United States Department of the Interior

FISH AND WILDLIFE SERVICE

TAKE PRIDE IN AMERICA

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Dear Interested Party:

July 2, 2004

Enclosed is the Final Compatibility Determination plus a Finding of No Significant Impact (FONSI) decision on the control of a Clearwing grasshopper infestation occurring this summer, and predicted in future years, on the Klamath Marsh National Wildlife Refuge (NWR).

The U.S. Fish and Wildlife Service (Service) has been asked by private landowners adjacent to Klamath Marsh NWR to control grasshopper populations on the refuge so that they will not negatively impact private ranch lands. Service policy allows for the control of pest populations where damage to private property might occur and if the control program is compatible with refuge purposes. Major goals of any control effort would be to reduce grasshopper populations on the refuge to below economic threshold levels of 12 - 24 grasshoppers per square yard and ensure that any treatment is consistent with the Endangered Species Act and compatible with refuge purposes and the mission of the Refuge System.

This year the Service has decided to treat 600 acres of the grasshopper infestation along the western boundary of the Klamath Marsh NWR which is immediately adjacent to private lands. The Service, in conjunction with Animal Plant Health Inspection Service (APHIS) will treat this area with an aerial application of carbaryl bran bait in a RAATs treatment pattern. The Service has decided against treating other areas of the refuge this year due to concerns over nesting bald eagles and/or distance to private lands.

In future years the Service will implement a long term Integrated Pest Management approach, which will allow for treating grasshopper egg beds during the spring months in a timely manner.

In issuing this FONSI, the Service has adopted APHIS's 2004 Site Specific Environmental Assessment for Rangeland Grasshopper and Mormon Cricket Suppression Program, Klamath County, Oregon.

Sincerely:

Ron Cole

Ron Cole
Refuge Manager

Compatibility Determination (6/30/04)

Use: Control of Clearwing grasshoppers

Refuge Name: Klamath Marsh National Wildlife Refuge, Klamath County, Oregon.

Establishing and Acquisition Authority(ies):

- Klamath Marsh NWR was established in 1958 under the Migratory Bird Conservation Act. (16 U.S.C. 715-175r).
- 16 U.S.C.§ 3901(b), 100 Stat. 3583 (Emergency Wetlands Resource Act of 1986)

Refuge Purpose(s):

- "... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "... suitable for – (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..."16 U.S.C.§ 460k-1 (Refuge Recreation Act)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C.§ 3901(b), 100 Stat. 3583 (Emergency Wetlands Resource Act of 1986)

Other applicable laws , regulations, and policies:

National Wildlife Refuge System Administration Act of 1966 (Public Law 94-223)
National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57)
Endangered Species Act of 1973 (16 U.S.C. 1531-1543, 87 Stat. 884).
Migratory Bird Treaty Act
Service Policy - Biological Integrity, Diversity, and Environmental Health (601 FW 3)

National Wildlife Refuge System Mission (NWRS):

The mission of the National Wildlife Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

Background

Clearwing grasshoppers (*Camnula pellucida*) have a long history of periodic outbreaks on both public and private lands in and adjacent to Klamath Marsh National Wildlife Refuge (NWR). These outbreaks generally coincide with extended periods of drought. The clearwing grasshopper consumes primarily grasses and lays its eggs in communal egg beds (>10,000 eggs/ft^2 (Pickford 1966)) in late summer (Schell et al. 2003). Upon hatching (usually after mid-May) nymphs go through several molts and gradually disperse from egg beds in search of forage. Winged adults often migrate in large swarms in search of food (University of Wyoming 1994). Large outbreaks of this native insect occur in 7-12 year cycles in Klamath, Lake, and Harney Counties (Street 1994) and generally exceed economic threshold levels of 14-24/yd^2 (Latchininsky and Schell 2004). Densities of over 100 adults/yd^2 were found on Klamath Marsh in 1994 (Street 1994) and in 2003 (USDA/APHIS 2004). Outbreaks in the area of Klamath Marsh generally coincide with extended periods of drought. Outbreaks in excess of economic thresholds, necessitating treatment of both refuge and private lands, have occurred in 8 of the last 49 years including 1954, 1959, 1973, 1980-81, and 1993-95. With the exception of 1995, past outbreaks have been treated with aerial applications of insecticides that have covered 10,000 to 25,664 acres (total of public and private lands in the vicinity of Klamath Marsh). The U.S. Department of Agriculture, Animal Plant Health Inspection Service (APHIS) has traditionally treated these outbreaks at the request of both public and private landowners. Treatment on the Refuge has, and would not, occur unless economic thresholds were exceeded.

In 1993, malathion was aerial applied to 11,200 acres of private rangelands. The U.S. Fish and Wildlife Service (Service) did not participate in the 1993 control effort and was blamed by adjacent ranchers for a resurgence of grasshopper populations in 1994. In 1994, control efforts were conducted on 19,902 acres of private lands (aerial application of malathion) and 3,575 acres of Refuge lands (aerial application of 5% carbaryl bran bait). The 1994 control program, which took place on the western side of the Refuge, was controversial. Area ranchers contended the outbreak posed a substantial threat to livestock forage and their financial well-being. Environmental interests were concerned about impacts to biological resources on the Refuge from the use of insecticides.

Damage to private lands

The National Wildlife Refuge System Administration Act (Administration Act) of 1966 permits the Service to allow the use of Refuge areas for secondary compatible uses, provided that such use was determined to be compatible with the "major" purposes of the Refuge (Pub. L. 94-223, 16 U.S.C. section 668dd(d)(1)(A)). The National Wildlife Refuge System Improvement Act (Improvement Act) of 1997, Pub. L. 105-57, codified the definition of "compatibility" adopted by the Service under the Administration Act, but added a requirement that the use must be compatible with the mission of the Refuge system as well as the purposes of the Refuge. In addition, the Improvement Act, Section 4(a)(4)(B) states, "In administering the system, the Secretary shall...ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans...". When completing compatibility determinations, refuge managers use sound professional judgment to determine if a refuge use will materially interfere with or detract from the fulfillment of the System mission or the refuge purposes(s). Inherent in fulfilling the System mission is protection of the biological integrity, diversity, and environmental health of the System (601 FW 3, Section 3.18).

U.S. Fish and Wildlife Service Policy (7 RM 14) allows for control of native pest populations where damage to private property occurs and if the planned control program is compatible with refuge purposes and the mission of the National Wildlife Refuge System. In a 1993 outbreak, the Service elected not to treat grasshoppers on the Refuge and was blamed by local ranchers for re-infestations that occurred in 1994. As a result of the 1993 outbreak, the Service received tort claims for $60,998 from 4 local ranchers. The Regional Solicitor ultimately denied these claims because the Service acted within its discretion which fell within an exemption to the Federal Tort Claims Act (28 U.S.C. §§ 2671-2680). In 2004 the Refuge has again received letters from local ranchers requesting treatment on the Refuge. In addition, an assessment of the 2003 outbreak by APHIS indicates that damage in 2004 is likely. A collection of documents indicative of damage to private lands is available in Attachment 1.

In Oregon Department of Agriculture's (ODA) 2003 annual report, the following narrative describes grasshopper populations at Klamath Marsh in 2003:

> "...the clearwinged grasshopper, *Camnula pellucida*, was again in extremely high numbers in most areas of the Klamath Marsh, Klamath County. This included neighboring pastures, in forest clearings, both federal and private, and adjacent to the Marsh. Populations exceeded 100 per square yard and egg deposition was rampant during the adult survey. On private lands, cattle were moved two months early because of exhausted pasture." ... ODA estimated that 22,500 acres private, 21,200 acres F&WS, and 4,480 acres FS land were infested. Unless a drastic shift in wet weather occurs this winter and in spring 2004, most pastures in and around the Marsh are expected to be at risk for severe grasshopper damage in 2004."

An Integrated Pest Management (IPM) Approach

After the 1994 Klamath Marsh grasshopper outbreak, APHIS, ODA and the Service recognized the need for a different approach to controlling grasshoppers in the vicinity of Klamath Marsh NWR. As a result, in 1995, APHIS wrote an Environmental Assessment (EA) (USDA/APHIS 1995) for grasshopper control efforts in Klamath and Lake Counties that was tiered to their 1987 Final Environmental Impact Statement (FEIS) (USDA/APHIS 1987). In this EA, APHIS and the Service developed a preferred alternative for Klamath Marsh NWR involving the principals of IPM. The approach is described in the following narrative:

"The area affected by grasshopper outbreaks is comprised of a mix of private land and land managed by the U.S. Dept. of Interior, Fish and Wildlife Service in the Klamath Forest (Marsh) National Wildlife Refuge. The management objectives of the refuge differ from those of the private landowners. Through consultation with all affected land managers/owners, the Oregon Department of Agriculture, APHIS and the public, a multi-faceted long term IPM approach is being implemented in this area. The actual IPM strategies were determined through consultation with IPM range management specialists from [land-grant] Universities and Agriculture Research Service [USDA], and program managers from ODA, APHIS and FWS."

"As part of this plan APHIS and ODA will undertake intensive surveys of the area each spring to locate hatching grasshopper egg beds. These areas will be mapped for future reference, and then treated with carbaryl bran bait using ground application equipment. In addition a limited number of egg beds may be treated with Nosema bran bait in an attempt to introduce this biological control agent into the local grasshopper population. By using this treatment strategy it is anticipated that total pesticide use in the area can be reduced by 85% or more, as compared to aerial application. It is anticipated that treating the egg beds in this manner will prevent grasshopper numbers from increasing to the point where aerial application of pesticide is required." (USDA/APHIS 1995).

This IPM approach involved several activities, including a study of range conditions that favored grasshopper outbreaks, placement of kestrel and bluebird boxes, experimentation with biological controls, and locating and treating egg beds with carbaryl bran bait. The grasshopper/range ecology study (Quinn 1997) was conducted during 1996 and 1997; however, low grasshopper densities in these two years limited the conclusions that could be drawn from this study. In particular Quinn (1997) felt that results obtained under low population densities may not reflect grasshopper movements and habitat use during outbreak conditions. Bluebird and kestrel boxes were placed on the refuge; however, use by the target species was sporadic. Attachment 2 summarizes work with biological controls that occurred in 1996. In addition to work at Klamath Marsh, APHIS conducted a 5-year grasshopper IPM program in North Dakota (USDA/APHIS 2002, pages A-5 to A-6) which concluded that the most efficacious method for reducing both cost and insecticide applications was to precisely delineate grasshopper infestations, conduct treatment programs in a timely manner, and treat hotspots with ground applied sprays or baits (Quinn et al. 2000).

Due to funding limitations within APHIS and the Service, the IPM approach was discontinued shortly after the 1995 EA was written. With the below program, the Service proposes a grasshopper control program which incorporates IPM strategies where practical.

Proposed grasshopper treatment program

Both recent outbreak periods (early 1990's and again in the early 2000's) illustrate the consequences of not treating in a coordinated fashion early in an outbreak period. In both cases treatment did not occur to egg beds during initial stages of outbreaks. As a result, the outbreak in the early 1990's required a large aerial program of insecticide application. **With this Compatibility Determination (CD), the Service may allow treatment up to 10,000 acres of grasshopper egg beds in 2004 using aerial and/or ground applied carbaryl bran bait and/or Dimilin under a reduced area agent treatments (RAATs) program (Fig. 1). The exact acreage and location in 2004 will be determined upon completion of spring egg bed surveys. The relatively large acreage of coverage of the 2004 program is a result of insufficient funds and manpower to properly coordinate and treat the outbreak in its initial stages. Following treatment in 2004, the Service will allow implementation of a long-term IPM approach similar to that envisioned in 1995. This approach incorporates the goals, strategies, and treatment criteria listed below and should reduce the acres treated, the severity of future outbreaks, and the potential for environmental effects. Thus, this CD represents both a 2004 year-specific document as well as a long-term programmatic approach.**

"RAATs, is a recently developed grasshopper suppression method in which the rate of insecticide is reduced from conventional levels, and treated swaths are alternated with swaths that are not treated. The RAATs strategy relies on the effects of an insecticide to suppress grasshoppers within treated swaths while conserving grasshopper predators and parasites in swaths not treated. .... The amount of area not treated (the untreated swath) under the RAATs approach is not standardized . In the past, the area infested with grasshoppers that remains untreated has ranged from 20 to 67 percent." (USDA/APHIS 2004). Thus, RAATs has both a direct grasshopper suppression component and a biological control component, ie natural grasshopper predators and parasites are maintained in untreated swaths (USDA/APHIS 2002). In general, RAATs is less expensive but somewhat less effective in reducing grasshopper numbers than conventional treatments.

Treatment program goals--Since APHIS's 1987 FEIS and 1995 EA were written, significant new information has been generated requiring development of new environmental documents. To this end a new FEIS (USDA/APHIS 2002) and EA (USDA/APHIS 2004) have been developed by APHIS. As a result of these new documents and information gathered from the IPM program in 1995 (Attachment 2), the Service is allowing implementation of both a 2004 year specific as well as a long-term grasshopper control strategy that has the following goals:

1. Suppress grasshopper populations, produced from Refuge lands that may damage private property. Target is to reduce populations to below economic threshold levels of 14-24/yd^2.
2. Minimize land area being treated by locating and treating egg beds in a timely manner.
3. Minimize impacts to non-target biological resources by utilizing buffer areas adjacent to sensitive habitats, biological controls when and where appropriate, a RAATS application method, and the most target-specific insecticides possible.

4. Coordinate treatment and scouting activities with APHIS, ODA, and local landowners, thus minimizing the potential for large aerial treatment programs on both Refuge and private lands, such as has occurred in the past and is likely in 2004.
5. Monitor potential effects of control actions such that treatment activities are refined and improved as new information is gathered.
6. Ensure the program is consistent with the Endangered Species Act and is compatible with the purposes for which Klamath Marsh NWR was established and the mission of the NWRS.

Treatment program strategy--To reach the goals of the program for 2004 and in the long-term, the Service's allowed treatment strategy is as follows:

1. Coordinate and conduct with APHIS, ODA, and local landowners late summer adult and spring egg bed surveys to locate egg beds on both Refuge and private lands. Because *C. pellucida* is capable of long distance flight, across land ownerships, a coordinated approach is desirable.
2. When appropriate, based on field surveys conducted each year, ground treat egg beds on Refuge lands (mid-May to mid-July) with carbaryl bran bait (<0.5/lbs or 0.2/lbs/acre active ingredient per acre) or Dimilin (0.012 active ingredient/acre). The objective is to reduce grasshopper populations below economic thresholds, not to eradicate the population. Efficacy monitoring in 1994 and 1995 indicated a control rate of 75-80% using carbaryl bran bait. Only a single application of insecticide would be conducted.
3. In addition to insecticide treatments, the Service will continue to explore the utility of biological controls particularly in years of low grasshopper populations. It is hoped that introduction of biological controls to the population will reduce severity and/or periodicity of outbreaks (it is important to note, however, that an unsuccessful biological control program, particularly in years of large grasshopper populations, may necessitate a much larger follow-up aerial application program utilizing insecticides). A summary of biological control work conducted at the Refuge in 1995 is located within Attachment 2.
4. As needed, meet with APHIS, ODA, local landowners, and the public to discuss past and potential future grasshopper control needs, monitoring information, and other issues as appropriate.
5. If the above measures are not successful in reducing grasshopper populations to below economic thresholds and outbreaks exceed the ability to treat using ground based equipment, the Service may allow a single treatment using aerial application of Dimilin or carbaryl bran bait using the RAATS method. Detailed discussion of this method and the environmental effects of Dimilin and carbaryl are discussed in USDA/APHIS (2002) and USDA APHIS (2004). Because egg beds were not treated in the early 2000's, an outbreak in excess of 48,000 acres of private and public lands occurred in the summer of 2003. As a result, a large aerial treatment program may occur in 2004 (Fig. 1).
6. To protect aquatic habitats in 2004 and future years, treatment buffers to water will be 500 feet for aerial applied Dimilin, 200 feet for aerial applied carbaryl bran bait, and 50 feet for ground applied Dimilin and carbaryl bran bait. Other criteria listed in APHIS's 2004 EA at Appendix 1 will also be adhered to, including control actions conducted in

future years.

7. All control activities will be consistent with Endangered Species Act compliance documents and measures as applicable.

Additional details of this strategy can be found in the USDA/APHIS 2004 EA at pages 8-9, Supplement to the 2004 EA at page 1, and within the USDA/APHIS 2002 EIS at pages 19-22.

In the long-term, it is expected that timely treatment of egg beds will result in far fewer acres requiring treatment both on and off-Refuge than has occurred in the past (Quinn 1997). For example, in 1995 (ground application of egg beds), 72% less acreage on the Refuge required treatment compared to 1994 (aerial application for adults), and for the entire Klamath Marsh including private lands, 85% less area was treated. The key to successful implementation of this strategy is locating egg beds, timely treatment programs and close coordination with APHIS, ODA, and adjacent private landowners. In preparing this CD the Service has adopted APHIS's 2004 Site Specific EA for Klamath County, Oregon (copies available at http://www.oda.state.or.us/Plant/ppd/Ent/gh/index.html, and at United States Dept. of Agriculture, Plant Protection and Quarantine, Airport Business Center, N.E. 80th Avenue Suite A-5, Portland, OR 97218-4033). The adoption memo can be viewed in Attachment 3. Alternatives listed in the EA include: No Action, application of carbaryl, malathion, and Dimilin, with complete area coverage and at conventional rates, and use of the same chemicals under a RAATs application strategy. This site-specific EA for Klamath County, Oregon is tiered to APHIS's Final Environmental Impact Statement (FEIS) for control of Mormon crickets and grasshoppers in the 17 Western States (dated June 21, 2002) (copies available at http://www.aphis.usda.gov/ppd/es/gh.html, and the above address). A detailed description of alternatives and potential impacts of these alternatives is described in both documents. In the Finding of No Significant Impact (FONSI) (see Attachment 3), the Service selected Alternative C - (Reduced agent area treatments (RAATs) alternative) for implementation from the adopted USDA/APHIS EA (2004), proposing only to allow treatment with carbaryl bran bait and Dimilin. Ground application of carbaryl bran bait and treatment of egg beds is the preferred method because it minimizes impacts to non-target insects, areas requiring treatment, and potential drift to water. In cases of extreme outbreak conditions (>1,000 acres) and if egg bed treatments are unsuccessful, the Service proposes to allow ground or aerial application of Dimilin or aerial applied carbaryl bran bait using a RAATS application strategy. Dimilin was selected because of its selective action (molt inhibition) and low toxicity. The RAATs application method was selected because of the reduced application rates and area requiring treatment, thus minimizing potential effects to non-target insects and maximizing the potential to maintain populations of natural predators and parasites of grasshoppers.

Availability of Resources:

In years of control efforts, APHIS would fund control activities including the costs of insecticides, application (ground and/or aerial), scouting, and monitoring. In some years, particularly where <300 acres require ground application and/or funding is unavailable from APHIS, the Service may supply equipment and personnel. Ground treatment in the early years of a building outbreak may significantly reduce the area requiring treatment in future years. Service personnel will likely assist with scouting activities and will provide program oversight. Monitoring activities (human safety, treatment efficacy, and environmental effects) will be carried out by APHIS as described in their 2002 EIS and 2004 EA (USDA/APHIS 2002 and 2004). Refuge managers and biologists will identify sensitive habitats to avoid. Currently, existing resources are adequate to safely and effectively administer this action.

Anticipated Impacts of the Use:

Chemical options

Dimilin and carbaryl bran bait have been selected as the 2 chemical control options. In general aerial application of either insecticide would be used where infestations were relatively large (>1,000 acres) or ground application was impractical. For example, ground application is not possible where the land is exceedingly rough or where the amount of time to cover infested areas is so great that the juvenile grasshoppers become flighted. Ground application of either insecticide would be used where outbreaks were small and coverage of affected areas would be relatively quick. In addition, ground application is preferable where precise application to specific locations is a necessity. The following narrative briefly describes the characteristics of both chemicals and is taken from USDA/APHIS (2004, pages 10-11.):

> "Diflubenzuron is a chitin inhibitor, and only kills grasshoppers or other insects when they are in their immature stages. It will not kill adult grasshoppers. It cannot be used late in the season because the grasshoppers are no longer molting, and thus not susceptible. In Oregon, the efficacy of diflubenzuron is notably decreased by the first week of July because of grasshopper maturity. This material would not normally be used after the third week of June, for most species of grasshoppers in Oregon. Insects usually die seven to ten days after treatment. Diflubenzuron is reported to have a residual activity against grasshoppers lasting up to 28 days. Diflubenzuron is less harmful to other insects, including pollinators, and is essentially harmless to vertebrates than the other insecticides. Diflubenzuron must be applied as a spray mixed with water and crop or vegetable oil. It is normally applied by air for grasshoppers on rangeland, but can also be applied by ground. It is the least costly option per acre treated. The formulation of diflubenzuron approved for use by APHIS is Dimilin 2L®.
>
> Carbaryl bait acts faster than diflubenzuron. It kills adults and immature grasshoppers and other insects that feed on the bait. It has a broader spectrum of

insecticidal activity than diflubenzuron, but must be ingested to be lethal. Therefore it is preferred over carbaryl or malathion sprays, in areas where foraging bees are a concern. It is the most costly option. It can be used effectively any time during the grasshopper season. In can be applied by air or ground. Carbaryl bait is applied in greater mass than any of the other treatments (up to 10 lbs. dry material per acre) and creates a greater logistical problem because of the amount of material which must be stored, transported and applied. Carbaryl bait can be applied by air in some situations when and where liquid insecticides cannot. Although no aerial applications of any insecticide can be conducted when wind speeds exceed 10 mph, carbaryl bait can be applied when air temperatures are too high to permit effective applications of sprays. Additionally, when terrain is too rough to maintain flying at the low altitude consistent with effective spray application, bait can be applied by flying at a safe altitude over the ground. Thus, the window of opportunity to apply bait is greater than for sprays. The carbaryl bait formulations approved for use by APHIS include products which impregnate carbaryl into wheat bran, rolled whole wheat, and pellets manufactured from grape and apple pumice. In Oregon, wheat bran formulations would be preferred when treating *Camnula pellucida* with bait."

Additional discussion of the toxicity of carbaryl and Dimilin and potential environmental effects of these chemicals and their application methods can be found in USDA/APHIS's 2004 EA and 2002 FEIS.

Biological Resources

The Williamson River and Big Spring Creek are the primary sources of surface water for the refuge. Several small creeks and springs also supplement water flows into the marsh. Groundwater flows on the refuge and surrounding area are heavy, resulting in open water potholes, artesians, and small springs. The refuge contains approximately 37,700 acres of seasonal and permanent marsh with the acreage varying by year depending on snow pack and precipitation.

A variety of wildlife resources inhabit the forests, meadows, and wetlands of Klamath Marsh National Wildlife Refuge including ungulates, small mammals, birds, fish, reptiles, amphibians, and invertebrates. Some common species include coyote (*Canus latrans*), mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus*), sandhill crane (*Grus canadensis*), mallard (*Anas platyrhynchos*), redhead (*Aythya americana*), cinnamon teal (*Anas cyanoptera*), lesser scaup (*Aythya affinis*), tundra swan (*Cygnus columbianus*), and Canada goose (*Branta canadensis*).

The refuge supports thousands of migrating and breeding waterfowl, as well as a host of other wildlife species. Approximately 45-60 pairs of sandhill cranes breed on the refuge. As water levels recede during late summer and early fall, excellent crane feeding conditions are created in the marsh. Close to 16,000 tundra swans have been observed on the refuge during spring migration. The refuge is also an important area for neotropical migratory birds that are dependent on both wetland and upland habitats.

The refuge contains calving and fawning areas for mule deer and Rocky Mountain elk, primarily in the northern portions of the refuge. Thickets of ponderosa pine and lodgepole pine with understory shrubs provide hiding cover and forage for these big game species. While fawning and calving areas can be found in adjacent private and public lands (Winema National Forest), those contained in the refuge are considered "high-quality" because of the close proximity to riparian areas, the associated forest edge habitat, and the abundance of forage.

Several "sensitive species" occupy the Refuge. The federally-threatened bald eagle is a regular visitor with several active nesting and roosting sites on the refuge and in the Winema National Forest immediately adjacent to the refuge boundaries. Klamath Marsh also supports populations of yellow rails (*Coturnicops noveboracensis*) (Oregon Sensitive-Critical) and the Oregon spotted frog (*Rana pretiosa*), a candidate (Category 1 species) for listing under the Endangered Species Act.

Preserving Klamath Marsh NWR's environmental integrity, diversity, and health through preservation and/or enhancement of the refuges wetlands, wet meadows, springs, creeks, and forested habitats and the endemic fish and wildlife resources that utilize those habitats is the key to achieving the Refuge's purposes. Preservation of certain species, especially those that are rare, threatened or endangered, is particularly important. Generally, these particular species are low in numbers because their respective habitats are uncommon in the surrounding landscape or there are other habitat attributes specific to the refuge that are limited elsewhere in the ecosystem. For example:

- Although the hydrology of most other wetlands in the Basin has been significantly altered for anthropogenic purposes, Kamath Marsh still retains much of its historic hydrology. This is important for the native fish and amphibian species on the refuge.
- Its status as a National Wildlife Refuge means it is relatively free of human disturbance. For this reason, species such as nesting sandhill cranes and other migratory waterbirds have proliferated.
- Water quality at Klamath Marsh is generally better than other water bodies in the Basin. This attribute allows for the continued survival of native fish species and the Oregon spotted frog.
- Large expanses of unique habitats such as seasonally flooded sedge meadows are present at Klamath Marsh. This habitat is beneficial to nesting and colt-rearing sandhill cranes as well as nesting yellow rails and spring migrant waterbirds.
- Certain exotic plant and animal species have not invaded Klamath Marsh. Purple loosestrife is not present at the Refuge, thus allowing for the continued persistence of native wetland vegetation. The lack of bullfrogs also contributes significantly to the abundance of Oregon spotted frogs.
- The juxtaposition of mature coniferous forests and wetland/wet meadow habitats have created ideal habitat conditions for roosting and nesting bald eagles as well as a host of neotropical migratory birds.

Potential impacts key species and habitats are discussed below. Additional effects analysis can be found in APHIS's 2004 EA and 2002 EIS.

Aquatic resources--Because of the sensitivity of many aquatic organisms to carbaryl, the Service and APHIS imposed a 200 ft buffer to water during aerial application of carbaryl bran bait in 1994. In 1994, 35 samples were collected pre and post treatment from 3 water bodies. No detections were made at Big Spring Creek and Graveyard Ditch. At the Pond site carbaryl levels averaged between the level of detection and 2 parts per billion (ppb) up to 2 days post treatment. Residues were not detected 6 days after treatment. Overall, the authors concluded that the 200 foot aerial buffer for carbayrl bran bait to water was adequate to protect aquatic habitats on the Refuge (USDA/APHIS 1994).

In 1995, monitoring was conducted adjacent to Sand Creek both prior to treatment and within 24 hours post-treatment (USDA/APHIS 1995). In this area bait was ground applied as close as 10 feet to water. Results indicated that despite no visible indication of bran flakes reaching water, carbaryl residues were detected. Mean concentration from the sites after adjusting for recovery from a spiked sample was 5.1 ppb. USDA/APHIS (1995) speculate that dust from the bran bait or winds that blew after application may have resulted in some drift to water. Residue concentrations were well below levels believed harmful to freshwater vertebrates, however, impacts to the most sensitive of freshwater crustaceans may have occurred. Overall, the authors felt that if there was an effect to aquatic life it was short-term suppression of populations of the most sensitive aquatic species with no long-term effects (USDA/APHIS 1995).

Dimilin is extremely toxic to the immature stages of aquatic invertebrates and is slighty toxic to practically non-toxic to fish. Chronic exposure of minnows to Dimilin did not did not have significant effects on survivability, growth, or reproduction during exposure for 10 months at a concentration of up to 0.10 parts per million (ppm). Dimilin is practically non toxic to birds and mammals and is relatively non-toxic to honey bees (USDA/Forest Service 2004).

Using Ag Drift model (Ag DRIFT 2001) and assuming a 50 ft ground application buffer, 0.016 lbs/acre a.i., very fine to fine droplet size, and 10 ft wide by 2 ft deep waterway, the model predicted drift would result in 0.116 ppb concentration in water. For aerial application with a 500 foot buffer, 10 mph cross wind, and a droplet distribution of aerosol to very fine, the Ag Drift model predicted drift to water would result in concentrations of 0.120 ppb in water. These concentrations are unlikely to effect birds, mammals, fish, or amphibians. However, effects to the more sensitive aquatic invertebrates are possible. Potential effects are believed to be short-term in nature due to the rapid generation time for these organisms.

Under both the 2004 and long-term grasshopper control programs, APHIS is proposing larger buffers than in 1994. Buffers to water have been expanded to 500 ft for aerial application of (Dimilin), 200 ft for aerial application of carbaryl bait and 50 ft for ground application of carbaryl bran bait and Dimilin. For an assessment of the effects of Dimilin and carbaryl see USDA/APHIS (2002, Appendix B and C).

Endangered/threatened/sensitive species--Prior to treatment the Service will consult under

Section 7 of the Endangered Species Act (ESA) to ensure that all activities associated with the grasshopper control program on the Refuge will not effect endangered, threatened, or candidate species. That consultation was completed on June 17, 2004 (Attachment 4). In addition, APHIS will abide by any applicable ESA requirements applicable to their operation.

Nine bald eagle (*Haliaeetus leucocephalus*) nests exist on the perimeter of Klamath Marsh, including the Refuge as well as U.S. Forest Service and private lands (Isaacs and Anthony 2002). Bald eagles typically have 1-3 nests within their territory thus not all nests are occupied in any given year. Bald eagles are listed as a Federally threatened species in Oregon. Given that eagles at Klamath Marsh forage primarily on waterbirds and the bran bait or Dimilin will not be applied to water, the potential for secondary poisoning from consuming contaminated prey is remote. Measures to protect listed and candidate species and additional discussion of the toxicity and effects of carbaryl bran bait and Dimilin to ESA listed species and Candidate species can be found in the Biological Assessment located in Attachment 4.

Sandhill cranes (*Grus canadensis*), Oregon spotted frogs (*Rana pretiosa*), and yellow rails (*Coturnicops noveboracensis*) are the primary "sensitive" species at Klamath Marsh NWR. Klamath Marsh NWR supports the largest population of yellow rails in the Klamath Basin (Lundsten and Popper 2002). Yellow rails frequent seasonally flooded sedge (*Carex sp*) habitats throughout the Refuge. Impacts to this species are not anticipated because buffer areas will prevent insecticides from reaching water and carbaryl and Dimilin has very low toxicity to birds.

Surveys for egg masses and adult spotted frogs over the last 4 years indicate that spotted frogs exist primarily near year-round flooded habitats. Occupied habitats include Big Spring Creek, several springs on the Refuge, and the Williamson River and closely associated wetlands. Treatment buffer zones will ensure that chemical entry to waters of the refuge are minimized or eliminated. Additional analysis of potential impact of control activities to spotted frogs can be found in the Biological Assessment located in Attachment 4.

From 45-60 nesting pairs of sandhill cranes typically breed at Klamath Marsh NWR. Cranes typically nest in shallow bulrush and sedge dominated marshes and rear colts in shallow wetlands and wet and dry meadow habitats. Because nesting areas are typically surrounded by water, no treatment activities will occur near nests. Disturbance related to monitoring, scouting, and treatment activities may cause temporary displacement of cranes near treatment areas.

<u>Upland habitats and other wildlife species</u>-- Although grasshopper outbreaks are likely a natural occurrence, treatment activities are not expected to reduce grasshopper population levels to the point where grasshoppers become limited as a food resource to refuge wildlife. The diversity and abundance of the Refuge's insect community is important to the area's biological integrity and grasshoppers are an important component of this community. Carbaryl is a broad spectrum insecticide that, if applied in liquid form, would likely kill

many non-target insects. For this reason, the Service selected the bran bait option. Use of carbaryl bran bait will only kill those insects that directly consume the bait, primarily grasshoppers. Dimilin was also selected by the Service for use because of its low toxicity to vertebrates, selective mode of action (molt inhibitor), and its reduced impact to native insects, especially when applied as a RAATs treatment. Use of Dimilin and carbaryl bran bait under a RAATs application is expected to minimally effect non-target insects and is not expected to reduce the overall diversity of the Refuge insect population. In addition to minimal effects to non-target insects, the RAATs application strategy allows for the preservation of natural grasshopper predators, competitors and parasites (USDA/APHIS 2002).

In 1994, the APHIS aerial applied carbaryl bran bait to 3,600 acres of the refuge as part of a 23,000 acre control effort. Monitoring on the Refuge indicated that the bran bait killed 75-80% of the grasshoppers which was enough to reduce populations below economic damage thresholds yet left more than enough grasshoppers for forage. Because only egg beds will be treated and a RAATs application strategy will be used, large areas within the treatment area will be untreated, thus impacts to non target insects and other arthropods in expected to be minimal and/or short-term. Large untreated areas will ensure that the full diversity of insects is maintained on the Refuge.

There may be some temporary displacement of refuge wildlife in localized areas due to disturbance created by treatment and monitoring activities. Primary species would include mule deer and elk, Canada geese, and a variety of grassland birds. Localized depression of grasshopper populations in treatment years may cause a reduction in bird numbers, however, the lower efficacy of carbaryl bran bait (75-80%) relative to liquid formulations and the RAATs application method should allow for more than enough grasshoppers as a forage base. Because carbaryl bran bait will not be consumed, native insect pollinators should not be effected by the treatment program. The low toxicity of carbaryl, the selective nature of the bran bait, and the limited area of application should result in minimal or no toxicological effects and minimal disturbance to upland species of wildlife.

Conclusion—Refuge habitats required to achieve Refuge and System purposes include springs, creeks, seasonally flooded sedge meadows, wetlands, and forest/wetland edge habitats. Key species occupying these habitats include several threatened, candidate, and sensitive species, migratory birds and the full compliment of endemic species. Species of particular importance are bald eagles, yellow rails, sandhill cranes, and Oregon spotted frogs. The 2004 year- specific and long-term grasshopper control program is not expected to materially interfere with achieving refuge purposes because selected insecticides have low to minimal toxicity, are relatively target specific, treatment buffers will protect sensitive habitats, adequate grasshoppers will remain for forage, and the RAATs strategy will maintain the full complement of native arthropod species.

Public use

Public use (consumptive and non-consumptive uses) of the Refuge will be minimally affected by grasshopper treatment activities. Historic outbreak areas are typically on the west and north sides of the Refuge, generally in areas closed to the general public. In addition, treatment activities will be completed prior to fall hunting seasons.

Klamath Tribal resources

Although minimal ground disturbing activities are anticipated with the proposed action, the Cultural Resources Branch of the Klamath Tribes will be consulted prior to implementation of any control activities. Because Klamath Marsh NWR is an important area for the Klamath Tribes subsistence activities, the Service will consult with the Tribes such that treatment activities will minimally interfere with these rights. Several meetings with the Klamath Tribes have already occurred and the Tribes are aware of the proposed program.

Public Review and Comment:

An announcement of the availability of this draft CD was published in the Klamath Falls Herald and News, the Bend Bulletin, and on the Refuge website at (klamathbasinrefuges.fws.gov) on May 26, 2004. Copies were also mailed to Klamath County officials and interested organizations and individuals. Comments on the Draft 2004 CD were accepted through June 10, 2004. Copies of APHIS's 2004 EA for Klamath County, Oregon can be found at http://www.oda.state.or.us/plant/ppd/Ent/gh/index.html and APHIS's 2002 FEIS can be viewed at http://www.aphis.usda.gov/ppd/es/gh.html.

Only one letter of comment was received during the review period. This letter represented the Oregon Natural Resources Council, Klamath-Siskiyou Wildlands Center, North Coast Environmental Center, Oregon Natural Desert Association, Audubon Society of Corvallis, Klamath Basin Audubon Society, Lane County Audubon Society, Salem Audubon Society, Siskiyou Regional Education Project, Umpqua Valley Audubon Society, and Umpqua Watersheds. These organizations also sought to incorporate comments submitted relative to a similar CD distributed in 2003. Substantive comments relative to this CD and the Service's responses are summarized in Attachment 5.

Determination:

___ Use is Not Compatible

_X_ Use is Compatible With the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. APHIS's treatment operations will comply with all applicable Biological Opinions issued by the Service to protect endangered and threatened species.
2. In 2004 and in future years, APHIS will comply with its "FY-2004 Guidelines for

Treatment of Rangeland for the Suppression of Grasshoppers and Mormon Crickets" This document can be found as Appendix 1 of APHIS's Site-specific EA for Klamath County, Oregon at http://www.oda.state.or.us/plant/ppd/Ent/gh/index.html. These guidelines describe the operational procedures required to protect environmentally sensitive areas as well as other operational criteria.

3. APHIS will monitor its applications to ensure that treatment buffers are not infringed upon and that insecticide inputs to sensitive habitats are minimized. Monitoring guidelines are outlined in APHIS's 2004 Site-Specific EA for Klamath County, Oregon and can be found at http://www.oda.state.or.us/plant/ppd/Ent/gh/index.html. Required monitoring includes efficacy of grasshopper treatment, compliance monitoring for sensitive habitats, and drift and water quality monitoring to verify adequacy of treatment buffers.
4. Carbaryl or Dimilin will be applied from ground based equipment or, if outbreaks are too large (>1,000 acres) or logistical constraints too difficult to make ground application practical, then aerial application using a RAATS treatment would be used. To minimize treatment areas and maximize effectiveness of control, wingless juvenile grasshoppers would be targeted on egg beds. This strategy allows for large untreated areas, thus minimizing impacts to non-target arthropods.
5. Prior to taking any control actions, the Service will consult with the Klamath Tribes to ensure that treatment activities will not impact subsistence or cultural resources.
6. Refuge managers and biologists will identify areas containing water and other important habitat areas to APHIS prior to conducting control activities.

Justification:

Periodic control of clearwing grasshopper outbreaks at Klamath Marsh NWR, that exceed the economic threshold, is necessary to prevent damage to private lands adjacent to the refuge. Using a proactive, coordinated, and well-planned approach, the Service and APHIS can conduct this program such that it is compatible with Refuge purposes and the mission of the National Wildlife Refuge System. The program should ultimately reduce the area treated and the quantity of insecticides used on both public and private lands at Klamath Marsh. Successful implementation of the long-term program should reduce the acreage treated by 70-80% compared to historic aerial treatment programs.

Refuge habitats required to achieve Refuge and System purposes include springs, creeks, seasonally flooded sedge meadows, wetlands, and forest/wetland edge habitats. Key species occupying these habitats include several threatened, candidate, and sensitive species, migratory birds and the full compliment of endemic fish and wildlife species. Species of particular importance include bald eagles, yellow rails, sandhill cranes, and Oregon spotted frogs. The 2004 year- specific and long-term grasshopper control program, as described, are not expected to materially interfere with achieving Refuge or System purposes. This conclusion is reached because selected insecticides have low to minimal toxicity to fish and wildlife, are relatively target specific, treatment buffers will protect sensitive habitats, adequate grasshoppers will remain for forage, and the RAATs strategy will maintain the full complement of native arthropod species. The proposed control program is consistent with 7 RM 14.

Mandatory Re-Evaluation Date:

___ Mandatory 15-year Re-Evaluation Date (for priority public uses)

_X Mandatory 10-year Re-Evaluation Date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

___ Categorical Exclusion without Environmental Action Statement

___ Categorical Exclusion and Environmental Action Statement

_X_ Environmental Assessment with Finding of No Significant Impacts (FONSI)

USDA/APHIS. 2004. Site specific Environmental Assessment, Rangeland grasshopper and Mormon cricket suppression program, Klamath County, Oregon, EA Number OR-04-02, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, 6135 NE 80th Avenue, Suite A-5, Portland, Oregon 97218-4033, 49 pp.

Finding of No Significant Impact– Control of Clear-winged Grasshoppers, Klamath Marsh National Wildlife Refuge, Klamath Basin National Wildlife Refuge Complex, 4009 Hill Road, Tulelake, CA 96134

Adoption Memo dated June 22, 2004 from Project Leader to Files formally adopting APHIS's 2004 Site-Specific Environmental Assessment for Rangeland Grasshopper and Mormon Cricket Suppression Program, Klamath County, Oregon, EA Number OR-04-02.

___ Environmental Impact Statement and Record of Decision

Refuge Determination:

Prepared by: (Signature)	[signature]	7/7/04 (Date)
Refuge Manager/ Project Leader Approval: (Signature)	[signature]	7-7-04 (Date)
Concurrence:		
Refuge Supervisor: (Signature)	[signature]	7/7/04 (Date)
Regional Chief, National Wildlife Refuge System: (Signature)	[signature]	7/1/04 (Date)
California/Nevada Operations Manager (CA and NV): (Signature)	[signature]	7/7/2004 (Date)

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USDA/APHIS. 1995. Site-specific Environmental Assessment tiered to the 1987 Final Environmental Impact Statement for rangeland grasshopper cooperative managment program, Klamath and Lake Counties, Oregon. EA Number OR-or-95, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, 6135 NE 80th Avenue, Suite A-5, Portland, Oregon 97218-4033.

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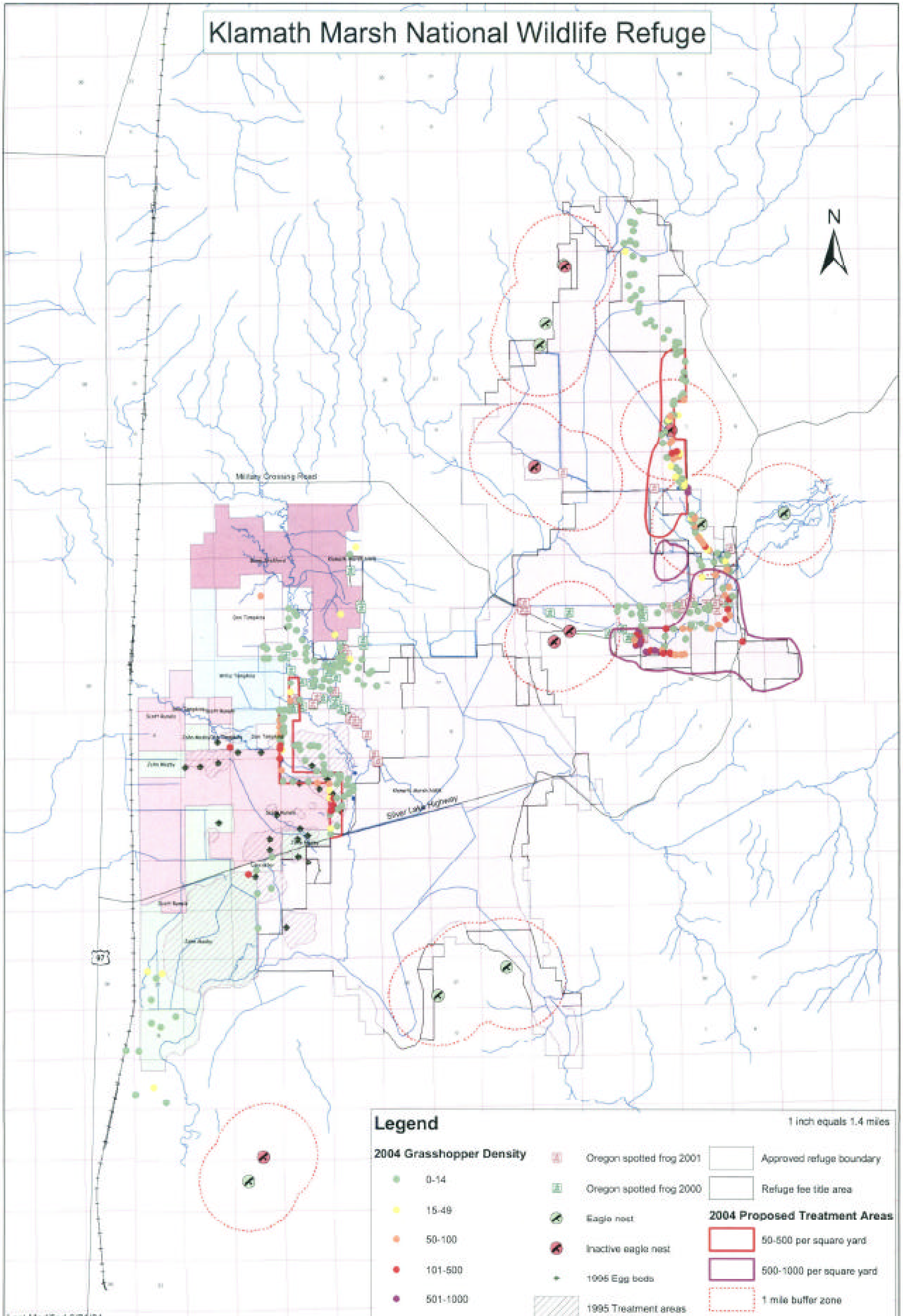
Figure 1. Location of grasshopper egg beds and other environmental features at Klamath Marsh National Wildlife Refuge. Proposed 2004 treatment area is outlined in red on the western portion of the Refuge between Silver Lake Highway and Military Crossing.


Klamath Marsh National Wildlife Refuge
N
Military Crossing Road
Silver Lake Highway
97
Legend
1 inch equals 1.4 miles
2004 Grasshopper Density
0-14
15-49
50-100
101-500
501-1000
Oregon spotted frog 2001
Oregon spotted frog 2000
Eagle nest
Inactive eagle nest
1995 Egg beds
1995 Treatment areas
Approved refuge boundary
Refuge fee title area
2004 Proposed Treatment Areas
50-500 per square yard
500-1000 per square yard
1 mile buffer zone
Last Modified 6/21/04

Attachment 1. Documents referencing damage to private lands from grasshopper infestations in the Klamath Marsh area.

To: Fish and Wildlife Service Refuge Manager
Klamath Basin National Wildlife Refuges
4009 Hill Road
Tulelake, CA 96134 Date: June 18, 2004

Subject: Update to Grasshopper Situation at Klamath Marsh Refuge

Ron, as we have discussed, here is the updated information on the extent of the grasshopper problem on the Klamath Marsh Refuge. The grasshoppers on the Marsh have far exceeded the densitiesof 0-24 hoppers per square yardthat are present in most years. The adult survey in 2004 indicated over 21,000 acres of the refuge had population over 24 per square yard. Many areas had over 100 per square yard. Currently, some areas where these grasshoppers are hatching on the refuge have grasshopper densities of 500-1000 per square yard. There are about 3000 acres of extended egg beds (other areas 50-100 per square yard). In several weeks, these 3000 acres could extend to coveras much as 20,000 acres again this year.Without treatment it is expected that under normal conditions the hoppers will mass migrate to private ranch land.

The next step is to receive a letter (electronic will be adequate) requesting PPQ assistance for grasshopper control on the Marsh. We will act on this request by issuing a FONSI as soon as possible,since both our EA and consultation work has been completed. It will take us at least a week to ten days to get a contract in place once we get your request. The longer we wait, the greater chance of the hoppers spreading to the surrounding ranch land.

Regarding whether or nota suppression program on the Marshwouldnow be economically effective, aprogram now would at least provide an economic service to the ranchers versus if no suppression program was undertaken. Although we cannot guarantee levels ofsuppression, we can say that given the right environmental restrictions and adequate time of application, our suppression programs can have positive economic reduction in grasshopper populations.

As we get further into June and July,the options available to APHIS for an effective suppression program are limited.Thislast minute decision to treat jeopardizes the effectiveness of any program we undertake, and increases the size of the program, as well as the cost to the tax payers.

As I proposed to FWS last year, it will be necessary in future years to complete allthe necessary paperwork by December, and issue provisional treatment requestsin January to be ready to apply treatmentsthe first week in June.

The events of last year cannot be repeated if an effective approach to addressing economically damaging grasshopper outbreaks on Klamath Marsh is to be developed.With the population levels seen in July of 2003 by our survey team, and your FWS biologists, it was already predicated that this year's levels would be beyond economic levels. Even a local flyer distributed last year pointed out, "come see the Biblical portions of grasshopper invading the Marsh."Furthermore, in September 2003 APHIS explained that unless something happened, the grasshopper populations on the Marsh had reached economic levels and would be a problem to the surrounding community if something did not happen to decrease their population. In my letter to you on March 9, 2004 I repeated again the economic damage problem the grasshoppers on the Marsh posed for the surrounding community; "Based upon last years survey, the grasshopper situation in this area could be of concern to the private ranchers;" and ..... "However, it may be necessary to control the grasshoppers on part of the Marsh Refuge that boarders their ranches to be effective. We could only do that if the Fish and Wildlife Service requested our assistance. In the spirit of cooperating with your neighbors, and controlling native pest populations when it will alleviate damage to private property; you may decide that is something you would consider."

If APHIS had received a tentative treatment request from FWS in late winter or early spring, as requested, stating that FWS would authorize the use of Dimilin, we could have bought ground application equipment and been prepared to treat just the egg beds. Now, this option is not available and we are restricted to aerial application of bait; and it maynow be necessary to treat an area four times the original, at a much greater cost of resources.

I agree with the choice byFWS to be a "good neighbor" and work with APHISto suppress grasshoppers in a sensitive area to prevent economically damage to private lands. I am hopingthe lessons learned this year will result in a more timely response in the future.I would also encourage FWS to work with the adjacent landowners and come up with a long term solution to this grasshopper periodic problem. There was a Klamath Marsh Grasshopper Working group in 1995, which made a series of recommendations. There was a course of action put forth that was agreed to by all parties. Although some of those recommendations were completed, there was not a follow up on some of the land manager issues. You might want to revisit those recommendations. We will continue to provide technical assistance in the area of grasshopper survey and suppression, including conducting an adult survey of the Marsh this summer.

Mitchell G. Nelson
Plant Health Director
Oregon

Oregon
Theodore R. Kulongoski, Governor

Department of Agriculture
635 Capitol Street NE
Salem, OR 97301-2532

18 May 2004

To: Walt Ford, Refuge Manager Klamath Marsh, NWR

From: Diana N. Kimberling, Ph.D., Entomologist (interim) DNK
Kathleen J.R. Johnson, Ph.D., IPPM Supervisor

Subject: Grasshopper populations in the Klamath Marsh

You recently requested information on the potential for grasshoppers to cause damage on private lands surrounding the Klamath Refuge. The ODA Plant Division annual report for 2003 states that "the clearwinged grasshopper, *Camnula pellucida*, was again in extremely high numbers in most areas of the Klamath Marsh, Klamath County. This included neighboring pastures in forest clearings, both federal and private, adjacent to the Marsh. Populations exceeded 100 per square yard and egg deposition was rampant during the adult survey. On private lands, cattle were moved two months early because of exhausted pasture. U.S. Fish and Wildlife Service (F&WS) and USDA Forest Service (FS) lands were equally hard hit with pastures stripped and riparian areas defoliated. In some locations rushes and other wetland plants were severely damaged. ODA estimated that 22,500 acres private, 21,200 acres F&WS, and 4,480 acres FS land were infested. Unless a drastic shift to wet weather occurs this winter and in spring 2004, most pastures in and around the Marsh are expected to be at risk for severe grasshopper damage in 2004. Grasshopper populations have built gradually during the past few years, then increased dramatically during 2002 and 2003. Based on ODA advice, private owners have baited emerging hatchlings for the past several years and one owner has aerially treated. However, favorable weather has allowed the grasshopper population to overwhelm these localized treatments. Economic numbers now occur from one end of the Marsh to the other. " Weather conditions this year have been favorable for grasshopper development and adverse weather conditions that would markedly reduce grasshopper populations are not expected this late in the spring (Dick Jackson, personal communication, May 14, 2004).

In 1993 and 1994 grasshopper populations moved from the refuge onto private lands and caused damage (Dick Jackson, personal communication, May 14, 2004). In an earlier report, Dick Jackson stated "This was the situation when the most recent hopper buildup was first noticed in 1991 and 1992. No action was taken and by the next season an outbreak had developed. In 1993 aerial treatment was accomplished on 11,200 acres of private land using malathion ULV @ 8 fluid oz per acre. Treatment was effective with immediate reductions of about 90% in the areas covered, however, within two weeks the area was reinfested by migrating egg-laying hoppers from the refuge."

"The 1994 effort was more concerted with 3,575 acres of federal lands aerially treated with 5% carbaryl bait @ 5-10 lbs per acre and 19,840 acres of private land was treated with malathion ULV @ 8 fluid oz per acre. However, due to environmental issues, the program was delayed and ineffectual as many hoppers had become egg layers by the time treatment began and many infested refuge acres were untreated because of close proximity to water. Adult survey again indicated profuse egg laying and an effort was made to map these locations."

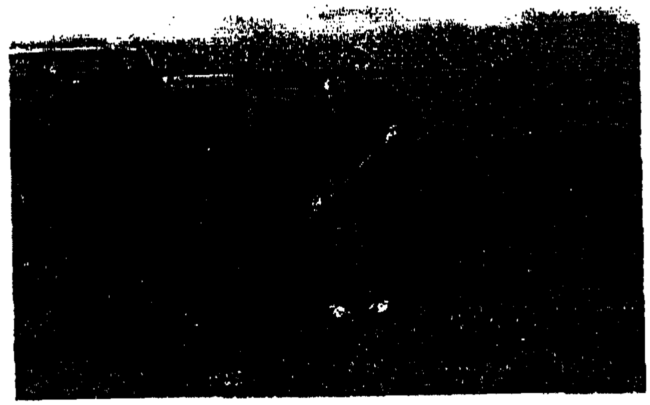
Clearly, grasshopper populations move freely between the Klamath Marsh and surrounding private lands and can cause severe damage to private lands. Successful grasshopper suppression programs in the past have included grasshopper egg-laying habitat on what is now federal as well as private land.

If you have any further questions, please feel free to contact us at 503-986-4636 or 1-800-525-0137.

significant pest of urban and shelterbelt elms. Although elms are the only known hosts in the U.S., it has been recorded from 10 *Prunus* species (apricots, cherries, peach and plums) as well as from apple, pear, willow, Russian olive, and Siberian pea tree species. Both negative and positive records for all target scolytid species, as well as the new records for the non-target exotic species above, will be entered into the National Agricultural Pest Information System (NAPIS) data base.

Scolytus schevyrewi

The protocols and methodologies for the pilot project were reviewed in 2001, 2002, and early 2003. One result was to exclude port areas from survey after 2001. Such sites yielded very few specimens and experienced high rates of trap vandalism. Consequently, SWPM or urban forest sites were substituted. A major concern was the limited taxonomic resources for woodborer identification, posing the question of whether surveys should focus on a list of target species or whether all individuals of targeted families should be identified. IPPM has found using both approaches simultaneously to be most valuable. A target list provides focus and a measure of our effectiveness at exclusion and detection. However, important invasive species, e.g., *Scolytus schevyrewi*, will not be detected if only the presence or absence of a restricted list of target species is determined. In this pilot project, identification of all individuals of most wood-associated families led to the detection of one of the target species, the detection of a potentially important non-target species of scolytid, as well as many new records for non-target exotic woodborers, including both scolytids and cerambycids. These data indicate that the basic trapping protocols and methodologies used in the pilot test and combining both taxonomic approaches are effective strategies.



Dick Jackson searches for grasshopper egg pods in the Klamath Marsh area.

Grasshoppers

The clearwinged grasshopper, *Camnula pellucida*, was again in extremely high numbers in most areas of the Klamath Marsh, Klamath County, in 2003. This included neighboring pastures in forest clearings, both federal and private, adjacent to the Marsh. Populations exceeded 100 per square yard and egg deposition was rampant during the adult survey. On private lands, cattle were moved two months early because of exhausted pasture. U.S. Fish and Wildlife Service (F&WS) and USDA Forest Service (FS) lands were equally hard hit with pastures stripped and riparian areas defoliated. In some locations rushes and other wetland plants were severely damaged. ODA estimated that 22,500 acres private, 21,200 acres F&WS, and 4,480 acres FS land were infested. Unless a drastic shift to wet weather occurs this winter and in spring 2004, most pastures in and around the Marsh are expected to be at risk for severe grasshopper damage in 2004.

Grasshopper populations have built gradually during the past few years, then increased dramatically during 2002 and 2003. Based on ODA advice, private owners have baited emerging hatchlings for the past several years and one owner has aerially treated. However, favorable weather has allowed the grasshopper population to overwhelm these localized treatments. Economic numbers now occur from one end of the Marsh to the other. ODA worked with local landowners to organize an area-wide private control program, exclusive of federal involvement for 2004; if needed, ODA suggested that preparations be made to implement an aerial Dimilin RAATS (reduced agent area treatment) application seven to 10 days after hatch begins, probably in early June 2004.

Section three—Insect Pest Prevention and Management

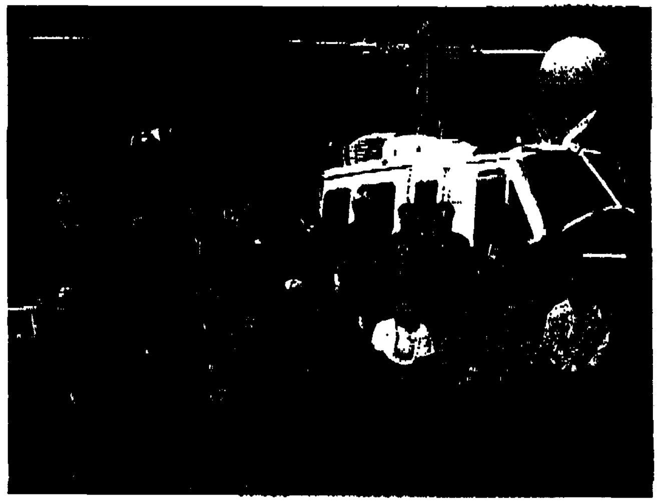
The clearwinged grasshopper continues to plague private managers in the Harney Basin of Harney County. Ranchers treated about 20,000 acres in 2003. However, grasshoppers from untreated adjacent areas continue to reinfest treated areas. *Cammula pellucida* is expected to become a pest in Lake County pastures again if weather remains favorable. Economic numbers are starting to appear in flood pasture from Silver Lake to Lakeview.

Other rangeland grasshopper species continue at non-economic levels in most eastern counties, with the exception of about 19,000 acres in northern Malheur County. *Melanoplus sanguinipes*, *Aulocara elliotti*, *Oedaleonotus enigma*, *M. foedus* and a few others occur in economic numbers. Mormon crickets, *Anabrus simplex*, are still not a problem in Oregon although neighboring states have been plagued for several years. Our survey technicians encountered no crickets, either solitary or in bands.

Gypsy moth

ODA maintains a high-level detection program for gypsy moth, *Lymantria dispar*, and its Asian strain (Asian gypsy moth). Early detection of gypsy moth introductions helps to keep eradication programs as small as possible. Twenty-eight gypsy moths were detected at nine new and one old site in 2003. Seventeen gypsy moths were trapped in the south hills area of Eugene where one moth was found in the same general area in 2002. Two gypsy moths were trapped in the parking lot of an industrial site in Gresham, where two moths were captured in 2002 and three in 2001. The rest of the moths caught in 2003 were single catches at new sites in Baker City (Baker County); Portland (Multnomah County); Eagle Creek, Estacada, and Sandy areas (Clackamas County); and Riddle (Douglas County). Seven of the nine new sites may be related to catches in the same general area in the previous year(s). All moths were submitted to the USDA Otis Methods Development Lab for genetic analysis and were determined to be the North American genotype. Two moths (Riddle, Douglas County and NE Portland, Multnomah County) bore a North American FS1 and an A1 mitochondrial DNA haplotype. The A1 mitochondrial DNA haplotype is common in Europe and central Russia and is also found at a low percentage in North American gypsy moth populations. Ten sites with single detections in 2001 and/or 2002 were negative in 2003.

ODA has conducted numerous gypsy moth eradication programs since 1981. These have ranged from large-scale aerial spray programs of 225,000 acres to ground application programs of 10 acres. Early detection of infestations has allowed eradication programs to become smaller and less costly, a benefit for everyone. Two consecutive years of negative delimitation trapping are needed before an investigation can be declared eradicated. Since no eradication programs were conducted in 2002, no sites were declared eradicated of gypsy moth in 2003. One gypsy moth eradication program was conducted in the spring of 2003 in a rural area near Fisher, Lincoln County. In 2002, three moths plus additional life stages were found at the home of a move-in from New York in 2000.



At the 2003 gypsy moth eradication site in the Fisher (Five Rivers) area, FAA and USDA FS and APHIS, PPQ cooperators join ODA staff and contractors Heli Jet Corp. and Henderson Aviation

Three treatments of *Bacillus thuringiensis* var. *kurstaki* (*Btk*) were applied in the spring of 2003 by helicopter to a 706-acre eradication area. Since the area was in or adjacent to the Siuslaw National Forest, environmental documentation and public comment periods had to meet both ODA and the U.S. Forest Service requirements. Many issues and challenges surrounded 2003's eradication program including: 1) successfully obtaining a National Pollutant Discharge Elimination System permit, the first time ever for a gypsy moth eradication program, 2) an unsuccessful search for an organic *Btk* product registered for use in forests, 3) concerns by some residents in or near the eradication area about potential impacts of the *Btk* sprays on their health and economic well-being, and 4) development of an environmental assessment and timelines meeting both ODA and USDA Forest Service requirements. Identification of several threatened and endangered species in the area complicated the process. No moths were found at this site in 2003.

SCOTT & MARGIE RUNELS

Arroyo Grande, Ca 93420
805-348-3243 or 805-478-7916

May 21, 2004

Klamath Marsh National Wildlife Refuge
Walt Ford, Refuge Manager
HC 63 Box 303
Chiloquin, Or 97624

Dear Walt,

As you know our property in the Klamath Marsh borders the Refuge. Grasshoppers don't respect fence lines, so when there is an infestation of grasshoppers in the area, it doesn't do any good for the private ranchers to treat them unless the Refuge treats them also. You have seen the video we took in 1994 of the grasshoppers flying from the Refuge onto private ground and the devastation it caused.

If the grasshoppers weren't treated it would be an economic disaster for the neighboring ranchers and us. We will be treating our ranch for grasshoppers this year as the need arises and we are requesting that the Refuge be a good neighbor and treat their grasshoppers also.

Sincerely,

Scott Runels

U.S. Department of the Interior May 21, 2004
Fish and Wildlife Service
Klamath Marsh National Wildlife Refuge
HC 63 Box 303
Chiloquin, OR 97624
Walt Ford,
Refuge Manager

Dear Walt:

I urge that the U.S. Fish and Wildlife Service/ Klamath Marsh National Wildlife Refuge actively participate in grasshopper control efforts in the areas South of Military Crossing Road. I am an adjacent landowner with several parcels over the fence of the Refuge

Last year on August 12, 2003 we had to remove all of our cows and calves due to the extremely heavy infestations and complete damge (loss of all pasture feed) caused by the grasshoppers. We had to move our cow herd to Klamath Falls area for the balance of the Season (August 12th thru November 8th, 2003). Finding pasture available was very difficult and expensive (wasn't the best feed either).

Therefore, as neighbors, we must treat

the grasshoppers on the Klamath Marsh and Refuge when the "economic threshold" occurs this Season.

Please alert and persuade the U.S. Fish and Wildlife Service to helpout and participate with us.

Sincerely,
Don Tompkins
Merrie L. Tompkins

Chiloquin, OR 97624
(541) 365-2260

Mosby Ranch

Brentwood, CA 94513

Mr. Walt Ford
Manager, Klamath National Wildlife Refuge
Chiloquin , Oregon

Dear Walt,

I am writing you to address the continuing problem with grasshoppers on the federal, as well as private lands in the Klamath Marsh area. After looking at the grasshopper egg beds on our parcels, and after talking with some of our neighbors, we believe that this year has the potential to have a real outbreak in grasshoppers. You may recall that when this has happened in the past, so much grass is destroyed on our grazing ground that we and others were forced to cut our animal grazing units back severely. This resulted in a serious economic hardship.

We all know that the grasshopper problem can be managed, but effective treatment is successful when everyone with grazing ground in the area participates. If certain areas are treated while other areas are not, the grasshoppers will flourish in the non treated areas and once again spread to the treated areas. Since the Refuge areas are such a huge part of the Klamath Marsh area, any effective plan to control the grasshoppers must include participation by the federal lands. Therefore, I am requesting your help as the federal representative on the Marsh. I am requesting that you participate with the private property owners and treat the appropriate federal ground for grasshoppers.

Time is of the essence, we know that if we treat early, the canola oil based treatment can be used. This of course is much less expensive and much more biocompatible than waiting for the adult grasshoppers to appear and be forced to use melathion. Please inform us of your decision and plan as soon as possible.

Respectfully,

Steve Mosby
Bar Y Ranch

United States Department of the Interior

FISH AND WILDLIFE SERVICE
KLAMATH BASIN NATIONAL WILDLIFE REFUGES
ROUTE 1, BOX 74
TULELAKE, CA 96134

COMMERCIAL (916) 667-2231 FAX (916) 667-3299

June 9, 1994

Gary Smith, Officer in Charge
USDA, APHIS PPQ
Airport Business Center
6135 N.E. 80th Avenue, Suite A-5
Portland, Oregon 97218-4033

Dear Mr. Smith:

Klamath Basin Refuges has received a letter from landowners (Klamath Marsh Grasshopper Committee) of northern Klamath County adjacent to Klamath Marsh National Wildlife Refuge requesting our participation in a grasshopper control effort (copy attached).

Could you please validate their expressed concern by providing this office with a written assessment of the problem, infestation levels, and specifics on any control measures including control options you deem necessary. Also, since the Refuge is on the periphery of the infested area, could you give us a determination as to whether control on the Refuge is a critical component to success of the control effort.

The Refuge has no known resource need to control grasshoppers within our boundary. If we are to consider participation in a cooperative effort, we need to evaluate control methods, control options, effects on non-target species, including endangered species, as well as economic impacts on neighboring lands. Could you please provide as much of this information as is presently known.

The approval process involves preparation of a Pesticide Use Proposal, Compatibility Determination, Internal Section 7 Consultation, and a brief Environmental Assessment. I realize that time frames may be critical and we would prepare and process these documents through our Regional Office as quickly as possible. Nevertheless, approval is dependent upon proper review of these documents even in emergency situations.

Sincerely,

Gary A Hagedorn

Gary A. Hagedorn
Acting Refuge Manager

Attachment

United States Department of Agriculture

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Airport Business Center
N.E. 80th Avenue Suite A-5
Portland, OR 97218-4033

June 14, 1994

Gary A. Hagedorn, Acting Refuge Manager
USDI, Fish and Wildlife Service
Klamath Basin National Wildlife Refuges
Route 1, Box 74
Tulelake, CA 96134

Dear Gary:

This letter is in response to your request for information regarding the grasshopper infestation problem in Klamath Forest National Wildlife Refuge and adjacent private rangeland.

Infestations of the clearwinged grasshopper, Camnula pellucida are a recurring problem in the high desert pastures of Southeast Oregon. These outbreaks are associated with drought conditions and occur about every seven to ten years. Extremely high numbers of this grasshopper hatch in egg beds that may contain as many as 10,000 per square foot. These incredible numbers cause the newly hatched grasshoppers to move away from the egg beds in search of forage. The young grasshoppers continue to move about throughout their nymphal stages, consuming large amounts of green vegetation. The adults are strong fliers and may migrate long distances in huge swarms. In a short time they will infest all suitable habitat in a given area. (See enclosed species fact sheet.)

Experience with this grasshopper in Harney, Lake, and Klamath Counties has shown that area-wide spray programs are effective in controlling these outbreaks. We have found through experience in all three counties that treatment must be timely, that is before egg laying commences, and it must include all of the infestation that is practicable. Omitting sizable areas of untreated lands leads to rapid reinfestation by immatures and adults. A case in point was the 1993 control program in Klamath Marsh. Although control was excellent within this treatment block, reinfestation occurred quickly from adjacent non-treated lands including the refuge.

Available grasshopper control options are addressed in the EIS and Site Specific Environmental Assessment for Klamath and Lake Counties, #OR-04-94, dated November 24, 1993. These options include the use of carbaryl spray or bait, malathion spray, acephate spray, and Nosema bait. Nosema bait was eliminated from consideration in Klamath Marsh based on recommendations from the grasshopper IPM project. (See enclosed document titled, Technical Review of the Utility of Nosema locustae in the Suppression of Rangeland Grasshoppers.)

In addition, we feel it is not practical to consider large areas for ground bait treatments. In rough terrain, such as the refuge, it is not possible to maintain a constant speed, therefore proper calibration and application cannot be assured. While ATVs with mounted bait spreaders are excellent for treating small sensitive areas, the rough terrain and their small capacity limit their use in this situation. Roughly 3,600 acres will need treatment, and at best an ATV will treat 40 acres per day.

Sincerely,

Gary G. Smith
Plant Health Director

2 Enclosures

MT. SCOTT RANCH

CHILOQUIN, OR 97624
503-365-2237

6/9/94

GARY HAGEDORN
US FISH AND WILDLIFE
RT. 1 BOX 74
TULELAKE, CA 96134

DEAR GARY,

THE RANCHERS IN THE KLAMATH MARSH ARE REQUESTING YOUR CO-OPERATION IN SOME TYPE OF GRASSHOPPER CONTROL ON THE KLAMATH MARSH WILDLIFE REFUGE.

IF THE WILDLIFE DOESN'T PARTICIPATE THE APHIS WILL NOT PROVIDE A SPRAY PROGRAM FOR THE RANCHERS. IF NOTHING IS DONE THE GRASSHOPPERS WILL WIPE US OUT IN JUST A FEW WEEKS.

WE NEED YOUR HELP AND CO-OPERATION. THANK YOU.

SINCERELY,

Scott Runels

SCOTT RUNELS, CHAIRMAN
KLAMATH MARSH GRASSHOPPER COMMITT

mbr

Attachment 2. Past use of biological controls, Klamath Marsh National Wildlife Refuge

Nosema locustae—In 1994, the biological control agent *N. locustae* (a microbial agent registered for use) was combined with carbaryl bran bait in an effort to introduce this agent into the population. Following treatment, grasshopper samples were collected from seven random sites within the Refuge. Collections were made prior to treatment and again 10, 14, 21, 28, 35, and 42 days post treatment. Analysis was conducted at the Rangeland Insect Laboratory, USDS/ARS, Montana State University, Bozeman (Street 1995).

No *Nosema* spores were detected in grasshopper samples after 28, 35, and 42 days post-application (*Nosema* spores are only detectable after 21 days post-application (Henry 1971). However, Street (1995) felt these results were not surprising given the very low ratio of *Nosema* to Carbayrl in the bait (1:10), the extreme densities of grasshoppers (100/yd^2), and the relatively older ages of grasshoppers at treatment (50% adults and 50% 5th instar). Street (1995) recommended that treatment should be applied to hatchlings or later instars with *Nosema*, Carbaryl, or a *Nosema*/Carbaryl mix (presumably with a higher ratio of *Nosema* to Carbaryl.

Vaughn et al. (1991) in a review of the utility of *N. locustae* for grasshopper control concluded:

> "*N. locustae* has been shown to induce measurable reductions in grasshopper longevity, fecundity, and consumption rates under controlled conditions in laboratory and field cages. There are also numerous examples from Canada and the United States which indicate that it is possible to obtain significant reductions in grasshopper numbers and damage under field conditions. However, the results are not consistent. Reports of apparent failure also exist and many of the "testimonial-type" data are suspect. ..."
>
> "As long as insecticides are available which provide high levels of control (70-95% is normal), control by *N. locustae* (30-40% under the best of conditions) will appear inadequate to ranchers and other concerned with economic, reliable grasshopper suppression. Until the basis for the inconsistencies are better understood, *N. locustae* should be reserved for areas where high levels of control are not essential, or where chemical insecticide usage is not a viable option."

Beauveria bassiana—In 1995, caged studies of *Beauveria bassiana*, a fungal pathogen, were conducted at Klamath Marsh NWR (Foster et al. 1995). The results of these studies indicated that 5 and 10 lbs/acre of this bio-control were 69% and 72% as effective as the carbaryl bran bait at the same application rate. Mortality of caged grasshoppers did not become significant compared to untreated controls until 25 days post-treatment. Foster et al. (1995) noted, however, that relatively high mortality rates observed in caged studies have not been observed in field studies and speculated that solar radiation may degrade the product prior to consumption by grasshoppers.

Entomophaga grylli—In 1995, experimental releases of *Entomophaga grylli* were conducted on Klamath Marsh NWR in the hope of introducing this fungus for long-term grasshopper control (Sanches-Pena et al. 1995). This particular fungal species was not previously present on Klamath Marsh NWR but has been shown to cause significant epizootics in *C. pellucida* in Arizona, New Mexico and other areas of North America (Carruthers et al. 1995). Following the release of 2,670 infected grasshoppers, adults were collected later in summer, none of which showed signs of infection. Sanchez-Pena et al. (1995) did determine that infected grasshoppers that were released showed signs of producing resting spores which should be capable of over-wintering. Follow-up studies in 1996 to determine whether this fungus had established itself in the general population were not conducted due to lack of funding, however, it is doubtful this organism, if still present, is currently controlling grasshopper numbers. Adult surveys in late summer of 2002 indicate large numbers of adult grasshoppers established egg beds on a 6,000 acre area at the northeast portion of Klamath Marsh NWR.

Protozoan parasites—During the 1994 grasshopper outbreak, a previously unknown protozoan parasite was identified in captured grasshoppers. Street (1995) in studies of this parasite found it to be moderately virulent to *C. pellucida* and relatively host specific. In 1995 an augmentative release of the parasite was conducted on Klamath Marsh NWR to determine if applications of this parasite to grasshopper concentrations could provide some measure of control (Street 1995). Street (1995) concluded that disease transmission occurred as a result of the release but the rapid dispersal of adults limited a determination of effectiveness.

Literature Cited

Carruthers, R. L, M. Ramops, T. Larkin, and R. S. Soper. 1995. The *Entomophaga grylli* (Fres). Batko species complex: its biology, ecology, and use in the biological control of range grasshoppers. Canadian Entomologist

Foster, R. N., K. C. Reuter, L. Black, J. Britton, G. Smith and G. Brown. 1995. Effect of Beauveria bassiana baits on the grasshopper *Camnula pellucida* (Scudder) on rangeland: A probative Beauveria bassiana bait study, Final summary report. USDA/APHIS/PPQ, Portland, Oregon. 13 pp.

Henry, J. E. 1971. Experimental application of *Nosema locustae* for control of grasshoppers. J. Invertebr. Pathol., 18:389-394.

Sanchez-Pena, S, M. Cummings, J. Correa, C. Carvajal-Cazola, and J. Gomez-Ruiz. Release of Entomophaga grylli Pathotype I in the Klamath Marsh National Wildlife Refuge. U.S.D.A. Agricultural Research Service, Bilogical Contorl of Pests Research Unit, Weslaco, Texas, 7 pp.

Street, D. A. 1995. Augmentative release of a protozoan parasite found *in Camnula pellucida* from Klamath Marsh, Oregon in 1995. Report to USDA/APHIS from USDA/ARS Rangeland Insect Laboratory, Bozeman, Montana, 6pp.

Vaughn, F. L., W. M. Brooks, T. L. Couch, J. L. Capinera, and J. V. Maddox. 1991. Review of the utility of Nosema locustae in the suppression of rangeland grasshoppers. USDA/ARS, Insect Biocontrol Laboratory, Beltsville, Md. 10pp.

Attachment 3. Finding of No Significant Impact – Control of Clearwing grasshoppers at Klamath Marsh NWR and Adoption Memo.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

TAKE PRIDE IN AMERICA

Klamath Basin National Wildlife Refuges
4009 Hill Road
Tulelake, CA 96134

IN REPLY REFER TO:

Telephone: (530) 667-2231 **Fax. (530) 667-3299**

MEMORANDUM

Date : June 22, 2004

To : Files

From : Project Leader, Klamath Basin NWRC

Subject: NEPA Compliance for Grasshopper Control at Klamath Marsh NWR

Ranchers adjacent to the Klamath Marsh NWR have requested that the FWS undertake control of grasshoppers on the refuge in 2004 in order to prevent re-infestation of their private lands, which they have all treated, at their own cost, in a coordinated effort by spraying all known egg beds on their private lands with an aerial application of dimilin.

Consequently, the FWS, Klamath Basin Refuges analyzed this request through the Compatibility Determination (CD) process, which included soliciting public comment on a draft CD.

The Service proposes to treat up to 10,000 acres of grasshopper egg beds in 2004 using aerial and/or ground applied carbaryl bran bait under a reduced area agent treatments (RAATs) program. The exact acreage and location to be treated will be determined upon completion of spring egg bed surveys by APHIS. Following treatment in 2004, the Service proposes to implement a long term IPM approach similar to that envisioned in 1995. An IPM approach incorporating the goals and strategies outlined in the final CD should reduce the acres treated, the severity of future outbreaks, and the potential for negative environmental effects.

In implementing grasshopper control treatments, both in 2004 and in the future, the refuge would request the assistance of USDA Animal and Plant Health Inspection Service (APHIS). Consequently we have reviewed the *Site-Specific Environmental Assessment, Rangeland Grasshopper and Mormon Cricket Suppression Program, Oregon, Klamath County, March 8, 2004* prepared by APHIS, Portland, Oregon which is tiered to *Rangeland Grasshopper and Moron Cricket Suppression Program, Final Environmental Impact Statement - 2002* prepared by APHIS Riverdale, MD. We believe the EA adequately addresses alternatives, environmental effects and other National Environmental Policy Act (NEPA) relevant issues. We therefore adopt and incorporate that EA by reference.

Additional documents that have been prepared to review this proposed action include a

Compatibility Determination, a NEPA Finding of No Significant Impact, a Section 7 determination pursuant to the Endangered Species Act and a Pesticide Use Proposal for aerially and ground applied carbaryl bran bait.

Ron Cole
Project Leader

U.S. FISH AND WILDLIFE SERVICE

Finding of No Significant Impact

Klamath Marsh National Wildlife Refuge – Control of Clear-winged Grasshoppers

Klamath Marsh National Wildlife Refuge
Klamath Basin National Wildlife Refuge Complex
4009 Hill Road
Tulelake, CA 96134

The U.S. Fish and Wildlife Service proposes to:

Treat up to 10,000 acres of grasshopper egg beds in 2004 using aerial and/or ground applied carbaryl bran bait under a reduced area agent treatments (RAATs) program. RAATs, is a recently developed grasshopper suppression method in which the rate of insecticide is reduced from conventional levels, and treated swaths are alternated with swaths that are not treated. The RAATs strategy relies on the effects of an insecticide to suppress grasshoppers within treated swaths while conserving grasshopper predators and parasites in swaths not treated. Thus, RAATs has both a direct grasshopper suppression component and a biological control component, ie natural grasshopper predators and parasites are maintained in untreated swaths. U.S. Fish and Wildlife Service Policy (7 RM 14.1) allows for control of native pest populations where damage to private property occurs and if the planned control program is compatible with refuge purposes.

The exact acreage and location of treatment will be determined upon completion of spring egg bed surveys. The relatively large acreage of coverage of the 2004 program is a result of insufficient funds and manpower to properly coordinate and treat the outbreak in its initial stages. Following treatment in 2004, the Service proposes to implement a long-term IPM approach. An IPM approach incorporating the goals and strategies below should reduce the acres treated, the severity of future outbreaks, and the potential for environmental effects.

Program goals:

1. Suppress grasshopper populations, produced from Refuge lands, that may damage private property. Target is to reduce populations to below economic threshold levels of 12-24/yd^2.
2. Minimize land area being treated by locating and treating egg beds in a timely manner.
3. Minimize impacts to non-target biological resources by utilizing buffer areas adjacent to sensitive habitats, biological controls when and where appropriate, a RAATS application method, and the most target-specific insecticides possible.

4. Coordinate treatment and scouting activities with APHIS, ODA, and local landowners, thus minimizing the potential for large aerial treatment programs on both Refuge and private lands, such as has occurred in the past and is likely in 2004.
5. Monitor potential effects of control actions such that treatment activities are refined and improved as new information is gathered.
6. Ensure the program is consistent with the Endangered Species Act and is compatible with the purposes for which Klamath Marsh NWR was established and the mission of the NWRS.

Program strategies:

1. Coordinate and conduct with APHIS, ODA, and local landowners late summer adult and spring egg bed surveys to locate egg beds on both Refuge and private lands. Because *C. pellucida* is capable of long distance flight, across land ownerships, a coordinated approach is desirable.
2. Ground treat egg beds on Refuge lands (mid-May to mid-July) with carbaryl bran bait (0.5/lbs active ingredient per acre) or diflubenzuron (Dimilin) (0.012 active ingredient/acre). The objective is to reduce grasshopper populations below economic thresholds, not to eradicate the population. Efficacy monitoring in 1994 and 1995 indicated a control rate of 75-80% using carbaryl bran bait. In addition to insecticide treatments, the Service will continue to explore the utility of biological controls particularly in years of low grasshopper populations. It is hoped that introduction of biological controls to the population will reduce severity and/or periodicity of outbreaks (it is important to note, however, that an unsuccessful biological control program, particularly in years of large grasshopper populations, may necessitate a much larger follow-up aerial application program utilizing insecticides).
3. As needed, meet with APHIS, ODA, local landowners, and the public to discuss past and potential future grasshopper control needs, monitoring information, and other issues as appropriate.
4. If the above measures are not successful in reducing grasshopper populations to below economic thresholds and outbreaks exceed the ability to treat using ground based equipment, the Service may treat using aerial application of Dimilin or carbaryl bran bait using the RAATS method.

In support of the proposed action, the Service has adopted APHIS's 2004 Site Specific EA for Klamath County, Oregon (copies available at http://www.oda.state.or.us/Plant/ppd/Ent/gh/index.html, and at United States Dept. of Agriculture, Plant Protection and Quarantine, Airport Business Center, N.E. 80th Avenue Suite A-5, Portland, OR 97218-4033). This site-specific EA for Klamath County, Oregon is tiered to APHIS's Final Environmental Impact Statement (FEIS) for control of Mormon crickets and grasshoppers in the 17 Western States (dated June 21, 2002) (copies available at http://www.aphis.usda.gov/ppd/es/gh.html, and the above address). A detailed description of alternatives and potential impacts of these alternatives is described in both documents.

The Service has analyzed a number of alternatives to the proposal, including the following:

1. No Action – no treatment of grasshoppers at Klamath Marsh NWR.
2. Insecticide applications at conventional rates and complete area coverage.
3. Reduced agent area treatment (RAATs) (Preferred Alternative).

The proposal was selected over the other alternatives because:

The Service selected Alternative 3. Reduced agent area treatments (RAATs) with ground or aerial application of carbaryl bran bait or Dimilin and treatment of egg beds as the preferred alternative because:

1. Total area treated and amount of insecticide used is minimized.
2. Untreated swaths preserve the natural diversity of insects on the Refuge.
3. Untreated swaths preserve natural predators and parasites of grasshoppers (biological control).
4. Dimilin and carbaryl bran bait are the most target specific insecticides available, thus minimizing potential effects to other species.
5. Toxicity of Dimilin and Carbaryl to most refuge wildlife and plants is extremely low.

Implementation of the preferred alternative would be expected to result in the following environmental and socioeconomic effects:

Environmental

1. Some wildlife species would be temporarily displaced in localized areas during program activities.
2. Some larval aquatic and terrestrial insects may be killed; however, effects are expected to be temporary and localized.

Socioeconomic

1. Damage to adjacent private ranch lands will be reduced.
2. Potential effects to workers or the public are negligible.
3. A short-term disruption of tribal subsistence hunting may occur in localized areas.

Measures to mitigate and/or minimize adverse effects have been incorporated into the proposal. These measures include:

1. No treatment buffers for ground application of carbaryl bran bait and Dimilin adjacent to water are 50 ft.
2. No treatment buffers to water for aerial application of carbaryl bran bait will be 200 ft.
3. No treatment buffers to water for aerial application of Dimilin will be 500 ft.
4. All treatment activities will be consistent with applicable agency consultations under Section 7 of the Endangered Species Act.
5. Aerial application of Dimilin will only occur in wind speeds less than 10 mph.
6. Additional measures to minimize potential adverse effects are listed in APHIS's 2004 Klamath County, Oregon EA, Appendix 1: "FY-2004 Guidelines for Treatment of Rangeland for Suppression of Grasshoppers and Mormon Crickets".
8. The Klamath Tribes will be consulted prior to any treatment programs.

The proposal is not expected to have any significant effects on the human environment because:

The proposal is not expected to have any significant effects on the human environment because carbaryl bait and Dimilin have low toxicity to birds and mammals, low environmental persistence, application rates are low and sensitive habitats are excluded from treatment activities. In addition, the reduced application rates and coverage of the RAATs application method will result in no long-term and minimal short-term impacts to the Refuge's terrestrial and aquatic invertebrate communities.

Therefore, it is my determination that the proposal does not constitute a major Federal action significantly affecting the quality of the human environment. As such, an environmental impact statement is not required. APHIS has prepared an environmental assessment, which the Service has adopted, in support of this finding. This document is available at http://www.oda.state.or.us/Plant/ppd/Ent/gh/index.html, and at the United States Dept. of Agriculture, Plant Protection and Quarantine, Airport Business Center, N.E. 80th Avenue Suite A-5, Portland, OR 97218-4033). A copy is also available upon request at the FWS facility identified above.

Reference: Klamath Marsh National Wildlife Refuge – Control of Clear-winged grasshoppers

Acting California/Nevada Operations Manager

22 June 04
Date

U.S. FISH AND WILDLIFE SERVICE

Environmental Action Memorandum

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the action of:

Control of clear-winged grasshoppers on Klamath Marsh National Wildlife Refuge

is found not to have significant environmental effects as determined by the attached Environmental Assessment and Finding of No Significant Impact.

Other supporting documents:

Rangeland Grasshopper and Mormon Cricket Suppression Program, Final Environmental Impact Statement – 2002, Aminal and Zplant Health Inspection Service, U.S. Department of Agriculture, 4700 River Road, Unit 134, Riverdale, Maryland 20737 – 1236

Endangered Species Concurrence on Effects Determination for Listed Species on Klamath Marsh National Wildlife Refuge from Proposed Grasshopper Suppression Project, Memo from Project Leader, U.S. Fish and Wildlife Service, Klamath Falls, Oregon to Project Leader, Klamath Basin National Wildlife Refuge, dated June 17, 2004

Intra-Service Biological Evaluation, Control of Clearwing grasshopper outbreaks at Klamath Marsh National Wildlife Refuge, U.S. Fish and Wildlife Refuge, Klamath Basin National Wildlife Refuge, Tulelake, California.

Recommended:

(1) Ron Cole 6-22-04
Project Leader Date

(2) [signature] 6/22/04
acting - Refuge Supervisor Date

(3) [signature] (acting) 22 JUNE 04
California/Nevada Operations Manager Date

Attachment 4. Endangered Species Act, Section 7 Compliance for grasshopper control program at Klamath Marsh NWR

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Klamath Falls Fish and Wildlife Office
6610 Washburn Way
Klamath Falls, OR 97603
(541) 885-8481 FAX (541) 885-7837

In Reply Refer To:
1-10-04-I-159
x ref. 1-10-04-I-128

Memorandum

JUN 17 2004

To: Project Leader, Klamath Basin National Wildlife Refuge
Tulelake, California

From: Field Supervisor, Klamath Falls Fish and Wildlife Office,
Klamath Falls, Oregon
Curt Mullis

Subject: Concurrence on Effects Determination for Listed Species on Klamath Marsh National Wildlife Refuge from Proposed Grasshopper Suppression Project

The Klamath Falls Fish and Wildlife Office has reviewed your request for concurrence that the referenced action may affect but is not likely to adversely affect the federally threatened bald eagle (*Haliaeetus leucocephalus*)and is not likely to jeopardize the Oregon spotted frog (*Rana pretiosa*), a federal candidate species.

Your request, with the attached biological assessment containing effects determinations for impacts to these species, was received by us on June 11, 2004. Our comments are provided in accordance with section 7 of the Endangered Species Act (87 stat. 884 as amended; 16 U.S.C. 1531 *et. seq*.).

We concur with your determinations and have indicated our concurrence by signing the appropriate signature block on page 13 of your Biological Assessment (attached). If you have any questions regarding this informal consultation and concurrence please contact me or Doug Laye of my staff at (541) 885-8481.

Attachment

cc: Dan Brown, FWS, Portland, OR
Ron Swann, DOI, Portland, OR

United States Department of the Interior

FISH AND WILDLIFE SERVICE

KLAMATH BASIN NATIONAL WILDLIFE
REFUGES
4009 HILL ROAD
TULELAKE, CALIFORNIA 96134

TELE: (530) 667-2231

FAX: (530) 667-3299

June 11, 2004

Memo to: Curt Mullis, Project Leader, Klamath Falls Field Office

From: Ron Cole, Project Leader, Klamath Basin National Wildlife Refuge

Subject: Concurrence for grasshopper control program at Klamath Marsh NWR

Attached is a Biological Assessment for the clear-winged grasshopper control program at Klamath Marsh NWR. This assessment covers the bald eagle (threatened), and consistent with Service policy, the Oregon spotted frog (candidate species). I hereby request your concurrence for the Refuge's determination of "may effect but not likely to adversely affect" (bald eagle), and "not likely to jeopardize the species" determination for the Oregon spotted frog. If you have any question(s) relative to the Biological Assessment, please contact myself or Dave Mauser.

INTRA-SERVICE BIOLOGICAL EVALUATION

Originating person: Dave Mauser
Telephone number: 530-667-2231
Date: June 10, 2004

I. Region: Region 1.

II. Service Activity (Program): Refuges and Wildlife

III. Pertinent Species and Habitat:

A. Listed species and/or their critical habitat within the action area:

Bald eagle

B. Proposed species and/or proposed critical habitat within the action area:

None

C. Candidate species with the action area:

Oregon spotted frog

D. For locations of spotted frogs at Klamath Marsh NWR, see Figure 1.

IV. Geographic area or station name and action:

Control of clearwing grasshopper outbreaks at Klamath Marsh NWR

V. Location: See Fig. 1

A. Ecoregion Number and Name: Klamath/Northcoast Ecoregion

B. County and State: Klamath County, Oregon

C. Section, township, and range (or latitude and longitude):

Location is within the Klamath Marsh National Wildlife Refuge

D. Distance (miles) and direction to nearest town:
Klamath Marsh NWR is located approximately 20 miles north of Chiloquin, OR

E. Species and habitat occurrance:

Bald eagle--The bald eagle (Haliaeetus leucocephalus) was federally listed on February 14, 1978 as an endangered species in all of the conterminous United states except Minnesota, Wisconsin, Michigan, Oregon, and Washington, which it was classified as threatened. (U.S. Fish and Wildlife Service 1986). A general description of the ecology and threats to the Pacific population of bald eagles can be found in the Pacific Bald Eagle Recovery Plan (U.S. Fish and Wildlife Service 1986) and the 2001 Biological Opinion for operation of the Klamath Reclamation Project (U.S. Fish and Wildlife Service 2001).

Nine bald eagle (*Haliaeetus leucocephalus*) nests exist on the perimeter of Klamath Marsh, including the Refuge as well as U.S. Forest Service and private lands (Isaacs and Anthony 2002). Bald eagles typically have 1-3 nests within their territory thus not all nests are occupied in any given year. Success of the eagle nests adjacent to Klamath Marsh NWR is depicted in Table 1.

Spotted Frog (Candidate species) - AmphibiaWeb (2003) reports:

> "The Oregon spotted frog once occurred from southwest British Columbia through western Washington and Oregon into northeastern California. Today the species is known from three localities in British Columbia, four localities in Washington and approximately twenty-four localities in Oregon (Marc Hayes pers. comm.), (McAllister and Leonard 1997; Green et al. 1997). In Washington, it occurs at elevations ranging from 40 to 620 meters (McAllister and Leonard 1997).
>
> Oregon spotted frog populations occur in association with relatively large wetland complexes. Breeding occurs in shallow, relatively unshaded emergent wetlands. The breeding ponds, which are typically dry by mid- to late summer, range in depth from 2 to 14 inches during the breeding season, and are vegetated by low-growing emergent species such as grasses, sedges (*Carex* spp.), and rushes (*Juncus* spp). After breeding adults disperse into adjacent wetland and riparian habitats. Adults remain active year-around near sea-level, but freezing temperatures apparently cause adults and juveniles to hibernate in streams, oxbows and springs at higher elevations."

Additional species life history information for the Oregon spotted frog can be found at http://amphibiaweb.org/. The Oregon spotted frog exists in the Klamath Basin and Upper Klamath River at elevations between 4,000 and 4,400 feet. Hayes (1994a) states "Klamath Basin historically harbored more shallow warm-water marshland, the habitat likely most suited to the Oregon spotted frog, than in any other area of the state [Oregon]". Changes in historic wetlands in the Klamath Basin have undoubtably impacted the species. In addition to habitat modification, exotic warm water species such as the bullfrog (Rana catesbeiana) are also believed to have impacted the species (Hayes 1994b). Surveys of Spotted frogs in the Oregon portion of the Basin found frogs at several locations including Wood River Ranch, Buck Lake, Jack Creek, Fourmile Creek, Upper Williamson River, and Klamath Marsh NWR.

Klamath Marsh NWR is believed to have one of the largest populations of the species in the Upper Klamath Basin. The Klamath Marsh NWR population can be roughly divided into 2 sub-populations. The first and largest population exists on the west side of the refuge and is associated with springs and spring fed creeks and ditches. The second population exists on the east portion of the refuge in the vicinity of the Williamson River and its connecting ditches (Carpenter 2000). The Oregon spotted frog is not believed to occupy seasonally flooded habitats south of Military Crossing (North and South Marshes) and north of the Peninsula and Sage Brush Point. Locations where spotted frog adults, juveniles, and egg masses have been detected are depicted in Figure 1.

Based on surveys conducted in 2000-2002, spotted frogs inhabit the following specific areas:

- Williamson River and all connected canals that hold water on a year-around basis
- Cholo Ditch and all connected year-around flooded canals
- Military Crossing Marsh north of Military Crossing
- Big Spring Creek
- Buck Pasture artesian wetland
- Loosely Spring
- Graveyard Ditch
- Pothole Spring
- Pat Kane Spring

VI. Description of proposed action:

Clearwing grasshoppers (*Camnula pellucida*) have a long history of periodic outbreaks on both public and private lands in and adjacent to Klamath Marsh National Wildlife Refuge (NWR). These outbreaks generally coincide with extended periods of drought. The clearwing grasshopper consumes primarily grasses and lays its eggs in communal egg beds (>10,000 eggs/ft^2 (Pickford 1966)) in late summer (Schell et al. 2003). Upon hatching (usually after mid-May) nymphs go through several molts and gradually disperse from egg beds in search of forage. Once flighted, adults migrate, often in large swarms in search of food. Large outbreaks of this native insect generally occur in 7-12 year cycles in Klamath, Lake, and Harney Counties(Street 1994) and generally exceed economic threshold levels of 12-24/yd^2 (G. Brown, APHIS, Portland, OR, pers. comm.). Densities of over 100 adults/yd^2 were found on Klamath Marsh in 1994 (Street 1994) and in 2003 (USDA/APHIS 2004). Outbreaks necessitating treatment of both refuge and private lands have occurred in 8 of the last 49 years including 1954, 1959, 1973, 1980-81, and 1993-95. With the exception of 1995, past outbreaks have been treated with aerial applications of insecticides that have covered 10,000 to 25,664 acres (total of public and private lands). The U.S. Department of Agriculture, Animal Plant Health Inspection Service (APHIS) has traditionally treated these outbreaks at the request of both public and private landowners.

Damage to private lands

U.S. Fish and Wildlife Service Policy (7 RM 14.1) allows for control of native pest populations where damage to private property occurs and if the planned control program is compatible with refuge purposes. In a 1993 outbreak, the Service elected not to treat grasshoppers on the Refuge and was blamed by local ranchers for re-infestations that occurred in 1994. As a result of the 1993 outbreak, the Service received tort claims for $60,998 from 4 local ranchers. The Regional Solicitor ultimately denied these claims because the Service acted within its discretion which fell within an exemption to the Federal Tort Claims Act (28 U.S.C. §§ 2671-2680). In 2004 the Refuge has again received letters from local ranchers and an assessment of the 2003 outbreak by APHIS indicates that damage in 2004 is likely.

Proposed grasshopper treatment program

Both recent outbreak periods (early 1990's and again in the early 2000's) illustrate the consequences of not treating in a coordinated fashion early in an outbreak period. In both cases treatment did not occur to egg beds during initial stages of outbreaks. As a result, the outbreak in the early 1990's required a large aerial program of insecticide application. **With this Biological Assessment, the Service proposes to treat up to 5,000 acres of grasshopper egg beds in 2004 using aerial or ground applied diflubenzuron (Dimilin) and/or carbaryl bran bait under a reduced area agent treatments (RAAT) program. The relatively large acreage of coverage of the 2004 program is a result of insufficient funds and manpower to properly coordinate and treat the outbreak in its initial stages. Following treatment in 2004, the Service proposes to implement a long-term IPM approach similar to that envisioned in 1995. An IPM approach will reduce the acres treated, the severity of future outbreaks, and the potential for adverse environmental effects.**

"RAATs, is a recently developed grasshopper suppression method in which the rate of insecticide is reduced from conventional levels, and treated swaths are alternated with swaths that are not treated. The RAATs strategy relies on the effects of an insecticide to suppress grasshoppers within treated swaths while conserving grasshopper predators and parasites in swaths not treated. .... The amount of area not treated (the untreated swath) under the RAATs approach is not standardized . In the past, the area infested with grasshoppers that remains untreated has ranged from 20 to 67 percent." (USDA/APHIS 2004)

Treatment program goals

1. Suppress grasshopper populations, produced from Refuge lands, that may damage private property. Target is to reduce populations to below economic threshold levels of 12-24/yd^2).
2. Minimize land area being treated by locating and treating egg beds in a timely manner.

3. Minimize impacts to non-target biological resources by utilizing buffer areas adjacent to sensitive habitats, biological controls when and where appropriate, a RAATS application method, and the most target-specific insecticides possible.
4. Coordinate treatment and scouting activities with APHIS, ODA, and local landowners, thus minimizing the potential for large aerial treatment programs on both Refuge and private lands, such as has occurred in the past and is likely in 2004.
5. Monitor potential effects of control actions such that treatment activities are refined and improved as new information is gathered.
6. Ensure the program is consistent with the Endangered Species Act and is compatible with the purposes for which Klamath Marsh NWR was established and the mission of the NWRS.

Treatment program strategy

To reach the goals of the program, the USFWS's treatment strategy is as follows:

1. Coordinate and conduct with APHIS, ODA, and local landowners late summer adult and spring egg bed surveys to locate egg beds on both Refuge and private lands. Because *C. pellucida* is capable of long distance flight, across land ownerships, a coordinated approach is desirable.
2. Treat egg beds on Refuge lands (mid-May to mid-July) with carbaryl bran bait and/or Dimilin. The objective is to reduce grasshopper populations below economic thresholds, not to eradicate the population. Efficacy monitoring in 1994 and 1995 indicated a control rate of 75-80% using carbaryl bran bait.
3. In addition to insecticide treatments, the Service will continue to explore the utility of biological controls particularly in years of low grasshopper populations. It is hoped that introduction of biological controls to the population will reduce severity and/or periodicity of outbreaks. It is important to note, however, that an unsuccessful biological control program, particularly in years of large grasshopper populations, may necessitate a much larger follow-up aerial application program utilizing insecticides.
4. As needed, meet with APHIS, ODA, local landowners, and the public to discuss past and potential future grasshopper control needs, monitoring information, and other issues as appropriate.
5. If the above measures are not successful in reducing grasshopper populations to below economic thresholds and outbreaks exceed the ability to treat using ground based equipment and carbyrl bran bait, the Service may treat using aerial application of Dimilin or carbaryl bran bait using the RAATS method. Detailed discussion of this method and the environmental effects of Dimilin are discussed in USDA/APHIS (2002) and USDA APHIS (2004). Because egg beds were not treated in the early 2000's, an outbreak in excess of 48,000 acres of private and public lands occurred in the summer of 2003. As a result, a large treatment program is likely in 2004.

In the long-term, it is expected that timely treatment of egg beds will result in far fewer acres requiring treatment both on and off-Refuge than has occurred in the past. For example, in 1995 (ground application of egg beds), 72% less acreage on the Refuge required treatment compared to 1994 (aerial application for adults), and for the entire Klamath Marsh including private lands, 85% less area was treated. The key to successful implementation of this strategy is locating egg beds, timely treatment programs and close coordination with APHIS, ODA, and adjacent private landowners.

Buffers to sensitive habitats

Chemicals proposed for use are carbaryl bran bait and Dimilin (diflubenzuron) both of which would be applied by air or ground as conditions warrant. Carbaryl bran bait would be applied at a rate of 10 lbs/acre (0.50 lb a.i.) of 5% bait per acre. Dimilin will be applied at 1.0 fluid ounce (0.016 lb a.i.) per acre. Actual application of both chemicals would be less under a RAATs treatment strategy. The following buffers would be employed to protect the Oregon spotted frog and the bald eagle.

Oregon spotted frog: Carbaryl bran bait and Dimilin applied from the ground would observe a 50 foot buffer to water. Aerial application of carbyrl bran bait would observe a 200 foot buffer and Dimilin applied via aircraft would observe a 500 ft buffer to water. All other application procedures would follow APHIS's 2004 guidelines (USDA/APHIS 2004).

Bald eagle: Consistent with the most recent Biological Opinion for APHIS's grasshopper control program in Oregon, a 1 mile no activity (ground or air access) buffer to active eagle nests will be observed with no aircraft fly-over during spray operations. Between 1 mile and 2.5 miles from active eagle nests (eagle foraging areas), a 0.25 mile buffer to water for aerial Dimilin will be observed. Within this 1-2.5 mile area from active eagle nests, ground applied Dimilin or carbaryl bran bait could be applied with a 50 ft buffer. Aerial application of carbaryl bran bait within this foraging zone would be allowed within 200 feet of water. Active bald eagle nests in any given year will be identified via surveys conducted by the Oregon Eagle Foundation and/or Service biologists.

APHIS is currently consulting with the Service regarding their nationwide grasshopper and Mormon cricket control program. When completed, measures within the Biological Opinion from this consultation will supercede measures to protect listed species identified in this Biological Assessment.

VII. Determination of Effects

A. Explanation of the effects of the action on listed species.

Monitoring carbaryl applications in 1994 and 1995

Thirty-five water samples were used to monitor an aerial application of carbaryl bran bait in 1994 (USDA/APHIS 1994). This particular application (aerial) required a 200 foot buffer to water and was monitored both pre- and post treatment. To determine whether the bran bait was reaching water, drift pans were placed as close to wetlands and canals as possible. In addition, dead grasshoppers were collected for analysis. No carbaryl bran bait was detected in the drift pans after application.

Of the water sampling sites (Big Spring Creek, Graveyard Ditch, and Pat Kane Spring) only Pat Kane Spring showed levels of carbaryl above the limits of detection (LD) (0.263 ppb). Surface and subsurface residues averaged between the LD and 2 ppb up to 2 days after application. Residues were not detected 6 days after treatment. The calculated half-life for this site was 2.6 days. Wind was described as "very strong" at the time of application. Residues in dead grasshoppers averaged 24.8 ppm at Pat Kane Spring, 34 ppm at Big Spring Creek, and 37.1 ppm at the Graveyard Ditch. Based on these results, USDA/APHIS (1994) concluded that effects to both aquatic vertebrates and invertebrates were minimal. Despite the presence of bran bait observed in the Graveyard Ditch, no residues at this site were detected.

In 1995, grasshopper egg beds at Klamath Marsh NWR were treated with ground applied carbaryl bran bait (0.5 lbs/acre active ingredient) with a 10 foot buffers to water. Monitoring took place only where application occurred within 100 feet or the slope of he land made contamination of water via runoff possible. In this application, no bran bait was observed floating on water. Because of the application pattern in 1995, only Sand Creek was monitored as treatment at this location occurred within 100 feet and up to 10 feet at some locations. Carbaryl residues of 0.585, 3.033, and 8.620 ppb (average = 4.08 ppb) were detected in the 3 samples collected. Based on recovery in a spike sample (80.5%), the calculated average concentration was increased to 5.10 ppb. The source of carbaryl reaching water was believed to be dust from the bran bait. USDA/APHIS (1995) did not believe these concentrations substantially impacted aquatic invertebrates. To provide an additional measure of protection, in 2004, and in future years, no treatment ground application buffers are increased to 50 ft.

Anticipated effects to spotted frogs (Carbaryl bran bait)--

> "Carbaryl bait acts faster than diflubenzuron. It kills adults and immature grasshoppers and other insects that feed on the bait. It has a broader spectrum of insecticidal activity than diflubenzuron, but must be ingested to be lethal. Therefore it is preferred over carbaryl or malathion sprays, in areas where foraging bees are a concern. It is the most costly option. It can be used effectively any time during the grasshopper season. In can be applied by air or ground. Carbaryl bait is applied in greater mass than any of the other treatments (up to 10 lbs. dry material per acre) and creates a greater logistical problem because of the amount of material which must be stored, transported and applied. Carbaryl bait can be applied by air in some situations when and where liquid insecticides cannot. Although no aerial applications of any insecticide can be conducted when wind speeds exceed 10 mph, carbaryl bait can be applied when air temperatures are too high to permit effective applications of sprays. Additionally, when terrain is too rough to maintain flying at the low altitude consistent with effective spray application, bait can be applied by flying at a safe altitude over the ground. Thus, the window of opportunity to apply bait is greater than for sprays. The carbaryl bait formulations approved for use by APHIS include products which impregnate carbaryl into wheat bran, rolled whole wheat, and pellets manufactured from grape and apple

pumice. In Oregon, wheat bran formulations would be preferred when treating *Camnula pellucida* with bait." (USDA\APHIS 2004).

Monitoring for carbaryl residues in water resulting from ground application of carbaryl in 1995, indicated that carbaryl was reaching water with a 10 foot no treatment buffer. Although concentrations were below those believed harmful to frogs and most of the invertebrate community, sample size was small and there was indication of a high degree of variability (>15 fold difference between highest and lowest value). However, APHIS's currently proposed no treatment buffers for carbaryl bran bait is 50 feet which should reduce or eliminate concentrations reaching water. Treatment of unflighted juvenile grasshoppers on egg beds should prevent grasshoppers from consuming the bait and moving long distances prior to death and falling into water as occurred in 1994. In addition, given a larger buffer of 50 ft, any potential effects to non-target terrestrial insects (food items to adult and juvenile frogs) in the vicinity of spotted frog habitat would be minimized. Carpenter (2000) seldom observed spotted frogs at Klamath Marsh NWR beyond 1 m from the waters edge.

Carbaryl LC50s (median lethal concentration) in water range from 2.5-6.2 ppm for frogs. The Environmental Protection Agency (EPA) recommends a threshold of 1/20 of the LC50 to screen for adverse effects in listed aquatic species. The Service has concluded that this risk analysis approach will produce effects determinations that reliably identify actions that are not likely to adversely affect listed species (USFWS and NMFS 2004). The 1/20th threshold would result in a value of 125 ppb to prevent impacts to frogs. A sub-lethal concentration of 160 ppb is believed to decrease the size of metamorphs in ranid frogs (Tony Hawkes, Environmental Contaminants Specialist, USFWS, Klamath Falls, pers. comm.). The maximum concentration observed in 1995 from 3 samples was 8.62 ppb, far below the 125 ppb threshold. Sampling in 1995 occurred in Sand Creek where carbaryl bran bait was applied within 100 ft of water and in some areas as close as 10 ft. In the currently proposed action, the minimum carbaryl bran bait buffer would be extended to 50 ft.

Median lethal dose (LD50) for bullfrogs, orally administered, is 4000 ppm yielding a 1/20 threshold of 200 ppm. Assuming frogs were consuming dead grasshoppers at the maximum observed concentration of 37.1 ppm, a frog would have to consume 5.39 times its weight in grasshoppers per day. Frogs being cold blooded and having a slower metabolism than warm blooded vertebrates would not be expected to consume food at this rate. This analysis assumes that spotted frogs are as sensitive to carbaryl as are bullfrogs.

No mortality of spotted frogs was observed by Refuge biologists in the 1994 or the 1995 treatment operations. In addition, Klamath Marsh currently supports one of the more robust populations of spotted frogs in the Klamath Basin, despite the previous treatment programs. Thus, given the five-fold expansion in no treatment buffers, indications of relatively low concentrations of carbaryl residues in waters in 1994 and 1995, no detected spotted frog mortalities, and the low likelihood of treated juvenile grasshoppers reaching water, the grasshopper control program as outlined above is not likely to effect and will not jeopardize the continued existence of spotted frogs at Klamath Marsh NWR.

Anticipated effects to spotted frogs (Dimilin)--

> "Diflubenzuron is a chitin inhibitor, and only kills grasshoppers or other insects when they are in their immature stages. It will not kill adult grasshoppers. It cannot be used late in the season because the grasshoppers are no longer molting, and thus not susceptible. In Oregon, the efficacy of diflubenzuron is notably decreased by the first week of July because of grasshopper maturity. This material would not normally be used after the third week of June, for most species of grasshoppers in Oregon. Insects usually die seven to ten days after treatment. Diflubenzuron is reported to have a residual activity against grasshoppers lasting up to 28 days. Diflubenzuron is less harmful to other insects, including pollinators, and is essentially harmless to vertebrates than the other insecticides. Diflubenzuron must be applied as a spray mixed with water and crop or vegetable oil. It is normally applied by air for grasshoppers on rangeland, but can also be applied by ground. It is the least costly option per acre treated. The formulation of diflubenzuron approved for use by APHIS is Dimilin 2L®. (USDA\APHIS 2004).

Dimilin is extremely toxic to the immature stages of aquatic invertebrates and is slighty toxic to practically non-toxic to fish. Chronic exposure of minnows to Dimilin did not did not have significant effects on survivability, growth, or reproduction during exposure for 10 months at a concentration of up to 0.10 ppm. Dimilin is practically non toxic to birds and mammals and is relatively non-toxic to honey bees (USDA/Forest Service 2004).

Using the Ag Drift model (Ag DRIFT 2001) and assuming a 50 ft ground application buffer, 0.016 lbs/acre a.i., very fine to fine droplet size, and 10 ft wide by 2 ft deep waterway, the model predicted drift would result in 0.116 ppb concentration in water. For aerial application with a 500 foot buffer, 10 mph cross wind, and a droplet distribution of aerosol to very fine, the Ag Drift model predicted drift to water would result in concentrations of 0.120 ppb in water. These concentrations are unlikely to effect birds, mammals, fish, or amphibians. However, effects to the more sensitive aquatic invertebrates are possible. Potential effects are believed to be short-term in nature due to the rapid generation time for these organisms. Effects to non-target insects (potential food items for frogs) is expected to be negligible due to the selective nature of Dimilin, ie. it targets larval insects which must molt prior to reaching adult stages. Thus, given the low toxicity of Dimilin to vertebrates, low concentrations predicted to reach water, and selective nature of Dimilin to insects, no effect to the Refuge's spotted frog population is anticipated. A more detailed risk assessment for diflubenzuron is attached as Appendix 1.

Anticipated effects to bald eagles-- The 1994 Intra-Service Biological Evaluation concluded that no affect to bald eagles would occur because the nearest nest to the treatment sites was over 2.5 miles distant. Subsequent environmental compliance documents related to grasshopper control inappropriately assumed that this distance represented a standard regulatory no treatment buffer area adjacent to eagle nests. In the Upper Klamath Basin the traditional no activity buffer adjacent to eagle nests has been a 400 m primary zone (no activities) and an additional 400 m secondary zone where activities are allowed if beyond line-of-sight of eagle nests. These buffers were recommended by the Pacific Bald Eagle Recovery Plan (U.S. Fish and Wildlife Service 1986) as well as McGarigal (1988) and Anthony and Isaacs (1989). Thus, the 1 mile buffer proposed for the grasshopper control program should result in few if any effects to nesting bald eagles. It is important to note that with the 800 meter regulatory standard, nesting bald eagles in the Klamath Basin are increasing in abundance and have exceeded recovery goals.

It is extremely unlikely that bald eagles would be effected by direct exposure to the carbaryl bran bait as it is not a contact insecticide and the small size and nature of the bran bait make it unavailable to foraging eagles. Bald eagles forage primarily on fish (Stalmaster 1987), waterfowl (Frenzel 1985), and small mammals (Keister 1981). The no treatment buffers to aquatic habitat and the treatment of unflighted juvenile grasshoppers should prevent treated grasshoppers from reaching water where they could be consumed by fish or waterbirds. Carbaryl does not exceed EPA levels of concern for direct acute or chronic effects in birds or fish (T. Hawkes, Environmental Contaminant Specialist, USFWS, Klamath Falls, OR, pers. comm.), thus the potential for dead or sick birds being available to foraging eagles is negligible. In addition, carbaryl levels found in dead grasshoppers as a result of the 1994 treatment (range of 24.8 - 37.1 ppm) were far below the LC50 for birds (5000 ppm) (Montague 2000). Because Dimilin is practically non toxic to birds and mammals (USDA/Forest Service 2004), effects to bald eagles are extremely unlikely. Therefore, during implementation of the above described grasshopper control program the chance of an adverse impact through direct or indirect exposure to bald eagles at Klamath Marsh NWR is discountable. Overall, a determination of May Affect but not likely to Adversely Affect is appropriate for both carbaryl bran bait and Dimilin and the respective treatment methods and buffers proposed.

B. Explanation of actions to be implemented to reduce adverse effects:

Oregon spotted frog:

- Carbaryl bran bait and/or Dimilin using a RAATs strategy will be used to minimize impacts to non target insects.
- No treatment buffer zones will be used to ensure that only minimal concentrations of Carbaryl and Dimilin reach water.
- Treatment of egg beds will ensure minimal acreage treated.
- Treatment of unflighted juvenile grasshoppers will ensure that poisoned grasshoppers do no fly to habitats occupied by spotted frogs.

- No treatment buffers and use of carbaryl bait and Dimilin will minimize potential impacts to the terrestrial insect community near spotted frog habitats.

Bald eagle:

- One mile no treatment buffer zones will ensure minimal disturbance to nesting eagles.
- Use of carbaryl bran bait will minimize the potential for consumption by water birds and small mammals used by eagles as forage items.
- No treatment buffers adjacent to water will eliminate or sharply reduce the potential for carbyrl bran bait and/or Dimilin to effect waterbirds.
- No treatment buffers and control activities on juvenile grasshoppers will ensure that killed grasshoppers do not reach water where they could become food for fish or waterbirds (potential forage for eagles).

VIII. Effect Determination and Response Requested: [* = optional]

A. Listed species/designated critical habitat:

Determination	Response requested
no effect/no adverse modification (Species: ____________________)	___ *Concurrence
May affect, but is not likely to adversely affect species/adversely modify critical habitat (Species: Bald eagle)	X Concurrence
May affect, and is likely to adversely affect species/adversely modify critical habitat (Species: ____________________)	___ Formal Consultation

B. Proposed species/proposed critical habitat

Determination	Response requested
no effect on proposed species/no adverse modification of proposed critical habitat (Species: ____________________)	___ *Concurrence
is likely to jeopardize proposed species/ adversely modify proposed critical habitat (Species: ____________________)	___ Conference

C. Candidate species:

Determination **Response requested**

not likely to jeopardize candidate species
(Species: Spotted frog) _X_ *Concurrence

is likely to jeopardize candidate species
(Species:_____________) ___ Conference

6-9-04
Date

Signature

[Title/office of supervisor at originating station]

IX. Reviewing ESO Evaluation

A Concurrence X **Nonconcurrence** ____

B. Formal consultation required ____

C. Conference required ____

D. Informal conference required ____

E. Remarks (attach additional pages as needed):

Curt Mullis — 17 June '04

Signature — Date

Field Supervisor
Klamath Falls Field Office

Reference 1-10-04-I-159
x ref. 1-10-04-I-128

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Personnel Communications

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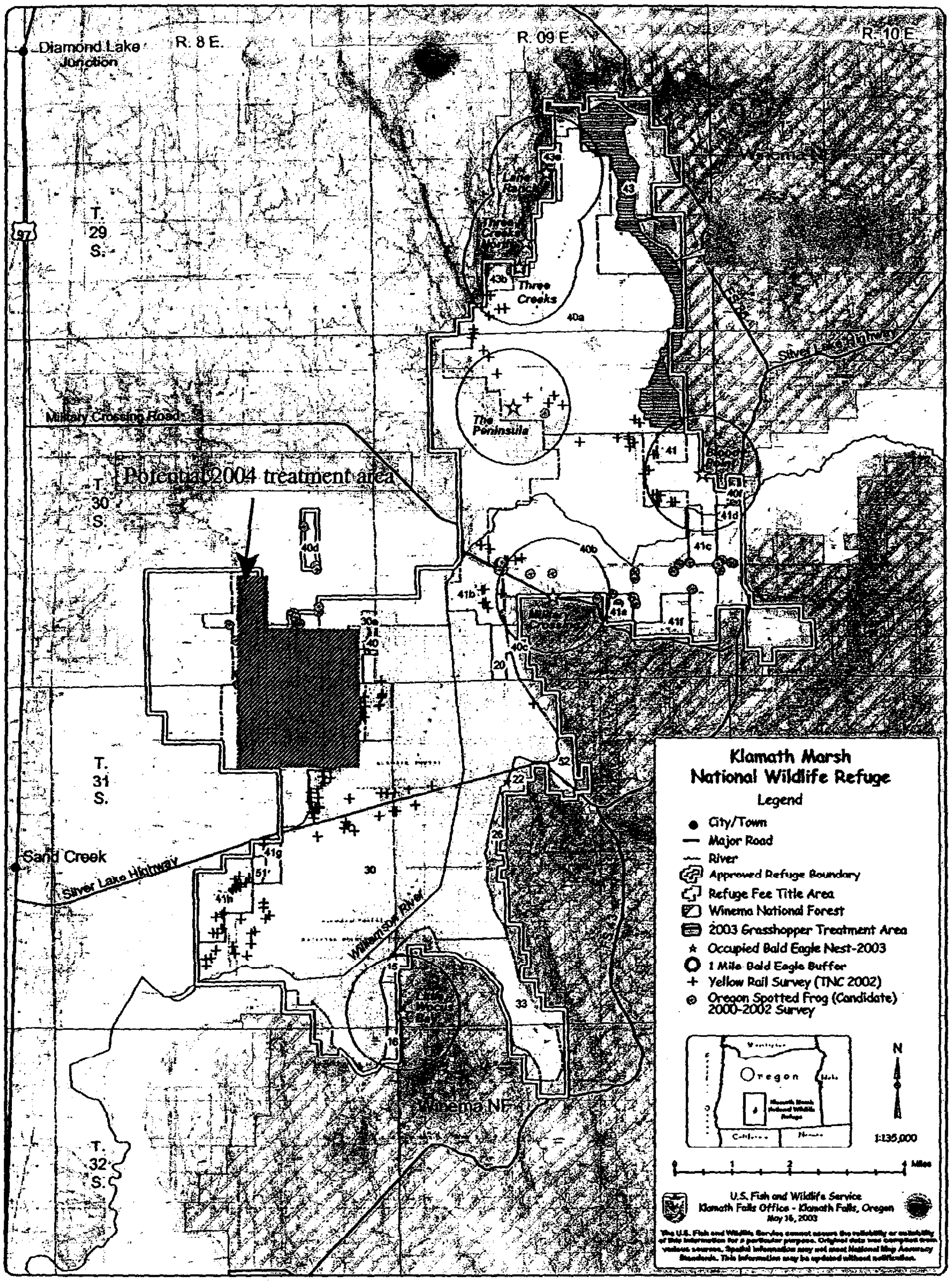

Fig. 1. Oregon spotted frog and bald eagle nest locations on Klamath Marsh National Wildlife Refuge, Oregon. Also depicted is potential 2004 treatment area.

Table 1. Bald Eagle Nest locations and Production Trends at Klamath Marsh NWR, 1978-2002. *

Nest Sites

Year	Kittredge	Lane	Military Crossing	Penninsula	Three Creeks	Wocus Bay	Little Wocus Bay	Soloman Flat	Sagebrush Point	Avg # Yg/Yr
1978						2				2
1979	O?	2				oF		oF		0.5
1980	F	2				F		F		0.5
1981	F	2				F		F		0.5
1982	F	1				1		F		0.5
1983	F	F				F		F		0
1984	1	2				1		oF		1
1985	1	1	1			1		F		0.8
1986	1	1	2			2		1		1.4
1987	2	F	2			2		2		1.6
1988	2	2	F		1	F		2		1.17
1989	2	1	1		1	oF		1		1
1990	2	2	2	1	2	1		1		1.57
1991	1	F	2	1	oF	1		1		0.86
1992	2	2	oF	F	1	F		2		1
1993	F	F	2	1	1	F	oF	1		0.63
1994	oF	2	F	F	A?	F	2	1		0.63
1995	2	F	2	oF	1	2	F	oF	oF	0.78
1996	oF	F	2	2	2	1	F	oF	oF	0.78
1997	1	oF	1	oF	2	F	F	2	2	0.89
1998	oF	1	3	2	2	oF	oF	1	oF	1
1999	oF	F	F	2	oF	oF	1	oF	oF	0.33
2000	oF	1	1	2	F	F	2	2	oF	0.89
2001	2	1	F	oF	F	oF	oF	1	oF	0.44
2002	oF	2	oF	1	1	F	oF	2	2	0.89
Avg # Yg/Site	0.79	1.04	1.17	0.92	1.07	0.56	0.5	0.83	0.5	0.87

F =active or nesting failure; nest with evidence of eggs, but no young raised.

oF=occupied or breeding failure; > 1 adult and a nest observed during the breeding season; no evidence of eggs or young.

A? = active, outcome unknown; evidence of eggs observed, outcome not determined.

1,2,3 = 1,2 or 3 nestlings > 4 or 5 weeks old present when the nest was last observed; partly featherd and feathered.

O? = occupied, outcome unknown:adult eagle(s) observed, but no nest located, or outcome not determined; repaired nest but no adult eagle(s) observed

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Appendix 1.

Chemical Risk Assessment for Diflubenzuron Use in Grasshopper Cooperative Control Program

Chemical Risk Assessment
for
Diflubenzuron Use in Grasshopper Cooperative Control Program

March 2000

United States Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental Analysis and Documentation

Table of Contents

I Introduction

This risk assessment considers potential human health risks and environmental effects of diflubenzuron (Dimilin®) that have been proposed for use in the National Grasshopper Cooperative Control Program. Table I-1 below summarizes the proposed use patterns of diflubenzuron.

Table I-1. Proposed Use Patterns for Insecticides

Insecticide	Application Rate (lb a.i./acre)	Application Method	Active ingredient
Diflubenzuron	0.0156	Aerial and Ground	N-[(4-chlorophenyl) amino carbonyl]-2,6-difluorobenzamide

To aid understanding of the EPA terminology used to describe the relative toxicity of diflubenzuron discussed in this section, table I-2 provides EPA categories of values for comparison.

Table I-2. Toxicity Categories

Habitat	Terminology	Toxicity
Terrestrial	Severely toxic	LD_{50}[1] is less than 50 mg/kg
	Moderately toxic	LD_{50} is 50 to 500 mg/kg
	Slightly toxic	LD_{50} is 500 to 5,000 mg/kg
	Very slightly toxic	LD_{50} is 5,000 to 50,000 mg/kg
Aquatic	Very highly toxic	LC_{50}[2] (or EC_{50}) is less than 0.1 ppm (mg/L)
	Highly toxic	LC_{50} is 0.1 to 1 ppm
	Moderately toxic	LC_{50} is 1 to 10 ppm
	Slightly toxic	LC_{50} is 10 to 100 ppm
	Practically nontoxic	LC_{50} is greater than 100 ppm

[1] LD_{50} = median lethal dose. Dose lethal to 50% of the test organisms.

[2] LC_{50} = median lethal concentration. Concentration which kills 50% of the test organisms.

Quantification of the risk is achieved by comparing predicted exposure to toxicity reference levels based upon intrinsic hazards. The toxicity reference values were correlated with the exposures to determine the relative risk to humans.

Table I-3. Acute and Chronic Toxicity Reference Levels Used in This Analysis

Pesticide	Acute oral LD_{50} in rats (mg/kg)	Systemic NOEL[1] (mg/kg/day)		Reproductive/developmental NOEL (mg/kg/day)
		Human	Rat	
Diflubenzuron	>4,640	NA	1	>8.0

[1]NOEL = the no observed effect level. The highest dose level at which there are no observable differences between the test and control populations.

II. Environmental Fate

Analysis of the environmental fate of diflubenzuron used in the grasshopper program is related in this section to potential exposure and risk. The environmental fate parameters used in analysis are presented in table II-1. This information is used to determine the concentration and location of pesticide that will occur after application. The drift of pesticide was determined from results determined through use of the Agricultural Dispersal model (AGDISP). These results of drift analysis are presented in table II-2. The amount of insecticide that is carried off in runoff water and eroded soil following a 2-year storm 1 is calculated from the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model. These results are presented in table II-3. The modeling results for environmental fate are used in the determination of exposure.

Table II-1. Evnironmental Fate Parameters of Pesticides

		Half-Life				
Chemical	Water Solubility (ppm)	Foliar (days)	Soil (days)	K_{oc}	Washoff Fraction	Plant Uptake
Diflubenzuron	0.2	27	9	0.05	1	0

Table II-2. Estimated Cumulative Drift Deposition Based on Results of Modeling with AGDISP

Distance from edge of field (ft.)	Cumulative diflubenzuron deposition (mg a.i./m³)
Calm conditions (crosswind speed of 1 mph[1]):	
25	0.1
50	0
100	0
200	0
300	0
500	0
Extreme conditions (crosswind speed of 10 mph[1]):	
25	1
50	0.4
100	0
200	0
300	0
500	0

[1]Crosswind speed measured 6 feet above ground surface. Crosswind speed at altitude of flight was assumed to be higher.

Table II-3. Predicted Insecticide Losses for a 2-year Storm in Runoff Water and Eroded Soil Under a Beltwide ERADICATION Program (GLEAMS simulation)

[1]A 2-year storm is an occurrence of precipitation projected to be the highest over a 2-year period.

Soil type	Diflubenzuron Concentration	
	Water (mg/L)	Soil (µg/g)
Victoria clay	0.00126	0.1386

III. Hazard Assessment

A. Diflubenzuron

Diflubenzuron is classified as an insect growth regulator. It has been used to control various insect pests in cotton, field crops, forests, orchards, and for public health applications.

Diflubenzuron seldom persists more than a few days in soil and water, so the toxic effects from direct exposure anticipated in these locations all would be acute. The vapor pressure is relatively low (Wauchope et al., 1992), so exposure to substantial concentrations in air is unlikely. Diflubenzuron applied to foliage tends to remain adsorbed to leaf surfaces for several weeks with little or no absorption or translocation from plant surfaces (Eisler, 1992). This persistence on leaves may result in exposure and toxic effects to nontarget species as late as the time of fall foliage drop (Harrahy et al., 1993; Wimmer et al., 1993). Loss from foliage occurs mainly by wind, rain, and shedding of leaves in the fall. Diflubenzuron indirectly entering water on foliage in the fall (cold water temperatures) is more persistent and can result in chronic toxicity to aquatic invertebrates that frequent the leaf packs as grazers (Wimmer et al., 1993). Chronic toxicity is possible for animals that feed on leaves or have regular contact with treated leaf surfaces.

Metabolism in mammals is rapid (EPA, OPP, 1987). Diflubenzuron is not well absorbed by skin with only 0.2 percent absorption within 48 hours from shaved skin of a treated rabbit (Keet et al., 1982). Little, if any, bioconcentration or bioaccumulation would be expected for any animals (Booth, 1978). The rapid metabolism and lack of bioconcentration indicate that only acute toxic effects would be expected for diflubenzuron exposures. Metabolism of diflubenzuron by mammals and birds occurs through hydroxylation, conjugation, and cleavage of the urea moiety (Opdycke et al., 1982). The only metabolite or degradation product of human health concern is 4-chloroaniline (discussed later in this section).

Diflubenzuron is toxic to insects through inhibition of chitin synthesis (interference with the formation of the insect's cuticle or shell). The likely mechanism is through blockage of chitin synthetase, the ultimate enzyme in the biosynthesis pathway of chitin (Cohen, 1993). Exposure of insect life stages to diflubenzuron can result in larvicidal and ovicidal effects. The larvae are unable to molt properly due to a lack of chitin in the new cuticle. Exposure of larvae may occur through dermal contact, but the primary route of intoxication is as a stomach poison. Ovicidal effects may occur through direct contact of eggs or through exposure of gravid females by ingestion or dermal routes. The larva develops fully in the egg, but is either unable to hatch or dies soon after hatching due to chitin deficiency in the cuticle. This inhibition of chitin synthesis affects primarily insects, but can also affect other arthropods and some fungi. Chitinous algae (diatoms) are not adversely affected by diflubenzuron (Antia et al., 1985). Most other organisms lack chitin and are not affected by exposure to diflubenzuron.

Diflubenzuron has only very slight to slight acute oral toxicity to man. Acute toxicity through dermal and inhalation routes is also low. There are no reports of skin sensitization or neurotoxic effects from diflubenzuron, and it is only a mild skin and eye irritant (EPA, OPP, 1987).

Studies of chronic exposure to diflubenzuron indicate that hemotological effects are the issue of greatest potential concern to humans. The toxic effect resulting from excessive exposure to diflubenzuron is the induction of methemoglobin and sulfhemoglobin. These modified forms of hemoglobin are unable to function normally in the transport of oxygen by blood. The no-observed-effect level (NOEL) for the formulation of these modified forms of hemoglobin in a 1-year dog-feeding study of diflubenzuron was determined to be 2 mg/kg/day (Duphar, 1985), but actual toxic effects were not noted at this exposure level.

Reproductive and teratogenic effects were not reported in several teratogenicity and multigeneration reproduction studies of mammals conducted by the World Health Organization (1985). Only one study has noted a dose-related decrease in testosterone in chickens (Smalley, 1976), but this study is inconsistent with the full report for the same facility (Kubena, 1982) and with other studies (Cecil et al., 1981).

Diflubenzuron has no reported carcinogenic effects and very limited evidence of mutagenic effects. Neither a 2-year feeding study of rats (Keet, 1984a) nor a 2-year feeding study of mice (Keet, 1984b) found any evidence of carcinogenic effects. Although EPA has not formally classified diflubenzuron, these negative studies indicate that this compound meets the criteria for EPA's group E classification (evidence of noncarcinogenicity). Diflubenzuron had negative findings in a dominant lethal study of mice (Arnold, 1974), a cell transformation assay, an assay of induction of unscheduled DNA synthesis (Brusick and Weir, 1977a), transplacental hamster cell transformation assays (Quarles et al., 1980), and Ames mutagenicity assays (Brusick and Weir, 1977b). The only positive finding was in a study of cell transformations that showed weak mutagenic effects in the absence of metabolic activation (Perocco et al., 1993). These mutagenic effects were not observed with metabolic activation.

Diflubenzuron is slightly to very slightly toxic to mammals, birds, and earthworms. Phytotoxicity has not been found to be of any concern to green plants when diflubenzuron is applied at the recommended rate. Most fungi contain chitin and, therefore, may be affected by diflubenzuron. Toxicity of diflubenzuron to terrestrial arthropods varies, but all show adverse effects at high exposures. Diflubenzuron is moderately to severely toxic to terrestrial insects. Diflubenzuron is moderately toxic to spiders and mites.

Toxicity of diflubenzuron to aquatic organisms varies by taxa. Diflubenzuron is slightly to practically nontoxic to fish, aquatic snails, and most bivalve species. It is very highly toxic to most aquatic insects, crustaceans, horseshoe crabs, and barnacles.

The only metabolite or degradation product of some concern is 4-chloroaniline. This metabolite was shown to be mutagenic (Prasad, 1970) and was found to have dose-related carcinogenic activity in male rats (NCI, 1979). The reference dose for 4-chloroaniline is 0.004 mg/kg/day (EPA, 1994). The cancer potency of 4-chloroaniline used in this risk assessment is 0.013 $(mg/kg/day)^{-1}$. The rapid metabolism and degradation of this metabolite's low concentrations make it highly unlikely that there would be sufficient exposure to cause any of the adverse toxicological effects noted in these studies. Diflubenzuron is reported to be synergistic only with the defoliant DEF (NLM, 1988). Because the defoliant is applied only at the end of the cotton season and is not applied concurrently with pesticide treatments, there is minimal risk of synergistic effects.

IV. Human Exposure Assessment

The quantitative risk assessment considers potential exposure scenarios applicable to most site-specific program areas. The qualitative risk assessment takes into account important factors that influence exposure and risk, but are outside the direct control of the program or cannot be quantitatively related to exposure. For example, risk to human health from applications of pesticide on sites adjacent to rangelands treated through program activities would be analyzed subjectively. This qualitative approach is taken because the chemical, rate, and method of application for treatment of these adjacent sites are not known and cannot be predicted with certainty.

A. Quantitative Assessment

The quantitative analyses determine both typical and extreme exposures to workers and the public from the Grasshopper Cooperative Control Program applications of diflubenzuron. Comprehensive training of all workers assures that the margins of safety are adequate for exposures by all likely routes. Exposures from scenarios for all applications are presented in table IV-1.

Exposures vary considerably among the different exposure scenarios. The exposures of the public to diflubenzuron in all analyzed scenarios are very low. Ground applicators tend to have higher exposures than other workers, but these exposure scenarios do not consider the protective gear worn by these individuals or adherence to all required safety procedures, so their actual exposure is anticipated to be considerably less. The exposure of observers is also determined to be somewhat elevated, but this scenario does not consider the decreased exposure from adherence to required safety procedures. As would be anticipated, there is greater exposure with some accident scenarios, particularly with direct exposure through spills and broken hoses. Other accidents do not result in such high exposures.

Table IV-1. Exposure Assessment for Diflubenzuron Applications in the Grasshopper Cooperative Control Program

Exposure scenario	Potential Dose (mg/kg/day) for: Typical Scenario	Extreme Scenario
Public[1]:		
Dermal and inhalation drift	0.00000	0.00004
Dietary -		
Water	0.00000	0.00005
Fish	0.00000	0.00207
Venison	0.00001	0.00002
Legumes	0.00001	0.00021
Berries	0.00000	0.00010
Workers[2]:		
Pilot	0.00007	0.00012
Mixer/Loader	0.00016	0.00037
Observer	0.00088	0.00638
Monitoring Team	0.00005	0.00004
Ground applicator	0.02179	0.13800
Accidents:		
Spill of concentrate		66.2
Broken hose		16.5
Immediate field entry		0.00005
Spray at 25 feet - adult		0.00048
Direct spray - adult		0.00057
Drink reservoir water/release		0.00053
Eating berries - direct spray		0.00018
Eating legumes - direct spray		0.00036

[1] Dermal and inhalation exposures: typical at 500 ft., extreme at 100 ft.; dietary exposures: typical at 100 feet, extreme at 25 ft.

[2] Worker exposures: typical is based on average dose; extreme is based on upper 95% confidence limit.

B. Qualitative Assessment

Qualitative exposure assessments either relate directly to the formulated pesticides (impurities and degradation products) used in program treatments or to treatment of adjacent rangelands with pesticides by private growers as they relate to program pesticide applications. Impurities vary with formulation and degradation; therefore, the exposure concentration may vary considerably, so accurate assessment of dose is not possible. Likewise, exposure of individuals from treatment of adjacent rangelands with pesticides can vary considerably with the method of application and the pesticide. This analysis considers qualitatively the most likely treatments that could occur in adjacent rangelands and their interactions either directly with the program chemicals or their cumulative influence on adverse toxic responses to pesticide exposure.

Impurities and degradation products may occur in the formulated product, result from improper storage, or result from use of chemicals after the expiration date for shelf life. Although impurities in formulated products are a consideration, the program samples the product for purity before use. The program also requires proper storage of all pesticides and orders only for the anticipated needs. Storage and shelf life concerns are not anticipated for this program. The only metabolite or degradation product of diflubenzuron to consider is 4-chloroaniline due to its mutagenic and carcinogenic potential. The rapid metabolism and degradation of this metabolite at such low concentrations make it highly unlikely that there would be sufficient exposure to cause any of the adverse toxicological effects noted in laboratory studies.

Simultaneous exposure to pesticide residues from treatment of crops in adjacent sites is possible, but highly unlikely. To avoid conflicts in scheduling and space requirements, growers are likely to apply their pesticides at times when program treatments are not being made. Appropriate communication with growers and residents in adjacent properties through the notification process assures that most residents will be aware of the treatments, understand the meaning of the treatment flags, and adhere to the required re-entry periods. The re-entry period is the time when no one should enter a site following a treatment based on degradation of the pesticide applied. All workers are required to adhere to the re-entry periods following treatments.

Treatment of adjacent rangelands by growers 1 day or more before or after program treatment is more likely, but not expected for most sites. Exposure to more than one chemical under these circumstances depends upon the rate of degradation of the pesticides used and the location relative to treatment areas. Persistence of pesticide residues in specific environmental media can increase the likelihood of exposure to more than one pesticide. The degradation of most of the program pesticides is rapid on plants, in soil, and in water under the warm conditions in the treated rangelands. Cumulative effects should generally be limited to periods shortly after treatments. Diflubenzuron residues can persist on leaf surfaces, but degrade readily in the warm soil and water. Any adverse cumulative or synergistic effects of program pesticides would be limited to the period of persistence in the rangelands.

Various safety procedures for pesticide treatments limit possible exposure and thereby decrease the potential for synergistic effects. Adherence to re-entry periods prevents some exposures and decreases the possibility of synergism from multiple exposures. Program applications are applied low to the ground on days with only light wind, so any drift which may occur would be over short distances. Although program treatments avoid water, some drift into water may occur. Rapid water movement in rivers and streams can readily carry pesticides downstream to other areas that could be treated with different pesticides.

There are several pesticides other than those used in the program that may be used by growers in rangelands near program treatment sites. Exposure to some of these compounds may result in additive or cumulative toxicity if a person were affected by a program pesticide. Also, exposure to some pesticides could result in synergism such that the adverse effects from exposure to more than one pesticide exceed the sum of the adverse effects of exposure to each pesticide separately. Diflubenzuron is only reported to be synergistic with the defoliant DEF (NLM, 1988). DEF is not likely to be used on rangelands. Because the defoliant is generally only applied at the end of the growing season to a few crops and is not applied concurrently with pesticide treatments, there is minimal risk of synergistic effects.

V. Human Health Risk Characterization

Exposure to any chemical agent is associated with some level of risk and the risk is assessed with some level of uncertainty. All human activity or inactivity is accompanied by risk and uncertainty. The decision to apply pesticides to control grasshoppers is based, at least implicitly, on a comparison of risks among the various alternative control methods and an assessment of the benefits associated with each alternative.

This assessment reviewed information about diflubenzuron to identify the potential toxic effects (hazard identification), determine exposure levels associated with these effects (dose-response assessment), estimate levels to which individuals may be exposed (exposure assessment), and discuss the consequences of such exposure (risk characterization). Each phase of this assessment is accompanied by uncertainties imposed by either limited data or limitations in the ability to extrapolate the available data to exposure scenarios of concern to this risk assessment. This risk comparison is intended to place both the quantitative assessments and their uncertainties into perspective with the problem posed by grasshoppers and the control methods for dealing with this insect pest.

A. Quantitative Risk Characterization

The exposure scenarios analyzed quantitatively apply equally well to most program areas. The potential risk for scenarios involving diflubenzuron is determined by comparing the exposures (table IV-1) to the toxicity reference levels (table I-3). The margin of safety is determined by dividing the lowest toxicity reference level of the pesticide by the exposure level determined in the scenario.

The risk determined for exposed individuals depends largely upon the exposure scenario. This information is summarized in table V-1. The highest risk occurs from the exposure of workers in accidental scenarios. There is greater risk to workers from diflubenzuron with direct exposure from a spill or broken hose. Immediate cleansing of the exposed skin and other required safety procedures lower these risks to an acceptable level. Typical exposures pose negligible risk to the public. Risks are negligible to the public, even for extreme exposures to diflubenzuron. Risks to workers are generally slight to moderate. Although observers, mixer/loaders, and ground applicators are indicated to have substantial risk in some scenarios, these scenarios do not consider the effect of required safety procedures and protective gear on the overall exposure and, therefore, considerably overstate the potential risk. Use of required protective gear and proper adherence to safety procedures ensures that risks to workers are within acceptable limits.

Table V-1. Summary of Highest Public and Worker Risks From Control Operations by Chemical

Exposure Scenarios	Diflubenzuron	
	Typical	Extreme
Public:		
Dermal and Inhalation	E	E
Dietary	E	E
Workers:		
Pilot	E	E
Mixer/loader	E	E
Observer	E	E
Monitoring Team	E	E
Ground Applicators	C	B
Accidents:		
Worker		A
Public		E

'When there is more than one risk category for an exposure scenario, only the highest risk category is included.

Risks are categorized as follows:
A = Substantial risk - margin of safety is less than 1.
B = Moderate to substantial risk - margin of safety is between 1 and 10.
C = Slight to moderate risk - margin of safety is between 10 and 50.
D = Slight risk - margin of safety is between 50 and 100.
E = Negligible risk - margin of safety is greater than 100.

B. Qualitative Risk Characterization

There are several potential adverse health effects that are best analyzed qualitatively. This may be the result of inadequate exposure information or unclear relationships between dose and response. Qualitative risk for exposure to more than one chemical is reviewed in the next section on cumulative and synergistic effects.

Diflubenzuron is of only slight acute oral toxicity to humans. Neither acute nor chronic toxic effects are anticipated for this compound. Immunotoxic, mutagenic, and genotoxic effects are only recorded for exposures much higher than in grasshopper programs. Diflubenzuron has been found negative in tests for neurotoxicity, teratogenicity, fetotoxicity, reproductive and developmental effects, and carcinogenicity. There is a degradation product and impurity of concern in diflubenzuron called 4-chloroaniline, but the small amount of exposure to this compound poses negligible risk of carcinogenic or acute toxic effects. Hematological effects from exposure to diflubenzuron pose the greatest concern. The formation of substantial amounts of methemoglobin and sulfhemoglobin following exposure to diflubenzuron requires exposures higher than those in the grasshopper programs, but some subgroups of the population (i.e., smokers) could be at increased risk due to low viable hemoglobin counts from other exposures.

C. Cumulative and Synergistic Effects

Cumulative and synergistic effects are those adverse effects that result from exposures to more than one chemical or exposure to a given chemical more than once with a frequency that results in greater adverse effects than a single exposure. The potential for multiple exposures depends on site-specific conditions and persistence of the chemical. Cumulative effects are those adverse effects from exposures that can be added together to indicate overall potential risk. Synergistic effects are those adverse effects from exposure to more than one compound that result in greater overall potential risk than the sum of the risks from individual exposures.

Cumulative effects are most likely from multiple exposures to the same compound. Diflubenzuron normally is not used by growers in the areas where grasshopper treatments are anticipated, so the only potential cumulative effects for diflubenzuron would relate directly to program use. Diflubenzuron is only known to persist on leaf surfaces where it adsorbs tightly. It does not persist on soil or in water during the growing season. Diflubenzuron is readily metabolized by mammals. Cumulative exposure to diflubenzuron could only result if multiple exposures occurred in rapid succession. This is very unlikely because of its limited use and adherence to proper safety procedures by program personnel.

Diflubenzuron is only known to be synergistic to the defoliant DEF, which is not likely to be used on rangelands. Diflubenzuron has potential for cumulative or synergistic effects with other (nonpesticide) compounds known to bind hemoglobin. For example, exposure to cigarette smoke and carbon monoxide from incomplete combustion can result in binding of hemoglobin. Exposure to diflubenzuron after these exposures can result in additional binding of hemoglobin and the greater risk associated with less oxygen transport by blood.

D. Connected Actions

In general, there is no reason to expect increased risk when combining chemical control using diflubenzuron with other alternative control techniques. In fact, it is reasonable to expect reduced risks because combined alternatives may reduce the number of chemical applications needed. Exposures from biological control and other techniques do not involve exposures to cumulative or synergistic compounds.

The history of the national program to control grasshoppers demonstrates that well coordinated control efforts can result in a lessening of environmental impacts from agricultural practices. As a result of these coordinated programs, damage from grasshoppers is greatly reduced and pesticide use against secondary pests in treated areas can be substantially reduced.

E. Groups at Special Risk

An attempt was made to identify groups at special risk from diflubenzuron exposure due to location, disease state, or other biological variation. Safety procedures assure that program workers are not exposed to levels of these pesticides high enough to increase risk. The group at the greatest risk are those individuals who live next to treated rangelands. A careful assessment of their risk indicates that these individuals need to be notified of the times of pesticide application and instructed about safe reentry times for rangelands. Infants may be more sensitive than adults to the effects of exposure to program pesticides. Individuals on certain medicines may also be at increased risk. Some individuals may be less tolerant of exposure to diflubenzuron because of a diminished ability to recover from the effects induced by exposure.

Individuals with multiple chemical sensitivity (MCS) may be extremely sensitive to even very low levels of exposure to a variety of chemical agents. Because of the highly variable nature of this condition, it is not possible to quantitatively or qualitatively assess the effects to such people. The percentage of MCS in the general population is unknown, partly because there is no acceptance of a single set of criteria for the diagnosis of MCS. Because the program would tend to limit pesticide use in the area, any incidence of MCS from program pesticide use would be local and of limited duration.

VI. Non-target Species Hazard Identification and Exposure Assessment

The criteria that EPA (U.S. EPA, OPP, 1986) uses in their ecological risk assessment of nontarget species were used to determine the risks to different representative wildlife species for diflubenzuron. Methodology for calculation of the hazards and exposures to wildlife species are described in detail in a previous assesment (USDA, APHIS, 1991).

A. Exposures of Terrestrial Wildlife Species and Hazard Indices

Risk to terrestrial wildlife is assessed by comparing the exposure to a hazard index. The acute median lethal dose (LD_{50}) is the standard value used for comparison to exposure of terrestrial wildlife species to determine the risk. The LD_{50} is the dose in laboratory tests at which there is mortality to one-half of the exposed population. For nonendangered terrestrial wildlife species, the assessment of risk from chemical exposure is determined according to the following scale (U.S. EPA, OPP, 1986):

A = High risk - Dose is greater than or equal to LD_{50} for terrestrial species.
B = Moderate risk - Dose is greater than or equal to 1/5 LD_{50} but is less than LD_{50} for terrestrial species.
C = Low risk - Dose is less than 1/5 LD_{50} for terrestrial species.

Absorption of diflubenzuron by mammals and birds is minimal and the body tissues do not retain or concentrate the residues. Intestinal absorption in mammals decreases with increasing dose levels (Dost et al., 1985). Complete excretion of diflubenzuron residues in milk cattle occurs within 4 days (FAO, 1981). Dermal absorption through rabbit skin was only 0.2% of the applied dose and this residue was readily excreted. The principal metabolites are of comparable toxicity to the parent compound and are excreted readily from the body (FAO, 1981).

The exposure of terrestrial wildlife depends upon many factors such as habits, physiology, and niche. The species receiving the highest exposure in the scenarios for each chemical was the deer mouse. This species has the potential for considerable exposure through diet, dermal exposure, and respiration. This species is, however, usually not the most sensitive to the adverse effects of pesticides. Table VI-1 presents the estimated dose and values used as hazard indices (i.e., LD_{50}) for each terrestrial species for the proposed diflubenzuron use in grasshopper control programs.

Table VI-1. Exposure of Terrestrial Wildlife Species to Diflubenzuron

Species	Typical Dose stimate (mg/kg)	Extreme Dose estimate (mg/kg)	1/5 LD_{50} (mg/kg)	LD_{50} (mg/kg)	Indicator species
E. kingbird	0.069	0.622	400	2000	Mallard
N. bobwhite	0.025	0.228	400	2000	Mallard
Belted kingfisher	0.03	0.227	400	2000	Mallard
American kestrel	0.04	0.505	400	2000	Mallard
Deer mouse	0.104	0.915	928	4640	Mouse
E. cottontail rabbit	0.012	0.19	928	4640	Rat
White-tailed deer	0.0014	0.036	928	4640	Rat
Coyote	0.0029	0.059	928	4640	Rat
W. diamondback rattlesnake	0.035	0.58	400	2000	Mallard
Rocky Mtn. toad	0.053	0.46	400	2000	Mallard
Honey bee	0.008	0.074	191	957	Honey bee
Cow	0.0008	0.043	928	4640	Rat
Chicken	0.0059	0.057	400	2000	Mallard
Dog	0.0024	0.021	928	4640	Rat

B. Exposure of Aquatic Wildlife Species and Hazard Indices

Risk to aquatic wildlife is assessed by comparing the expected environmental concentration (EEC) in water to a hazard index. The acute median lethal concentration (LC_{50}) is the standard value used for comparison to the expected environmental concentration in the water of aquatic wildlife species to determine their risk. The LC_{50} is the concentration in water in laboratory tests at which there is mortality to one-half of the exposed population. For nonendangered aquatic wildlife species, the assessment of risk from chemical exposure is determined according to the following scale (U.S. EPA, OPP, 1986):

A = High risk - EEC is greater than or equal to 1/2 LC_{50} for aquatic species.
B = Moderate risk - EEC is greater than or equal to 1/10 LC_{50} but is less than 1/2 LC_{50} for aquatic species.
C = Low risk - EEC is less than 1/10 LC_{50} for aquatic species.

Bioconcentration was studied in brown bullhead catfish and black crappie (Colwell and Schaefer, 1980). Tissue residues ranged from 291 to 466 ppm at 1-day post-treatment, but there were no detectable residues within 7 days.

The exposure of aquatic wildlife to pesticides depends upon many factors such as habits, physiology, and niche. The primary factor for most species is the concentration in the water. Use of the EEC assumes that the concentration is the same throughout the water, independent of depth, organic matter, and nature of bottom sediments. The tendency of pesticides to settle, degrade, and adsorb to surfaces may affect the actual exposure considerably. By assuming even mixing of the pesticide in the water, the actual exposure to species may be either overestimated or underestimated. This approach is generally conservative and usually overestimates exposure for these species. Table VI-2 presents the estimated environmental concentration in the water for typical and extreme scenarios, values used as hazard indices (ie. LC_{50}) for each terrestrial species for diflubenzuron, and gives a relative risk rating for each exposure scenario by species (ie. low, moderate, high) in ponds (static water). Table VI-3 provides this same information determined for aquatic species in creeks (flowing water).

Table VI-2. Exposure of Aquatic Species to Diflubenzuron in Ponds

Species	LC_{50} or EC_{50} (mg/L)	1/10 LC_{50} or EC_{50} (mg/L)	Typical Case Risk Level	Extreme Case Risk Level
Typical Case EEC = 0.000329 mg/L Extreme Case EEC = 0.000609 mg/L				
Fish				
Bluegill	660	66	Low	Low
Channel catfish	370	37	Low	Low
Fathead minnow	430	43	Low	Low
Invertebrates				
Daphnia	0.0015	0.00015	Moderate	Moderate
Scud	0.025	0.0025	Low	Low
Stonefly	57.5	5.75	Low	Low

Table VI-3. Exposure of Aquatic Species to Diflubenzuron in Creeks

Species	LC_{50} or EC_{50} (mg/L)	1/10 LC_{50} or EC_{50} (mg/L)	Typical Case Risk Level	Extreme Case Risk Level
Typical Case EEC = 0.00000566 mg/L; Extreme Case EEC = 0.00000566 mg/L				
Fish				
Bluegill	660	66	Low	Low
Channel catfish	370	37	Low	Low
Fathead minnow	430	43	Low	Low
Invertebrates				
Daphnia	0.0015	0.00015	Low	Low
Scud	0.025	0.0025	Low	Low
Stonefly	57.5	5.75	Low	Low

VII. Non-target Species Risk Characterization

Methodology for calculation of the risks to wildlife species are described in detail in a previous risk assessment (USDA, APHIS, 1991). Review of the exposure and hazard indices indicates that diflubenzuron use in the program poses greater risks to certain wildlife species (e.g., aquatic invertebrates in standing water) than some other program chemicals.

A. Terrestrial Wildlife Risk Characterization

The risks to terrestrial wildlife species are presented in table VII-1. The risks that would usually be expected from program applications would be those for the typical scenarios. Based upon this, the risks to wildlife species are very low for program use of diflubenzuron. Risks to some wildlife species are elevated for use of the other program pesticides.

The selective mechanism of toxic action of diflubenzuron places immature invertebrate species at greater risk of adverse effects. Unlike immatures, the adult organisms generally do not require production of chitin for growth or metamorphosis. Actively growing species such as caterpillars would be adversely affected by applications of diflubenzuron. Program sites for grasshopper control include areas of intense pollination of crops by honey bees, alkali bees, and leaf cutter bees. There have been several studies of the effects of diflubenzuron on bees and hive productivity. A large scale field study in Canada found that aerial applications of diflubenzuron (87.5 g a.i./ha) to control spruce budworm had no effect on honey bees (Buckner et al., 1975). A laboratory experiment determined that contact activity on worker bees is negligible (Stevenson, 1975). The toxicity to eggs of honey bees was also low. Diflubenzuron fed to worker bees at concentrations in excess of 25 mg a.i./L results in disturbances in brood development through exposure of larvae being fed by the worker bees (Kuijpers, 1989). This exposure is much greater than could ever occur with the program applications for control of grasshoppers, so no effects are anticipated and there is no need for special protection measures for bee pollinators.

Table VII-1. Summary of Highest Risks to Nontarget Terrestrial Species From Insecticides

Species	Diflubenzuron	
	Typical	Extreme
Birds	C	C
Mammals	C	C
Reptiles	C	C
Amphibians	C	C
Insects	C	C
Domestic animals	C	C

Risks are categorized as follows:

A = High risk - Dose is greater than or equal to LD_{50} for terrestrial species.
B = Moderate risk - Dose is greater than or equal to 1/5 LD_{50} but is less than LD_{50} for terrestrial species.
C = Low risk - Dose is less than 1/5 LD_{50} for terrestrial species.

B. Aquatic Wildlife Risk Characterization

The risks to aquatic wildlife species are presented in tables VII-2 (ponds) and VII-3 (creeks). The risks that would usually be expected from program applications would be those for the typical scenarios. Based upon this, risks to aquatic invertebrates in ponds are moderate for diflubenzuron, but low for all other wildlife groups in the typical exposure scenarios for ponds. The models are based upon specific water depth and shallow standing water bodies would be expected to pose high risk to some aquatic invertebrates.

Residues of pesticides entering flowing water (i.e., creeks) dissipate more readily than ponds due to constant movement of water from upstream that lowers the potential exposure concentration. This effect diminishes the risk in the exposure scenarios for creeks relative to ponds. Risks to wildlife species in creeks are generally low for program use of diflubenzuron.

Table VII-2. Summary of Highest Risks to Aquatic Species in Ponds

Species	Diflubenzuron	
	Typical	Extreme
Fish	C	C
Aquatic Invertebrates	B	B

Risks are categorized as follows:

A = High risk - Estimated environmental concentration (EEC) is greater than or equal to 1/2 LC_{50} or 1/2 EC_{50} for aquatic species.
B = Moderate risk - EEC is greater than or equal to 1/10 LC_{50} or 1/10 EC_{50} but is less than 1/2 LC_{50} or 1/2 EC_{50} for aquatic species.
C = Low risk - EEC is less than 1/10 LC_{50} or 1/10 EC_{50} for aquatic species.

Table VII-3. Summary of Highest Risks to Aquatic Species in Creeks

Species	Diflubenzuron	
	Typical	Extreme
Fish	C	C
Aquatic Invertebrates	C	C

Risks are categorized as follows:

A = High risk - Estimated environmental concentration (EEC) is greater than or equal to 1/2 LC_{50} or 1/2 EC_{50} for aquatic species.

B = Moderate risk - EEC is greater than or equal to 1/10 LC_{50} or 1/10 EC_{50} but is less than 1/2 LC_{50} or 1/2 EC_{50} for aquatic species.

C = Low risk - EEC is less than 1/10 LC_{50} or 1/10 EC_{50} for aquatic species.

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Attachment 5. Comments received on the draft Compatibility Determination and Service Responses.

Comment 1. Control of grasshoppers is not compatible with refuge purposes and/or no refuge purposes are served by the proposed action.
Response: The compatibility standard does not require that refuge purposes be served. What is required is that the proposed use does not materially interfere with or detract from the National Wildlife Refuge System mission or purposes of the refuge. In this case, the Refuge Manager, using the advise and expertise of his staff, other agency personnel, and published literature, has determined that the proposed grasshopper control program will not materially interfere or detract from the purposes for which the refuge was established and the purposes of the National Wildlife Refuge System mission.

Comment 2. The Service is simply trying to "avoid tort claims and appease local ranchers". There is no scientific studies that document grasshopper movement from the Refuge to private lands. Nor is there studies that show that spraying grasshoppers will reduce movement off the Refuge and alleviate damage to private lands.
Response: As stated in the CD, Service policy allows for control of native pests if damage to private property is evident and the control program is compatible with Refuge purposes. The only reason the Service is allowing this activity is that the Service believes private property damage is likely and that stipulations on the control efforts can be made such that the use is compatible with Refuge purposes. Stipulations include treatment buffers to sensitive habitats, use of the most selective pesticides and application methods available, and treating juvenile grasshoppers on egg beds before they have time to spread over large areas. The fact that spring 2003 grasshopper populations localized on egg beds were able to spread to over 48,000 acres by summer's end is ample evidence of this grasshopper species ability to multiply and travel over extensive distances. The 2003, grasshopper infestation removed nearly all vegetation from seasonal marshes and grasslands in the northern portion of the Refuge thereby demonstrating the potential to negatively affect private grazing lands.

Comment 3: APHIS's 2004 EA lacks any real discussion of the Klamath Marsh National Wildlife Refuge. Given the non-specific nature of the EA, the CD does not adequately address impacts.
Response: The Service believes the environmental effects analysis in the APHIS 2004 EA and 2002 EIS were adequate to cover the host of vertebrate and invertebrate species occurring at Klamath Marsh NWR. The Service has included additional information in the final CD on important wildlife species at the Refuge including breeding sandhill cranes, Oregon spotted frogs, and yellow rails. The Service has also prepared a Refuge specific Biological Assessment to analyze potential impacts to listed species.

Comment 4: The Refuge and APHIS falsely claims that treatment this year will preclude the need for treatment in future years.
Response: One of the major goals of the proposed grasshopper control program is to reduce (not eliminate) grasshopper densities to below economic thresholds. The Service

anticipates that grasshopper outbreaks will continue into the future and that future control efforts may be needed to reduce populations. It is hoped that by treating in a timely and well coordinated manner with environmental safeguards in place that the severity and acres requiring treatment can be reduced. This native species of grasshopper is an important part of the Klamath Marsh ecosystem and, as such, the Service is not striving for eradication.

Comment 5: An IPM approach to grasshopper control at Klamath Marsh was initiated in 1995 with creation of a new EA. The Service and APHIS have not lived up to the promises made in that document. What assurances can be made that all elements of this CD and APHIS's 2004 EA and 2002 EIS will be carried out? An EA needs to explain the probability of monitoring and studies occurring.
Response: Some monitoring and studies were carried out after the 1995 EA was completed, results of which are included in Attachment 2. Unfortunately, some studies were not completed or initiated due to lack of program funding by both agencies. In addition, studies and their conclusions became more tenuous as grasshopper populations crashed in the late 1990's. There were essentially few subjects to study. Similar to 1995, the success or failure of the proposed program will also depend on funding and support. The Service will continue to work with APHIS and ODA to seek opportunities as they arise. Because of uncertainty in future funding no probabilities of success can be provided.

Comment 6: The CD falsely claims that "a multi-faceted longterm IMP approach is being implemented in this area".
Response: A two paragraph section from the 1995 EA was quoted in the CD to describe the IPM approach as envisioned in 1995. It was not intended to describe current activities.

Comment 7: The CD mischaracterizes the conditions of the 2003 grasshopper outbreak.
Response: The CD has been changed to reflect more up-to-date information.

Comment 8: No NEPA document or ESA consultation has specifically discussed or disclosed the possible impacts to nesting bald eagles at Klamath Marsh NWR.
Response: ESA consultation relative to grasshopper control will be completed prior to implementation of any control activities at Klamath Marsh NWR. Service has recently completed a Biological Assessment which analyzes potential effects to listed species.

Comment 9: The CD is in conflict with or does not disclose comments made by former refuge researcher Mark Quinn of Washington State University. The CD makes no attempt to explain the conclusions that were drawn from the study.
Response: Dr. Quinn states in the summary of his report: "The apparent crash in the grasshopper population after the 1995 outbreak severely hampered the research efforts in 1996. Because of the low population levels, results from the 1996 study are not directly applicable to other years when grasshoppers are much more abundant." In relation to his work on spatial movements Dr. Quinn states: "The lack of any directional spatial relationship suggests that grasshoppers did not move preferentially between the wildlife refuge and grazed land during 1996. This may simply be due to the low grasshopper densities in the study area. Directional movement may very well occur in outbreak years." There were no conclusions in the study that definitively described the ecology of

grasshoppers at Klamath Marsh in outbreak years. The study was important, however, in describing areas of potential study and appropriate analysis methods. Dr. Quinn was in support of an IPM approach to grasshopper control at Klamath Marsh as is the Service.

Comment 10: An EA needs to be prepared that discloses that there is no available evidence to indicate that grasshopper numbers will decline any more rapidly during this cycle, regardless of whether or not they are treated with insecticides.
Response: The Service is not attempting to shorten grasshopper cycles. The goals of the program is to reduce grasshopper population densities to economic thresholds and use methods that reduce potential environmental effects.

Comment 11: The CD and EA have not fully disclosed that an unknown number of non-targeted insect, and non insect wildlife species may also be killed and allowing that to happen makes the proposed action incompatible with refuge purposes.
Response: The Service believes that non-target impacts have been adequately addressed in the CD, APHIS's EA, and its recently prepared Biological Assessment. The Service has selected the most target specific and least toxic chemicals available for the program. In addition, treatment buffer zones are incorporated which will greatly reduce or eliminate risk to refuge fish and wildlife populations.

Comment 12: The CD does not acknowledge the present and future opportunities for biological controls at Klamath Marsh.
Response: At the present time the Service is unaware of any biological control that will reduce extremely high densities of grasshoppers to below economic thresholds over large land areas under outbreak conditions. Results of biological control work to date on the Refuge (Attachment 2) have not yielded a solution. However, the Service believes strongly that development of biological controls at Klamath Marsh is ideally where the program should be headed and will seek additional funding to explore this option as appropriate opportunities arise.

Supplement to:

Site-Specific Environmental Assessment

Rangeland Grasshopper and Mormon Cricket Suppression Program

OREGON

Klamath County

EA Number: OR-04-02

Prepared by:

Animal and Plant Health Inspection Service
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June 18, 2004

The purpose of this supplement to EA OR-04-02 is to provide corrections or clarification to certain parts of the original that were brought to our attention through public comment or discovered through our own review.

1. On page 9 under C. Reduced Agent Area Treatments (RAATs) Alternative, the chart indicating the rate for carbaryl bait should read:

    - Up to10.0 pounds of 2 or 5 percent carbaryl bait per acre (≤0.20 lb or 0.50 lb a.i.)

    The purpose of the RAATs technology is to achieve an adequate level of grasshopper control while reducing the total amount of pesticide applied to an area. This can be accomplished by reducing the rate of chemical active ingredient per acre, reducing the amount of area to which chemical is actually applied by leaving untreated areas between treated areas, or both. APHIS is considering the possibility of using a brand of bait that is only available in 5% formulation. Approximately 25-50% of the area would remain as untreated refuges for non-target species.

2. A mistake was noted in Table 1 Federally Listed T & E Species on page 21. It is replaced with the following table:

Table 1. **Federally listed T & E species**

Common Name	Scientific Name	Status
Eagle, bald (lower 48 States)	*Haliaeetus leucocephalus*	T
Lynx, Canada (lower 48 States DPS)	*Lynx canadensis*	T
Milkvetch, Applegate's	*Astragalus applegatei*	E
Sucker, Lost River	*Deltistes luxatus*	E
Sucker, Shortnose	*Chasmistes brevirostris*	E
Owl, northern spotted	*Strix occidentalis caurina*	T
Trout, bull (Klamath Basin Population)	*Salvelinus confluentus*	T

3. A mistake was noted in Table 2 Grasshopper and Mormon Cricket Suppression Program Protection Measures and Determinations to Protect Threatened, Endangered, or Proposed Species, on page 43. It is replaced with the following table:

Table 2 Grasshopper and Mormon Cricket Suppression Program Protection Measures and Determinations to Protect Threatened, Endangered, or Proposed Species

Species, Status, and Determination	Summary of Protective Measures
Applegate's milk-vetch (E) *Astragalus applegatei* (NLAA)	Aerial applications of ULV (spray) pesticides will not be used within 3 miles of these species occupied habitats. Within the 3 mile buffer, only carbaryl bait will be used. (FWS 09/24/92, 06/01/87)
Bald eagle (T) *Haliaeetus leucocephalus* Not likely to adversely affect (NLAA)	Maintain a 1-mile radius treatment-free zone around active bald eagle eyries found on rivers or lakes with no flyovers of this area by contract pilots. A 2.5 mile no-aerial ULV spray zone will be maintained upstream and downstream from the nest site as a forage area. This will include a 0.25 mile buffer along each side of the rivers. Lakes will be protected by a 0.25 no-aerial ULV spray buffer if they are considered foraging areas of the bald eagle. (FWS 06/01/87)
Bull trout (T) *Salvelinus confluentus*	FWS (6/15/04)
Canada Lynx (T) *Lynx Canadensis* (NE)	Known ranges of the Canada lynx and its travel corridors, in Oregon, will not be considered for treatment. FWS (6/15/04)
Lost River sucker (E) *Deltistes luxatus* (NLAA)	Buffers around areas of occurrence of 0.5 mile for the use of malathion and 0.25 mile for the use of aerially applied carbaryl. Within the buffers, only carbaryl bait will be used. (FWS 07/26/88)
Shortnose sucker (E) *Chasmiste brevirostris* (NLAA)	
Northern spotted owl (T) *Strix occidentalis caurin* No effect (NE)	Occurs primarily in old growth forest and not in rangeland. (FWS 08/03/91)

4. Section 7 consultation with US Fish and Wildlife Service and NOAA Fisheries is now complete. Their concurrence letters have been included in this EA as Appendix 3 and can be found at http://www.oda.state.or.us/plant/ppd/Ent/gh/index.html

This concludes the supplement to EA OR-04-02.