

PETITION TO LIST LEONA’S LITTLE BLUE BUTTERFLY
Philotiella leona
AS ENDANGERED UNDER THE U.S. ENDANGERED SPECIES ACT



Leona's little blue butterfly on its host plant, spurry buckwheat, by Dr. David V. McCorkle

Prepared by

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Submitted by

The Xerces Society for Invertebrate Conservation
Dr. David V. McCorkle
Oregon Wild

May 12, 2010

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Mr. Ken Salazar
Secretary of the Interior
Office of the Secretary
Department of the Interior
1849 C Street NW
Washington DC, 20240

Dear Mr. Salazar,

The Xerces Society, Dr. David V. McCorkle and Oregon Wild hereby formally petition to list the Leona's little blue butterfly (*Philotiella leona*) as endangered pursuant to the Endangered Species Act, 16 U.S.C. §§ 1531 *et seq.* This petition is filed under 5 U.S.C. § 553(e) and 50 C.F.R. § 424.14 (1990), which grants interested parties the right to petition for issue of a rule from the Secretary of the Interior.

Petitioners also request that critical habitat be designated concurrent with the listing, as required by 16 U.S.C. § 1533(b)(6)(C) and 50 C.F.R. § 424.12, and pursuant to the Administrative Procedure Act (5 U.S.C. § 553).

Due to the threat of extinction and because of its small population size, restricted distribution, isolation, and the numerous factors threatening the species and its remaining habitat, we request an emergency listing and emergency critical habitat designation pursuant to 16 U.S.C. § 1533(b)(7) and 50 CFR 424.20. While the species is emergency listed, the U.S. Fish and Wildlife Service should finalize a standard listing rule for Leona's little blue butterfly.

There is a single population of this butterfly consisting of an estimated 2,000 individuals within a 6 mile area of the Antelope Desert on the eastern side of the Oregon Cascade Range. This butterfly is threatened with extinction from insecticide and herbicide use, timber management, conifer encroachment, catastrophic wild fire, controlled burning, cinder mining, livestock grazing, and, potentially, an impending change in land ownership.

Petitioners understand that this petition action sets in motion a specific process placing definite response requirements on the U.S. Fish and Wildlife Service and very specific time constraints upon those responses. 16 U.S.C. § 1533(b).

Sincerely,

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The Xerces Society is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. Established in 1971, the Society is at the forefront of invertebrate protection worldwide, harnessing the knowledge of scientists and the enthusiasm of citizens to implement conservation programs.

Dr. David V. McCorkle is a Professor emeritus of Biology at Western Oregon University and one of the scientists who originally described the Leona's little blue butterfly.

Oregon Wild is a nonprofit organization that works to protect and restore Oregon's wildlands, wildlife and waters as an enduring legacy for all Oregonians. Oregon Wild (formerly the Oregon Natural Resources Council or ONRC) was founded in 1974 and has been instrumental in permanently safeguarding some of Oregon's most precious landscapes through campaigns for Wilderness, old-growth, rivers and watersheds, and roadless protection.

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I. INTRODUCTION

Leona's little blue butterfly (*Philotiella leona*) is in imminent danger of going extinct. After two years of comprehensive surveys, Leona's little blue is known only from a single population of 1,000-2,000 individuals that encompasses less than a six square mile area of the Antelope Desert in Klamath County, Oregon. This highly endemic species occupies a specialized niche within a volcanic pumice and ash ecosystem primarily on unprotected, non-federal timberland, near the town of Chinchalo. A small portion of the population occurs on the Winema National Forest. Because of Leona's little blue's single population, high degree of endemism and limited distribution, immediate protection of known and appropriate, contiguous habitat will be necessary for the survival of the species.

This minute butterfly is threatened by conifer encroachment, catastrophic and controlled fire, timbering activities, insecticide and herbicide use, cinder mining, livestock grazing, and, potentially, by a change in land management that will occur when the majority of its habitat changes ownership.

These threats, the small number of extant individuals, the species' low dispersal ability, and the natural instability of small populations lead us to conclude, unequivocally, that Leona's little blue butterfly is threatened with extinction and must be given immediate protection under the Endangered Species Act.

II. CANDIDATE BACKGROUND, STATUS AND LISTING HISTORY

Leona's little blue butterfly has never been petitioned for listing under the Endangered Species Act and it has no federal status. The Oregon Natural Heritage Information Center and NatureServe rank this species as S1/S2 (Critically Imperiled/Imperiled). The USDA Forest Service (FS) and USDI Bureau of Land Management (BLM) Interagency Special Status and Sensitive Species Program (ISSSSP) list this species as 'strategic', meaning that it may be a sensitive species, but either information was lacking or the species had not been documented on FS or BLM land when that determination was made. Now that two years of surveys have been completed, the ISSSSP may have sufficient information to list this species as 'sensitive'. However, even a 'sensitive' designation would provide little protection for this species, since the majority of the population occurs on private land.

III. SPECIES DESCRIPTION

A. Adult

Leona's little blue (*Philotiella leona*) was discovered in 1995 by Harold and Leona Rice and formally described in 1999 by Hammond and McCorkle.¹ Measuring less than three quarters of an inch, Leona's little blue is a small and charismatic butterfly. While Leona's little blue is the largest species of the tiny genus *Philotiella*, it is noticeably smaller than any of the other blue butterflies with which it co-occurs, including the Glaucous blue (*Euphilotes glaucus oregonensis*)

¹ Hammond, P.C. and D.V. McCorkle. 1999. A new species of *Philotiella* from the Oregon Cascade Range (Lepidoptera: Lycaenidae). *Holarctic Lepidoptera*, 6(2): 77-82.

and the Lupine blue (*Plebejus lupini*). The forewings of this species measure 9-12 mm in length.² The adult male's dorsal wings are colored blue, with blackish margins. The adult female's dorsal wings are black with brownish hues. The ventral hind wing of Leona's little blue is striking white with prominent black discal and median spots.³ The spots on the ventral forewings are elongated or rectangular in shape,⁴ and slightly larger than the spots on the ventral hind wings. The wings are somewhat narrow and elongated.⁵ For a complete description of this species, see Hammond and McCorkle 1999.



Figure 2. Photographs of pinned Leona's little blue, holotype male, dorsal surface (left), Leona's little blue, allotype female, dorsal surface (center), and Leona's little blue, allotype female, ventral surface (right). Reproduced from Hammond and McCorkle 1999.

B. Larva and pupa

The caterpillar life stage of Leona's little blue is typically pinkish, or more rarely, green in color and can be found on the larval host plant (spurry buckwheat, *Eriogonum spergulinum*) from 2-6 weeks after the adult flight period begins. This species overwinters in the pupal stage.⁶



Figure 3. Photos of Leona's little blue larva (left) and pupa (right) by D. McCorkle

² Hammond and McCorkle 1999

³ Hammond and McCorkle 1999

⁴ Hammond and McCorkle 1999

⁵ Pyle, R.M. 2002. *The Butterflies of Cascadia*. Seattle Audubon Society, Seattle, WA. 420 pages.

⁶ Ross, D. 2008. *Surveys for Leona's little blue (Philotiella leona) in the Antelope Desert of Klamath County, Oregon*. A report to High Desert Museum (Bend, OR) and USFWS (Portland, OR). 10 pages.

IV. TAXONOMY

In 1995, Leona's little blue was discovered by lepidopterists Harold and Leona Rice. It was confirmed as a discrete species by Hammond and McCorkle in 1999,⁷ and its designation as a full species was validated by Pelham in 2008 and remains uncontested.⁸ Superficially *P. leona* diverges markedly from *Philotiella speciosa speciosa*, *Philotiella speciosa purissima*, and *Philotiella boharatum*, which are its closest known relatives. The size and wing coloration of *P. leona* and *P. s. speciosa* are very different and the structural disparity in reproductive organs is especially pronounced. *P. s. purissima* is somewhat intermediate between *P. leona* and *P. speciosa*, but still able to be separated morphologically. Especially noteworthy is the absence of any keel on the reproductive organs of *P. leona*.⁹

V. POPULATION DISTRIBUTION AND STATUS

The type locality for Leona's little blue butterfly is an area of open ash-pumice land along a vegetated shoulder of U.S. Highway 97, near Sand Creek in Klamath County of south-central Oregon. This area falls roughly between the town of Chinchalo on the east and part of the Winema National Forest to the west, approximately 9 miles east of Crater Lake National Park. Since the discovery in 1995, thorough surveys (including exhaustive searches in the summers of 2008 and 2009), have established that the known range of Leona's little blue covers only six square miles.¹⁰ The north-south limits of the species' range run roughly from milepost 225 to milepost 230 on U.S. Highway 97. The majority of observations of the species have occurred near stretches of bare ground on the Mazama Tree Farm, presently held by Cascade Timberlands LLC. This habitat is scheduled for transfer to the Klamath Tribes (made up of the Klamath, Modoc and Yahooskin tribes) once the Klamath Basin Restoration Agreement becomes official and funds for the agreement are appropriated by Congress. The heart of the species distribution is centered roughly on a power line road directly west of Sand Creek Station. In 2008, two occupied sites were found just within the borders of the Winema National Forest, north of NFD Road 6602. In 2009, Leona's little blue was observed at two additional adjacent locations on the Winema National Forest.¹¹ There is also a small parcel of land managed by the Oregon Department of Transportation within this 6 square mile area where Leona's little blue has been found. This constitutes the entire known global distribution of Leona's little blue. Dana Ross, who led the 2008 and 2009 surveys, notes that this species only has one population, consisting of an estimated 1,000 to 2,000 individuals.¹² It is unknown whether this population is stable or declining, since it has only recently been discovered and population estimates from multiple years are not available.

It is possible, but unlikely, that Leona's little blue may also occur in the volcanic highlands of Northeastern California, where spurry buckwheat is common. There are no records of Leona's

⁷ Hammond and McCorkle 1999

⁸ Pelham, J.P. 2008. A Catalogue of the Butterflies of the United States and Canada. The Journal of Research on the Lepidoptera. Volume 40, 658 pages.

⁹ Hammond and McCorkle 1999

¹⁰ Ross 2008 and S. Jepsen pers. comm. with D. Ross 3 November 2009.

¹¹ Ross, D. 2009. 2009 Surveys for Leona's little blue (*Philotiella leona*). A report to The Xerces Society and U.S. Fish and Wildlife Service. 22 pages.

¹² Ross 2008

little blue from California, despite the fact that numerous hobby butterfly collectors have frequented these areas.¹³ In 2009, Dana Ross spent 10 days surveying ash-pumice habitats north, east and south of the known population in Oregon with abundant spurry buckwheat, but no additional populations outside of the 6-mile range established in 2008 were documented.¹⁴ Leona's little blue appears to favor open habitat types where spurry buckwheat can flourish.

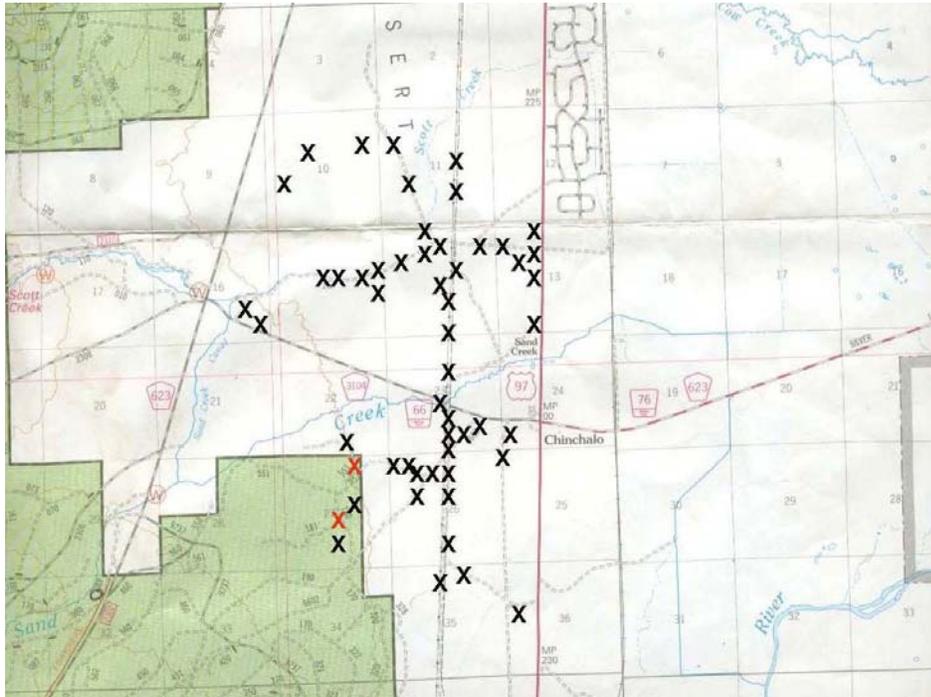


Figure 1. Map of Leona's little blue (LLB) range reproduced from Ross 2009. All X symbols indicate observations of LLB in 2008 and 2009. Red X symbols indicate observations on Winema National Forest that were made during surveys in 2009. Extensive surveys of potential habitat in surrounding areas did not expand the known range of Leona's little blue illustrated above.

VI. BIOLOGY AND HABITAT REQUIREMENTS

Larval development of Leona's little blue butterfly appears to be entirely dependant upon the plant, spurry buckwheat (*Eriogonum spergulinum*). Leona's little blue is only known to occur in association with robust patches of spurry buckwheat within the Mazama ash fields of Klamath County.¹⁵

The flight period of adult Leona's little blue generally occurs from mid-June through early July. Both male and female Leona's little blue have been observed nectaring on sulphur flower buckwheat (*Eriogonum umbellatum*)¹⁶ and a weedy species of *Epilobium* (Family: Onagraceae)

¹³ S. Jepsen, personal communication with D. McCorkle, 7 December 2009

¹⁴ S. Jepsen, personal communication with D. Ross, 3 November 2009

¹⁵ Hammond and McCorkle 1999

¹⁶ Ross 2009

that looks somewhat similar to spurry buckwheat.¹⁷ Leona's little blue adults have also been observed nectaring on its larval host plant spurry buckwheat.¹⁸ Females are less active fliers than males and spend long periods sedentary on vegetation with wings closed. Both sexes exhibit very low-flying flight patterns. Generally, this habit of low flight combined with their tiny size, dark outward cast and sedentary nature renders Leona's little blue difficult to observe in the field.¹⁹

VII. HABITAT STATUS AND CONDITION

The explosion of Mt. Mazama (now Crater Lake) approximately 6,600 years ago deposited deep fields of ash-pumice on the eastern slope of the Cascade Range; these xeric habitats host a unique butterfly fauna,²⁰ including the rare Moeck's fritillary (*Speyeria egleis moecki*).²¹ Leona's little blue butterfly is endemic to a 6 square-mile area of volcanic ash-pumice habitat within the Antelope Desert of southern Oregon. Its habitat is approximately 9 miles east of Crater Lake National Park, and directly west of U.S. Highway 97, near Sand Creek in Klamath County. Leona's little blue butterfly occurs primarily in openings of lodgepole pine-bitterbrush forests with abundant spurry buckwheat (*Eriogonum spergulinum*). The species has been found on a small area of public land within the Winema National Forest, although most occurrences have been documented on private land, owned and managed by Cascades Timberlands LLC.

As discussed below, these forest openings are threatened by conifer encroachment and decades of fire suppression. The habitat is physically disturbed by cinder pit mining, heavy equipment used in timbering operations, and livestock grazing. Pesticide use on the nearby Klamath Marsh and adjacent private lands may drift to contaminate Leona's little blue habitat.

VIII. LEONA'S LITTLE BLUE IS LISTABLE UNDER THE ESA

A. Leona's little blue butterfly is a species under the ESA

The Endangered Species Act, 16 U.S.C. §§ 1531 - 1544, allows any species of fish, wildlife or plant to be listed under the act's provisions. Section 3(8) of the ESA defines "fish or wildlife" to mean "any member of the animal kingdom, including without limitation any mammal, fish, bird..., mollusk, crustacean, arthropod or other invertebrate..." 16 U.S.C. § 1532 (8). Leona's little blue butterfly is an arthropod. Leona's little blue butterfly, *Philotiella leona*, was formally described as a species in 1999 by Hammond and McCorkle²² and its taxonomic status remains uncontested.²³ It qualifies as a "species" under the Act.

¹⁷ Hammond and McCorkle 1999

¹⁸ S. Jepsen, personal observation, 6 July 2009

¹⁹ Hammond and McCorkle 1999

²⁰ Hammond and McCorkle 1999 and Hammond, P.C. 1981(83). The colonization of violets and *Speyeria* butterflies on the Ash-Pumice fields deposited by Cascadian volcanoes. *Journal of Research on the Lepidoptera* 20(3): 179-191.

²¹ Hammond, P.C. and E.J. Dornfeld. 1983. A new subspecies of *Speyeria egleis* (nymphalidae) from the pumice region of central Oregon. *Journal of the Lepidopterists' Society* 37(2), 1983, 115-120.

²² Hammond and McCorkle 1999

²³ Pelham 2008

B. Leona's little blue butterfly is endangered under the ESA

The U.S. Fish and Wildlife Service must determine, based solely and demonstrably on the basis of the best scientific and commercial data available, if a species is threatened or endangered in all or a significant portion of its range because of *any* of the following factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) over-utilization for commercial, recreational, scientific or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or manmade factors affecting its continued existence. 16 U.S.C. §§ 1533(a)(1) and 1533(b).

Petitioners believe that factors 1, 2, 3, 4, and 5 may threaten Leona's little blue butterfly with extinction. Given Leona's little blue's single population, extremely limited range, the degree of threats and potential threats within its range, and the lack of regulatory measures in place to protect the survival of the species, petitioners have concluded that Leona's little blue has a high risk of becoming extinct in the immediate future.

1. Present or threatened destruction, modification or curtailment of habitat or range

Conifer Encroachment

Fire suppression over the past half century has led to a loss of meadow and other open canopy habitat. At present, young lodgepole pine trees are encroaching into numerous open patches of spurry buckwheat and other low-growing shrubs in the heart of Leona's little blue's habitat.²⁴ Unless addressed, the encroachment of conifers, and subsequent loss of open canopy habitat required by spurry buckwheat, poses a major threat to the survival of Leona's little blue. To ensure the survival of Leona's little blue in an actively managed forest, plans should be developed to selectively and carefully manage the encroachment of conifers in the open areas where the butterfly occurs. These plans need to be specific to each site and managers should consult with experts to determine how to manage these areas without further harming this species.

Fire

Fire suppression frequently causes extensive changes in forest structure. These changes include an increase in combustible fuel loads, increase in tree density, increase in fire intolerant species, and loss of the herbaceous layer as the shrub community matures.²⁵ Catastrophic fire often occurs as a result. The Mazama Tree Farm is recognized as having high fire danger due to a high density of lodgepole pine.²⁶ Because Leona's little blue has only a single population and an extremely limited range, a single wildfire in its habitat could lead to the extinction of the entire species.

Due to the importance of fire in maintaining many native ecosystems, the use of controlled burning as a management tool has become increasingly common. Although the effects of fire on vegetation and vertebrate communities are more widely understood than the effects of fire on

²⁴ S. Jepsen, personal observation, 6 July 2009

²⁵ Huntzinger M. 2003. Effects of fire management practices on butterfly diversity in the forested western united states. *Biological Conservation*, 113(1): 1-12.

²⁶ Milstein, M. December 18, 2008. Land Deal Returns Slice of Klamath Tribal Homeland. *The Oregonian*.

Accessible online:

http://www.oregonlive.com/environment/index.ssf/2008/12/land_deal_returns_slice_of_kla.html, last accessed 2 December 2009

invertebrates, fire can be detrimental to butterflies if their biology is not considered when designing a fire management strategy.²⁷ A recent study examining the impact of prescribed burning on the mardon skipper (*Polites mardon*) in Northern California showed that burned areas had an order of magnitude fewer butterflies than areas that were not burned. Burned areas may be re-colonized by butterflies flying in from unburned parts of the meadow, but the rate and extent of this re-colonization for mardon skippers has not been investigated and is currently unknown. If an entire area had been burned, the mardon skipper would likely have been extirpated from the site.²⁸

Similar to the mardon skipper, the single population of Leona's little blue is vulnerable to extirpation from controlled burning. The controlled burning of Leona's little blue habitat could extirpate the population if not done carefully, with consideration of butterfly behavior and life stage at the time of the burn and knowledge of where the butterfly population is distributed across the burn-site. Since only a single, isolated population of Leona's little blue exists, there would be no additional source population available to re-colonize a burned area if the Leona's little blue population was locally extirpated by a fire. The petitioners believe that both wildfires and certain controlled burns pose a major threat to the survival of Leona's little blue.

Timber Management

While some amount of selective timber harvest may benefit Leona's little blue, since its host plant is an early successional species, the impacts associated with intensified management of the Mazama Forest for timber production may cause a destructive increase of road building, traffic and heavy equipment operations throughout Leona's little blue's habitat. Management practices which favor increased stand density may result in the eventual compromise of the sunny, exposed conditions that spurry buckwheat requires. Furthermore, trampling by personnel, piling of log slash, and burning of log piles in Leona's little blue habitat, if done without consideration of Leona's little blue distribution and biology, may harm the butterfly.

Insecticide Use

Insecticides are commonly used in rangeland areas across south central Oregon to control native grasshoppers. Insecticides are routinely applied to the Klamath Marsh National Wildlife Refuge and nearby private lands, funded in part by the Animal and Plant Health Inspection Service and the Oregon Department of Agriculture. Leona's little blue habitat is approximately five miles west of Klamath Marsh National Wildlife Refuge, and is less than one mile west of privately owned rangelands that may be sprayed for native grasshoppers.

Insecticides that may be used in rangeland areas in Klamath County, Oregon to control native grasshoppers include: diflubenzuron (Dimilin, an Insect Growth Regulator), carbaryl (carbamate), and malathion (organophosphate). Broad-spectrum insecticides used for grasshopper control in rangelands negatively impact non-target insects,²⁹ including butterflies.

²⁷ Gibson C.D., V.K. Brown, L. Losito, and G.C. McGavin. 1992. The Response of Invertebrate Assemblies to Grazing. *Ecography* 15(2): 166-76.

²⁸ Black, S.H., C. Mazzacano, and L. Lauvray. 2009. Mardon skipper survey of Coon Mountain burn site. Report to the U.S. Fish and Wildlife Service and U.S. Forest Service. The Xerces Society for Invertebrate Conservation.

²⁹ Alston, D.G. and V.J. Tepedino. 2000. Direct and indirect effects of insecticides on native bees. In *Grasshopper Integrated Pest Management User Handbook* (Technical Bulletin No. 1809), edited by G.L. Cunningham and M.W. Sampson. Washington, DC: United States Department of Agriculture Animal and Plant Health Inspection Services.

All pesticides that can be used to control native grasshoppers are highly toxic to all life stages of this butterfly, with the exception of diflubenzuron, which is primarily toxic to the larval stage of Leona's little blue butterfly.

Diflubenzuron

Dimilin is the trade name for the pesticide diflubenzuron. Dimilin acts as an insect growth inhibitor by arresting chitin synthesis, i.e., the formation of an insect's exoskeleton. Dimilin is lethal to lepidoptera caterpillars at extremely small quantities.³⁰ Dimilin, applied by ATV, is the most commonly used insecticide for treatment of native grasshoppers on Klamath Marsh National Wildlife Refuge.³¹ Dimilin has been shown to last weeks on foliage. Dimilin caused 100% mortality of Douglas-fir tussock moth larvae up to seven weeks following application.³² Another study found residue on foliage 21 days after application.³³ Sample *et al.* found that after Dimilin spraying, the number of lepidoptera larvae was reduced at treated sites.³⁴ Leona's little blue butterfly can be found in all life stages (egg, larvae, pupae and adult) during the time period that Dimilin is generally applied for grasshoppers (June) and during the three-week post treatment period that Dimilin can remain active (into July). In general, Leona's little blue eggs are laid in late June and early July. Eggs take approximately one week to hatch into larvae. Larvae are active and feed on spurry buckwheat (*Eriogonum spergulinum*) until mid-July or early August, at which point the caterpillars pupate. This butterfly overwinters in the pupal life stage. Adults emerge in mid-late June, mate and begin laying eggs.³⁵

Carbaryl

Carbaryl is a carbamate insecticide. It inhibits the action of the enzyme acetyl cholinesterase (AChE) that is an essential component of insect, bird, fish, and mammal nervous systems. Carbaryl has "very high" toxicity levels for terrestrial invertebrates (including butterflies), aquatic invertebrates, and fish.³⁶ By inhibiting the function of Acetylcholinesterase (AChE) in the system, carbaryl causes loss of normal muscle control, and ultimately death.

Malathion

Malathion is an organophosphate insecticide. It is one of a class of pesticides that are chemically related to nerve gases used in World War II. Like carbaryl, malathion attacks the nervous system by inhibiting Acetyl-Cholinesterase (AChE). Malathion can also inhibit liver enzymes that effect biological membrane function. Malathion has been associated with numerous health problems, including acute toxicity, subchronic and chronic toxicity, cancer, genetic defects, birth defects, reproductive problems, immune system suppression, and vision impairment. Malathion is a

³⁰ Martinat, P. J., V. Christman, R. J. Cooper, K. M. Dodge, R. C. Whitmore, G. Booth, and G. Seidel. 1987. Environmental fate of dimilin 25-W in a central Appalachian Forest. *Bulletin of Environmental Contamination and Toxicology*. 39:142-149.

³¹ S. Jepsen pers. comm. with Gary Brown (APHIS), April 2009

³² Robertson J.L. and L.M. Boelter. 1979. Toxicity of insecticides to Douglas-fir tussock moth. Residual toxicity and rainfastness. *Canadian Entomology*. 111: 1161-1175.

³³ Martinat *et al.* 1987

³⁴ Sample, B. E., R. J. Cooper, and R. C. Whitmore. 1993 Dietary Shifts among Songbirds from a Diflubenzuron-Treated Forest. *Condor*. 95: 616-624.

³⁵ S. Jepsen pers. comm. with Dave McCorkle, April 2009

³⁶ Cox, C. Carbaryl. *Journal of Pesticide Reform*, Volume 13, Number 1, Spring 1993. Northwest Coalition for Alternatives to Pesticides, Eugene, OR.

broad spectrum insecticide that is highly toxic to insects, including butterflies, as well as snails, worms, and microcrustaceans.³⁷

Pesticide drift

Although ATV application is currently the most common application method for killing grasshoppers on the Klamath Marsh National Wildlife Refuge, insecticides are commonly applied aerially throughout the west. If insecticides are applied aerially near Leona's little blue habitat, the potential for pesticide drift to cause mortality to Leona's little blue butterflies is great. Drift is the movement of spray droplets or pesticide vapor out of the intended spray area. When pesticides are applied by ground application or by air, the potential exists for off-target movement or drift. Several factors affect how much and where a pesticide will drift, most importantly droplet size and weather. Smaller droplets remain suspended in the air much longer than larger droplets and can thus drift over longer distances. Wind speed and direction, relative humidity, air temperature, and atmospheric stability are weather factors that influence spray drift. During windy conditions, significant amounts of pesticide can drift outside the spray area. Even small amounts of a pesticide can drift great distances under stable weather conditions. This long range drift is often related to the occurrence of a temperature inversion, an atmospheric phenomenon generally associated with stable weather conditions when wind is calm and skies are clear. In these conditions, the air near the surface is cooler than the air above it, resulting in small spray droplets being suspended for longer periods and consequently able to move laterally very long distances in very light wind.

A study from Penn State assessing drift of malathion when used to control boll weevil found that it can drift up to one kilometer (5/8 mile)—the greatest distance measured—from the point of application.³⁸ According to the study, the highest amount of drift at one kilometer occurred when atmospheric conditions were stable, meaning vertical air mass movements were dampened. Two other field studies summarized in the 1997 EPA Registration Eligibility Decision for diflubenzuron (Dimilin) found that it drifted at least 1,200 feet. In Butte County, California, MCPA, dimethyl amine spray drifted 400 meters (1,300 feet) and in Tulare County, California, carbaryl drifted 550 meters (1,787 feet).³⁹ A study of carbaryl applications in orchards in Vermont found that aerially applied carbaryl repeatedly drifted to the most distant sampling point (about 500 yards) under all wind and atmospheric stability conditions tested.

Studies show consistently that pesticide drift can be found one kilometer (5/8 mile) from the edge of the spray site and sometimes much farther. In Arkansas, drift of the herbicide propanil was concentrated enough at one kilometer to be injurious to crop plants.⁴⁰ Ghassemi *et al.* analyzed six different field studies of insecticide drift using a curve fitting method to estimate the “worst case” and “best case” estimates of deposition over distances up to ten kilometers (6.21

³⁷ Brenner, L. 1992. Malathion Fact Sheet. Journal of Pesticide Reform, Volume 12, Number 4, Winter 1992. Northwest Coalition for Alternatives to Pesticides, Eugene, OR.

³⁸ Penn State. 1993. Study of off site deposition of malathion using operational procedures for Southeastern cotton boll Weevil eradication program. Aerial application technology laboratory. Department of Entomology.

³⁹ Majewski M. and Capel P. 1995. Pesticides in the Atmosphere: Distribution, trend and governing factors, Ann Arbor Press, Inc. Chelsea MI.

⁴⁰ Barnes, C.J., T.L. Lavy, and J.D. Mattice. 1987. Exposure to non-applicator personnel and adjacent areas to aerially applied propanil. *Bull. Environ. Contam. Toxicol.* 39:126-133.

miles).⁴¹ Even the best case scenario plotted drift over two kilometers (1.25 miles) and the worse case scenario found that 4.5% of the applied dose of pesticide would drift one kilometer (5/8 mile), 1.7% to two kilometers (1 1/4 miles), 0.38% to five kilometers (3.1 miles), and 0.1% to ten kilometers (6.21 miles). In one of the studies analyzed, carbaryl was found at over 1% of the applied dose over seven kilometers (4.3 miles) from the spray edge.⁴²

In summary, 1) All insecticides used against native grasshoppers are highly toxic to Leona's little blue butterfly; 2) The areas that are frequently treated are within one mile of Leona's little blue habitat; 3) Drift from pesticide application has been shown to occur up to many miles from the point of application; 4) The global distribution of this highly endemic butterfly includes only a six-mile area in the Antelope Desert; and 5) Exposure of Leona's little blue butterfly to any of the insecticides proposed for use against grasshoppers in Klamath County, Oregon could lead to the extinction of this butterfly.

Herbicide Use

Herbicides that are commonly used for timber management and restoration projects threaten Leona's little blue both directly (by harming larvae) and indirectly (by killing its host plant, spurry buckwheat). The broadcast application of a non-selective herbicide can indiscriminately reduce both floral resources and host plants for butterflies.⁴³ A few commonly used herbicides that negatively affect butterflies are discussed below: chlorsulfuron, glyphosate, triclopyr, sethoxydim and fluzafop-p-butyl.

Chlorsulfuron is an herbicide that controls select broadleaf weeds and undesirable grasses. Effects of chlorsulfuron to terrestrial invertebrates have been studied using a leaf beetle (*Gastrophysa polygoni*), and large white butterfly (*Pieris brassicae*).⁴⁴ Direct spray of first-instar larva and feeding of larva on treated plants did not produce significant changes in mortality, but did delay development of those feeding on treated plants. Placing eggs of the leaf beetle on treated plants significantly decreased survival.⁴⁵

Glyphosate and triclopyr, two other common herbicides, are also identified as potentially problematic for the Oregon Silver Spot butterfly in exposure scenarios.⁴⁶ In a laboratory study, Russell and Schultz showed that sethoxydim and fluzafop-p-butyl herbicides both reduce development time of Puget blue (*Plebejus icarioides blackmorei*) butterflies from the date of treatment to eclosure, and reduce survival, pupal weight, and wing size of cabbage white butterflies.⁴⁷

⁴¹ Ghassemi M., P. Painter and M. Powers. 1982. Estimating drift exposure due to aerial application of insecticides in forests. *Environmental Science Technology*. 16: 510-514.

⁴² Ghassemi *et al.* 1982

⁴³ Smallidge P.J. and D.J. Leopold. 1997. Vegetation management for the maintenance and conservation of butterfly habitats in temperate human-dominated habitats. *Landscape and Urban Planning* 38: 259-280.

⁴⁴ Kjaer, C. and N. Elmegaard. 1996. Effect of herbicide treatment on host plant quality for a leaf-eating beetle. *Pesticide Science*. 47(4) 319-325.

⁴⁵ Kjaer and Elmegaard 1996

⁴⁶ USDA Forest Service. April 2005. Preventing and managing invasive plants: Final Environmental Impact Statement. Pacific Northwest Region. 173 pages.

⁴⁷ Russell, C. and C.B. Schultz. (2009). Effects of grass-specific herbicides on butterflies: an experimental investigation to advance conservation efforts. *Journal of Insect Conservation*. Online publication date: 29 May 2009.

Cinder Mining

Numerous cinder pits operated by the Oregon Department of Transportation (ODOT) exist in the vicinity of Leona's little blue habitat, some of which are on Fremont-Winema National Forest land. ODOT uses volcanic rock material mined from cinder pits to apply to roads for safety in inclement weather. In order to meet demands for material, these cinder pits are periodically expanded. For example, in a recent Schedule of Proposed Actions, the Fremont-Winema National Forest proposed to expand the size of the Lookout Butte and Jackson Creek Cinder Pits on the Chemult Ranger District, which are relatively close to Leona's little blue habitat.⁴⁸ In 2006, a proposal to expand Burnt Butte Cinder Pit was approved – this cinder pit is within a couple of miles of Leona's little blue's known habitat. In one case, ODOT summarizes its exploration activities to search for new areas to expand cinder pits as drilling 10-30 holes with truck and track mounted equipment within a 40 acre area adjacent to the pit.⁴⁹ The drilling and heavy equipment traffic associated with exploration for new cinder pits, the development of new cinder pits, and the expansion of existing pits, all have a high potential to destroy the habitat and cause direct butterfly mortality.

Change in land ownership

The majority of the six-square mile patch of Leona's little blue habitat exists on the Mazama Tree Farm, which is presently owned by Cascade Timberlands LLC and scheduled for transfer to the Klamath Tribes once funds for the Klamath Basin Restoration Agreement (KBRA) are appropriated by Congress. Once the land transfer occurs, land management may be incompatible with the survival of Leona's little blue butterfly. A recent newspaper article reports that the Klamath Tribes may develop a biomass energy facility on the Mazama Tree Farm that would create power by burning wood waste and/or garbage.⁵⁰ Such a facility, if built on Leona's little blue habitat, could drive this species to extinction. Also if lodgepole pine trees were intensively harvested for this biomass facility, the associated impacts could further harm this species and its habitat.

The Mazama Tree Farm currently has a high density of lodgepole pine trees that pose a risk for wildfire – once the land transfer occurs, the tribes plan to restore the land to a “healthy, productive forest.”⁵¹ While a change in timber management practices may ultimately benefit some species, it is possible that land management changes will negatively impact the habitat, and ultimately the survival, of Leona's little blue.

Livestock Grazing

The impact of livestock grazing on Leona's little blue habitat is unknown, but current or future grazing practices may threaten this species. Cattle are non-selective browsers with the capacity to destroy native vegetation,⁵² such as spurry buckwheat and other plants that Leona's little blue visits for nectar. Intensive livestock grazing can cause adverse impacts to butterfly populations

⁴⁸ <http://www.fs.fed.us/r6/frewin/projects/sopa/20091008-chemult.pdf>, last accessed 1 December 2009.

⁴⁹ <https://scholarsbank.uoregon.edu/xmlui/handle/1794/6906>, last accessed 1 December 2009.

⁵⁰ Milstein 2008

⁵¹ Milstein 2008

⁵² Pickering, D.L. 1997. The influence of fire on west coast grasslands and concerns about its use as a management tool. A case study of the Oregon silverspot butterfly *Speyeria zerene hippolyta* (Lepidoptera, Nymphalidae). Pages 37-46 *In* Proceedings of fire effects on rare and endangered species and habitats conference in Coeur d'Alene, Idaho. 1995. IAWF

by (1) trampling eggs, larvae, pupae, and adults and (2) eating larval and adult food sources, and (3) disturbing the soil, which allows weeds to invade.⁵³ The Klamath Tribe's Timber management plan, which will be used once the Mazama tree farm is transferred to the Klamath tribes, allows domestic livestock grazing on winter range if it enhances mule deer habitat.⁵⁴ Under the current management plan for the Winema National Forest, grazing is allowed within habitat suitable for Leona's little blue butterfly.⁵⁵

2. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Insect collecting is an essential component of scientific study; advances in research further our understanding and ability to conserve a species, and certainly Leona's little blue is no exception. In the case of Leona's little blue, collection of more than 100 individual butterflies was a requisite of the species description and validation as a unique species. Given the limited range and single population of only 1,000-2,000 individuals, Leona's little blue may be vulnerable to over-collection.

3. Disease or predation

As discussed below, small and fragmented populations face a greater extinction risk from normal population fluctuations due to disease and predation than large, unfragmented populations.⁵⁶ Many, if not most insect populations normally experience large fluctuations in size.⁵⁷ Predation and disease may cause annual changes in butterfly numbers of an order of magnitude or more. Normal population fluctuations, coupled with habitat alteration or loss (sometimes seemingly minor habitat alterations) can result in population extirpations.⁵⁸ Since only a single population of Leona's little blue exists in a highly restricted area, this species is vulnerable to extinction from naturally occurring disease and predation. Leona's little blue butterfly may also be at risk of extinction from exotic diseases and predators, such as the Asian lady beetle (*Harmonia axyridis*).

⁵³ Warren MS. 1993. A review of butterfly conservation in central southern Britain: II. Site management and habitat selection of key species. *Biological Conservation*. 64: 37-49.

⁵⁴ Johnson, K.N., J.F. Franklin, and D.L. Johnson. May, 2008. A Plan for the Klamath Tribes' Management of the Klamath Reservation Forest. 225 pages. Accessible online: http://www.klamathtribes.org/information/background/documents/Klamath_Plan_Final_May_2008.pdf, last accessed 3 December 2009.

⁵⁵ USDA Forest Service, Pacific Northwest Region. 1990. Winema National Forest Land and Resource Management Plan. Accessible online: <http://www.fs.fed.us/r6/frewin/projects/forestplan/index.shtml>, last accessed 3 December 2009.

⁵⁶ Reviewed in Shaffer, M.L. 1981. Minimum Population Sizes for Species Conservation. *BioScience* 31(2): 131-134.

⁵⁷ Ehrlich, P.R. 1992. Population biology of checkerspot butterflies and the preservation of global biodiversity. *Oikos*. 63:6-12 and Schultz, C.B. 1998. Ecology and Conservation of the Fender's Blue Butterfly. PhD. Dissertation, University of Washington. Seattle, WA. 145pp.

⁵⁸ Hanski, I., J. Poyry, T. Pakkala, and M. Kuussaari. 1995. Multiple equilibria in metapopulation dynamics. *Nature*. 377:618-621.

4. The inadequacy of existing regulatory mechanisms

There are no specific existing regulatory measures to protect the unique requirements of Leona's little blue butterfly. No conservation agreements have yet been developed to protect Leona's little blue. Leona's little blue is not included in the Winema National Forest Plan or its subsequent amendments (although the Forest Service has funded surveys and has expressed interest in pursuing activities that might help maintain its open habitat in the Winema National Forest). The Oregon Board of Forestry is charged with the protection of biological diversity and environmental assets on private lands within the state but there are no Oregon Board of Forestry regulations that provide protection for this species. The Oregon Department of Fish and Wildlife has not evaluated or considered the status of Leona's little blue in the most recent Oregon Conservation Strategy and thus, the species receives no benefits of targeted protection under Oregon State Law. Oregon has an Endangered Species statute, but insects do not qualify for listing under this law. The U.S. Fish and Wildlife Service does not provide any special protection for this species. However, the U.S. Fish and Wildlife Service, the Oregon High Desert Museum and The Xerces Society for Invertebrate Conservation have funded surveys for this species to better understand its distribution. Neither the Winema National Forest Plan nor the Klamath Reservation Forest Management Plan, which will apply to the bulk of Leona's little blue's habitat post land-transfer, offers any special protection for this species. The Klamath Reservation Forest Plan includes special provisions for mule deer and federally listed endangered species, but does not include provisions for other, non-listed sensitive species.⁵⁹ Without special management measures applied throughout the species' confined distribution, Leona's little blue butterfly will not enjoy protection of the plans' ecological and species diversity provisions. In addition, Leona's little blue does not receive any special protection under state or local law. The present regulatory measures are woefully inadequate to protect this species from going extinct. Without an Endangered listing under the ESA, and the protections that such a status affords, Leona's little blue will likely go extinct in the near future.

5. Other natural or manmade factors affecting its continued existence

Because of its exceptionally limited range and small population size, Leona's little blue butterfly is uniquely susceptible to extinction from stochastic events, such as disease and predation (discussed above), changing food supply, and natural disasters such as droughts.⁶⁰ Small populations are also threatened with extinction from a loss of genetic variability and reduced fitness due to the unavoidable inbreeding that occurs in such small populations.⁶¹

Small butterfly populations are dependent upon the dispersal of butterflies from larger source populations for re-colonization post-extirpation.⁶² A natural, catastrophic event, such as a fire, could exterminate the entire global population of Leona's little blue butterfly in a single event. In the case of Leona's little blue butterfly, there are no exterior populations that could re-colonize

⁵⁹ Johnson *et al.* 2008

⁶⁰ Reviewed in Shaffer 1981

⁶¹ Reviewed in Shaffer 1981

⁶² Thomas, C.D. and S. Harrison. 1992. Spatial dynamics of a patchily distributed butterfly species. *Journal of Animal Ecology*. 61:437-446.

an area that was extirpated. Thus, full protection of the species throughout its limited range under the ESA is absolutely essential.

IX. CRITICAL HABITAT

Petitioners request the designation of critical habitat for Leona's little blue butterfly concurrent with its listing. 16 U.S.C. § 1533(b)(6)(C) and 50 C.F.R. § 424.12. Critical habitat should include the entire 6 mile range of Leona's little blue butterfly in the Antelope desert of south-central Oregon.

X. CONCLUSION

Approximately two thousand Leona's little blue butterflies persist on a small area of open ash-pumice habitat in the high desert of the Cascades' eastern slope in southern Oregon. The majority of this butterfly's habitat is on private land; the remainder is on the Winema National Forest. This single population of Leona's little blue butterflies faces numerous threats, the most significant include: conifer encroachment, catastrophic fire resulting from decades of fire suppression, timbering activities, insecticides used to control native grasshoppers, cinder mining, and livestock grazing. The impending change in ownership of the Mazama Tree Farm, where the majority of this butterfly's habitat occurs, presents the real possibility of future threats, such as the development of a biomass energy production facility. Without federal intervention in the form an endangered listing under the ESA, the risk of Leona's little blue butterfly going extinct – scarcely more than a decade after its discovery – is very high.

For the following reasons, Leona's little blue butterfly meets the criteria under the Endangered Species Act for consideration as an endangered species: 16 U.S.C. § 1533 (a)(1)(A,B,C,D,E) (Section 4).

- (A) The present or threatened destruction, modification, or curtailment of its habitat or range
- (B) Over-utilization for commercial, recreational, scientific or educational purposes
- (C) Disease and predation
- (D) The inadequacy of existing regulatory mechanisms
- (E) Other natural or manmade factors affecting its continued existence

Due to the single, small population, minute range and isolation, and the numerous factors threatening Leona's little blue butterfly with extinction, The Xerces Society, Dr. David V. McCorkle and Oregon Wild formally petition for listing of the Leona's little blue butterfly (*Philotiella leona*) as an endangered species under the U.S. Endangered Species Act. Furthermore, petitioners request USFWS to use its authority to establish Critical Habitat based on the facts presented to prevent further decline of this beautiful and gravely vulnerable butterfly.