure to birds and mammals can occur orally to dazomet granules and/or by inhalation of MITC. Acute toxicity studies are available to assess oral dazomet risk to birds. Acute and chronic studies are available for oral exposure to mammals. Inhalation toxicity studies for MITC are only available for mammals. Avian inhalation risk will be evaluated using the mammal assessment; however, the sensitivities of birds and mammals may not be equivalent due to physiological differences that could result in higher

exposures to birds. Consequently, results indicating no risk to mammals may underestimate risk and not be protective of birds. Acute toxicity studies with fish and acute and chronic studies with aquatic invertebrates are available for MITC. Since dazomet rapidly hydrolyzes to MITC, potential exposure to aquatic receptors would occur through surface runoff/leaching of MITC; consequently, the toxicity data for MITC will be used to assess risk to fish, aquatic invertebrates, and aquatic plants.

Results of toxicity studies indicate that technical grade dazomet is moderately toxic to upland game birds orally but only slightly toxic by the dietary route. The submitted chronic studies for upland game birds and waterfowl are not adequate for quantitative risk assessment; however, reproductive effects were observed. Both dazomet and MITC are categorized as Toxicity Category II (Warning) to small mammals on an acute oral basis and acute inhalation basis. Toxicity studies demonstrate that the degradate MITC is very highly toxic to freshwater fish, invertebrates, algae, and macrophytes following acute exposure. Chronic exposure of MITC to freshwater invertebrates produces adverse reproductive effects and parental mortality. In aquatic plants, MITC produces adverse effects in both algae and vascular plants. Data are not available to characterize the effects of dazomet and MITC to terrestrial plants.

1. Aquatic Effects

Details of the registrant-submitted studies for aquatic animals and plants are provided in Appendix E. Table III.g. presents the toxicity endpoint values from these studies used to calculate RQs and estimate risk to aquatic receptors from exposure to MITC through surface runoff/leaching.

Table III.g. MITC Toxicity Endpoint Values for Assessing Risk to Aquatic Organisms.

Exposure Scenario	*Species*	*Exposure Duration*	*Toxicity Endpoint Value*	*Endpoint*	*Reference (Classification)*
Freshwater Fish					
Acute	Rainbow Trout *Oncorhynchus mykiss*	96 hours	LC_{50} = 0.0512 ppm	Lethality	MRID 45919420 (Supplemental)
Chronic	Study Invalid				
Freshwater Invertebrates					
Acute	Water flea *Daphnia magna*	48 hours	EC_{50} = 0.055 ppm	Lethality	MRID 41819302 (Acceptable)
Chronic	Water flea *Daphnia magna*	21 days	NOAEC = 0.025 ppm LOAEC > 0.025 ppm	Reproductive effects/ parental mort.	MRID 45634001 (Supplemental)
Estuarine/Marine Fish					
Acute	No Data Submitted				

Table III.g. MITC Toxicity Endpoint Values for Assessing Risk to Aquatic Organisms.

Exposure Scenario	*Species*	*Exposure Duration*	*Toxicity Endpoint Value*	*Endpoint*	*Reference (Classification)*
Chronic	No Data Submitted				
Estuarine/Marine Invertebrates					
Acute	No Data Submitted				
Chronic	No Data Submitted				
Aquatic Plants					
Nonvascular	Algae *Scenedesmus subspicatus*	120 days	EC_{50} = 0.254 ppm NOAEC = NA	Cell density	MRID 44588903 (Supplemental)
Macrophytes	Duckweed *Lemna gibba*	120 days	EC_{50} = 0.59 ppm NOAEC = 0.09 ppm	Frond number	MRID 45919421 (Acceptable)

a. Aquatic Animals

Freshwater Fish - The acute toxicity of the degradate MITC was evaluated in rainbow trout (*Oncorhynchus mykiss*) and bluegill sunfish (*Lepomis macrochirus*). Details of these studies are provided in Appendix E. Results of acute exposure studies indicate that MITC is very highly toxic to rainbow trout with 96-hour LC_{50} values ranging from 0.0512 to 0.094 ppm. MITC is also highly toxic to bluegill sunfish with a reported 96-hour LC_{50} of 0.142 ppm. Acute risk to freshwater fish species will be assessed using the lowest toxicity value from these studies (rainbow trout LC_{50} of 0.0512 ppm; static renewal test; MRID 45919420).

A non-guideline 28-day subchronic study exposing rainbow trout to MITC has been submitted. However, this study (MRID 45634002) is considered invalid due to insufficient analytical data and MITC stability was not adequately assessed. Consequently, this guideline (§72-4a) is not fulfilled and data are unavailable to assess the chronic risk of MITC to freshwater fish.

Freshwater Invertebrates - The acute toxicity of the degradate MITC was evaluated in *Daphnia magna*. Study details are provided in Appendix E. Acute toxicity data for MITC indicate that aquatic invertebrates are sensitive to the degradate, exhibiting very high toxicity with 48-hour EC_{50} values ranging from 0.055 to 0.076 ppm. Aquatic organisms will likely be exposed only to MITC; consequently, acute risk to freshwater invertebrate species will be assessed using the lowest toxicity value from these studies (EC_{50} of 0.055 ppm: flow-through test; MRID 41819302).

The chronic toxicity of the degradate MITC to freshwater invertebrates has been assessed in a 21-day life-cycle toxicity test using *Daphnia magna*. Study details are summarized in Appendix E. The data submitted show that MITC produced chronic toxicity in daphnids. The 21-day NOAECs for both reproductive effects and parental mortality were 0.025 ppm and the 21-day LOAECs based on reproductive effects and parental mortality were >0.025 and 0.050 ppm, respectively.

This study was classified as supplemental because mean measured concentrations were not determined, the stability of the test substance was not assessed under actual use conditions, and terminal growth measurements were not obtained. Consequently, the guideline requirement (§72-4b) is not fulfilled. The lowest NOAEC (0.025 ppm; static renewal test; MRID 45634001) will be used in assessing chronic risk to freshwater invertebrates.

Estuarine/Marine Fish - Toxicity data are not available for the degradate MITC. Risks to marine/estuarine fish will be estimated based on the assumption that freshwater and marine/estuarine organisms are of similar sensitivity.

Estuarine/Marine Invertebrates - Toxicity data are not available for the degradate MITC. Risks to marine/estuarine invertebrates will be estimated based on the assumption that freshwater and marine/estuarine organisms are of similar sensitivity.

b. Aquatic Plants

Acute toxicity studies on the degradate MITC were conducted with duckweed (*Lemna gibba*), green algae (*Selenastrum capricornutum*), blue-green algae (*Anabaena flos-aquae*), and another algae (*Scenedesmus subspicatus*). Study details are provided in Appendix E. In the duckweed study an EC_{50} of 0.59 ppm a.i. (NOEC of 0.09 ppm a.i) was determined, and the algae studies ascertained EC_{50} values ranging from 0.254 to 1.5 ppm. Duckweed showed statistically significant reductions in frond number and growth rate at 0.269 ppm and above. In the alga studies, cell densities or biomass were significantly reduced. Acute risk to aquatic plant species will be assessed using the lowest toxicity value from these studies [nonvascular EC_{50} of 0.254 ppm (MRID 44588903); vascular EC_{50} of 0.59 ppm (MRID 45919421)]. The MITC aquatic vascular plant study requirements are fulfilled; however, the MITC aquatic nonvascular plant requirements are only partially fulfilled as the three studies conducted are considered supplemental.

2. Terrestrial Effects

Details of the registrant-submitted studies for terrestrial animals are provided in Appendix E. No studies (seedling emergence and vegetative vigor) were submitted to evaluate the effects of dazomet or MITC to terrestrial monocots and dicots. Tables III.h. and III.i. present the toxicity endpoint values from the studies used to calculate RQs and estimate risk to terrestrial receptors from oral exposure to dazomet granules through ground deposition and/or by inhalation of MITC due to drift (volatilization and wind dispersion) and runoff.

Table III.h. Dazomet Toxicity Endpoint Values for Assessing Risk to Terrestrial Organisms.

Exposure Scenario	*Species*	*Exposure Duration*	*Toxicity Endpoint Value*	*Endpoint*	*Reference (Classification)*
Mammal					
Acute Oral	Rat *Rattus norvegicus*	Single Oral Dose	LD_{50} = 415 mg/kg/day	Lethality	MRID 00132468 (Acceptable)
Birds					
Acute Oral	Bobwhite Quail *Colinus virginianus*	Single dose	LD_{50} = 424 mg/kg bw NOEC = 147 mg/kg bw	Lethality	MRID 42365101 (Acceptable)
Subacute Dietary	Bobwhite Quail *Colinus virginianus*	8 days	LC_{50} = 2301 ppm	Lethality	MRID 42365102 (Supplemental)
Chronic	Studies not adequate for quantitative risk assessment.				
Terrestrial Plants					
	No Data Submitted				

Table III.i. MITC Toxicity Endpoint Values for Assessing Risk to Terrestrial Organisms.

Exposure Scenario	*Species*	*Exposure Duration*	*Toxicity Endpoint Value*	*Endpoint*	*Reference (Classification)*
Mammal					
Acute Inhalation	Rat *Rattus norvegicus*	Single Inhalation Exposure	LC_{50} = 0.54 mg/L	Lethality	MRID 45919410 (Acceptable)
Subchronic Inhalation	Rat *Rattus norvegicus*	28 days	NOAEL = 19.9 mg/m^3 LOAEL = 100 mg/m^3	Pathological effects (metaplasia) of respiratory epithelium	MRID 45314802 (Acceptable)
Birds					
No Data Submitted					
Terrestrial Plants					
No Data Submitted					

a. Terrestrial Animals

Mammals - The results indicate that both dazomet and MITC are categorized as Toxicity Category II (Warning) to small mammals on an acute oral basis and acute inhalation basis, respectively. The lowest endpoint values for rats will be used to assess acute risk to mammals from oral exposure to granular dazomet and from inhalation exposure to volatile MITC (see Appendix E for study details). A 90-day oral study with rats reported that dazomet caused increased liver weight and increased incidence of pronounced foci in the liver. A 28-day inhalation study with rats indicates that MITC causes pathological effects in the nasal cavity and tracheabronchial region, including metaplasia of respiratory epithelium. See the HED assessment for further details and guideline status. Chronic inhalation toxicity studies are not available to assess the chronic (developmental/reproductive) inhalation risk from MITC.

Birds - The data submitted show that the oral LD_{50} for dazomet is 424 mg/kg bw for bobwhite quail. The NOEC is 147 mg/kg with observed effects at higher dose(s) including lethargy, anorexia, and reduced mean body weights and feed consumption. Based on these results, dazomet is categorized as moderately toxic to avian species on an acute oral basis. This study (MRID 42365101) fulfills the guideline requirement for an acute oral toxicity study with birds (§71-1) and is classified as acceptable. The 21-day LD_{50} of 424 mg/kg bw will be used to assess the risk of acute oral exposure of dazomet to avian species.

Dazomet data indicate that the 8-day acute dietary LC_{50} values are 2301 and >5137 ppm for bobwhite quail and mallard duck, respectively. Therefore, dazomet is categorized as slightly toxic to avian species on a subacute dietary basis. The guideline (§71-2) is partially fulfilled with an acceptable subacute dietary study with the mallard duck (MRID 41596901). The quail study (MRID 42365102) was determined to be supplemental because the stability and homogeneity of the test substance was not determined.

The submitted chronic studies (MRID 43245002 ; MRID 43245001) with dazomet are considered to be Supplemental and do not fulfill guideline requirements (§71-4) due to high embryonic mortality in the mallard controls and inadequate incorporation of test substance at the 10 ppm and 100 ppm levels in both the bobwhite and mallard studies.. Nevertheless, treatment-related effects were observed. An overall NOAEL/LOAEL, needed for risk assessment, could not be determined for either study. New studies are needed for risk assessment due to the potential for reproductive effects from exposure to dazomet granules.

Avian inhalation risk will be evaluated using the mammal assessment; however, the sensitivities of birds and mammals may not be equivalent due to physiological differences that could result in higher exposures to birds. Consequently, results indicating no risk to mammals may underestimate risk and not be protective of birds.

Non-target Insects - An acute contact study (ID #00001999) indicates an LD_{50} >24 ug ai/bee for dazomet, indicating that it is relatively non-toxic to honey bees. Further, substantial honey bee exposure is not expected since dazomet is applied to bare soil and incorporated; it is not applied by foliar application. Acute contact honeybee data are primarily used by EFED in regard to label recommendations, not for risk quotients.

b. Terrestrial Plants

Terrestrial plant testing (seedling emergence and vegetative vigor) is required for pesticides that have terrestrial non-residential outdoor use patterns and that may move off the application site through either volatilization (vapor pressure > 1.0×10^{-5} mm Hg at 25°C) or drift (aerial or irrigation), and/or that may have listed species associated with the application site. In addition, terrestrial Tier II studies are required for all low dose pesticides (those with the maximum use rate of 0.5 lbs ai/A or less) and any pesticide showing a negative response equal to or greater than 25% in Tier I tests. For seedling emergence and vegetative vigor testing, the following plant species and groups should be tested: (1) six species of at least four dicotyledonous families, one species of which is soybean (*Glycine max*) and the second species of which is a root crop; and (2) four species of at least two monocotyledonous families, one of which is corn (*Zea mays*).

Terrestrial plant toxicity studies have not been conducted for MITC, which could drift off-site; consequently, these guidelines (seedling emergence §122-1a and §123-1a; vegetative vigor §122-1b and §123-1b) have not been satisfied. Data are thus not available to quantify the risk of MITC to non-target terrestrial plants through drift or surface runoff.

An ECOTOX literature search was conducted by EFED on dazomet (see 7/16/04 Interim Guidance). No additional data useful to the present risk assessment (e.g., additional avian or mammalian acute oral data to assess granule risk) were located. Although this particular search did not include MITC, this review did benefit from additional open literature data on MITC received/located as part of the previous metam sodium/MITC review.

IV. RISK CHARACTERIZATION

Risk characterization provides the final step in the risk assessment process. In this step, exposure and effects characterization are integrated to provide an estimate of risk relative to established levels of concern (LOC). The results are then interpreted for the risk manager through a risk description and synthesized into an overall conclusion.

A. Risk Estimation - Integration of Exposure and Effects Data

A deterministic approach is used to evaluate the likelihood of adverse ecological effects to non-target species. In this approach, risk quotients (RQs) are calculated by dividing exposure estimates (EECs) by ecotoxicity values for non-target species, both acute and chronic.

$$RQ = \text{EXPOSURE/TOXICITY}$$

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on non-target organisms. LOCs currently address the following risk presumption categories: (1) acute - potential for acute risk is high, regulatory action may be warranted in addition to restricted use classification (2) acute restricted use - the potential for acute risk is high, but this may be mitigated through restricted use classification (3) acute endangered species - the potential for acute risk to endangered species is high, regulatory action may be warranted, and (4) chronic risk - the potential for chronic risk is high, regulatory action may be warranted. Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to non-target insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of ecotoxicity values derived from the results of short-term laboratory studies that assess acute effects are: (1) LC_{50} (fish) (2) LD_{50} (birds and mammals) (3) EC_{50} (aquatic plants and aquatic invertebrates) and (4) EC_{25} (terrestrial plants). An example of a toxicity test effect level derived from the results of long-term laboratory study that assesses chronic effects is: NOAEC (birds, fish and aquatic invertebrates). Risk presumptions, along with the corresponding RQs and LOCs are tabulated below:

TABLE IV.a. Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
Birds:		
Acute Risk	EEC[1]/LC_{50} or LD_{50}/sqft[2] or LD50/day[3]	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1
Wild Mammals:		

TABLE IV.a. Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
Acute Risk	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/sqft or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD_{50}/sqft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1

[1] Estimated Environmental Concentration (ppm) on avian/mammalian food items

[2] (mg/ft) / LD_{50} * wt. of bird

[3](mg of toxicant consumed/day)/ LD_{50} * wt. of bird

TABLE IV.b. Risk Presumptions for Aquatic Animals

Risk Presumption	RQ	LOC
Acute Risk	EEC[1]/LC_{50} or EC_{50}	0.5
Acute Restricted Use	EEC/LC_{50} or EC_{50}	0.1
Acute Endangered Species	EEC/LC_{50} or EC_{50}	0.05
Chronic Risk	EEC/ NOAEC	1

[1] EEC = (ppm or ppb) in water

TABLE IV.c. Risk Presumptions for Plants

Risk Presumption	RQ	LOC
Terrestrial and Semi-Aquatic Plants:		
Acute Risk	EEC[1]/EC_{25}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1
Aquatic Plants:		
Acute Risk	EEC[2]/EC_{50}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1

[1] EEC = lbs ai/A

[2] EEC = (ppb/ppm) in water

1. Non-target Aquatic Animals and Plants

a. Fish and Invertebrates

California strawberry has the highest EECs (for MITC) of the use sites modeled, but no LOCs are exceeded for fish and invertebrates (Table IV.d.). Other scenarios had lower acute EECs and would also not exceed LOCs. The chronic LOC was not exceeded for freshwater invertebrates with the highest available 21-day EEC (California strawberry, Table IV.e.), and thus other scenarios modeled would not exceed this LOC either. However, this chronic risk quotient is based on supplemental toxicity data without measured concentrations of actual test solutions and thus may be an underestimate of risk. A new study is needed for risk assessment.

Table IV.d. Acute RQs for Fish and Invertebrates Exposed to MITC

Crop scenarios	Species Category	Organism	LC_{50} or EC_{50} (µg a.i./L)	Peak 24-hour EEC (µg a.i./L)	Acute RQ (EEC/LC_{50})
CA Strawberry	Freshwater fish	rainbow trout	51.2	1.08	0.021
	Freshwater invertebrates	water flea	55.0	1.08	0.020
FL Turf	Freshwater fish	rainbow trout	51.2	0.02	0.015
	freshwater invertebrates	water flea	55.0	0.02	0.014

* indicates an exceedance of Endangered Species Level of Concern (LOC); RQ > 0.05
** indicates an exceedance of Endangered Species LOC and Acute Restricted Use LOC; RQ > 0.10.
*** indicates an exceedance of Endangered Species LOC, Acute Restricted Use LOC; RQ > 0.10, and.Acute Risk LOC; RQ > 0.50.

Table IV.e. Chronic RQs for Fish and Invertebrates Exposed to MITC.

Species Category	Organism	NOAEC (µg a.i./L)	EEC (µg a.i./L)	Chronic RQ (EEC/NOAEC)
freshwater fish	No data submitted			
freshwater invertebrates	water flea	25.0	0.29	0.01**
estuarine/marine fish	No data submitted			
estuarine/marine invertebrates	No data submitted			

*indicates exceedance of Chronic LOC; RQ>1.0
**based on supplemental toxicity data without measured concentrations of actual test solutions (but did include static renewal and separate stability data); RQ may thus be an underestimate.

b. Vascular and Nonvascular Aquatic Plants

No LOCs were exceeded for aquatic plant exposure to MITC (Tables IV.f. and IV.g.) with the highest peak EEC, for California strawberries. Other scenarios modeled had substantially lower peak EECs and would thus also not exceed LOCs.

Table IV.f. Acute RQs for aquatic plants exposed to MITC.

Organism	EC_{50} (µg a.i./L)	Peak 24-hour EEC (µg a.i./L)	Acute RQ (EEC/EC_{50})
Algae (*Scenedesmus subspicatus)*	254.0	1.08	0.004
Duckweed (*Lemna gibba)*	590.0	1.08	0.002

Table IV.g. Acute RQs for listed aquatic plants exposed to MITC.

Organism	NOAEC (µg a.i./L)	Peak 24-hour EEC (µg a.i./L)	Acute RQ (EEC/NOAEC)
Algae (*Scenedesmus subspicatus)*	No data submitted		
Duckweed (*Lemna gibba)*	90.0	1.08	0.012

2. Non-target Terrestrial Animals

a. Birds

LD_{50}/square foot values for parent dazomet were calculated using T-REX (version 1.2.3) at the maximum application rate of 530 lb/A. Calculations are made for three size classes of bird (20 g, 100 g, and 1000 g). The current model version calculations assume 100% unincorporated product, although Table 3-2 of the 8/8/05 User's Guide indicates that 15% unincorporated may be used with broadcast incorporated. Thus, T-REX values have been multiplied by 0.15, since dazomet is used with incorporation. Based on the resulting LD_{50}/square foot values, the Acute Risk LOC, Acute Restricted Use LOC, and the Endangered Species LOC are exceeded for all three size classes of birds.

TABLE IV.h. Avian Acute Risk Quotient Summary for Dazomet [a,b,c]

Weight class (g)	530 lbs /acre
	Acute RQ –LD_{50}/sq. Ft.
20	135.51***
100	21.29***
1000	1.51***

[a] Acute toxicity threshold was LD_{50} =424 mg/kg-bwt.; T-REX generates weight-adjusted values for each weight class.

[b] Input and output for T-REX Ver. 1.2.3 are provided in attachment.

TABLE IV.h. Avian Acute Risk Quotient Summary for Dazomet [a,b,c]

Weight class (g)	530 lbs /acre
	Acute RQ –LD_{50}/sq. Ft.

[c] LD50/sq. ft. values assume 15% unincorporated granules (Table 3-2 8/8/05 T-REX User's Guide).
* indicates an exceedance of Endangered Species Level of Concern (LOC); RQ > 0.10.
** indicates an exceedance of Acute Restricted Use LOC and Endangered Species LOC; RQ > 0.20.
*** indicates an exceedance of Acute Risk LOC, Acute Restricted Use LOC and Endangered Species LOC; RQ > 0.50.

b. Mammals

LD_{50}/square foot calculations are made in a similar manner as for birds above. For mammals there are three size classes: 15 grams, 35 grams, and 1000 grams. Assuming 15% unincorporation, the Acute Risk LOC, Acute Restricted Use LOC, and the Endangered Species LOC are exceeded for all three size classes of mammals.

TABLE IV.i. Mammalian Acute Risk Quotient Summary for Dazomet [a,b,c]

Weight class (g)	**530 lbs /acre**
	Acute RQ –LD_{50}/sq. Ft.
15	60.51***
35	32.05***
1000	2.59***

[a] Acute toxicity threshold was LD_{50} =415 mg/kg.bw.; T-REX generates weight-adjusted values for each weight class.
[b] Input and output for T-REX Ver. 1.2.3 are provided in attachment.
[c] LD50/sq. ft. values assume 15% unincorporated granules (Table 3-2 8/8/05 T-REX User's Guide).
* indicates an exceedance of Endangered Species Level of Concern (LOC); RQ > 0.10.
** indicates an exceedance of Acute Restricted Use LOC and Endangered Species LOC; RQ > 0.20.
*** indicates an exceedance of Acute Risk LOC, Acute Restricted Use LOC and Endangered Species LOC; RQ > 0.50.

Granular dazomet converts to the gas MITC. As a strictly preliminary screen to see whether the total amount of MITC generated could potentially pose a risk to wild mammals, an LD_{50}/square foot analysis as above is calculated for MITC. Using the 212.2 lb/A MITC equivalent used in the aquatic assessment, the resulting LD_{50}/square foot values are 1260 for 15 gram mammals, 667 for 35 gram mammals, and 54 for 1000 gram mammals. Thus, it is appropriate to examine inhalation exposure as a potential source of exposure and risk. Inhalation is expected to be the principal route of exposure of terrestrial wildlife to MITC.

Risk Quotients (RQs) were calculated using modeled estimated MITC concentrations for 0 to 100 meters from the treated fields of various sizes (1 - 40 acres) (Table III.h.). The Agency has not

established level of concern thresholds for the interpretation of RQs calculated for inhalation exposures. However, if the LOCs for acute mammalian oral wildlife risk are used to evaluate these RQs, none are exceeded under the scenario of MITC volatilization and drifting to habitats adjacent to treated fields at the predicted ISCST3 EECs for MITC in air (Table IV.j.).

Table IV.j. Acute Risk Quotients for Mammalian Inhalation of MITC[ab]

Distance from treated field (m)	RQ for various sizes of treated fields				
	1 acre	5 acre	10 acre	20 acre	40 acre
0	0.0025	0.003	0.0035	0.0038	0.004
25	0.0009	0.0015	0.002	0.002	0.0024
50	0.0006	0.0011	0.001	0.0016	0.002
100	0.0004	0.0008	0.00097	0.001	0.0015

[a] RQs calculated for maximum labeled application rate of 530 lbs ai/acre for tomato and strawberry. EECs listed in Table III.h.

[b] Acute toxicity threshold was LC_{50} = 0.54 mg/L (540,000 $\mu g/m^3$)

B. Risk Description - Interpretation of Direct Effects

The risk hypothesis states that the use of dazomet as a soil fumigant for pre-plant soil use is likely to expose terrestrial and aquatic animals and plants to dazomet and/or MITC, with resulting adverse effects. Based on available ecotoxicity data and predicted environmental exposures, this ecological risk assessment supports the presumption of risk to birds and mammals from dazomet granules and risk to fish and aquatic invertebrates from the degradate MITC.

Contamination of soil and the atmosphere following soil application of dazomet presents potential exposure pathways for non-target terrestrial plants, birds, mammals and invertebrates. Surface runoff and leaching of MITC following the rapid abiotic hydrolytic degradation of dazomet presents the potential for acute exposures to non-target fish, invertebrates and vascular and non-vascular plants in aquatic systems. MITC accounts for most of the fumigant activity by diffusing, either as a gas or volatile liquid, upward through the interstitial spaces in the soil and killing living organisms with which it comes in contact. MITC is highly toxic and results in the disruption of biological functions of soil organisms. For example, MITC is highly reactive with the nucleophilic centers such as thiol groups in vital enzymes of nematodes, and thus appears to kill these organisms (Cremlyn, 1991). Dazomet is assumed to be toxic to all growing plants. Current label precautions prohibit application within 3 - 4 feet of growing plants or closer than the drip line of trees and large shrubs and during weather conditions that favor drift to non-target plants.

1. Risks to Aquatic Organisms

Dazomet rapidly hydrolyzes to MITC; consequently, in the conceptual model, surface runoff/leaching to adjacent bodies of water were predicted as the most likely sources of exposure of MITC to nontarget aquatic organisms. Risks to aquatic organisms (i.e. fish, invertebrates, and plants) were assessed based on modeled EECs and available toxicity data. Aquatic EECs for the ecological exposure to MITC/dazomet were estimated using PRZM 3.12/EXAMS 2.98 employing the standard field pond scenario (Table III.e.). MITC is not expected to bioaccumulate in aquatic organisms.

a. Fish and Invertebrates

Toxicity studies demonstrate that the degradate MITC is very highly toxic to freshwater fish, invertebrates, algae, and macrophytes following acute exposure. Chronic exposure of MITC to freshwater invertebrates produces adverse reproductive effects and parental mortality. Data are unavailable to assess the chronic risk of MITC to freshwater fish. Acute and chronic data are unavailable to assess the risk of MITC to marine/estuarine organisms; however, it is assumed that the toxic response would be similar to that of freshwater aquatic species. Under the scenarios modeled, it is assumed that MITC reaches surface water via runoff and/or leaching. Based on this assumption, the RQs calculated from the predicted PRZM/EXAMS EECs (Table III.e.) do not exceed any LOCs for freshwater fish and invertebrates (Table IV.d). As described earlier, there are some uncertainties related to PRZM/EXAMS modeling of volatile chemicals. Therefore, the estimated concentrations of MITC in surface water may be upper bound, and consequently the calculated RQs may also be upper bound. Due to insufficient toxicity data, chronic risk to fish remains an uncertainty.

A study (Haendel, et al. 2004) examines the developmental toxicity of both metam sodium and MITC in the zebrafish (*Danio rerio*). The LOAEL for both notochord defects and decreased hatching rate is reported to be 29 ppb for MITC. This is above the EFED peak aquatic EEC of 1.08 ppb for California strawberries, and even further above longer-term EECs. Nevertheless, and although not an OPP guideline study, this study raises potentially serious concerns about the developmental toxicity of MITC. It adds further weight to the identified need for fish early life-stage testing of MITC under USEPA test guidelines.

b. Aquatic Plants

LOCs for aquatic plants are not exceeded based on available data, but additional toxicity data with MITC are needed to complete this assessment.

2. Risks to Terrestrial Organisms

Terrestrial exposure to birds, mammals and terrestrial invertebrates could occur orally as dazomet granules and/or by inhalation of MITC. Agricultural fields, forests, and terrestrial and aquatic

environments adjacent to treated crop areas may provide suitable habitat for numerous species of birds, mammals, and plants. Risk was evaluated for direct effects to these organisms from dazomet and/or MITC through ground deposition, volatilization and/or wind dispersion, and leaching/surface runoff and for indirect effects to forests, wetlands, edge and riparian habitats.

a. Terrestrial Animals

Risk quotients for birds and mammals from exposure to granular dazomet are shown in the Risk Estimation section above. Since the granules are applied to bare ground and foliar residues are not expected, an LD_{50}s/square foot analysis is conducted by EFED. Results indicate that both birds and mammals may be exposed to a sufficient amount of granules to exceed Levels of Concern (acute endangered species, acute restricted use, and acute risk). The calculations assume 15% of granules could be exposed from a broadcast incorporated use and that individual birds and mammals could consume or be exposed via other routes (e.g., dermal) to the amount found in a square foot. In the case of dazomet, substantial irrigation to move the pesticide into the soil, convert the dazomet to MITC, and create a water seal to prevent or slow the upward movement of MITC gas may also reduce exposure of wildlife to the dazomet granules.

While acceptable studies are available to assess the acute oral risk of dazomet to avian species, reproduction studies with the bobwhite quail and mallard are considered supplemental and not adequate for quantitative risk assessment. Nevertheless, substantial effects were seen, particularly in the mallard study. Neither study is able to provide an overall NOAEL/LOAEL needed for risk assessment. However, based on the proposed ground application of dazomet and its rapid degradation to MITC, chronic exposure of birds to dazomet is not expected. Nevertheless, reproductive effects from short-term exposure are still possible and new reproduction studies are needed for risk assessment.

EFED's second major concern with dazomet is the transformation to MITC, which is highly volatile and can off-gas from treated fields and potentially expose a range of nontarget terrestrial organisms as it moves and dissipates. In the Analysis section above, EFED used the screening-level LD50/ft^2 method strictly as a preliminary step to see whether a focused inhalation analysis is appropriate. If equivalent LOCs were not exceeded in this preliminary step that assumes exposure to the entire quantity of MITC from a square foot at once, there would likely not be a need for a refined analysis. However, based on the mammal acute inhalation data, equivalent LOCs are far exceeded. Thus, risk quotients are then calculated based on the modeled air residues (ISCST3). EFED in the past has not typically conducted inhalation analyses and does not have established LOCs based on inhalation (existing acute LOCs for terrestrial wildlife use acute oral or dietary data).

As indicated in the Risk Estimation section, it appears that equivalent acute risk quotients for inhalation would not be exceeded based on edge of the field (0 meter) air residues for a 40-acre field. The model calculation does not specifically produce on-field, ground surface level air residues. Also, residues (and risks) may be greater if multiple fields in an area are treated at the same time. The uncertainty level in these analyses can be reduced with submission of ground-level monitoring data (e.g., 3 inches) both within-field and edge-of-field, for maximum application rates and standard seal application methods.

The above assessment is limited to acute effects and exposure windows. Wild mammals may have home ranges in the treatment area and may be exposed continuously and/or repeatedly as the result of dazomet use on multiple fields over multiple days in any geographic area. The rat 28-day inhalation NOAEL for MITC is 20 µg/L, lower than the acute inhalation endpoint. The maximum modeled acute air residue of 2230 µg/m^3 is equivalent to 2.23 µg/L, roughly 10X lower than the 28-day NOAEL. Thus, air residues from single fields treated sequentially over time may not be enough to exceed effect levels. However, multiple fields on multiple days may produce higher residues and risk. Longer-term air monitoring (e.g., 28 days) of MITC in areas of widespread dazomet use would reduce the uncertainty of this rough estimate.

The above analysis is based on mammalian toxicity data for the inhalation route. A similar analysis could be performed for birds, if the necessary data were available. However, no inhalation toxicity data for MITC are available for birds. If acute toxicity by the oral route were available for both mammals and birds, an evaluation of the relative sensitivity via the oral route might be extrapolated to the inhalation route to estimate an acute inhalation endpoint for birds. However, no acute oral toxicity data for MITC are available for birds. Therefore, EFED is limited to an assumption of equivalent sensitivity between birds and mammals for MITC exposure through inhalation. EFED feels that such an extrapolation may not be protective, given physiological differences in the avian lung that would tend to favor higher diffusion rates across the lung membrane when compared to mammals. Therefore, inhalation analyses that suggest a potential for adverse effects in mammals would also suggest potential risks to birds via the inhalation route, but analyses not indicating risk to wild mammals would not necessarily be true for birds also.

Although birds are mobile and some may only have a very brief exposure flying by, others may have territories or nests in the area and be exposed more substantially and/or repeatedly. Repeat exposures can occur since dazomet may be applied to different fields in a given geographic area on different days. The uncertainty level can be reduced with this screening-level analysis by submission of avian toxicity data, in addition to the above-cited ground-level monitoring data. HED has indicated previously in a draft HIARC report (in relation to MITC from metam sodium) that a chronic mammal inhalation study (developmental neurotoxicity study) with MITC is needed. A sub-chronic/chronic avian inhalation study will enable EFED to address longer-term exposure to birds as well.

EFED does not currently calculate RQs for non-target insects. An acute contact study (ID #00001999) that included dazomet indicates an LD_{50} >24 µg ai/bee, indicating that it is relatively non-toxic to honey bees. Further, substantial exposure of honey bees is not expected since dazomet is applied to bare soil and not by foliar application. However, MITC is highly toxic and results in the disruption of biological functions of soil organisms; consequently, any non-target insect in the treated soil would likely be at high risk of mortality from exposure to the degradate MITC.

b. Terrestrial and Semi-aquatic Plants

Based on the labeled phytotoxicity of MITC on the treated fields, it is expected that non-target plants off-site may also be a risk from off-gassed MITC. Terrestrial plant guideline toxicity data are needed to evaluate this risk.

3. Review of Incident Data

FIFRA 6(a)(2) incident data add lines of evidence to provide evidence that the risk predictions from the screening level assessment are substantiated with actual effects in the field. Incident reports submitted to EPA since approximately 1994 have been tracked by assignment of EIIS (Environmental Incident Information System) in an Incident Data System (IDS). Fish, crawfish and migratory eels were reportedly killed in a 2001 incident at a Virginia golf course, when heavy rains followed a dazomet application (I012014-003). Similar exposure and effects could potentially occur with application to agricultural fields. Another fish kill involving dazomet occurred in 1993 in North Carolina in an agricultural setting. Granules were reportedly not disced in, and rain followed (I003654-002). Another incident in Pennsylvania (I014993-001) involved an overturned truck and both fish and invertebrates were reported killed. Although the second incident above appears to have been a misapplication (failure to incorporate the granules), both the first and second incidents show the potential for field applied dazomet to cause fish and/or aquatic invertebrate kills if rain transports the material to water bodies. Based on EFED modeling, the agent that probably killed the aquatic organisms is MITC.

Additionally, there have been reported incidents with metam sodium where it was claimed that off-gassed MITC entered the air intake for fish farm aeration systems and killed fish. A similar potential for risk would likely be present for dazomet, since it is also an MITC generator.

4. Endocrine Effects

Under the Federal Food, Drug and Cosmetic Act (FFDCA), as amended by the Food Quality Protection Act (FQPA), EPA is required to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) "may have an effect in humans that is similar to an effect produced by a naturally-occurring estrogen, or other such endocrine effects as the Administrator may designate." Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there was scientific basis for including, as part of the program, the androgen- and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC's recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use FIFRA, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, and the FFDCA authority to require the wildlife evaluations. As the science develops and the resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP). Reproductive effects have been seen in some available reproduction studies with dazomet and/or MITC.

5. Threatened and Endangered Species Concerns

a. Action Area

For listed species assessment purposes, the action area is considered to be the area affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. At the initial screening-level, the risk assessment considers broadly described taxonomic groups and so conservatively assumes that listed species within those broad groups are collocated 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 II.A.4 of this risk assessment presents the pesticide use sites that are employed to establish initial location of species with treatment areas.

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 may be made with respect to listed species in that taxa (for direct effects), and no further refinement of the action area is necessary (assumptions include a complete data set for that taxa). Furthermore, RQs below the listed species LOCs for a given taxonomic group indicate no concern for indirect effects upon listed species that depend upon the taxonomic group covered by the RQ as a resource. 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 could be considered along with available information on the fate and transport properties of the pesticide to determine the extent to which screening assumptions regarding an action area apply to a particular listed organism. These subsequent refinement steps could consider how this information would impact the action area for a particular listed organism and may potentially include areas of exposure that are downwind and downstream of the pesticide use site.

b. Taxonomic Groups Potentially at Risk

1. Discussion of Risk Quotients

The preliminary risk assessment for endangered species indicates that under the application scenarios evaluated, potential exposure to dazomet or MITC resulted in RQs that exceed the Endangered Species LOCs for the following taxonomic groups:

- birds (also used as a surrogate for reptiles and terrestrial phase amphibians) -- dazomet
- mammals -- dazomet

In addition to these taxonomic groups, it is assumed that dazomet and/or MITC may pose a direct risk to terrestrial and semi-aquatic plants as well as terrestrial invertebrates (e.g., insects), due to the broad spectrum of target organisms that this fumigant is intended to control. Based on incident data, fish and other aquatic organisms may also be at risk. Should estimated exposure levels occur in proximity to listed resources, the available screening level information suggests a potential concern for direct effects on listed species within these taxonomic groups listed above associated with the use of dazomet as described in Section II.A.4.

2. Probit Dose Response Relationship

An analysis has been conducted of the probability of individual mortality at an LOC of 0.1, the acute endangered species LOC for terrestrial wildlife. It is recognized that extrapolation of very low probability events is associated with considerable uncertainty in the resulting estimates. The analysis uses the EFED spreadsheet IECv1.1.xls, developed by EFED (USEPA, 2004).

For birds, a bobwhite quail LD_{50} of 424 mg/kg (MRID 423651) is used for the assessment of acute risk from exposure to dazomet granules. A probit slope (6.7) and 95% confidence interval (-3.7 - 17.2), rounded off, are provided in the DER for the data set (although not used, as noted below). Based on these inputs and an assumption of a probit dose response relationship, the IEC spreadsheet indicates an estimated chance of individual mortality associated with the listed species LOC of 0.1, the acute toxic endpoint for birds, of approximately one in 9.54E+10. To explore possible bounds to this estimate, the upper and lower values for the mean slope estimate were used to calculate upper and lower estimates of the effects probability associated with the listed species LOC. These values are approximately one in 1.00E+00 and one in 1.00E+16 (10^{16}, default limit of Excel reporting).

However, it should be noted that the moving average (and not the probit method) was selected in the DER for the statistical analysis, due to a poor goodness of fit probability with the probit method. Thus, although the Agency has assumed a probit dose response relationship in establishing the listed species LOCs, the available data for the toxicity study generating RQs for this taxonomic group do not statistically support a probit dose response relationship ($p < 0.05$) and so the confidence in estimated event probabilities based on this dose response relationship and the listed species LOC is low.

An analysis has been conducted of the probability of individual mortality at an LOC of 0.05, the acute endangered species LOC for aquatic animals. It is recognized that extrapolation of very low probability events is associated with considerable uncertainty in the resulting estimates. The analysis uses the EFED spreadsheet IECv1.1.xls, developed by EFED (USEPA, 2004).

For fish, an LC50 of 51.2 ppb (MRID 45919420) is used to evaluate the risk of acute exposure to MITC resulting from dazomet use. However, no probit analysis is included in the DER, and thus probit slope and confidence interval information for the slope were not available. A check of the dose response shows only one partial mortality (i.e., % mortality > 0 and <100) across test concentrations at 96 hours. Since probit results are not possible with only one partial mortality, a default slope of 4.5 and confidence interval of 2 to 9 are used for the individual mortality

probability analysis. Based on an assumption of a probit dose response relationship with a mean estimated slope of 4.5, the corresponding estimated chance of individual mortality associated with the listed species LOC of 0.05, the acute toxic endpoint for aquatic animals, is approximately one in 4.17E+08. To explore possible bounds to such estimates, the upper and lower values for the mean slope estimate (2 - 9) were used to calculate upper and lower estimates of the effects probability associated with the listed species LOC. These values are approximately one in 2.16E+02 and one in 1.00E+16 (10^{16}, default limit of Excel reporting).

c. Data Related to Under-represented Taxa

No data are currently available in EFED that would indicate that taxa under-represented among those used for risk quotient calculations are more sensitive to dazomet and/or MITC.

d. Implications of Sublethal Effects

Chronic studies are available for freshwater invertebrates and mammals; however, the calculated RQs for these taxa do not exceed Chronic LOCs. Chronic studies (avian reproduction) are also available for birds, but are not adequate for quantitative analysis, as discussed earlier. Chronic studies are not available for freshwater fish, marine/estuarine fish, or marine/estuarine invertebrates.

e. Indirect Effects Analysis

Pesticides have the potential to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, and creating gaps in the food chain. In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle. Species specific concerns for dazomet indirect effects to listed organisms will require a determination of the coincidence of dazomet use with locations of listed species and the biologically based resources upon which they depend.

Based on the proposed usage of dazomet the screening level risk assessment shows that there is a concern for indirect effects to listed species that may depend upon other taxonomic group for their survival. As described above, acute RQs for birds and mammals exceed endangered species LOCs (and birds are surrogates for reptiles and terrestrial-phase amphibians). Although aquatic LOCs are not exceeded based on current modeling, additional toxicity data are requested for risk assessment. Also, fish and aquatic invertebrate mortality incidents have been attributed to dazomet/MITC. Thus, there appears to be a potential for direct adverse effects to aquatic life (including aquatic-phase amphibians). It is assumed (e.g., based on label language and broad spectrum use of dazomet) that plants and many terrestrial invertebrates could also be harmed by exposure to dazomet and/or MITC. Therefore, the nature of the toxicological endpoint, Services-provided "species profiles", and further evaluation of the geographical and temporal nature of the exposure will need to be considered. Indirect effects analyses for organisms that depend on birds, mammals, fish and aquatic invertebrates, plants, and/or terrestrial invertebrates as a critical component of their resource needs are described in further detail below.

Birds - Acute endangered species LOCs were exceeded for birds based on dazomet use patterns and application rates. Therefore the potential exists for adverse effects on those listed species that eat or otherwise depend on birds (or reptiles or terrestrial-phase amphibians). For example, some listed plants may require birds as pollinators or seed dispersers.

Mammals - Acute endangered species LOCs were exceeded for mammals based on dazomet use patterns and application rates. Therefore the potential exists for adverse effects on those listed species that eat or otherwise depend on mammals (e.g., plants that require mammals as pollinators or seed dispersers).

Fish and Aquatic Invertebrates – Although aquatic LOCs are not exceeded based on current modeling, additional toxicity data are requested for risk assessment. Also, fish and aquatic invertebrate mortality incidents have been attributed to dazomet/MITC. Thus, there appears to be a potential for direct adverse effects to aquatic life (including aquatic-phase amphibians). In turn, there would be a potential for some risk of indirect effects to any listed species that consume or otherwise depend on fish and/or aquatic invertebrates (freshwater or marine/estuarine) and/or aquatic-phase amphibians.

Plants and Terrestrial Invertebrates - It is assumed (e.g., based on label language and broad spectrum use of dazomet) that plants and many terrestrial invertebrates could be harmed by exposure to dazomet and/or MITC. There is therefore some potential for adverse effects on those listed species that depend on these taxonomic groups. Additional guideline terrestrial and aquatic plant data described earlier will enable EFED to be more specific about the potential indirect effect on listed species from effects to plants.

f. Critical Habitat

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

The screening-level risk assessment has identified potential concerns for indirect effects on listed species for those organisms dependant upon birds and mammals, based on specific LOC exceedances for acute effects to listed species. In addition, potential concerns for indirect effects on listed species for those organisms dependant upon fish and aquatic invertebrates, plants, terrestrial invertebrates, reptiles, and amphibians were also identified based on certain assumed toxicities (see section e. Indirect Effects, above). In light of the potential for indirect effects, the next step for EPA and the Service(s) is to identify which listed species and critical habitat are potentially implicated. Analytically, the identification of such species and critical habitat can

occur in either of two ways. First, the agencies could determine whether the action area overlaps critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential impacts on non-endangered species would affect the listed species indirectly or directly affect a constituent element of the critical habitat. Alternatively, the agencies could determine which listed species depend on biological resources, or have constituent elements that fall into, the taxa that may be directly or indirectly impacted by the pesticide. Then EPA would determine whether use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA does not permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that is potentially impacted directly by the use of the pesticide. EPA and the Service(s) are working together to conduct the necessary analysis.

g. Co-occurrence Analysis

Because of the potential for direct and/or indirect effects to all taxonomic groups from the use of dazomet (see above discussions), the LOCATES program was run for all taxonomic groups. Since turf and ornamentals could be located in any county, it was run for all counties. For birds and mammals both the Acute Risk LOCs for non-endangered species and the Endangered Species LOCs for dazomet were exceeded; consequently a potential concern arises for species with both narrow (i.e., species that are obligates or have very specific habitat or feeding requirements) and general dependencies (i.e., cover type requirements). Information from LOCATES is provided in Appendix G. Potential indirect effects could include, for example, effects upon predatory or scavenger birds and mammals that might consume other species that consumed granules directly; and effects upon plants that require birds and/or mammals for pollination or seed dispersal. See the above section on indirect effects for additional details.

This is a screening assessment only. LOCATES identifies those federally-listed species that are located in the same county as the identified crop is located. While LOCATES includes tomatoes and strawberries (and many other crops), it does not include all use sites that could be included under turf and ornamental use patterns. Turf and ornamentals could potentially occur in any county in the country. Thus, it is not possible for this initial screen to narrow the county list for these use patterns. Rather, all counties with listed species in the taxonomic categories potentially affected either directly or indirectly have a potential for listed species impacts. A refined assessment will be needed to determine which species are actually located in sufficiently close proximity to the potential treatment sites that they could be potentially exposed. This is true for both the crop and non-crop use patterns of dazomet.

The registrant must provide information on the proximity of all federally listed species to the dazomet use sites. This requirement may be satisfied in one of three ways: 1) having membership in the FIFRA Endangered Species Task Force (Pesticide Registration [PR] Notice 2000-2); 2) citing FIFRA Endangered Species Task Force data; or 3) independently producing these data, provided the information is of sufficient quality to meet FIFRA requirements. The information will be used by the OPP Endangered Species Protection Program to develop recommendations to avoid adverse effects to listed species.

h. Summary Table

Table IV k. Listed species risks associated with direct or indirect effects due to applications of dazomet to one or more use sites (based on dazomet and/or MITC exposure), if organisms in listed taxa are exposed (direct effects) or are dependent on other organisms that are exposed (indirect effects). Risks are based on available data (and/or assumptions based on target organisms of dazomet). Aquatic assessment is based on MITC. See text for additional details. Requested data may result in additional potential direct effects.

Listed Taxon	Direct Effects	Indirect Effects[6]
Terrestrial and semi-aquatic plants - monocots	**Yes**[1]	**Yes**
Terrestrial and semi-aquatic plants – dicots	**Yes**[1]	**Yes**
Terrestrial Invertebrates	**Yes**[1]	**Yes**
Birds	**Acute (Additional chronic data needed)**	**Yes**
Terrestrial phase amphibians[2]	**Acute (Additional chronic data needed)**	**Yes**
Reptiles[2]	**Acute (Additional chronic data needed)**	**Yes**
Mammals	**Acute (Additional chronic data needed)**	**Yes**
Aquatic non-vascular plants*	**Yes**[1,3]	**Yes**
Aquatic vascular plants	**Yes**[1,3]	**Yes**
Freshwater fish	**(No chronic data)**	**Yes**
Aquatic phase amphibians[4]	**(No chronic data)**	**Yes**
Freshwater crustaceans	**(Additional chronic data needed[5])**	**Yes**
Mollusks	**(No acute or chronic data)**	**Yes**
Marine/estuarine fish	**(No acute or chronic data)**	**Yes**
Marine/estuarine crustaceans	**(No acute or chronic data)**	**Yes**

* At the present time no aquatic non-vascular plants are included in Federal listings of threatened and endangered species. The taxonomic group is included here for the purposes of evaluating potential contributions to indirect

effects to other taxa and as a record of exceedances should future listings of non-vascular aquatic plants warrant additional evaluation of Federal actions.

[1]Acute toxicity to nontarget plants and insects is assumed, based on target organisms of dazomet.

[2]Risk assessment is based on avian assessment.

[3]Based on available data, LOC not exceeded; however, additional data are needed for risk assessment.

[4]Risk assessment is based on freshwater fish assessment.

[5]Based on available data, the chronic LOC is not exceeded; however, additional data are needed for risk assessment.

[6]Indirect effects are considered possible for every taxonomic group when one or more direct effect LOCs are met/exceeded. Listed species could be affected by the loss of other species that they depend on for food, cover, and/or reproduction (e.g., pollination, seed dispersal). This is only a screening assessment. A refined assessment will consider the specifics of the food, cover, and reproduction needs of each listed species.

C. Description of Assumptions, Limitations, Uncertainties, Strengths, and Data Gaps

1. Uncertainties, Assumptions, and Limitations Associated with Models

Extrapolating the risk conclusions from the standard pond scenario modeled by PRZM/EXAMS may either underestimate or overestimate the potential risks. Major uncertainties with the standard runoff scenario are associated with the physical construct of the watershed and representation of vulnerable aquatic environments for different geographic regions. The physicochemical properties (pH, redox conditions, etc.) of the standard farm pond are based on a Georgia farm pond. These properties are likely to be regionally specific because of local hydrogeological conditions. Any alteration in water quality parameters may impact the environmental behavior of the pesticide. The farm pond represents a well mixed, static water body. Because the farm pond is a static water body (no flow-through), it does not account for pesticide removal through flow through or accidental water releases. However, the lack of water flow in the farm pond provides an environmental condition for accumulation of persistent pesticides. The assumption of uniform mixing does not account for stratification due to thermoclines (e.g., seasonal stratification in deep water bodies). Additionally, the physical construct of the standard runoff scenario assumes a watershed:pond area ratio of 10. This ratio is recommended to maintain a sustainable pond in the Southeastern United States. The use of higher watershed:pond ratios (as recommended for sustainable ponds in drier regions of the United States) may lead to higher pesticide concentrations when compared to the standard watershed:pond ratio.

The standard pond scenario assumes that uniform environmental and management conditions exist over the standard 10 hectare watershed. Soils can vary substantially across even small areas, and thus, this variation is not reflected in the model simulations. Additionally, the impact of unique soil characteristics (e.g., fragipan) and soil management practices (e.g., tile drainage) are not considered in the standard runoff scenario. The assumption of uniform site and management conditions is not expected to represent some site-specific conditions. Extrapolating the risk conclusions from the standard pond scenario to other aquatic habitats (e.g., marshes, streams,

creeks, and shallow rivers, intermittent aquatic areas) may either underestimate or overestimate the potential risks in those habitats.

2. Uncertainties, Assumptions, and Limitations Associated with the Toxicity Data

There are a number of areas of uncertainty in the terrestrial and the aquatic organism risk assessments that could potentially cause an underestimation of risk. Use of toxicity data on representative species does not provide information on the potential variability in susceptibility to acute and chronic exposures. For screening terrestrial risk assessments, a generic bird or mammal is assumed to occupy either the treated field or adjacent areas receiving the pesticide at a rate commensurate with the treatment rate on the field. The actual habitat requirements of any particular terrestrial species are not considered, and it is assumed that species occupy, exclusively and permanently, the treated area being modeled. This assumption leads to a maximum level of exposure in the risk assessment. Second, for the aquatic organism risk assessment, there are uncertainties associated with the PRZM/EXAMS model, input values, and scenarios including the use of surrogate scenarios; however these uncertainties cannot be quantified. The potential impacts of these uncertainties are outlined in the Aquatic Exposure and Risk Assessment and the Terrestrial Exposure and Risk Assessment sections of this document.

Although the screening risk assessment relies on a selected toxicity endpoint from the most sensitive species tested, it does not necessarily mean that the selected toxicity endpoints reflect sensitivity of the most sensitive species existing in a given environment. The relative position of the most sensitive species tested in the distribution of all possible species is a function of the overall variability among species to a particular chemical. In the case of listed species, there is uncertainty regarding the relationship of the listed species' sensitivity and the most sensitive species tested. Surrogates were used to predict potential risks for species with no data (i.e., reptiles and amphibians). It was assumed that the use of surrogate effects data is sufficiently conservative to apply the broad of species within taxonomic groups. If other species are more or less sensitive to dazomet/MITC than the surrogates, risks may be under- or overestimated, respectively.

3. Uncertainties and Assumptions Associated with Gaps in Fate and Toxicity Data

Additional uncertainty results from the lack of information and/or data concerning the fate and dissipation of dazomet and MITC in environmental compartments. Field dissipation rates for dazomet are needed for surface application as well as for incorporation of dazomet in soil. Likewise, dissipation information is needed for both tarped and untarped conditions after soil application. Although it is known that the primary degradation product of dazomet is the volatile compound MITC, the rate of MITC formation after dazomet application in field conditions has not been well defined. Based on current fate information which indicates that abiotic degradation is rapid and a single application per year, this screening risk assessment assumed that chronic exposure of birds and mammals to dazomet would not be expected; consequently, chronic (developmental/reproductive) risk to birds and mammals from oral exposure to granular dazomet was not assessed. Also, chronic exposure is usually assessed based on exposure to foliar residues, not granules. Nevertheless, acceptable avian reproduction studies may help the Agency determine whether even short-term exposure to dazomet granules may have a potential reproductive effect.

No toxicity studies were submitted to determine the effects of dazomet or MITC to terrestrial plants; however, it is known that dazomet is highly toxic to all plants. In addition, field studies are not available to determine the potential adverse impacts to edge and riparian habitats from drift and surface runoff/leaching of MITC.

There are no monitoring studies for MITC in groundwater or surface water; therefore, the exposure of aquatic species is based entirely on the modeled data. Surface water monitoring data would be useful in order to determine how well the modeled results fit measured levels of MITC in aquatic environments following its application to crops at appropriate rates. While acceptable studies are available to assess the acute toxicity of MITC to freshwater fish and invertebrates, toxicity data are not available to determine the potential chronic toxicity of MITC to freshwater fish. In addition, no acute or chronic toxicity data are available to determine the risk of MITC to marine/estuarine fish and invertebrates. Risk to these organisms was estimated based on the assumption that freshwater and marine/estuarine organisms are of equal sensitivity.

Since no inhalation or oral toxicity data are available for exposure of birds to MITC, an evaluation of relative sensitivity based on extrapolation from one exposure route to another cannot be performed. Consequently, avian inhalation risk was evaluated by assuming an equivalent sensitivity between birds and mammals. The sensitivity between birds and mammals may not be equivalent due to physiological differences (higher respiration rates and higher diffusion rates across the lung membrane in birds) that could result in higher exposures to birds. In addition, the Agency has not established level of concern thresholds for the interpretation of RQs calculated for inhalation exposures. Consequently, in this screening risk assessment, the same LOCs values used for wild mammal risk based on acute oral or dietary exposure were used to evaluate the RQs derived for acute inhalation exposures.

The screening assessment does not consider dermal exposure through contact with contaminated water or soil. Data which address dermal exposure of wildlife to pesticides in a quantitative fashion are extremely limited. The Agency is actively pursuing modeling techniques to account for dermal exposure via direct application and by incidental contact.

V. ACKNOWLEDGMENT

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VII. APPENDICES

Appendix A. Data Requirement Tables for Dazomet and MITC

Table A1-(A). Environmental Fate Data Requirements for Dazomet and MITC

Guide-line #	Data Requirement	Are Additional Data Needed for Risk Assessment?	MRID #s	Study Classification
161-1	**Hydrolysis**	**No**	**45908301 42111401 41479903**	**A S S**
161-2	**Photodegradation in Water**	**No**	**41479901 42111402**	**A A**
161-3	**Photodegradation on Soil**	**No**	**43172501**	**A**
161-4	**Photodegradation in Air (dazomet) (MITC)**	**No Reserved**	**N/A N/A**	**N/A N/A**
162-1	**Aerobic Soil Metabolism**	**No**	**40211901 42111403 46084701**	**A A S**
162-2	**Anaerobic Soil Metabolism**	**No**	**N/A**	**N/A**
162-3	**Anaerobic Aquatic Metabolism**	**No**	**43596501**	**A**
162-4	**Aerobic Aquatic Metabolism**	**No**	**N/A**	**N/A**
163-1	**Leaching- Adsorption/Desorption**	**No**	**42569201**	**A**
163-2	**Laboratory Volatility**	**No**	**42569202**	**A**
163-3	**Field Volatility**	**Yes**	**46340401**	**A**
164-1	**Terrestrial Field Dissipation**	**No**	**46084702 41874801 41874802**	**S S S**
164-2	**Aquatic Field Dissipation**	**No**	**N/A**	**W**
165-4	**Accumulation in Fish**	**No**	**N/A**	**W**
166-1	**Ground Water- small scale prospective**	**No**	**44641601**	**S**

A=Acceptable; N/A=Not Applicable; NA=Not Available; S=Supplemental; U=Unnaceptable; W=Waived

Table A1(B). Ecological Effects Data Requirements for: Dazomet (including MITC, as indicated)

Guideline #	Data Requirement	Are Additional Data Needed for Risk Assessment?	MRID #s	Study Classification
71-1(a)	Avian Acute Oral	N	42365101	A
71-1(a)	Avian Acute Oral (MITC)	Y	----------	N/A
-----	Avian Acute Inhalation (MITC)	Y	----------	N/A
71-2(a)	Avian Dietary–quail	N	42365102 (resub. of 131918, w/ added info.)	S
71-2(b)	Avian Dietary–mallard	N	41596901	A
--------	Avian Subchronic/Chronic Inhalation (MITC)	Y (reserved)	----------	N/A
71-4(a)	Avian Reproduction – quail	Y	43245002	S
71-4(b)	Avian Reproduction – mallard	Y	43245001	S
72-1(a)	Fish Acute Toxicity–bluegill (MITC)	N	44523412 = 42058002	A
72-1(b)	Fish Acute Toxicity–rainbow trout (MITC)	N	44523413 =42058002 45919420	A S
72-2(a)	Aquatic Invertebrate Acute Toxicity–freshwater (MITC)	N	41819302 45919419	A S
72-3(a)	Marine/Estuarine Acute Toxicity–Fish (MITC)	Y	----------	N/A
72-3(b)	Marine/Estuarine Acute Toxicity–Mollusk (shell deposition) (MITC)	Y	----------	N/A
72-3(c)	Marine/Estuarine Acute Toxicity–Shrimp (MITC)	Y	----------	N/A
72-4(a)	Fish Early Life Stage–freshwater (MITC)	Y	----------	N/A
72-4(a)	Fish Early Life Stage–marine/estuarine (MITC)	Y (study reserved)	----------	N/A
72-4(b)	Aquatic Invertebrate Life Cycle–freshwater (MITC)	Y	45634001	S
72-5	Fish Life Cycle (MITC)	Y (study reserved)	----------	N/A
123-1(a)	Seedling Emergence–Tier II (MITC)	Y	----------	N/A

Table A1(B). Ecological Effects Data Requirements for: Dazomet (including MITC, as indicated)

Guideline #	Data Requirement	Are Additional Data Needed for Risk Assessment?	MRID #s	Study Classification
123-1(b)	Vegetative Vigor–Tier II (MITC)	Y	----------	N/A
123-2	Aquatic Plant Growth – Tier II (MITC)	Y	45919421 45919422 45919416 44588903	A S S S
141-1	Honeybee Acute Contact	N	00001999	A

A=Acceptable (Core); S=Supplemental; U=Unacceptable; W=Waived; N/A=Not Applicable; NA=Not Available; Inv.=Invalid; R=Potentially Repairable

Appendix B. Environmental Fate Studies

Hydrolysis (161-1, MRID 45908301, Study Status: Acceptable).
The hydrolysis of [2-^{14}C]3,5-dimethyl-1,3,5-thiadiazinane-2-thione (dazomet; BAS 002 N), at 10.6-11.7 mg a.i./L), was studied under unspecified lighting conditions at 25□C for 30 days in sterile aqueous pH 4 (citrate), pH 5 (citrate), pH 7 (phosphate), and pH 9 (borate) 0.1M buffer solutions. In all four buffer solutions, dazomet dissipated with an observed DT50 of 9 hours and was generally not detected at and after 48 hours. Methylisothiocyanate (MITC; Rt 16.2 minutes) was a major transient transformation product in all pH buffer solutions. Carbon disulfide (CS_2; Rt 23.1 minutes) was a major transient transformation product in pH 4 and pH 7 buffer solutions and a minor product in pH 5 and pH 9 buffer solutions. (Methylamino)(thioxo) methanesulfenic acid or hydroxymethyldithiocarbamic acid (isomers) (Rt 10.8-10.9 minutes), (Methylamino)(thioxo)methanethiosulfenic acid or [1,2,4]dithiazolidine-3-thione (Rt 20.8-21 and 21.9-22 minutes), and N,N'-dimethylthiourea (and/or S_n-homologues) and CO_2 (Rt 6.7-6.8 minutes) were major transient transformation products in pH 7 and pH 9 buffer solutions and minor products in pH 4 and pH 5 buffer solutions. N,N'-Dimethylurea (Rt 5.6-5.7 minutes) was a minor transformation product in the pH 7 and pH 9 buffer solutions. Unidentified minor HPLC peaks totaled 4.2% of the applied in all pH buffer solutions.

Three dazomet degradation pathways designated A, B and C were proposed by the study author (see hydrolysis degradation products and pathways at the end of the fate summaries). In degradation pathway A, dazomet combined with SH_2 to produce [1,2,4]dithiazolidine-3-thione and (methylamino)(thioxo)methanethiosulfenic acid. [1,2,4]Dithiazolidine-3-thione and (methylamino)(thioxo)methanethiosulfenic acid degraded to MITC through the loss of S_nH_2. MITC either combined with SH_2 to produce N,N'-dimethylthiourea or combined with S_nH_2 to produce S_n-homologues of N,N'-dimethylthiourea. N,N'-Dimethylthiourea degraded to N,N'-dimethylurea. In degradation pathway B, dazomet degraded with a ring opening to an intermediate compound (not isolated) which then degraded to MITC either directly by loss of SH_2 or indirectly by two sequential oxidations to (methylamino)(thioxo)methanesulfenic acid (or hydroxymethyldithiocarbamic acid) and a further oxidized intermediate compound (not isolated). The oxidized intermediate compound degraded to MITC via loss of SO_2 and water. MITC degraded in the manner described in degradation pathway A. In degradation pathway C, dazomet degraded directly to volatiles (carbon disulfide, methyl amine, formaldehyde, SH_2, and S_nH_2) after combining with O_2 and water.

Hydrolysis Results

25°C	Half-life	Major transformation products
pH 4	6.75 hours	Methylisothiocyanate; Carbon disulfide.
pH 5	4.29 hours	Methylisothiocyanate.

pH 7	4.39 hours	Methylisothiocyanate; Carbon disulfide; N,N'-dimethylthiourea (and/or S_n-homologues); (Methylamino)(thioxo)methanesulfenic acid or hydroxymethyldithiocarbamic acid (isomer); (Methylamino)(thioxo)methanethiosulfenic acid or [1,2,4]dithiazolidine-3-thione CO_2.
pH 9	2.35 hours	Methylisothiocyanate; N,N'-dimethylthiourea (and/or S_n-homologues); (Methylamino)(thioxo)methanesulfenic acid or hydroxymethyldithiocarbamic acid (isomer); (Methylamino)(thioxo)methanethiosulfenic acid or [1,2,4]dithiazolidine-3-thione CO_2.

Photodegradation in Water (161-2, MRIDs 41479901 and 42111402, Study Status: Acceptable)

Radiolabeled dazomet had a half-life of 3.98 hours (-0.1742 hours^{-1}) in irradiated, pH 5 buffer solution. Dazomet had a half-life of 8.82 hours in a dark control buffer solution at pH 5. The corrected photodegradation half-life of dazomet could not be calculated because of rapid dazomet degradation in irradiated and dark control treatments. The major transformation product identified was MITC.

Photodegradation on Soil (161-3, MRID 43172501, Study Status: Acceptable)
Radiolabeled dazomet at 54.7 mg a.i./ft^2 was amended with soil collected from the A horizon in an agricultural field located in Madison, KY. The soil is classified as coarse-loamy, mixed, non-acid, mesic, Typic Udifuvents and was passed through a 2 mm sieve. After sieving, the soil was added to irradiation test vessels where it was amended with dazomet. Test vessels were exposed to continuous Xenon light for 8 and 24 hours. The dissipation half-life for dazomet in irradiated and dark controls ranged from 9 to 10 days. There was no noted difference in dissipation rates between the irradiated and dark controls. The reported data suggest dazomet does not photodegrade on soil surfaces. The main transformation product in ethyl acetate gas traps from both the irradiated and dark controls was MITC as confirmed by GC and HPLC.

Photodegradation in Air (161-4)
There is no photodegradation in air study for dazomet; however, dazomet rapidly degrades (< 4 hours) when applied to soil generating MITC, a volatile biocidal active product. Once MITC volatilizes into the atmosphere, it undergoes direct photolysis. Geddes et al. (1995) estimated the half-live of MITC in atmosphere ranged from 29 to 39 hours. Alvarez and Moore (1994) calculated a photolysis half-life of 39 hours for noontime condition of mid summer at 40□ N latitude. Several metabolites were identified that included methyl isocyanate (MIC), methyl isocyanide, sulfur dioxide, hydrogen sulfide, carbonyl sulfur, N-methylthioformamide, and

methylamine (Geddes et al.,1995). They also reported that 7% of MITC can potentially degrade to MIC. MIC is known to be very reactive and can be acutely toxic to terrestrial animals. In California, ambient air concentrations of MIC were monitored following a ground injection of metam sodium and reported concentrations were 0.09 to 2.5 ppb (0.2-5.8 mg/m^3) in the first 72 hours (ARB, 1997).

Aerobic Soil Metabolism (162-1)

MRIDs 40211901 and 42111403), Study Status: Acceptable)
Radiolabeled dazomet had a half-life of 17.18 hours (-0.0403 $hours^{-1}$) in aerobic sandy loam soil. The major transformation product was identified as MITC. Taken together, these studies are considered acceptable. [2-^{14}C]Dazomet, at 0.65 mg/cm^2, degraded with a calculated half-life of 17.8 hours in sandy loam soil incubated in the dark at 25±2°C and 40% of field moisture capacity for up to 72 hours. Dazomet decreased from 92.3% of the applied radioactivity immediately posttreatment to 39.7% at 17 hours, and 5.8% at 72 hours. The primary degradate was volatilized. It was MITC, which comprised 92.05% of the applied at 72 hours. MITC was also detected at 1.1-6.5% of the applied in ethyl acetate extracts. Unidentified nonvolatile ethyl acetate and methanol extractable [^{14}C] residues comprised 2.3-11.25% and 1.09-3.57% of the applied, respectively, during the study. Volatilized [^{14}C] residues other than methyl isothiocyanate, possible $^{14}CO_2$, ^{14}COS, or $^{14}CS_2$, comprised a total of 3.02% of the applied at 72 hours. Unextractable soil residues increased from 1.16% of the applied immediately posttreatment to 3.82-4.27% at 48-72 hours. Material balances ranged from 93.14 to 109.06 of the applied during the study.

MRID 46084701, Study Status: Supplemental)
The biotransformation of [2-^{14}C]3,5-dimethyl-1,3,5-thiadiazinane-2-thione (dazomet; BAS 002 N) was studied in a loamy sand soil (code Li35b, pH 7.4, organic carbon 1.28%), loamy sand soil (code Lufa 2.2, pH 6.6, organic carbon 1.98%) and a sandy loam soil (code Lufa 3A, pH 7.8, organic carbon 2.55%) from Germany. Dazomet treated soils were maintained for 64 days under aerobic conditions in darkness at 20°C with a soil moisture content of 40% of the maximum water holding capacity. Dazomet was applied to the soils at a nominal rate of 167 mg a.i./kg soil (equivalent to 500 kg a.i./ha assuming a 20 cm depth).

In Li35b loamy sand soil, [^{14}C]dazomet was 52.3% of the applied in the 0 hour posttreatment sample, 29.2% at 0.167 days (4 hours), 9.4% at 1 day, and 0.3% at and after 10 days. MITC was a maximum of 63.4% of the applied at 2 days posttreatment and decreased to 26.6% at 14 days and 0.5% at 34 days (study termination). Degradation products TDL-S/TDL-SO were a maximum of 16.0% of the applied at 0 hours posttreatment, decreased to 4.7% at 1 day, and were 0.3% at and after 10 days. No minor transformation products were identified. At 34 days posttreatment, $^{14}CO_2$ and volatile organics (MITC) totaled 55.5% and 5.6% of the applied, respectively.

In Lufa 2.2 loamy sand soil, [^{14}C]dazomet was 42.0% of the applied in the 0 hour posttreatment sample, 32.7% at 0.167 days (4 hours), 12.3% at 1 day, 1.5% at 14 days, and was not detected at and after 20 days. MITC was a maximum of 53.5% of the applied at 1 day posttreatment and

decreased to 29.4% at 6 days, 11.2% at 14 days, and 2.6-2.7% at 28-34 days (study termination). TDL-S/TDL-SO was a maximum of 22.8% of the applied at 0 hours posttreatment, decreased to 8.3% at 1 day, and was 3.0% at and after 6 days. No minor transformation products were identified. At 34 days posttreatment, $^{14}CO_2$ and volatile organics (MITC) totaled 75.8% and 2.2% of the applied, respectively.

In the Lufa 3A sandy loam soil, [^{14}C]dazomet was 34.6% of the applied in the 0 hour posttreatment sample, 19.7% at 0.167 days (4 hours), increased from 11.1% to 14.5% at 1 through 10 days, and was 10.0% at 14 days and 3.2% at 64 days (study termination). MITC was a maximum of 47.0% of the applied at 1 day posttreatment and decreased to 23.5 and 24.1% at 6 and 21 days, 7.8% at 34 days, and 3.6% at 64 days. TDL-S/TDL-SO was a maximum of 25.0% of the applied at 0 hours posttreatment, decreased to 9.6-9.8% at 3-6 days, and was 2.8% at 64 days. No minor transformation products were identified. At 64 days posttreatment, $^{14}CO_2$ and volatile organics (MITC) totaled 49.8% and 2.9% of the applied, respectively.

Because dazomet comprised 52.3% of the applied at time 0 and 32.7% at 4 hours (first sampling interval after time 0), an accurate half-life could not be calculated using first-order linear regression techniques. It could not be determined if dazomet degradation occurred in the soil or because of improper handling of the test compound, samples or sample extracts. Assuming that the dazomet had not degraded prior to application to the soil, the observed DT50 is <0.167 days. Based on first-order linear regression analysis (MS Excel, 2000), the transformation product MITC degraded with half-lives (reviewer-calculated) of 5.4 days in the Li35b loamy sand soil, 7.0 days in the Lufa 2.2 loamy sand soil, and 20.2 days in the Lufa 3A sandy loam soil.

A proposed transformation pathway indicates dazomet degrades to MITC or to a theorized intermediate that degrades to TDL-S. TDL-S degrades to TDL-SO, which degrades to MITC. MITC in turn degrades to unidentified minor compounds that are incorporated into the organic material and mineralized to CO_2 (see aerobic soil degradation products at the end of the fate summaries).

Soil Metabolism Results

Soil types: Li35b loamy sand.
Lufa 2.2 loamy sand.
Lufa 3A sandy loam.

DT_{50}: <0.167 days (observed).

Major transformation products:
Methyl-isothiocyanate (MITC).
Thiadiazolidine sulphur (TDL-S)/thiadiazolidine sulphoxide (TDL-SO).
CO_2.

Minor identified transformation products: None.

Anaerobic Aquatic Metabolism (162-3, MRID 43596501, Study Status: Acceptable)
Radiolabeled dazomet, applied at 11.76 □g/mL, had a half-life of 3 hours in the test water of non-sterile, anaerobic soil-water system under a static incubation system. Major transformation products of dazomet were MITC and methyl S-[N-formyl-N-methylaminomethyl-(N-methyl)aminomethyl]dithiocarbamate (MAM-DCT). Radiolabeled MITC had a half-life of 27

days in a non-sterile, anaerobic soil-water test system under a static incubation system. Minor transformation products were 1,3-dimethyl-2-thiourea and 1-methyl-2-thiourea (DMTU-MMTU) and Unknown #2. Radiolabeled residues were also detected in the humic acid, fulvic acid, and humin fractions of soil organic matter.

Leaching - Adsorption/Desorption (163-1, MRID 42569201, Study Status: Acceptable)
Soil adsorption coefficient (K_{oc}) of dazomet cannot be estimated from the batch equilibrium study (MRID 42569201). This study provides marginally acceptable data on the soil-water partitioning of MITC. Due to the rapid degradation of dazomet to MITC, it is unlikely that an equilibrium of dazomet in the batch equilibrium will be reached. The K_{oc} of dazomet was estimated using the EPA's computer model PCKOCWIN v1.66 of EPISUITE. EPI's K_{oc} estimations are based on the Sabljic molecular connectivity method. The estimated K_{oc} of dazomet is 13.64 L/Kg.
Radiolabeled MITC had Freundlich adsorption coefficients of < 1.8 mL/g in a Mississippi clay, Maryland sand, Maryland sandy clay loam, and California sandy loam. The desorption coefficients of MITC ranged from 3.91 to > 23 mL/g. However, Gerstl et al. (1977) investigated the adsorption behavior of MITC in four soils with variable amounts of clay and organic matter contents. The results presented in Table 4 show that soils high in clay and organic matter adsorb more MITC than the soils with little and no clay and organic matter.

Table VI-B.a. Estimation of Koc[‡]

Soil	Organic matter (%)	Organic Carbon (%)	Clay (%)	Kd (mL/g)	Koc (mL/g)
Mivtachim	0.45	0.26	3	0.012	4.6
Gilat	0.5	29	20	0.045	15.52
Golan	4.98	2.89	68.5	0.41	14.19
Har Baroan	4.1	2.38	65.3	0.57	23.97
Median Value					14.86

[‡] Gerstl et al., 1977

Laboratory Volatilization (163-2, MRID 42569202, Study Status: Acceptable)
Radiolabeled dazomet, formulated as Basamid Granular and applied at an equivalent application rate of 500 lbs a.i./A, did not volatilize from soil. The major transformation product and active ingredient of dazomet, MITC, was volatile from soil. The maximum concentration and volatility rate of MITC ranged from 1.02×10^5 to 2.8×10^5 $\mu g/m^3$ and 16.9 to 24.9 $\mu g/cm^2/hr$ at 50% FC or 75% FC and 100 or 300 mL/minute air flow, respectively.

Field Volatilization (163-3, MRID 46340401, Study Status: acceptable)
The volatilization of dazomet was studied in bareground plots (sandy loam) in California. Dazomet (Basamid® Granular Soil Fumigant; formulation BAS 002 01N, analytical purity 95.7%-96.8%) was applied according to label directions to the bareground plots as surface soil and soil incorporated treatments. Dazomet was applied as a surface treatment at a target rate of 265 lb/A and as an incorporated treatment at a target rate of 530 lb/A, then was incorporated into

the soil to a depth of 8 inches, then rototilled and ring rolled to pack the soil. The bareground plots (ca. 90 m x 117 m, equivalent to ca. 10 acres) of sandy loam soil (0-15 cm depth, 0.8-0.9% organic matter, pH 6.9-7.1, bulk density 1.49-1.73 g/cc, CEC 8.1-9.2 meq/100 g soil; moisture at 1/3 bar 12.2-13.5%; water pH 7.8-8.1) were located ca. one mile east of Dinuba, in Tulare County, California (ecoregion 11.1). Air samples were collected from five air samplers located on a center mast at heights of 15 cm, 33 cm, 55 cm, 90 cm, and 150 cm above ground level, four off-site air samplers ca. 15 m from the edge of each side of the test plot at its approximate midpoint, and four air samplers ca. 15 m out from each plot corner; air samples at each off-site location were collected 1.5 m above the ground. Air samples were drawn through the sampling tubes using battery-operated-vacuum pumps (ca. 1.0 liters/minute; continuous) and ambient methyl isothiocyanate (MITC), the volatile that fumigant Basamid® forms upon contact with water, was collected on coconut based activated charcoal adsorption tubes (800 mg front section; 200 mg back section). Samples were collected every 4 hours on days 1 and 2, ca. every 8 hours on days 3 and 4, and at sunrise and sunset on days 5, 6, and 7 (11-hour daylight period and 13-hour dark period). The anasorb carbon matrix from the columns was extracted twice with ethyl acetate:carbon disulfide (ratio not reported) and analyzed by GC-MSD. Samples were analyzed for MITC by comparison to reference standard (purity 98.0%; Lot No.: 287-22A). The Limit of Quantitation (LOQ) for MITC was 0.5 µg/carbon tube.

Volatilization of dazomet applied to the soil surface, measured as flux rates of MITC, exhibited diurnal fluctuation, with daytime period flux rates greater than nighttime period flux rates. MITC flux rates were 3.25 $\mu g/m^2$/sec during the first 6 hours after application (9 A.M. to 3 P.M.), a maximum of 16.06 $\mu g/m^2$/sec at 6-10 hours (3 P.M to 7 P.M.), and decreased to 6.35-8.11 $\mu g/m^2$/sec at 10-24 hours following application (nighttime). Flux rates decreased to 2.83-7.62 $\mu g/m^2$/sec on day 2, 0.19-0.53 $\mu g/m^2$/sec on day 3, 0.05-0.16 $\mu g/m^2$/sec on day 4, and were not detected on days 5-7. The highest concentration of MITC in air was 569.30 µg (2341.17 $\mu g/m^3$), detected in the center mast at the 150 cm height at 20 hours posttreatment. The emission rate, defined as the flux rate of MITC divided by the application rate of dazomet (applied as Basamid®, equivalent to 292.3 lbs/acre), was ca. 2.0% of the applied emitted as MITC (5.34 lb/acre and 1.8% for 22 hours posttreatment) in the first 24 hours, decreasing to 1.4% on day 2, 0.09% on day 3, 0.025% of the applied on day 4, and was not detected on day 5 or thereafter. The total amount of dazomet emitted as MITC over the 7-day period was 3.7% of the applied.

Volatilization of dazomet incorporated into the soil, measured as flux rates of MITC, did not exhibit distinct diurnal fluctuation. MITC flux rates were 1.97 $\mu g/m^2$/sec during the first 6 hours after application (8 A.M. to 2 P.M.), 14.56 $\mu g/m^2$/sec at 6-10 hours (2 P.M to 6 P.M.), 4.84 $\mu g/m^2$/sec at 10-14 hours, a maximum of 30.05 $\mu g/m^2$/sec at 14-18 hours, 4.15 $\mu g/m^2$/sec at 18-22 hours, and was 11.01 $\mu g/m^2$/sec at 22-24 hours following application. Flux rates decreased to 2.98-9.25 $\mu g/m^2$/sec on day 2, 0.13-0.42 $\mu g/m^2$/sec on day 3, 0.07-0.20 $\mu g/m^2$/sec on day 4, and were not detected on days 5-7. The highest concentration of MITC in air was 628.75 µg (2524.72 $\mu g/m^3$), detected in the center mast at the 55 cm height at 20 hours posttreatment. The emission rate, defined as the flux rate of MITC divided by the application rate of dazomet (applied as Basamid®, equivalent to 577 lbs/acre), was ca. 1.48% of the applied, emitted as MITC (7.2 lb/acre and 1.2% for 22 hours posttreatment) in the first 24 hours, decreasing to 0.7% on day 2,

0.04% on day 3, 0.015% of the applied on day 4, and was not detected on day 5 or thereafter. The total amount of dazomet emitted as MITC over the 7-day period was 2.24% of the applied.

During the study, daily temperatures for surface and incorporated application studies ranged from 48.8-91.9°F and 32.3-71.7°F, respectively; wind speed ranged from 0.00-3.48 m/s and 0.00-3.21 m/s.

Regression analysis of ISC model predictions compared to actual flux rates resulted in poor fit and wide error bounds in the 95% confidence intervals of the estimated flux rate, possibly due to uncertainty in the ISC model with low wind speed. In the surface and incorporated applications, calm winds (<1 m/sec) existed during 73% and 57% of the testing period. This study is classified as acceptable. No significant deviations from good scientific practices were noted.

Terrestrial Field Dissipation (164-1, MRID 46084702, Study Status: Supplemental)

Soil dissipation/accumulation of 3,5-dimethyl-1,3,5-thiadiazinane-2-thione (dazomet; BAS 002 N) under European field conditions was conducted in a bareground plot in Germany (Trial 1) and two bareground plots (side by side) in Spain (Trials 2 and 3). For each test plot, dazomet was broadcast once at a target application rate of 485 kg a.i./ha (433 lb a.i./A) in triplicate 30 x 2 m (Trial 1), 10 x 2 m (Trial 2), or 10 x 2 m (Trial 3) sampling plots. The microgranules were worked into the soil to a depth of 17-20 cm immediately after application using a rotary tiller. Immediately following incorporation, the soil surface was compacted with a roller and wetted. The soil from Trial 1 and Trial 3 was covered with a polyethylene sheet. The soil from Trial 2 was sealed by irrigating at 3 and 6 days posttreatment to prevent drying. The upper layer of soil was aerated at 12 days (Trial 1) or 8 days posttreatment (Trials 2 and 3). A control plot was established for each trial.

For Trial 1, soil samples were taken from 0 to 30 days posttreatment. For Trials 2 and 3, soil samples were taken from 0 to 20 days posttreatment. Soil samples were collected to a depth of 50 cm to determine if leaching occurred. Soil samples were analyzed separately for dazomet and the transformation product MITC (methyl isothiocyanate) due to the high volatility of MITC. Dazomet was rapidly degraded in the soil to the major transformation product MITC in all three study trials, with MITC reaching maximum concentrations in the soil within 3 days posttreatment. The dissipation of dazomet was independent of the trial location, the weather conditions, and the type of soil sealing (with or without plastic cover).

Under field conditions at the Germany test site (Trial 1), dazomet had a reviewer-calculated half-life value of 1.5 days (r^2 = 0.93), calculated using linear regression and based on residues in the 0-20 cm soil depth. The registrant-calculated DT50 value was 0.9 days and the DT90 value was 2.9 days. The total carryover of residues of dazomet and MITC was <3% of the applied at the end of the 30-day study period.
Under field conditions at the Spain test site (Trial 2), dazomet had a reviewer-calculated half-life value of 1.8 days (r^2 = 0.91) calculated using linear regression and based on residues in the 0-20 cm soil depth. The registrant-calculated DT50 value was 1.2 days and the DT90 value was 3.8

days. The total carryover of residues of dazomet and MITC was <1% of the applied at the end of the 20-day study period. Under field conditions at the Spain test site (Trial 3), dazomet had a reviewer-calculated half-life value of 1.9 days ($r^2 = 0.94$), calculated using linear regression and based on residues in the 0-20 cm soil depth. The registrant-calculated DT50 value was 1.6 days and the DT90 value was 5.2 days. The total carryover of residues of dazomet and MITC was <1% of the applied at the end of the 20-day study period. The major route of dissipation of dazomet under terrestrial field conditions in the study trials conducted in Germany and Spain was transformation.

Field Dissipation Results

Trial 1

Location/soil type: Germany/Silt loam.
Half-life: 1.5 days (reviewer-calculated).
DT90: 2.9 days (registrant-calculated).
Major transformation products detected: Methyl isothiocyanate (MITC).
Dissipation routes: Transformation.

Trial 2

Location/soil type: Spain/Loamy sand.
Half-life: 1.8 days (reviewer-calculated).
DT90: 3.8 days (registrant-calculated).
Major transformation products detected: Methyl isothiocyanate (MITC).
Dissipation routes: Transformation.

Trial 3

Location/soil type: Spain/Loamy sand.
Half-life: 1.9 days (reviewer-calculated).
DT90: 5.2 days (registrant-calculated).
Major transformation products detected: Methyl isothiocyanate (MITC).
Dissipation routes: Transformation.

Field Dissipation (164-1, MRID 41874801 and 41874802, Study Status: Supplemental)
There are no field studies available to quantify the volatilization of MITC under actual dazomet use conditions. However, two studies (MRID 41874801 and 41874802) provide supplemental data on the dissipation of dazomet and MITC in field study conducted in California. Dazomet residues analyzed as dazomet + MITC had a range of field dissipation half-lives from 1.69 to 9.65 days (DT_{50} < 3 days) in a California loamy sand soil. Dazomet residues were predominately detected in the surface 6 inch soil layer. However, dazomet residues (dazomet or MITC) were detected in 12 to 36 inch soil samples from 3 to 90 days post-treatment.

Small Scale Prospective Groundwater Monitoring (166-1, MRID 44641601, Study Status: Supplemental)

The dissipation study of [2-^{14}C]3,5-dimethyl-1,3,5-thiadiazinane-2-thione(dazomet; BAS 002 N) was conducted in three outdoor lysimeter-enclosed plots (1.2-m diameter and 1.2-m height) of loamy sandy-sandy loam soil in Germany. One lysimeter was treated at a target application rate of 600 kg/ha on May 9, 1990. The second lysimeter was treated at a target application rate of

400 kg/ha on May 30, 1990. The third lysimeter was treated at a target application rate of 200 kg/ha on September 4, 1990. The lysimeters treated in the spring were planted with lettuce followed by cabbage, winter wheat, and winter barley. The lysimeter treated in the fall was planted with spring barley before application, and was left uncropped until potatoes were set in spring followed by spring wheat. A total of 51 leachate samples was collected throughout the study period beginning in October 1990, and analyzed for the degradate methyl isothiocyanate (MITC) and [^{14}C]CO_2. The leachate sample containing the highest radioactivity content was also analyzed for the possible metabolites; methylthiourea, N,N'-dimethylthiourea and 1,3,5-trimethyl-hexahydro-triazine-thione. Leachate samples were not analyzed for parent dazomet due to its short half-life of 14 hours in soil. Lysimeters were collected at the end of the two-year study period and the total radioactivity in soil was determined in 10-cm layers. Soil layers were not extracted to characterize the radioactivity in soil due to the low extractability of radioactive material into organic extracts (1-4%) and the low levels of radioactivity detected in soil (approximately 4-6% of the total applied). Rainfall was supplemented with 20-40 mm of irrigation during the study period for a total water input of 1798-1806 mm during the two-year study period.

Results indicate that the majority of the applied radioactivity, 93-96%, was lost to the atmosphere and not characterized, 4-6% was present in the soil, 0.1-0.9% in the leachate, and <0.1% in the plants. Of the radioactivity present in the soil, 3.62-4.91% was detected in the top three soil layers (0-10 cm, 10-20 cm, and 20-30 cm layers) and only 0.16-0.26% was detected in the soil layers below 30 cm. The highest concentrations of radioactivity in the 0-10 cm, 10-20 cm, 20-30 cm, and >30 cm soil layers were 7.6 µg/g, 7.0 µg/g, 2.7 µg/g, and 0.4 µg/g, respectively, all from the lysimeter receiving the 600 kg/ha application rate.

The majority of the radioactivity detected in the leachate was detected during the first year of the study. Total [^{14}C]-CO_2 in the leachate ranged from 0.03-0.53% of the applied, and total unidentified radioactivity ranged from 0.04-0.30% of the applied. Methyl isothiocyanate (MITC) was not detected in any leachate samples above 0.1 µg/L.

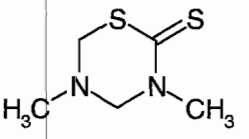
No radioactivity was detected in plants above 0.01% of the applied radioactivity with the exception of lettuce, the first crop planted; which accounted for 0.04% of the applied radioactivity (91.6-124.3 µg/g).

In summary, this study provides only limited information on the dissipation of dazomet from outdoor lysimeters, due to the loss of dazomet from the test system (93-96%). The study author attributed all loss of radioactivity to the formation of volatile degradates.

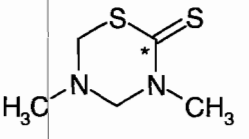
Structures of Dazomet Hydrolysis Degradation Products

Dazomet (BAS 002 N)
IUPAC name: 3,5-Dimethyl-1,3,5-thiadiazinane-2-thione
CAS name: Tetrahydro-3,5-dimethyl-2*H*-1,3,5-thiadiazine-2-thione
CAS No: 533-74-4

Unlabeled

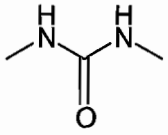


[2-^{14}C] thiadizine label

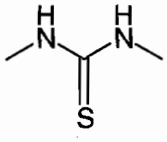


*** Position of the radiolabel.**

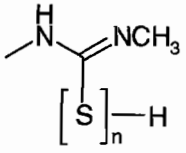
N,N'-Dimethylurea
IUPAC name: N,N'-Dimethylurea
CAS name: **NA**
CAS No: **NA**



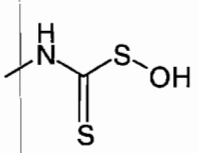
N,N'-Dimethylthiourea
IUPAC name: N,N'-Dimethylthiourea
CAS name: **NA**
CAS No: **NA**



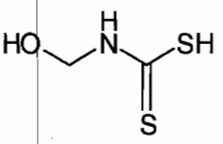
S_n-homologues of N,N'-Dimethylthiourea
IUPAC name: N,N'-Dimethylthiourea
CAS name: NA
CAS No: NA



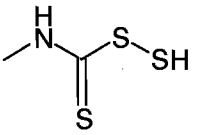
(Methylamino)(thioxo)methanesulfenic acid
IUPAC name: (Methylamino)(thioxo)methanesulfenic acid
CAS name: NA
CAS No: NA



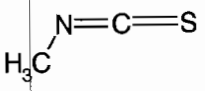
Hydroxymethyl dithiocarbamic acid (isomer)
IUPAC name: Hydroxymethyl dithiocarbamic acid
CAS name: NA
CAS No: NA



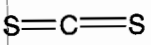
(Methylamino)(thioxo)methanethiosulfenic acid
IUPAC name: (Methylamino)(thioxo)methanethiosulfenic acid
CAS name: NA
CAS No: NA


H
N
S
SH
S

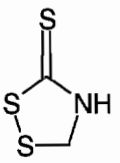
MITC
IUPAC name: Methylisothiocyanate
CAS name: NA
CAS No: NA



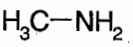
Carbon disulfide
IUPAC name: Carbon disulfide
CAS name: NA
CAS No: NA



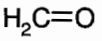
Dithiazolidine-3-thione
IUPAC name: [1,2,4]dithiazolidine-3-thione
CAS name: NA
CAS No: NA



Methyl amine
IUPAC name: Methyl amine
CAS name: NA
CAS No: NA



Formaldehyde
IUPAC name: Formaldehyde
CAS name: NA
CAS No: NA



Carbon dioxide
IUPAC name: Carbon dioxide
CAS name: NA
CAS No: NA

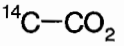
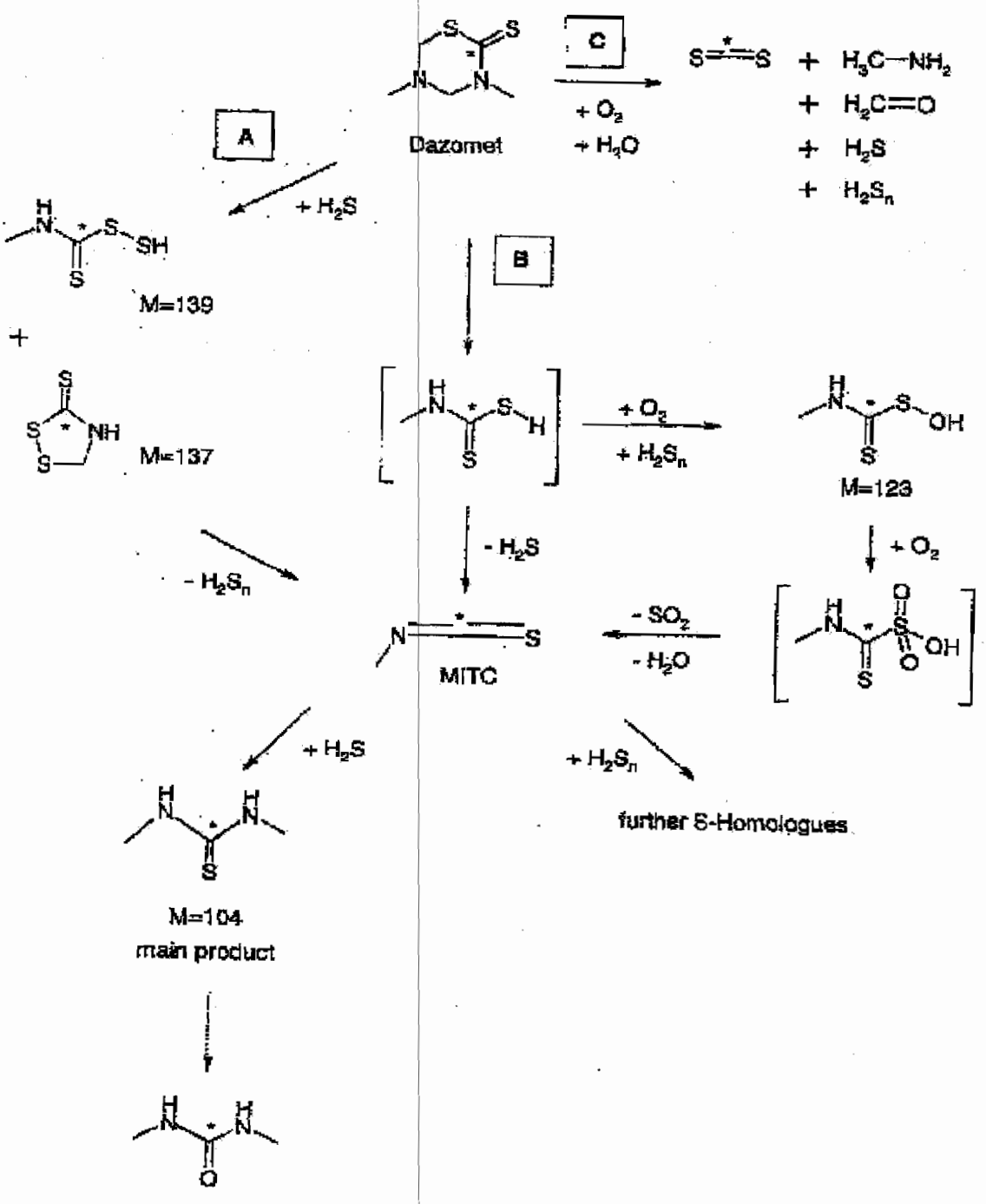


Figure 1: Degradation pathway of Dazomet due to hydrolysis



Appendix C: Models, Scenarios, Input Parameters and Outputs

Estimation of surface water exposure concentrations for Ecological Risk Assessment

The estimated ecological effects concentrations were calculated using Tier II PRZM (Pesticide Root Zone Model, v. 3.12) and EXAMS (Exposure Analysis Modeling System. 2.98.5). The maximum application rates and relevant environmental fate parameters for dazomet and MITC were used in the PRZM/EXAMS Tier II model in estimating EECs in the surface water. Tables VI.c1 and c2 summarizes the input values used in the selected crops and models run for PRZM/EXAMS. The output of the screening model represent an upper-bound estimate of the concentrations of dazomet and MITC that might be found in surface water due to use of dazomet on selected crops (Tables VI. c3 to c8. The weather, agricultural practices, and Dazomet applications were simulated over 30 years so that the ten year excedence probability at the site could be estimated. The EECs generated in this analysis were estimated using PRZM for simulating runoff and erosion from the agricultural field and EXAMS for estimating environmental fate and transport in surface water.

(1) PRZM/EXAMS Model Input for Ecological Risk Assessment

Table VI.c1. PRZM/EXAMS Input Parameters for Dazomet

Parameters	Values & Units	Sources
Molecular Weight	162.3 g $Mole^{-1}$	
Vapor Pressure 20°C	2.8 X 10^{-6} mm Hg	
Water Solubility @ pH 7.0 and 25°C	3000 mg L^{-1}	
Hydrolysis Half-Life (pH 7)	0.18 Days (0.17 and 0.18 days)	(Calculated 90th Percentile) MRID#s 4211140-01 and 459083-01
Aerobic Soil Metabolism $t_{½}$,	2.13 Days*	MRID#s 40211901, 42111403
Aerobic Aquatic metabolism:	4.26 Days**	EFED Guideline
Anaerobic Aquatic metabolism: for entire sediment/water system	0.13 Days	MRID 43596501
Aqueous Photolysis	0.17 Day	MRID#s 41479901, 42111402
Soil Water Partition Coefficient	13.64 L Kg^{-1} ***	EPISUITE
Pesticide is Wetted-In	No	Product Label
Crop Management		
Application rates (lb a.i./A)	530	Basamid®G Granular Proposed Certis Label (EPA Reg. No. 70051-101)

Table VI.c1. PRZM/EXAMS Input Parameters for Dazomet

Parameters	Values & Units	Sources
Pesticide Application Frequency	1	Basamid®G Granular Proposed Certis Label (EPA Reg. No. 70051-101)
Application Date-CA tomato	October 15	USDA Crop Profiles‡
Application Date- CA strawberry	November 15	USDA Crop Profiles‡
Application Date-FL Turf	October 15	USDA Crop Profiles‡
Application Date- PA Turf	May 15	USDA Crop Profiles‡
Application Date- OR Christmas Tree	April 15	USDA Crop Profiles‡
Application Method	Ground and 8 inches incorporation	Basamid®G Granular Proposed Certis Label (EPA Reg. No. 70051-101)
Spray Efficiency	Not applicable	EFED

* = Due to one reported half-life, input half-life was multiplied by 3 according to Guidance for selecting input parameters in modeling for environmental fate and transport of pesticides. Version II. December 4, 2001.
**= In absence of aerobic aquatic metabolism half-life, the reported half-lives of aerobic soil metabolism multiplied by 2 according to Guidance for selecting input parameters in modeling for environmental fate and transport of pesticides. Version II. December 4, 2001.
*** = The EPI (Estimation Program Interface) SuiteTM is a Windows® based suite of physical/chemical property and environmental fate estimation models developed by the EPA's Office of Pollution Prevention Toxics and Syracuse Research Corporation SRC. http://www.epa.gov/opptintr/exposure/docs/updates_episuite_v3.11.htm
‡ www.pestdata.ncsu.edu/cropprofiles/cropprofiles.cfm

Table VI.c2. PRZM/EXAMS Input Parameters for MITC, a Dazomet Metabolite

Parameters	Values & Units	Sources
Molecular Weight	73.12g $Mole^{-1}$	Product Chemistry
Vapor Pressure 25°C	19 mm Hg	CDPR, 2002
Water Solubility @ pH 7.0 and 25°C	7600 mg L^{-1}	Product Chemistry
Vapor Phase Diffusion Coefficient (DAIR)	8227 cm^2 day^{-1}	Fuller et al., 1966
Enthalpy of Vaporization	8.91 kcal $mole^{-1}$	Chickos and Acree, 2003
Hydrolysis Half-Life (pH 7)	20.4	MRID 001581-62

Table VI.c2. PRZM/EXAMS Input Parameters for MITC, a Dazomet Metabolite

Parameters	Values & Units	Sources
Aerobic Soil Metabolism $t_{½}$,	9.61 Days	(Calculated 90th Percentile)
	(5.4 - 20.2 days) (3.3-9.9 days)	MRID 460847-01 Gerstl et al, 1977
Aerobic Aquatic metabolism: for entire sediment/water system	19.2†	EFED Guideline
Anaerobic aquatic metabolism	Stable	MRID 439084-26
Aqueous Photolysis	51.6 Day	CDPR, 2002
Soil Water Partition Coefficient	0.26 L Kg^{-1} (Mean K_d)	Gerstl et al., 1977
Crop Management		
Pesticide application frequency and rate	219.4 (lb a.i./A)‡	Estimated
Application Date- CA tomato	October 15	USDA Crop Profiles
Application Date-CA strawberry	October 15	USDA Crop Profiles
Application Date-FL Turf	October 15	USDA Crop Profiles‡
Application Date- PA Turf	May 15	USDA Crop Profiles‡
Application Date- OR Christmas Tree	April 15	USDA Crop Profiles‡
Application Method	MITC generates from ground application of dazomet	MRID#s 40211901, 42111403
Spray Efficiency	Not applicable	EFED Guideline

† = In absence of aerobic aquatic half-life, the reported half-life of aerobic soil metabolism is multiplied by 2 according to Guidance for selecting input parameters in modeling for environmental fate and transport of pesticides. Version II. December 4, 2001.

‡ = Dazomet application rate x [(0.92, (the maximum conversion of dazomet to MITC in the aerobic soil metabolism) x (0.45, the molecular weight ratio of MITC to dazomet]

(II) PRZM/EXAMS Model Output for Ecological Risk Water Assessment

stored as FLturfP.out
Chemical: Dazomet
PRZM envir modified Monday, 16 June 2003 at 13:48:06
EXAMS env modified Thuday, 29 August 2002 at 16:33:30
Metfile: w1: modified Wedday, 3 July 2002 at 09:04:28
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.00	0.00	0.00	0.00	0.00	0.00
1963	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.00	0.00	0.00	0.00	0.00
0.16	0.00	0.00	0.00	0.00	0.00	0.00
0.19	0.00	0.00	0.00	0.00	0.00	0.00
0.23	0.00	0.00	0.00	0.00	0.00	0.00
0.26	0.00	0.00	0.00	0.00	0.00	0.00
0.29	0.00	0.00	0.00	0.00	0.00	0.00
0.32	0.00	0.00	0.00	0.00	0.00	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.00
0.39	0.00	0.00	0.00	0.00	0.00	0.00
0.42	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
				Average of yearly a		0.00

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: FLturfP
Metfile: w12834.dvf
PRZM scen: FLturfC.txt
EXAMS env pond298.exv
Chemical N: Dazomet

Description	Variable Na	Value	Units	Comments
Molecular w	mwt	162.3	g/mol	
Henry's Law	henry		atm-m^3/mol	
Vapor Press	vapr	2..8E-6	torr	
Solubility	sol	3000	mg/L	
Kd	Kd		mg/L	
Koc	Koc	13.64	mg/L	
Photolysis h	kdp	0.17	days	Half-life
Aerobic Aqu	kbacw		days	Halfife
Anaerobic A	kbacs	0.39	days	Halfife
Aerobic Soi	asm	2.13	days	Halfife
Hydrolysis:	pH 7	0.2	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporatic	DEPI	20	cm	
Application	TAPP	594	kg/ha	
Application	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application	Date	15-10	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Ind	IR	Pond		
Flag for run	RUNOFF	none	none, monthly or total(average of entire run)	

stored as FL_MTturf.out
Chemical: MITC
PRZMenvi modified Friday, 4 July 2003 at 19:12:58
EXAMS en modified Thuday, 29 August 2002 at 16:33:30
Metfile: w1 modified Wedday, 3 July 2002 at 09:04:28
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.97	0.67	0.28	0.12	0.08	0.02
1962	0.24	0.15	0.07	0.04	0.02	0.01
1963	0.34	0.21	0.11	0.05	0.04	0.01
1964	0.26	0.16	0.11	0.05	0.04	0.01
1965	0.41	0.29	0.18	0.08	0.05	0.01
1966	0.26	0.18	0.12	0.06	0.04	0.01
1967	0.23	0.14	0.09	0.05	0.03	0.01
1968	0.24	0.18	0.10	0.05	0.03	0.01
1969	0.83	0.60	0.24	0.10	0.07	0.02
1970	0.29	0.18	0.11	0.05	0.04	0.01
1971	0.15	0.09	0.05	0.03	0.02	0.00
1972	0.19	0.14	0.08	0.04	0.03	0.01
1973	0.44	0.32	0.15	0.07	0.04	0.01
1974	0.18	0.11	0.09	0.05	0.03	0.01
1975	0.35	0.24	0.12	0.06	0.04	0.01
1976	0.58	0.39	0.22	0.11	0.07	0.02
1977	0.31	0.21	0.11	0.05	0.04	0.01
1978	0.35	0.23	0.12	0.05	0.04	0.01
1979	0.33	0.22	0.13	0.06	0.04	0.01
1980	0.44	0.32	0.17	0.07	0.05	0.01
1981	0.28	0.20	0.13	0.07	0.04	0.01
1982	0.32	0.22	0.11	0.05	0.03	0.01
1983	0.23	0.15	0.10	0.06	0.04	0.01
1984	0.46	0.30	0.16	0.07	0.05	0.01
1985	0.80	0.50	0.22	0.09	0.06	0.02
1986	0.23	0.15	0.07	0.03	0.02	0.01
1987	0.35	0.23	0.13	0.06	0.04	0.01
1988	0.19	0.13	0.09	0.04	0.03	0.01
1989	0.48	0.35	0.20	0.09	0.06	0.01
1990	0.00	0.00	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.97	0.67	0.28	0.12	0.08	0.02
0.06	0.83	0.60	0.24	0.11	0.07	0.02
0.10	0.80	0.50	0.22	0.10	0.07	0.02
0.13	0.58	0.39	0.22	0.09	0.06	0.02
0.16	0.48	0.35	0.20	0.09	0.06	0.01
0.19	0.46	0.32	0.18	0.08	0.05	0.01
0.23	0.44	0.32	0.17	0.07	0.05	0.01
0.26	0.44	0.30	0.16	0.07	0.05	0.01
0.29	0.41	0.29	0.15	0.07	0.04	0.01
0.32	0.35	0.24	0.13	0.07	0.04	0.01
0.35	0.35	0.23	0.13	0.06	0.04	0.01
0.39	0.35	0.23	0.13	0.06	0.04	0.01
0.42	0.34	0.22	0.12	0.06	0.04	0.01
0.45	0.33	0.22	0.12	0.06	0.04	0.01
0.48	0.32	0.21	0.12	0.06	0.04	0.01
0.52	0.31	0.21	0.11	0.05	0.04	0.01
0.55	0.29	0.20	0.11	0.05	0.04	0.01
0.58	0.28	0.18	0.11	0.05	0.04	0.01
0.61	0.26	0.18	0.11	0.05	0.04	0.01
0.65	0.26	0.18	0.11	0.05	0.04	0.01
0.68	0.24	0.16	0.10	0.05	0.03	0.01
0.71	0.24	0.15	0.10	0.05	0.03	0.01
0.74	0.23	0.15	0.09	0.05	0.03	0.01
0.77	0.23	0.15	0.09	0.05	0.03	0.01
0.81	0.23	0.14	0.09	0.04	0.03	0.01
0.84	0.19	0.14	0.08	0.04	0.03	0.01
0.87	0.19	0.13	0.07	0.04	0.02	0.01
0.90	0.18	0.11	0.07	0.03	0.02	0.01
0.94	0.15	0.09	0.05	0.03	0.02	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.78	0.49	0.22	0.10	0.07	0.02
					Average of :	0.01

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: FL_MTturf
Metfile: w12842.dvf
PRZM scen FLstrawberryC.txt
EXAMS en pond298.exv
Chemical N MITC

Description	Variable Na	Value	Units	Comments
Molecular w	mwt	73.11	g/mol	
Henry's Law	henry	1.79E-04	atm-m^3/mol	
Vapor Press	vapr	19	torr	
Solubility	sol	7600	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis h	kdp	51.6	days	Half-life
Aerobic Aq	kbacw	19.22	days	Halfife
Anaerobic A	kbacs		days	Halfife
Aerobic Soi	asm	9.61	days	Halfife
Hydrolysis:	pH 7	20.4	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporatic	DEPI	20	cm	
Application	TAPP	237.7	kg/ha	
Application	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application	Date	15-10	dd/mm or dd/mmm or dd-mm or dd-mmm	
Reeord 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Ind	IR	Pond		
Flag for run	RUNOFF	none	none, monthly or total(average of entire run)	

stored as CA_strawberry_Dazomet.xls
Chemical: Dazomet
PRZM environment: CA modified Tueday, 20 February 2007 at 12:04:00
EXAMS environment: p modified Thuday, 29 August 2002 at 16:33:30
Metfile: w23234.dvf modified Wedday, 3 July 2002 at 10:04:22
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.00	0.00	0.00	0.00	0.00	0.00
1963	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.00	0.00	0.00	0.00	0.00
0.16	0.00	0.00	0.00	0.00	0.00	0.00
0.19	0.00	0.00	0.00	0.00	0.00	0.00
0.23	0.00	0.00	0.00	0.00	0.00	0.00
0.26	0.00	0.00	0.00	0.00	0.00	0.00
0.29	0.00	0.00	0.00	0.00	0.00	0.00
0.32	0.00	0.00	0.00	0.00	0.00	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.00
0.39	0.00	0.00	0.00	0.00	0.00	0.00
0.42	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
					Average of	0.00

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:

Output File: CAstrwtDZ				
Metfile:	w23234.dvf			
PRZM scenario:	CAStrawberry-noplasticRLF.txt			
EXAMS environment file:	pond298.exv			
Chemical Name:	Dazomet			
Description	Variable Na	Value	Units	Comments
Molecular weight	mwt	162.3	g/mol	
Henry's Law Const.	henry		atm-m^3/mol	
Vapor Pressure	vapr	2..8E-6	torr	
Solubility	sol	3000	mg/L	
Kd	Kd		mg/L	
Koc	Koc	13.64	mg/L	
Photolysis half-life	kdp	0.17	days	Half-life
Aerobic Aquatic Metabo	kbacw		days	Halflife
Anaerobic Aquatic Meta	kbacs	0.39	days	Halflife
Aerobic Soil Metabolism	asm	2.13	days	Halflife
Hydrolysis:	pH 7	0.2	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporation Depth:	DEPI	20	cm	
Application Rate:	TAPP	594	kg/ha	
Application Efficiency:	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application Date	Date	15-11	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Index Res. Run	IR	EPA Pond		
Flag for runoff calc.	RUNOFF	none	none, monthly or total(average of entire run)	

stored as CA_Strawberry_MITC.xls
Chemical: MITC
PRZM environment: C modified Tueday, 20 February 2007 at 12:04:00
EXAMS environment: modified Thuday, 29 August 2002 at 16:33:30
Metfile: w23234.dvf modified Wedday, 3 July 2002 at 10:04:22
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.94	0.71	0.26	0.09	0.06	0.02
1963	0.06	0.04	0.01	0.01	0.01	0.00
1964	1.07	0.79	0.30	0.10	0.07	0.02
1965	0.36	0.28	0.10	0.03	0.02	0.01
1966	0.21	0.15	0.06	0.02	0.02	0.00
1967	0.23	0.18	0.06	0.02	0.01	0.00
1968	0.49	0.33	0.09	0.03	0.02	0.01
1969	0.75	0.57	0.20	0.07	0.05	0.01
1970	0.07	0.05	0.03	0.01	0.01	0.00
1971	0.47	0.35	0.11	0.04	0.03	0.01
1972	0.45	0.33	0.12	0.04	0.03	0.01
1973	0.41	0.29	0.12	0.04	0.03	0.01
1974	0.25	0.17	0.05	0.02	0.01	0.00
1975	0.09	0.06	0.02	0.01	0.01	0.00
1976	0.52	0.23	0.04	0.02	0.01	0.00
1977	0.77	0.52	0.23	0.08	0.05	0.02
1978	0.13	0.10	0.04	0.02	0.01	0.00
1979	1.10	0.81	0.26	0.09	0.06	0.02
1980	0.26	0.19	0.09	0.03	0.02	0.01
1981	1.61	1.09	0.38	0.13	0.09	0.02
1982	1.08	0.81	0.26	0.09	0.06	0.02
1983	0.29	0.21	0.06	0.02	0.01	0.01
1984	0.06	0.04	0.01	0.01	0.00	0.00
1985	0.02	0.01	0.00	0.00	0.00	0.00
1986	0.59	0.42	0.15	0.05	0.04	0.01
1987	0.31	0.22	0.08	0.03	0.02	0.01
1988	0.94	0.77	0.30	0.11	0.07	0.02
1989	0.19	0.13	0.05	0.02	0.01	0.00
1990	0.07	0.05	0.02	0.01	0.01	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	1.61	1.09	0.38	0.13	0.09	0.02
0.06	1.10	0.81	0.30	0.11	0.07	0.02
0.10	1.08	0.81	0.30	0.10	0.07	0.02
0.13	1.07	0.79	0.26	0.09	0.06	0.02
0.16	0.94	0.77	0.26	0.09	0.06	0.02
0.19	0.94	0.71	0.26	0.09	0.06	0.02
0.23	0.77	0.57	0.23	0.08	0.05	0.02
0.26	0.75	0.52	0.20	0.07	0.05	0.01
0.29	0.59	0.42	0.15	0.05	0.04	0.01
0.32	0.52	0.35	0.12	0.04	0.03	0.01
0.35	0.49	0.33	0.12	0.04	0.03	0.01
0.39	0.47	0.33	0.11	0.04	0.03	0.01
0.42	0.45	0.29	0.10	0.03	0.02	0.01
0.45	0.41	0.28	0.09	0.03	0.02	0.01
0.48	0.36	0.23	0.09	0.03	0.02	0.01
0.52	0.31	0.22	0.08	0.03	0.02	0.01
0.55	0.29	0.21	0.06	0.02	0.02	0.01
0.58	0.26	0.19	0.06	0.02	0.01	0.00
0.61	0.25	0.18	0.06	0.02	0.01	0.00
0.65	0.23	0.17	0.05	0.02	0.01	0.00
0.68	0.21	0.15	0.05	0.02	0.01	0.00
0.71	0.19	0.13	0.04	0.02	0.01	0.00
0.74	0.13	0.10	0.04	0.02	0.01	0.00
0.77	0.09	0.06	0.03	0.01	0.01	0.00
0.81	0.07	0.05	0.02	0.01	0.01	0.00
0.84	0.07	0.05	0.02	0.01	0.01	0.00
0.87	0.06	0.04	0.01	0.01	0.01	0.00
0.90	0.06	0.04	0.01	0.01	0.00	0.00
0.94	0.02	0.01	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	1.08	0.81	0.29	0.10	0.07	0.02
				Average of yearly a		0.01

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: CAStrwMT

Metfile:	w23234.dvf			
PRZM scenario:	CAStrawberry-noplasticRLF.txt			
EXAMS environment f	pond298.exv			
Chemical Name:	MITC			
Description	Variable Na	Value	Units	Comments
Molecular weight	mwt	73.11	g/mol	
Henry's Law Const.	henry	1.79E-04	atm-m^3/mol	
Vapor Pressure	vapr	19	torr	
Solubility	sol	7600	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	51.6	days	Half-life
Aerobic Aquatic Metat	kbacw	19.2	days	Halfife
Anaerobic Aquatic Met	kbacs		days	Halffe
Aerobic Soil Metabolis	asm	9.61	days	Halffe
Hydrolysis:	pH 7	20.4	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporation Depth:	DEPI	20	cm	
Application Rate:	TAPP	245.7	kg/ha	
Application Efficiency:	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application Date	Date	15-11	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Index Res. Ru	IR	EPA Pond		
Flag for runoff calc.	RUNOFF	none	none, monthly or total(average of entire run)	

stored as CAtomP.out
Chemical: Dazomet
PRZM envi modified Satday, 12 October 2002 at 16:38:04
EXAMS en modified Thuday, 29 August 2002 at 16:33:30
Metfile: w9: modified Wedday, 3 July 2002 at 09:04:24
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.00	0.00	0.00	0.00	0.00	0.00
1963	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.00	0.00	0.00	0.00	0.00
0.16	0.00	0.00	0.00	0.00	0.00	0.00
0.19	0.00	0.00	0.00	0.00	0.00	0.00
0.23	0.00	0.00	0.00	0.00	0.00	0.00
0.26	0.00	0.00	0.00	0.00	0.00	0.00
0.29	0.00	0.00	0.00	0.00	0.00	0.00
0.32	0.00	0.00	0.00	0.00	0.00	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.00
0.39	0.00	0.00	0.00	0.00	0.00	0.00
0.42	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.00	0.00	0.00	0.00	0.00	0.00
					Average of :	0

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: CAtomP
Metfile: w93193.dvf
PRZM scen: CAtomatoC.txt
EXAMS en: pond298.exv
Chemical N Dazomet

Description	Variable Na	Value	Units	Comments
Molecular w	mwt	162.3	g/mol	
Henry's Law	henry		atm-m^3/mol	
Vapor Press	vapr	2..8E-6	torr	
Solubility	sol	3000	mg/L	
Kd	Kd		mg/L	
Koc	Koe	13.64	mg/L	
Photolysis h	kdp	0.17	days	Half-life
Aerobic Aqu	kbacw		days	Halfife
Anaerobic A	kbacs	0.39	days	Halfife
Aerobic Soi	asm	2.13	days	Halfife
Hydrolysis:	pH 7	0.2	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporatic	DEPI	20	cm	
Application	TAPP	594	kg/ha	
Application	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application	Date	15-10	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Ind	IR	Pond		
Flag for run	RUNOFF	none	none, monthly or total(average of entire run)	

stored as CATomato.out
Chemical: MITC
PRZM enviro modified Satday, 12 October 2002 at 16:38:04
EXAMS envir modified Thuday, 29 August 2002 at 16:33:30
Metfile: w931 modified Wedday, 3 July 2002 at 09:04:24
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.04	0.03	0.01	0.00	0.00	0.00
1962	0.00	0.00	0.00	0.00	0.00	0.00
1963	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.02	0.01	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.03	0.02	0.01	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.01	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.01	0.01	0.00	0.00	0.00	0.00
1975	0.01	0.01	0.00	0.00	0.00	0.00
1976	0.02	0.01	0.00	0.00	0.00	0.00
1977	0.06	0.04	0.02	0.01	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.01	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.02	0.01	0.01	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.01	0.01	0.00	0.00	0.00	0.00
1986	0.01	0.01	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.01	0.01	0.00	0.00	0.00	0.00
1989	0.01	0.01	0.00	0.00	0.00	0.00
1990	0.01	0.01	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.06	0.04	0.02	0.01	0.00	0.00
0.06	0.04	0.03	0.01	0.00	0.00	0.00
0.10	0.03	0.02	0.01	0.00	0.00	0.00
0.13	0.02	0.01	0.01	0.00	0.00	0.00
0.16	0.02	0.01	0.00	0.00	0.00	0.00
0.19	0.02	0.01	0.00	0.00	0.00	0.00
0.23	0.01	0.01	0.00	0.00	0.00	0.00
0.26	0.01	0.01	0.00	0.00	0.00	0.00
0.29	0.01	0.01	0.00	0.00	0.00	0.00
0.32	0.01	0.01	0.00	0.00	0.00	0.00
0.35	0.01	0.01	0.00	0.00	0.00	0.00
0.39	0.01	0.01	0.00	0.00	0.00	0.00
0.42	0.01	0.01	0.00	0.00	0.00	0.00
0.45	0.01	0.00	0.00	0.00	0.00	0.00
0.48	0.01	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.03	0.02	0.01	0.00	0.00	0.00
					Average of	0.00

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: CATomato
Metfile: w93193.dvf
PRZM scena CAtomatoC.txt
EXAMS envir pond298.exv
Chemical Na MITC

Description	Variable Na	Value	Units	Comments
Molecular we	mwt	73.11	g/mol	
Henry's Law (	henry	1.79E-04	atm-m^3/mol	
Vapor Pressu	vapr	19	torr	
Solubility	sol	7600	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis ha	kdp	51.6	days	Half-life
Aerobic Aqua	kbacw	19.2	days	Halfife
Anaerobic Ac	kbacs		days	Halfife
Aerobic Soil I	asm	9.61	days	Halfife
Hydrolysis:	pH 7	20.4	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporation	DEPI	20	cm	
Application R	TAPP	245.7	kg/ha	
Application E	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application D	Date	15-10	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Inde	IR	Pond		
Flag for runof	RUNOFF	none	none, monthly or total(average of entire run)	

stored as PAturfP.out
Chemical: Dazomet
PRZM envi modified Satday, 12 October 2002 at 16:27:02
EXAMS en modified Thuday, 29 August 2002 at 16:33:30
Metfile: w1 modified Wedday, 3 July 2002 at 09:06:12
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961.00	0.00	0.00	0.00	0.00	0.00	0.00
1962.00	0.00	0.00	0.00	0.00	0.00	0.00
1963.00	0.00	0.00	0.00	0.00	0.00	0.00
1964.00	0.00	0.00	0.00	0.00	0.00	0.00
1965.00	0.00	0.00	0.00	0.00	0.00	0.00
1966.00	0.00	0.00	0.00	0.00	0.00	0.00
1967.00	0.00	0.00	0.00	0.00	0.00	0.00
1968.00	0.00	0.00	0.00	0.00	0.00	0.00
1969.00	0.00	0.00	0.00	0.00	0.00	0.00
1970.00	0.00	0.00	0.00	0.00	0.00	0.00
1971.00	0.00	0.00	0.00	0.00	0.00	0.00
1972.00	0.00	0.00	0.00	0.00	0.00	0.00
1973.00	0.00	0.00	0.00	0.00	0.00	0.00
1974.00	0.00	0.00	0.00	0.00	0.00	0.00
1975.00	0.00	0.00	0.00	0.00	0.00	0.00
1976.00	0.00	0.00	0.00	0.00	0.00	0.00
1977.00	0.00	0.00	0.00	0.00	0.00	0.00
1978.00	0.00	0.00	0.00	0.00	0.00	0.00
1979.00	0.00	0.00	0.00	0.00	0.00	0.00
1980.00	0.00	0.00	0.00	0.00	0.00	0.00
1981.00	0.00	0.00	0.00	0.00	0.00	0.00
1982.00	0.00	0.00	0.00	0.00	0.00	0.00
1983.00	0.00	0.00	0.00	0.00	0.00	0.00
1984.00	0.00	0.00	0.00	0.00	0.00	0.00
1985.00	0.00	0.00	0.00	0.00	0.00	0.00
1986.00	0.00	0.00	0.00	0.00	0.00	0.00
1987.00	0.00	0.00	0.00	0.00	0.00	0.00
1988.00	0.00	0.00	0.00	0.00	0.00	0.00
1989.00	0.00	0.00	0.00	0.00	0.00	0.00
1990.00	0.00	0.00	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.00	0.00	0.00	0.00	0.00
0.16	0.00	0.00	0.00	0.00	0.00	0.00
0.19	0.00	0.00	0.00	0.00	0.00	0.00
0.23	0.00	0.00	0.00	0.00	0.00	0.00
0.26	0.00	0.00	0.00	0.00	0.00	0.00
0.29	0.00	0.00	0.00	0.00	0.00	0.00
0.32	0.00	0.00	0.00	0.00	0.00	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.00
0.39	0.00	0.00	0.00	0.00	0.00	0.00
0.42	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
				Average of yearly a		0.00

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: PAturfP
Metfile: w14737.dvf
PRZM scen: PAturfC.txt
EXAMS en: pond298.exv
Chemical N: Dazomet

Description	Variable Na	Value	Units	Comments
Molecular w	mwt	162.30	g/mol	
Henry's Law	henry		atm-m^3/mol	
Vapor Press	vapr	2..8E-6	torr	
Solubility	sol	3000.00	mg/L	
Kd	Kd		mg/L	
Koc	Koe	13.64	mg/L	
Photolysis h	kdp	0.17	days	Half-life
Aerobic Aq	kbacw		days	Halfife
Anaerobic A	kbacs	0.39	days	Halfife
Aerobic Soi	asm	2.13	days	Halfife
Hydrolysis:	pH 7	0.20	days	Half-life
Method:	CAM	8.00	integer	See PRZM manual
Incorporatic	DEPI	20.00	cm	
Application	TAPP	594.00	kg/ha	
Application	APPEFF	1.00	fraction	
Spray Drift	DRFT	0.00	fraction of application rate applied to pond	
Application	Date	15-05	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1.00		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0.00		
Flag for Ind	IR	Pond		
Flag for run	RUNOFF	none	none, monthly or total(average of entire run)	

stored as PA_Turf_MITC.xls
Chemical: MITC
PRZM environment: P modified Thuday, 23 February 2006 at 17:55:08
EXAMS environment: modified Thuday, 29 August 2002 at 16:33:30
Metfile: w14751.dvf modified Wedday, 3 July 2002 at 10:06:14
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.00	0.00	0.00	0.00	0.00	0.00
1963	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.01	0.01	0.00	0.00	0.00	0.00
1968	0.01	0.01	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.01	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.02	0.02	0.01	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.01	0.01	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.01	0.01	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.02	0.01	0.01	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.02	0.01	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.01	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.01	0.01	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.02	0.02	0.01	0.00	0.00	0.00
0.06	0.02	0.01	0.01	0.00	0.00	0.00
0.10	0.02	0.01	0.00	0.00	0.00	0.00
0.13	0.01	0.01	0.00	0.00	0.00	0.00
0.16	0.01	0.01	0.00	0.00	0.00	0.00
0.19	0.01	0.01	0.00	0.00	0.00	0.00
0.23	0.01	0.01	0.00	0.00	0.00	0.00
0.26	0.01	0.01	0.00	0.00	0.00	0.00
0.29	0.01	0.00	0.00	0.00	0.00	0.00
0.32	0.01	0.00	0.00	0.00	0.00	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.00
0.39	0.00	0.00	0.00	0.00	0.00	0.00
0.42	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.02	0.01	0.00	0.00	0.00	0.00
					Average of	7E-05

Inputs generated by pe5.pl - Novemeber 2006

Data used for this run:
Output File: PA_MTXX

Metfile:	w14751.dvf			
PRZM scenario:	PAturfSTD.txt			
EXAMS environment f	pond298.exv			
Chemical Name:	MITC			
Description	Variable Na	Value	Units	Comments
Molecular weight	mwt	73.11	g/mol	
Henry's Law Const.	henry	1.79E-04	atm-m^3/mol	
Vapor Pressure	vapr	19	torr	
Solubility	sol	7600	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis half-life	kdp	51.6	days	Half-life
Aerobic Aquatic Metat	kbacw	19.22	days	Halfife
Anaerobic Aquatic Me	kbacs		days	Halfife
Aerobic Soil Metabolis	asm	9.61	days	Halfife
Hydrolysis:	pH 7	20.4	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporation Depth:	DEPI	20	cm	
Application Rate:	TAPP	237.7	kg/ha	
Application Efficiency:	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application Date	Date	15-05	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Index Res. Rt	IR	EPA Pond		
Flag for runoff calc.	RUNOFF	none	none, monthly or total(average of entire run)	

stored as ORxtreeP.out
Chemical: Dazomet
PRZM envi modified Satday, 12 October 2002 at 16:23:10
EXAMS en modified Thuday, 29 August 2002 at 16:33:30
Metfile: w2 modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.00	0.00	0.00	0.00	0.00	0.00
1963	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.00	0.00	0.00	0.00	0.00
0.16	0.00	0.00	0.00	0.00	0.00	0.00
0.19	0.00	0.00	0.00	0.00	0.00	0.00
0.23	0.00	0.00	0.00	0.00	0.00	0.00
0.26	0.00	0.00	0.00	0.00	0.00	0.00
0.29	0.00	0.00	0.00	0.00	0.00	0.00
0.32	0.00	0.00	0.00	0.00	0.00	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.00
0.39	0.00	0.00	0.00	0.00	0.00	0.00
0.42	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.00	0.00	0.00	0.00	0.00
					Average of :	0.00

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: ORxtreeP
Metfile: w24232.dvf
PRZM scen: ORXmasTreeC.txt
EXAMS en: pond298.exv
Chemical N: Dazomet

Description	Variable Na	Value	Units	Comments
Molecular w	mwt	162.3	g/mol	
Henry's Law	henry		atm-m^3/mol	
Vapor Press	vapr	2..8E-6	torr	
Solubility	sol	3000	mg/L	
Kd	Kd		mg/L	
Koc	Koc	13.64	mg/L	
Photolysis h	kdp	0.17	days	Half-life
Aerobic Aq	kbacw		days	Halfife
Anaerobic A	kbacs	0.39	days	Halfife
Aerobic Soi	asm	2.13	days	Halfife
Hydrolysis:	pH 7	0.2	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporatic	DEPI	20	cm	
Application	TAPP	594	kg/ha	
Application	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application	Date	15-04	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Ind	IR	Pond		
Flag for run	RUNOFF	none	none, monthly or total(average of entire run)	

stored as OR_MTxmas.out
Chemical: MITC
PRZM envir modified Satday, 12 October 2002 at 16:23:10
EXAMS en modified Thuday, 29 August 2002 at 16:33:30
Metfile: w2 modified Wedday, 3 July 2002 at 09:06:10
Water segment concentrations (ppb)

Year	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
1961	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.34	0.23	0.08	0.03	0.02	0.00
1963	0.64	0.48	0.17	0.06	0.04	0.01
1964	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.04	0.03	0.01	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.10	0.07	0.02	0.01	0.01	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.27	0.20	0.07	0.03	0.02	0.00
1979	0.01	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.01	0.01	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.42	0.29	0.10	0.04	0.02	0.01
1985	0.05	0.04	0.01	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.03	0.02	0.01	0.00	0.00	0.00

Sorted results

Prob.	Peak	96 hr	21 Day	60 Day	90 Day	Yearly
0.03	0.64	0.48	0.17	0.06	0.04	0.01
0.06	0.42	0.29	0.10	0.04	0.02	0.01
0.10	0.34	0.23	0.08	0.03	0.02	0.00
0.13	0.27	0.20	0.07	0.03	0.02	0.00
0.16	0.10	0.07	0.02	0.01	0.01	0.00
0.19	0.05	0.04	0.01	0.00	0.00	0.00
0.23	0.04	0.03	0.01	0.00	0.00	0.00
0.26	0.03	0.02	0.01	0.00	0.00	0.00
0.29	0.01	0.01	0.00	0.00	0.00	0.00
0.32	0.01	0.00	0.00	0.00	0.00	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.00
0.39	0.00	0.00	0.00	0.00	0.00	0.00
0.42	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.00	0.00	0.00	0.00	0.00	0.00
0.52	0.00	0.00	0.00	0.00	0.00	0.00
0.55	0.00	0.00	0.00	0.00	0.00	0.00
0.58	0.00	0.00	0.00	0.00	0.00	0.00
0.61	0.00	0.00	0.00	0.00	0.00	0.00
0.65	0.00	0.00	0.00	0.00	0.00	0.00
0.68	0.00	0.00	0.00	0.00	0.00	0.00
0.71	0.00	0.00	0.00	0.00	0.00	0.00
0.74	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	0.00	0.00	0.00	0.00	0.00
0.81	0.00	0.00	0.00	0.00	0.00	0.00
0.84	0.00	0.00	0.00	0.00	0.00	0.00
0.87	0.00	0.00	0.00	0.00	0.00	0.00
0.90	0.00	0.00	0.00	0.00	0.00	0.00
0.94	0.00	0.00	0.00	0.00	0.00	0.00
0.97	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.33	0.23	0.08	0.03	0.02	0.00
					Average of:	0.00

Inputs generated by pe4.pl - 8-August-2003

Data used for this run:
Output File: OR_MTxmas
Metfile: w24232.dvf
PRZM scen: ORXmasTreeC.txt
EXAMS en pond298.exv
Chemical N. MITC

Description	Variable Na	Value	Units	Comments
Molecular w	mwt	73.11	g/mol	
Henry's Law	henry	1.79E-04	atm-m^3/mol	
Vapor Press	vapr	19	torr	
Solubility	sol	7600	mg/L	
Kd	Kd	0.26	mg/L	
Koc	Koc		mg/L	
Photolysis h	kdp	51.6	days	Half-life
Aerobic Aqu	kbacw	19.22	days	Halflife
Anaerobic A	kbacs		days	Halflife
Aerobic Soi	asm	9.61	days	Halflife
Hydrolysis:	pH 7	20.4	days	Half-life
Method:	CAM	8	integer	See PRZM manual
Incorporatic	DEPI	20	cm	
Application	TAPP	237.7	kg/ha	
Application	APPEFF	1	fraction	
Spray Drift	DRFT	0	fraction of application rate applied to pond	
Application	Date	15-04	dd/mm or dd/mmm or dd-mm or dd-mmm	
Record 17:	FILTRA			
	IPSCND	1		
	UPTKF			
Record 18:	PLVKRT			
	PLDKRT			
	FEXTRC	0		
Flag for Ind	IR	Pond		
Flag for run	RUNOFF	none	none, monthly or total(average of entire run)	

Appendix D: ISCST Estimation of MITC concentrations in air

The potential for inhalation of MITC to be a toxicologically significant route of exposure to birds and mammals within the use area was evaluated with the Agency's Industrial Source Complex Short Term (ISCST3) model. The ISCST3 model with information about emissions from a treated field (i.e., known as flux) estimates the range of concentrations which might be found under different conditions of application rate, weather, source size and shape (e.g., field size in acres), and distance from the treated field, building or structure.

MITC Concentrations in Air after Dazomet Application

Table VII.D.a: MITC Concentrations in Air after Dazomet Application

Wind Speed (mph)	2.25	2.25	3.1	4	5	6	7	8	9	10	10
Wind Speed (m/s)	1.01	1.01	1.39	1.79	2.24	2.68	3.13	3.58	4.02	4.47	4.47
Stability Category	F	D	C	C	C	C	C	C	C	C	B
Distance (m)	Concentration (µg/m3)										
Field Size: 1 acre											
0	2383.99	1350.11	670.42	521.44	426.63	347.63	302.77	260.72	234.65	208.58	152.73
25	988.41	514.13	237.16	184.45	150.92	122.97	107.10	92.23	83.00	73.78	51.91
50	698.75	354.54	159.58	124.12	101.55	82.75	72.07	62.06	55.85	49.65	33.53
100	462.05	227.08	95.89	74.58	61.02	49.72	43.31	37.29	33.56	29.83	17.75
200	289.92	127.99	45.44	35.34	28.92	23.56	20.52	17.67	15.90	14.14	7.16
300	216.33	81.45	25.86	20.11	16.46	13.41	11.68	10.06	9.05	8.05	3.78
400	170.14	56.38	16.63	12.93	10.58	8.62	7.51	6.47	5.82	5.17	2.32
500	136.80	41.25	11.60	9.02	7.38	6.02	5.24	4.51	4.06	3.61	1.54
600	111.81	31.53	8.57	6.67	5.46	4.45	3.87	3.33	3.00	2.67	1.10
700	93.19	24.93	6.61	5.14	4.21	3.43	2.99	2.57	2.31	2.06	0.82
800	79.44	20.24	5.26	4.09	3.35	2.73	2.37	2.04	1.84	1.64	0.64
900	68.51	16.81	4.29	3.34	2.73	2.22	1.94	1.67	1.50	1.33	0.51
1000	59.80	14.26	3.57	2.78	2.27	1.85	1.61	1.39	1.25	1.11	0.42
Field Size: 5 acres											
0	3090.15	1704.11	828.87	644.68	527.46	429.78	374.33	322.34	290.10	257.87	187.59
25	1572.08	802.87	364.91	283.82	232.21	189.21	164.80	141.91	127.72	113.53	80.06
50	1198.86	599.31	267.55	208.10	170.26	138.73	120.83	104.05	93.64	83.24	58.10
100	856.87	417.76	182.46	141.92	116.11	94.61	82.40	70.96	63.86	56.77	38.51
200	576.59	271.22	113.13	87.99	71.99	58.66	51.09	43.99	39.59	35.19	21.39
300	447.23	204.69	78.69	61.20	50.07	40.80	35.54	30.60	27.54	24.48	13.27
400	369.66	163.42	57.37	44.62	36.51	29.75	25.91	22.31	20.08	17.85	8.83
500	317.15	133.28	43.37	33.73	27.60	22.49	19.59	16.87	15.18	13.49	6.21
600	278.78	110.29	33.82	26.30	21.52	17.54	15.27	13.15	11.84	10.52	4.59
700	250.61	92.48	27.07	21.06	17.23	14.04	12.23	10.53	9.47	8.42	3.52
800	228.23	78.51	22.15	17.23	14.09	11.48	10.00	8.61	7.75	6.89	2.79

Table VII.D.a: MITC Concentrations in Air after Dazomet Application

Wind Speed (mph)	2.25	2.25	3.1	4	5	6	7	8	9	10	10
Wind Speed (m/s)	1.01	1.01	1.39	1.79	2.24	2.68	3.13	3.58	4.02	4.47	4.47
Stability Category	F	D	C	C	C	C	C	C	C	C	B
Distance (m)	Concentration (µg/m3)										
900	208.88	67.47	18.46	14.36	11.75	9.57	8.34	7.18	6.46	5.74	2.26
1000	192.35	59.12	15.63	12.15	9.94	8.10	7.06	6.08	5.47	4.86	1.87
Field Size: 10acres											
0	3436.95	1873.79	903.43	702.67	574.91	468.44	408.00	351.33	316.20	281.07	202.85
25	1880.02	951.62	429.50	334.06	273.32	222.70	193.97	167.03	150.33	133.62	93.89
50	1476.33	731.85	324.68	252.53	206.61	168.35	146.63	126.26	113.64	101.01	70.49
100	1092.83	528.52	229.99	178.88	146.36	119.25	103.87	89.44	80.50	71.55	49.07
200	760.89	356.75	150.58	117.12	95.82	78.08	68.00	58.56	52.70	46.85	30.20
300	600.02	276.82	111.68	86.86	71.07	57.91	50.43	43.43	39.09	34.74	20.42
400	501.04	228.50	86.73	67.46	55.19	44.97	39.17	33.73	30.35	26.98	14.40
500	433.08	193.94	69.03	53.69	43.93	35.79	31.17	26.84	24.16	21.48	10.54
600	384.35	167.04	55.99	43.55	35.63	29.03	25.29	21.77	19.60	17.42	8.02
700	348.96	145.19	46.18	35.91	29.38	23.94	20.85	17.96	16.16	14.37	6.28
800	321.44	127.11	38.66	30.07	24.60	20.05	17.46	15.03	13.53	12.03	5.05
900	298.70	112.43	32.80	25.51	20.87	17.01	14.81	12.76	11.48	10.21	4.15
1000	279.74	100.80	28.17	21.91	17.92	14.61	12.72	10.95	9.86	8.76	3.46
Field Size: 20 acres											
0	3799.77	2044.62	976.16	759.24	621.19	506.16	440.85	379.62	341.66	303.69	219.40
25	2217.82	1110.04	497.16	386.68	316.38	257.79	224.53	193.34	174.01	154.67	108.54
50	1794.39	880.42	387.88	301.69	246.83	201.12	175.17	150.84	135.76	120.67	83.82
100	1372.73	658.32	284.46	221.25	181.02	147.50	128.47	110.62	99.56	88.50	60.65
200	989.59	462.04	194.19	151.04	123.58	100.69	87.70	75.52	67.97	60.42	39.82
300	794.85	366.34	149.46	116.24	95.11	77.50	67.50	58.12	52.31	46.50	28.84
400	671.62	307.58	121.22	94.28	77.14	62.86	54.75	47.14	42.43	37.71	21.66
500	586.25	266.29	100.96	78.52	64.25	52.35	45.59	39.26	35.34	31.41	16.68
600	524.79	235.00	85.37	66.40	54.33	44.27	38.55	33.20	29.88	26.56	13.17
700	479.14	209.91	72.96	56.75	46.43	37.83	32.95	28.38	25.54	22.70	10.63
800	443.50	189.33	62.95	48.96	40.06	32.64	28.43	24.48	22.03	19.58	8.74
900	414.46	172.51	54.75	42.58	34.84	28.39	24.73	21.29	19.16	17.03	7.30
1000	390.46	158.69	47.99	37.33	30.54	24.88	21.67	18.66	16.80	14.93	6.18
Field Size: 40 acres											
0	4195.77	2229.52	1054.36	820.06	670.96	546.71	476.16	410.03	369.03	328.02	234.71
25	2589.77	1282.52	569.16	442.68	362.19	295.12	257.04	221.34	199.21	177.07	123.17
50	2147.70	1044.06	454.65	353.62	289.32	235.75	205.33	176.81	159.13	141.45	97.67
100	1692.05	805.27	344.49	267.93	219.22	178.62	155.57	133.97	120.57	107.17	72.88
200	1261.13	586.45	244.04	189.81	155.30	126.54	110.21	94.91	85.41	75.92	49.94

Table VII.D.a: MITC Concentrations in Air after Dazomet Application

Wind Speed (mph)	2.25	2.25	3.1	4	5	6	7	8	9	10	10
Wind Speed (m/s)	1.01	1.01	1.39	1.79	2.24	2.68	3.13	3.58	4.02	4.47	4.47
Stability Category	F	D	C	C	C	C	C	C	C	C	B
Distance (m)	Concentration (µg/m3)										
300	1032.53	474.70	192.64	149.83	122.59	99.89	87.00	74.92	67.42	59.93	37.77
400	885.03	404.06	160.07	124.50	101.86	83.00	72.29	62.25	56.03	49.80	29.80
500	781.86	353.81	136.99	106.55	87.18	71.03	61.87	53.27	47.95	42.62	24.08
600	706.01	315.83	119.36	92.84	75.96	61.89	53.91	46.42	41.78	37.14	19.82
700	648.59	286.33	105.21	81.83	66.95	54.55	47.51	40.91	36.82	32.73	16.56
800	603.38	263.07	93.46	72.69	59.47	48.46	42.21	36.34	32.71	29.08	14.00
900	566.12	244.36	83.51	64.95	53.14	43.30	37.71	32.48	29.23	25.98	11.97
1000	534.93	228.96	74.99	58.33	47.72	38.88	33.87	29.16	26.25	23.33	10.34

Appendix E. Ecological Effects Data

In this risk assessment, surrogate test species of birds, mammals, fish, aquatic and terrestrial invertebrates and plants are used to estimate treatment-related direct effects on acute mortality and chronic reproduction, growth, and survival of non-target species. Toxicity tests include short-term acute, subacute, and reproduction/chronic studies that progress from basic laboratory tests to applied field studies. In addition, avian species are used as surrogates for reptiles and fish species are used as surrogates for amphibians. Dazomet is applied in a granular form and rapidly hydrolyzes to methyl isothiocyanate (MITC), which is dissipated by volatilization and leaching. Consequently, terrestrial exposure to birds and mammals can occur orally as dazomet granules and/or by inhalation of MITC. Acute and chronic toxicity studies are available to assess the risk of dazomet to birds and mammals by the oral route; however, inhalation toxicity studies for MITC are only available for mammals. Avian inhalation risk will be evaluated using the mammal assessment; however, the sensitivities of birds and mammals may not be equivalent due to physiological differences that could result in higher exposures to birds. Consequently, results indicating no risk to mammals may underestimate risk and not be protective of birds. Since dazomet rapidly hydrolyzes to MITC, potential exposure to aquatic receptors would by surface runoff/leaching of MITC. PRZM/EXAMS modeling indicates aquatic organism exposure only to MITC. Consequently, the toxicity data for MITC are presented here and will be used to assess risk to fish, aquatic invertebrates, and aquatic plants.

Toxicity to Terrestrial Animals

Birds, Acute and Subacute

An oral toxicity study using the technical grade of the active ingredient (TGAI) is required to establish the acute toxicity of dazomet to birds. The preferred guideline test species is either mallard duck (a waterfowl) or bobwhite quail (an upland gamebird). The data that were submitted show that the oral LD_{50} is 424 mg/kg bw for bobwhite quail. The NOEC is 147 mg/kg with observed effects at higher dose(s) including lethargy, anorexia, and reduced mean body weights and feed consumption. Based on these results, dazomet is categorized as moderately toxic to avian species on an acute oral basis. This study (MRID 42365101) fulfills the guideline requirement for an acute oral toxicity study with birds (§71-1) and is classified as acceptable. The LD_{50} of 424 mg/kg bw was used to assess the risk of acute oral exposure of dazomet to avian species.

Avian Acute Oral Toxicity for Dazomet					
Species	% ai	LD50 (mg/kg bw)	Toxicity Category	MRID # Author, Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	99.6-99.8	424	moderately toxic	42365101 Bisinger, 1982 (=Accession No. 251207; Fletcher, 1982)	Acceptable

Two dietary studies using the TGAI are required to establish the subacute toxicity of dazomet to birds. The preferred test species are mallard duck and bobwhite quail. Dazomet data indicate that the 8-day acute dietary LC_{50} values are 2301 and >5137 ppm for bobwhite quail and mallard duck, respectively. Therefore, dazomet is categorized as slightly toxic to avian species on a subacute dietary basis. The guideline (§71-2) is partially fulfilled with an acceptable subacute dietary study with the mallard duck (MRID 41596901). The quail study (MRID 42365102) was determined to be supplemental because the stability and homogeneity of the test substance was not determined.

Avian Subacute Dietary Toxicity for Dazomet					
Species	% ai	5-Day LC50 (ppm)1	Toxicity Category	MRID # Author, Year	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	99.6-99.8	2301	slightly toxic	42365102 Bisinger, 1982 (Bio-Life study/Fletcher)	Supplemental
Mallard duck *(Anas platyrhynchos)*	99.3	>5137	practically non-toxic	41596901 Munk, 1986	Acceptable

Birds, Chronic

Avian reproduction studies using the TGAI are required for dazomet because birds may be subject to repeated or continuous exposure to the pesticide, especially preceding or during the breeding season. The preferred test species are mallard duck and bobwhite quail. The submitted studies (MRID 43245002 ; MRID 43245001) are considered supplemental. Neither study is able to provide an overall NOAEL/LOAEL and the studies are therefore not adequate for quantitative risk assessment. They do not fulfill guideline requirements (71-4) due to high embryonic mortality in the mallard controls between day 21 and hatch and inadequate incorporation of test substance at the 10 and 100 levels in both studies. Significant treatment-related effects in the mallard study included reductions in egg production, egg quality, fertility, and embryonic survival at the 1000 ppm level. A significant reduction in hatchling weight was also observed at the 100 ppm level. In the bobwhite quail study, dazomet exposure of 100 ppm significantly reduced the number of hatched to eggs laid and the proportion of live embryos to viable

embryos was significantly reduced at all treatment levels. At the 1000 ppm level, egg fertility, embryonic survival, hatchability, and chick survival were adversely affected.

Avian Reproduction Toxicity for Dazomet					
Species	% ai	NOEC/LOEC (ppm)	LOEC Endpoints	MRID # Author, Year	Study Classification
Northern bobwhite quail *Colinus virginianus)*	98.0	NA	NA	43245002 Leopold, 1994	Supplemental
Mallard duck *(Anas platyrhynchos)*	98.0	NA	NA	43245001 Leopold, 1994	Supplemental

Mammals, Acute and Subchronic (HED)

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. These toxicity values are reported below. The results indicate that both dazomet and MITC are categorized as Toxicity Category II (Warning) to small mammals on an acute oral basis and acute inhalation basis, respectively. A 90-day oral study with rats reported that dazomet caused increased liver weight and increased incidence of pronounced foci in the liver. A 28-day inhalation study with rats indicates that MITC causes pathological effects in the nasal cavity and tracheabronchial region, including metaplasia of respiratory epithelium. See the HED assessment for further details and guideline status. The lowest endpoint values will be used to assess acute risk to mammals from oral exposure to granular dazomet and from inhalation exposure to volatile MITC.

Mammalian Acute and Subchronic Oral Toxicity for Dazomet					
Species	% a.i.	Test Type	Toxicity	Affected Endpoints	MRID # Author, Year
Rat (Rattus norvegicus)	NA	Acute	LD50 = 596 mg/kg/day LD50 = 415 mg/kg/day LD50 = 519 mg/kg/day (combined)	Mortality	00132468 Jacekh, 1980
Rat (Rattus norvegicus)	97.0	Subchronic feeding	NOAEL = 20 ppm (1.5/1.7 mg/kg/day) LOAEL (M) = 60 ppm (4.5 mg/kg/day) LOAEL (F) = 180 ppm (15.4 mg/kg/day)	increased liver to body weight ratio	41865502 Hellwig, 1987

Mammalian Acute and Subchronic Oral Toxicity for Dazomet					
Species	% a.i.	Test Type	Toxicity	Affected Endpoints	MRID # Author, Year
Dog	NA	Subchronic feeding	NOAEL/LOAEL = 3.5/7.25 mg/kg/day	increased liver to body weight ratio	41866501 Hellwig, 1987

Mammalian Acute and Subchronic Inhalation Toxicity for MITC					
Species	% a.i.	Test Type	Toxicity	Affected Endpoints	MRID # Author, Year
Rat (Rattus norvegicus)	NA	Acute	LC50 = 0.54 mg/L	Mortality	45919410 NA
Rat (Rattus norvegicus)	96.9	28-day sub-acute	Systemic LOAEL = 19.9 mg/m3 (6.8 ppm) LOAEL (ET) = 100 mg/m3 (34 ppm) NOAEL (ET) = 19.9 mg/m3 (6.8 ppm) LOAEL (TB) = 100 mg/m3 (34 ppm) NOAEL (TB) = 19.9 mg/m3 (6.8 ppm)	irritation pathological changes of the nasal cavity pathological changes	45314802 NA, 1987

Mammals, Chronic and Developmental/Reproductive (HED)

Results from acceptable guideline studies for dazomet and MITC are presented in the following tables (Information is from HED). Oral chronic exposure to dazomet resulted in liver effects at levels as low as 1.15 mg/kg/day (NOAEL 0.35 mg/kg/day) in dogs. Liver effects were also observed in a rat reproduction study at 3 mg/kg/day dazomet (NOAEL 0.5 mg/kg/day). Maternal toxicity was observed in rat developmental toxicity studies with MITC at 10 mg/kg/day (NOAEL 3 mg/kg/day; salivation and decreased body weight gain) and with dazomet at 30 mg/kg/day (NOAEL 10 mg/kg/day; decreased body weight gain and food consumption). Reduced fetal weight and an increased incidence of skeletal variation of unossified sternebrae were observed in a rat developmental study with MITC at 30 mg/kg/day (NOAEL 10 mg/kg/day).

Mammalian Chronic and Developmental/Reproductive Toxicity for Dazomet.

Species	Test Type	Toxicity	Affected Endpoints	MRID # Author, Year
Rat	chronic feeding	NOAEL = 0.84 mg/kg/day LOAEL = 4.83 mg/kg/day	neoplastic pathology	41865001 Kuhbroth, 1989
Dog	chronic feeding	NOAEL = 0.35 mg/kg/day LOAEL = 1.15 mg/kg/day	increased liver to body weight ratio; increased pigmentation in liver	41967701 Hellwig, 1989
Rat	Teratology	NOAEL/LOAEL = 10/30 mg/kg/day NOAEL/LOAEL= 30/30 mg/kg/day	Maternal tox[1] Developmental	41483701 Hellwig, 1987
Rat	Reproduction	NOAEL/LOAEL = 0.5/3 mg/kg/day NOAEL/LOAEL = 17-19/17-19 mg/kg/day	Parental systemic[2] Reproductive	41865301 Hellwig, 1989

[1]Maternal toxicity - reduced body weight gain and decreased food consumption.
[2]Parental systemic toxicity - increased incidence and severity of hepatic intracellular neutral lipids in male rats; decreased body weight in F1 males.

Mammalian Chronic and Developmental/Reproductive Toxicity for MITC .				
Species	Test Type	Toxicity	Affected Endpoints	MRID # Author, Year
Rat	Teratology	NOAEL/LOAEL = 3/10 mg/kg/day NOAEL/LOAEL= 10/30 mg/kg/day	Maternal tox[1] Developmental	44733602 NA, 1998

[3]Maternal toxicity - salivation and decreased body weight gain

Developmental toxicity - reduced fetal weight and an increased incidence of skeletal variation of unossified sternebrae.

Insects, Acute Contact

A honey bee acute contact study (ID #00001999) indicates an LD_{50} >24 □g ai/bee for dazomet, indicating that it is relatively non-toxic to honey bees. Further, substantial honey bee exposure is not expected since dazomet is applied to bare soil and incorporated; it is not applied by foliar application. This data is not used for risk assessment.

Toxicity to Aquatic Organisms

Freshwater Fish, Acute
Freshwater fish acute studies for the degradate (MITC) indicate that it is very highly toxic to rainbow trout with 96-hour LC_{50} values ranging from 0.094 to 0.0512 ppm. MITC is also highly toxic to bluegill sunfish with a reported 96-hour LC_{50} of 0.142 ppm. Based on the rapid hydrolysis of dazomet, aquatic organisms will likely be exposed only to

MITC; consequently, acute risk to freshwater fish species will be assessed using the lowest toxicity value from these studies (rainbow trout LC_{50} of 0.0512 ppm; static renewal test).

Freshwater Fish Acute Toxicity for MITC					
Species	% ai	96-hour LC50 (ppm)	Toxicity Category	MRID # Author, Year	Study Classification
Bluegill sunfish *(Lepomis macrochirus)*	94.9	0.142	highly toxic	44523412 (42058001) Schupner & Stachural, 1991	Acceptable
Rainbow trout *(Oncorhynchus mykiss)*	94.9	0.094	very highly toxic	44523413 (42058002) Schupner & Stachural, 1991	Acceptable
Rainbow trout *(Oncorhynchus mykiss)*	99.6	0.0512	very highly toxic	45919420 Zok, 2002	Supplemental

Freshwater Fish, Chronic

A freshwater fish early life-stage test is normally required for the TGAI of the parent compound (dazomet); however, due to the rapid degradation of dazomet to MITC in the presence of water, the required test material is MITC. The degradate is expected to be transported to water from the intended use site, and one or more of the following conditions are met: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent, (2) any aquatic acute LC_{50} or EC_{50} is less than 1 ppm, and/or (3) the EEC in water is equal to or greater than 0.01 of any acute LC_{50} or EC_{50} value. The preferred test species is rainbow trout. A non-guideline 28-day subchronic study with rainbow trout has been submitted. However, this study (MRID 45634002) is considered invalid due to insufficient analytical data and MITC stability was not adequately assessed; consequently this guideline (72-4a) is not fulfilled.

Freshwater Invertebrates, Acute

Acute toxicity data for MITC indicate that it is very highly toxic to aquatic invertebrates, with 48-hour EC_{50} values ranging from 0.055 to 0.076 ppm. Aquatic organisms will likely be exposed only to MITC; consequently, acute risk to freshwater invertebrate species will be assessed using the lowest toxicity value from these studies (EC_{50} of 0.055 ppm - flow-through test).

Freshwater Invertebrate Acute Toxicity for MITC

Species	% ai	48-hour LC50 (ppm)	Toxicity category	MRID # Author, Year	Study Classification
Waterflea (*Daphnia magna*)	95	0.055	Very highly toxic	41819302 Schupmer, 1991	Acceptable
Waterflea (*Daphnia magna*)	99.6	0.076	Very highly toxic	45919419 Dohmen, 2002	Supplemental

Freshwater Invertebrate, Chronic

A freshwater aquatic invertebrate life-cycle test using the TGAI is normally required for dazomet; however, due to the rapid degradation of dazomet to MITC in the presence of water, the required test material is MITC. The degradate is expected to be transported to water from the intended use site, and one or more of the following conditions are met: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent, (2) any aquatic acute LC50 or EC_{50} is less than 1ppm, and/or (3) the EEC in water is equal to or greater than 0.01 of any acute LC_{50} or EC_{50} value. The preferred test is a 21-day life cycle on *Daphnia magna*. The data that were submitted show that MITC has the potential for chronic toxicity to daphnids and possibly other freshwater invertebrates. The 21-day NOAECs based on both reproductive effects and parental mortality was 0.025 ppm and the 21-day LOAECs based on reproductive effects and parental mortality were >0.025 and 0.050 ppm, respectively. This study was classified as supplemental because mean measured concentrations were not determined, the stability of the test substance was not assessed under actual use conditions, and terminal growth measurements were not obtained. Consequently, the guideline requirement (72-4b) is not fulfilled. The lowest NOAEC (0.025 ppm; static renewal test) will be used in assessing chronic risk to freshwater invertebrates.

Freshwater Aquatic Invertebrate Life-Cycle Toxicity for MITC					
Species	% ai	21-day NOAEC/LOAEC (ppm)	Endpoints Affected	MRID # Author, Year	Study Classification
Waterflea *(Daphnia magna)*	NR	0.025/>0.025 0.025/0.050	Reproduction Parental mortality	45634001 Jatzek, 2001	Supplemental

Freshwater Field Studies
No data submitted.

Estuarine and Marine Fish, Acute

No data submitted for the degradate MITC.

Estuarine and Marine Fish, Chronic

No data submitted for the degradate MITC.

Estuarine and Marine Invertebrates, Acute
No data submitted for the degradate MITC.

Estuarine and Marine Invertebrate, Chronic

No data submitted for the degradate MITC.

Estuarine and Marine Field Studies

No data submitted.
Aquatic Plants

Acute toxicity studies on the degradate MITC were conducted with duckweed (*Lemna gibba*), green algae (*Selenastrum capricornutum*), blue-green alga (*Anabaena flos-aquae*), and another algae (*Scenedesmus subspicatus*). In the duckweed study an EC_{50} of 0.59 ppm a.i. (NOEC of 0.09 ppm a.i) was determined and the algae studies ascertained EC_{50} values ranging from 0.254 to 1.5 ppm. Duckweed showed statistically significant reductions in frond number and growth rate at 0.269 ppm and above. In the alga studies, cell densities or biomass were significantly reduced. Acute risk to aquatic plant species will be assessed using the lowest toxicity value from these studies [nonvascular EC_{50} of 0.254 ppm (MRID 44588903); vascular EC_{50} of 0.59 ppm (MRID 45919421)]. The MITC aquatic vascular plant study requirements are fulfilled; however the MITC aquatic nonvascular plant requirements are only partially fulfilled as the three studies conducted are considered supplemental.

Non-target Aquatic Plant Toxicity for MITC					
Species [Study Type]	% a.i.	EC_{50}/NOAEC (ppm)	Endpoints Affected	MRID # Author, Year	Study Classification
Duckweed (*Lemna gibba*) [Tier 2]	99.6	0.59/0.09	# fronds/growth	45919421 Junker, 2002	Acceptable
Blue-green Algae (*Anabaena flos-aquae*) [Tier 2]	99.6	1.5	Cell density	45919422 Kubitza, 2002	Supplemental
Green Algae (*Selenastrum capricornutum*) [Tier 2]	99	0.28/0.207	biomass	45919416 Kubitza, 1998	Supplemental

Non-target Aquatic Plant Toxicity for MITC					
Species [Study Type]	% a.i.	EC_{50}/NOAEC (ppm)	Endpoints Affected	MRID # Author, Year	Study Classification
Algae (*Scenedesmus subspicatus*) [Tier 2]	95.7	0.254	Cell density (nominal)	44588903 van Dijk, 1990	Supplemental

Terrestrial Plants

Terrestrial plant Tier I seedling emergence and vegetative vigor testing of a Typical End-Use Product is currently recommended for all pesticides having outdoor uses (EFED Policy, Keehner, July 1999). Tier II studies are required for all low dose pesticides (those with the maximum use rate of 0.5 lbs a.i./A or less) and for any pesticide showing a negative response equal to or greater than 25% in Tier I studies. The recommendations for seedling emergence and vegetative vigor studies are for testing of (1) six species of at least four dicotyledonous families, one species of which is soybean (*Glycine max*) and the second of which is a root crop, and (2) four species of at least two monocotyledonous families, one of which is corn (*Zea mays*). Toxicity studies have not been conducted for MITC; consequently, these guidelines [seedling emergence 122-1(a) and 123-1(a); vegetative vigor 122-1(b) and 123-1(b)] have not been satisfied.

Appendix F. Terrestrial Risk Quotients T-REX model OUTPUTS

The EFED terrestrial exposure model, T-REX (Version 1.2.3, 8/8/05), is used to estimate exposures and risks to avian and mammalian species. Input values on avian and mammalian toxicity as well as chemical application are required to run the model. The model generates LD50/square foot values, which can be compared to OPP Levels-of-Concern (LOCs). T-REX is a spreadsheet-based model. The results are presented by weight class for various sized birds and mammals for each type of application. T_REX adjusts acute and chronic toxicity values based on the relative body weight of the animal being assessed compared with the animal used in the toxicity studies

T-REX was run for tomato and strawberry crops for a single application of dazomet applied at the maximum rate of 530 lb a.i./A, to estimate acute risk to birds and mammals from dazomet granules. It was also used as a strictly preliminary screen to see whether the total amount of MITC generated could potentially pose an acute risk to mammals. The risk assessment to wildlife from MITC is then based entirely on a specific inhalation analysis (see text for details).

Chemical: Dazomet

LD50 ft-2

INPUTS	Do not overwrite these numbers.	
Application Rate:	530	lbs ai/acre
% A.I.:	1	
Avian LD50 (20g):	305.45	mg/kg bw
(100g)	388.87	
(1000g)	549.29	
Mammalian LD50 (15g):	912.10	mg/kg bw
(35g)	737.99	
(1000g)	319.20	
Row Spacing:	0	inches
Bandwidth:	0	inches
Unincorporation:	100%	

Changes to the inputs must be made in the "INPUTS" worksheet.

Row/Band/In-furrow applications

Granular

Intermediate Calculations	
# rows acre-1:	N/A
row length (ft):	N/A
lb ai/1000 ft row:	N/A
bandwidth (ft):	N/A
mg ai/ft2:	N/A
exposed mg ai/ft2:	N/A

LD50 ft-2		
	wgt class	
Avian	20 g	N/A
	100 g	N/A
	1000 g	N/A
Mammal	15 g	N/A
	35 g	N/A
	1000 g	N/A

Liquid

Intermediate Calculations	
mg a.i./1000 ft row:	N/A
bandwidth:	N/A
mg a.i./ft2:	N/A
exposed mg a.i./ft2:	N/A

LD50 ft-2		
	wgt class	
Avian	20 g	N/A
	100 g	N/A
	1000 g	N/A
Mammal	15 g	N/A
	35 g	N/A
	1000 g	N/A

Broadcast applications

Granular

Intermediate Calculations	
mg ai/ft2:	5518.89

LD50 ft-2		
	wgt class	
Avian	20 g	903.37
	100 g	141.92
	1000 g	10.05
Mammal	15 g	403.38
	35 g	213.67
	1000 g	17.29

Chemical: MITC equiv. (from dazomet)

LD50 ft-2

INPUTS	Do not overwrite these numbers.	
Application Rate:	219.4	lbs ai/acre
% A.I.:	1	
Avian LD50 (20g):	0.00	mg/kg bw
(100g)	0.00	
(1000g)	0.00	
Mammalian LD50 (15g):	120.98	mg/kg bw
(35g)	97.81	
(1000g)	42.30	
Row Spacing:	0	inches
Bandwidth:	0	inches
Unincorporation:	100%	

Changes to the inputs must be made in the "INPUTS" worksheet.

Warning! You Have Failed to Enter a Toxicity Scaling Factor on the Inputs Page

Row/Band/In-furrow applications

Granular

Intermediate Calculations	
# rows acre-1:	N/A
row length (ft):	N/A
lb ai/1000 ft row:	N/A
bandwidth (ft):	N/A
mg ai/ft2:	N/A
exposed mg ai/ft2:	N/A

LD50 ft-2		
	wgt class	
Avian	20 g	N/A
	100 g	N/A
	1000 g	N/A
Mammal	15 g	N/A
	35 g	N/A
	1000 g	N/A

Liquid

Intermediate Calculations	
mg a.i./1000 ft row:	N/A
bandwidth:	N/A
mg a.i./ft2:	N/A
exposed mg a.i./ft2:	N/A

LD50 ft-2		
	wgt class	
Avian	20 g	N/A
	100 g	N/A
	1000 g	N/A
Mammal	15 g	N/A
	35 g	N/A
	1000 g	N/A

Broadcast applications

Granular

Intermediate Calculations	
mg ai/ft2:	2284.61

LD50 ft-2		
	wgt class	
Avian	20 g	#DIV/0!
	100 g	#DIV/0!
	1000 g	#DIV/0!
Mammal	15 g	1259.98
	35 g	667.39
	1000 g	54.00

Species Occurrence in Selected States and Selected Taxa

No species were excluded
All Medium Types Reported

Mammal, Marine mml, Bird, Amphibian, Reptile, Fish, Crustacean, Bivalve, Gastropod, Arachnid, Insect, Dicot, Monocot, Ferns, Conf/cycds, Coral, Lichen

AL, AK, AZ, AR, CA, CO, CT, DE, DC, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, OR, PA, PR, RI, SC, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY

Alabama **(91) species:**

				CH
Amphibian				
Salamander, Flatwoods	*Ambystoma cingulatum*	Threatened	Freshwater, Vernal pool, Terrestrial	No
Salamander, Red Hills	*Phaeognathus hubrichti*	Threatened	Freshwater, Terrestrial	No
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Stork, Wood	*Mycteria americana*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Combshell, Southern (=Penitent mussel)	*Epioblasma penita*	Endangered	Freshwater	No
Combshell, Upland	*Epioblasma metastriata*	Endangered	Freshwater	Yes
Kidneyshell, Triangular	*Ptychobranchus greenii*	Endangered	Freshwater	Yes
Mucket, Orangenacre	*Lampsilis perovalis*	Threatened	Freshwater	Yes
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Acornshell Southern	*Epioblasma othcaloogensis*	Endangered	Freshwater	Yes
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	Threatened	Freshwater	Yes
Mussel, Coosa Moccasinshell	*Medionidus parvulus*	Endangered	Freshwater	Yes
Mussel, Cumberland Combshell	*Epioblasma brevidens*	Endangered	Freshwater	Yes

Mussel, Dark Pigtoe	*Pleurobema furvum*	Endangered	Freshwater	Yes
Mussel, Fine-lined Pocketbook	*Lampsilis altilis*	Threatened	Freshwater	Yes
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	Endangered	Freshwater	No
Mussel, Flat Pigtoe (=Marshall's Mussel)	*Pleurobema marshalli*	Endangered	Freshwater	No
Mussel, Heavy Pigtoe (=Judge Tait's Mussel)	*Pleurobema taitianum*	Endangered	Freshwater	No
Mussel, Heelsplitter Inflated	*Potamilus inflatus*	Threatened	Freshwater	No
Mussel, Ovate Clubshell	*Pleurobema perovatum*	Endangered	Freshwater	Yes
Mussel, Ring Pink (=Golf Stick	*Obovaria retusa*	Endangered	Freshwater	No
Mussel, Rough Pigtoe	*Pleurobema plenum*	Endangered	Freshwater	No

Mussel, Shiny Pigtoe	*Fusconaia cor*	Endangered	Freshwater	No
Mussel, Shiny-rayed Pocketbook	*Lampsilis subangulata*	Endangered	Freshwater	No
Mussel, Southern Clubshell	*Pleurobema decisum*	Endangered	Freshwater	Yes
Mussel, Southern Pigtoe	*Pleurobema georgianum*	Endangered	Freshwater	Yes
Pearlymussel, Alabama Lamp	*Lampsilis virescens*	Endangered	Freshwater	No
Pearlymussel, Cracking	*Hemistena lata*	Endangered	Freshwater	No
Pearlymussel, Cumberland Monkeyface	*Quadrula intermedia*	Endangered	Freshwater	No
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	Endangered	Freshwater	No
Pearlymussel, Pale Lilliput	*Toxolasma cylindrellus*	Endangered	Freshwater	No
Pearlymussel, Turgid-blossom	*Epioblasma turgidula*	Endangered	Freshwater	No
Pearlymussel, White Wartyback	*Plethobasus cicatricosus*	Endangered	Freshwater	No
Stirrupshell	*Quadrula stapes*	Endangered	Freshwater	No
Crustacean				
Shrimp, Alabama Cave	*Palaemonias alabamae*	Endangered	Freshwater	No
Dicot				
Amphianthus, Little	*Amphianthus pusillus*	Threatened	Freshwater	No
Barbara Buttons, Mohr's	*Marshallia mohrii*	Threatened	Terrestrial	No
Bladderpod, Lyrate	*Lesquerella lyrata*	Threatened	Terrestrial	No
Clover, Leafy Prairie	*Dalea foliosa*	Endangered	Terrestrial	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No
Leather-flower, Alabama	*Clematis socialis*	Endangered	Terrestrial	No
Leather-flower, Morefield's	*Clematis morefieldii*	Endangered	Terrestrial	No
Pitcher-plant, Alabama Canebrake	*Sarracenia rubra alabamensis*	Endangered	Freshwater, Terrestrial	No
Pitcher-plant, Green	*Sarracenia oreophila*	Endangered	Terrestrial, Freshwater	No
Potato-bean, Price's	*Apios priceana*	Threatened	Terrestrial	No
Ferns				
Fern, Alabama Streak-sorus	*Thelypteris pilosa var. alabamensis*	Threatened	Terrestrial	No
Fern, American hart's-tongue	*Asplenium scolopendrium var.*	Threatened	Terrestrial	No

	americanum			
Quillwort, Louisiana	*Isoetes louisianensis*	Endangered	Freshwater, Terrestrial	No

Fish

Cavefish, Alabama	*Speoplatyrhinus poulsoni*	Endangered	Freshwater	Yes
Chub, Spotfin	*Erimonax monachus*	Threatened	Freshwater	Yes
Darter, Boulder	*Etheostoma wapiti*	Endangered	Freshwater	No
Darter, Goldline	*Percina aurolineata*	Threatened	Freshwater	No
Darter, Slackwater	*Etheostoma boschungi*	Threatened	Freshwater	Yes
Darter, Snail	*Percina tanasi*	Threatened	Freshwater	No

Darter, Vermilion	*Etheostoma chermocki*	Endangered	Freshwater	No	
Darter, Watercress	*Etheostoma nuchale*	Endangered	Freshwater	No	
Madtom, Yellowfin	*Noturus flavipinnis*	Threatened	Freshwater	Yes	
Sculpin, Pygmy	*Cottus pauius (=pygmaeus)*	Threatened	Freshwater	No	
Shiner, Blue	*Cyprinella caerulea*	Threatened	Freshwater	No	
Shiner, Cahaba	*Notropis cahabae*	Endangered	Freshwater	No	
Shiner, Palezone	*Notropis albizonatus*	Endangered	Freshwater	No	
Sturgeon, Alabama	*Scaphirhynchus suttkusi*	Endangered	Freshwater	No	
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	Threatened	Saltwater, Freshwater	Yes	
Gastropod					
Campeloma, Slender	*Campeloma decampi*	Endangered	Freshwater	No	
Elimia, Lacy	*Elimia crenatella*	Threatened	Freshwater	No	
Pebblesnail, Flat	*Lepyrium showalteri*	Endangered	Freshwater	No	
Riversnail, Anthony's	*Athearnia anthonyi*	Endangered	Freshwater	No	
Rocksnail, Painted	*Leptoxis taeniata*	Threatened	Freshwater	No	
Rocksnail, Plicate	*Leptoxis plicata*	Endangered	Freshwater	No	
Rocksnail, Round	*Leptoxis ampla*	Threatened	Freshwater	No	
Snail, Armored	*Pyrgulopsis (=Marstonia) pachyta*	Endangered	Freshwater	No	
Snail, Lioplax Cylindrical	*Lioplax cyclostomaformis*	Endangered	Freshwater	No	
Snail, Tulotoma	*Tulotoma magnifica*	Endangered	Terrestrial	No	
Mammal					
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No	
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes	
Mouse, Alabama Beach	*Peromyscus polionotus ammobates*	Endangered	Terrestrial, Coastal (neritic)	Yes	
Mouse, Perdido Key Beach	*Peromyscus polionotus trissyllepsis*		Endangered	Coastal (neritic)	Yes
Marine mml					

Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Monocot				
Grass, Tennessee Yellow-eyed	*Xyris tennesseensis*	Endangered	Terrestrial	No
Trillium, Relict	*Trillium reliquum*	Endangered	Terrestrial	No
Water-plantain, Kral's	*Sagittaria secundifolia*	Threatened	Freshwater	No
Reptile				
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes

Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Snake, Eastern Indigo	*Drymarchon corais couperi*	Threatened	Terrestrial	No
Tortoise, Gopher	*Gopherus polyphemus*	Threatened	Terrestrial	No
Turtle, Alabama Red-bellied	*Pseudemys alabamensis*	Endangered	Terrestrial, Freshwater	No
Turtle, Flattened Musk	*Sternotherus depressus*	Threatened	Freshwater, Terrestrial	No
Alaska	**(9) species:**			**CH**
Bird				
Curlew, Eskimo	*Numenius borealis*	Endangered	Terrestrial	No
Eider, Spectacled	*Somateria fischeri*	Threatened	Saltwater, Terrestrial	Yes
Eider, Steller's	*Polysticta stelleri*	Threatened	Terrestrial, Saltwater	Yes
Ferns				
Fern, Aleutian Shield	*Polystichum aleuticum*	Endangered	Terrestrial	No
Marine mml				
Otter, Northern Sea	*Enhydra lutris kenyoni*	Threatened	Saltwater	No
Sea-lion, Steller (eastern)	*Eumetopias jubatus*	Threatened	Saltwater	Yes
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Reptile				
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Arizona	**(57) species:**			**CH**
Amphibian				
Frog, Chiricahua Leopard	*Rana chiricahuensis*	Threatened	Freshwater, Terrestrial	No
Salamander, Sonora Tiger	*Ambystoma tigrinum stebbinsi*	Endangered	Vernal pool, Freshwater, Terrestrial	No
Bird				
Bobwhite, Masked	*Colinus virginianus ridgwayi*	Endangered	Terrestrial	No
Condor, California	*Gymnogyps californianus*	Endangered	Terrestrial	Yes
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	Endangered	Terrestrial	No
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	Endangered	Terrestrial	Yes

Owl, Mexican Spotted	*Strix occidentalis lucida*	Threatened	Terrestrial	Yes
Pygmy-owl, Cactus Ferruginous	*Glaucidium brasilianum cactorum*	Endangered	Terrestrial	No
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	Endangered	Terrestrial	No
Dicot				
Blue-star, Kearney's	*Amsonia kearneyana*	Endangered	Terrestrial	No
Cactus, Arizona Hedgehog	*Echinocereus triglochidiatus var. arizonicus*	Endangered	Terrestrial	No
Cactus, Brady Pincushion	*Pediocactus bradyi*	Endangered	Terrestrial	No
Cactus, Cochise Pincushion	*Coryphantha robbinsorum*	Threatened	Terrestrial	No

Cactus, Nichol's Turk's Head	*Echinocactus horizonthalonius var. nicholii*	Endangered	Terrestrial	No	
Cactus, Peebles Navajo	*Pediocactus peeblesianus peeblesianus*	Endangered	Terrestrial	No	
Cactus, Pima Pineapple	*Coryphantha scheeri var. robustispina*	Endangered	Terrestrial	No	
Cactus, Siler Pincushion	*Pediocactus (=Echinocactus,=Utahia) sileri*	Threatened	Terrestrial	No	
Cliffrose, Arizona	*Purshia (=cowania) subintegra*	Endangered	Terrestrial	No	
Cycladenia, Jones	*Cycladenia jonesii (=humilis)*	Threatened	Terrestrial	No	
Fleabane, Zuni	*Erigeron rhizomatus*	Threatened	Terrestrial	No	
Groundsel, San Francisco Peaks	*Senecio franciscanus*	Threatened	Terrestrial	Yes	
Milk-vetch, Holmgren	*Astragalus holmgreniorum*	Endangered	Terrestrial	No	
Milk-vetch, Sentry	*Astragalus cremnophylax var. cremnophylax*	Endangered	Terrestrial	No	
Milkweed, Welsh's	*Asclepias welshii*	Threatened	Terrestrial	Yes	
Umbel, Huachuca Water	*Lilaeopsis schaffneriana var. recurva*		Endangered	Terrestrial, Freshwater	Yes
Fish					
Catfish, Yaqui	*Ictalurus pricei*	Threatened	Freshwater	Yes	
Chub, Bonytail	*Gila elegans*	Endangered	Freshwater	Yes	
Chub, Gila	*Gila intermedia*	Endangered	Freshwater	Yes	
Chub, Humpback	*Gila cypha*	Endangered	Freshwater	Yes	
Chub, Sonora	*Gila ditaenia*	Threatened	Freshwater	Yes	
Chub, Virgin River	*Gila seminuda (=robusta)*	Endangered	Freshwater	Yes	
Chub, Yaqui	*Gila purpurea*	Endangered	Freshwater	Yes	
Minnow, Loach	*Tiaroga cobitis*	Threatened	Freshwater	Yes	
Pupfish, Desert	*Cyprinodon macularius*	Endangered	Freshwater	Yes	
Shiner, Beautiful	*Cyprinella formosa*	Threatened	Freshwater	Yes	
Spikedace	*Meda fulgida*	Threatened	Freshwater	Yes	
Spinedace, Little Colorado	*Lepidomeda vittata*	Threatened	Freshwater	Yes	

Squawfish, Colorado	*Ptychocheilus luclus*	Endangered	Freshwater	Yes
Sucker, Razorback	*Xyrauchen texanus*	Endangered	Freshwater	Yes
Topminnow, Gila (Yaqui)	*Poeciliopsis occidentalis*	Endangered	Freshwater	No
Trout, Apache	*Oncorhynchus apache*	Threatened	Freshwater	No
Trout, Gila	*Oncorhynchus gilae*	Endangered	Freshwater	No
Woundfin	*Plagopterus argentissimus*	Endangered	Freshwater	Yes
Gastropod				
Ambersnail, Kanab	*Oxyloma haydeni kanabensis*	Endangered	Freshwater, Terrestrial	No
Mammal				

Bat, Lesser (=Sanborn's) Long-nosed	*Leptonycteris curasoae yerbabuenae*		Endangered Terrestrial	Subterraneous, No
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No
Jaguar	*Panthera onca*	Endangered	Terrestrial	No
Jaguarundi, Sinaloan	*Herpailurus (=Felis) yagouaroundi tolteca*	Endangered	Terrestrial	No
Ocelot	*Leopardus (=Felis) pardalis*	Endangered	Terrestrial	No
Pronghorn, Sonoran	*Antilocapra americana sonoriensis*	Endangered	Terrestrial	No
Squirrel, Mount Graham Red	*Tamiasciurus hudsonicus grahamensis*	Endangered	Terrestrial	Yes
Vole, Hualapai Mexican	*Microtus mexicanus hualpaiensis*	Endangered	Terrestrial	No
Wolf, Gray	*Canis lupus*	Endangered	Terrestrial	Yes
Monocot				
Ladies'-tresses, Canelo Hills	*Spiranthes delitescens*	Endangered	Terrestrial	No
Sedge, Navajo	*Carex specuicola*	Threatened	Terrestrial	Yes
Reptile				
Rattlesnake, New Mexican Ridge-nosed	*Crotalus willardi obscurus*	Threatened	Terrestrial	Yes
Tortoise, Desert	*Gopherus agassizii*	Threatened	Terrestrial	Yes
Arkansas	**(22) species:**			**CH**
Bird				
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Fatmucket, Arkansas	*Lampsilis powelli*	Threatened	Freshwater	No
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Scaleshell	*Leptodea leptodon*	Endangered	Freshwater	No
Mussel, Speckled Pocketbook	*Lampsilis streckeri*	Endangered	Freshwater	No
Pearlymussel, Fat Pocketbook	*Potamilus capax*	Endangered	Freshwater	No
Rock-pocketbook, Ouachita	*Arkansia wheeleri*	Endangered	Freshwater	No

(=Wheeler's pm)				
Crustacean				
Crayfish, Cave (Cambarus	*Cambarus aculabrum*	Endangered	Freshwater	No
Crayfish, Cave (Cambarus zophonastes)	*Cambarus zophonastes*	Endangered	Freshwater	No
Dicot				
Bladderpod, Missouri	*Lesquerella filiformis*	Threatened	Terrestrial	No
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	Threatened	Terrestrial	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No
Pondberry	*Lindera melissifolia*	Endangered	Terrestrial	No

Fish				
Cavefish, Ozark	*Amblyopsis rosae*	Threatened	Freshwater	No
Darter, Leopard	*Percina pantherina*	Threatened	Freshwater	Yes
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Gastropod				
Shagreen, Magazine Mountain	*Mesodon magazinensis*	Threatened	Terrestrial	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Bat, Ozark Big-eared	*Corynorhinus (=Plecotus) townsendii ingens*	Endangered	Terrestrial, Subterraneous	No
California **(301) species:**				**CH**
Amphibian				
Frog, California Red-legged	*Rana aurora draytonii*	Threatened	Terrestrial, Freshwater	Yes
Frog, Mountain Yellow-legged	*Gopherus agassizli*	Endangered	Terrestrial, Freshwater	No
Salamander, California Tiger	*Ambystoma californiense*	Endangered	Terrestrial, Vernal pool	No
Salamander, Desert Slender	*Batrachoseps aridus*	Endangered	Freshwater, Terrestrial	No
Salamander, Santa Cruz Long-toed	*Ambystoma macrodactylum croceum*		Endangered Terrestrial	Freshwater, Vernal pool, No
Toad, Arroyo Southwestern	*Bufo californicus (=microscaphus)*	Endangered	Freshwater, Terrestrial	Yes
Bird				
Condor, California	*Gymnogyps californianus*	Endangered	Terrestrial	Yes
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	Endangered	Terrestrial	Yes
Gnatcatcher, Coastal California	*Polioptila californica californica*	Threatened	Terrestrial	Yes
Murrelet, Marbled	*Brachyramphus marmoratus marmoratus*	Threatened	Freshwater, Terrestrial, Saltwater	Yes

Owl, Northern Spotted	*Strix occidentalis caurina*	Threatened	Terrestrial	Yes
Pelican, Brown	*Pelecanus occidentalis*	Endangered	Terrestrial	No
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	Threatened	Terrestrial	Yes
Rail, California Clapper	*Rallus longirostris obsoletus*	Endangered	Terrestrial	No
Rail, Light-footed Clapper	*Rallus longirostris levipes*	Endangered	Terrestrial	No
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	Endangered	Terrestrial	No
Shrike, San Clemente Loggerhead	*Lanius ludovicianus mearnsi*	Endangered	Terrestrial	No
Sparrow, San Clemente Sage	*Amphispiza belli clementeae*	Threatened	Terrestrial	No
Tern, California Least	*Sterna antillarum browni*	Endangered	Terrestrial	No

Towhee, Inyo Brown	*Pipilo crissalis eremophilus*	Threatened	Terrestrial	Yes	
Vireo, Least Bell's	*Vireo bellii pusillus*	Endangered	Terrestrial	Yes	
Conf/cycds					
Cypress, Gowen	*Cupressus goveniana ssp. goveniana*		Threatened	Terrestrial	No
Cypress, Santa Cruz	*Cupressus abramsiana*	Endangered	Terrestrial	No	
Crustacean					
Abalone, White	*Haliotis sorenseni*	Endangered	Saltwater	No	
Crayfish, Shasta	*Pacifastacus fortis*	Endangered	Freshwater	No	
Fairy Shrimp, Conservancy Fairy	*Branchinecta conservatio*	Endangered	Vernal pool	Yes	
Fairy Shrimp, Longhorn	*Branchinecta longiantenna*	Endangered	Vernal pool	Yes	
Fairy Shrimp, Riverside	*Streptocephalus woottoni*	Endangered	Vernal pool	Yes	
Fairy Shrimp, San Diego	*Branchinecta sandiegonensis*	Endangered	Vernal pool	Yes	
Fairy Shrimp, Vernal Pool	*Branchinecta lynchi*	Threatened	Vernal pool	Yes	
Shrimp, California Freshwater	*Syncaris pacifica*	Endangered	Freshwater	No	
Tadpole Shrimp, Vernal Pool	*Lepidurus packardi*	Endangered	Vernal pool	Yes	
Dicot					
Adobe Sunburst, San Joaquin	*Pseudobahia peirsonii*	Threatened	Terrestrial	No	
Allocarya, Calistoga	*Plagiobothrys strictus*	Endangered	Vernal pool	No	
Ambrosia, San Diego	*Ambrosia pumila*	Endangered	Terrestrial	No	
Baccharis, Encinitas	*Baccharis vanessae*	Threatened	Terrestrial	No	
Barberry, Island	*Berberis pinnata ssp. insularis*	Endangered	Terrestrial	No	
Barberry, Nevin's	*Berberis nevinii*	Endangered	Terrestrial	No	
Bedstraw, El Dorado	*Galium californicum ssp. sierrae*	Endangered	Terrestrial	No	
Bedstraw, Island	*Gallum buxifolium*	Endangered	Terrestrial	No	
Bird's-beak, Palmate-bracted	*Cordylanthus palmatus*	Endangered	Terrestrial	No	
Bird's-beak, Pennell's	*Cordylanthus tenuis ssp. capillaris*	Endangered	Terrestrial	No	
Bird's-beak, salt marsh	*Cordylanthus maritimus ssp. maritimus*		Endangered	Saltwater	No

Bird's-beak, Soft	*Cordylanthus mollis ssp. mollis*	Endangered	Brackish, Saltwater	No		
Bladderpod, San Bernardino Mountains	*Lesquerella kingii ssp. bernardina*			Endangered	Terrestrial	Yes
Bluecurls, Hidden Lake	*Trichostema austromontanum ssp. compactum*	Threatened	Terrestrial	No		
Broom, San Clemente Island	*Lotus dendroideus ssp. traskiae*	Endangered	Terrestrial	No		
Buckwheat, Cushenbury	*Eriogonum ovalifolium var. vineum*	Endangered	Terrestrial	Yes		
Buckwheat, Ione (incl. Irish Hill)	*Eriogonum apricum (incl. var. prostratum)*	Endangered	Terrestrial	No		
Buckwheat, Southern Mountain Wild	*Eriogonum kennedyi var. austromontanum*	Threatened	Terrestrial	No		

Bush-mallow, San Clemente Island	*Malacothamnus clementinus*	Endangered	Terrestrial	No	
Bush-mallow, Santa Cruz Island	*Malacothamnus fasciculatus var. nesioticus*	Endangered	Terrestrial	No	
Butterweed, Layne's	*Senecio layneae*	Threatened	Terrestrial	No	
Button-celery, San Diego	*Eryngium aristulatum var. parishii*	Endangered	Terrestrial	No	
Cactus, Bakersfield	*Opuntia treleasei*	Endangered	Terrestrial	No	
Ceanothus, Coyote	*Ceanothus ferrisae*	Endangered	Terrestrial	No	
Ceanothus, Pine Hill	*Ceanothus roderickii*	Endangered	Terrestrial	No	
Ceanothus, Vail Lake	*Ceanothus ophiochilus*	Threatened	Terrestrial	No	
Centaury, Spring-loving	*Centaurium namophilum*	Threatened	Terrestrial	Yes	
Checker-mallow, Keck's	*Sidalcea keckii*	Endangered	Terrestrial	Yes	
Checker-mallow, Kenwood Marsh	*Sidalcea oregana ssp. valida*	Endangered	Terrestrial	No	
Checker-mallow, Pedate	*Sidalcea pedata*	Endangered	Terrestrial	No	
Clarkia, Pismo	*Clarkia speciosa ssp. immaculata*	Endangered	Terrestrial	No	
Clarkia, Presidio	*Clarkia franciscana*	Endangered	Terrestrial	No	
Clarkia, Springville	*Clarkia springvillensis*	Threatened	Terrestrial	No	
Clarkia, Vine Hill	*Clarkia imbricata*	Endangered	Terrestrial	No	
Clover, Fleshy Owl's	*Castilleja campestris ssp. succulenta*		Threatened	Vernal pool	Yes
Clover, Monterey	*Trifolium trichocalyx*	Endangered	Terrestrial	No	
Clover, Showy Indian	*Trifolium amoenum*	Endangered	Terrestrial	No	
Coyote-thistle, Loch Lomond	*Eryngium constancei*	Endangered	Terrestrial	No	
Crownbeard, Big-leaved	*Verbesina dissita*	Threatened	Terrestrial	No	
Crownscale, San Jacinto Valley	*Atriplex coronata var. notatior*	Endangered	Terrestrial	No	
Daisy, Parish's	*Erigeron parishii*	Threatened	Freshwater	Yes	
Dudleya, Conejo	*Dudleya abramsii ssp. parva*	Threatened	Terrestrial	No	
Dudleya, Marcescent	*Dudleya cymosa ssp. marcescens*	Threatened	Terrestrial	No	
Dudleya, Santa Clara Valley	*Dudleya setchellii*	Endangered	Terrestrial	No	
Dudleya, Santa Cruz Island	*Dudleya nesiotica*	Threatened	Terrestrial	No	

Dudleya, Santa Monica Mountains	*Dudleya cymosa ssp. ovatifolia*	Threatened	Terrestrial	No	
Dudleya, Verity's	*Dudleya verityi*	Threatened	Terrestrial	No	
Dwarf-flax, Marin	*Hesperolinon congestum*	Threatened	Terrestrial	No	
Evening-primrose, Antioch Dunes	*Oenothera deltoides ssp. howellii*	Endangered	Terrestrial	Yes	
Evening-primrose, Eureka Valley	*Oenothera avita ssp. eurekensis*	Endangered	Terrestrial	No	
Evening-primrose, San Benito	*Camissonia benitensis*	Threatened	Terrestrial	No	
Fiddleneck, Large-flowered	*Amsinckia grandiflora*	Endangered	Terrestrial	Yes	
Flannelbush, Mexican	*Fremontodendron mexicanum*	Endangered	Terrestrial	No	
Flannelbush, Pine Hill	*Fremontodendron californicum ssp. decumbens*		Endangered	Terrestrial	No

Fringepod, Santa Cruz Island	*Thysanocarpus conchuliferus*	Endangered	Terrestrial	No	
Gilia, Hoffmann's Slender-flowered	*Gilia tenuiflora ssp. hoffmannii*	Endangered	Terrestrial	No	
Gilia, Monterey	*Gilia tenuiflora ssp. arenaria*	Endangered	Terrestrial	No	
Golden Sunburst, Hartweg's	*Pseudobahia bahiifolia*	Endangered	Terrestrial	No	
Goldfields, Burke's	*Lasthenia burkei*	Endangered	Terrestrial	No	
Goldfields, Contra Costa	*Lasthenia conjugens*	Endangered	Terrestrial	Yes	
Grass, Hairy Orcutt	*Orcuttia pilosa*	Endangered	Vernal pool	Yes	
Grass, Sacramento Orcutt	*Orcuttia viscida*	Endangered	Vernal pool	Yes	
Grass, Slender Orcutt	*Orcuttia tenuis*	Threatened	Vernal pool	Yes	
Gumplant, Ash Meadows	*Grindelia fraxino-pratensis*	Threatened	Terrestrial	Yes	
Ivesia, Ash Meadows	*Ivesia kingii var. eremica*	Threatened	Terrestrial	Yes	
Jewelflower, California	*Caulanthus californicus*	Endangered	Terrestrial	No	
Jewelflower, Metcalf Canyon	*Streptanthus albidus ssp. albidus*	Endangered	Terrestrial	No	
Jewelflower, Tiburon	*Streptanthus niger*	Endangered	Terrestrial	No	
Larkspur, Baker's	*Delphinium bakeri*	Endangered	Terrestrial	Yes	
Larkspur, San Clemente Island	*Delphinium variegatum ssp. kinkiense*		Endangered	Terrestrial	No
Larkspur, Yellow	*Delphinium luteum*	Endangered	Terrestrial	Yes	
Layia, Beach	*Layia carnosa*	Endangered	Terrestrial, Coastal (neritic)	No	
Lessingia, San Francisco	*Lessingia germanorum (=L.g. var. germanorum)*	Endangered	Terrestrial	No	
Liveforever, Laguna Beach	*Dudleya stolonifera*	Threatened	Terrestrial	No	
Liveforever, Santa Barbara Island	*Dudleya traskiae*	Endangered	Terrestrial	No	
Lupine, Clover	*Lupinus tidestromii*	Endangered	Coastal (neritic)	No	
Lupine, Nipomo Mesa	*Lupinus nipomensis*	Endangered	Coastal (neritic)	No	
Malacothrix, Island	*Malacothrix squalida*	Endangered	Terrestrial	No	
Malacothrix, Santa Cruz Island	*Malacothrix indecora*	Endangered	Terrestrial	No	
Mallow, Kern	*Eremalche kernensis*	Endangered	Terrestrial	No	

Manzanita, Del Mar	*Arctostaphylos glandulosa ssp. crassifolia*	Endangered	Terrestrial	No	
Manzanita, Ione	*Arctostaphylos myrtifolia*	Threatened	Terrestrial	No	
Manzanita, Morro	*Arctostaphylos morroensis*	Threatened	Terrestrial	No	
Manzanita, Pallid	*Arctostaphylos pallida*	Threatened	Terrestrial	No	
Manzanita, Presidio (=Raven's)	*Arctostaphylos hookeri var. ravenii*	Endangered	Terrestrial	No	
Manzanita, Santa Rosa Island	*Arctostaphylos confertiflora*	Endangered	Terrestrial	No	
Meadowfoam, Butte County	*Limnanthes floccosa ssp. californica*		Endangered	Vernal pool	Yes
Meadowfoam, Sebastopol	*Limnanthes vinculans*	Endangered	Freshwater, Terrestrial	No	
Milk-vetch, Braunton's	*Astragalus brauntonii*	Endangered	Terrestrial	No	

Milk-vetch, Clara Hunt's	*Astragalus clarianus*	Endangered	Terrestrial	No
Milk-vetch, Coachella Valley	*Astragalus lentiginosus var. coachellae*	Endangered	Terrestrial	Yes
Milk-vetch, Coastal Dunes	*Astragalus tener var. titi*	Endangered	Terrestrial	No
Milk-vetch, Cushenbury	*Astragalus albens*	Endangered	Terrestrial	Yes
Milk-vetch, Fish Slough	*Astragalus lentiginosus var. piscinensis*	Threatened	Terrestrial	No
Milk-vetch, Lane Mountain	*Astragalus jaegerianus*	Endangered	Terrestrial	Yes
Milk-vetch, Pierson's	*Astragalus magdalenae var.*	Threatened	Terrestrial	Yes
Milk-vetch, Triple-ribbed	*Astragalus tricarinatus*	Endangered	Terrestrial	No
Milk-vetch, Ventura Marsh	*Astragalus pycnostachyus var. lanosissimus*	Endangered	Terrestrial, Freshwater	Yes
Mint, Otay Mesa	*Pogogyne nudiuscula*	Endangered	Terrestrial	No
Mint, San Diego Mesa	*Pogogyne abramsii*	Endangered	Terrestrial	No
Monardella, Willowy	*Monardella linoides ssp. viminea*	Endangered	Terrestrial	No
Morning-glory, Stebbins	*Calystegia stebbinsii*	Endangered	Terrestrial	No
Mountainbalm, Indian Knob	*Eriodictyon altissimum*	Endangered	Terrestrial	No
Mountain-mahogany, Catalina Island	*Cercocarpus traskiae*	Endangered	Terrestrial	No
Mustard, Slender-petaled	*Thelypodium stenopetalum*	Endangered	Terrestrial	No
Navarretia, Few-flowered	*Navarretia leucocephala ssp. pauciflora (=N. pauciflora)*	Endangered	Vernal pool, Terrestrial	No
Navarretia, Many-flowered	*Navarretia leucocephala ssp. plieantha*	Endangered	Terrestrial, Vernal pool	No
Navarretia, Spreading	*Navarretia fossalis*	Threatened	Vernal pool	No
Niterwort, Amargosa	*Nitrophila mohavensis*	Endangered	Terrestrial	Yes
Oxytheca, Cushenbury	*Oxytheca parishii var. goodmaniana*	Endangered	Terrestrial	Yes
Paintbrush, Ash-grey Indian	*Castilleja cinerea*	Threatened	Terrestrial	No
Paintbrush, San Clemente Island Indian	*Castilleja grisea*	Endangered	Terrestrial	No
Paintbrush, Soft-leaved	*Castilleja mollis*	Endangered	Terrestrial	No

Paintbrush, Tiburon	*Castilleja affinis ssp. neglecta*	Endangered	Terrestrial	No
Penny-cress, Kneeland Prairie	*Thlaspi californicum*	Endangered	Terrestrial	Yes
Pentachaeta, Lyon's	*Pentachaeta lyonii*	Endangered	Terrestrial	No
Pentachaeta, White-rayed	*Pentachaeta bellidiflora*	Endangered	Terrestrial	No
Phacelia, Island	*Phacelia insularis ssp. insularis*	Endangered	Terrestrial	No
Phlox, Yreka	*Phlox hirsuta*	Endangered	Terrestrial	No
Polygonum, Scott's Valley	*Polygonum hickmanii*	Endangered	Terrestrial	Yes
Potentilla, Hickman's	*Potentilla hickmanii*	Endangered	Terrestrial	No
Pussypaws, Mariposa	*Calyptridium pulchellum*	Threatened	Terrestrial	No
Rock-cress, Hoffmann's	*Arabis hoffmannii*	Endangered	Terrestrial	No

Rock-cress, McDonald's	*Arabis mcdonaldiana*	Endangered	Terrestrial	No	
Rock-cress, Santa Cruz Island	*Sibara filifolia*	Endangered	Terrestrial	No	
Rush-rose, Island	*Helianthemum greenei*	Threatened	Terrestrial	No	
Sandwort, Bear Valley	*Arenaria ursina*	Threatened	Terrestrial	No	
Sandwort, Marsh	*Arenaria paludicola*	Endangered	Freshwater, Terrestrial	No	
Sea-blite, California	*Suaeda californica*	Endangered	Terrestrial	No	
Spineflower, Ben Lomond	*Chorizanthe pungens var. hartwegiana*	Endangered	Terrestrial	No	
Spineflower, Howell's	*Chorizanthe howellii*	Endangered	Terrestrial	No	
Spineflower, Monterey	*Chorizanthe pungens var. pungens*	Threatened	Terrestrial	Yes	
Spineflower, Orcutt's	*Chorizanthe orcuttiana*	Endangered	Terrestrial	No	
Spineflower, Robust	*Chorizanthe robusta var. robusta*	Endangered	Terrestrial	Yes	
Spineflower, Scotts Valley	*Chorizanthe robusta var. hartwegii*	Endangered	Terrestrial	Yes	
Spineflower, Slender-horned	*Dodecahema leptoceras*	Endangered	Terrestrial	No	
Spineflower, Sonoma	*Chorizanthe valida*	Endangered	Terrestrial	No	
Spurge, Hoover's	*Chamaesyce hooveri*	Threatened	Vernal pool	Yes	
Stickyseed, Baker's	*Blennosperma bakeri*	Endangered	Vernal pool	No	
Stonecrop, Lake County	*Parvisedum leiocarpum*	Endangered	Vernal pool	No	
Sunflower, San Mateo Woolly	*Eriophyllum latilobum*	Endangered	Terrestrial	No	
Taraxacum, California	*Taraxacum californicum*	Endangered	Terrestrial	No	
Tarplant, Gaviota	*Deinandra increscens ssp. villosa*	Endangered	Terrestrial	Yes	
Tarplant, Otay	*Deinandra (=Hemizonia) conjugens*	Threatened	Terrestrial	Yes	
Tarplant, Santa Cruz	*Holocarpha macradenia*	Threatened	Terrestrial	Yes	
Thistle, Chorro creek Bog	*Cirsium fontinale var. obispoense*	Endangered	Terrestrial, Freshwater	No	
Thistle, Fountain	*Cirsium fontinale var. fontinale*	Endangered	Terrestrial	No	
Thistle, La Graciosa	*Cirsium loncholepis*	Endangered	Coastal (neritic), Freshwater, Saltwater, Brackish	Yes	
Thistle, Suisun	*Cirsium hydrophilum var. hydrophilum*		Endangered	Brackish, Terrestrial	No

Thornmint, San Diego	*Acanthomintha ilicifolia*	Threatened	Terrestrial	No	
Thornmint, San Mateo	*Acanthomintha obovata ssp. duttonii*	Endangered	Terrestrial	No	
Tuctoria, Green's	*Tuctoria greenei*	Endangered	Vernal pool	Yes	
Vervain, California	*Verbena californica*	Threatened	Terrestrial	No	
Wallflower, Ben Lomond	*Erysimum teretifolium*	Endangered	Terrestrial	No	
Wallflower, Contra Costa	*Erysimum capitatum var. angustatum*	Endangered	Terrestrial	Yes	
Wallflower, Menzie's	*Erysimum menziesii*	Endangered	Terrestrial	No	
Watercress, Gambel's	*Rorippa gambelii*	Endangered	Terrestrial, Brackish, Freshwater	No	

Woodland-star, San Clemente Island	*Lithophragma maximum*	Endangered	Terrestrial	No	
Woolly-star, Santa Ana River	*Eriastrum densifolium ssp. sanctorum*	Endangered	Terrestrial	No	
Woolly-threads, San Joaquin	*Monolopia (=Lembertia) congdonii*	Endangered	Terrestrial	No	
Yerba Santa, Lompoc	*Eriodictyon capitatum*	Endangered	Terrestrial	Yes	
Fish					
Chub, Bonytail	*Gila elegans*	Endangered	Freshwater	Yes	
Chub, Hutton Tui	*Gila bicolor ssp.*	Threatened	Freshwater	No	
Chub, Mohave Tui	*Gila bicolor mohavensis*	Endangered	Freshwater	No	
Chub, Owens Tui	*Gila bicolor snyderi*	Endangered	Freshwater	Yes	
Dace, Ash Meadows Speckled	*Rhinichthys osculus nevadensis*	Endangered	Freshwater	Yes	
Goby, Tidewater	*Eucyclogobius newberryi*	Endangered	Freshwater	Yes	
Pupfish, Desert	*Cyprinodon macularius*	Endangered	Freshwater	Yes	
Pupfish, Owens	*Cyprinodon radiosus*	Endangered	Freshwater	No	
Salmon, Chinook (California Coastal Run)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Brackish	Freshwater, Saltwater,	Yes
Salmon, Chinook (Central Valley Fall Run)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Saltwater	Brackish, Freshwater,	No
Salmon, Chinook (Central Valley Spring Run)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Freshwater	Brackish, Saltwater,	Yes
Salmon, Chinook (Sacramento River Winter Run)	*Oncorhynchus (=Salmo) tshawytscha*		Endangered Brackish	Saltwater, Freshwater,	No
Salmon, Coho (Central California Coast population)	*Oncorhynchus (=Salmo) kisutch*	Endangered	Saltwater, Brackish, Freshwater	No	
Salmon, Coho (Southern OR/Northern CA Coast)	*Oncorhynchus (=Salmo) kisutch*	Threatened	Freshwater, Brackish, Saltwater	Yes	
Smelt, Delta	*Hypomesus transpacificus*	Threatened	Freshwater, Brackish	Yes	
Squawfish, Colorado	*Ptychochellus lucius*	Endangered	Freshwater	Yes	
Steelhead, (California Central Valley population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Brackish, Freshwater, Saltwater	Yes	
Steelhead, (Central California Coast	*Oncorhynchus (=Salmo) mykiss*	Threatened	Freshwater, Saltwater,	Yes	

population)			Brackish	
Steelhead, (Northern California population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Saltwater, Brackish, Freshwater	No
Steelhead, (South-Central California population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Freshwater, Saltwater, Brackish	Yes
Steelhead, (Southern California population)	*Oncorhynchus (=Salmo) mykiss*	Endangered	Brackish, Saltwater, Freshwater	Yes
Stickleback, Unarmored Threespine	*Gasterosteus aculeatus williamsoni*	Endangered	Freshwater	No
Sturgeon, green	*Acipenser medirostris*	Threatened		No
Sucker, Lost River	*Deltistes luxatus*	Endangered	Freshwater	No
Sucker, Modoc	*Catostomus microps*	Endangered	Freshwater	Yes
Sucker, Razorback	*Xyrauchen texanus*	Endangered	Freshwater	Yes

Sucker, Santa Ana	*Catostomus santaanae*	Threatened	Freshwater	Yes	
Sucker, Shortnose	*Chasmistes brevirostris*	Endangered	Freshwater	No	
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	Threatened	Freshwater	No	
Trout, Little Kern Golden	*Oncorhynchus aguabonita whitei*	Threatened	Freshwater	Yes	
Trout, Paiute Cutthroat	*Oncorhynchus clarki seleniris*	Threatened	Freshwater	No	
Gastropod					
Snail, Morro Shoulderband	*Helminthoglypta walkeriana*	Endangered	Terrestrial	Yes	
Insect					
Beetle, Delta Green Ground	*Elaphrus viridis*	Threatened	Vernal pool, Terrestrial	Yes	
Beetle, Mount Hermon June	*Polyphylla barbata*	Endangered	Subterraneous, Terrestrial	No	
Beetle, Ohlone Tiger	*Cicindela ohlone*	Endangered	Terrestrial	No	
Beetle, Valley Elderberry Longhorn	*Desmocerus californicus dimorphus*		Threatened	Terrestrial	Yes
Butterfly, Bay Checkerspot (Wright's euphydryas)	*Euphydryas editha bayensis*	Threatened	Terrestrial	Yes	
Butterfly, Behren's Silverspot	*Speyeria zerene behrensii*	Endangered	Terrestrial	No	
Butterfly, Callippe Silverspot	*Speyeria callippe callippe*	Endangered	Terrestrial	No	
Butterfly, El Segundo Blue	*Euphilotes battoides allyni*	Endangered	Terrestrial	No	
Butterfly, Lange's Metalmark	*Apodemia mormo langei*	Endangered	Terrestrial	No	
Butterfly, Lotis Blue	*Lycaeides argyrognomon lotis*	Endangered	Terrestrial	No	
Butterfly, Mission Blue	*Icaricia icarioides missionensis*	Endangered	Terrestrial	No	
Butterfly, Myrtle's Silverspot	*Speyeria zerene myrtleae*	Endangered	Terrestrial	No	
Butterfly, Oregon Silverspot	*Speyeria zerene hippolyta*	Threatened	Terrestrial	Yes	
Butterfly, Palos Verdes Blue	*Glaucopsyche lygdamus palosverdesensis*	Endangered	Terrestrial	Yes	
Butterfly, Quino Checkerspot	*Euphydryas editha quino (=E. e. wrighti)*	Endangered	Terrestrial	Yes	
Butterfly, San Bruno Elfin	*Callophrys mossii bayensis*	Endangered	Terrestrial	No	
Butterfly, Smith's Blue	*Euphilotes enoptes smithi*	Endangered	Terrestrial	No	
Fly, Delhi Sands Flower-loving	*Rhaphiomidas terminatus*	Endangered	Terrestrial	No	

	abdominalis			
Grasshopper, Zayante Band-winged	*Trimerotropis infantilis*	Endangered	Terrestrial	Yes
Moth, Kern Primrose Sphinx	*Euproserpinus euterpe*	Threatened	Terrestrial	No
Skipper, Carson Wandering	*Pseudocopaeodes eunus obscurus*	Endangered	Terrestrial	No
Skipper, Laguna Mountain	*Pyrgus ruralis lagunae*	Endangered	Terrestrial	No
Mammal				
Fox, San Joaquin Kit	*Vulpes macrotis mutica*	Endangered	Terrestrial	No
Fox, San Miguel Island	*Urocyon littoralis littoralis*	Endangered	Terrestrial	Yes
Fox, Santa Catalina Island	*Urocyon littoralis catalinae*	Endangered	Terrestrial	Yes
Fox, Santa Cruz Island	*Urocyon littoralis santacruzae*	Endangered	Terrestrial	Yes

Fox, Santa Rosa Island	*Urocyon littoralis santarosae*	Endangered	Terrestrial	Yes	
Kangaroo Rat, Fresno	*Dipodomys nitratoides exilis*	Endangered	Terrestrial	Yes	
Kangaroo Rat, Giant	*Dipodomys ingens*	Endangered	Terrestrial	No	
Kangaroo Rat, Morro Bay	*Dipodomys heermanni morroensis*	Endangered	Terrestrial	Yes	
Kangaroo Rat, San Bernardino Merriam's	*Dipodomys merriami parvus*	Endangered	Terrestrial	Yes	
Kangaroo Rat, Stephens'	*Dipodomys stephensi (incl. D. cascus)*	Endangered	Terrestrial	No	
Kangaroo Rat, Tipton	*Dipodomys nitratoides nitratoides*	Endangered	Terrestrial	No	
Mountain Beaver, Point Arena	*Aplodontia rufa nigra*	Endangered	Freshwater, Terrestrial	No	
Mouse, Pacific Pocket	*Perognathus longimembris pacificus*		Endangered	Terrestrial	No
Mouse, Salt Marsh Harvest	*Reithrodontomys raviventris*	Endangered	Terrestrial	No	
Rabbit, Riparian Brush	*Sylvilagus bachmani riparius*	Endangered	Terrestrial	No	
Sheep, Peninsular Bighorn	*Ovis canadensis*	Endangered	Terrestrial	Yes	
Sheep, Sierra Nevada Bighorn	*Ovis canadensis californiana*	Endangered	Terrestrial	No	
Shrew, Buena Vista Lake Ornate	*Sorex ornatus relictus*	Endangered	Terrestrial	Yes	
Vole, Amargosa	*Microtus californicus scirpensis*	Endangered	Terrestrial	Yes	
Woodrat, Riparian	*Neotoma fuscipes riparia*	Endangered	Terrestrial	No	
Marine mml					
Otter, Southern Sea	*Enhydra lutris nereis*	Threatened	Saltwater	No	
Seal, Guadalupe Fur	*Arctocephalus townsendi*	Threatened	Coastal (neritic), Saltwater	No	
Sea-lion, Steller (eastern)	*Eumetopias jubatus*	Threatened	Saltwater	Yes	
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No	
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No	
Monocot					
Alopecurus, Sonoma	*Alopecurus aequalis var. sonomensis*		Endangered	Terrestrial	No
Amole, Cammatta Canyon	*Chlorogalum purpureum var. reductum*	Threatened	Terrestrial	Yes	

Amole, Purple	*Chlorogalum purpureum var. purpureum*	Threatened	Terrestrial	Yes
Bluegrass, Napa	*Poa napensis*	Endangered	Terrestrial, Freshwater	No
Bluegrass, San Bernardino	*Poa atropurpurea*	Endangered	Terrestrial	No
Brodiaea, Chinese Camp	*Brodiaea pallida*	Threatened	Terrestrial	No
Brodiaea, Thread-leaved	*Brodiaea filifolia*	Threatened	Terrestrial	Yes
Grass, California Orcutt	*Orcuttia californica*	Endangered	Vernal pool, Terrestrial	No
Grass, Colusa	*Neostapfia colusana*	Threatened	Vernal pool	No
Grass, Eureka Dune	*Swallenia alexandrae*	Endangered	Terrestrial	No
Grass, San Joaquin Valley Orcutt	*Orcuttia inaequalis*	Threatened	Vernal pool	Yes

Grass, Solano	*Tuctoria mucronata*	Endangered	Vernal pool, Terrestrial	Yes
Lily, Pitkin Marsh	*Lilium pardalinum ssp. pitkinense*	Endangered	Freshwater	No
Lily, Tiburon Mariposa	*Calochortus tiburonensis*	Threatened	Terrestrial	No
Lily, Western	*Lilium occidentale*	Endangered	Terrestrial	No
Onion, Munz's	*Allium munzii*	Endangered	Terrestrial	No
Piperia, Yadon's	*Piperia yadonii*	Endangered	Terrestrial	No
Sedge, White	*Carex albida*	Endangered	Freshwater, Terrestrial	No
Reptile				
Lizard, Blunt-nosed Leopard	*Gambelia silus*	Endangered	Terrestrial	No
Lizard, Coachella Valley Fringe-toed	*Uma inornata*	Threatened	Terrestrial	Yes
Lizard, Island Night	*Xantusia riversiana*	Threatened	Terrestrial	No
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Sea turtle, olive ridley	*Lepidochelys olivacea*	Threatened	Saltwater	No
Snake, Giant Garter	*Thamnophis gigas*	Threatened	Freshwater, Terrestrial	No
Snake, San Francisco Garter	*Thamnophis sirtalis tetrataenia*	Endangered	Freshwater, Terrestrial	No
Tortoise, Desert	*Gopherus agassizii*	Threatened	Terrestrial	Yes
Whipsnake (=Striped Racer),	*Masticophis lateralis euryxanthus*	Threatened	Terrestrial	Yes
Colorado	**(25) species:**			**CH**
Bird				
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes
Owl, Mexican Spotted	*Strix occidentalis lucida*	Threatened	Terrestrial	Yes
Dicot				
Beardtongue, Penland	*Penstemon penlandii*	Endangered	Terrestrial	No
Bladderpod, Dudley Bluffs	*Lesquerella congesta*	Threatened	Terrestrial	No
Butterfly Plant, Colorado	*Gaura neomexicana var. coloradensis*		Threatened	Terrestrial Yes
Cactus, Knowlton	*Pediocactus knowltonii*	Endangered	Terrestrial	No

Cactus, Mesa Verde	*Sclerocactus mesae-verdae*	Threatened	Terrestrial	No
Cactus, Uinta Basin Hookless	*Sclerocactus glaucus*	Threatened	Terrestrial	No
Milk-vetch, Mancos	*Astragalus humillimus*	Endangered	Terrestrial	No
Milk-vetch, Osterhout	*Astragalus osterhoutii*	Endangered	Terrestrial	No
Mustard, Penland Alpine Fen	*Eutrema penlandii*	Threatened	Terrestrial, Freshwater	No
Phacelia, North Park	*Phacelia formosula*	Endangered	Terrestrial	No
Twinpod, Dudley Bluffs	*Physaria obcordata*	Threatened	Terrestrial	No
Wild-buckwheat, Clay-loving	*Eriogonum pelinophilum*	Endangered	Terrestrial	Yes

Fish				
Chub, Bonytail	*Gila elegans*	Endangered	Freshwater	Yes
Chub, Humpback	*Gila cypha*	Endangered	Freshwater	Yes
Squawfish, Colorado	*Ptychocheilus lucius*	Endangered	Freshwater	Yes
Sucker, Razorback	*Xyrauchen texanus*	Endangered	Freshwater	Yes
Trout, Bull	*Salvelinus confluentus*	Threatened	Freshwater	No
Trout, Greenback Cutthroat	*Oncorhynchus clarki stomias*	Threatened	Freshwater	No
Insect				
Butterfly, Uncompahgre Fritillary	*Boloria acrocnema*	Endangered	Terrestrial	No
Skipper, Pawnee Montane	*Hesperia leonardus montana*	Threatened	Terrestrial	No
Mammal				
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No
Mouse, Preble's Meadow Jumping	*Zapus hudsonius preblei*	Threatened	Terrestrial	Yes
Monocot				
Ladies'-tresses, Ute	*Spiranthes diluvialis*	Threatened	Terrestrial	No
Connecticut	**(15) species:**			**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Roseate	*Sterna dougallii dougallii*	Endangered	Terrestrial	No
Bivalve				
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	Endangered	Freshwater	No
Dicot				
Gerardia, Sandplain	*Agalinis acuta*	Endangered	Terrestrial	No
Fish				
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Insect				
Beetle, Puritan Tiger	*Cicindela puritana*	Threatened	Terrestrial, Coastal (neritic)	No
Mammal				

Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Marine mml				
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes

Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Turtle, Bog (Northern population)	*Clemmys muhlenbergli*	Threatened	Terrestrial, Freshwater	No
Delaware **(14) species:**				**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Fish				
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Mammal				
Squirrel, Delmarva Peninsula Fox	*Sciurus niger cinereus*	Endangered	Terrestrial	No
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Pink, Swamp	*Helonias bullata*	Threatened	Terrestrial, Freshwater	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Turtle, Bog (Northern population)	*Clemmys muhlenbergii*	Threatened	Terrestrial, Freshwater	No
District of Columbia **(1) species:**				**CH**
Crustacean				
Amphipod, Hay's Spring	*Stygobromus hayi*	Endangered	Freshwater, Subterraneous	No

Florida **(108) species:** **CH**

Amphibian

Salamander, Flatwoods	*Ambystoma cingulatum*	Threatened	Freshwater, Vernal pool, Terrestrial	No

Bird

Caracara, Audubon's Crested	*Polyborus plancus audubonii*	Threatened	Terrestrial	No
Kite, Everglade Snail	*Rostrhamus sociabilis plumbeus*	Endangered	Terrestrial	Yes
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes

Scrub-Jay, Florida	*Aphelocoma coerulescens*	Threatened	Terrestrial	No	
Sparrow, Cape Sable Seaside	*Ammodramus maritimus mirabilis*	Endangered	Terrestrial	Yes	
Sparrow, Florida Grasshopper	*Ammodramus savannarum floridanus*		Endangered	Terrestrial	No
Stork, Wood	*Mycteria americana*	Endangered	Terrestrial	No	
Tern, Roseate	*Sterna dougallii dougallii*	Endangered	Terrestrial	No	
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No	
Bivalve					
Bankclimber, Purple	*Elliptoideus sloatianus*	Threatened	Freshwater	No	
Mussel, Gulf Moccasinshell	*Medionidus penicillatus*	Endangered	Freshwater	No	
Mussel, Ochlockonee Moccasinshell	*Medionidus simpsonianus*	Endangered	Freshwater	No	
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	Endangered	Freshwater	No	
Mussel, Shiny-rayed Pocketbook	*Lampsilis subangulata*	Endangered	Freshwater	No	
Slabshell, Chipola	*Elliptio chipolaensis*	Threatened	Freshwater	No	
Threeridge, Fat (Mussel)	*Amblema neislerii*	Endangered	Freshwater	No	
Conf/cycds					
Torreya, Florida	*Torreya taxifolia*	Endangered	Terrestrial	No	
Coral					
Staghorn coral	*Acropora cervicornis*	Threatened	Saltwater	No	
Crustacean					
Shrimp, Squirrel Chimney Cave	*Palaemonetes cummingi*	Threatened	Freshwater, Subterraneous	No	
Dicot					
Aster, Florida Golden	*Chrysopsis floridana*	Endangered	Terrestrial	No	
Bellflower, Brooksville	*Campanula robinsiae*	Endangered	Terrestrial	No	
Birds-in-a-nest, White	*Macbridea alba*	Threatened	Terrestrial	No	
Blazing Star, Scrub	*Liatris ohlingerae*	Endangered	Terrestrial	No	
Bonamia, Florida	*Bonamia grandiflora*	Threatened	Terrestrial	No	
Buckwheat, Scrub	*Eriogonum longifolium var. gnaphalifolium*	Threatened	Terrestrial	No	

Butterwort, Godfrey's	*Pinguicula ionantha*	Threatened	Terrestrial, Freshwater	No
Cactus, Key Tree	*Pilosocereus robinii*	Endangered	Terrestrial	No
Campion, Fringed	*Silene polypetala*	Endangered	Terrestrial	No
Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Fringe Tree, Pygmy	*Chionanthus pygmaeus*	Endangered	Terrestrial	No
Gooseberry, Miccosukee	*Ribes echinellum*	Threatened	Terrestrial	No
Gourd, Okeechobee	*Cucurbita okeechobeensis ssp. okeechobeensis*	Endangered	Terrestrial	No
Harebells, Avon Park	*Crotalaria avonensis*	Endangered	Terrestrial	No

Hypericum, Highlands Scrub	*Hypericum cumulicola*	Endangered	Terrestrial	No	
Jacquemontia, Beach	*Jacquemontia reclinata*	Endangered	Terrestrial, Coastal (neritic)	No	
Lead-plant, Crenulate	*Amorpha crenulata*	Endangered	Terrestrial	No	
Lupine, Scrub	*Lupinus aridorum*	Endangered	Terrestrial	No	
Meadowrue, Cooley's	*Thalictrum cooleyi*	Endangered	Terrestrial	No	
Milkpea, Small's	*Galactia smallii*	Endangered	Terrestrial	No	
Mint, Garrett's	*Dicerandra christmanii*	Endangered	Terrestrial	No	
Mint, Lakela's	*Dicerandra immaculata*	Endangered	Terrestrial	No	
Mint, Longspurred	*Dicerandra cornutissima*	Endangered	Terrestrial	No	
Mint, Scrub	*Dicerandra frutescens*	Endangered	Terrestrial	No	
Mustard, Carter's	*Warea carteri*	Endangered	Terrestrial	No	
Pawpaw, Beautiful	*Deeringothamnus pulchellus*	Endangered	Terrestrial	No	
Pawpaw, Four-petal	*Asimina tetramera*	Endangered	Terrestrial	No	
Pawpaw, Rugel's	*Deeringothamnus rugelii*	Endangered	Terrestrial	No	
Pinkroot, Gentian	*Spigelia gentianoides*	Endangered	Terrestrial	No	
Plum, Scrub	*Prunus geniculata*	Endangered	Terrestrial	No	
Polygala, Lewton's	*Polygala lewtonii*	Endangered	Terrestrial	No	
Polygala, Tiny	*Polygala smallii*	Endangered	Terrestrial	No	
Prickly-apple, Fragrant	*Cereus eriophorus var. fragrans*	Endangered	Terrestrial	No	
Rhododendron, Chapman	*Rhododendron chapmanii*	Endangered	Terrestrial	No	
Rosemary, Apalachicola	*Conradina glabra*	Endangered	Terrestrial	No	
Rosemary, Etonia	*Conradina etonia*	Endangered	Terrestrial	No	
Rosemary, Short-leaved	*Conradina brevifolia*	Endangered	Terrestrial	No	
Sandlace	*Polygonella myriophylla*	Endangered	Terrestrial	No	
Skullcap, Florida	*Scutellaria floridana*	Threatened	Terrestrial	No	
Snakeroot	*Eryngium cuneifolium*	Endangered	Terrestrial	No	
Spurge, Deltoid	*Chamaesyce deltoidea ssp. deltoidea*		Endangered	Terrestrial	No

Spurge, Garber's	*Chamaesyce garberi*	Threatened	Terrestrial	No
Spurge, Telephus	*Euphorbia telephioides*	Threatened	Terrestrial	No
Warea, Wide-leaf	*Warea amplexifolia*	Endangered	Terrestrial	No
Water-willow, Cooley's	*Justicia cooleyi*	Endangered	Terrestrial	No
Whitlow-wort, Papery	*Paronychia chartacea*	Threatened	Terrestrial	No
Wings, Pigeon	*Clitoria fragrans*	Threatened	Terrestrial	No
Wireweed	*Polygonella basiramia*	Endangered	Terrestrial	No
Ziziphus, Florida	*Ziziphus celata*	Endangered	Terrestrial	No

Fish

Darter, Okaloosa	*Etheostoma okaloosae*	Endangered	Freshwater	No	
Sawfish, Smalltooth	*Pristis pectinata*	Endangered	Saltwater, Freshwater	No	
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	Threatened	Saltwater, Freshwater	Yes	
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No	
Gastropod					
Snail, Stock Island Tree	*Orthalicus reses (not incl. nesodryas)*	Threatened	Terrestrial	No	
Insect					
Butterfly, Schaus Swallowtail	*Heraclides aristodemus ponceanus*	Endangered	Terrestrial	No	
Lichen					
Cladonia, Florida Perforate	*Cladonia perforata*	Endangered	Terrestrial	No	
Mammal					
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No	
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes	
Deer, Key	*Odocoileus virginianus clavium*	Endangered	Terrestrial	No	
Mouse, Anastasia Island Beach	*Peromyscus polionotus phasma*	Endangered	Terrestrial, Coastal (neritic)	No	
Mouse, Choctawhatchee Beach	*Peromyscus polionotus allophrys*	Endangered	Coastal (neritic), Terrestrial	Yes	
Mouse, Key Largo Cotton	*Peromyscus gossypinus allapaticola*		Endangered	Terrestrial	No
Mouse, Perdido Key Beach	*Peromyscus polionotus trissyllepsis*		Endangered	Coastal (neritic)	Yes
Mouse, Southeastern Beach	*Peromyscus polionotus niveiventris*	Threatened	Coastal (neritic), Terrestrial	No	
Mouse, St. Andrew Beach	*Peromyscus polionotus peninsularis*		Endangered (neritic)	Terrestrial, Coastal	No
Panther, Florida	*Puma (=Felis) concolor coryi*	Endangered	Terrestrial	No	
Rabbit, Lower Keys Marsh	*Sylvilagus palustris hefneri*	Endangered	Terrestrial	No	
Rice Rat (=Silver Rice Rat)	*Oryzomys palustris natator*	Endangered	Terrestrial	Yes	
Vole, Florida Salt Marsh	*Microtus pennsylvanicus*	Endangered	Terrestrial, Brackish	No	

	dukecampbelli			
Woodrat, Key Largo	*Neotoma floridana smalli*	Endangered	Terrestrial	No
Marine mml				
Manatee, West Indian	*Trichechus manatus*	Endangered	Saltwater	Yes
Seal, Caribbean Monk	*Monachus tropicalis*	Endangered	Coastal (neritic), Saltwater	No
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Beargrass, Britton's	*Nolina brittoniana*	Endangered	Terrestrial	No

Beauty, Harper's	*Harperocallis flava*	Endangered	Freshwater, Terrestrial	No
Seagrass, Johnson's	*Halophila johnsonii*	Threatened	Coastal (neritic), Saltwater	Yes
Reptile				
Crocodile, American	*Crocodylus acutus*	Threatened	Terrestrial, Freshwater	Yes
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Skink, Blue-tailed Mole	*Eumeces egregius lividus*	Threatened	Terrestrial	No
Skink, Sand	*Neoseps reynoldsi*	Threatened	Terrestrial	No
Snake, Atlantic Salt Marsh	*Nerodia clarkii taeniata*	Threatened	Saltwater, Terrestrial, Brackish	No
Snake, Eastern Indigo	*Drymarchon corais couperi*	Threatened	Terrestrial	No
Georgia	**(66) species:**			**CH**
Amphibian				
Salamander, Flatwoods	*Ambystoma cingulatum*	Threatened	Freshwater, Vernal pool, Terrestrial	No
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Stork, Wood	*Mycteria americana*	Endangered	Terrestrial	No
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Bankclimber, Purple	*Elliptoideus sloatianus*	Threatened	Freshwater	No
Combshell, Upland	*Epioblasma metastriata*	Endangered	Freshwater	Yes
Fanshell	*Cyprogenia stegaria*	Endangered	Freshwater	No
Kidneyshell, Triangular	*Ptychobranchus greenii*	Endangered	Freshwater	Yes

Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Acornshell Southern	*Epioblasma othcaloogensis*	Endangered	Freshwater	Yes
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	Threatened	Freshwater	Yes
Mussel, Coosa Moccasinshell	*Medionidus parvulus*	Endangered	Freshwater	Yes
Mussel, Fine-lined Pocketbook	*Lampsilis altilis*	Threatened	Freshwater	Yes
Mussel, Gulf Moccasinshell	*Medionidus penicillatus*	Endangered	Freshwater	No
Mussel, Oval Pigtoe	*Pleurobema pyriforme*	Endangered	Freshwater	No
Mussel, Ovate Clubshell	*Pleurobema perovatum*	Endangered	Freshwater	Yes
Mussel, Shiny-rayed Pocketbook	*Lampsilis subangulata*	Endangered	Freshwater	No

Mussel, Southern Clubshell	*Pleurobema decisum*	Endangered	Freshwater	Yes
Mussel, Southern Pigtoe	*Pleurobema georgianum*	Endangered	Freshwater	Yes
Threeridge, Fat (Mussel)	*Amblema neislerii*	Endangered	Freshwater	No
Conf/cycds				
Torreya, Florida	*Torreya taxifolia*	Endangered	Terrestrial	No
Dicot				
Amphianthus, Little	*Amphianthus pusillus*	Threatened	Freshwater	No
Barbara Buttons, Mohr's	*Marshallia mohrii*	Threatened	Terrestrial	No
Campion, Fringed	*Silene polypetala*	Endangered	Terrestrial	No
Dropwort, Canby's	*Oxypolis canbyi*	Endangered	Terrestrial, Freshwater	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No
Pitcher-plant, Green	*Sarracenia oreophila*	Endangered	Terrestrial, Freshwater	No
Pondberry	*Lindera melissifolia*	Endangered	Terrestrial	No
Rattleweed, Hairy	*Baptisia arachnifera*	Endangered	Terrestrial	No
Skullcap, Large-flowered	*Scutellaria montana*	Threatened	Terrestrial	No
Spiraea, Virginia	*Spiraea virginiana*	Threatened	Terrestrial	No
Sumac, Michaux's	*Rhus michauxii*	Endangered	Terrestrial	No
Ferns				
Quillwort, Black-spored	*Isoetes melanospora*	Endangered	Vernal pool	No
Quillwort, Mat-forming	*Isoetes tegetiformans*	Endangered	Vernal pool	No
Fish				
Chub, Spotfin	*Erimonax monachus*	Threatened	Freshwater	Yes
Darter, Amber	*Percina antesella*	Endangered	Freshwater	Yes
Darter, Cherokee	*Etheostoma scotti*	Threatened	Freshwater	No
Darter, Etowah	*Etheostoma etowahae*	Endangered	Freshwater	No
Darter, Goldline	*Percina aurolineata*	Threatened	Freshwater	No
Darter, Snail	*Percina tanasi*	Threatened	Freshwater	No
Logperch, Conasauga	*Percina jenkinsi*	Endangered	Freshwater	Yes

Madtom, Yellowfin	*Noturus flavipinnis*	Threatened	Freshwater	Yes
Shiner, Blue	*Cyprinella caerulea*	Threatened	Freshwater	No
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	Threatened	Saltwater, Freshwater	Yes
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No

Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes	
Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	Endangered	Terrestrial, Subterraneous		Yes
Marine mml					
Manatee, West Indian	*Trichechus manatus*	Endangered	Saltwater	Yes	
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No	
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No	
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes	
Monocot					
Grass, Tennessee Yellow-eyed	*Xyris tennesseensis*	Endangered	Terrestrial	No	
Pink, Swamp	*Helonias bullata*	Threatened	Terrestrial, Freshwater	No	
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No	
Trillium, Persistent	*Trillium persistens*	Endangered	Terrestrial	No	
Trillium, Relict	*Trillium reliquum*	Endangered	Terrestrial	No	
Water-plantain, Kral's	*Sagittaria secundifolia*	Threatened	Freshwater	No	
Reptile					
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No	
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes	
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No	
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes	
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No	
Snake, Eastern Indigo	*Drymarchon corais couperi*	Threatened	Terrestrial	No	
Hawaii	**(348) species:**			**CH**	
Arachnid					
Spider, Kauai Cave Wolf	*Adelocosa anops*	Endangered	Terrestrial, Subterraneous		Yes
Bird					
'Akepa, Hawaii	*Loxops coccineus coccineus*	Endangered	Terrestrial	No	
'Akepa, Maui	*Loxops coccineus ochraceus*	Endangered	Terrestrial	No	

'Akia Loa, Kauai (Hemignathus procerus)	*Hemignathus procerus*	Endangered	Terrestrial	No
'Akia Pola'au (Hemignathus munroi)	*Hemignathus munroi*	Endangered	Terrestrial	No
Albatross, Short-tailed	*Phoebastria (=Diomedea) albatrus*	Endangered	Terrestrial, Saltwater	No
Coot, Hawaiian (=Alae keo keo)	*Fulica americana alai*	Endangered	Terrestrial	No
Creeper, Hawaii	*Oreomystis mana*	Endangered	Terrestrial	No
Creeper, Molokai (Kakawahie)	*Paroreomyza flammea*	Endangered	Terrestrial	No
Creeper, Oahu (Alauwahio)	*Paroreomyza maculata*	Endangered	Terrestrial	No
Crow, Hawaiian ('Alala)	*Corvus hawaiiensis*	Endangered	Terrestrial	No

Duck, Hawaiian (Koloa)	*Anas wyvilliana*	Endangered	Freshwater, Terrestrial	No
Duck, Laysan	*Anas laysanensis*	Endangered	Terrestrial, Freshwater	No
Elepaio, Oahu	*Chasiempis sandwichensis ibidis*	Endangered	Terrestrial	Yes
Finch, Laysan	*Telespyza cantans*	Endangered	Terrestrial	No
Finch, Nihoa	*Telespyza ultima*	Endangered	Terrestrial	No
Goose, Hawaiian (Nene)	*Branta (=Nesochen) sandvicensis*	Endangered	Terrestrial, Freshwater	No
Hawk, Hawaiian (Io)	*Buteo solitarius*	Endangered	Terrestrial	No
Honeycreeper, Crested ('Akohekohe)	*Palmeria dolei*	Endangered	Terrestrial	No
Millerbird, Nihoa	*Acrocephalus familiaris kingi*	Endangered	Terrestrial	No
Moorhen, Hawaiian Common	*Gallinula chloropus sandvicensis*	Endangered	Terrestrial	No
Nuku Pu'u	*Hemignathus lucidus*	Endangered	Terrestrial	No
'O'o, Kauai (='A'a)	*Moho braccatus*	Endangered	Terrestrial	No
'O'u (Honeycreeper)	*Psittirostra psittacea*	Endangered	Terrestrial	No
Palila	*Loxioides bailleui*	Endangered	Terrestrial	Yes
Parrotbill, Maui	*Pseudonestor xanthophrys*	Endangered	Terrestrial	No
Petrel, Hawaiian Dark-rumped	*Pterodroma phaeopygia sandwichensis*	Endangered	Terrestrial	No
Po'ouli	*Melamprosops phaeosoma*	Endangered	Terrestrial	No
Shearwater, Newell's Townsend's	*Puffinus auricularis newelli*	Threatened	Terrestrial, Saltwater	No
Stilt, Hawaiian (=Ae'o)	*Himantopus mexicanus knudseni*	Endangered	Terrestrial	No
Thrush, Large Kauai	*Myadestes myadestinus*	Endangered	Terrestrial	No
Thrush, Molokai (Oloma'o)	*Myadestes lanaiensis rutha*	Endangered	Terrestrial	No
Thrush, Small Kauai (Puaiohi)	*Myadestes palmeri*	Endangered	Terrestrial	No
Crustacean				
Amphipod, Kauai Cave	*Spelaeorchestia koloana*	Endangered	Freshwater, Subterraneous	Yes
Dicot				
Abutilon eremitopetalum (ncn)	*Abutilon eremitopetalum*	Endangered	Terrestrial	Yes
Abutilon sandwicense (ncn)	*Abutilon sandwicense*	Endangered	Terrestrial	Yes

Achyranthes mutica (ncn)	*Achyranthes mutica*	Endangered	Terrestrial	Yes
Achyranthes splendens var. rotundata (ncn)	*Achyranthes splendens var. rotundata*	Endangered	Terrestrial	No
A'e (Zanthoxylum dipetalum var. tomentosum)	*Zanthoxylum dipetalum var. tomentosum*	Endangered	Terrestrial	Yes
A'e (Zanthoxylum hawaiiense)	*Zanthoxylum hawaiiense*	Endangered	Terrestrial	Yes
'Aiea (Nothocestrum breviflorum)	*Nothocestrum breviflorum*	Endangered	Terrestrial	Yes
'Aiea (Nothocestrum peltatum)	*Nothocestrum peltatum*	Endangered	Terrestrial	Yes
'Akoko (Chamaesyce celastroides var. kaenana)	*Chamaesyce celastroides var. kaenana*	Endangered	Terrestrial	Yes
'Akoko (Chamaesyce deppeana)	*Chamaesyce deppeana*	Endangered	Terrestrial	Yes

'Akoko (Chamaesyce herbstii)	*Chamaesyce herbstii*	Endangered	Terrestrial	Yes
'Akoko (Chamaesyce kuwaleana)	*Chamaesyce kuwaleana*	Endangered	Terrestrial	Yes
'Akoko (Chamaesyce rockii)	*Chamaesyce rockii*	Endangered	Terrestrial	Yes
'Akoko (Chamaesyce skottsbergii var. skottsbe	*Chamaesyce skottsbergii var. kalaeloana*	Endangered	Terrestrial	No
'Akoko (Euphorbia haeleeleana)	*Euphorbia haeleeleana*	Endangered	Terrestrial	Yes
Alani (Melicope adscendens)	*Melicope adscendens*	Endangered	Terrestrial	Yes
Alani (Melicope balloui)	*Melicope balloui*	Endangered	Terrestrial	Yes
Alani (Melicope haupuensis)	*Melicope haupuensis*	Endangered	Terrestrial	Yes
Alani (Melicope knudsenii)	*Melicope knudsenii*	Endangered	Terrestrial	Yes
Alani (Melicope lydgatei)	*Melicope lydgatei*	Endangered	Terrestrial	Yes
Alani (Melicope mucronulata)	*Melicope mucronulata*	Endangered	Terrestrial	Yes
Alani (Melicope munroi)	*Melicope munroi*	Endangered	Terrestrial	No
Alani (Melicope ovalis)	*Melicope ovalis*	Endangered	Terrestrial	Yes
Alani (Melicope pallida)	*Melicope pallida*	Endangered	Terrestrial	Yes
Alani (Melicope quadrangularis)	*Melicope quadrangularis*	Endangered	Terrestrial	No
Alani (Melicope reflexa)	*Melicope reflexa*	Endangered	Terrestrial	Yes
Alani (Melicope saint-johnii)	*Melicope saint-johnii*	Endangered	Terrestrial	Yes
Alani (Melicope zahlbruckneri)	*Melicope zahlbruckneri*	Endangered	Terrestrial	Yes
Alsinidendron obovatum (ncn)	*Alsinidendron obovatum*	Endangered	Terrestrial	Yes
Alsinidendron trinerve (ncn)	*Alsinidendron trinerve*	Endangered	Terrestrial	Yes
Alsinidendron viscosum (ncn)	*Alsinidendron viscosum*	Endangered	Terrestrial	Yes
Amaranthus brownii (ncn)	*Amaranthus brownii*	Endangered	Terrestrial	Yes
'Anaunau (Lepidium arbuscula)	*Lepidium arbuscula*	Endangered	Terrestrial	Yes
'Anunu (Sicyos alba)	*Sicyos alba*	Endangered	Terrestrial	Yes
Aupaka (Isodendrion hosakae)	*Isodendrion hosakae*	Endangered	Terrestrial	Yes
Aupaka (Isodendrion laurifolium)	*Isodendrion laurifolium*	Endangered	Terrestrial	Yes
Aupaka (Isodendrion longifolium)	*Isodendrion longifolium*	Threatened	Terrestrial	Yes

'Awikiwiki (Canavalia molokaiensis)	*Canavalia molokaiensis*	Endangered	Terrestrial	Yes
'Awiwi (Centaurium sebaeoides)	*Centaurium sebaeoides*	Endangered	Terrestrial	Yes
'Awiwi (Hedyotis cookiana)	*Hedyotis cookiana*	Endangered	Terrestrial	Yes
Bonamia menziesii (ncn)	*Bonamia menziesii*	Endangered	Terrestrial	Yes
Chamaesyce Halemanui (ncn)	*Chamaesyce halemanui*	Endangered	Terrestrial	Yes
Cyanea undulata (ncn)	*Cyanea undulata*	Endangered	Terrestrial	Yes
Delissea rhytodisperma (ncn)	*Delissea rhytidosperma*	Endangered	Terrestrial	Yes
Dubautia latifolia (ncn)	*Dubautia latifolia*	Endangered	Terrestrial	Yes
Dubautia pauciflorula (ncn)	*Dubautia pauciflorula*	Endangered	Terrestrial	Yes

Geranium, Hawaiian Red-flowered	*Geranium arboreum*	Endangered	Terrestrial	Yes
Gouania hillebrandii (ncn)	*Gouania hillebrandii*	Endangered	Terrestrial	Yes
Gouania meyenii (ncn)	*Gouania meyenii*	Endangered	Terrestrial	Yes
Gouania vitifolia (ncn)	*Gouania vitifolia*	Endangered	Terrestrial	Yes
Haha (Cyanea acuminata)	*Cyanea acuminata*	Endangered	Terrestrial	Yes
Haha (Cyanea asarifolia)	*Cyanea asarifolia*	Endangered	Terrestrial	Yes
Haha (Cyanea copelandii ssp. copelandii)	*Cyanea copelandii ssp. copelandii*	Endangered	Terrestrial	No
Haha (Cyanea copelandii ssp. haleakalaensis)	*Cyanea copelandii ssp. haleakalaensis*	Endangered	Terrestrial	Yes
Haha (Cyanea Crispa) (=Rollandia crispa)	*Cyanea (=Rollandia) crispa*	Endangered	Terrestrial	Yes
Haha (Cyanea dunbarii)	*Cyanea dunbarii*	Endangered	Terrestrial	Yes
Haha (Cyanea glabra)	*Cyanea glabra*	Endangered	Terrestrial	Yes
Haha (Cyanea grimesiana ssp. grimesiana)	*Cyanea grimesiana ssp. grimesiana*	Endangered	Terrestrial	Yes
Haha (Cyanea grimesiana ssp. obatae)	*Cyanea grimesiana ssp. obatae*	Endangered	Terrestrial	Yes
Haha (Cyanea hamatiflora ssp. carlsonii)	*Cyanea hamatiflora carlsonii*	Endangered	Terrestrial	Yes
Haha (Cyanea hamatiflora ssp. hamatiflora)	*Cyanea hamatiflora ssp. hamatiflora*	Endangered	Terrestrial	Yes
Haha (Cyanea humboldtiana)	*Cyanea humboldtiana*	Endangered	Terrestrial	Yes
Haha (Cyanea koolauensis)	*Cyanea koolauensis*	Endangered	Terrestrial	Yes
Haha (Cyanea longiflora)	*Cyanea longiflora*	Endangered	Terrestrial	Yes
Haha (Cyanea Macrostegia var. gibsonii)	*Cyanea macrostegia ssp. gibsonii*	Endangered	Terrestrial	No
Haha (Cyanea mannii)	*Cyanea mannii*	Endangered	Terrestrial	Yes
Haha (Cyanea mceldowneyi)	*Cyanea mceldowneyi*	Endangered	Terrestrial	Yes
Haha (Cyanea pinnatifida)	*Cyanea pinnatifida*	Endangered	Terrestrial	Yes
Haha (Cyanea platyphylla)	*Cyanea platyphylla*	Endangered	Terrestrial	Yes

Haha (Cyanea procera)	*Cyanea procera*	Endangered	Terrestrial	Yes
Haha (Cyanea recta)	*Cyanea recta*	Threatened	Terrestrial	Yes
Haha (Cyanea remyi)	*Cyanea remyi*	Endangered	Terrestrial	Yes
Haha (Cyanea shipmanii)	*Cyanea shipmannii*	Endangered	Terrestrial	Yes
Haha (Cyanea stictophylla)	*Cyanea stictophylla*	Endangered	Terrestrial	Yes
Haha (Cyanea St-Johnii) (=Rollandia St-Johnii)	*Cyanea st-johnii*	Endangered	Terrestrial	Yes
Haha (Cyanea superba)	*Cyanea superba*	Endangered	Terrestrial	Yes
Ha'iwale (Cyrtandra crenata)	*Cyrtandra crenata*	Endangered	Terrestrial	No
Ha'iwale (Cyrtandra dentata)	*Cyrtandra dentata*	Endangered	Terrestrial	Yes
Ha'iwale (Cyrtandra giffardii)	*Cyrtandra giffardii*	Endangered	Terrestrial	Yes

Ha'iwale (Cyrtandra limahuliensis)	*Cyrtandra limahuliensis*	Threatened	Terrestrial	Yes		
Ha'iwale (Cyrtandra munroi)	*Cyrtandra munroi*	Endangered	Terrestrial	Yes		
Ha'iwale (Cyrtandra polyantha)	*Cyrtandra polyantha*	Endangered	Terrestrial	Yes		
Ha'iwale (Cyrtandra subumbellata)	*Cyrtandra subumbellata*	Endangered	Terrestrial	Yes		
Ha'iwale (Cyrtandra tintinnabula)	*Cyrtandra tintinnabula*	Endangered	Terrestrial	Yes		
Ha'iwale (Cyrtandra viridiflora)	*Cyrtandra viridiflora*	Endangered	Terrestrial	Yes		
Haplostachys Haplostachya (ncn)	*Haplostachys haplostachya*	Endangered	Terrestrial	No		
Hau Kauhiwi (Hibiscadelphus woodi)	*Hibiscadelphus woodii*	Endangered	Terrestrial	Yes		
Hau Kuahiwi (Hibiscadelphus distans)		*Hibiscadelphus distans*		Endangered	Terrestrial	No
Heau (Exocarpos luteolus)	*Exocarpos luteolus*	Endangered	Terrestrial	Yes		
Hedyotis degeneri (ncn)	*Hedyotis degeneri*	Endangered	Terrestrial	Yes		
Hedyotis parvula (ncn)	*Hedyotis parvula*	Endangered	Terrestrial	Yes		
Hedyotis St.-Johnii (ncn)	*Hedyotis st.-johnii*	Endangered	Terrestrial	Yes		
Hesperomannia arborescens (ncn)	*Hesperomannia arborescens*	Endangered	Terrestrial	Yes		
Hesperomannia arbuscula (ncn)	*Hesperomannia arbuscula*	Endangered	Terrestrial	Yes		
Hesperomannia lydgatei (ncn)	*Hesperomannia lydgatei*	Endangered	Terrestrial	Yes		
Hibiscus, Clay's	*Hibiscus clayi*	Endangered	Terrestrial	Yes		
Holei (Ochrosia kilaueaensis)	*Ochrosia kilaueaensis*	Endangered	Terrestrial	No		
Iliau (Wilkesia hobdyi)	*Wilkesia hobdyi*	Endangered	Terrestrial	Yes		
Kamakahala (Labordia cyrtandrae)	*Labordia cyrtandrae*	Endangered	Terrestrial	Yes		
Kamakahala (Labordia lydgatei)	*Labordia lydgatei*	Endangered	Terrestrial	Yes		
Kamakahala (Labordia tinifolia var. lanaiensis)	*Labordia tinifolia var. lanaiensis*	Endangered	Terrestrial	No		
Kamakahala (Labordia tinifolia var. wahiawaen)	*Labordia tinifolia var. wahiawaensis*	Endangered	Terrestrial	Yes		
Kamakahala (Labordia triflora)	*Labordia triflora*	Endangered	Terrestrial	No		
Kanaloa kahoolawensis (ncn)	*Kanaloa kahoolawensis*	Endangered	Terrestrial	Yes		
Kauila (Colubrina oppositifolia)	*Colubrina oppositifolia*	Endangered	Terrestrial	Yes		
Kaulu (Pteralyxia kauaiensis)	*Pteralyxia kauaiensis*	Endangered	Terrestrial	Yes		

Klo'Ele (Hedyotis coriacea)	*Hedyotis coriacea*	Endangered	Terrestrial	Yes		
Kiponapona (Phyllostegia racemosa)	*Phyllostegia racemosa*	Endangered	Terrestrial	Yes		
Koki'o (Kokia drynarioides)	*Kokia drynarioides*	Endangered	Terrestrial	Yes		
Koki'o (Kokia kauaiensis)	*Kokia kauaiensis*	Endangered	Terrestrial	Yes		
Koki'o Ke'oke'o (Hibiscus arnottianus ssp. immaculatus)	*Hibiscus arnottianus ssp. immaculatus*	Endangered	Terrestrial	Yes		
Koki'o Ke'oke'o (Hibiscus waimeae ssp. hannerae)	*Hibiscus waimeae ssp. hannerae*	Endangered	Terrestrial	Yes		
Kolea (Myrsine juddii)	*Myrsine juddii*	Endangered	Terrestrial	Yes		
Kolea (Myrsine linearifolia)	*Myrsine linearifolia*	Threatened	Terrestrial	Yes		

Ko'oko'olau (Bidens micrantha ssp. kalealaha)	*Bidens micrantha ssp. kalealaha*	Endangered	Terrestrial	Yes		
Ko'oko'olau (Bidens wiebkei)	*Bidens wiebkei*	Endangered	Terrestrial	Yes		
Ko'oloa'ula (Abutilon menziesii)	*Abutilon menziesii*	Endangered	Terrestrial	No		
Kopa (Hedyotis schlechtendahliana var. remyi)	*Hedyotis schlechtendahliana var. remyi*	Endangered	Terrestrial	No		
Kuawawaenohu (Alsinidendron lychnoides)	*Alsinidendron lychnoides*	Endangered	Terrestrial	Yes		
Kulu'l (Nototrichium humile)	*Nototrichium humile*	Endangered	Terrestrial	Yes		
Laukahi Kuahiwi (Plantago hawaiensis)	*Plantago hawaiensis*	Endangered	Terrestrial	Yes		
Laukahi Kuahiwi (Plantago princeps)	*Plantago princeps*	Endangered	Terrestrial	Yes		
Laulihilihi (Schiedea stellarioides)	*Schiedea stellarioides*	Endangered	Terrestrial	Yes		
Lipochaeta venosa (ncn)	*Lipochaeta venosa*	Endangered	Terrestrial	No		
Lobelia monostachya (ncn)	*Lobelia monostachya*	Endangered	Terrestrial	Yes		
Lobelia niihauensis (ncn)	*Lobelia niihauensis*	Endangered	Terrestrial	Yes		
Lobelia oahuensis (ncn)	*Lobelia oahuensis*	Endangered	Terrestrial	Yes		
Lysimachia filifolia (ncn)	*Lysimachia filifolia*	Endangered	Terrestrial	Yes		
Lysimachia lydgatei (ncn)	*Lysimachia lydgatei*	Endangered	Terrestrial	Yes		
Lysimachia maxima (ncn)	*Lysimachia maxima*	Endangered	Terrestrial	Yes		
Mahoe (Alectryon macrococcus)	*Alectryon macrococcus*	Endangered	Terrestrial	Yes		
Makou (Peucedanum sandwicense)	*Peucedanum sandwicense*	Threatened	Terrestrial	Yes		
Ma'o Hau Hele (Hibiscus brackenridgei)	*Hibiscus brackenridgei*	Endangered	Terrestrial	Yes		
Ma'oli'oli (Schiedea apokremnos)	*Schiedea apokremnos*	Endangered	Terrestrial	Yes		
Ma'oli'oli (Schiedea kealiae)	*Schiedea kealiae*	Endangered	Terrestrial	Yes		
Mapele (Cyrtandra cyaneoides)	*Cyrtandra cyaneoides*	Endangered	Terrestrial	Yes		
Mehamehame (Flueggea neowawraea)	*Flueggea neowawraea*	Endangered	Terrestrial	Yes		
Munroidendron racemosum (ncn)	*Munroidendron racemosum*	Endangered	Terrestrial	Yes		

Na'ena'e (Dubautia herbstobatae)	*Dubautia herbstobatae*	Endangered	Terrestrial	Yes
Na'ena'e (Dubautia plantaginea ssp. humilis)	*Dubautia plantaginea ssp. humilis*	Endangered	Terrestrial	Yes
Nani Wai'ale'ale (Viola kauaensis var. wahiawaensis)	*Viola kauaensis var. wahiawaensis*	Endangered	Terrestrial	Yes
Nanu (Gardenia mannii)	*Gardenia mannii*	Endangered	Terrestrial	Yes
Na'u (Gardenia brighamii)	*Gardenia brighamii*	Endangered	Terrestrial	No
Naupaka, Dwarf (Scaevola coriacea)	*Scaevola coriacea*	Endangered	Terrestrial	No
Nehe (Lipochaeta fauriei)	*Lipochaeta fauriei*	Endangered	Terrestrial	Yes
Nehe (Lipochaeta kamolensis)	*Lipochaeta kamolensis*	Endangered	Terrestrial	Yes
Nehe (Lipochaeta lobata var. leptophylla)	*Lipochaeta lobata var. leptophylla*	Endangered	Terrestrial	Yes

Nehe (Lipochaeta micrantha)	*Lipochaeta micrantha*	Endangered	Terrestrial	Yes		
Nehe (Lipochaeta tenuifolia)	*Lipochaeta tenuifolia*	Endangered	Terrestrial	Yes		
Nehe (Lipochaeta waimeaensis)	*Lipochaeta waimeaensis*	Endangered	Terrestrial	Yes		
Neraudia angulata (ncn)	*Neraudia angulata*	Endangered	Terrestrial	Yes		
Neraudia ovata (ncn)	*Neraudia ovata*	Endangered	Terrestrial	Yes		
Neraudia sericea (ncn)	*Neraudia sericea*	Endangered	Terrestrial	Yes		
Nioi (Eugenia koolauensis)	*Eugenia koolauensis*	Endangered	Terrestrial	Yes		
Nohoanu (Geranium multiflorum)	*Geranium multiflorum*	Endangered	Terrestrial	Yes		
'Oha (Delissea rivularis)	*Delissea rivularis*	Endangered	Terrestrial	Yes		
'Oha (Delissea subcordata)	*Delissea subcordata*	Endangered	Terrestrial	Yes		
'Oha (Delissea undulata)	*Delissea undulata*	Endangered	Terrestrial	Yes		
'Oha (Lobelia gaudichaudii koolauensis)	*Lobelia gaudichaudii ssp. koolauensis*	Endangered	Terrestrial	Yes		
'Oha Wai (Clermontia drepanomorpha)	*Clermontia drepanomorpha*	Endangered	Terrestrial	Yes		
'Oha Wai (Clermontia lindseyana)	*Clermontia lindseyana*	Endangered	Terrestrial	Yes		
'Oha Wai (Clermontia oblongifolia ssp. brevipes)	*Clermontia oblongifolia ssp. brevipes*	Endangered	Terrestrial	Yes		
'Oha Wai (Clermontia oblongifolia ssp. mauiensis)	*Clermontia oblongifolia ssp. mauiensis*	Endangered	Terrestrial	Yes		
'Oha Wai (Clermontia peleana)	*Clermontia peleana*	Endangered	Terrestrial	Yes		
'Oha Wai (Clermontia pyrularia)	*Clermontia pyrularia*	Endangered	Terrestrial	Yes		
'Oha Wai (Clermontia samuelii)	*Clermontia samuelii*	Endangered	Terrestrial	Yes		
'Ohai (Sesbania tomentosa)	*Sesbania tomentosa*	Endangered	Terrestrial	Yes		
'Ohe'ohe (Tetraplasandra gymnocarpa)	*Tetraplasandra gymnocarpa*	Endangered	Terrestrial	Yes		
'Olulu (Brighamia insignis)	*Brighamia insignis*	Endangered	Terrestrial	Yes		
Opuhe (Urera kaalae)	*Urera kaalae*	Endangered	Terrestrial	Yes		
Pamakani (Viola chamissoniana ssp. chamissoniana)	*Viola chamissoniana ssp. chamissoniana*	Endangered	Terrestrial	Yes		
Phyllostegia hirsuta (ncn)	*Phyllostegia hirsuta*	Endangered	Terrestrial	Yes		

Phyllostegia kaalaensis (ncn)	*Phyllostegia kaalaensis*	Endangered	Terrestrial	Yes
Phyllostegia knudsenii (ncn)	*Phyllostegia knudsenii*	Endangered	Terrestrial	Yes
Phyllostegia mannii (ncn)	*Phyllostegia mannii*	Endangered	Terrestrial	Yes
Phyllostegia mollis (ncn)	*Phyllostegia mollis*	Endangered	Terrestrial	Yes
Phyllostegia parviflora (ncn)	*Phyllostegia parviflora*	Endangered	Terrestrial	Yes
Phyllostegia velutina (ncn)	*Phyllostegia velutina*	Endangered	Terrestrial	Yes
Phyllostegia waimeae (ncn)	*Phyllostegia waimeae*	Endangered	Terrestrial	Yes
Phyllostegia warshaueri (ncn)	*Phyllostegia warshaueri*	Endangered	Terrestrial	Yes
Phyllostegia wawrana (ncn)	*Phyllostegia wawrana*	Endangered	Terrestrial	Yes
Pilo (Hedyotis mannii)	*Hedyotis mannii*	Endangered	Terrestrial	Yes

Po'e (Portulaca sclerocarpa)	*Portulaca sclerocarpa*	Endangered	Terrestrial	Yes		
Popolo 'Alakeakua (Solanum sandwicense)	*Solanum sandwicense*	Endangered	Terrestrial	Yes		
Popolo Ku Mai (Solanum incompletum)		*Solanum incompletum*		Endangered	Terrestrial	Yes
Pua'ala (Brighamia rockii)	*Brighamia rockii*	Endangered	Terrestrial	Yes		
Remya kauaiensis (ncn)	*Remya kauaiensis*	Endangered	Terrestrial	Yes		
Remya montgomeryi (ncn)	*Remya montgomeryi*	Endangered	Terrestrial	Yes		
Remya, Maui	*Remya mauiensis*	Endangered	Terrestrial	Yes		
Sandalwood, Lanai (='Iliahi)	*Santalum freycinetianum var. lanaiense*	Endangered	Terrestrial	No		
Sanicula mariversa (ncn)	*Sanicula mariversa*	Endangered	Terrestrial	Yes		
Sanicula purpurea (ncn)	*Sanicula purpurea*	Endangered	Terrestrial	Yes		
Schiedea haleakalensis (ncn)	*Schiedea haleakalensis*	Endangered	Terrestrial	Yes		
Schiedea helleri (ncn)	*Schiedea helleri*	Endangered	Terrestrial	Yes		
Schiedea hookeri (ncn)	*Schiedea hookeri*	Endangered	Terrestrial	Yes		
Schiedea kaalae (ncn)	*Schiedea kaalae*	Endangered	Terrestrial	Yes		
Schiedea kauaiensis (ncn)	*Schiedea kauaiensis*	Endangered	Terrestrial	Yes		
Schiedea lydgatei (ncn)	*Schiedea lydgatei*	Endangered	Terrestrial	Yes		
Schiedea membranacea (ncn)	*Schiedea membranacea*	Endangered	Terrestrial	Yes		
Schiedea nuttallii (ncn)	*Schiedea nuttallii*	Endangered	Terrestrial	Yes		
Schiedea sarmentosa (ncn)	*Schiedea sarmentosa*	Endangered	Terrestrial	Yes		
Schiedea spergulina var. leiopoda (ncn)	*Schiedea spergulina var. leiopoda*	Endangered	Terrestrial	Yes		
Schiedea spergulina var. spergulina (ncn)	*Schiedea spergulina var. spergulina*	Threatened	Terrestrial	Yes		
Schiedea verticillata (ncn)	*Schiedea verticillata*	Endangered	Terrestrial	Yes		
Schiedea, Diamond Head (Schiedea adamantis)	*Schiedea adamantis*	Endangered	Terrestrial	No		
Silene alexandri (ncn)	*Silene alexandri*	Endangered	Terrestrial	Yes		

Silene hawaiiensis (ncn)	*Silene hawaiiensis*	Threatened	Terrestrial	Yes
Silene lanceolata (ncn)	*Silene lanceolata*	Endangered	Terrestrial	Yes
Silene perlmanii (ncn)	*Silene perlmanii*	Endangered	Terrestrial	Yes
Silversword, Haleakala ('Ahinahina)	*Argyroxiphium sandwicense ssp. macrocephalum*	Threatened	Terrestrial	Yes
Silversword, Ka'u (Argyroxiphium kauense)	*Argyroxiphium kauense*	Endangered	Terrestrial	Yes
Silversword, Mauna Kea ('Ahinahina)	*Argyroxiphium sandwicense ssp. sandwicense*	Endangered	Terrestrial	No
Spermolepis hawaiiensis (ncn)	*Spermolepis hawaiiensis*	Endangered	Terrestrial	Yes
Stenogyne angustifolia (ncn)	*Stenogyne angustifolia var. angustifolia*	Endangered	Terrestrial	No

Stenogyne bifida (ncn)	*Stenogyne bifida*	Endangered	Terrestrial	Yes
Stenogyne campanulata (ncn)	*Stenogyne campanulata*	Endangered	Terrestrial	Yes
Stenogyne kanehoana (ncn)	*Stenogyne kanehoana*	Endangered	Terrestrial	Yes
Tetramolopium arenarium (ncn)	*Tetramolopium arenarium*	Endangered	Terrestrial	No
Tetramolopium capillare (ncn)	*Tetramolopium capillare*	Endangered	Terrestrial	Yes
Tetramolopium filiforme (ncn)	*Tetramolopium filiforme*	Endangered	Terrestrial	Yes
Tetramolopium lepidotum ssp. lepidotum (ncn)	*Tetramolopium lepidotum ssp. lepidotum*	Endangered	Terrestrial	Yes
Tetramolopium remyi (ncn)	*Tetramolopium remyi*	Endangered	Terrestrial	Yes
Tetramolopium rockii (ncn)	*Tetramolopium rockii*	Threatened	Coastal (neritic), Terrestrial	Yes
Trematolobelia singularis (ncn)	*Trematolobelia singularis*	Endangered	Terrestrial	Yes
Uhiuhi (Caesalpinia kavaiensis)	*Caesalpinia kavaiense*	Endangered	Terrestrial	No
Ulihi (Phyllostegia glabra var. lanaiensis)	*Phyllostegia glabra var. lanaiensis*	Endangered	Terrestrial	No
Vetch, Hawaiian (Vicia menziesii)	*Vicia menziesii*	Endangered	Terrestrial	No
Vigna o-wahuensis (ncn)	*Vigna o-wahuensis*	Endangered	Terrestrial	Yes
Viola helenae (ncn)	*Viola helenae*	Endangered	Terrestrial	Yes
Viola lanaiensis (ncn)	*Viola lanaiensis*	Endangered	Terrestrial	No
Viola oahuensis (ncn)	*Viola oahuensis*	Endangered	Terrestrial	Yes
Wahine Noho Kula (Isodendrion pyrifolium)	*Isodendrion pyrifolium*	Endangered	Terrestrial	Yes
Xylosma crenatum (ncn)	*Xylosma crenatum*	Endangered	Terrestrial	Yes
Ferns				
Asplenium fragile var. insulare (ncn)	*Asplenium fragile var. insulare*	Endangered	Terrestrial	Yes
Diellia erecta (ncn)	*Diellia erecta*	Endangered	Terrestrial	Yes
Diellia falcata (ncn)	*Diellia falcata*	Endangered	Terrestrial	Yes
Diellia pallida (ncn)	*Diellia pallida*	Endangered	Terrestrial	Yes
Diellia unisora (ncn)	*Diellia unisora*	Endangered	Terrestrial	Yes
Diplazium molokaiense (ncn)	*Diplazium molokaiense*	Endangered	Terrestrial	Yes

Fern, Pendant Kihi (Adenophorus periens)	*Adenophorus periens*	Endangered	Terrestrial	Yes	
'Ihi'Ihi (Marsilea villosa)	*Marsilea villosa*	Endangered	Vernal pool, Terrestrial	Yes	
Pauoa (Ctenitis squamigera)	*Ctenitis squamigera*	Endangered	Terrestrial	Yes	
Pteris lidgatei (ncn)	*Pteris lidgatei*	Endangered	Terrestrial	Yes	
Wawae'Iole (Phlegmariurus (=Huperzia) mannii)	*Huperzia mannii*	Endangered	Terrestrial	Yes	
Wawae'Iole (Phlegmariurus (=Lycopodium) nutans)	*Lycopodium (=Phlegmariurus) nutans*		Endangered	Terrestrial	Yes
Gastropod					
Snail, Newcomb's	*Erinna newcombi*	Threatened	Freshwater	Yes	

Snail, O'ahu Tree (Achatinella abbreviata)	*Achatinella abbreviata*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella apexfulva)	*Achatinella apexfulva*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella bellula)	*Achatinella bellula*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella buddii)	*Achatinella buddii*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella bulimoides)	*Achatinella bulimoides*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella byronii)	*Achatinella byronii*			Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella caesia)	*Achatinella caesia*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella casta)	*Achatinella casta*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella cestus)	*Achatinella cestus*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella concavospira)	*Achatinella concavospira*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella curta)	*Achatinella curta*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella decipiens)	*Achatinella decipiens*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella decora)	*Achatinella decora*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella dimorpha)	*Achatinella dimorpha*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella elegans)	*Achatinella elegans*			Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella fulgens)	*Achatinella fulgens*			Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella fuscobasis)	*Achatinella fuscobasis*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella juddii)	*Achatinella juddii*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella juncea)	*Achatinella juncea*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella lehuiensis)	*Achatinella lehuiensis*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella leucorraphe)	*Achatinella leucorraphe*	Endangered	Terrestrial	No		
Snail, O'ahu Tree (Achatinella lila)	*Achatinella lila*	Endangered	Terrestrial	No		

Snail, O'ahu Tree (Achatinella livida)	*Achatinella livida*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella lorata)	*Achatinella lorata*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella mustelina)	*Achatinella mustelina*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella papyracea)	*Achatinella papyracea*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella phaeozona)	*Achatinella phaeozona*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella pulcherrima)	*Achatinella pulcherrima*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella pupukanioe)	*Achatinella pupukanioe*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella rosea)	*Achatinella rosea*	Endangered	Terrestrial	No

Snail, O'ahu Tree (Achatinella sowerbyana)	*Achatinella sowerbyana*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella spaldingi)	*Achatinella spaldingi*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella stewartii)	*Achatinella stewartii*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella swiftii)	*Achatinella swiftii*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella taeniolata)	*Achatinella taeniolata*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella thaanumi)	*Achatinella thaanumi*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella turgida)	*Achatinella turgida*	Endangered	Terrestrial	No
Snail, O'ahu Tree (Achatinella valida)	*Achatinella valida*	Endangered	Terrestrial	No
Insect				
Moth, Blackburn's Sphinx	*Manduca blackburni*	Endangered	Terrestrial	Yes
Mammal				
Bat, Hawaiian Hoary	*Lasiurus cinereus semotus*	Endangered	Terrestrial, Subterraneous	No
Marine mml				
Seal, Hawaiian Monk	*Monachus schauinslandi*	Endangered	Coastal (neritic), Saltwater	Yes
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Monocot				
Bluegrass, Hawaiian	*Poa sandvicensis*	Endangered	Terrestrial	Yes
Bluegrass, Mann's (Poa mannii)	*Poa mannii*	Endangered	Terrestrial	Yes
Gahnia Lanaiensis (ncn)	*Gahnia lanaiensis*	Endangered	Terrestrial	No
Grass, Fosberg's Love	*Eragrostis fosbergii*	Endangered	Terrestrial	Yes
Hala Pepe (Pleomele hawaiiensis)	*Pleomele hawaiiensis*	Endangered	Terrestrial	Yes
Hilo Ischaemum (Ischaemum	*Ischaemum byrone*	Endangered	Terrestrial	Yes
Kamanomano (Cenchrus agrimonioides)	*Cenchrus agrimonioides*	Endangered	Terrestrial	Yes

Lau'ehu (Panicum niihauense)	*Panicum niihauense*	Endangered	Terrestrial	Yes
Lo`ulu (Pritchardia affinis)	*Pritchardia affinis*	Endangered	Terrestrial	No
Lo`ulu (Pritchardia kaalae)	*Pritchardia kaalae*	Endangered	Terrestrial	No
Lo`ulu (Pritchardia munroi)	*Pritchardia munroi*	Endangered	Terrestrial	Yes
Lo`ulu (Pritchardia napaliensis)	*Pritchardia napaliensis*	Endangered	Terrestrial	No
Lo`ulu (Pritchardia remota)	*Pritchardia remota*	Endangered	Terrestrial	Yes
Lo`ulu (Pritchardia schattaueri)	*Pritchardia schattaueri*	Endangered	Terrestrial	No
Lo`ulu (Pritchardia viscosa)	*Pritchardia viscosa*	Endangered	Terrestrial	No
Mariscus fauriei (ncn)	*Mariscus fauriei*	Endangered	Terrestrial	Yes
Mariscus pennatiformis (ncn)	*Mariscus pennatiformis*	Endangered	Terrestrial	Yes

Panicgrass, Carter's (Panicum fauriei var.carteri)	*Panicum fauriei var. carteri*	Endangered	Terrestrial	Yes	
Platanthera holochila (ncn)	*Platanthera holochila*	Endangered	Terrestrial	Yes	
Poa siphonoglossa (ncn)	*Poa siphonoglossa*	Endangered	Terrestrial	Yes	
Pu'uka'a (Cyperus trachysanthos)	*Cyperus trachysanthos*	Endangered	Terrestrial	Yes	
Wahane (Pritchardia aylmer-robinsonii)	*Pritchardia aylmer-robinsonii*	Endangered	Terrestrial	No	
Reptile					
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No	
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes	
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes	
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No	
Idaho	**(21) species:**			**CH**	
Bird					
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes	
Dicot					
Catchfly, Spalding's	*Silene spaldingii*	Threatened	Terrestrial	No	
Four-o'clock, Macfarlane's	*Mirabilis macfarlanei*	Threatened	Terrestrial	No	
Howellia, Water	*Howellia aquatilis*	Threatened	Freshwater	No	
Fish					
Salmon, Chinook (Snake River Fall Run)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Brackish	Freshwater, Saltwater,	No
Salmon, Chinook (Snake River spring/summer)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Freshwater	Brackish, Saltwater,	Yes
Salmon, Sockeye (Snake River population)	*Oncorhynchus (=Salmo) nerka*	Endangered	Brackish, Saltwater, Freshwater	No	
Steelhead, (Snake River Basin population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Freshwater, Brackish, Saltwater	Yes	
Sturgeon, White	*Acipenser transmontanus*	Endangered	Saltwater, Freshwater	Yes	
Trout, Bull	*Salvelinus confluentus*	Threatened	Freshwater	No	

Trout, Bull (Columbia River	*Salvelinus confluentus*	Threatened	Freshwater	Yes		
Trout, Bull (Klamath River population)		*Salvelinus confluentus*		Threatened	Freshwater	Yes
Gastropod						
Limpet, Banbury Springs	*Lanx sp.*	Endangered	Freshwater	No		
Snail, Bliss Rapids	*Taylorconcha serpenticola*	Threatened	Freshwater	No		
Snail, Snake River Physa	*Physa natricina*	Endangered	Terrestrial	No		
Snail, Utah Valvata	*Valvata utahensis*	Endangered	Terrestrial	No		
Springsnail, Bruneau Hot	*Pyrgulopsis bruneauensis*	Endangered	Freshwater	No		
Mammal						
Bear, Grizzly	*Ursus arctos horribilis*	Threatened	Terrestrial	No		

Caribou, Woodland	*Rangifer tarandus caribou*	Endangered	Terrestrial	No
Squirrel, Northern Idaho Ground	*Spermophilus brunneus brunneus*	Threatened	Terrestrial	No
Wolf, Gray	*Canis lupus*	Endangered	Terrestrial	Yes
Illinois **(25) species:**				**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Bivalve				
Fanshell	*Cyprogenia stegaria*	Endangered	Freshwater	No
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Clubshell	*Pleurobema clava*	Endangered	Freshwater	No
Pearlymussel, Fat Pocketbook	*Potamilus capax*	Endangered	Freshwater	No
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	Endangered	Freshwater	No
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	Endangered	Freshwater	No
Pearlymussel, White Wartyback	*Plethobasus cicatricosus*	Endangered	Freshwater	No
Crustacean				
Amphipod, Illinois Cave	*Gammarus acherondytes*	Endangered	Subterraneous, Freshwater	No
Dicot				
Aster, Decurrent False	*Boltonia decurrens*	Threatened	Terrestrial, Freshwater	No
Clover, Leafy Prairie	*Dalea foliosa*	Endangered	Terrestrial	No
Clover, Prairie Bush	*Lespedeza leptostachya*	Threatened	Terrestrial	No
Daisy, Lakeside	*Hymenoxys herbacea*	Threatened	Freshwater	No
Milkweed, Mead's	*Asclepias meadii*	Threatened	Terrestrial	No
Potato-bean, Price's	*Apios priceana*	Threatened	Terrestrial	No
Thistle, Pitcher's	*Cirsium pitcheri*	Threatened	Terrestrial	No
Fish				
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Gastropod				

Snail, Iowa Pleistocene	*Discus macclintocki*	Endangered	Terrestrial	No
Insect				
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No
Dragonfly, Hine's Emerald	*Somatochlora hineana*	Endangered	Freshwater, Terrestrial	Yes
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes

Monocot

Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No

Indiana **(23) species:** **CH**

Bird

Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No

Bivalve

Fanshell	*Cyprogenia stegaria*	Endangered	Freshwater	No
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Clubshell	*Pleurobema clava*	Endangered	Freshwater	No
Mussel, Ring Pink (=Golf Stick	*Obovaria retusa*	Endangered	Freshwater	No
Mussel, Rough Pigtoe	*Pleurobema plenum*	Endangered	Freshwater	No
Pearlymussel, Fat Pocketbook	*Potamilus capax*	Endangered	Freshwater	No
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	Endangered	Freshwater	No
Pearlymussel, Tubercled-blossom	*Epioblasma torulosa torulosa*	Endangered	Freshwater	No
Pearlymussel, White Cat's Paw	*Epioblasma obliquata perobliqua*	Endangered	Freshwater	No
Pearlymussel, White Wartyback	*Plethobasus cicatricosus*	Endangered	Freshwater	No
Rifffleshell, Northern	*Epioblasma torulosa rangiana*	Endangered	Freshwater	No

Dicot

Clover, Running Buffalo	*Trifolium stoloniferum*	Endangered	Terrestrial	No
Goldenrod, Short's	*Solidago shortii*	Endangered	Terrestrial	No
Milkweed, Mead's	*Asclepias meadii*	Threatened	Terrestrial	No
Thistle, Pitcher's	*Cirsium pitcheri*	Threatened	Terrestrial	No

Insect

Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	Endangered	Terrestrial	No

Mammal

Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Monocot				
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Reptile				
Snake, Northern Copperbelly Water	*Nerodia erythrogaster neglecta*	Threatened	Freshwater, Terrestrial	No

Iowa **(14) species:** **CH**

Bird

Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Bivalve				
Pearlymussel, Fat Pocketbook	*Potamilus capax*	Endangered	Freshwater	No
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	Endangered	Freshwater	No
Dicot				
Clover, Prairie Bush	*Lespedeza leptostachya*	Threatened	Terrestrial	No
Milkweed, Mead's	*Asclepias meadii*	Threatened	Terrestrial	No
Monkshood, Northern Wild	*Aconitum noveboracense*	Threatened	Terrestrial	No
Ferns				
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	Threatened	Terrestrial	No
Fish				
Shiner, Topeka	*Notropis topeka (=tristis)*	Endangered	Freshwater	Yes
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Gastropod				
Snail, Iowa Pleistocene	*Discus macclintocki*	Endangered	Terrestrial	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Monocot				
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Orchid, Western Prairie Fringed	*Platanthera praeclara*	Threatened	Terrestrial	No
Kansas **(12) species:**				**CH**
Bird				
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Dicot				

Milkweed, Mead's	*Asclepias meadii*	Threatened	Terrestrial	No
Fish				
Madtom, Neosho	*Noturus placidus*	Threatened	Freshwater	No
Shiner, Arkansas River	*Notropis girardi*	Threatened	Freshwater	Yes
Shiner, Topeka	*Notropis topeka (=tristis)*	Endangered	Freshwater	Yes
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Mammal				

Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No
Monocot				
Orchid, Western Prairie Fringed	*Platanthera praeclara*	Threatened	Terrestrial	No
Kentucky **(48) species:**				**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	Endangered	Terrestrial	No
Warbler, Bachman's	*Vermivora bachmanii*	Endangered	Terrestrial	No
Woodpecker, Ivory-billed	*Campephilus principalis*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Fanshell	*Cyprogenia stegaria*	Endangered	Freshwater	No
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Clubshell	*Pleurobema clava*	Endangered	Freshwater	No
Mussel, Cumberland Combshell	*Epioblasma brevidens*	Endangered	Freshwater	Yes
Mussel, Cumberland Elktoe	*Alasmidonta atropurpurea*	Endangered	Freshwater	Yes
Mussel, Oyster	*Epioblasma capsaeformis*	Endangered	Freshwater	Yes
Mussel, Ring Pink (=Golf Stick	*Obovaria retusa*	Endangered	Freshwater	No
Mussel, Rough Pigtoe	*Pleurobema plenum*	Endangered	Freshwater	No
Mussel, Winged Mapleleaf	*Quadrula fragosa*	Endangered	Freshwater	No
Pearlymussel, Appalachian Monkeyface	*Quadrula sparsa*	Endangered	Freshwater	No
Pearlymussel, Cracking	*Hemistena lata*	Endangered	Freshwater	No
Pearlymussel, Cumberland Bean	*Villosa trabalis*	Endangered	Freshwater	No
Pearlymussel, Dromedary	*Dromus dromas*	Endangered	Freshwater	No
Pearlymussel, Fat Pocketbook	*Potamilus capax*	Endangered	Freshwater	No

Pearlymussel, Little-wing	***Pegias fabula***	**Endangered**	**Freshwater**	**No**
Pearlymussel, Orange-footed	***Plethobasus cooperianus***	**Endangered**	**Freshwater**	**No**
Pearlymussel, Purple Cat's Paw	***Epioblasma obliquata obliquata***	**Endangered**	**Freshwater**	**No**
Pearlymussel, Tubercled-blossom	***Epioblasma torulosa torulosa***	**Endangered**	**Freshwater**	**No**
Pearlymussel, White Wartyback	***Plethobasus cicatricosus***	**Endangered**	**Freshwater**	**No**
Pearlymussel, Yellow-blossom	***Epioblasma florentina florentina***	**Endangered**	**Freshwater**	**No**
Riffleshell, Northern	***Epioblasma torulosa rangiana***	**Endangered**	**Freshwater**	**No**
Riffleshell, Tan	***Epioblasma florentina walkeri (=E. walkeri)***	**Endangered**	**Freshwater**	**No**

Crustacean				
Shrimp, Kentucky Cave	*Palaemonias ganteri*	Endangered	Freshwater	Yes
Dicot				
Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Clover, Running Buffalo	*Trifolium stoloniferum*	Endangered	Terrestrial	No
Goldenrod, Short's	*Solidago shortii*	Endangered	Terrestrial	No
Goldenrod, White-haired	*Solidago albopilosa*	Threatened	Terrestrial	No
Potato-bean, Price's	*Apios priceana*	Threatened	Terrestrial	No
Rock-cress, Large (=Braun's)	*Arabis perstellata E. L. Braun var. ampla Rollins*	Endangered	Terrestrial	Yes
Rock-cress, Small	*Arabis perstellata E. L. Braun var. perstellata Fernald*	Endangered	Terrestrial	Yes
Rosemary, Cumberland	*Conradina verticillata*	Threatened	Terrestrial	No
Sandwort, Cumberland	*Arenaria cumberlandensis*	Endangered	Terrestrial	No
Spiraea, Virginia	*Spiraea virginiana*	Threatened	Terrestrial	No
Fish				
Dace, Blackside	*Phoxinus cumberlandensis*	Threatened	Freshwater	No
Darter, Bluemask (=jewel)	*Etheostoma /*	Endangered	Freshwater	No
Darter, Relict	*Etheostoma chlenense*	Endangered	Freshwater	No
Shiner, Palezone	*Notropis albizonatus*	Endangered	Freshwater	No
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	Endangered	Terrestrial, Subterraneous	Yes

Louisiana	**(24) species:**			**CH**
Bird				
Pelican, Brown	***Pelecanus occidentalis***	**Endangered**	**Terrestrial**	**No**
Plover, Piping	***Charadrius melodus***	**Endangered**	**Terrestrial**	**Yes**
Tern, California Least	***Sterna antillarum browni***	**Endangered**	**Terrestrial**	**No**
Tern, Interior (population) Least	***Sterna antillarum***	**Endangered**	**Terrestrial**	**No**
Woodpecker, Red-cockaded	***Picoides borealis***	**Endangered**	**Terrestrial**	**No**
Bivalve				
Mucket, Pink (Pearlymussel)	***Lampsilis abrupta***	**Endangered**	**Freshwater**	**No**

Mussel, Heelsplitter Inflated	*Potamilus inflatus*	Threatened	Freshwater	No
Pearlshell, Louisiana	*Margaritifera hembeli*	Threatened	Freshwater	No
Dicot				
Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	Threatened	Terrestrial	No
Ferns				
Quillwort, Louisiana	*Isoetes louisianensis*	Endangered	Freshwater, Terrestrial	No
Fish				
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	Threatened	Saltwater, Freshwater	Yes
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Mammal				
Bear, Louisiana Black	*Ursus americanus luteolus*	Threatened	Terrestrial	No
Marine mml				
Manatee, West Indian	*Trichechus manatus*	Endangered	Saltwater	Yes
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempli*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Tortoise, Gopher	*Gopherus polyphemus*	Threatened	Terrestrial	No
Turtle, Ringed Sawback	*Graptemys oculifera*	Threatened	Freshwater, Terrestrial	No
Maine	**(12) species:**			**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Roseate	*Sterna dougallii dougallii*	Endangered	Terrestrial	No
Dicot				

Lousewort, Furbish	*Pedicularis furbishiae*	Endangered	Terrestrial	No
Fish				
Salmon, Atlantic	*Salmo salar*	Endangered	Brackish, Saltwater, Freshwater	No
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Mammal				
Lynx, Canada	*Lynx canadensis*	Threatened	Terrestrial	No
Marine mml				

Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Maryland	**(22) species:**			**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Bivalve				
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	Endangered	Freshwater	No
Dicot				
Dropwort, Canby's	*Oxypolis canbyi*	Endangered	Terrestrial, Freshwater	No
Gerardia, Sandplain	*Agalinis acuta*	Endangered	Terrestrial	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No
Joint-vetch, Sensitive	*Aeschynomene virginica*	Threatened	Terrestrial, Brackish	No
Fish				
Darter, Maryland	*Etheostoma sellare*	Endangered	Freshwater	Yes
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Insect				
Beetle, Northeastern Beach Tiger	*Cicindela dorsalis dorsalis*	Threatened	Terrestrial	No
Beetle, Puritan Tiger	*Cicindela puritana*	Threatened	Terrestrial, Coastal (neritic)	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Squirrel, Delmarva Peninsula Fox	*Sciurus niger cinereus*	Endangered	Terrestrial	No

Marine mml

Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes

Monocot

Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	Endangered	Terrestrial, Freshwater	No
Pink, Swamp	*Helonias bullata*	Threatened	Terrestrial, Freshwater	No

Reptile

Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Turtle, Bog (Northern population)	*Clemmys muhlenbergli*	Threatened	Terrestrial, Freshwater	No
Massachusetts **(19) species:**				**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Starling, Ponape Mountain	*Aplonis pelzelni*	Endangered	Terrestrial	No
Tern, Roseate	*Sterna dougallii dougallii*	Endangered	Terrestrial	No
Dicot				
Gerardia, Sandplain	*Agalinis acuta*	Endangered	Terrestrial	No
Fish				
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Beetle, Northeastern Beach Tiger	*Cicindela dorsalis dorsalis*	Threatened	Terrestrial	No
Beetle, Puritan Tiger	*Cicindela puritana*	Threatened	Terrestrial, Coastal (neritic)	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	Endangered	Terrestrial, Freshwater	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				

Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Turtle, Bog (Northern population)	*Clemmys muhlenbergii*	Threatened	Terrestrial, Freshwater	No
Turtle, Plymouth Red-bellied	*Pseudemys rubriventris bangsi*	Endangered	Terrestrial, Freshwater	Yes

Michigan **(20) species:** **CH**

Bird

Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes	
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	Endangered	Terrestrial	No	
Bivalve					
Mussel, Clubshell	*Pleurobema clava*	Endangered	Freshwater	No	
Riffleshell, Northern	*Epioblasma torulosa ranglana*	Endangered	Freshwater	No	
Dicot					
Daisy, Lakeside	*Hymenoxys herbacea*	Threatened	Freshwater	No	
Goldenrod, Houghton's	*Solidago houghtonii*	Threatened	Terrestrial	No	
Monkey-flower, Michigan	*Mimulus glabratus var. michiganensis*		Endangered	Terrestrial, Freshwater	No
Thistle, Pitcher's	*Cirsium pitcheri*	Threatened	Terrestrial	No	
Ferns					
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	Threatened	Terrestrial	No	
Insect					
Beetle, Hungerford's Crawling Water	*Brychius hungerfordi*	Endangered	Freshwater	No	
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No	
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	Endangered	Terrestrial	No	
Dragonfly, Hine's Emerald	*Somatochlora hineana*	Endangered	Freshwater, Terrestrial	Yes	
Mammal					
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes	
Lynx, Canada	*Lynx canadensis*	Threatened	Terrestrial	No	
Wolf, Gray	*Canis lupus*	Endangered	Terrestrial	Yes	
Monocot					
Iris, Dwarf Lake	*Iris lacustris*	Threatened	Terrestrial	No	
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No	
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No	
Reptile					
Snake, Northern Copperbelly Water	*Nerodia erythrogaster neglecta*	Threatened	Freshwater, Terrestrial	No	

Minnesota	**(11) species:**			**CH**
Bird				
Plover, Piping	***Charadrius melodus***	**Endangered**	**Terrestrial**	**Yes**
Bivalve				
Mussel, Winged Mapleleaf	***Quadrula fragosa***	**Endangered**	**Freshwater**	**No**
Pearlymussel, Higgins' Eye	***Lampsilis higginsii***	**Endangered**	**Freshwater**	**No**
Dicot				
Clover, Prairie Bush	***Lespedeza leptostachya***	**Threatened**	**Terrestrial**	**No**

Roseroot, Leedy's	*Sedum integrifolium ssp. leedyi*	Threatened	Terrestrial	No
Fish				
Shiner, Topeka	*Notropis topeka (=tristis)*	Endangered	Freshwater	Yes
Insect				
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No
Mammal				
Lynx, Canada	*Lynx canadensis*	Threatened	Terrestrial	No
Wolf, Gray	*Canis lupus*	Threatened	Terrestrial	Yes
Monocot				
Lily, Minnesota Trout	*Erythronium propullans*	Endangered	Terrestrial	No
Orchid, Western Prairie Fringed	*Platanthera praeclara*	Threatened	Terrestrial	No
Mississippi **(35) species:**				**CH**
Amphibian				
Frog, Dusky Gopher (Mississippi	*Rana capito sevosa*	Endangered	Terrestrial, Freshwater	No
Bird				
Crane, Mississippi Sandhill	*Grus canadensis pulla*	Endangered	Terrestrial, Freshwater	Yes
Pelican, Brown	*Pelecanus occidentalis*	Endangered	Terrestrial	No
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Combshell, Southern (=Penitent mussel)	*Epioblasma penita*	Endangered	Freshwater	No
Mucket, Orangenacre	*Lampsilis perovalis*	Threatened	Freshwater	Yes
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	Threatened	Freshwater	Yes
Mussel, Black (=Curtus' Mussel) Clubshell	*Pleurobema curtum*	Endangered	Freshwater	No
Mussel, Heavy Pigtoe (=Judge Tait's Mussel)	*Pleurobema taitianum*	Endangered	Freshwater	No
Mussel, Heelsplitter Inflated	*Potamilus inflatus*	Threatened	Freshwater	No

Mussel, Ovate Clubshell	*Pleurobema perovatum*	Endangered	Freshwater	Yes
Mussel, Southern Clubshell	*Pleurobema decisum*	Endangered	Freshwater	Yes
Pearlymussel, Fat Pocketbook	*Potamilus capax*	Endangered	Freshwater	No
Dicot				
Pondberry	*Lindera melissifolia*	Endangered	Terrestrial	No
Potato-bean, Price's	*Apios priceana*	Threatened	Terrestrial	No
Ferns				
Quillwort, Louisiana	*Isoetes louisianensis*	Endangered	Freshwater, Terrestrial	No

Fish				
Darter, Bayou	*Etheostoma rubrum*	Threatened	Freshwater	No
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	Threatened	Saltwater, Freshwater	Yes
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Bear, Louisiana Black	*Ursus americanus luteolus*	Threatened	Terrestrial	No
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempli*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Snake, Eastern Indigo	*Drymarchon corais couperi*	Threatened	Terrestrial	No
Tortoise, Gopher	*Gopherus polyphemus*	Threatened	Terrestrial	No
Turtle, Ringed Sawback	*Graptemys oculifera*	Threatened	Freshwater, Terrestrial	No
Turtle, Yellow-blotched Map	*Graptemys flavimaculata*	Threatened	Freshwater, Terrestrial	No
Missouri	**(29) species:**			**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Bivalve				
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No

Mussel, Scaleshell	*Leptodea leptodon*	Endangered	Freshwater	No
Mussel, Winged Mapleleaf	*Quadrula fragosa*	Endangered	Freshwater	No
Pearlymussel, Curtis'	*Epioblasma florentina curtisii*	Endangered	Freshwater	No
Pearlymussel, Fat Pocketbook	*Potamilus capax*	Endangered	Freshwater	No
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	Endangered	Freshwater	No
Crustacean				
Crayfish, Cave (Cambarus	*Cambarus aculabrum*	Endangered	Freshwater	No
Dicot				
Aster, Decurrent False	*Boltonia decurrens*	Threatened	Terrestrial, Freshwater	No

Bladderpod, Missouri	*Lesquerella filiformis*	Threatened	Terrestrial	No
Clover, Running Buffalo	*Trifolium stoloniferum*	Endangered	Terrestrial	No
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	Threatened	Terrestrial	No
Milkweed, Mead's	*Asclepias meadii*	Threatened	Terrestrial	No
Pondberry	*Lindera melissifolia*	Endangered	Terrestrial	No
Sneezeweed, Virginia	*Helenium virginicum*	Threatened	Vernal pool	No
Fish				
Cavefish, Ozark	*Amblyopsis rosae*	Threatened	Freshwater	No
Chub, Humpback	*Gila cypha*	Endangered	Freshwater	Yes
Darter, Niangua	*Etheostoma nianguae*	Threatened	Freshwater	Yes
Madtom, Neosho	*Noturus placidus*	Threatened	Freshwater	No
Shiner, Topeka	*Notropis topeka (=tristis)*	Endangered	Freshwater	Yes
Sturgeon, Gulf	*Acipenser oxyrinchus desotoi*	Threatened	Saltwater, Freshwater	Yes
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Gastropod				
Cavesnail, Tumbling Creek	*Antrobia culveri*	Endangered	Subterranean, Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Dragonfly, Hine's Emerald	*Somatochlora hineana*	Endangered	Freshwater, Terrestrial	Yes
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterranean, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterranean, Terrestrial	Yes
Monocot				
Orchid, Western Prairie Fringed	*Platanthera praeciara*	Threatened	Terrestrial	No

Montana **(13) species:** **CH**

Bird

Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Dicot				
Catchfly, Spalding's	*Silene spaldingii*	Threatened	Terrestrial	No
Howellia, Water	*Howellia aquatilis*	Threatened	Freshwater	No
Fish				
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Sturgeon, White	*Acipenser transmontanus*	Endangered	Saltwater, Freshwater	Yes

Trout, Bull	*Salvelinus confluentus*	Threatened	Freshwater	No		
Trout, Bull (Columbia River	*Salvelinus confluentus*	Threatened	Freshwater	Yes		
Trout, Bull (Klamath River population)		*Salvelinus confluentus*		Threatened	Freshwater	Yes
Mammal						
Bear, Grizzly	*Ursus arctos horribills*	Threatened	Terrestrial	No		
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No		
Wolf, Gray	*Canis lupus*	Endangered	Terrestrial	Yes		
Nebraska	**(10) species:**			**CH**		
Bird						
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes		
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes		
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No		
Dicot						
Butterfly Plant, Colorado	*Gaura neomexicana var. coloradensis*		Threatened	Terrestrial	Yes	
Penstemon, Blowout	*Penstemon haydenli*	Endangered	Terrestrial	No		
Fish						
Shiner, Topeka	*Notropis topeka (=tristis)*	Endangered	Freshwater	Yes		
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No		
Insect						
Beetle, Salt Creek Tiger	*Cicindela nevadica lincolniana*	Endangered	Terrestrial	No		
Mammal						
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No		
Monocot						
Orchid, Western Prairie Fringed	*Platanthera praeclara*	Threatened	Terrestrial	No		
Nevada	**(37) species:**			**CH**		
Bird						
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	Endangered	Terrestrial	Yes		
Rail, Yuma Clapper	*Rallus longirostris yumanensis*	Endangered	Terrestrial	No		

Dicot

Blazing Star, Ash Meadows	*Mentzelia leucophylla*	Threatened	Terrestrial	Yes
Buckwheat, Steamboat	*Eriogonum ovalifolium var. williamsiae*	Endangered	Terrestrial	No
Centaury, Spring-loving	*Centaurium namophilum*	Threatened	Terrestrial	Yes
Gumplant, Ash Meadows	*Grindelia fraxino-pratensis*	Threatened	Terrestrial	Yes
Ivesia, Ash Meadows	*Ivesia kingii var. eremica*	Threatened	Terrestrial	Yes
Milk-vetch, Ash Meadows	*Astragalus phoenix*	Threatened	Terrestrial	Yes
Niterwort, Amargosa	*Nitrophila mohavensis*	Endangered	Terrestrial	Yes

Sunray, Ash Meadows	*Enceliopsis nudicaulis var.*	Threatened	Terrestrial	Yes
Fish				
Chub, Bonytail	*Gila elegans*	Endangered	Freshwater	Yes
Chub, Pahranagat Roundtail	*Gila robusta jordani*	Endangered	Freshwater	No
Chub, Virgin River	*Gila seminuda (=robusta)*	Endangered	Freshwater	Yes
Cui-ui	*Chasmistes cujus*	Endangered	Freshwater	No
Dace, Ash Meadows Speckled	*Rhinichthys osculus nevadensis*	Endangered	Freshwater	Yes
Dace, Clover Valley Speckled	*Rhinichthys osculus oligoporus*	Endangered	Freshwater	No
Dace, Desert	*Eremichthys acros*	Threatened	Freshwater	Yes
Dace, Independence Valley Speckled	*Rhinichthys osculus lethoporus*	Endangered	Freshwater	No
Dace, Moapa	*Moapa coriacea*	Endangered	Freshwater	No
Poolfish, Pahrump (= Pahrump Killifish)	*Empetrichthys latos*	Endangered	Freshwater	No
Pupfish, Ash Meadows Amargosa	*Cyprinodon nevadensis mionectes*	Endangered	Freshwater	Yes
Pupfish, Devils Hole	*Cyprinodon diabolis*	Endangered	Freshwater	No
Pupfish, Warm Springs	*Cyprinodon nevadensis pectoralis*	Endangered	Freshwater	No
Spinedace, Big Spring	*Lepidomeda mollispinis pratensis*	Threatened	Freshwater	Yes
Spinedace, White River	*Lepidomeda albivallis*	Endangered	Freshwater	Yes
Springfish, Hiko White River	*Crenichthys baileyi grandis*	Endangered	Freshwater	Yes
Springfish, Railroad Valley	*Crenichthys nevadae*	Threatened	Freshwater	Yes
Springfish, White River	*Crenichthys baileyi baileyi*	Endangered	Freshwater	Yes
Sucker, Razorback	*Xyrauchen texanus*	Endangered	Freshwater	Yes
Sucker, Warner	*Catostomus warnerensis*	Threatened	Freshwater	Yes
Trout, Bull	*Salvelinus confluentus*	Threatened	Freshwater	No
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	Threatened	Freshwater	No
Woundfin	*Plagopterus argentissimus*	Endangered	Freshwater	Yes
Insect				
Naucorid, Ash Meadows	*Ambrysus amargosus*	Threatened	Terrestrial	Yes
Skipper, Carson Wandering	*Pseudocopaeodes eunus obscurus*	Endangered	Terrestrial	No

Monocot				
Ladies'-tresses, Ute	***Spiranthes diluvialis***	**Threatened**	**Terrestrial**	**No**
Reptile				
Tortoise, Desert	***Gopherus agassizii***	**Threatened**	**Terrestrial**	**Yes**
New Hampshire	**(7) species:**			**CH**
Bivalve				
Mussel, Dwarf Wedge	***Alasmidonta heterodon***	**Endangered**	**Freshwater**	**No**
Dicot				

Milk-vetch, Jesup's	*Astragalus robbinsii var. jesupi*	Endangered	Terrestrial	No
Insect				
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Monocot				
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
New Jersey	**(17) species:**			**CH**
Bird				
Curlew, Eskimo	*Numenius borealis*	Endangered	Terrestrial	No
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Dicot				
Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Joint-vetch, Sensitive	*Aeschynomene virginica*	Threatened	Terrestrial, Brackish	No
Fish				
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				

Beaked-rush, Knieskern's	*Rhynchospora knieskernii*	Threatened	Terrestrial	No
Pink, Swamp	*Helonias bullata*	Threatened	Terrestrial, Freshwater	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Turtle, Bog (Northern population)	*Clemmys muhlenbergii*	Threatened	Terrestrial, Freshwater	No

New Mexico	**(46) species:**			**CH**
Amphibian				
Frog, Chiricahua Leopard	*Rana chiricahuensis*	Threatened	Freshwater, Terrestrial	No
Bird				
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	Endangered	Terrestrial	No
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	Endangered	Terrestrial	Yes
Owl, Mexican Spotted	*Strix occidentalis lucida*	Threatened	Terrestrial	Yes
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Crustacean				
Amphipod, Noel's	*Gammarus desperatus*	Endangered	Freshwater	No
Isopod, Socorro	*Thermosphaeroma thermophilus*	Endangered	Freshwater	No
Dicot				
Cactus, Knowlton	*Pediocactus knowltonii*	Endangered	Terrestrial	No
Cactus, Kuenzler Hedgehog	*Echinocereus fendleri var. kuenzleri*	Endangered	Terrestrial	No
Cactus, Lee Pincushion	*Coryphantha sneedii var. leei*	Threatened	Terrestrial	No
Cactus, Mesa Verde	*Sclerocactus mesae-verdae*	Threatened	Terrestrial	No
Cactus, Sneed Pincushion	*Coryphantha sneedii var. sneedii*	Endangered	Terrestrial	No
Fleabane, Zuni	*Erigeron rhizomatus*	Threatened	Terrestrial	No
Ipomopsis, Holy Ghost	*Ipomopsis sancti-spiritus*	Endangered	Terrestrial	No
Milk-vetch, Mancos	*Astragalus humillimus*	Endangered	Terrestrial	No
Pennyroyal, Todsen's	*Hedeoma todsenii*	Endangered	Terrestrial	Yes
Poppy, Sacramento Prickly	*Argemone pleiacantha ssp. pinnatisecta*	Endangered	Terrestrial	No
Sunflower, Pecos	*Helianthus paradoxus*	Threatened	Terrestrial, Freshwater	No
Thistle, Sacramento Mountains	*Cirsium vinaceum*	Threatened	Terrestrial	No
Wild-buckwheat, Gypsum	*Eriogonum gypsophilum*	Threatened	Terrestrial	Yes
Fish				

Chub, Chihuahua	*Gila nigrescens*	Threatened	Freshwater	No
Chub, Gila	*Gila intermedia*	Endangered	Freshwater	Yes
Gambusia, Pecos	*Gambusia nobilis*	Endangered	Freshwater	No
Minnow, Loach	*Tiaroga cobitis*	Threatened	Freshwater	Yes
Minnow, Rio Grande Silvery	*Hybognathus amarus*	Endangered	Freshwater	Yes
Shiner, Arkansas River	*Notropis girardi*	Threatened	Freshwater	Yes
Shiner, Beautiful	*Cyprinella formosa*	Threatened	Freshwater	Yes
Shiner, Pecos Bluntnose	*Notropis simus pecosensis*	Threatened	Freshwater	Yes

Spikedace	*Meda fulgida*	Threatened	Freshwater	Yes
Squawfish, Colorado	*Ptychocheilus lucius*	Endangered	Freshwater	Yes
Sucker, Razorback	*Xyrauchen texanus*	Endangered	Freshwater	Yes
Topminnow, Gila (Yaqui)	*Poeciliopsis occidentalis*	Endangered	Freshwater	No
Trout, Gila	*Oncorhynchus gilae*	Endangered	Freshwater	No
Gastropod				
Snail, Pecos Assiminea	*Assiminea pecos*	Endangered	Freshwater	Yes
Springsnail, Alamosa	*Tryonia alamosae*	Endangered	Freshwater	No
Springsnail, Koster's	*Juturnia kosteri*	Endangered	Terrestrial	No
Springsnail, Roswell	*Pyrgulopsis roswellensis*	Endangered	Freshwater	No
Springsnail, Socorro	*Pyrgulopsis neomexicana*	Endangered	Freshwater	No
Mammal				
Bat, Lesser (=Sanborn's) Long-nosed	*Leptonycteris curasoae yerbabuenae*		Endangered Terrestrial	Subterraneous, No
Bat, Mexican Long-nosed	*Leptonycteris nivalis*	Endangered	Subterraneous, Terrestrial	No
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No
Jaguar	*Panthera onca*	Endangered	Terrestrial	No
Wolf, Gray	*Canis lupus*	Endangered	Terrestrial	Yes
Reptile				
Rattlesnake, New Mexican Ridge-nosed	*Crotalus willardi obscurus*	Threatened	Terrestrial	Yes

New York **(22) species:** **CH**

Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Roseate	*Sterna dougallii dougallii*	Endangered	Terrestrial	No
Bivalve				
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	Endangered	Freshwater	No
Dicot				

Amaranth, Seabeach	*Amaranthus pumilus*	Threatened	Coastal (neritic)	No
Gerardia, Sandplain	*Agalinis acuta*	Endangered	Terrestrial	No
Monkshood, Northern Wild	*Aconitum noveboracense*	Threatened	Terrestrial	No
Roseroot, Leedy's	*Sedum integrifolium ssp. leedyi*	Threatened	Terrestrial	No
Ferns				
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	Threatened	Terrestrial	No
Fish				
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Gastropod				

Snail, Chittenango Ovate Amber	*Succinea chittenangoensis*	Threatened	Terrestrial, Freshwater	No
Insect				
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Turtle, Bog (Northern population)	*Clemmys muhlenbergii*	Threatened	Terrestrial, Freshwater	No
North Carolina **(59) species:**				**CH**
Arachnid				
Spider, Spruce-fir Moss	*Microhexura montivaga*	Endangered	Terrestrial	Yes
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Stork, Wood	*Mycteria americana*	Endangered	Terrestrial	No
Tern, Roseate	*Sterna dougallii dougallii*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Elktoe, Appalachian	*Alasmidonta ravenellana*	Endangered	Freshwater	Yes

Mussel, Dwarf Wedge	*Alasmidonta heterodon*	Endangered	Freshwater	No
Mussel, Heelsplitter Carolina	*Lasmigona decorata*	Endangered	Freshwater	Yes
Mussel, Oyster	*Epioblasma capsaeformis*	Endangered	Freshwater	Yes
Pearlymussel, Little-wing	*Pegias fabula*	Endangered	Freshwater	No
Purple Bean	*Villosa perpurpurea*	Endangered	Freshwater	Yes
Spinymussel, James River	*Pleurobema collina*	Endangered	Freshwater	No
Spinymussel, Tar River	*Elliptio steinstansana*	Endangered	Freshwater	No

Dicot

Amaranth, Seabeach	*Amaranthus pumilus*	Threatened	Coastal (neritic)	No
Avens, Spreading	*Geum radiatum*	Endangered	Terrestrial	No
Bittercress, Small-anthered	*Cardamine micranthera*	Endangered	Terrestrial	No
Blazing Star, Heller's	*Liatris helleri*	Threatened	Terrestrial	No
Bluet, Roan Mountain	*Hedyotis purpurea var. montana*	Endangered	Terrestrial	No
Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Coneflower, Smooth	*Echinacea laevigata*	Endangered	Terrestrial	No
Dropwort, Canby's	*Oxypolis canbyi*	Endangered	Terrestrial, Freshwater	No
Goldenrod, Blue Ridge	*Solidago spithamaea*	Threatened	Terrestrial	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No
Heartleaf, Dwarf-flowered	*Hexastylis naniflora*	Threatened	Terrestrial	No
Heather, Mountain Golden	*Hudsonia montana*	Threatened	Terrestrial	Yes
Joint-vetch, Sensitive	*Aeschynomene virginica*	Threatened	Terrestrial, Brackish	No
Loosestrife, Rough-leaved	*Lysimachia asperulaefolia*	Endangered	Terrestrial	No
Meadowrue, Cooley's	*Thalictrum cooleyi*	Endangered	Terrestrial	No
Pitcher-plant, Green	*Sarracenia oreophila*	Endangered	Terrestrial, Freshwater	No
Pitcher-plant, Mountain Sweet	*Sarracenia rubra ssp. jonesii*	Endangered	Freshwater, Terrestrial	No
Pondberry	*Lindera melissifolia*	Endangered	Terrestrial	No
Spiraea, Virginia	*Spiraea virginiana*	Threatened	Terrestrial	No
Sumac, Michaux's	*Rhus michauxii*	Endangered	Terrestrial	No
Sunflower, Schweinitz's	*Helianthus schweinitzii*	Endangered	Terrestrial	No
Fish				
Chub, Spotfin	*Erimonax monachus*	Threatened	Freshwater	Yes
Shiner, Cape Fear	*Notropis mekistocholas*	Endangered	Freshwater	Yes
Silverside, Waccamaw	*Menidia extensa*	Threatened	Freshwater	Yes
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Gastropod				
Snail, Noonday	*Mesodon clarki nantahala*	Threatened	Terrestrial	No

Insect				
Butterfly, Saint Francis' Satyr	*Neonympha mitchellii francisci*	Endangered	Terrestrial	No
Lichen				
Lichen, Rock Gnome	*Gymnoderma lineare*	Endangered	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes

Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	Endangered	Terrestrial, Subterraneous		Yes
Squirrel, Carolina Northern Flying	*Glaucomys sabrinus coloratus*	Endangered	Terrestrial	No	
Marine mml					
Manatee, West Indian	*Trichechus manatus*	Endangered	Saltwater	Yes	
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No	
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No	
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes	
Monocot					
Arrowhead, Bunched	*Sagittaria fasciculata*	Endangered	Freshwater	No	
Irisette, White	*Sisyrinchium dichotomum*	Endangered	Terrestrial	No	
Pink, Swamp	*Helonias bullata*	Threatened	Terrestrial, Freshwater	No	
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No	
Sedge, Golden	*Carex lutea*	Endangered	Terrestrial	No	
Reptile					
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No	
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes	
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No	
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes	
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No	
North Dakota	**(5) species:**			**CH**	
Bird					
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes	
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes	
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No	
Fish					
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No	
Monocot					
Orchid, Western Prairie Fringed	*Platanthera praeclara*	Threatened	Terrestrial	No	

Ohio	**(22) species:**			**CH**
Bird				
Plover, Piping	***Charadrius melodus***	**Endangered**	**Terrestrial**	**Yes**
Bivalve				
Fanshell	***Cyprogenia stegaria***	**Endangered**	**Freshwater**	**No**
Mucket, Pink (Pearlymussel)	***Lampsilis abrupta***	**Endangered**	**Freshwater**	**No**
Mussel, Clubshell	***Pleurobema clava***	**Endangered**	**Freshwater**	**No**
Pearlymussel, Purple Cat's Paw	***Epioblasma obliquata obliquata***	**Endangered**	**Freshwater**	**No**

Pearlymussel, White Cat's Paw	*Epioblasma obliquata perobliqua*	Endangered	Freshwater	No
Riffleshell, Northern	*Epioblasma torulosa rangiana*	Endangered	Freshwater	No
Dicot				
Clover, Running Buffalo	*Trifolium stoloniferum*	Endangered	Terrestrial	No
Daisy, Lakeside	*Hymenoxys herbacea*	Threatened	Freshwater	No
Monkshood, Northern Wild	*Aconitum noveboracense*	Threatened	Terrestrial	No
Spiraea, Virginia	*Spiraea virginiana*	Threatened	Terrestrial	No
Fish				
Madtom, Scioto	*Noturus trautmani*	Endangered	Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	Endangered	Terrestrial	No
Dragonfly, Hine's Emerald	*Somatochlora hineana*	Endangered	Freshwater, Terrestrial	Yes
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Monocot				
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Snake, Lake Erie Water	*Nerodia sipedon insularum*	Threatened	Terrestrial, Freshwater	No
Snake, Northern Copperbelly Water	*Nerodia erythrogaster neglecta*	Threatened	Freshwater, Terrestrial	No
Oklahoma **(18) species:**				**CH**
Bird				
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes
Curlew, Eskimo	*Numenius borealis*	Endangered	Terrestrial	No

Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Vireo, Black-capped	*Vireo atricapilla*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Mussel, Scaleshell	*Leptodea leptodon*	Endangered	Freshwater	No
Rock-pocketbook, Ouachita (=Wheeler's pm)	*Arkansia wheeleri*	Endangered	Freshwater	No
Fish				

Cavefish, Ozark	*Amblyopsis rosae*	Threatened	Freshwater	No
Darter, Leopard	*Percina pantherina*	Threatened	Freshwater	Yes
Madtom, Neosho	*Noturus placidus*	Threatened	Freshwater	No
Shiner, Arkansas River	*Notropis girardi*	Threatened	Freshwater	Yes
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Bat, Ozark Big-eared	*Corynorhinus (=Plecotus) townsendii ingens*	Endangered	Terrestrial, Subterraneous	No
Monocot				
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Orchid, Western Prairie Fringed	*Platanthera praeclara*	Threatened	Terrestrial	No
Oregon **(51) species:**				**CH**
Bird				
Murrelet, Marbled	*Brachyramphus marmoratus marmoratus*	Threatened	Freshwater, Terrestrial, Saltwater	Yes
Owl, Northern Spotted	*Strix occidentalis caurina*	Threatened	Terrestrial	Yes
Pelican, Brown	*Pelecanus occidentalis*	Endangered	Terrestrial	No
Plover, Western Snowy	*Charadrius alexandrinus nivosus*	Threatened	Terrestrial	Yes
Crustacean				
Fairy Shrimp, Vernal Pool	*Branchinecta lynchi*	Threatened	Vernal pool	Yes
Dicot				
Catchfly, Spalding's	*Silene spaldingii*	Threatened	Terrestrial	No
Checker-mallow, Nelson's	*Sidalcea nelsoniana*	Threatened	Terrestrial	No
Daisy, Willamette	*Erigeron decumbens var. decumbens*	Endangered	Terrestrial	No

Four-o'clock, Macfarlane's	*Mirabilis macfarlanei*	Threatened	Terrestrial	No	
Lomatium, Bradshaw's	*Lomatium bradshawii*	Endangered	Terrestrial, Freshwater	No	
Lomatium, Cook's	*Lomatium cookii*	Endangered	Vernal pool	No	
Lupine, Kincaid's	*Lupinus sulphureus (=oreganus) ssp. kincaidii (=var. kincaldii)*	Threatened	Terrestrial	No	
Meadowfoam, Large-flowered Woolly	*Limnanthes floccosa ssp. Grandiflora*		Endangered	Vernal pool	No
Milk-vetch, Applegate's	*Astragalus applegatei*	Endangered	Terrestrial	No	
Popcornflower, Rough	*Plagiobothrys hirtus*	Endangered	Vernal pool	No	
Thelypody, Howell's Spectacular	*Thelypodium howellii spectabilis*	Threatened	Terrestrial	No	
Wire-lettuce, Malheur	*Stephanomeria malheurensis*	Endangered	Terrestrial	Yes	

Fish

Chub, Borax Lake	*Gila boraxobius*	Endangered	Freshwater	Yes	
Chub, Hutton Tui	*Gila bicolor ssp.*	Threatened	Freshwater	No	
Chub, Oregon	*Oregonichthys crameri*	Endangered	Freshwater	No	
Dace, Foskett Speckled	*Rhinichthys osculus ssp.*	Threatened	Freshwater	No	
Salmon, Chinook (Lower Columbia River)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Saltwater	Freshwater, Brackish,	Yes
Salmon, Chinook (Snake River Fall Run)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Brackish	Freshwater, Saltwater,	No
Salmon, Chinook (Snake River spring/summer)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Freshwater	Brackish, Saltwater,	Yes
Salmon, Chinook (Upper Columbia River Spring)	*Oncorhynchus (=Salmo) tshawytscha*		Endangered Brackish	Freshwater, Saltwater,	Yes
Salmon, Chinook (Upper Willamette River)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Freshwater	Saltwater, Brackish,	Yes
Salmon, Chum (Columbia River population)	*Oncorhynchus (=Salmo) keta*	Threatened	Brackish, Freshwater, Saltwater	Yes	
Salmon, Coho (Southern OR/Northern CA Coast)	*Oncorhynchus (=Salmo) kisutch*	Threatened	Freshwater, Brackish, Saltwater	Yes	
Salmon, Sockeye (Snake River population)	*Oncorhynchus (=Salmo) nerka*	Endangered	Brackish, Saltwater, Freshwater	No	
Steelhead, (Lower Columbia River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Brackish, Freshwater, Saltwater	Yes	
Steelhead, (Middle Columbia River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Freshwater, Saltwater, Brackish	Yes	
Steelhead, (Snake River Basin population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Freshwater, Brackish, Saltwater	Yes	
Steelhead, (Upper Columbia River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Brackish, Saltwater, Freshwater	Yes	
Steelhead, (Upper Willamette River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Brackish, Saltwater, Freshwater	Yes	
Sucker, Lost River	*Deltistes luxatus*	Endangered	Freshwater	No	

Sucker, Shortnose	*Chasmistes brevirostris*	Endangered	Freshwater	No		
Sucker, Warner	*Catostomus warnerensis*	Threatened	Freshwater	Yes		
Trout, Bull	*Salvelinus confluentus*	Threatened	Freshwater	No		
Trout, Bull (Columbia River	*Salvelinus confluentus*	Threatened	Freshwater	Yes		
Trout, Bull (Klamath River population)		*Salvelinus confluentus*		Threatened	Freshwater	Yes
Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	Threatened	Freshwater	No		
Insect						
Butterfly, Fender's Blue	*Icaricia icarioides fenderi*	Endangered	Terrestrial	No		
Butterfly, Oregon Silverspot	*Speyeria zerene hippolyta*	Threatened	Terrestrial	Yes		
Mammal						
Deer, Columbian White-tailed	*Odocoileus virginianus leucurus*	Endangered	Terrestrial	No		
Marine mml						

Sea-lion, Steller (eastern)	*Eumetopias jubatus*	Threatened	Saltwater	Yes
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Monocot				
Fritillary, Gentner's	*Fritillaria gentneri*	Endangered	Terrestrial	No
Lily, Western	*Lilium occidentale*	Endangered	Terrestrial	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Pennsylvania **(8) species:**				**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Bivalve				
Mussel, Clubshell	*Pleurobema clava*	Endangered	Freshwater	No
Riffleshell, Northern	*Epioblasma torulosa rangiana*	Endangered	Freshwater	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Squirrel, Delmarva Peninsula Fox	*Sciurus niger cinereus*	Endangered	Terrestrial	No
Monocot				
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	Endangered	Terrestrial, Freshwater	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Turtle, Bog (Northern population)	*Clemmys muhlenbergii*	Threatened	Terrestrial, Freshwater	No
Puerto Rico **(73) species:**				**CH**
Amphibian				
Coqui, Golden	*Eleutherodactylus jasperi*	Threatened	Freshwater, Terrestrial	Yes
Guajon	*Eleutherodactylus cooki*	Threatened	Freshwater, Terrestrial	No

Toad, Puerto Rican Crested	*Peltophryne lemur*	Threatened	Terrestrial, Freshwater	No
Bird				
Blackbird, Yellow-shouldered	*Agelaius xanthomus*	Endangered	Terrestrial	Yes
Hawk, Puerto Rican Broad-winged	*Buteo platypterus brunnescens*	Endangered	Terrestrial	No
Hawk, Puerto Rican Sharp-shinned	*Accipiter striatus venator*	Endangered	Terrestrial	No
Nightjar, Puerto Rico	*Caprimulgus noctitherus*	Endangered	Terrestrial	No
Parrot, Puerto Rican	*Amazona vittata*	Endangered	Terrestrial	No
Pelican, Brown	*Pelecanus occidentalis*	Endangered	Terrestrial	No
Pigeon, Puerto Rican Plain	*Columba inornata wetmorei*	Endangered	Terrestrial	No

Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Tern, Roseate	*Sterna dougallii dougallii*	Endangered	Terrestrial	No
Dicot				
Auerodendron pauciflorum (ncn)	*Auerodendron pauciflorum*	Endangered	Terrestrial	No
Bariaco	*Trichilla triacantha*	Endangered	Terrestrial	No
Boxwood, Vahl's	*Buxus vahlii*	Endangered	Terrestrial	No
Calyptranthes Thomasiana (ncn)	*Calyptranthes thomasiana*	Endangered	Terrestrial	No
Capa Rosa	*Callicarpa ampla*	Endangered	Terrestrial	No
Catesbaea Melanocarpa (ncn)	*Catesbaea melanocarpa*	Endangered	Terrestrial	No
Chamaecrista glandulosa (ncn)	*Chamaecrista glandulosa var. mirabilis*	Endangered	Terrestrial	No
Chumbo, Higo	*Harrisia portoricensis*	Threatened	Terrestrial	No
Chupacallos	*Pleodendron macranthum*	Endangered	Terrestrial	No
Cobana Negra	*Stahlia monosperma*	Threatened	Terrestrial	No
Cordia bellonis (ncn)	*Cordia bellonis*	Endangered	Terrestrial	No
Daphnopsis hellerana (ncn)	*Daphnopsis hellerana*	Endangered	Terrestrial	No
Erubia	*Solanum drymophilum*	Endangered	Terrestrial	No
Eugenia Woodburyana	*Eugenia woodburyana*	Endangered	Terrestrial	No
Gesneria pauciflora (ncn)	*Gesneria pauciflora*	Threatened	Terrestrial	No
Goetzea, Beautiful (Matabuey)	*Goetzea elegans*	Endangered	Terrestrial	No
Higuero De Sierra	*Crescentia portoricensis*	Endangered	Terrestrial	No
Holly, Cook's	*Ilex cookii*	Endangered	Terrestrial	No
Ilex sintenisii (ncn)	*Ilex sintenisii*	Endangered	Terrestrial	No
Leptocereus grantianus (ncn)	*Leptocereus grantianus*	Endangered	Terrestrial	No
Lyonia truncata var. proctorii (ncn)	*Lyonia truncata var. proctorii*	Endangered	Terrestrial	No
Mitracarpus Maxwelliae	*Mitracarpus maxwelliae*	Endangered	Terrestrial	No
Mitracarpus Polycladus	*Mitracarpus polycladus*	Endangered	Terrestrial	No
Myrcia Paganii	*Myrcia paganii*	Endangered	Terrestrial	No
Palo Colorado (Ternstroemia	*Ternstroemia luquillensis*	Endangered	Terrestrial	No

luquillensis)				
Palo de Jazmin	*Styrax portoricensis*	Endangered	Terrestrial	No
Palo de Nigua	*Cornutia obovata*	Endangered	Terrestrial	No
Palo de Ramon	*Banara vanderbiltii*	Endangered	Terrestrial	No
Palo de Rosa	*Ottoschulzia rhodoxylon*	Endangered	Terrestrial	No
Peperomia, Wheeler's	*Peperomia wheeleri*	Endangered	Terrestrial	No
Prickly-ash, St. Thomas	*Zanthoxylum thomasianum*	Endangered	Terrestrial	No
Schoepfia arenaria (ncn)	*Schoepfia arenaria*	Threatened	Terrestrial	No
Ternstroemia subsessilis (ncn)	*Ternstroemia subsessilis*	Endangered	Terrestrial	No

Uvillo	*Eugenia haematocarpa*	Endangered	Terrestrial	No
Vernonia Proctorii (ncn)	*Vernonia proctorii*	Endangered	Terrestrial	No
Walnut, Nogal	*Juglans jamaicensis*	Endangered	Terrestrial	No
Ferns				
Fern, Adiantum vivesii	*Adiantum vivesii*	Endangered	Terrestrial	No
Fern, Elaphoglossum serpens	*Elaphoglossum serpens*	Endangered	Terrestrial	No
Fern, Thelypteris inabonensis	*Thelypteris inabonensis*	Endangered	Terrestrial	No
Fern, Thelypteris verecunda	*Thelypteris verecunda*	Endangered	Terrestrial	No
Fern, Thelypteris yaucoensis	*Thelypteris yaucoensis*	Endangered	Terrestrial	No
Polystichum calderonense (ncn)	*Polystichum calderonense*	Endangered	Terrestrial	No
Tectaria Estremerana	*Tectaria estremerana*	Endangered	Terrestrial	No
Tree Fern, Elfin	*Cyathea dryopteroides*	Endangered	Terrestrial	No
Marine mml				
Manatee, West Indian	*Trichechus manatus*	Endangered	Saltwater	Yes
Seal, Caribbean Monk	*Monachus tropicalis*	Endangered	Coastal (neritic), Saltwater	No
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Monocot				
Aristida chaseae (ncn)	*Aristida chaseae*	Endangered	Terrestrial	No
Cranichis Ricartii	*Cranichis ricartii*	Endangered	Terrestrial	No
Lepanthes eltorensis (ncn)	*Lepanthes eltoroensis*	Endangered	Terrestrial	No
Manaca, palma de	*Calyptronoma rivalis*	Threatened	Terrestrial	No
Pelos del Diablo	*Aristida portoricensis*	Endangered	Terrestrial	No
Reptile				
Anole, Culebra Island Giant	*Anolis roosevelti*	Endangered	Terrestrial	Yes
Boa, Mona	*Epicrates monensis monensis*	Threatened	Terrestrial	Yes
Boa, Puerto Rican	*Epicrates inornatus*	Endangered	Terrestrial	No
Gecko, Monito	*Sphaerodactylus micropithecus*	Endangered	Terrestrial	Yes
Iguana, Mona Ground	*Cyclura stejnegeri*	Threatened	Terrestrial	Yes

Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Rhode Island	**(13) species:**			**CH**
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Dicot				

Gerardia, Sandplain	*Agalinis acuta*	Endangered	Terrestrial	No
Fish				
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
South Carolina	**(38) species:**			**CH**
Amphibian				
Salamander, Flatwoods	*Ambystoma cingulatum*	Threatened	Freshwater, Vernal pool, Terrestrial	No
Bird				
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Stork, Wood	*Mycteria americana*	Endangered	Terrestrial	No
Warbler, Bachman's	*Vermivora bachmanii*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				

Mussel, Heelsplitter Carolina	*Lasmigona decorata*	Endangered	Freshwater	Yes
Dicot				
Amaranth, Seabeach	*Amaranthus pumilus*	Threatened	Coastal (neritic)	No
Amphianthus, Little	*Amphianthus pusillus*	Threatened	Freshwater	No
Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Coneflower, Smooth	*Echinacea laevigata*	Endangered	Terrestrial	No
Dropwort, Canby's	*Oxypolis canbyi*	Endangered	Terrestrial, Freshwater	No
Gooseberry, Miccosukee	*Ribes echinellum*	Threatened	Terrestrial	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No

Heartleaf, Dwarf-flowered	*Hexastylis naniflora*	Threatened	Terrestrial	No
Loosestrife, Rough-leaved	*Lysimachia asperulaefolia*	Endangered	Terrestrial	No
Pitcher-plant, Mountain Sweet	*Sarracenia rubra ssp. jonesii*	Endangered	Freshwater, Terrestrial	No
Pondberry	*Lindera melissifolia*	Endangered	Terrestrial	No
Sunflower, Schweinitz's	*Helianthus schweinitzii*	Endangered	Terrestrial	No
Ferns				
Quillwort, Black-spored	*Isoetes melanospora*	Endangered	Vernal pool	No
Fish				
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Lichen				
Lichen, Rock Gnome	*Gymnoderma lineare*	Endangered	Terrestrial	No
Mammal				
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Marine mml				
Manatee, West Indian	*Trichechus manatus*	Endangered	Saltwater	Yes
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Arrowhead, Bunched	*Sagittaria fasciculata*	Endangered	Freshwater	No
Irisette, White	*Sisyrinchium dichotomum*	Endangered	Terrestrial	No
Pink, Swamp	*Helonias bullata*	Threatened	Terrestrial, Freshwater	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Trillium, Persistent	*Trillium persistens*	Endangered	Terrestrial	No
Trillium, Relict	*Trillium reliquum*	Endangered	Terrestrial	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes

Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Snake, Eastern Indigo	*Drymarchon corais couperi*	Threatened	Terrestrial	No
South Dakota	**(8) species:**			**CH**
Bird				
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes

Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Fish				
Shiner, Topeka	*Notropis topeka (=tristis)*	Endangered	Freshwater	Yes
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Insect				
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No
Mammal				
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No
Monocot				
Orchid, Western Prairie Fringed	*Platanthera praeclara*	Threatened	Terrestrial	No
Tennessee **(86) species:**				**CH**
Arachnid				
Spider, Spruce-fir Moss	*Microhexura montivaga*	Endangered	Terrestrial	Yes
Bird				
Stork, Wood	*Mycteria americana*	Endangered	Terrestrial	No
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No
Bivalve				
Combshell, Upland	*Epioblasma metastriata*	Endangered	Freshwater	Yes
Elktoe, Appalachian	*Alasmidonta raveneliana*	Endangered	Freshwater	Yes
Fanshell	*Cyprogenia stegaria*	Endangered	Freshwater	No
Kidneyshell, Triangular	*Ptychobranchus greenli*	Endangered	Freshwater	Yes
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Alabama Moccasinshell	*Medionidus acutissimus*	Threatened	Freshwater	Yes
Mussel, Clubshell	*Pleurobema clava*	Endangered	Freshwater	No
Mussel, Coosa Moccasinshell	*Medionidus parvulus*	Endangered	Freshwater	Yes
Mussel, Cumberland Combshell	*Epioblasma brevidens*	Endangered	Freshwater	Yes
Mussel, Cumberland Elktoe	*Alasmidonta atropurpurea*	Endangered	Freshwater	Yes
Mussel, Cumberland Pigtoe	*Pleurobema gibberum*	Endangered	Freshwater	No

Mussel, Fine-lined Pocketbook	*Lampsilis altilis*	Threatened	Freshwater	Yes
Mussel, Fine-rayed Pigtoe	*Fusconala cuneolus*	Endangered	Freshwater	No
Mussel, Ovate Clubshell	*Pleurobema perovatum*	Endangered	Freshwater	Yes
Mussel, Oyster	*Epioblasma capsaeformis*	Endangered	Freshwater	Yes
Mussel, Ring Pink (=Golf Stick	*Obovaria retusa*	Endangered	Freshwater	No
Mussel, Rough Pigtoe	*Pleurobema plenum*	Endangered	Freshwater	No
Mussel, Shiny Pigtoe	*Fusconaia cor*	Endangered	Freshwater	No
Mussel, Southern Pigtoe	*Pleurobema georgianum*	Endangered	Freshwater	Yes

Pearlymussel, Alabama Lamp	*Lampsilis virescens*	Endangered	Freshwater	No
Pearlymussel, Appalachian Monkeyface	*Quadrula sparsa*	Endangered	Freshwater	No
Pearlymussel, Birdwing	*Conradilla caelata*	Endangered	Freshwater	No
Pearlymussel, Cracking	*Hemistena lata*	Endangered	Freshwater	No
Pearlymussel, Cumberland Bean	*Villosa trabalis*	Endangered	Freshwater	No
Pearlymussel, Cumberland Monkeyface	*Quadrula intermedia*	Endangered	Freshwater	No
Pearlymussel, Dromedary	*Dromus dromas*	Endangered	Freshwater	No
Pearlymussel, Green-blossom	*Epioblasma torulosa gubernaculum*	Endangered	Freshwater	No
Pearlymussel, Little-wing	*Pegias fabula*	Endangered	Freshwater	No
Pearlymussel, Orange-footed	*Plethobasus cooperianus*	Endangered	Freshwater	No
Pearlymussel, Pale Lilliput	*Toxolasma cylindrellus*	Endangered	Freshwater	No
Pearlymussel, Purple Cat's Paw	*Epioblasma obliquata obliquata*	Endangered	Freshwater	No
Pearlymussel, Tubercled-blossom	*Epioblasma torulosa torulosa*	Endangered	Freshwater	No
Pearlymussel, Turgid-blossom	*Epioblasma turgidula*	Endangered	Freshwater	No
Pearlymussel, White Wartyback	*Plethobasus cicatricosus*	Endangered	Freshwater	No
Pearlymussel, Yellow-blossom	*Epioblasma florentina florentina*	Endangered	Freshwater	No
Purple Bean	*Villosa perpurpurea*	Endangered	Freshwater	Yes
Rabbitsfoot, Rough	*Quadrula cylindrica strigillata*	Endangered	Freshwater	Yes
Riffleshell, Tan	*Epioblasma florentina walkeri (=E. walkeri)*	Endangered	Freshwater	No
Crustacean				
Crayfish, Nashville	*Orconectes shoupi*	Endangered	Freshwater	No
Dicot				
Aster, Ruth's Golden	*Pityopsis ruthii*	Endangered	Terrestrial	No
Avens, Spreading	*Geum radiatum*	Endangered	Terrestrial	No
Bladderpod, Spring Creek	*Lesquerella perforata*	Endangered	Floodplain	No
Bluet, Roan Mountain	*Hedyotis purpurea var. montana*	Endangered	Terrestrial	No

Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Clover, Leafy Prairie	*Dalea foliosa*	Endangered	Terrestrial	No
Coneflower, Tennessee Purple	*Echinacea tennesseensis*	Endangered	Terrestrial	No
Goldenrod, Blue Ridge	*Solidago spithamaea*	Threatened	Terrestrial	No
Ground-plum, Guthrie's	*Astragalus bibullatus*	Endangered	Terrestrial	No
Pitcher-plant, Green	*Sarracenia oreophila*	Endangered	Terrestrial, Freshwater	No
Potato-bean, Price's	*Apios priceana*	Threatened	Terrestrial	No
Rock-cress, Large (=Braun's)	*Arabis perstellata E. L. Braun var. ampla Rollins*	Endangered	Terrestrial	Yes
Rock-cress, Small	*Arabis perstellata E. L. Braun var. perstellata Fernald*	Endangered	Terrestrial	Yes

Rosemary, Cumberland	*Conradina verticillata*	Threatened	Terrestrial	No
Sandwort, Cumberland	*Arenaria cumberlandensis*	Endangered	Terrestrial	No
Skullcap, Large-flowered	*Scutellaria montana*	Threatened	Terrestrial	No
Spiraea, Virginia	*Spiraea virginiana*	Threatened	Terrestrial	No
Ferns				
Fern, American hart's-tongue	*Asplenium scolopendrium var. americanum*	Threatened	Terrestrial	No
Fish				
Chub, Slender	*Erimystax cahni*	Threatened	Freshwater	Yes
Chub, Spotfin	*Erimonax monachus*	Threatened	Freshwater	Yes
Dace, Blackside	*Phoxinus cumberlandensis*	Threatened	Freshwater	No
Darter, Amber	*Percina antesella*	Endangered	Freshwater	Yes
Darter, Bluemask (=jewel)	*Etheostoma /*	Endangered	Freshwater	No
Darter, Boulder	*Etheostoma wapiti*	Endangered	Freshwater	No
Darter, Duskytail	*Etheostoma percnurum*	Endangered	Freshwater	No
Darter, Slackwater	*Etheostoma boschungi*	Threatened	Freshwater	Yes
Darter, Snail	*Percina tanasi*	Threatened	Freshwater	No
Logperch, Conasauga	*Percina jenkinsi*	Endangered	Freshwater	Yes
Madtom, Pygmy	*Noturus stanauli*	Endangered	Freshwater	No
Madtom, Smoky	*Noturus baileyi*	Endangered	Freshwater	Yes
Madtom, Yellowfin	*Noturus flavipinnis*	Threatened	Freshwater	Yes
Shiner, Blue	*Cyprinella caerulea*	Threatened	Freshwater	No
Shiner, Palezone	*Notropis albizonatus*	Endangered	Freshwater	No
Sturgeon, Pallid	*Scaphirhynchus albus*	Endangered	Freshwater	No
Gastropod				
Marstonia, Royal (=Royal Snail)	*Pyrgulopsis ogmorhaphe*	Endangered	Terrestrial	No
Riversnail, Anthony's	*Athearnia anthonyi*	Endangered	Freshwater	No
Snail, Painted Snake Coiled Forest	*Anguispira picta*	Threatened	Terrestrial	No
Lichen				

Lichen, Rock Gnome	*Gymnoderma lineare*	Endangered	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Squirrel, Carolina Northern Flying	*Glaucomys sabrinus coloratus*	Endangered	Terrestrial	No
Monocot				
Grass, Tennessee Yellow-eyed	*Xyris tennesseensis*	Endangered	Terrestrial	No

Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No	
Texas	**(89) species:**			**CH**	
Amphibian					
Salamander, Barton Springs	*Eurycea sosorum*	Endangered	Freshwater, Terrestrial	No	
Salamander, San Marcos	*Eurycea nana*	Threatened	Freshwater, Terrestrial	Yes	
Salamander, Texas Blind	*Typhlomolge rathbuni*	Endangered	Subterraneous, Freshwater	No	
Toad, Houston	*Bufo houstonensis*	Endangered	Terrestrial, Freshwater	Yes	
Arachnid					
Harvestman, Bee Creek Cave	*Texella reddelli*	Endangered	Terrestrial, Subterraneous		No
Harvestman, Bone Cave	*Texella reyesi*	Endangered	Terrestrial, Subterraneous		No
Harvestman, Robber Baron Cave	*Texella cokendolpheri*	Endangered	Subterraneous, Terrestrial	Yes	
Meshweaver, Braken Bat Cave	*Cicurina venii*	Endangered	Terrestrial, Subterraneous		Yes
Pseudoscorpion, Tooth Cave	*Tartarocreagris texana*	Endangered	Terrestrial, Subterraneous		No
Spider, Government Canyon Cave	*Neoleptoneta microps*	Endangered	Subterraneous, Terrestrial	No	
Spider, Madla's Cave	*Cicurina madla*	Endangered	Subterraneous, Terrestrial	Yes	
Spider, Robber Baron Cave	*Cicurina baronia*	Endangered	Terrestrial, Subterraneous		Yes
Spider, Tooth Cave	*Neoleptoneta myopica*	Endangered	Terrestrial, Subterraneous		No
Spider, Vesper Cave	*Cicurina vespera*	Endangered	Subterraneous, Terrestrial	No	
Bird					
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes	
Curlew, Eskimo	*Numenius borealis*	Endangered	Terrestrial	No	
Falcon, Northern Aplomado	*Falco femoralis septentrionalis*	Endangered	Terrestrial	No	

Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	Endangered	Terrestrial	Yes
Owl, Mexican Spotted	*Strix occidentalis lucida*	Threatened	Terrestrial	Yes
Pelican, Brown	*Pelecanus occidentalis*	Endangered	Terrestrial	No
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Prairie-chicken, Attwater's Greater	*Tympanuchus cupido attwateri*	Endangered	Terrestrial	No
Tern, Interior (population) Least	*Sterna antillarum*	Endangered	Terrestrial	No
Vireo, Black-capped	*Vireo atricapilla*	Endangered	Terrestrial	No
Warbler (=Wood), Golden-cheeked	*Dendroica chrysoparia*	Endangered	Terrestrial	No
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No

Crustacean

Amphipod, Peck's Cave	*Stygobromus (=Stygonectes) pecki*	Endangered	Subterraneous, Freshwater	No	
Dicot					
Ambrosia, South Texas	*Ambrosia cheiranthifolia*	Endangered	Terrestrial	No	
Ayenia, Texas	*Ayenia limitaris*	Endangered	Terrestrial	No	
Bladderpod, White	*Lesquerella pallida*	Endangered	Terrestrial	No	
Bladderpod, Zapata	*Lesquerella thamnophila*	Endangered	Terrestrial	Yes	
Cactus, Black Lace	*Echinocereus reichenbachii var. albertii*	Endangered	Terrestrial	No	
Cactus, Bunched Cory	*Coryphantha ramillosa*	Threatened	Terrestrial	No	
Cactus, Chisos Mountain Hedgehog	*Echinocereus chisoensis var. chisoensis*	Threatened	Terrestrial	No	
Cactus, Lloyd's Mariposa	*Echinomastus mariposensis*	Threatened	Terrestrial	No	
Cactus, Nellie Cory	*Coryphantha minima*	Endangered	Terrestrial	No	
Cactus, Sneed Pincushion	*Coryphantha sneedii var. sneedii*	Endangered	Terrestrial	No	
Cactus, Star	*Astrophytum asterias*	Endangered	Terrestrial	No	
Cactus, Tobusch Fishhook	*Ancistrocactus tobuschii*	Endangered	Terrestrial	No	
Cat's-eye, Terlingua Creek	*Cryptantha crassipes*	Endangered	Terrestrial	No	
Dawn-flower, Texas Prairie (=Texas Bitterweed)	*Hymenoxys texana*	Endangered	Terrestrial	No	
Dogweed, Ashy	*Thymophylla tephroleuca*	Endangered	Terrestrial	No	
Frankenia, Johnston's	*Frankenia johnstonii*	Endangered	Terrestrial	No	
Fruit, Earth (=geocarpon)	*Geocarpon minimum*	Threatened	Terrestrial	No	
Manioc, Walker's	*Manihot walkerae*	Endangered	Terrestrial	No	
Oak, Hinckley	*Quercus hinckleyi*	Threatened	Terrestrial	No	
Phlox, Texas Trailing	*Phlox nivalis ssp. texensis*	Endangered	Terrestrial	No	
Pitaya, Davis' Green	*Echinocereus viridiflorus var. davisii*		Endangered	Terrestrial	No
Poppy-mallow, Texas	*Callirhoe scabriuscula*	Endangered	Terrestrial	No	
Rush-pea, Slender	*Hoffmannseggia tenella*	Endangered	Terrestrial	No	
Sand-verbena, Large-fruited	*Abronia macrocarpa*	Endangered	Terrestrial	No	

Snowbells, Texas	*Styrax texanus*	Endangered	Terrestrial	No
Sunflower, Pecos	*Helianthus paradoxus*	Threatened	Terrestrial, Freshwater	No
Wild-buckwheat, Gypsum	*Eriogonum gypsophilum*	Threatened	Terrestrial	Yes
Fish				
Darter, Fountain	*Etheostoma fonticola*	Endangered	Freshwater	Yes
Gambusia, Big Bend	*Gambusia gaigei*	Endangered	Freshwater	No
Gambusia, Clear Creek	*Gambusia heterochir*	Endangered	Freshwater	No
Gambusia, Pecos	*Gambusia nobilis*	Endangered	Freshwater	No
Gambusia, San Marcos	*Gambusia georgei*	Endangered	Freshwater	Yes

Minnow, Devils River	*Dionda diaboli*	Threatened	Freshwater	No	
Pupfish, Comanche Springs	*Cyprinodon elegans*	Endangered	Freshwater	No	
Pupfish, Leon Springs	*Cyprinodon bovinus*	Endangered	Freshwater	Yes	
Shiner, Arkansas River	*Notropis girardi*	Threatened	Freshwater	Yes	
Gastropod					
Snail, Pecos Assiminea	*Assiminea pecos*	Endangered	Freshwater	Yes	
Insect					
Beetle, American Burying	*Nicrophorus americanus*	Endangered	Terrestrial	No	
Beetle, Coffin Cave Mold	*Batrisodes texanus*	Endangered	Subterraneous	No	
Beetle, Comal Springs Dryopid	*Stygoparnus comalensis*	Endangered	Subterraneous, Freshwater	No	
Beetle, Comal Springs Riffle	*Heterelmis comalensis*	Endangered	Subterraneous, Freshwater	No	
Beetle, Helotes Mold	*Batrisodes venyivi*	Endangered	Subterraneous	Yes	
Beetle, Kretschmarr Cave Mold	*Texamaurops reddelli*	Endangered	Subterraneous	No	
Beetle, Tooth Cave Ground	*Rhadine persephone*	Endangered	Subterraneous	No	
Rhadine exilis (ncn)	*Rhadine exilis*	Endangered	Terrestrial, Subterraneous		Yes
Rhadine infernalis (ncn)	*Rhadine infernalis*	Endangered	Terrestrial, Subterraneous		Yes
Mammal					
Bat, Mexican Long-nosed	*Leptonycteris nivalis*	Endangered	Subterraneous, Terrestrial	No	
Bear, Louisiana Black	*Ursus americanus luteolus*	Threatened	Terrestrial	No	
Jaguarundi, Gulf Coast	*Herpailurus (=Felis) yagouaroundi cacomitli*	Endangered	Terrestrial	No	
Jaguarundi, Sinaloan	*Herpailurus (=Felis) yagouaroundi tolteca*	Endangered	Terrestrial	No	
Ocelot	*Leopardus (=Felis) pardalis*	Endangered	Terrestrial	No	
Marine mml					
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No	

Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Monocot				
Ladies'-tresses, Navasota	*Spiranthes parksii*	Endangered	Terrestrial	No
Pondweed, Little Aguja Creek	*Potamogeton clystocarpus*	Endangered	Freshwater	No
Wild-rice, Texas	*Zizania texana*	Endangered	Freshwater	Yes
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes

Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Snake, Concho Water	*Nerodia paucimaculata*	Threatened	Freshwater, Terrestrial	Yes
Utah	**(37) species:**			**CH**
Bird				
Flycatcher, Southwestern Willow	*Empidonax traillii extimus*	Endangered	Terrestrial	Yes
Owl, Mexican Spotted	*Strix occidentalis lucida*	Threatened	Terrestrial	Yes
Dicot				
Bear-poppy, Dwarf	*Arctomecon humilis*	Endangered	Terrestrial	No
Bladderpod, Kodachrome	*Lesquerella tumulosa*	Endangered	Terrestrial	No
Buttercup, Autumn	*Ranunculus aestivalis (=acriformis)*	Endangered	Terrestrial	No
Cactus, San Rafael	*Pediocactus despainii*	Endangered	Terrestrial	No
Cactus, Siler Pincushion	*Pediocactus (=Echinocactus,=Utahia) sileri*	Threatened	Terrestrial	No
Cactus, Uinta Basin Hookless	*Sclerocactus glaucus*	Threatened	Terrestrial	No
Cactus, Winkler	*Pediocactus winkleri*	Threatened	Terrestrial	No
Cactus, Wright Fishhook	*Sclerocactus wrightiae*	Endangered	Terrestrial	No
Cycladenia, Jones	*Cycladenia jonesii (=humilis)*	Threatened	Terrestrial	No
Daisy, Maguire	*Erigeron maguirei*	Threatened	Freshwater	No
Milk-vetch, Deseret	*Astragalus desereticus*	Threatened	Terrestrial	No
Milk-vetch, Heliotrope	*Astragalus montii*	Threatened	Terrestrial	Yes
Milk-vetch, Holmgren	*Astragalus holmgreniorum*	Endangered	Terrestrial	No
Milk-vetch, Shivwits	*Astragalus ampullarioides*	Endangered	Terrestrial	No
Milkweed, Welsh's	*Asclepias welshii*	Threatened	Terrestrial	Yes
Phacelia, Clay	*Phacelia argillacea*	Endangered	Terrestrial	No
Primrose, Maguire	*Primula maguirei*	Threatened	Terrestrial	No
Reed-mustard, Barneby	*Schoenocrambe barnebyi*	Endangered	Terrestrial	No
Reed-mustard, Clay	*Schoenocrambe argillacea*	Threatened	Terrestrial	No
Reed-mustard, Shrubby	*Schoenocrambe suffrutescens*	Endangered	Terrestrial	No
Ridge-cress (=Pepper-cress),	*Lepidium barnebyanum*	Endangered	Terrestrial	No

Townsendia, Last Chance	*Townsendia aprica*	Threatened	Terrestrial	No
Fish				
Chub, Bonytail	*Gila elegans*	Endangered	Freshwater	Yes
Chub, Humpback	*Gila cypha*	Endangered	Freshwater	Yes
Chub, Virgin River	*Gila seminuda (=robusta)*	Endangered	Freshwater	Yes
Squawfish, Colorado	*Ptychocheilus lucius*	Endangered	Freshwater	Yes
Sucker, June	*Chasmistes liorus*	Endangered	Freshwater	Yes
Sucker, Razorback	*Xyrauchen texanus*	Endangered	Freshwater	Yes

Trout, Lahontan Cutthroat	*Oncorhynchus clarki henshawi*	Threatened	Freshwater	No	
Woundfin	*Plagopterus argentissimus*	Endangered	Freshwater	Yes	
Mammal					
Ferret, Black-footed	*Mustela nigripes*	Endangered	Terrestrial	No	
Prairie Dog, Utah	*Cynomys parvidens*	Threatened	Terrestrial, Subterraneous		No
Monocot					
Ladies'-tresses, Ute	*Spiranthes diluvialis*	Threatened	Terrestrial	No	
Sedge, Navajo	*Carex specuicola*	Threatened	Terrestrial	Yes	
Reptile					
Tortoise, Desert	*Gopherus agassizii*	Threatened	Terrestrial	Yes	
Vermont	**(4) species:**			**CH**	
Bivalve					
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	Endangered	Freshwater	No	
Dicot					
Milk-vetch, Jesup's	*Astragalus robbinsii var. jesupi*	Endangered	Terrestrial	No	
Mammal					
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes	
Monocot					
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	Endangered	Terrestrial, Freshwater	No	
Virginia	**(67) species:**			**CH**	
Amphibian					
Salamander, Shenandoah	*Plethodon shenandoah*	Endangered	Freshwater, Terrestrial	No	
Bird					
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes	
Woodpecker, Red-cockaded	*Picoides borealis*	Endangered	Terrestrial	No	
Bivalve					
Fanshell	*Cyprogenia stegaria*	Endangered	Freshwater	No	

Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Cumberland Combshell	*Epioblasma brevidens*	Endangered	Freshwater	Yes
Mussel, Cumberland Elktoe	*Alasmidonta atropurpurea*	Endangered	Freshwater	Yes
Mussel, Dwarf Wedge	*Alasmidonta heterodon*	Endangered	Freshwater	No
Mussel, Fine-rayed Pigtoe	*Fusconaia cuneolus*	Endangered	Freshwater	No
Mussel, Oyster	*Epioblasma capsaeformis*	Endangered	Freshwater	Yes
Mussel, Rough Pigtoe	*Pleurobema plenum*	Endangered	Freshwater	No
Mussel, Shiny Pigtoe	*Fusconaia cor*	Endangered	Freshwater	No

Pearlymussel, Appalachian Monkeyface	*Quadrula sparsa*	Endangered	Freshwater	No
Pearlymussel, Birdwing	*Conradilla caelata*	Endangered	Freshwater	No
Pearlymussel, Cracking	*Hemistena lata*	Endangered	Freshwater	No
Pearlymussel, Cumberland Bean	*Villosa trabalis*	Endangered	Freshwater	No
Pearlymussel, Cumberland Monkeyface	*Quadrula intermedia*	Endangered	Freshwater	No
Pearlymussel, Dromedary	*Dromus dromas*	Endangered	Freshwater	No
Pearlymussel, Green-blossom	*Epioblasma torulosa gubernaculum*	Endangered	Freshwater	No
Pearlymussel, Little-wing	*Pegias fabula*	Endangered	Freshwater	No
Purple Bean	*Villosa perpurpurea*	Endangered	Freshwater	Yes
Rabbitsfoot, Rough	*Quadrula cylindrica strigillata*	Endangered	Freshwater	Yes
Riffleshell, Tan	*Epioblasma florentina walkeri (=E. walkeri)*	Endangered	Freshwater	No
Spinymussel, James River	*Pleurobema collina*	Endangered	Freshwater	No
Crustacean				
Isopod, Lee County Cave	*Lirceus usdagalun*	Endangered	Freshwater	No
Isopod, Madison Cave	*Antrolana lira*	Threatened	Freshwater	No
Dicot				
Amaranth, Seabeach	*Amaranthus pumilus*	Threatened	Coastal (neritic)	No
Birch, Virginia Round-leaf	*Betula uber*	Threatened	Floodplain	No
Bittercress, Small-anthered	*Cardamine micranthera*	Endangered	Terrestrial	No
Chaffseed, American	*Schwalbea americana*	Endangered	Terrestrial	No
Coneflower, Smooth	*Echinacea laevigata*	Endangered	Terrestrial	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No
Joint-vetch, Sensitive	*Aeschynomene virginica*	Threatened	Terrestrial, Brackish	No
Mallow, Peter's Mountain	*Illamna corei*	Endangered	Terrestrial	No
Rock-cress, Shale Barren	*Arabis serotina*	Endangered	Terrestrial	No
Sneezeweed, Virginia	*Helenium virginicum*	Threatened	Vernal pool	No

Spiraea, Virginia	*Spiraea virginiana*	Threatened	Terrestrial	No
Sumac, Michaux's	*Rhus michauxii*	Endangered	Terrestrial	No
Sunflower, Schweinitz's	*Helianthus schweinitzii*	Endangered	Terrestrial	No
Fish				
Chub, Slender	*Erimystax cahni*	Threatened	Freshwater	Yes
Chub, Spotfin	*Erimonax monachus*	Threatened	Freshwater	Yes
Dace, Blackside	*Phoxinus cumberlandensis*	Threatened	Freshwater	No
Darter, Duskytail	*Etheostoma percnurum*	Endangered	Freshwater	No
Logperch, Roanoke	*Percina rex*	Endangered	Freshwater	No

Madtom, Yellowfin	*Noturus flavipinnis*	Threatened	Freshwater	Yes
Sturgeon, Shortnose	*Acipenser brevirostrum*	Endangered	Saltwater, Freshwater	No
Gastropod				
Snail, Virginia Fringed Mountain	*Polygyriscus virginianus*	Endangered	Terrestrial	No
Insect				
Beetle, Northeastern Beach Tiger	*Cicindela dorsalis dorsalis*	Threatened	Terrestrial	No
Butterfly, Mitchell's Satyr	*Neonympha mitchellii mitchellii*	Endangered	Terrestrial	No
Butterfly, Saint Francis' Satyr	*Neonympha mitchellii franciscl*	Endangered	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	Endangered	Terrestrial, Subterraneous	Yes
Squirrel, Delmarva Peninsula Fox	*Sclurus niger cinereus*	Endangered	Terrestrial	No
Squirrel, Virginia Northern Flying	*Glaucomys sabrinus fuscus*	Endangered	Terrestrial	No
Marine mml				
Whale, Finback	*Balaenoptera physalus*	Endangered	Saltwater	No
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Whale, northern right	*Eubalaena glacialis (incl. australis)*	Endangered	Saltwater	Yes
Monocot				
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	Endangered	Terrestrial, Freshwater	No
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Pink, Swamp	*Helonias bullata*	Threatened	Terrestrial, Freshwater	No
Pogonia, Small Whorled	*Isotria medeoloides*	Threatened	Terrestrial	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, hawksbill	*Eretmochelys imbricata*	Endangered	Saltwater	Yes

Sea turtle, Kemp's ridley	*Lepidochelys kempii*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
Sea turtle, loggerhead	*Caretta caretta*	Threatened	Saltwater	No
Washington **Bird**	**(40) species:**			**CH**
Murrelet, Marbled	*Brachyramphus marmoratus marmoratus*	Threatened	Freshwater, Terrestrial, Saltwater	Yes
Owl, Northern Spotted	*Strix occidentalis caurina*	Threatened	Terrestrial	Yes
Pelican, Brown	*Pelecanus occidentalis*	Endangered	Terrestrial	No

Plover, Western Snowy	*Charadrius alexandrinus nivosus*	Threatened	Terrestrial	Yes	
Dicot					
Catchfly, Spalding's	*Silene spaldingii*	Threatened	Terrestrial	No	
Checker-mallow, Nelson's	*Sidalcea nelsoniana*	Threatened	Terrestrial	No	
Checker-mallow, Wenatchee Mountains	*Sidalcea oregana var. calva*	Endangered	Terrestrial	Yes	
Howellia, Water	*Howellia aquatilis*	Threatened	Freshwater	No	
Lupine, Kincaid's	*Lupinus sulphureus (=oreganus) ssp. kincaidii (=var. kincaidii)*	Threatened	Terrestrial	No	
Paintbrush, Golden	*Castilleja levisecta*	Threatened	Terrestrial	No	
Stickseed, Showy	*Hackelia venusta*	Endangered	Terrestrial	No	
Fish					
Salmon, Chinook (Lower Columbia River)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Saltwater	Freshwater, Brackish,	Yes
Salmon, Chinook (Puget Sound)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Saltwater	Freshwater, Brackish,	Yes
Salmon, Chinook (Snake River Fall Run)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Brackish	Freshwater, Saltwater,	No
Salmon, Chinook (Snake River spring/summer)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Freshwater	Brackish, Saltwater,	Yes
Salmon, Chinook (Upper Columbia River Spring)	*Oncorhynchus (=Salmo) tshawytscha*		Endangered Brackish	Freshwater, Saltwater,	Yes
Salmon, Chinook (Upper Willamette River)	*Oncorhynchus (=Salmo) tshawytscha*		Threatened Freshwater	Saltwater, Brackish,	Yes
Salmon, Chum (Columbia River population)	*Oncorhynchus (=Salmo) keta*	Threatened	Brackish, Freshwater, Saltwater	Yes	
Salmon, Chum (Hood Canal Summer population)	*Oncorhynchus (=Salmo) keta*	Threatened	Freshwater, Brackish, Saltwater	Yes	
Salmon, Sockeye (Ozette Lake population)	*Oncorhynchus (=Salmo) nerka*	Threatened	Saltwater, Freshwater, Brackish	Yes	
Salmon, Sockeye (Snake River population)	*Oncorhynchus (=Salmo) nerka*	Endangered	Brackish, Saltwater, Freshwater	No	

Steelhead, (Lower Columbia River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Brackish, Freshwater, Saltwater	Yes		
Steelhead, (Middle Columbia River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Freshwater, Saltwater, Brackish	Yes		
Steelhead, (Snake River Basin population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Freshwater, Brackish, Saltwater	Yes		
Steelhead, (Upper Columbia River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Brackish, Saltwater, Freshwater	Yes		
Steelhead, (Upper Willamette River population)	*Oncorhynchus (=Salmo) mykiss*	Threatened	Brackish, Saltwater, Freshwater	Yes		
Steelhead, Puget Sound	*Oncorhynchus mykiss*	Threatened		No		
Trout, Bull	*Salvelinus confluentus*	Threatened	Freshwater	No		
Trout, Bull (Columbia River	*Salvelinus confluentus*	Threatened	Freshwater	Yes		
Trout, Bull (Klamath River population)		*Salvelinus confluentus*		Threatened	Freshwater	Yes

Insect				
Butterfly, Oregon Silverspot	*Speyeria zerene hippolyta*	Threatened	Terrestrial	Yes
Mammal				
Bear, Grizzly	*Ursus arctos horribilis*	Threatened	Terrestrial	No
Caribou, Woodland	*Rangifer tarandus caribou*	Endangered	Terrestrial	No
Deer, Columbian White-tailed	*Odocoileus virginianus leucurus*	Endangered	Terrestrial	No
Rabbit, Pygmy	*Brachylagus idahoensis*	Endangered	Terrestrial	No
Wolf, Gray	*Canis lupus*	Endangered	Terrestrial	Yes
Marine mml				
Sea-lion, Steller (eastern)	*Eumetopias jubatus*	Threatened	Saltwater	Yes
Whale, Humpback	*Megaptera novaeangliae*	Endangered	Saltwater	No
Reptile				
Sea turtle, green	*Chelonia mydas*	Endangered	Saltwater	No
Sea turtle, leatherback	*Dermochelys coriacea*	Endangered	Saltwater	Yes
West Virginia	**(17) species:**			**CH**
Amphibian				
Salamander, Cheat Mountain	*Plethodon nettingi*	Threatened	Freshwater, Terrestrial	No
Bivalve				
Fanshell	*Cyprogenia stegaria*	Endangered	Freshwater	No
Mucket, Pink (Pearlymussel)	*Lampsilis abrupta*	Endangered	Freshwater	No
Mussel, Clubshell	*Pleurobema clava*	Endangered	Freshwater	No
Pearlymussel, Tubercled-blossom	*Epioblasma torulosa torulosa*	Endangered	Freshwater	No
Spinymussel, James River	*Pleurobema collina*	Endangered	Freshwater	No
Dicot				
Clover, Running Buffalo	*Trifolium stoloniferum*	Endangered	Terrestrial	No
Harperella	*Ptilimnium nodosum*	Endangered	Freshwater	No
Rock-cress, Shale Barren	*Arabis serotina*	Endangered	Terrestrial	No
Spiraea, Virginia	*Spiraea virginiana*	Threatened	Terrestrial	No
Gastropod				

Snail, Flat-spired Three-toothed	*Triodopsis platysayoides*	Threatened	Terrestrial	No
Mammal				
Bat, Gray	*Myotis grisescens*	Endangered	Subterraneous, Terrestrial	No
Bat, Indiana	*Myotis sodalis*	Endangered	Subterraneous, Terrestrial	Yes
Bat, Virginia Big-eared	*Corynorhinus (=Plecotus) townsendii virginianus*	Endangered	Terrestrial, Subterraneous	Yes
Squirrel, Carolina Northern Flying	*Glaucomys sabrinus coloratus*	Endangered	Terrestrial	No

Squirrel, Virginia Northern Flying	*Glaucomys sabrinus fuscus*	Endangered	Terrestrial	No
Monocot				
Bulrush, Northeastern (=Barbed Bristle)	*Scirpus ancistrochaetus*	Endangered	Terrestrial, Freshwater	No
Wisconsin **(15) species:**				**CH**
Bird				
Crane, Whooping	*Grus americana*	Endangered	Terrestrial, Freshwater	Yes
Plover, Piping	*Charadrius melodus*	Endangered	Terrestrial	Yes
Warbler (=Wood), Kirtland's	*Dendroica kirtlandii*	Endangered	Terrestrial	No
Bivalve				
Mussel, Winged Mapleleaf	*Quadrula fragosa*	Endangered	Freshwater	No
Pearlymussel, Higgins' Eye	*Lampsilis higginsii*	Endangered	Freshwater	No
Dicot				
Clover, Prairie Bush	*Lespedeza leptostachya*	Threatened	Terrestrial	No
Locoweed, Fassett's	*Oxytropis campestris var. chartacea*	Threatened	Terrestrial	No
Monkshood, Northern Wild	*Aconitum noveboracense*	Threatened	Terrestrial	No
Thistle, Pitcher's	*Cirsium pitcheri*	Threatened	Terrestrial	No
Insect				
Butterfly, Karner Blue	*Lycaeides melissa samuelis*	Endangered	Terrestrial	No
Dragonfly, Hine's Emerald	*Somatochlora hineana*	Endangered	Freshwater, Terrestrial	Yes
Mammal				
Lynx, Canada	*Lynx canadensis*	Threatened	Terrestrial	No
Wolf, Gray	*Canis lupus*	Endangered	Terrestrial	Yes
Monocot				
Iris, Dwarf Lake	*Iris lacustris*	Threatened	Terrestrial	No
Orchid, Eastern Prairie Fringed	*Platanthera leucophaea*	Threatened	Terrestrial	No
Wyoming **(9) species:**				**CH**
Amphibian				
Toad, Wyoming	*Bufo baxteri (=hemiophrys)*	Endangered	Freshwater, Terrestrial	No

Dicot

Butterfly Plant, Colorado	*Gaura neomexicana var. coloradensis*		Threatened	Terrestrial	Yes
Yellowhead, Desert	*Yermo xanthocephalus*	Threatened	Terrestrial	Yes	

Fish

Dace, Kendall Warm Springs	*Rhinichthys osculus thermalis*	Endangered	Freshwater	No
Dace, Moapa	*Moapa coriacea*	Endangered	Freshwater	No

Mammal

Bear, Grizzly	*Ursus arctos horribilis*	Threatened	Terrestrial	No

Ferret, Black-footed	***Mustela nigripes***	**Endangered**	**Terrestrial**	**No**
Mouse, Preble's Meadow Jumping	***Zapus hudsonius preblei***	**Threatened**	**Terrestrial**	**Yes**
Wolf, Gray	***Canis lupus***	**Endangered**	**Terrestrial**	**Yes**

No species were selected for exclusion.

Dispersed species included in report.