March 20, 2006

Robert King
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USDA-APHIS-PPQ
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RE: Comments on Site-Specific Nevada Environmental Assessments Rangeland Grasshopper and Mormon Cricket Suppression Program 2006.

These include:

NV-01-06 is Site-Specific Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program Churchill, Humboldt, Pershing and Washoe Counties, Nevada

NV-02-06 Site Specific Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program Esmeralda, Lincoln, Nye and White Pine Counties, Nevada

NV-03-06 Site Specific Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program Carson, Douglas, Lyon, Mineral and Storey Counties, Nevada

NV-04-06 Site Specific Environmental Assessment Rangeland Grasshopper and Mormon Cricket Suppression Program Elko, Eureka and Lander Counties, Nevada.

The Xerces Society for Invertebrate Conservation has worked on issues related to biological diversity of western public lands for over 30 years. We have members in Nevada and throughout the US that utilize Nevada's public lands for recreational and scientific purposes.

We appreciate the opportunity to comment on this EA. Please add the Xerces Society to all future correspondence concerning your Rangeland Grasshopper and Mormon Cricket Suppression Program.

Summary
The USDA APHIS's Nevada Grasshopper and Mormon Cricket Suppression Program Proposed Action 2006 could authorize aerial spraying of the insecticides (Dimilin, carbaryl, and malathion) in spring/summer 2006.

Although we are not opposed to all pesticide use, the Xerces Society opposes the use of all malathion and liquid carbaryl use for the control of native insects on grasslands across Nevada.

We believe that to protect vital resources, APHIS should:
1) only use Dimilin or carbaryl granular formulation;
2) continue to complete frequent and intense monitoring to identify populations that can be controlled when they are small with ground based pesticide application equipment;
3) 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;
4) for Mormon crickets use insecticides only after it is judged that an outbreak will adversely impact private property through the loss of a crop resource;
5) monitor sites before and after spraying to determine if there is an impact on water quality or non-target species.

I have attached our comments at the end of this letter. Please do not hesitate to contact me if you have any questions regarding our comments.

Sincerely,

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Pesticide Choice

If pesticides must be used to manage native grasshoppers and Mormon crickets we feel that diflubenzuron and carbaryl bait are the best options. Both carbaryl bait and diflubenzuron will result in; reduced mortality of non-target species, greater protection of pollinators and other beneficial insects and the best option for protection of water quality.

The EA lists three pesticides commonly used for Mormon cricket and grasshopper control: diflubenzuron (Dimilin), carbaryl (spray and granular formulations), and malathion. All of these pesticides can be harmful to both terrestrial and aquatic organisms, but malathion and carbaryl spray provide the least protection for non-target species.

Carbaryl Spray

Carbaryl is a calbamate 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 (Cox 1993). By inhibiting the function of AChE in the system, carbaryl causes loss of normal muscle control, and ultimately death. Carbaryl has been associated with a large number of health problems, including acute toxicity, suppression of immune system functions, genetic damage, reproductive problems, and cancer (Cox 1993).

Malathion

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 (Brenner 1992). Malathion has been associated with numerous health problems, including acute toxicity, subchronic and chronic toxicity, cancer, genetic defects, birth defects, reproductive problems, immune system suppression, and vision impairment (Brenner 1992). Malathion is highly toxic to snails, worms, microcrustaceans, and aquatic insects.

Due to the non-target impacts malathion and carbaryl spray should not be used for the control of these native insects.

Carbaryl Bait
Carbaryl, even in bait form, is still a very toxic substance that can have significant, negative impacts to water quality and aquatic life.

Carbaryl in bait form may stay active for extended periods of time before breaking down into less toxic components. If bait is leached into aquatic ecosystems it 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.

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.

Since wheat bran has nutritional value and is consumed by small mammals (Barrett 1998), carbaryl-treated baits may represent an important risk factor for these animals. Punzo (2003) reported reduced running speed and increased cannibalism levels of young in rodents that feed on 2% carbaryl bait. They reported that the use of insecticide containing baits may increase mortality and reduce population densities in small mammals and that this might limit food for predators (Punzo 2003). Hoy and Shea (1981) reported depression in numbers of certain soil arthropod taxa up to 138 days after carbaryl treatment. Even carbaryl bait has been shown to have an impact on soil fauna (Schulze et al. 2003). The data presented in Schulze et al. (2003) suggest that even low dosage applications of carbaryl bait can have significant adverse effects on non-target arthropods.

Diflubenzuron
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. There is ample evidence that Dimilin can cause adverse acute and chronic effects, (is very highly toxic), to freshwater invertebrates, including crustaceans, mollusks, and insects (Hanson and Gartum 1981, Hurd et al. 1996, , McCasland et al. 1998, O'Halloran 1994, McKague and Pridmore 1978, Martinat et al. 1987, Sundaram et al 1990). Forest application of diflubenzuron can effect nontarget organisms in streams. In one study Dimilin was applied by helicopter to two watersheds in the Fernow Experimental Forest near Parsons, West Virginia. Taxa that had reduced mean densities in treatment watersheds included the stoneflies, *Leuctra* sp. and *Isoperla* sp., the mayfly, *Paraleptophlebia* sp., and the crane fly, *Hexatoma* sp (Hurd et al 1996). Sundaram et al. (1990) found significant mortality occurred in amphipoda and immature corixidae 1 to 6 days after the ponds were treated with Dimilin.

Dimilin is also lethal to Lepidoptera caterpillars at extremely small quantities (Martinat 1987). Dimilin has been shown to last weeks on foliage. Dimilin caused 100% mortality of Douglas-fir tussock moth larvae up to seven weeks following application (Robertson and Boelter 1979). Another study found residue on foliage 21 days after application (Martinat 1987). Although

Dimilin does not directly impact vertebrates its use has been shown to cause a dietary shift among songbirds. Bradley et al. (1993) found that after Dimilin spraying, Lepidoptera larvae were reduced at treated sites. In addition, two bird species displayed reduced total gut biomass at treated sites. These data show that while diflubenzuron is not directly toxic to vertebrates, birds are affected indirectly through reduced availability of Lepidoptera larvae (Bradley et al. 1993).

Although diflubenzuron can be expected to break down into less toxic components quicker than carbaryl in bait form, it still can have adverse ecological consequences. There are clearly times when the use of diflubenzuron would be preferred over carbaryl. However, this general preference for diflubenzuron is tempered by the greater likelihood that diflubenzuron, (since it is a liquid), will drift outside of the target area. In areas near water bodies, this could result in diflubenzuron contaminating waters of the United States, resulting in violations of the Clean Water Act and harming aquatic organisms.

Protecting Aquatic Systems

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 and 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 insecticides 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 doses 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 of viruses and parasites.

Small amounts of malathion and carbaryl are routinely found in streams across the U.S. 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 Utah Grasshopper and Mormon Cricket Suppression Program may place these organisms at risk from pesticide poisoning.

<u>Waters of the United States</u>

We disagree with the narrow definition that APHIS has applied to water bodies. The EA defines water bodies as

> reservoirs, lakes, ponds left by seasonal streams, springs, wetlands, and perennial streams and rivers. EA Appendix 1.

This definition is counter to the judicial understanding of water bodies that constitute “waters of the United States” and are thus protected from contamination and pollution under the Clean Water Act. Courts have consistently held that intermittent streams, even when water is not present, constitute waters of the United States.

By failing to harmonize the APHIS definition of water bodies (which is used to govern the use of buffer strips) with the Clean Water Act definition of ‘waters of the United States,’ APHIS is virtually assuring that this program will result in violation of the Clean Water Act.

<u>Buffer widths for aerial pesticide applications.</u>

The EA proposes buffers for spray treatments to protect certain resources. The proposed buffer widths are as follows: 500 feet for water bodies with aerial liquid insecticides; 200-foot buffer with aerial bait; and 50-foot buffer with ground bait. These buffers are not adequate to ensure there are not adverse ecosystem impacts from pesticides drift and washing of granular insecticide into aquatic systems.

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 to 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)

Penn State (1993) 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) (Majewski and Capel 1995). A study of carbaryl applications in orchards in Vermont found that aerially 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 (Barnes et al. 1987). Ghassemi et al (1982) 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.

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.

There is significant documentation demonstrating that aerially applied liquid pesticides can reasonably be expected to drift more than 500 feet. Thus, it is a reasonable expectation that the proposed 500 foot buffers will not be protective of water quality and that drifting pesticides will result in violations of the Clean Water Act.

We urge APHIS to adopt 0.5 mile buffers for all water bodies with aerial liquid insecticides; 500-foot buffer with aerial bait; and 100-foot buffer with ground bait.

Mormon Crickets and Rangeland Health

There is no evidence to warrant control of Mormon crickets on rangeland. The bulk of the scientific evidence available does not support that Mormon crickets are a threat to rangeland resources. Mormon crickets are native insects that have inhabited these rangelands for millennia. They are an important food source for a variety of native birds as well as small mammals and other insects.

Although some authors have written that Mormon crickets and cattle compete for the same forage few actual field data are available documenting the effect of this insect on rangelands (Redak et al. 1992). Historically (during droughts of the Dust Bowl era of the 1930's), Mormon crickets achieved actual pest status in areas that were poorly managed and subjected to severe overgrazing (MacVean 1987). Redak et al. (1992) and MacVean (1987) provide two of the only recent studies that looked at the impact of Mormon crickets on rangeland. Both of these studies found that despite the reputation of Mormon crickets as a rangeland pest, there was little evidence that this insect significantly affects understory vegetative biomass or production of palatable forage (Redak et al. 1992 and MacVean 1987).

MacVean (1987) found that in mixed vegetation, forbs were the principle food category during nymphal development, grasses were a minor component, and shrubs dominated the adult diet. This implies low competition with domestic livestock for forage grasses (MacVean 1987).

Redak et al. (1992) looked at insects collected from experimental plots in July 1986. The average diet of Mormon cricket used in this study consisted of 51.1% sagebrush, 22.6% forbs, 7.3% grasses, and 6.3% arthropods. Small amounts of moss, fungi and seeds were also consumed.

Analysis of cricket crop contents suggested that sagebrush was fed upon predominately; there was little dietary overlap between crickets and cattle. Cover estimates which are commonly used by ranchers to estimate forage availability, provide deceptive assessments of cricket effects, ultimately leading to an undeserved reputation as a rangeland pest (Redak et al. 1992).

Both studies suggest that these insects may actually be beneficial to the range ecosystem. Mormon crickets may actually make a net improvement to range condition by removing (at least to some extent) the sagebrush overstory (Redak et al 1992). With respect to the pest status of the Mormon cricket, their cannibalistic and predatory nature as well as scavenging on feces and carrion, deserve further study, since these components of the diet may serve to offset damage to range vegetation (MacVean 1987).

In light of the information presented above insecticide should only be used in Mormon cricket control after it is judged that an outbreak of will adversely impact private property through the loss of a crop resource.

Mormon Crickets and Crop Damage

There is evidence that periodic outbreaks of Mormon crickets have caused severe damage to crops, especially wheat and alfalfa (MacVean 1987). But all of the evidence we have is from prior to 1960. Can APHIS present any recent information on Mormon crickets causing damage to crops? If so that information should be provided as a supplement to this EA so that the public can fairly evaluate the pros and cons of control efforts.

The Buffers Proposed by APHIS are Inadequate 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.

For example, one study (Seeley, 1995) conducted in a natural area in upstate New York demonstrated that the average distance traveled by a colony's foragers was 1.32 miles (2.2 km) and that 95% of foraging trips occurred within a 3.6 mile (6 km) radius (see also Gould and Gould, 1988). Furthermore, this same study demonstrated that scouts regularly tracked floral resources 2.4 to 3.6 miles (4to 6 kilometers) from the hive (Winston, 1987). 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 (Visscher and Seeley, 1982). However, in more nectar-poor agricultural landscapes, honey bees may travel 2.2 miles (3.7 km) in search of nectar (Gary, Witherell, and Marston, 1972). If foraging conditions are particularly bad, bees have been induced to forage from feeding stations set up 6 miles (10 km) from a hive (Winston, 1987).

Impact of Control on Native Bees and other Importance 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 reflects 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 (Gilbert 1980), 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% of human and animal waste (Pimentel 1980). The perpetuation of food webs is often dependent on critical species performing essential services such as pollination or seed dispersal (Dodson 1975). 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 may be used in this project are not only lethal to Mormon crickets and grasshoppers, they 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 (Cane 2001). The importance of protecting the pollinators of rare plants during spraying programs is already recognized (Sipes and Tepedino 1995), but it is not just rare plants that require pollinators. If malathion and carbaryl spray are used in the control program proposed for Mormon cricket and grasshoppers, it could have a negative 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 (Delaplane and Mayer 2000), as in essence most bee poisonings occur from contact between treated vegetation and the bee. Second, smaller bees are more susceptible to poisoning from pesticide residues (Johansen et al. 1983).

Native bees will be nesting in all suitable locations within the Mormon cricket and grasshopper control area. Approximately 70 percent of native bees nest in the ground, burrowing into areas of bare or partially vegetated soil (O'Toole and Raw 1999, Michener 2000). 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 nor prevent native bees from leaving their nests for foraging during or immediately after spraying operations. Leaving a buffer zone around honey bee and leafcutter bee hives will not have any benefit for native bees, unless they happen to be nesting in the same area.

Using only Dimilin or carbaryl bait would be a very positive step to protect native bees and other beneficial insects.

Cost Benefit Analysis

We believe the costs of this project may be more than the resource is worth. Even in agricultural areas with higher monetary value than open rangeland, control campaigns were sometimes conducted at an expense greater than the value of the crop (MacVean 1991).To judge the economic impact of crickets or grasshoppers on rangelands, an estimate of forage consumption is needed. The monetary value of forage lost in a given area can then be compared to the costs of controlling the insects to provide a cost/benefit ratio. The loss of the forage and current value of the federal rangeland should be compared with the cost of treatment.

Monitoring

APHIS should complete frequent and intense monitoring to identify populations that can be controlled when they are small with ground based pesticide application equipment. Also APHIS should monitor sites before and after spraying to determine if there is an impact on water quality or non-target species.

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