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RE: Comments on USDA APHIS's Idaho Grasshopper and Mormon Cricket Suppression Program Proposed Action 2004

Thank you for allowing us to comment to provide scoping comments on this important issue.

These comments were prepared by Scott Hoffman Black, Matthew Shepherd, and Mace Vaughan and are submitted on behalf of the Xerces Society. The Xerces Society is an international nonprofit organization dedicated to protecting biological diversity through the conservation of invertebrates. We have over 5,000 members throughout the United States, including 73 members in Idaho. Scott Hoffman Black, Executive Director, has degrees in plant science, entomology, and ecology and has worked, monitoring aquatic macroinvertebrates, researching biological control agents and conserving with endangered invertebrates for over 20 years. Matthew Shepherd, Pollinator Program Director, has an M.Sc. in Land Resource Management and extensive experience in habitat management and native bee conservation. Mace Vaughan, Staff Entomologist, has an M.S. in Entomology and has extensive research experience in insect population biology and honey bee behavior.

### **Summary**

The USDA APHIS's Idaho Grasshopper and Mormon Cricket Suppression Program Proposed Action 2004 could authorize aerial spraying of the insecticides (Dimilin, carbaryl, and malathion) in spring/summer 2004 over potentially large swaths of eastern, southern, and central Idaho, ostensibly for purposes of controlling grasshopper and Mormon cricket infestations. In the past APHIS has proposed buffer strategies for protecting resources such as rivers and streams, endangered species, and honey bee hives that are inadequate to protect critical natural resources within the project area.

Although we are not opposed to all pesticide use, the Xerces Society opposes the use of aerial spraying for the control of native insects on grasslands across Idaho. We believe that to protect vital resources, APHIS should

- 1) only use insecticide bait or granular formulation

- 2) use insecticides only after it is judged that an outbreak of Mormon crickets will adversely impact private property through the loss of a crop resource;
- 3) complete more frequent and intense monitoring to identify populations that can be controlled when they are small with ground based pesticide application equipment;
- 4) 4) use large buffers around all water sources, including intermittent and ephemeral streams, wetlands and streams and rivers, as well as threatened and endangered species habitat, honey bee hives, and any human inhabited area;
- 5) ensure that notification of all individuals near a sprayed area is completed before any spraying occurs; and
- 6) monitor sites before and after spraying to determine if there is an impact on water quality or non-target species.

The comments that follow address the impact of pesticides on non-target invertebrates and spray drift as these are our areas of expertise.

### **Buffer widths for aerial pesticide applications.**

In 2003 APHIS proposed buffers for aerial spray treatments to protect certain resources. The proposed buffer widths were as follows: 1) 500 feet for canals and ditches; 2) ¼ mile for rivers, tributaries, streams, reservoirs, and wetlands; 3) ½ mile for the Bruneau hot springs snails; and 4) one mile for managed pollinators. These buffers are not adequate to ensure there are not adverse ecosystem impacts from pesticides drift.

Drift is the movement of spray droplets or pesticide vapor out of the intended spray area. Whenever pesticides are applied by ground application or by air, the potential exists for off-target movement or drift. This can create risk for nearby people and wildlife, damage non-target crops, and pollute surface and ground water resources.

Several factors affect how much and where a pesticide will drift. The most important factors are droplet size and weather. Droplet size is important because smaller droplets remain suspended in the air much longer and can thus drift over longer distances than larger droplets. Wind speed and direction, relative humidity, air temperature, and atmospheric stability are weather factors that have an impact on spray drift. During windy conditions significant amounts of pesticide can drift outside the spray area. What many people do not realize is that small amounts of pesticide can also drift great distances under stable weather conditions. This long range drift is often related to the occurrence of a temperature inversion, an atmospheric phenomenon generally associated with stable weather conditions when wind is calm and skies are clear. In these conditions, the air near the surface is cooler than the air above it, resulting in small spray droplets being suspended for longer periods and consequently able move laterally very long distances in very light wind.

There are numerous studies that have assessed the movement of pesticide out of the intended spray area. These studies show how much drift can move out of an area and begin to address the potential impact from drifting pesticides. The *Grasshopper Integrated Pest Management User Handbook* (APHIS Technical Bulletin No. 1809) notes:

“Results of monitoring showed that when the standard 500 ft (153m) no spray buffer was employed, trace amounts of pesticide was **always** detected in aquatic habitats.” (Chapter III.6-2.

Grasshopper Treatment Effects on Aquatic Communities, by D. W. Beyers and L. C. McEwen)  
(Emphasis added)

This same study also showed that the drift from the pesticide application had a noticeable impact on aquatic macroinvertebrates. In the drought year 1991 when discharge and the dilution potential of the river were low, the pesticide in the drift deposition caused an increase in invertebrate downstream movement during the first three hours of applications.

Another study cited in the USDA handbook *Grasshoppers; Their Biology, Identification and Management*, estimated that small droplets could travel 1,372 meters (4,502 feet) with only a 3 meter fall and 5 km/h wind. This and most of the other studies cited in these comments assessed drift over very flat agricultural fields. We can assume that under the conditions on rangeland in Idaho planes cannot fly consistently at a height of 3 meters above the ground, which will compound the problem of controlling drift.

A Penn State University study found drift at great distances. In an assessment of drift of malathion resulting from use to control boll weevil, malathion concentrations were found up to one kilometer (5/8 mile)—the greatest distance measured—from the point of application. According to the study the highest amount of drift at one kilometer occurred when atmospheric conditions were stable, meaning vertical air mass movements were dampened.

There are many more studies that show pesticides can drift much farther. Two field studies summarized in the 1997 EPA registration Eligibility Decision for Diflubenzon (one of the chemicals that could be used in the spray area) found that it drifted at least 1,200 feet. In Butte County, California, MCPA, dimethyl amine spray drifted 400 meters (1,300 feet) and in Tulare County, California, carbaryl drifted 550 meters (1,787 feet). A study of carbaryl applications in orchards in Vermont found that aeriually applied carbaryl repeatedly drifted to the most distant sampling point (about 500 yards) under all wind and atmospheric stability conditions tested.

Drift studies show consistently that pesticide drift can be found one kilometer (5/8 mile) from the edge of the spray site and sometimes much farther. In Arkansas, drift of the herbicide propanil was concentrated enough at one kilometer to be injurious to crop plants. This study analyzed six different field studies of insecticide drift using a curve fitting method to estimate the “worst case” and “best case” estimates of deposition over distances up to ten kilometers (6.21 miles). Even the best case scenario plotted drift over two kilometer (1.25 miles) and the worse case scenario found that 4.5% of the applied dose of pesticide would drift one kilometer (5/8 mile), 1.7% to two kilometers (1 1/4 miles), 0.38% to five kilometers (3.1 miles), and 0.1% to ten kilometers (6.21 miles). In one of the studies analyzed, carbaryl was found at over 1% of the applied dose over seven kilometers (4.3 miles) from the spray edge.

Cold air drainage carried forestry applications of the insecticides orthene and trichlorfon over 1.25 miles in Washington’s Cascade Mountains. Moderate winds (5-7 miles per hour) carried carbaryl over two miles from a Vermont apple orchard. In a Maine spruce budworm spray program, aeriually applied carbaryl appears to have drifted 7 miles from the target area. Using a fluorescent tracer, drift was measured 4 miles from an insecticide application on a California oat field. From Colorado wheat fields during hot weather, 2,4-D and dicamba drifted between five

and ten miles. In central Washington, winds and hilly terrain combine to cause 2,4-D drift for ten to fifty miles and paraquat drift for up to twenty miles.

It is clear from the research summarized above and from numerous studies not mentioned that pesticide will drift great distances and cannot be adequately controlled under many weather conditions. Granular pesticides do not drift as far and are therefore preferable to sprays. That said buffers for granular pesticides should be large as well to ensure that pesticide does not wash into water bodies.

### **Impacts of pesticide drift to aquatic ecosystems.**

The three pesticides commonly used for Mormon cricket and grasshopper control (Dimilin, carbaryl, and malathion) can be extremely harmful to aquatic organisms.

Dimilin is the trade name for the pesticide diflubenzuron. Dimilin acts as an insect growth inhibitor by arresting chitin synthesis, i.e., the formation of an insect's exoskeleton. Dimilin can cause adverse acute and chronic effect (is very highly toxic) to freshwater invertebrates, including crustaceans, mollusks, and insects.

Carbaryl is a carbamate insecticide. It inhibits the action of the enzyme acetyl cholinesterase (AChE) that is an essential component of insect, bird, fish, and mammal nervous systems. Carbaryl has "very high" toxicity levels for terrestrial invertebrates, aquatic invertebrates, and fish.

Malathion is an organophosphate insecticide. It is one of a class of pesticides that are chemically related to nerve gases used in World War II. Like carbaryl, malathion attacks the nervous system by inhibiting AChE. Malathion can also inhibit liver enzymes that effect biological membrane function. Malathion is highly toxic to snails, worms, microcrustaceans, and aquatic insects. One study concluded that the use of malathion near any natural body of water should be avoided due to its toxicity to microcrustaceans.

These chemicals have a long recorded half-life and can stay in water from days to weeks. Half-lives in water range from 1.5 days to 21 weeks. In one river, 30 percent of the initial malathion was present after 30 days.

Beyond its direct toxicity, malathion breaks down into highly toxic components, including isomalathion (95 times as toxic as malathion) and malaaxon (68 times as toxic as malathion). Recent studies suggest that following aerial application of malathion, malaaxon was detectable in air and on various test surfaces for days after the treatment; in fact, the levels of malaaxon increased on some surfaces for the length of the study (nine days).

Spray drift into aquatic ecosystems may have a severe adverse impact on individual organisms and the entire ecosystem. Direct contact with aquatic macroinvertebrates may cause immediate mortality and sub-lethal doses may cause the loss of ability to gather food or to bear young successfully. Aquatic macroinvertebrates are highly important components of aquatic ecosystems. Most fish species use aquatic macroinvertebrates as their primary food source. Without a healthy aquatic macroinvertebrate community you will not have the species (fish,

amphibians) that use them as food. Aquatic macroinvertebrates are sensitive to environmental change and because of this are used as indicators of aquatic ecosystem health.

Pesticide spray drift may have an especially severe impact on wetlands where there is not adequate flow to dilute the chemicals quickly. Wetland invertebrates serve as a major food source of migratory birds as well as resident animals such as amphibians.

The small amounts of insecticide that reach aquatic ecosystems can have an adverse impact on aquatic invertebrates and other aquatic animals. To protect aquatic life the recommended maximum concentration (RMC) for malathion in water is 0.1 parts per billion (PPB) and for carbaryl it is only 0.017 PPB. Studies have shown that trace amounts of pesticide can change behavior and cause macroinvertebrates to move away from the area downstream. Non-lethal dose of insecticides can affect fitness, the ability of the invertebrates to bear young successfully. Research has also shown that trace amounts of malathion cause immune system problems in frogs. Animals that have weak immune systems are more susceptible to exposures to viruses and parasites.

Small amounts of malathion and carbaryl are routinely found in streams across the US and Canada. The U.S. Geological Survey conducted surveys at 59 sites across the nation between 1992 and 1997. In surface water samples malathion was one of three organophosphate insecticides detected in the greatest percentage of samples and at the highest concentrations. A study in the Puget Sound area found that five pesticides including, carbaryl and malathion, exceeded concentration limits for the protection of aquatic life. The aquatic-life criteria indicate concentrations that can adversely affect aquatic organisms. Because of these findings both King County and Pierce County in Washington labeled malathion and carbaryl “Tier 1” pesticides. These pesticides are “considered highest concern and priority for phase-out” and are “the most hazardous products still in use or storage at either the City of Seattle shops or within King and Pierce county operations” because of potential impacts to aquatic life and salmon.”

Toxicity to aquatic life is shown to be greater than additive when pesticides are mixed together in a water body. Studies have shown that the mixture of malathion and carbaryl is much more toxic than either one on their own. As noted above, pesticides are routinely found in streams throughout the U.S. Many streams and rivers in the west already have small concentrations of herbicides and insecticides and there is evidence that the risk to aquatic life will be further increased by adding small amounts of malathion and carbaryl to these areas.

In short, aquatic invertebrates are vitally important for food webs and the Idaho Grasshopper and Mormon Cricket Suppression Program Proposed Action places these organisms at risk from pesticide poisoning. If pesticides are to be sprayed from the air, the buffers for all aquatic features should be a minimum of one mile.

**APHIS must provide for the protection of the Bruneau hot springsnail (*Pyrgulopsis bruneauensis*)**

In 1997 the U.S. Fish and Wildlife Service listed the Bruneau hot springsnail (*Pyrgulopsis bruneauensis*) as endangered pursuant to the Endangered Species Act. This species occurs only in a complex of related thermal springs and their immediate outflows along a five-mile stretch

the Bruneau River in Owyhee County, Idaho. They are generally found in thin sheets of water flowing over exposed surfaces of rock, gravel, sand, mud, and algal film. The primary threat to this species is loss of habitat due to the reduction of thermal springs from agriculture-related ground water withdrawal and pumping.

The Bruneau hot springsnail is extremely susceptible to pesticide drift from this project. Dimilin, carbaryl, and malathion are all very toxic to snails. The Bruneau hot springsnails habit of residing in thin sheets of water around the edges of their hot spring habitat make them even more susceptible because the springsnails could be killed by absorbing into their bodies even small amounts of pesticide drift added to this film.

As documented above drift can travel considerable distances. With 1) pesticide residues routinely traveling one kilometer (5/8 mile) and more; 2) the highly toxic nature of these chemicals to mollusks, including snails; 3) the springsnails' habit of residing in thin sheets of water which are extremely susceptible to accumulation of drifting pesticides; and 4) the springsnails' small and potentially declining population, a two mile buffer is warranted. Because this species is listed under the ESA it is vitally important that every precaution is taken to protect it from pesticide drift.

#### **APHIS must provide adequate buffers to protect honey bee hives**

Efforts to protect colonies of honey bees from pesticides need to address not only drift that may occur over apiaries, but also drift through, or direct application on, the area in which these colonies forage for nectar and pollen. It is well established that the majority of poisonings occur due to contact between the bee and contaminated foliage while the bees are out foraging and not while they are in the nest. Malathion residues on plants will remain toxic to honey bees for up to 5.5 days.

Many studies have documented the wide area over which honey bees roam when foraging. For example, one study conducted in a natural area in upstate New York demonstrated that the average distance traveled by a colony's foragers was 1.32 miles and that 95 percent of foraging trips occurred within a 3.6 mile radius. Furthermore, this same study demonstrated that scouts regularly tracked floral resources 2.4 to 3.6 miles from the hive. Studies in agricultural landscapes have produced somewhat different results. If copious nectar sources are available close to a hive, the bees may forage an average of only a few hundred meters from a hive. However, in more nectar-poor agricultural landscapes, honey bees may travel 2.2 miles in search of nectar. If foraging conditions are particularly bad, bees have been induced to forage from feeding stations set up 6 miles from a hive.

Efforts to protect colonies of honey bees from pesticide applications should take these distances into account. If sufficient nectar sources are not available close to an apiary, then foragers will range over a large area (easily up to 3.6 miles, and likely further). Therefore, a one-mile buffer zone around known apiaries is insufficient to prevent significant poisoning of foragers visiting flowers in the field. A two-mile buffer is necessary to take into account both the drift, which can travel substantial distances, and the area in which these colonies forage for nectar and pollen.

In addition to honey bees, other bees are also used as agricultural pollinators, particularly the alkali bee and alfalfa leafcutting bee as pollinators of alfalfa. These bees are both smaller than the honey bee and because of their higher surface to volume ratio are more susceptible to poisonings. This greater susceptibility means these bees are affected by lower concentrations of insecticides and that toxic residue times are longer. Malathion remains toxic to alfalfa leafcutting bees for seven days, compared to 5.5 for honey bees.

Although Dimilin has low toxicity for honey bees, carbaryl, and malathion are highly toxic to them. In one study, exposure to malathion caused significant mortality of adult bees and reduced pollination and honey production of the survivors. In another study, honeybee colonies fed low concentrations of malathion became unusually susceptible to the wax moth.

### **APHIS should provide for protection of native bees and other important invertebrates**

Invertebrates eclipse all other forms of life on Earth, not only in sheer numbers, diversity, and biomass, but also in their importance to functioning ecosystems. The sheer number and mass of invertebrates reflect their enormous ecological impact. Admittedly, some have a negative impact on humans, either by harming us directly (as disease agents) or attacking food crops, tree plantations, and livestock. Even so, all adverse effects combined are insignificant compared to invertebrates' beneficial actions. Invertebrates are a part of nearly every food chain, either directly as food for other insects, fishes, amphibians, reptiles, birds, mammals, and other arthropods, or indirectly as agents in the endless recycling of nutrients in the soil. Insects, worms, and mites are extremely important in helping microbes break down dung and dead plant and animal matter. Invertebrates are thought to decompose 99 percent of human and animal waste. The perpetuation of food webs is often dependent on critical species performing essential services such as pollination or seed dispersal. There are dozens more examples of how invertebrates benefit ecosystems and humans as natural biological control, and as potential cures for human disease.

The pesticides that will be used to control Mormon crickets and grasshoppers are also lethal to most beneficial insects and other invertebrates. In areas that had been sprayed with malathion in California to eradicate the Mediterranean fruit fly there was a large increase in populations of whiteflies, aphids, mites, olive scale, black scale, brown soft scale, Florida red scale, and the gall midge. The increases of these insect populations were due to the effect of malathion on the parasitoids and other natural enemies of these pests. In many cases malathion has been found to be more toxic to the natural enemies than it is to the pest species themselves. The use of malathion to eradicate one pest may in turn upset the balance of many other natural host-parasitoid systems. Malathion can also impact soil organisms and impact decomposition.

Native bees are a group of beneficial insects that are often not considered in management decisions. Bees are considered the most important group of pollinators in temperate regions. The importance of protecting the pollinators of rare plants during spraying programs is already recognized, but it is not just rare plants that require pollinators. A control program for Mormon cricket could have a devastating impact on the native bee fauna—and other pollinator insects—which in turn can affect the ability of many rangeland plants to reproduce.

There are two major reasons for native bees being affected. First, as with honey bees, exposure to insecticides while foraging can be more hazardous to bees than having the outside of the nest sprayed, as in essence all bee poisonings occur from contact between treated vegetation and the bee. Second, smaller bees usually have a high surface to volume ratio and therefore are more susceptible to poisoning from pesticide residues.

Native bees will be nesting in all suitable locations within the Mormon cricket control area. Approximately 70 percent of native bees nest in the ground, burrowing into areas of bare or partially vegetated soil. Most of the remaining 30 percent nest in abandoned beetle galleries in snags or soft-centered and hollow twigs and plant stems. Bumble bees nest in cavities in the ground or under grass tussocks. Unlike managed honey bee hives, it is not possible to protect the nest sites or prevent native bees from leaving their nests for foraging during or immediately after spraying operations. Leaving a buffer zone around honey bee hives will not have any benefit for native bees, unless they happen to be nesting in the same area.

### **Conclusion**

Mormon cricket control could cause devastating adverse impact to aquatic and terrestrial resources because of the chemicals that might be used and the scale at which the application could take place. The insecticides are a blunt tool capable of killing any insect they hit directly or come into contact with via contaminated surfaces and can cause disruption to the entire ecosystem. APHIS should assess the circumstances of the outbreak—and that the grasshoppers and Mormon cricket abundance on range lands may be due in large part to over grazing of cattle combined with dry weather conditions. APHIS also needs to seriously explore alternatives, which include more frequent and intense monitoring to identify populations that can be controlled when they are small with ground based pesticide application equipment and consider alternative controls that are more targeted to grasshoppers and their allies such as baits. If APHIS chooses to spray pesticides by aircraft buffers around all water bodies should be a minimum of one mile, buffers around populations of the Bruneau hot springs snail should be two miles, and buffers around honey bee apiaries and nesting sites of other managed pollinators should be two miles.

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