**BEFORE THE SECRETARY OF THE INTERIOR**

# PETITION TO LIST THE BLEACHED SANDHILL SKIPPER UNDER THE ENDANGERED SPECIES ACT AND CONCURRENTLY DESIGNATE CRITICAL HABITAT

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**August 8, 2022**

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**CENTER FOR BIOLOGICAL DIVERSITY**

**NOTICE OF PETITION**

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Submitted on this 8th of August, 2022

Pursuant to Section 4(b) of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b); Section 553(e) of the Administrative Procedure Act, 5 U.S.C. § 553(e); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity hereby petitions the Secretary of the Interior, through the United States Fish and Wildlife Service ("FWS," "Service"), to protect the bleached sandhill skipper (*Polites sabuleti sinemaculata* Austin 1985) under the ESA. Petitioner also requests that critical habitat be designated for the bleached sandhill skipper concurrently with the species being listed, pursuant to 16 U.S.C. § 1533(a)(3)(A) and 50 C.F.R. § 424.12.

Petitioners request emergency listing of the bleached sandhill skipper at the soonest possible time, due to the impending threat of geothermal energy production near its only known inhabited area. The Service has the authority to promulgate an emergency listing rule for any species when an emergency exists that poses a significant risk to the species. 16 U.S.C. §1533(b)(7).

FWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on the Service. Specifically, the Service must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id*.

Petitioner is the Center for Biological Diversity ("Center"). The Center is a nonprofit, public interest environmental organization dedicated to the protection of imperiled species and the habitat and climate they need to survive through science, policy, law, and creative media. The Center is supported by more than 1.7 million members and online activists throughout the country. The Center works to secure a future for all species, great or small, hovering on the brink of extinction. The Center submits this petition on its own behalf and on behalf of its members and staff with an interest in protecting the bleached sandhill skipper and its habitat.

Please contact either Jess Tyler or Patrick Donnelly if you have any questions or need any clarification on the information in this petition. References will be submitted electronically via a shared folder link.

Sincerely,

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## Abbreviations

| | |
|---|---|
| BGDP | Baltazor Geothermal Development Project |
| BLM | Bureau of Land Management |
| cfs | Cubic-Feet per Second |
| CSU | Colorado State University, C.P. Gillette Museum of Arthropod Diversity |
| EA | Environmental Assessment |
| ESA | Endangered Species Act |
| FWS | United States Fish and Wildlife Service |
| GBIF | Global Biodiversity Information Facility |
| ITIS | Integrated Taxonomic Information System |
| IUCN | International Union for the Conservation of Nature |
| JVGP | Jersey Valley Geothermal Project |
| LEPSOC | Lepidopterists Society |
| MPM | Milwaukee Public Museum |
| NEPA | National Environmental Policy Act |
| NDOW | Nevada Department of Wildlife |
| NDWR | Nevada Department of Water Resources |
| NTSRV | NatureServe Network |
| OSAC | Oregon State Arthropod Collection |

## Suggested Citation

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# Table of Contents

# I. Executive Summary

The bleached sandhill skipper is a unique species of butterfly found only in the meadows formed by Baltazor Hot Spring near Denio, Nevada. The bleached sandhill skipper faces a clear, imminent threat to its continued existence from a proposed geothermal energy project. This subspecies of the wider ranging sandhill skipper is distinctive for its ‘bleached’ appearance. The bleached sandhill skipper depends on single geothermal hot spring meadow 1,000-2,000 acres in size. The meadow supports a dense population of its larval host plant, salt grass. The Baltazor geothermal development project threatens the groundwater that sustains the salt grass meadow.

Like the recently listed Dixie Valley toad, the bleached sandhill skipper faces the risk of diminished or altered groundwater flow to its habitat. Examples of geothermal energy development in Nevada and from around the world show that alterations to groundwater quantity and quality from geothermal energy development is the rule and not the exception. While the geothermal project is intended to be ‘closed-loop’ and not directly consume groundwater, it is possible that the process of pumping and reinjection will alter aquifer flowpaths and pressure gradients, thereby reducing the surface expression of the hot spring. Lowering the shallow groundwater table below the effective rooting depth of the salt grass will reduce salt grass abundance potentially causing the collapse of the bleached sandhill skipper population.

The bleached sandhill skipper warrants listing as a threatened or endangered species. The Endangered Species Act states that a species shall be determined to be endangered or threatened based on any one of five factors (16 U.S.C. § 1533 (a)(1)). The skipper is threatened by three of these factors – the modification or curtailment of habitat or range from geothermal energy production and cattle grazing, the inadequacy of existing regulatory mechanisms, and other natural or manmade factors including climate change.

# II. Introduction

The Great Basin is home to a great diversity of wildlife including more than 155 butterflies, more than half of which have differentiated subspecies (Austin & Murphy 1987 p. 186). While there are no butterfly species endemic to the Great Basin, there are more than 50 named and unnamed subspecies or other differentiated populations of butterflies that are endemic to the region (Austin & Murphy 1987 p. 187). Endemism in the Great Basin produces subspecies and populations of butterflies, as well as for birds, that have the most pallid phenotype for a particular species (Austin & Murphy 1987 p. 188). It is thought that pale coloration is an important phenotypic selection for predator avoidance in areas with pale colored or alkaline soil (Austin & Murphy 1987 p. 197).

The sandhill skipper (*Polites sabuleti* Boisduval 1852) is a widespread western species found from Washington to Arizona and east to Colorado (Newcomer 1966 p. 243). Variation in the phenology and morphology of the species has led to the naming of more than 13 subspecies (Austin 1987 p. 1). The bleached sandhill skipper (*Polites sabuleti sinemaculata* Austin 1987) was described by George Austin as a distinct subspecies in 1987 (Austin 1987 pp. 7-9). The bleached sandhill skipper is the most pallid subspecies of the sandhill skipper that Austin described as "…by far the most distinctive…" (Austin 1987 p. 8).

The bleached sandhill skipper is unique for its coloration, but also for its narrow range. The subspecies is only found within in the vicinity of a single geothermal spring in northwestern Nevada (Austin 1987 p. 8). Baltazor Hot Spring and the surrounding meadow spans approximately 2.25 miles long by 0.5 miles wide. The spring-fed meadow supports the skipper's presumed larval host plant, salt grass, and adult nectar plants, which are several species of rabbitbrush. The skipper's small geographic range and specific habitat make it highly vulnerable to extinction.

WildEarth Guardians petitioned the U.S. Fish and Wildlife Service (FWS) to protect this species in 2010 (Wild Earth Guardians 2010 pp. 14–15). FWS published a positive 90-day finding on October 4, 2011 (FWS 2011 p. 61549) and a subsequent 12-month finding on September 4, 2012 (FWS 2012a p. 54324) in the Federal Register. FWS determined that the bleached sandhill skipper was not warranted for listing under the ESA because of lack of threat to its habitat (FWS 2012 p. 54294).

Since the 2012 not warranted finding, the Baltazor Hot Spring meadow has come under threat because of a geothermal energy project permitted by the U.S. Bureau of Land Management (BLM), Winnemucca District. The geothermal project is highly likely to alter the hydrology of the hot spring, with the potential to dry up the hot spring altogether. The proposed geothermal project presents a real, tangible threat to the spring that supports the skippers larval host plant and adult nectar plants.

This petition presents the best available evidence of the status of the species as well as the potential impacts to the spring-fed meadow from geothermal energy development and climate change.

# III. Natural History

## A. Taxonomy and Description

*Polites sabuleti sinemaculata* is one of 13 named subspecies of the sandhill skipper. George T. Austin described this subspecies from specimens taken from the area of Baltazor Hot Spring in 1985 (Austin 1987 pp. 7–9). *P. s. sinemaculata* is referred to as the bleached sandhill skipper in this petition. It is also known by the common name Denio sandhill skipper. The bleached sandhill skipper is a valid taxon listed in the Integrated Taxonomic Information System (ITIS) (ITIS n.d.). The taxonomy for this species is provide in Table 1.

**Table 1.** Taxonomy of *Polities sabuleti sinemaculata* Austin 1987.

| | |
|---|---|
| Kingdom | *Animalia* |
| Phylum | *Arthropoda* |
| Class | *Insecta* |
| Order | *Lepidoptera* |
| Family | *Hesperiidae* |
| Genus | *Polites* |
| Species | *sabuleti* |
| Subspecies | *sinemaculata* |

The bleached sandhill skipper can be distinguished from other sandhill skipper subspecies based on the unusually pale coloration of the wings that give the subspecies a 'bleached' appearance. George Austin described the bleached sandhill skipper as "…by far the most distinctive of the *Polites sabuleti* subspecies" (Austin 1987 p. 8). Austin described *P. s. sinemaculata* as having wing markings typical of other sandhill skippers with a deeper and brighter dorsal orange color, but that overall, *P. s. sinemaculata* is paler than any other subspecies because both sexes lack or have very pale serrated marginal dark areas that are present on other subspecies (Austin 1987 p. 8). The subspecies name *sinemaculata* refers to this absence of the typical dark colorations that are present in other *P. sabuleti*.

Males of the subspecies are large (average forewing length 12.6mm) compared to other subspecies and have distinctive genitalia (Austin 1987 p. 8). The upper (dorsal) surface of the forewing has bright golden-orange markings with prominent black stigma similar to other sandhill skippers. However, the dark margin of the forewings and hindwings typical of other sandhill skippers is absent to faint yellow-orange (Austin 1987 p. 7). The underside (ventral) surface of the wings is paler yellow-orange than the upper surface with black markings only at the very base each wing cell and not as far distally as other sandhill skippers (Austin 1987 p. 8).

Bleached sandhill skipper females are also large (average forewing length 14.0mm) for the species. Overall, both upper and lower wings are paler in color than the typical sandhill skipper. The upper surface has the typical sandhill skipper pattern, but it is pale yellow-orange with narrower dark areas overscaled with background color (Austin 1987 p. 8). The underside surface is also very pale in color, but with a more distinct pattern than the male ventral wing surface (Austin 1987 p. 8).

## B. Biology

The bleached sandhill skipper has an annual life cycle and produces one generation per year (univoltine). The specific timing and expression of life history characteristics of the bleached sandhill skipper subspecies have not been studied in detail, but the phenology of the subspecies is similar to other univoltine sandhill skipper subspecies. Adult butterflies lay eggs on the underside of the leaves of the presumed larval host plant (*Distichlis spicata*) commonly known as salt grass (Austin 1987 p. 8). Based on study of the sandhill skippers from Yakima Valley, Washington, eggs laid in August-September hatch after about one week and larvae begin feeding on the host plant (Newcomer 1966 p. 244). Larvae continue to feed on the larval host plant and may progress through five instars (Newcomer 1966 pp. 244-245). Pupation in a multivoltine sandhill skipper with separate spring and fall broods occurs just before winter hibernation and the skipper remains in the pupal stage during hibernation (Newcomer 1966 p. 244). It is not known whether pupation for the bleached sandhill skipper, that is univoltine, occurs before or after winter hibernation. The exact timing of pupation/hibernation and emergence from hibernation is unknown. While in the pupal stage, the skipper undergoes complete metamorphosis. Adults emerge and fly from late-August until mid-September (Austin 1987 p. 8). Austin did not know whether there was an additional, earlier adult flight period (Austin 1987 p. 8), but surveys by Stantec in 2015 confirmed that no adults fly between June and late August, therefore this species has only one brood per year (Stantec 2020 p. 10). Adults nectar on rabbitbrush (*Chrysothamnus sp*.) (Stantec 2020 p. 125). Mating and egg deposition occurs during the adult flight period. Adults fly for only a limited time and die soon after mating and laying eggs.

Little is known about the dispersal ability of this species, but it is likely to be low since the remoteness of Baltazor Hot Springs has proven to have effectively isolated this subspecies (Austin 1987 p. 8).

## C. Habitat

The bleached sandhill skipper subspecies has only been observed in the meadow surrounding Baltazor Hot Springs (Austin 1987 p. 8; BLM 2021a p. 26). This meadow is also referred to as the Pueblo Slough. Baltazor Hot Springs is a geothermally fed spring system located in northwestern Nevada at an elevation between 4,200 and 4,500 feet (Stantec 2016 p. 2). The surrounding alkali meadow is 1,000-2,000 acres in size and is a relatively intact native plant community. The alkali meadow plant community is characterized by a dense growth of the salttolerant grass (*Distichlis spicata*) interspersed with iodinebush (*Allenrolfea occidentalis*). Surrounding the hot-spring meadow is a salt desert scrub typical of the areas around ancient, dry lakebeds in Nevada. The salt desert scrub plant community includes greasewood (*Sarcobatus vermiculatus*) along with yellow, white, and rubber rabbitbrush (*Chrysothamnus albidus, Chrysothamnus viscidiflorus* ssp. *puberulus* and ssp. *viscidiflorus*, and *Ericameria nauseosa* var. *oreophila*) (Stantec 2016 p. 2). The rabbitbrush species that occur in the area around the hot spring function as the primary nectar plants for adults (Stantec 2020 p. 125).

The salt grass is presumed to be the bleached sandhill skipper's larval host plant (Austin 1987 p. 8). Salt grass is a halophyte found along coastlines as well as inland sites across North America (Hansen et al. 1976 p. 635). It is adapted to grow in salty soils with salt glands that extrude salt from the leaves (Hansen et al. 1976 p. 645) among other adaptations. Within the high salinity, moist soil of the hot spring meadow, the salt grass forms a dense growth but does not readily grow outside of the meadow (Stantec 2016 p. 2, pers. ob.). The emergent wetland of the Pueblo Slough produces favorable growing conditions for salt grass that are not found outside of the wetland or in the dry lakebed of Continental Lake.

# IV. Distribution and Status

The bleached sandhill skipper is only found in the Baltazor Hot Spring area in northwestern Nevada (see Figure 1). As a species, sandhill skippers inhabit areas throughout Nevada including at two nearby sites, Bog Hot Springs (Stantec 2020 p. 9) and the Duferrena Ranch (Austin 1987 pp. 8-9). George Austin surveyed in the nearby Bog Hot Springs at the time when he set out the taxonomy of sandhill skipper and found that the Bog Hot Springs skippers were intermediate between *P. s. alkaliensis* and *P. s. sinemaculata* (Stantec 2021 p. 9). Austin also formally described *P. s. alkaliensis* in 1987 and he claimed this subspecies had the nearest known population to the bleached sandhill skipper (Austin 1987 p. 22). *P. s. alkaliensis* is known to inhabit dry, alkaline lakes in northwestern Nevada, northeastern California, and southeastern Oregon. Austin also indicated that the '*sinemaculata'* subspecies was not present in the population of sandhill skippers at the nearby Duferrena Ranch about 30km west of Baltazor Hot Springs (Austin 1987 p. 8-9). When Austin formally described the species, Austin claimed that the nearest other population of sandhill skipper was in the Pine Forest Range 16 km SSE from Baltazor Hot Spring (Austin 1987 p. 8).

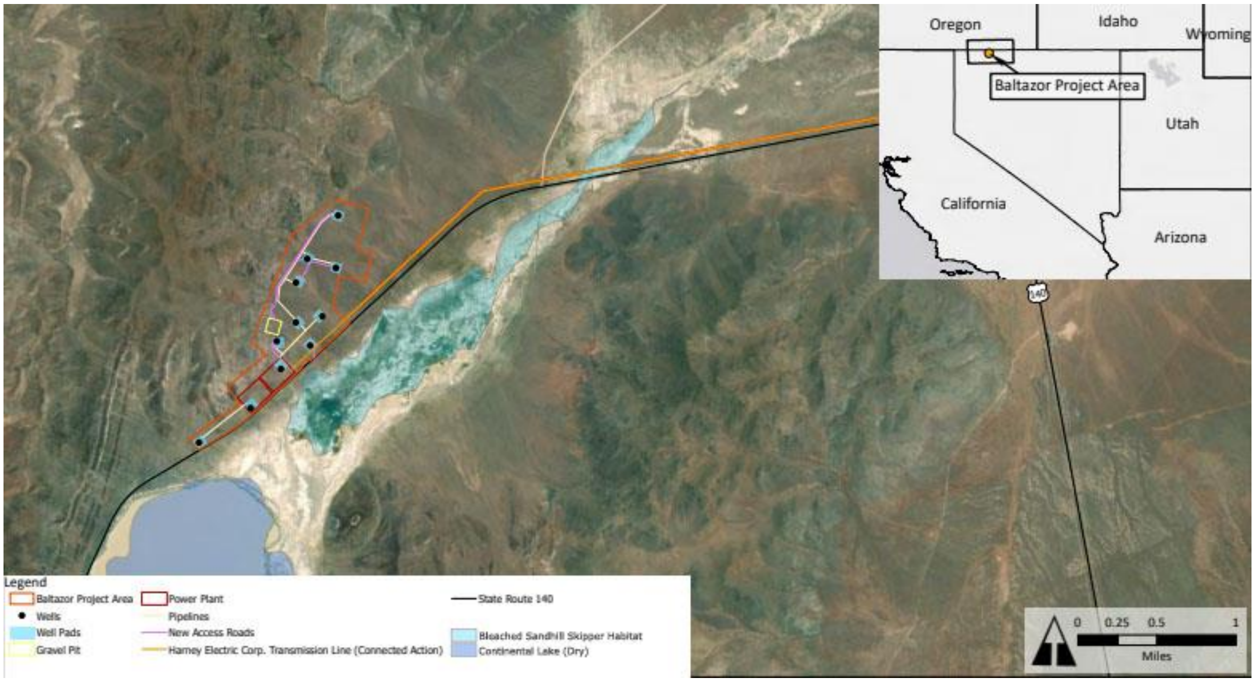


**Figure 1.** Map of bleached sandhill skipper habitat and proposed geothermal energy project. Map modified from (BLM 2021a Figure 3.2-1).

Publicly available records from the Global Biodiversity Information Facility (GBIF) shows that since the mid-1980s, when the subspecies was described, the bleached sandhill skipper has been present at Baltazor Hot Springs (Table 1). GBIF data indicates there were significant collection events in 1992 and 1999 (Table 1), but there are no observations after the year 2000. Available records indicate that have there been no recorded, verified observations[1] of the bleached sandhill skipper outside of the Baltazor Hot Springs meadow (GBIF 2022).

**Table 1.** Publicly available occurrence records for the bleached sandhill skipper. Data provided from GBIF 2022.

| **Date** | **Location** | **Latitude** | **Longitude** | **Type** | **Institution** |
|---|---|---|---|---|---|
| 1985-09-15 | Not Provided | -- | -- | Occurrence | NTSRV |
| 1989-08-16 | Baltazor Hot Spring. | -- | -- | Preserved Specimen | MPM |
| 1989-08-16 | Baltazor Hot Spring. | -- | -- | Preserved Specimen | MPM |
| 1989-08-16 | Baltazor Hot Spring. | -- | -- | Preserved Specimen | MPM |
| 1989-08-16 | Baltazor Hot Spring. | -- | -- | Preserved Specimen | MPM |

[1] One observation from the GBIF collection was recorded approximately 18 km (11.2 miles) to the north of the Baltazor Hot Springs meadow in Oregon. We attempted to confirm this observation with the Lepidopterists Society, but at the time of writing this observation could not be verified. This observation has no physical specimen nor any photographic evidence. Based on the habitat and location of this observation, we consider this observation errant and invalid.

| | | | | | |
|---|---|---|---|---|---|
| 1992-08-26 | 5 mi. SW Denio Junction, State Route 140 | 41.92382 | -118.712 | Preserved Specimen | CSU |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1992-08-26 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1997-08-29* | RT. 292, 13 mi. S Fields | 42.07599 | -118.675 | Human Observation | LEPSOC |
| 1999-08-29 | 5 mi W of Denio jct Hwy 140 | 41.98985 | -118.732 | Human Observation | LEPSOC |
| 1999-08-29 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1999-08-29 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1999-08-29 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1999-08-29 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1999-08-29 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1999-08-29 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 1999-08-29 | Denio Jct., 5 mi. SW; St. Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 2000-08-22 | Baltazor Hot Spring, 5 mi. W. Denion Jct.; Hwy. 140 | -- | -- | Preserved Specimen | OSAC |
| 2000-08-22 | Baltazor Hot Spring, 5 mi. W. Denion Jct.; Hwy. 140 | -- | -- | Preserved Specimen | OSAC |

*Unverified observation that we consider invalid.

No long-term, systematic sampling exists for the bleached sandhill skipper that could assess population trend. The consulting firm Stantec surveyed the area using standardized protocols in 2014, 2015, and 2019 (Stantec 2015 p. 13, 2020 pp. 9–10), however this short-term and sporadic monitoring in adequate to determine a population trend. Stantec surveyed an area of 1,627 acres that enclosed the Pueblo Slough (Stantec 2016 p. 2) using a visual encounter survey (Stantec 2016 p. 3). Results from the Stantec surveys (Table 2) show that the bleached sandhill skipper population decreased in total observations and maximum daily observations in 2019 compared to 2014-2015. A potential decline in population of this highly endemic skipper is concerning given the current threat of cattle grazing and the ongoing effects of climate change. However, further monitoring is clearly needed to determine a clear population trend over time.

**Table 2.** Bleached sandhill skipper abundance reported in Stantec surveys.

| Year | Total Daily Observations (All surveys) | Maximum Daily Total | Max observations per mile of transect |
|---|---|---|---|
| **2014** | 7,934 | >3,300 | 1,010 |
| **2015** | 6,829 | 1,426 | 1,027 |
| **2016** | No Survey | -- | -- |
| **2017** | No Survey | -- | -- |
| **2018** | No Survey | -- | -- |
| **2019** | 2,376 | 543 | Not provided |

Stantec surveyed an area of Bog Hot Springs in 2015 and found skippers they identified as the bleached sandhill skipper (Stantec 2016 pp. 14–15). These observations were assessed by an independent expert, Dr. Andrew Warren at the McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History at the University of Florida. Dr. Warren concluded that the individuals found at Bog Hot Spring were not the pure bleached sandhill skipper but were intermediate between the bleached sandhill skipper and the alkali sandhill skipper (*P. s. alkaliensis*) (Stantec 2021 p. 9). Genetic analysis could be used as another tool for identification, but at the time of petition writing, this work has not been done. The professional opinion of Dr. Warren represents the best available science and that the population at Bog Hot Springs are not the bleached sandhill skipper and therefore the bleached sandhill skipper's only known population is from Baltazor Hot Springs.

# V. Current and Potential Threats

## A. Threatened destruction, modification, or curtailment of habitat

### 1. Geothermal Energy Production

The development of geothermal energy at Baltazor Hot Springs presents an immediate threat to the bleached sandhill skipper that will likely adversely modify, if not destroy, its habitat. Operation of the geothermal power plant will likely lead to a reduction or significant alteration in hot spring flow, groundwater flow, and changes in water temperature and chemistry. Geothermal water pumping has the potential to cause a complete loss of spring flow over time (Hunt 2001 p. 16). The spring's water supports the plant community of the surrounding meadow upon which this unique skipper depends.

In 2021, the BLM approved the Baltazor Geothermal Development Project (BGDP) (BLM 2021b entire) proposed by ORNI 52, LLC a subsidiary of Ormat Nevada, Inc., hereafter referred to as Ormat. The project is permitted to allow up to 11 geothermal production and injection wells to power two closed-loop (air cooled) power plants over a period of 50 years (BLM 2021a pp. 1, 12). Overall, the geothermal development project will impact 84.1 acres for the construction of wells, power plants, upgrading five miles of power lines, and other infrastructure (BLM 2021c p. 1). The entire project will be sited immediately across SR-140 from the bleached sandhill skipper's habitat at Baltazor Hot Springs (see Figure 1). The final Environmental Assessment (EA) states that the Baltazor Hot Springs area was surveyed in 2014, 2015, and 2019 by Stantec and that the area contains the presumed larval hostplant, salt grass, and the adult nectar plant, rabbitbrush (BLM 2021a p. 26). The site surveys only found the skipper along the edges of the Pueblo Slough east and south of SR 140 (Stantec 2020 pp. 132-138, 279-282; BLM 2021a p. 26). The EA indicates that no skipper habitat would be directly harmed by the construction of the geothermal facility because none were observed north or east of SR 140 (BLM 2021a p. 42) (see Figure 1). On May 21, 2021, the BLM issued a Finding of No Significant Impact (FONSI) for the BGDP (BLM 2021c entire). In the FONSI, BLM required only a groundwater monitoring program and a 5-year monitoring program for the skipper with the need for monitoring reevaluated after five years (BLM 2021c p. 2).

The BLM has wrongly concluded that the BGDP will have no significant impact on the bleached sandhill skipper. Multiple examples from geothermal power plants around the world show that geothermal energy necessarily involves altering surface expression of spring flow and/or chemistry. The loss of spring flow would negatively impact the vegetative community, and by extension the skipper, up to and including the complete die-off of the Pueblo Slough meadow, leading to the potential extinction of the bleached sandhill skipper. There are no acceptable mitigation measures to prevent this outcome.

**Impacts from Closed-Loop Pumping and Reinjection**

Most modern geothermal facilities are closed-loop and dry-cooled. A closed-loop geothermal facility is one which pumps groundwater from the geothermal reservoir, extracts heat from the water, and then reinjects the cooled water into the geothermal reservoir. A dry-cooled facility uses air in its cooling towers, rather than water. These two features mean that most geothermal facilities are not considered to directly consume groundwater. Thus, they are generally exempt from needing to obtain certain water permits, for example certificated water rights. However, this does not mean they do not cause impacts to surface expression of groundwater. Closed loop pumping and reinjection causes: changes to volume of spring discharge, changes to the temperature, and changes to the chemical composition of spring discharge among other impacts (Hunt 2001 p. 14).

*Changes to spring flow*

Reduction in spring discharge is the primary threat to the Pueblo Slough and to the bleached sandhill skipper. Analysis of the environmental impacts of geothermal energy around the world have cited changes to surface manifestations of geothermal waters as inherent in geothermal energy production technology (Maochang 2001 p. 99; Kristmannsdóttir & Ármannsson 2003 p. 454; Bayer et al. 2015 p. 374). Kaya et al. (2011) examined geothermal reinjection projects around the world and concluded that pumping and reinjection is an iterative process, involving many changes and fine-tuning to achieve desired results (Kaya et al. 2011 pp. 55-56). Reductions in surface flow from geothermal production are variable with the geology of a site and other factors, but development and production can result in severe reductions in flow including complete loss of flow (Hunt 2001 p. 16). Reductions in surface flow are so common with geothermal development that these impacts should be viewed as the rule, rather than the exception (Sorey 2000 p. 708).

Several mechanisms cause springs to lose flow. Volume of groundwater pumping, changes in pressure gradients, and geologic heterogeneity all contribute to altering the surface expression of water (Myers 2017 pp. 6-8). In the context of other similar hot springs such as the Jersey Valley Hot Springs and the Dixie Valley Hot Spring (Myers 2017 pp. 6-8), the effects to the hydrology of a system from geothermal power production are likely to similarly affect the Baltazor geothermal development.

A spring will decrease in flow when there are changes in the pressure of groundwater as a result of pumping (Pringle 2000 p. 92). Both pumping and reinjection wells alter the natural pressure gradients in the aquifer (Myers 2017 p. 7). Water pumping from a well creates a zone of reduced pressure which draws in water from the surrounding substrate, while the injection wells create areas of very high pressure. Operating several production and injection wells in close proximity could significantly alter the water pressure gradients that naturally produce the surface spring flow. Pressure gradients could be minimized if production and injection wells are spread out evenly for several kilometers along the fault (Myers 2017 p. 7). This is not the case at the

BGDP since the wells are clustered along about two kilometers of SR-140 rather than spread out over several kilometers.

The overall discharge of the Baltazor Hot Spring is quite small (~25-104 L/min) (Stantec 2019 Appendix A) relative to the amount of water being proposed for pumping and reinjection (~57,000 L/min) (BLM 2021a p. 7). This difference between spring discharge and proposed pumping volume is even larger than at Dixie Meadows, another Nevada geothermal spring, which is larger (~190-757 L/min). Based on the pumping rates alone, the volume of geothermal water pumping required to operate the power plant can be enough to overwhelm the flow of the natural system (Myers 2017 p. 7).

Due to the heterogeneity of the substrate, it is highly unlikely that reinjection wells will replace water in the same area from where it was pumped. High pressure injection can force water into fractures, or create new fractures, thereby significantly altering flow paths (Myers 2017 pp. 7-8). Theoretically, water from the injection wells travels through permeable substrate or along faults to the collection well because of the lower pressure. However, there is no certainty that permeable fractures in the substrate around the injection wells would intersect the permeable fractures near the collection wells (Myers 2017 p. 7). If injection water cannot easily flow towards the collection well, this would cause reinjected water to flow along other fractures or disperse into surround bulk media and can be lost from circulation (Myers 2017 p. 8) and therefore lower the water table. This can happen if reinjection reaches fractures that are transverse to the general fracture trend found in the fault system. Reinjection pressure can also open new flow paths between the shallow aquifer and the un-mixed hot springs, and new paths or fractures in the substrate are potentially irreparable (Dyer Engineering Consultants, Inc. 2017, p. 2). Considering these risks, the hydrology of the Baltazor Hot Spring system has not been studied enough to know how the fault and fracture patterns in the substrate would affect water dispersion (Braumiller 2020 p. 4).

There are numerous examples of geothermal energy facilities causing impacts to adjacent thermal water features, up to and including complete drying of the features. *See* Lund (1982 p. 14); Sorey & Colvard (1992 p. 101); Bolanos & Parrilla (2000 p. 47); Sorrey (2000 p. 706); Hunt (2001 p. 32 & 43); Rissman et. al (2012 p. 224).

The example of Jersey Valley Hot Springs in Nevada is worth examining. BLM approved the Jersey Valley Geothermal Project (JVGP) in 2010. JVGP was also developed by Ormat, who are the proponents of the BGDP. Both Jersey Valley and BGDP are dry-cooled and closed-loop facilities, meaning there is ostensibly no or minimal consumption of geothermal water; and both are located directly adjacent to an important thermal spring. JVGP began production in 2011 and there is reliable time-series data available for discharge from Jersey Hot Springs from the Nevada Department of Water Resources (NDWR). From 2009-2011, the average flow rate remained within ~15% of 2009 levels. However, by 2012 the flow rate began consistently falling until it reached no flow by the end of 2014 (Figure 2).

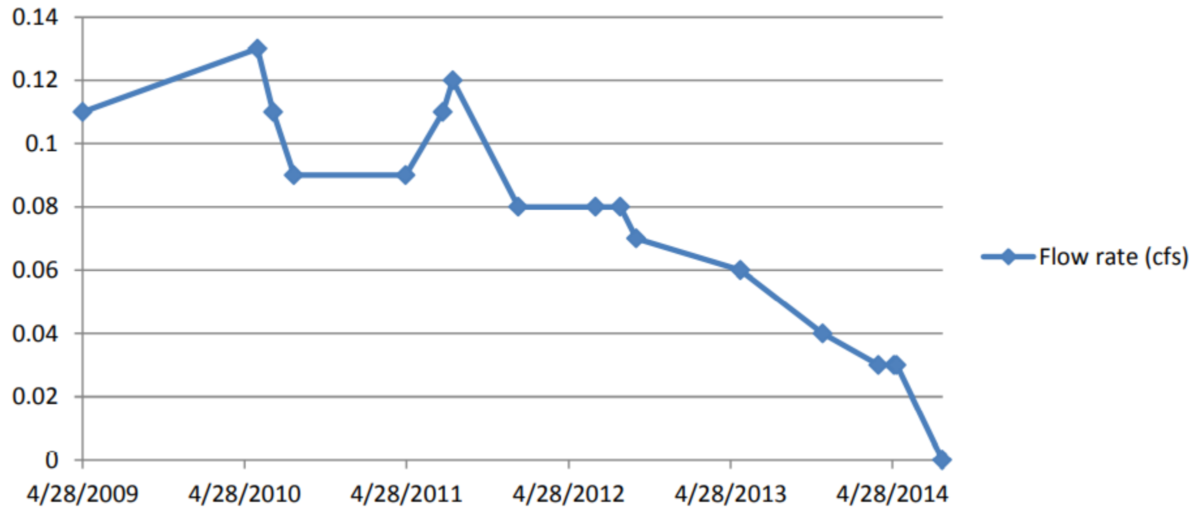


**Figure 2.** Flow rate of Jersey Valley Hot Springs since the Ormat geothermal facility began production. Data from NDWR. Units are in cubic feet per second (cfs).

The Jersey Valley Hot Springs is about one kilometer from the nearest well, and the correlation is extremely strong between the initiation of operations at JVGP and the drying up of the hot spring.

As a mitigation measure for the spring drying up, it became necessary for BLM to publish an EA for the restoration of the now-dry Jersey Valley Hot Spring (BLM 2022 entire). Ormat's primary proposal to mitigate the dry spring is to pump geothermal water into the spring from an existing well (BLM 2022 pp. 5–7). Given the similarity between the JVGP and BGDP and the strong correlation between geothermal development and impacts to the spring, there is sufficient reason to think that this is a potential outcome of geothermal development at the Baltazor Hot Spring.

*Changes in Temperature and Chemistry*

Reduction in overall temperature of the geothermal reservoir is inherent in the technology of closed-loop pumping and reinjection (Kaya et al. 2011 p. 48). Simple application of the laws of thermodynamics tells us that reinjecting cooled water (hot geothermal water which has passed through a heat exchanger) into the hot geothermal water reservoir will incrementally cool off the reservoir. For example, the Oromesa Power Plants in California which reinject 100% of produced fluid show a trend of about a 0.6ºC annual cooling. At the Steamboat Springs Power Plants in Nevada, the geothermal reservoir experienced a 1ºC annual cooling in addition to having dried up the surface features.

Flow paths for the injection fluid is one of the key factors influencing changes to temperature (Myers 2017 p. 7). Depending on the fault pattern and location of reinjection wells, changes to flow paths might alter the mixing ratio of geothermal to shallow, alluvial waters discharging at the surface. Thermal breakthrough (when cool injection water reaches the production wells) can also happen rapidly which can result in diminished energy production and the need to move reinjection wells farther from production wells (Kaya et al. 2011 p. 48). Moving injection wells farther from the production wells can alter the pressure gradient and a reduction in pressure of the geothermal reservoir can cause colder water from the shallow alluvial aquifer to flow downward due to the pressure gradient (Bayer et al. 2015 p. 374). This would also have the effect of reducing shallow groundwater levels at the surface.

Pumping and reinjection alter the natural mixing process and can change the water chemistry at the surface (Myers 2017 p. 8). Changes to water chemistry can be highly variable depending on the geology and production and reinjection patterns. For example, the Wairakei geothermal field had the chloride content of discharge from numerous springs decrease subsequent to geothermal well development- some by as much as 70% or more- over a period of several years (Hunt 2001, p. 25). Similarly at the Bao-Banati thermal springs, both temperature and chloride concentrations in spring discharge declined over time (Bolanos and Parrilla 2000 p. 47).

*Impacts to the vegetative community and bleached sandhill skipper*

The vegetative community of the Pueblo Slough will be seriously impacted if the BGDP alters groundwater flow, temperature, and/or chemistry. The Pueblo Slough is an alkali meadow like many in Nevada with saline soil and consistent, shallow groundwater. The meadow supports a local abundance of the bleached sandhill skipper’s host plant, salt grass, and adult nectar plant, rabbitbrush (Stantec 2016 p. 2). Salt grass and rabbitbrush can survive seasonal groundwater fluctuations better than some wetland species with shallower root systems (Patten et al. 2008 p. 8), but long-term declining or fluctuating water tables have been shown to reduce the growth of groundwater dependent species such as rabbitbrush and salt grass (Patten et al. 2008 p. 8).

Salt grass is a groundwater dependent species (Elmore et al. 2006 p. 771) but not an obligate wetland plant. It benefits from shallow groundwater although it can exist where the water table is below its rooting depth of ~2-4 m (6.5-13.1 feet) (Elmore et al. 2006 pp. 771-772). Study of other salt grass meadows in Owens Valley, California showed that vegetation cover declined over a period of a few years when the ground water level decreased from significant pumping that occurred in the late 1980s and early 1990s (Elmore et al. 2006 pp. 775-776). Grasses and forbs were among the first species to respond to declines in groundwater (Elmore et al. 2006 p. 777) and they are therefore indicators of changes in a region’s hydrology. The plant community in the Owen’s Valley was most sensitive to the initial drop in groundwater with sensitivity decreasing as depth to groundwater increases (Elmore et al. 2006 p. 776). Salt grass has an effective rooting depth of 2.5 m (8.2 feet) (Elmore et al. 2006 pp. 776), therefore any groundwater drawdown below this threshold could cause serious, rapid declines in the salt grass population. A long-term decline in groundwater supply may shift the vegetative community from ground water dependent plants to more upland species (Patten et al. 2008 p. 10) that rely on precipitation rather than groundwater.

The salt grass that dominates the Pueblo Slough thrives in moist, saline soil, but changes in the temperature and chemistry of groundwater could influence the salt content of the soil. If the overall salt content in the thermal spring were to decline, over time it could make the soil more tolerable to invasive grasses, destabilize the plant community, and negatively impact the bleached sandhill skipper. Declining shallow water tables can also reduce the amount of salt in the surface layers of the soil over time by reducing the amount of water wicked up to the surface by capillary action (Patten et al. 2008 p. 8). Changes to spring temperature and chemistry alone may not precipitate plant community change given the alkali and saline nature of the soils in and around the Pueblo Slough. Salt grass and rabbitbrush would likely persist, but in lower abundance potentially at a level that would not sustain the population of the bleached sandhill skipper.

The bleached sandhill skipper is reliant on dependable groundwater flows that support the vegetative community of the Pueblo Slough. If the springs were to decrease in flow, it would reduce the salt grass population thereby reducing egg laying opportunities and food for skipper larvae. Reduced larval success will drive down the skipper's population over time. The population is already isolated and without gene flow from other sandhill skipper populations a reduced population size can result in inbreeding depression. Inbreeding can increase the risk of extinction for butterflies with small populations (Saccheri et al. 1998 pp. 492–493; Nieminen et al. 2001 pp. 242–243). The bleached sandhill skipper has no chance of rescue or recolonization from another population since none exist. If the groundwater spring was to dry up altogether, it is likely that the meadow would see a sharp decline in salt grass cover over a period of several years with a corresponding loss in the skipper population. Spring recovery on the order of years to decades will likely not be fast enough to recover the species. Simply put, it would spell extinction for the skipper.

*Lack of acceptable mitigation*

Geothermal production at the Baltazor Hot Springs is an existential threat to the skipper because there are no acceptable mitigations for the potential impacts. BLM claims that they do not expect drawdown of the aquifer from the BGDP (BLM 2021a p. 33), and that ground and surface water monitoring and skipper population monitoring would be adequate mitigation actions (BLM 2021a pp. 26, 33). However, evidence shows that some changes to the groundwater conditions or surface water discharges are likely. A monitoring and mitigation plan was developed as a part of the JVGP, and yet Jersey Valley Hot Spring still went dry and has remained dry for nearly a decade. The point of such a program would be to detect impacts to surface water as they are occurring, and to change parameters of a project to attempt to ameliorate those impacts. Clearly, parameters of the JVGP project could not be changed fast enough or at all to reduce impacts to the spring.

BLM has been made aware, in draft EA comments from a FWS hydrologist, that the BGDP proposal presents inadequate hydrologic baseline information for the spring flow that supports the Baltazor meadow (BLM 2021a p. 194). The reviewer points out that the water that sustains the meadow would be impacted by any pumping of the shallow basin-fill aquifer and that the hydrologic monitoring plan presented in the EA is inadequate to sufficiently monitor the changes in groundwater and spring flow (Braumiller 2020 pp. 8-9).

The way to recover surface flow after a decline in groundwater would be to reduce or halt geothermal energy production. However, even if the power plant temporarily ceased pumping and reinjection, it is not clear that this would prevent impacts. Assuming monitoring can adequately detect impacts, by the time that spring flow is reduced, it may require substantial time for mitigation to take effect. Aquifer drawdown requires time to recover, and drawdown can worsen before improving (Myers 2017 p. 9).

It can take years or even decades for aquifers to recover from depletion or significant perturbation. For example, after an effort to save the geysers at the Rotorua project in New Zealand, the government abruptly began reducing pumping activity in 1986 and within two years flows had increased and geyser eruptions resumed at some sources (Hunt 2001 pp. 40-42). At the Ohaaki Hot Spring pool in New Zealand the pool stopped overflowing and the pool depth decreased quickly during well testing from 1967-1972 but the water level in the pool recovered and reached pretest levels by 1982, a full 10 years after the testing ended (Glover et al. 2000 p. 517). The Ohaaki pool continued to flow during the following years of energy production but only because of the cultural value of the pool to the Ngatu Tahu people which forced the developer to pipe geothermal fluid into the pool to keep it flowing (Glover et al. 2000 p. 519). However, not all geothermal surface features have such support and there are many examples of springs that have not flowed again after energy production began. The Wairakei system in New Zealand started testing in 1958 but production caused most geysers to stop and never recover (Hunt 2001 p. 16). The Geyers formation in California has also had decrease in flow from many surface thermal features (Hunt 2001 p. 16) with no information available to whether any have recovered. The hot pool at Jersey Valley in Nevada has been dry since 2014 with no sign of recovery making it necessary for BLM to publish an EA for the mitigation for the spring (BLM 2022 entire). Considering these examples, the possibility that spring flow would never recover or even that recovery time could take years to decades is unacceptable for the bleached sandhill skipper.

Groundwater monitoring and mitigation plans may not show the effects of drawdown in time for mitigations to be implemented. There can be a temporal lag between the onset of impacts and the ability to detect them; and then another temporal lag between potential mitigation measures and when they begin to ameliorate negative impacts (Bredehoeft & Durbin 2009 p. 8). While evidence for temporal lag for groundwater monitoring comes from interbasin groundwater export, and thus is dealing in distances much larger than those being discussed here, a lag likely still exists that depends on geology and distance to the spring.

It is also unclear that mitigation measures would be adhered to, once the BGDP is operational. Mitigations for the JVGP included a monitoring and mitigation plan, yet Jersey Hot Spring still went dry. The monitoring and mitigation plan developed for JVGP was inadequate, has not been followed, and has failed to prevent catastrophic impacts. This is one example, but JVGP and BGDP were developed by the same company, and we have no reason to believe that the result would be any different at Baltazor Hot Springs. BLM has not proven itself to be a trustworthy partner in protecting wildlife resources adjacent to geothermal energy development.

Since the monitoring plan at Jersey Valley did not work, BLM, Ormat, and the existing water rights holders in Jersey Valley are currently in negotiations to utilize mitigation water to satisfy the concerns of the existing rights holders (BLM 2022 pp. 5–7). The use of mitigation water requires piping water that a geothermal facility is already pumping to the surface back into the springs to compensate for reduced or zero spring discharge. Should this eventuality occur at the BGDP, it in no way provides protection for the wildlife and other resources dependent on the Baltazor Hot Spring. Resorting to mitigation pumping would mean that the Pueblo Slough and the bleached sandhill skipper would forever be dependent on the operation of the geothermal facility for the remainder of its life span. As soon as the facility was decommissioned, the springs could be dry, the Baltazor Hot Spring meadow could die-off, and the skipper could go extinct.

Mitigation water into the spring pool itself would be inadequate to support the skipper's population as it would not sufficiently recharge the groundwater throughout the entire area of the Pueblo Slough. The pool may be full, but that would unlikely affect the groundwater table that supports the entire meadow. Additional mitigation irrigation of the entire ~1,500 acre meadow would be impractical at best and would contribute to increasing the salinity of the soil due to the evaporation of high salt-content geothermal well water. Applying additional salt to the meadow would potentially increase the salinity of the soil to the point that even the salt grass cannot persist there in the large numbers that it had previously.

In short, the drying of Baltazor Hot Springs and the meadow it supports would be unmitigable and would result in the extinction of the bleached sandhill skipper.

*Listing of the Dixie Valley toad*

On April 6, 2022, the FWS took the rare step of issuing an emergency Endangered Species Act listing for the Dixie Valley toad. The Dixie Valley toad lives at Dixie Meadows in Churchill County, Nevada, and is a species with a very narrow distribution and entirely dependent on sustained discharge from a thermal spring system, like the bleached sandhill skipper. Ormat has proposed and been authorized to construct a geothermal project at Dixie Meadows, and as a result the Center petitioned the Service to protect the toad in 2017. The Service issued the emergency listing and a proposed rule for permanent listing after BLM authorized the geothermal project in November of 2021.

The emergency listing rule (FWS 2022a) and accompanying Species Status Assessment (FWS 2022b) validate the analysis presented here of the risks of geothermal development to the bleached sandhill skipper. Citing many of the same references cited here, the Service concludes, "Changes associated with surface expression of thermal waters from geothermal production are common and are expected," (FWS 2022b p. 30). The Service noted that "geothermal environments often harbor unique flora and fauna," and that "[c]hanges to these rare habitats often cause declines in these endemic organisms or even results in destruction of their habitat," (FWS 2022b p. 31). The Service notes the lack of baseline information on both the hydrology and biology of the Dixie Valley toad (FWS 2022b p. 34).

The Service then conducted an "Expert Knowledge Elicitation," which sought to get the expert opinion from scientists on the consequences of geothermal development adjacent to Dixie Meadows. While opinions among the six experts varied, there was universal consensus that the geothermal development project would result in changes to spring discharge quantity and temperature, with most saying changes would be observed in a very short time period (FWS 2022b pp. 37-41).

There are differences between the situations faced by the Dixie Valley toad and the bleached sandhill skipper. Most notably, the Dixie Valley toad relies on sustained discharge of surface water, and the impacts of geothermal energy development would be felt immediately by the toads. Whereas, the plants which the bleached sandhill skipper relies on for survival live primarily off of groundwater, as well as areas saturated by surface discharge. As a result, the time frame of impacts would be different, though no less devastating.

The Service listed the Dixie Valley toad using its emergency authorities due to the imminent threat of extinction it faced from Ormat's geothermal energy development at Dixie Meadows. The bleached sandhill skipper faces no less of a threat. The BGDP is approved and ready for construction, with functionally no mitigation plan in place to protect the skipper should things inevitably go awry.

### 2. Cattle Grazing

Livestock grazing threatens the bleached sandhill skipper through reduction of nectar sources and salt grass abundance, trampling, ground compaction, and increased spread of invasive grasses. Light grazing carefully managed for butterfly conservation can help maintain early successional plant communities (Bussan 2022 p. 7), but any grazing in arid habitats can reduce insect abundance and richness (Debano 2006 pp. 2554–2555). More generally, grazing can lead to soil erosion, loss of biotic integrity, promote invasive species, and generally degrade grasslands (Fleischner 1994 p. 631; Belsky et al. 1999; Filazzola et al. 2020 p. 1304). Grazing impacts many ESA listed butterflies with severity depending on environmental context (e.g. Elam et al. 1998 p. II-191, FWS 2019 p. I-15, FWS 1997 p. 64307, FWS 2007 p. 27).

Livestock grazing is very common across BLM lands in Nevada with many areas grazed in open range across thousands of acres. The BLM manages the area of the Baltazor Hot Spring meadow with livestock grazing. According to the BGDP EA, the BGDP proposed area including the Pueblo Slough is located within the Chokecherry pasture of the Pueblo Mountain Allotment (allotment number 00046) (BLM 2021a p. 27). The allotment is grazed approximately nine months out of the year and is held by a single operator. Cows have been observed there as recently as June 2022 (pers. obs.) (Figure 3).

**Figure 3.** (Top photo) Cattle grazing at the Baltazor Hot Spring meadow. (Bottom photo) Calf caught inside the exclusion fence around the hot spring with clear evidence of trampling around the fence. The gate to the exclusion zone was open. Additional photos of trampling and cattle excrement inside the exclusion zone available upon request.

While the severity of the impacts of grazing on the bleached sandhill skipper is unclear, excessive grazing could be a considerable threat to salt grass abundance and skipper larval survival. Assessments of a related species, the Carson wandering skipper, suggest that grazing animals can reduce salt grass abundance and trample larvae (FWS 2007 p. 27). The Carson wandering skipper is a similar, endangered butterfly that inhabits low elevation grasslands east of the Sierra Nevada in California and Nevada. The Carson wandering skipper inhabits small springs and seeps that support salt grass which is also the larval host plant. The 2007 Recovery Plan clearly states that excessive livestock trampling and salt grass grazing are a threat to this species (FWS 2007 p. 27). Grazing has been intensive enough in several locations that cattle have been excluded from some salt grass spring habitat to protect Carson wandering skipper populations (FWS 2012b pp. 17–20). Given the similarity between the Carson wandering and the bleached sandhill skipper, grazing should be considered a serious, potential threat to the bleached sandhill skipper.

## B. Overutilization

There is no information available regarding the collection of the bleached sandhill skipper and overutilization is not likely a current threat. However, press coverage after this petition and FWS actions may lead collectors to seek out this isolated, unique species.

## C. Disease

We are not aware of any disease threats to the bleached sandhill skipper. Its small population size and potential lack of genetic diversity make it vulnerable to an outbreak of a native or exotic disease.

## D. Inadequacy of Existing Regulatory Mechanisms

The bleached sandhill skipper is vulnerable to extinction given its isolated population and must be protected from threats to survive. Existing regulatory mechanisms are inadequate to prevent it becoming extinct.

A key regulatory gap in Nevada state law is a lack of statutory management authority over terrestrial invertebrates by any agency. Neither the Nevada Department of Wildlife (NDOW) nor the Nevada Department of Conservation and Natural Resources have any authority to manage or conserve terrestrial invertebrates such as the bleached sandhill skipper. NRS § 501.110 outlines the "Classification of Wildlife" in Nevada, and lists NDOW as having authority over wild mammals, wild birds, fish, reptiles, amphibians, mollusks, and crustaceans. Nowhere in the NDOW chapters of the NRS (501, 502, or 503) are insects mentioned. The Nevada Department of Agriculture has statutory authority over insects that are "normally considered to be a pest of cultivated plants, uncultivated plants, agricultural commodities, or nursery stock, or that the Director [of the Department of Agriculture] declares to be a pest," (NRS § 555.005(5)). Since the bleached sandhill skipper is not an agriculture pest, it is functionally unmanaged by any agency. No agency has authority to conduct conservation actions on the bleached sandhill skipper's behalf, nor to intervene if activities or developments pose a risk of extinction to the species.

The skipper is recognized as imperiled by state, national, and international entities. NatureServe assessed this species as critically imperiled in Nevada (NatureServe n.d. p. 2). However, this recognition is informational (i.e. non-regulatory) in nature. The skipper has been placed on Nevada's list of "at-risk species" by the Nevada Division of Natural Heritage (Nevada Division of Natural Heritage 2022 p. 16). However, species included on the At-Risk Plant and Animal Tracking List are not provided any additional protections by the state (Nevada Natural Heritage Program 2022 p. 1). The At-Risk List simply directs the data acquisition priorities of the Division of Natural Heritage and provides current information on the conservation status of these taxa.

The bleached sandhill skipper is considered a BLM Sensitive Species in Nevada (BLM 2017 p. 24). BLM Sensitive Species are "species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA," (BLM 2008 p. 3). However, BLM approved a geothermal project with the potential to drive the bleached sandhill skipper to extinction despite the Sensitive Species designation. In fact, the Sensitive Species designation of the bleached sandhill skipper was not even mentioned in the final environmental assessment. The Sensitive Species designation did not factor in to BLM's approval of the BGDP, and thus provides no protection whatsoever for the bleached sandhill skipper.

Beyond the Sensitive Species designation, other BLM regulations do not provide protections for the bleached sandhill skipper. The BLM Winnemucca District Resources Management Plan requires that proposed actions on BLM land do not affect a species in such a way that it may lead to further listing under the ESA (BLM 2013 p. 34). However, the project's only required mitigation would be that Ormat conduct periodic surveys to monitor the impacts to the skipper (BLM 2021b p. 6) and to monitor surface and ground water (BLM 2021b p. 7). BLM offers no contingency plan or guarantee that the geothermal plant will be required to reduce production or shut down if changes in groundwater flow cause the spring to dry. Reducing or halting production would be the only way to restore a loss of spring flow to the Pueblo Slough. A halting of energy production seems highly unlikely considering the multi-million dollar capital investment in developing and operating a geothermal power plant. In short, BLM has no regulatory mechanisms under which adequately protect the bleached sandhill skipper.

Identification of the imperiled status of the skipper prompted WildEarth Guardians to petition the FWS to protect this species in 2010 (Wild Earth Guardians 2010 pp. 14–15). FWS ruled that listing the bleached sandhill skipper under the ESA was not warranted because of lack of threat to its habitat (FWS 2012 p. 54294). A previous not warranted for ESA listing finding from FWS does not rule out protection under the Act in the future as threats develop and are better understood. Notably, geothermal energy was not considered in the 2012 listing decision.

No other ESA listed species offer additional protections since none occur in the area (BLM 2021a p. 3). There is no designated critical habitat for any ESA protected species at the Baltazor Hot Springs nor were any federal or state listed species found there during wildlife baseline surveys produced for Ormat (Stantec 2020 p. 8).

## E. Other Natural or Manmade Factors

### 1. Climate Change

Climate change is already affecting the Great Basin in ways that could impact the bleached sandhill skipper. The Southwest is expected to become hotter and dryer as a result of anthropogenic climate change (Garfin et al. 2018 pp. 1104–1106). The fourth national climate assessment shows that the average temperature in the Southwest has increased 0.9°C from 1901-2016 (Garfin et al. 2018 p. 1108). Lepidoptera show a complex range of adaptations to physiology, behavior, genes, etc. to climate change (Hill et al. 2021 p. 2115). Increased temperatures and associated ecological consequences that have driven some species to higher elevations, higher latitudes, or even to physiological changes to move towards their favored food plants and microhabitat (Hill et al. 2021 pp. 2118–2119). If climate change makes the habitat for the bleached sandhill skipper less favorable over time, this subspecies has few options. It is already very effectively isolated from other subspecies of sandhill skipper. It's presumably low dispersal ability make it highly vulnerable to decline if its salt grass host plant or adult nectar plants are unable to support the population.

The Southwest is expected to be dryer in the future (Jones & Gutzler 2016 p. 4637) and groundwater-fed meadows like the Pueblo Slough are not immune to the increasingly arid climate of the Southwest. There has been no systematic study of how groundwater springs in the Great Basin have changed over recent decades, but in many systems that have been examined, groundwater levels and spring discharge have declined over time due to a variety of factors (Patten et al. 2008 pp. 9-12). Changes in precipitation regimes including decreased winter precipitation and snowpack are projected to lower groundwater levels across the western United States (Meixner et al. 2016 pp. 132-134). Reduced groundwater levels coupled with increased evapotranspiration and other factors means that decreases in discharge in desert springs due to climate change is likely (Parker et al. 2021 p. 322). Increased temperatures and decreased precipitation decrease stream flows and spring discharge, groundwater recharge rates, and increase the severity and duration of droughts across the region (Garfin et al. 2018 p. 1109). Modeling of temperature and rainfall patters under different climate change scenarios shows that the increased aridity in the northern part of the Southwest is most likely to be driven by increased evapotranspiration especially in the cold season (Jones & Gutzler 2016 p. 4647). Greater evapotranspiration from plants lowers soil moisture at a faster rate under increased temperatures caused by climate change (Garfin et al. 2018 p. 1109).

It is difficult to predict the exact impacts climate change will have for the bleached sandhill skipper, but a hotter and drier future may put the plant community of the Pueblo Slough at risk. The bleached sandhill skipper relies on its larval host plant, salt grass, a $C_4$ halophyte, that is already very well adapted to drought stress and high soil salinity (Hansen et al. 1976 p. 648). While salt grass can grow in salty soil, its growth depends on the depth of the water table. Laboratory experiments show that salt grass produces the most biomass when groundwater is constant and in the middle of its rooting zone ~1 m (3 ft) below the surface (Naumburg et al. 2005 p. 735). Salt grass likely produces only half as much biomass when groundwater fluctuates annually between 1 m and 4 m and biomass is severely impacted if groundwater is below 4 m (13.1 ft) (Naumburg et al. 2005 p. 735). Increasing salinity past what the plants can tolerate as a result of greater evapotranspiration of water wicked up to the surface also decreases aboveground biomass production of salt grass (Christman et al. 2009 p. 52). The stability of salt grass in the Pueblo Slough is vital to the growth and health of bleached sandhill skipper larvae. Decreasing or fluctuating groundwater levels or increased salinity as a result of climate change may reduce the growth of salt grass in the Pueblo Slough past a tipping point that puts the population of the skipper at risk of extinction.

# VI. Request for Critical Habitat Designation

We urge the Service to designate critical habitat for the bleached sandhill skipper concurrent with listing it as endangered under the ESA. Critical habitat as defined by Section 3 of the ESA is: (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) the specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species (16 U.S.C. § 1532(5)).

Congress recognized that the protection of habitat is essential to the recovery and/or survival of listed species, stating that: "classifying a species as endangered or threatened is only the first step in ensuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence… If the protection of endangered and threatened species depends in large measure on the preservation of the species' habitat, then the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat." H. Rep. No. 94-887 at 3 (1976).

Critical habitat is an extremely effective and important component of the ESA, without which the bleached sandhill skipper's chance for survival significantly diminishes. Petitioners request that the Service propose critical habitat for the skipper concurrently with its listing.

# VII. Conclusion

The bleached sandhill skipper is a unique subspecies found only in the meadow that surrounds the Baltazor Hot Springs and is highly vulnerable to impacts to the spring flow that sustains the plant community of the Pueblo Slough. Geothermal energy development in the immediate vicinity of the hot springs brings the inherent risk of reduction in spring flow including the possibility of a complete drying of the spring. Under moderate or severe drying of the Baltazor Hot Spring, the skipper's presumed larval host plant, salt grass, is expected to decline in abundance possibly to the point that it can no longer support the skipper's population. Mitigations proposed by the energy development proponent are insufficient to protect the skipper from threats to its habitat. The Baltazor Geothermal Development Project is permitted, and construction of the power plant can begin at any time. Due to the direct threats to its only known habitat, the bleached sandhill skipper warrants listing as endangered under the Act. Listing under the ESA and the designation of critical habitat would provide greater protection to the bleached sandhill skipper from reductions in spring flow. The ESA requires that the Services promptly issue an initial finding as to whether this petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A).

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