PETITION TO LIST THE *Euphilotes ancilla purpura* AND *Euphilotes ancilla cryptica* UNDER THE U.S. ENDANGERED SPECIES ACT

Euphilotes ancilla cryptica, a newly described subspecies.

Petition Submitted to the U.S. Secretary of Interior
Acting through the U.S. Fish and Wildlife Service

<u>Petitioner</u>:

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WILDEARTH GUARDIANS
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I. Summary

The many, varied habitats in the Great Basin of the western United States are home to a vast diversity of flora and fauna, including many endemic species. Speciation and endemism in butterflies is unusually high in the region: there are more than 200 species—and 700 subspecies—of butterflies in Nevada.

The Spring Mountains are a sky island and a biological hot spot for species endemism in southern Nevada. Speciation in butterflies is significant. Numerous species and subspecies occur throughout the varying elevations and habitat types in the mountain range.

Unfortunately, several butterflies in the Spring Mountains are imperiled, mirroring trends elsewhere (New 1997). Butterfly populations and habitat are affected by natural events and myriad human activities (New 1997; Hoffman Black and Vaughan 2003). Many butterfly species need active conservation if they are to persist (New 1997).

WildEarth Guardians petitions the U.S. Fish and Wildlife Service (Service) to list two butterflies, *Euphilotes ancilla purpora* and *Euphilotes ancilla cryptica* under the Endangered Species Act. Each of these butterflies specializes in or is restricted to limited habitats that are threatened by land uses and other factors. Listing these subspecies as "endangered" or "threatened" under the Endangered Species Act would help conserve them and their habitat (Hoffman Black and Vaughan 2003).

II. Spring Mountains, Nevada

The Spring Mountains are located in southern Nevada, running generally northwest-southeast along the west side of Las Vegas and to the California border. The range is named for the numerous springs to be found, many of them in Red Rock Canyon located on the eastern side of the mountains. The sandstone reefs of Red Rock Canyon separate and bridge higher peaks in the northern and southern parts of the range. The Spring Mountains divide the Pahrump Valley and Amargosa River basin from the Las Vegas Valley and define part of the hydrologic boundary of the Great Basin. The highest peak in the range is Mount Charleston, at 11,918 ft (3,633 m). Most of the Spring Mountains range is located in Clark County, with a small part in Nye County.

The Spring Mountains comprise an area of about 857 mi² (2,220 km²). The varied geography, geology and climate in the Spring Mountains create a wide variety of habitats and support high biological diversity. The Spring Mountains ecosystem includes red rock and desert shrublands; low elevation conifer woodlands, montane shrublands and chaparral; high elevation conifer forests; alpine zones; and riparian areas and springs.

Most of the Spring Mountains is public land. The U.S. Forest Service and the Bureau of Land Management (BLM) manage parts of the mountain range as the Spring Mountains National Recreation Area and Red Rock Canyon National Conservation Area, respectively. Three wilderness areas (Mount Charleston, La Madre Mountain, and Rainbow Mountain) and one BLM Wilderness Study Area (Mount Stirling) are designated in the mountain range. There are also numerous private inholdings in the mountain range.

Established in 1993, the Spring Mountains National Recreation Area (SMNRA) comprises 316,000 acres and offers a variety of recreational opportunities. The area receives as many as 2.5 million visitors per year. It is administered by the Humboldt-Toiyabe National Forest under the 1986 Toiyabe National Forest Land and National Resource Management Plan, as amended by the Spring Mountain National Recreation Area General Management Plan (1996). Most habitat for *Euphilotes ancilla purpora* and *Euphilotes ancilla cryptica* is found within the SMNRA.

III. Endangered Species Act and Implementing Regulations

The Endangered Species Act of 1973 (ESA) protects plants and animals that are listed by the federal government as "endangered" or "threatened" (16 U.S.C. § 1531 et seq.). Any interested person may submit a written petition to the Secretary of the Interior requesting him to list a species as "endangered" or "threatened" under the ESA (50 C.F.R. § 424.14(a)). An "endangered species" is "any species that is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. § 1532(6)). A "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C § 1532(20)). "Species" includes subspecies and distinct population segments of sensitive taxa (16 U.S.C § 1532(16)).

The ESA sets forth listing factors under which a species can qualify for protection (16 U.S.C. § 1533(a)(1)):

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

A taxon need only meet one of the listing criteria outlined in the ESA to qualify for federal listing.

If the Secretary determines that a species warrants a listing as "endangered" or "threatened" under the ESA, he is obligated to designate critical habitat for that species based on the best scientific data available (16 U.S.C. § 1533(b)(2)).

IV. Spring Mountains Butterflies Petitioned for Listing under the Endangered Species Act

WildEarth Guardians petitions to list *Euphilotes ancilla purpura* and *Euphilotes ancilla cryptica* as "threatened" or "endangered" under the ESA. These endemic butterflies occur in the Spring Mountains in southern Nevada. Subspecies *cryptica* was recently described (Austin et al. 2008); both subspecies are collectively known as the "Spring Mountains dark blue butterfly" (Boyd, pers. comm., 08/09/10).

NatureServe nationally ranks subspecies *purpura* as "imperiled" and within Nevada as "critically imperiled/imperiled" (NatureServe 2010).

> Critically Imperiled **--** At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
>
> Imperiled -- At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

The Forest Service, Region 4, lists *Euphilotes ancilla purpura* as a "sensitive species" on the Humbolt-Toiyabe National Forest (Forest Service 2008). The Nevada Natural Heritage Program considers subspecies *purpura* "rare" and "at-risk" in Clark County, Nevada (NNHP 2004).

A. Taxonomy, Description, Life History, Distribution

Distinct populations of *Euphilotes* have been observed and recognized in the Spring Mountains for more than four decades (*see* Austin et al. 2008: 149). They were eventually classified as endemic subspecies of *E. ancilla* in 1998 (Pratt and Emmel 1998). Austin (1998) subsequently described the phenotype *E. a. purpura* in the Spring Mountains, which occurs at the southern extent of known distribution of *E. ancilla*. Austin et al. (2008) later described *E. a. cryptica* based on distinct biological and phenological characteristics.

Euphilotes ancilla purpura (Austin 1998)

Euphilotes ancilla purpura is commonly called the "Spring Mountains dark blue butterfly"; it is also locally known as the "dark blue butterfly." We refer to the subspecies by its scientific name in this petition to distinguish it from *E. a. cryptica.*

Table 1. Taxonomy of *Euphilotes ancilla purpura*	
Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Lepidoptera
Family	Lycaenidae
Genus	*Euphilotes*
Species	*Euphilotes ancilla*
Subspecies	*Euphilotes ancilla purpura*
Sources: Integrated Taxonomic Information System, www.itis.gov; Austin et al. 2008.	

Austin (1998: 552) described *E. ancilla purpura*:

> **MALE.** Size = 12.0 (10.9-12.9). Dorsum deep purple-blue (near Cyanine Blue); outer margins broadly black (2-2.5mm); thin black cell-end bar; veins black; forewing fringe black, occasionally faintly checkered posteriorly with grayish; hindwing fringe indistinctly checkered with whitish and gray. Ventral surface grayish-white with usual maculation of the genus boldly represented; forewing macules large and squarish; submarginal macules fused into single band posteriorly; strong gray flush along inner margin; hindwing macules smaller, generally squarish; Chrome Orange aurora well developed.
>
> **FEMALE.** Size = 11.5 (10.0-12.8). Dorsum dark brown (Vandyke Brown, color 121) with Spectrum Orange aurora on hindwing; fringes whitish, checkered indistinctly with grayish at vein tips. Ventral surface as male but macules tending smaller on forewing and with less distinct gray flush; hindwing with Chrome Orange aurora broader than on male.

Euphilotes spp. use many varieties of buckwheat (*Eriogonum*) as larval host plants (Austin et al. 2008 and others). A single taxon of *Euphilotes* typically will use one species of host plant (Austin et al. 2008 and others). *Euphilotes* eclosion is closely coordinated with host plant flowering and nearly all populations are univoltine (Austin et al. 2008, citing others, and noting exceptions).

Subspecies *purpura* use *Eriogonum umbellatum* var. *juniporinum* as a host plant (Austin et al. 2008; Austin and Leary 2008), commonly known as juniper buckwheat, juniper sulphur flower or juniper sulphur-flowered buckwheat. The plant generally occurs in sandy soils or gravelly flats and slopes in saltbrush, sagebrush, and pinyon-juniper communities, and occasionally in montane conifer woodlands. It is described as “widespread and infrequent in widely scattered and disjunct populations in isolated desert mountain ranges” in Arizona, California, Nevada and Utah, between 1,300-2,500m (4,265-8,202 ft) in elevation (Flora of North America, undated, unpaginated).

Similar to other *Euphilotes*, larvae of subspecies *purpura* feed on reproductive parts and seeds of *E. u. juniporinum* (Austin et al. 2008). Austin et al. (2008) found *E. u. juniporinum* only in the northeastern portion of the Spring Mountains, sparsely distributed on dry slopes in piñon pine-juniper woodland and on disturbed areas (especially from fire) at elevations ranging between 1,775-1,950m (5,823-6397 ft). It was reported blooming from late April to late June (Austin et al. 2008).

Euphilotes ancilla occur in close proximity to their larval host plant. The species distribution may be described as a spatial subset of those of *Eriogonum umbellatum* (Austin et al. 2008). *Euphilotes ancilla* in the Spring Mountains may prefer denser patches of *Eriogonum* (Austin et al. 2008, *citing* Shields and Reveal 1988). Subspecies *purpura* is currently known only from relatively small stands of *E. u. juniporinum* in the northeastern portion of the Spring Mountains (Austin et al. 2008; *see* Map 1 and Map 2). It occurs in lower elevation piñon pine-juniper woodland on Forest Service land between Willow Creek and West Mud Spring and lower Macks Canyon (Austin et al. 2008).

Both subspecies *purpura* and *cryptica* are believed to pupate in litter or soil (Austin et al. 2008). *Euphilotes* spp. may remain in diapause for several years while waiting for appropriate conditions to emerge as adults (A. Warren, pers. comm.; Shields and Reveal 1988). For this reason, it may be difficult to estimate *Euphilotes* populations. Early accounts of *E. ancilla* may have overestimated their distribution in the Spring Mountains (Austin et al. 2008).

Although Austin et al. (2008: 158) described subspecies *purpura* as "often abundant" within its limited range, more recent surveys may indicate the species population has declined (Boyd, pers. comm., 06/19/10). Hundreds of larval host plants were found dead, probably from drought and exposure, at a site believed to be a source for subspecies *purpura* (Boyd, pers. comm., 06/19/10). Very few butterflies (±20 individuals) were observed during six trips to the site, representing perhaps 5 percent of annual peak numbers documented at the same location ten years ago (Boyd, pers. comm., 06/19/10).

Euphilotes ancilla cryptica (Austin et al. 2008)

Euphilotes ancilla cryptica is a newly described subspecies (Austin et al. 2008).

Table 2. Taxonomy of *Euphilotes ancilla cryptica*

Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Lepidoptera
Family	Lycaenidae
Genus	*Euphilotes*
Species	*Euphilotes ancilla*
Subspecies	*Euphilotes ancilla cryptica*

Sources: Integrated Taxonomic Information System, www.itis.gov; Austin et al. 2008.

Austin et al. (2008: 157) described morphological characteristics of *E. ancilla cryptica* as "apparently identical" to *E. ancilla purpura*, but with different biological and phenological characteristics. Subspecies *cryptica* and *purpura* are biologically distinct seasonal cohorts of the same species (Austin et al. 2008). Table 3, adapted from Austin et al. (2008: 156, Table 2), lists the biological differences between ssp. *cyrptica* and *purpura*. Differences in larval host plants, flight season and diapause intensity are significant. The Nevada Natural Heritage Program intends to recognize subspecies *cryptica* based on information in Austin et al. (2008) (Chaney, pers. comm., 08/03/10).

Table 3. Comparison of the Seasonal Cohorts of *Euphilotes ancilla* at Willow and Cold creeks, Spring Mountains, Nevada◆		
trait	***E. ancilla purpura***	***E. ancilla cryptica***
Host plant		
larval host plant	*Eriogonum umbellatum* var. *juniporinum*	*Eriogonum umbellatum* var. *subaridum*
flowering period	late April – late June	mid-July – early September
Butterfly		
flight season 1	early May – early July	mid-July – mid-August
length of flight season	55 days	39 days
visitation to mud	common to abundant	infrequent
length of pupation period	24 days (n=81)	24 days (n=30)
mean length of pupation period	12.8 days	16.6 days
variance of pupation date	38.6%	6.3%
diapause intensity	46.9 days (range 39-65)	109.0 (range 62-169)
variance of diapause intensity	9.9%	22.7%
emergence span	26 days (n=74)	75 days (n=15)
mean length of emergence period	16.9 days	35.3 days
emergence time lag (male-female)	-0.3 days (n=26 m, 46 f)	8.0 days (n=11 m, 11 f)
non-diapause pupae	5 (n=81)	0 (n=38)
holdover pupae	0 (n=79)	13 (n=35)
◆ Internal footnotes in original table omitted.		

Subspecies *cryptica* use *Eriogonum umbellatum* var. *subaridum* as a host plant (Austin et al. 2008), commonly called Ferris's sulphur flower. (It and other varieties of *Eriogonum umbellatum* are also generally known as sulfer flower buckwheat.) The *subaridum* subspecies occurs in sandy soils and gravelly flats and slopes; mixed grasslands; saltbrush and sagebrush communities; and in oak, piñon pine-juniper and montane conifer woodlands, between 1,200-3,100m (3937-10,170 ft), in Arizona, California, Colorado, Nevada, and Utah (Flora of North America, undated, unpaginated). *Eriogonum umbellatum subaridum* is more common than *E. u. juniporinum*, including in the Spring Mountains (Austin et al. 2008).

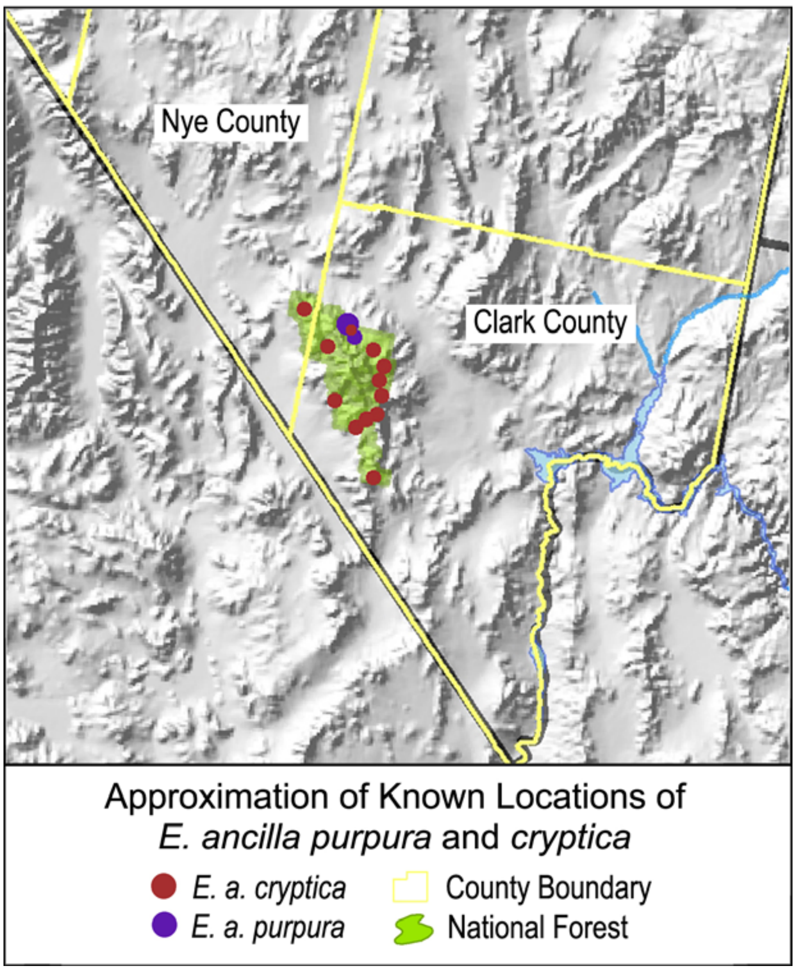
Stan Shebs/Wikimedia

Euphilotes ancilla cryptica use *Eriogonum umbellatum subaridum* as its larval host plant.

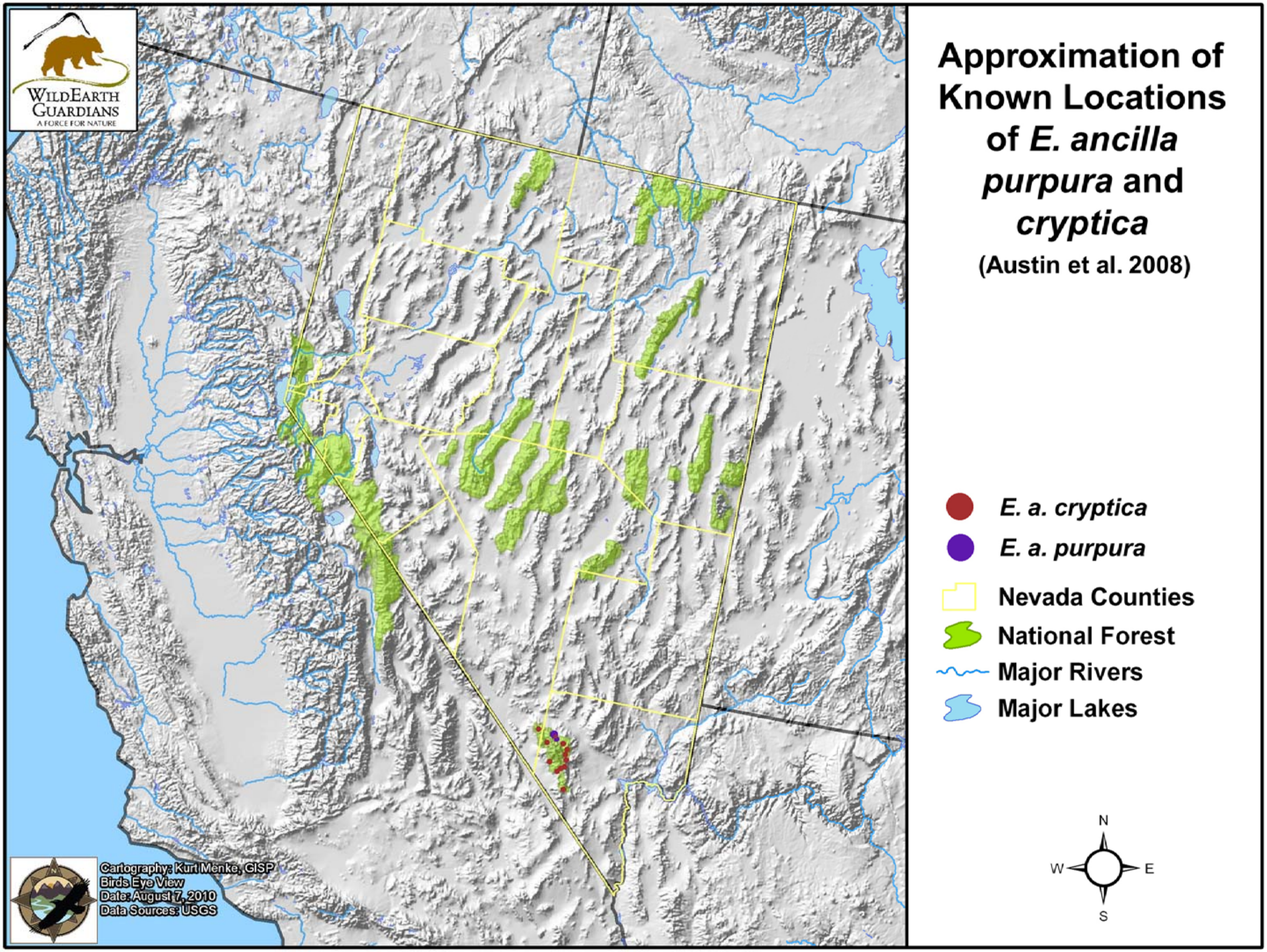
Euphilotes ancilla cryptica is more widespread, though less numerous than ssp. *purpura* (*see* Map 1 and Map 2). The butterfly occurs in scattered populations in piñon pine-juniper to mixed ponderosa pine/white fir forest in the Spring Mountains, on both sides of the range, and from Big Timber Spring in the north to Potosi Mountain in the south (Austin et al. 2008; Boyd, pers. comm., 06/19/10; *see* Maps 1 and 2). Recent observations of the species (between 1993-2007) suggest that subspecies *cryptica* may occupy a zone or belt encircling the mountain range (Boyd, pers. comm., 06/19/10).

Boyd (pers. comm., 06/19/10) last observed subspecies *cryptica*—a single butterfly—in the Spring Mountains in 2007.

Map 1



Map 2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Approximation of Known Locations of *E. ancilla purpura* and *cryptica*
(Austin et al. 2008)
E. a. cryptica
E. a. purpura
Nevada Counties
National Forest
Major Rivers
Major Lakes
N
W
E
S
Cartography: Kurt Menke, GISP
Birds Eye View
Date: August 7, 2010
Data Sources: USGS

B. Threats

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

The known center of abundance for both subspecies *purpura* and *cryptica*, in the Cold and Willow creeks area, faces considerable disturbance (Austin et al. 2008). Both butterflies, and especially ssp. *purpura*, are at risk from wildfire (exacerbated by invasive weeds) and habitat degradation from recreation, off-road vehicle use, equestrian use, and grazing by native and feral ungulates (Austin et al. 2008), which affect larval and adult resources.

Weed incursion, particularly by annual grasses, may become an increasingly important threat to both *ancilla* subspecies. Cheatgrass is present in the SMNRA (SMNRA 1996, 2007a; Boyd, pers. comm., 09/14/10), and both cheatgrass and red brome have been found in the Red Rocks NCA (Keough 2004). These grasses aggressively invade western landscapes (cheatgrass is estimated to occur on millions of acres in the West), alter natural fire regimes and can irreparably damage ecosystems. Both grasses thrive in disturbed and burned areas, and red brome will invade undisturbed areas as well. Both grasses cure quickly in spring, providing additional fuel for summer wildfires, which are more frequent and more intense in cheatgrass and red brome. The resultant cheatgrass/red brome fire cycle threaten to convert entire landscapes to annual grasslands.

Unfortunately, efforts to prevent wildfire in the SMNRA present their own threats to *ancilla* ssp. and their host plants. The Humboldt-Toiyabe National Forest proposed and approved a fire fuels reduction project in the Spring Mountains National Recreation Area in 2007 (SMNRA 2007a, 2007b). The project was authorized pursuant to the National Fire Plan of 2000 and the 2003 Healthy Forest Restoration Act (Pub. Law 108-148), as well as the local land management plan and general management plan for the NRA (SMNRA 2007a). The Healthy Forest Restoration Act is criticized for prioritizing fuels reduction over other management goals on public land.

Although the total acreage to be treated is relatively small (2,330 acres), targeted sites include areas near Cold Creek, Willow Creek, and other priority areas for subspecies *purpura* and *cryptica* (SMNRA 2007a). The Forest Service admitted that fuels management "may impact individual [*purpura*], but is not likely to cause a trend to federal listing" (SMNRA 2007a: 18). (The agency's did not address *cryptica* in its plan as it was not yet described.)

Fuels treatment in habitat similar to nearby locations in the east-central part of the Spring Mountains range where *Euphilotes ancilla cryptica* has been found (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; June 2010).

Fuels treatment in habitat similar to nearby locations in the east-central part of the Spring Mountains range where *Euphilotes ancilla cryptica* has been found (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; June 2010).

Fuels treatment in the east-central part of the Spring Mountains range near sites where *Euphilotes ancilla cryptica* has been found (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; June 2010).

Fuels treatment in the east-central part of the Spring Mountains range near sites where *Euphilotes ancilla cryptica* has been found (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; June 2010).

A treated location in the northeast region of the Spring Mountains that previously had supported *Ephilotes ancilla purpura*; the flattened accumulations of dead plant material were shrub species that had provided cover for *Eriogonum umbellatum juniporinum*, larval host plant of the butterfly. (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; May/June 2010).

Vegetation treatment done to protect a structure (marked with arrow) in the east-central part of the Spring Mountains range where *Euphilotes ancilla cryptica* has been found. (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; May/June 2010).

Eriogonum umbellatum juniporinum recovering in early May 2010, following vegetation treatment. The mat of dead plant material was the shrub that had shaded the *juniporinum*, which could now die from solar exposure. (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; May/June 2010).

Dead *Eriogonum umbellatum juniporinum*, larval host plant of *Ephilotes ancilla purpura,* at an untreated site in the northeast region of the Spring Mountains. (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; May/June 2010).

Vegetation treatment in the Spring Mountains on the Humbolt-Toiyabe National Forest (left); untreated area on the right. The area had supported *Ephilotes ancilla purpura*. Huge areas are subject to fuel reduction projects on public land in the Spring Mountains. (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; May/June 2010).

Fuel reduction treatment in the northeast region of the Spring Mountains where *Ephilotes ancilla purpura* has been found. (B. Boyd; Spring Mountains National Recreation Area, Humboldt-Toiyabe National Forest; May/June 2010).

2. Overutilization for commercial, recreational, scientific, or educational purposes.

Individuals of the petitioned butterflies have been collected by scientists and amateur collectors for many years. Research on Spring Mountains Lepidoptera may include takings. Boyd (pers. comm.) encountered an individual who illegally captured a protected butterfly species in the Spring Mountains range. The Service should investigate whether collecting is a threat to *E. a. purpora* and *cryptica* in the course of a full status review for the subspeicies.

3. Disease or predation.

Parasitism of *Euphilotes* larvae is expected (Austin et al. 2008). Although Austin et al. (2008) did not notice any incidences in samples collected from the Spring Mountains, parasitism of larvae by tachnids (Diptera) and/or braconids (Hymenoptera) have been recorded at rates approaching 60% in California (Arnold 1983; Mattoni 1990) and Washington (Peterson 1997). Larvae and adult butterflies are also preyed upon by a wide variety of vertebrate and invertebrate wildlife (e.g., birds, herptiles, other insects). However, it is not known whether predation constitutes a threat to *E. a. purpura* and *cryptica*. Disease is not known to be a threat to the petitioned butterflies.

4. Inadequacy of existing regulatory mechanisms.

There is no federal or state program charged with managing sensitive invertebrates in Nevada. Nevada state law only protects species that the state Wildlife Commission has specifically determined to be imperiled (Nev. Rev. Stat. 503.584 – 503.589). Protected species may include mollusks and crustaceans, but apparently not other invertebrates (Nev. Rev. Stat. 501.110)—no butterfly is protected under the statute.

The Nevada Wildlife Action Plan (NWAP) does not prescribe conservation measures for sensitive butterflies in the state, and noted that "there has been very little state focus on the conservation of rare insects beyond participation in management strategy development for endangered butterflies which as a result of their federal listing have become the primary responsibility of the [U.S. Fish and Wildlife Service]" (WAPT 2006: 62). The Spring Mountains are identified as a "preliminary focal area" in the NWAP, although it is unclear what regulatory authority, if any, the state has to affect management in these areas.

5. Other natural or manmade factors affecting a species' continued existence.

Drought. Much of the Great Basin is an arid and hot landscape (in summer). Potential evapotranspiration exceeds annual precipitation by a factor of over 5 in some parts of the region (West 1983: 344, *citing* Major 1963). Drought, though a natural phenomenon, speeds evapotranspiration and could negatively affect riparian habitats, moist meadows, and similar habitats, particularly those already stressed by other factors. Droughts may become even more common in the Great Basin as climate change alters future precipitation (Chambers et al. 2008; Seager et al. 2007).

Austin et al. (2008) and others noted that exposed *Eriogonum umbellatum* may dry out before blooming or producing seeds. Drought may also kill plants, particularly at lower (xeric) elevations or in marginal settings (Boyd, pers. comm., 06/19/10). *Eriogonum* spp. are also palatable to native ungulates and domestic livestock. Austin et al. (2008: 153) found *Eriogonum umbellatum subaridum* "heavily grazed by ungulates severely reducing the number of flowers available to any *Euphilotes* present."

Climate Change. Average temperature has increased 0.6-1.1° F in the last 100 years in the Great Basin (Chambers 2008a). Raupach et al. (2007) discovered that the growth rate in anthropogenic CO_2 emissions increased more rapidly between 2000 and 2004 than even predicted by the highest growth rate (i.e., "worst case") scenario developed by a leading intergovernmental organization in the late 1990s. Drought may also contribute to increased atmospheric CO_2 by reducing the amount of CO_2 that is annually taken up by terrestrial vegetation (Peters et al. 2007). Increased CO_2 may favor invasive, annual grasses, including cheatgrass (*Bromus tectorum*) (Smith et al. 2000).

Climate change has and will continue to affect hydrology and ecosystems in the American West. Up to 60 percent of the climate-related trends in river flow, winter air temperature and snow pack between 1950-1999 were influenced by human-induced climate change (Barnett et al. 2008). Climate change is already reducing snowpack in the West (Mote et al. 2005), expediting snow melt in spring and appears to be affecting the bloom-date of some plants in the Great Basin (Chambers 2008b; Stewart et al. 2005). Climate change is expected to affect the timing and flow from streams, springs and seeps in the Great Basin (Sada 2008; Chambers 2008a), which support the moist meadows on which some imperiled butterflies depend.

Climate change is projected to cause temperatures to continue to increase in the Great Basin by 3-4° F in spring and autumn, and by 5-6° F in winter and summer, by 2100 (Chambers 2008a, *citing* Cubashi et al. 2001). Any stabilization or cooling trend in average temperatures is expected to be temporary (Kerr 2008). Climate change is not a temporary or stochastic occurrence; it will cause permanent changes to Great Basin ecosystems.

Increasing levels of CO2 and increased temperatures have myriad effects on plant growth and chemistry, which may affect insect persistence and abundance (Stiling 2003). Climate change could affect bloom phenology in butterfly hostplants, disrupting butterfly use of those plants and/or force the insects to either evolve to accommodate earlier bloom periods or switch to other hostplants (*see* Pratt and Ballmer 1993). This may be difficult or impossible for some butterfly species, particularly those that specialize in a single hostplant. Increasing temperatures may also have varying effects on insect development and reproduction (Sehnal et al. 2003).

New research suggests that species and ecosystems will need to shift (northward, away from the equator) an average of .42 km per year to survive the deleterious effects of increasing temperatures associated with climate change (Loarie et al. 2009). Distances may be greater, more than 1 km per year, for species in deserts, where climate change is predicted to have greater effect (Loarie et al. 2009). Research on a sample of 35 nonmigratory butterflies in Europe showed that 63 percent had ranges that shifted northward by 35 to 240 km during the 20th century (while only 3 percent shifted to the south) (Stiling 2003).[1] It is unlikely that small, isolated populations of imperiled butterflies in the Great Basin, already dependent on diminished and likely immovable habitats, will be able to shift to other habitats to adapt to the effects of climate change.

Fleishman (2008: 61) summarized the potential effects of climate change in the Great Basin to species persistence:

> Native species in the Great Basin are adapted to extreme and variable weather patterns on daily to decadal or longer time scales. The magnitude and speed of climatic changes anticipated by 2100 may exceed the plasticity of many species with respect to their phenology and patterns of resource use.

The specialized habitat requirements and limited mobility of many native or endemic species in the Great Basin limits their ability to adapt to anthropogenic environmental change (Fleishman 2008). Moreover, species and habitats already stressed by water diversion, groundwater pumping, development, grazing and other threats will be less able to cope with climate change.

Biological Vulnerability. The butterflies petitioned here have limited distribution and apparently small and/or a small number of populations, which may increase the likelihood of extinction. "Population size matters; small populations are more likely to go extinct as a result of chance effects (known as the small population paradigm)" (Brook et al. 2008: 455, internal citation omitted). FWS has frequently recognized small population size as a threat to species' persistence.[2]

Britten et al. (2003) noted that characteristic population fluctuation and short generation times, combined with small populations, can influence genetic diversity and may threaten long-term persistence of a butterfly. Moreover, Sanford (2006) contended population size is not as important as the number of populations when assessing the status of an imperiled butterfly. *E. a. purpura* and *cryptica* apparently occur as small populations that may be more vulnerable to extirpation.

V. Request for Listing under the Endangered Species Act

Hoffman Black and Vaughan (2003) considered listing imperiled insects as "endangered" or "threatened" under the Endangered Species Act as "vital" to their protection and effective for protecting their habitat. Listing may be especially important for rare, endemic insects and/or habitat specialists due to their anonymity and their dependence on limited or micro-habitats (Dunn 2005). However, despite all its vaunted strength as a biodiversity protection statute, the

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[1] Importantly, while butterflies may not be useful indicator species of ecosystem health, they might signal effects of climate change on butterfly populations and assemblages (Fleishman and Murphy 2009).

[2] See, for examples, candidate assessment forms for *Porzana tabuensis* (spotless crake, April 2010), *Eumops floridanus* (Florida bonneted bat, March 2010), *Vagrans egistina* (Mariana wandering butterfly, April 2010), *Gallicolumba stairi* (friendly ground-dove, March 2010), *Eremophila alpestris strigata* (streaked horned lark, April 2010), and *Hyla wrightorum* (Arizona treefrog, April 2010) (Available at http://ecos.fws.gov/tess_public/pub/SpeciesReport.do?listingType=C&mapstatus=1).

ESA does nothing to protect a species unless it is first listed under the act. Listing is the critical first step in the ESA's system of species protection.

WildEarth Guardians petitions the U.S. Fish and Wildlife Service in the U.S. Department of Interior to list two subspecies of butterflies, *Euphilotes ancilla purpura* and *Euphilotes ancilla cryptica*, as "endangered" or "threatened" under the ESA. Protecting these butterflies under the act is warranted, given their small populations, limited range and the threats they face.

VI. Request for Designation of Critical Habitat

WildEarth Guardians requests that the Service designate critical habitat for these butterflies concurrent with final ESA listing. Critical habitat should be sufficiently large to stabilize and recover butterfly populations, support their complete life cycle, and buffer them from harmful land uses and other impacts (*see* Sanford 2006). Greenwald and Bradley (2008) noted that protecting key habitats in Nevada can effectively conserve entire assemblages of sensitive species. More than two dozen endemic plants and animals have been identified in the Spring Mountains (WAPT 2006) that could benefit from designation of critical habitat.

VII. References

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