# 8. NORTHWESTERN SACRAMENTO VALLEY VERNAL POOL REGION

The vernal pool fairy shrimp and vernal pool tadpole shrimp are both known to occur within the Northwestern Sacramento Valley Vernal Pool Region. The Conservancy fairy shrimp is not known to occur within this region.

## 8.1. Vernal Pool Habitat

Approximately 50,314 acres of vernal pool grassland existed within, or immediately adjacent to, this region when the Recovery Plan was published in 2005 (see **Figure 8.1**, **Table 8.1**; Witham et al. 2013). Approximately 46,016 acres remained as of 2012, with 4,335 acres (8.6% of 2005 total) lost between 2005 and 2012 (Witham et al. 2014). However, 27 acres of new vernal pool grassland were created over that same period on vernal pool mitigation banks and other managed wetlands, and 10 additional acres were identified that were either not present or not visible on the 2005 aerial imagery. Of the habitat lost, 585 acres (13.5%) were to urbanization and 3,750 acres (86.5%) were to agricultural conversion (58.5% to orchards, 27.5% to bare plowed agricultural land, and 0.5% to other agricultural conversions) (Witham et al. 2014).

By 2018, approximately 42,521 acres of vernal pool grassland remained, with a total of 7,830 acres (15.6% of 2005 total) lost between 2005 and 2018 (see **Table 8.1**; Witham 2021). No areas of new vernal pool grassland were identified in the 2018 aerial imagery that were either not present or not visible on both the 2005 and 2012 aerial imagery. Of the habitat lost since 2005, 592 acres (7.6%) were to urbanization and 7,238 acres (92.4%) were to agricultural conversion (82.5% to orchards, 9.0% to bare plowed agricultural land, and 0.9% to other agricultural conversions) (see **Table 8.2**; Witham 2021). Note that most patches of vernal pool grassland that had been converted to bare plowed land in 2012 had been fully converted to agricultural use for orchards by 2018.

This vernal pool region has exhibited the largest percentage of total vernal pool losses and the largest percentage of losses to agricultural conversion within the Central Valley, although other regions do have a greater amount of loss (Witham 2021). The vast majority of vernal pool losses within this region have been to agricultural conversions (92.4%), which is unsurprising given that the region is composed primarily of agricultural lands and very few cities or towns. Many of these losses are likely due to land conversions to orchards that should be regulated by the Clean Water Act but that are proceeding illegally without the necessary 404 permit from the Corps (Witham et al. 2014; Witham 2021). This region also had the second highest amount and percentage of vernal pool grassland lost to urban development, after the Southeastern Sacramento Valley Vernal Pool Region. Almost all of these losses (579 of 592 acres) in this region are associated with the development of a golf course at the Rolling Hills Casino and Resort (Witham 2021).

As of 2018, roughly 4,018 acres of vernal pool grassland was estimated to be protected in this region, or immediately adjacent to it, typically under a conservation easement (see **Figure 8.1**, **Figure 8.2**, **Table 8.1**; Witham 2021; Vollmar et al. 2017). This represents only 8.0% of both the currently remaining vernal pool grassland in the region and the vernal pool grassland that existed in the region in 2005, the Recovery Plan's baseline. This region has both the lowest amount and

lowest percentage of protected vernal pool grasslands of all the vernal pool regions that are entirely within the Central Valley.

## 8.2. Species Occurrences

### 8.2.1. Vernal Pool Fairy Shrimp

There are 29 occurrence records of the vernal pool fairy shrimp documented within, or immediately adjacent to, the Northwestern Sacramento Valley Vernal Pool Region in the Diversity Database (see **Figure 8.3**; Diversity Database 2022). The majority of these occurrences are on privately owned land and are therefore vulnerable to extirpation. Of these 29 occurrences, all are listed by the Diversity Database as presumed extant, though 1 occurrence is within extirpated vernal pool habitat based on Witham's (2021) mapping efforts. There are also six occurrences that are outside of vernal pool habitat mapped by Witham (2021). It is likely that some of the occurrences that are presumed extant are no longer extant, but have not been surveyed recently, particularly given the amount of habitat loss in the region.

The protected areas contain, at least partially, 8 of the 29 Diversity Database records (28%) for the vernal pool fairy shrimp in this region. However, this does not mean that 28% of all occurrences of the vernal pool fairy shrimp in this region have been protected, as the Diversity Database is not an appropriate source for determining all known occurrences (individual Diversity Database records are not necessarily equivalent to occurrences, and some known occurrences may not be documented in the Diversity Database). Only 3 of the 29 Diversity Database polygons (10%) are entirely within the protected areas.

### 8.2.2. Vernal Pool Tadpole Shrimp

There are 24 occurrence records of the vernal pool tadpole shrimp documented within the Northwestern Sacramento Valley Vernal Pool Region in the Diversity Database (see **Figure 8.4**; Diversity Database 2022). The majority of these occurrences are on privately owned land and are therefore vulnerable to extirpation. Of these 24 occurrences, all are listed by the Diversity Database as presumed extant; 17 are within extant vernal pool grasslands and 7 are outside of vernal pool grasslands mapped by Witham (2021). It is likely that some of the occurrences that are presumed extant are no longer extant, but have not been surveyed recently, particularly given the amount of habitat loss in the region.

The protected areas contain, at least partially, 10 of the 24 Diversity Database records (42%) for the vernal pool tadpole shrimp in this region. Only 2 of the 24 Diversity Database polygons (8%) are entirely within the protected areas.

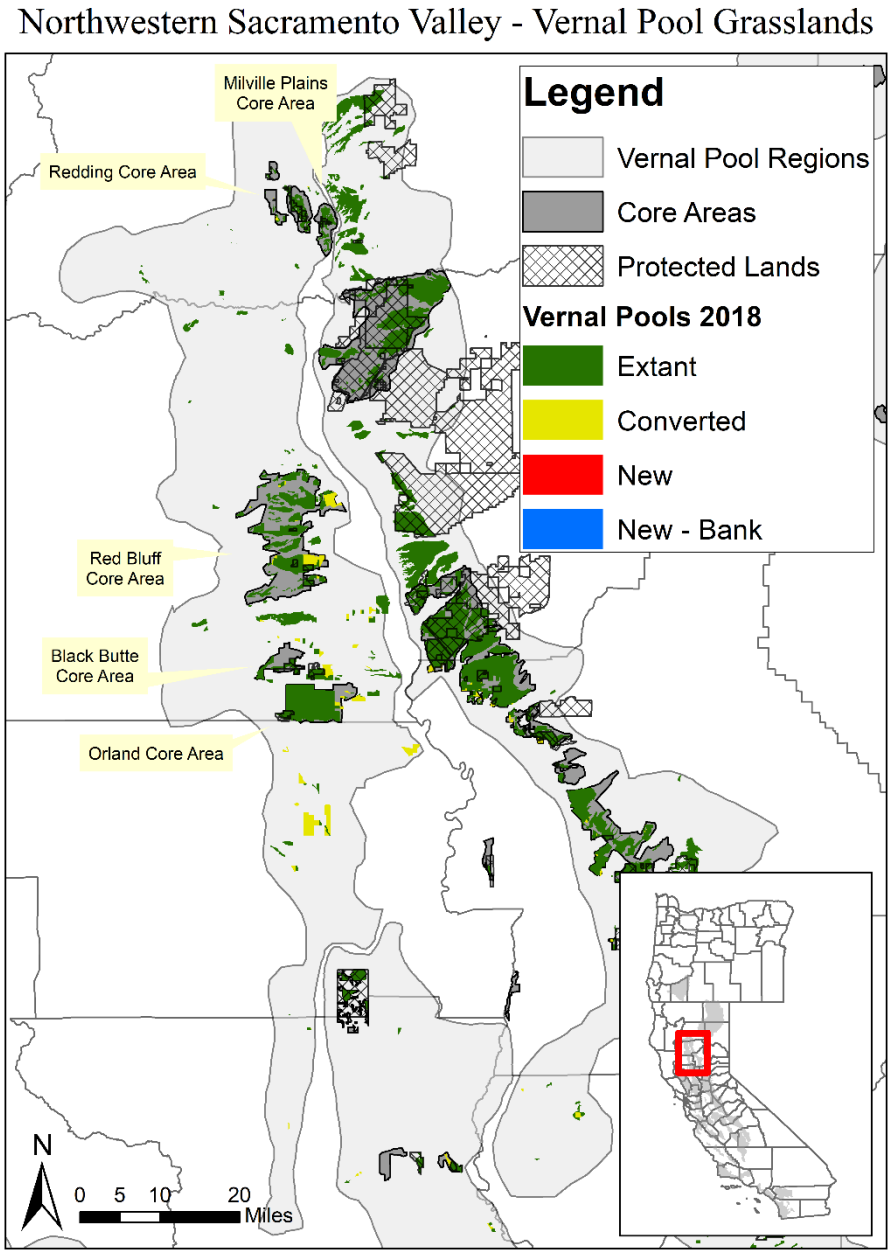


**Figure 8.1.** Map of vernal pool habitat within the Northwestern Sacramento Valley Vernal Pool Region mapped by Witham (2021) created using aerial imagery from 2018 compared to 2005 and 2012. "New" vernal pool habitat refers to areas not seen in the 2005 or 2012 aerial imagery (either missed or restored). "New - bank" refers to newly created vernal pool habitat on mitigation lands. Converted habitat refers to vernal pool habitat that was seen in 2005 or 2012 aerial imagery and by 2018 was converted to other land uses. Modified habitat as described by Witham (2021) was altered but still provides suitable vernal pool habitat (e.g., mitigation banks, lands managed for waterfowl), and so is mapped as extant. Zoom in for finer resolution.

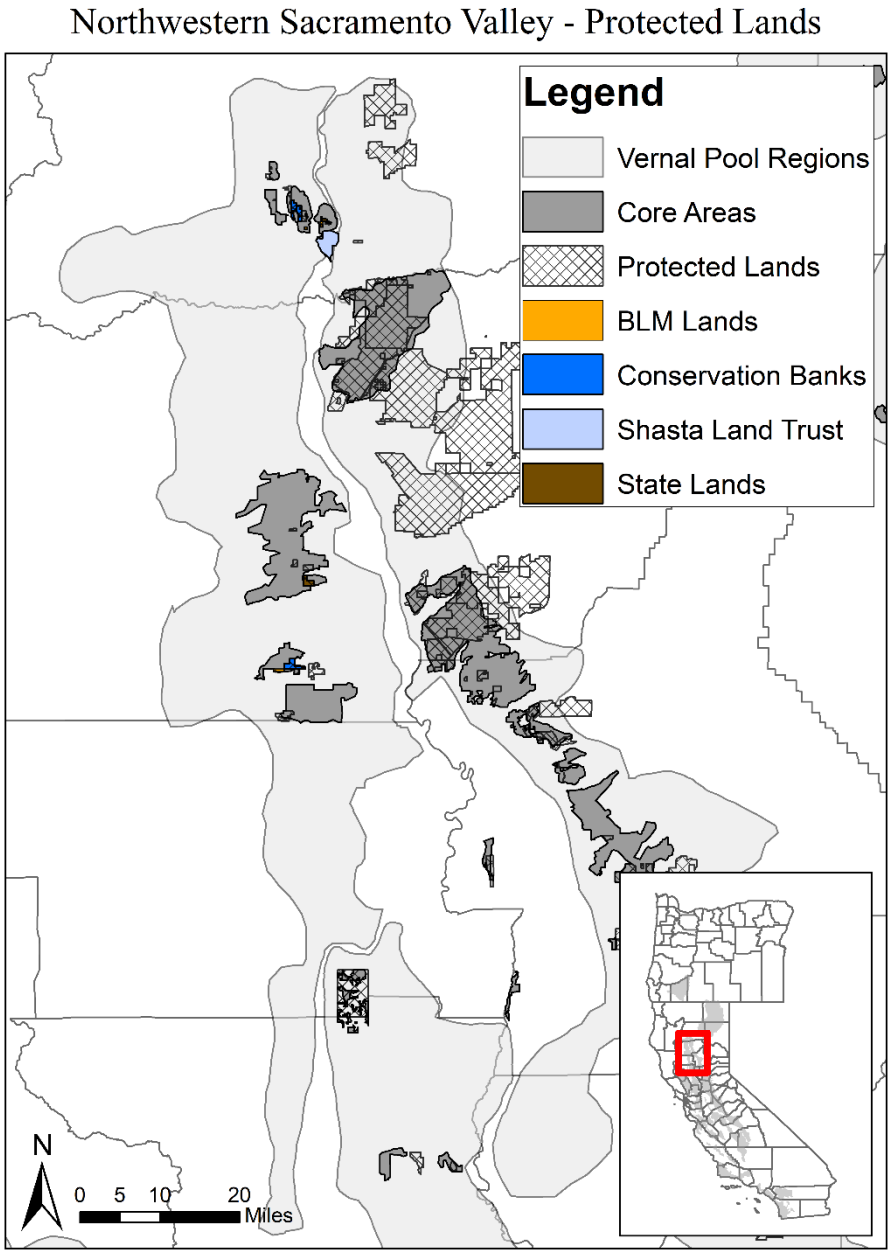


**Figure 8.2.** Map of protected areas that contain vernal pool grassland habitat and/or vernal pool fairy shrimp or vernal pool tadpole within the Northwestern Sacramento Valley Vernal Pool Region**.** Protected lands are based on Vollmar et al. (2017) and include various preserves. Zoom in for finer resolution. BLM = Bureau of Land Management.

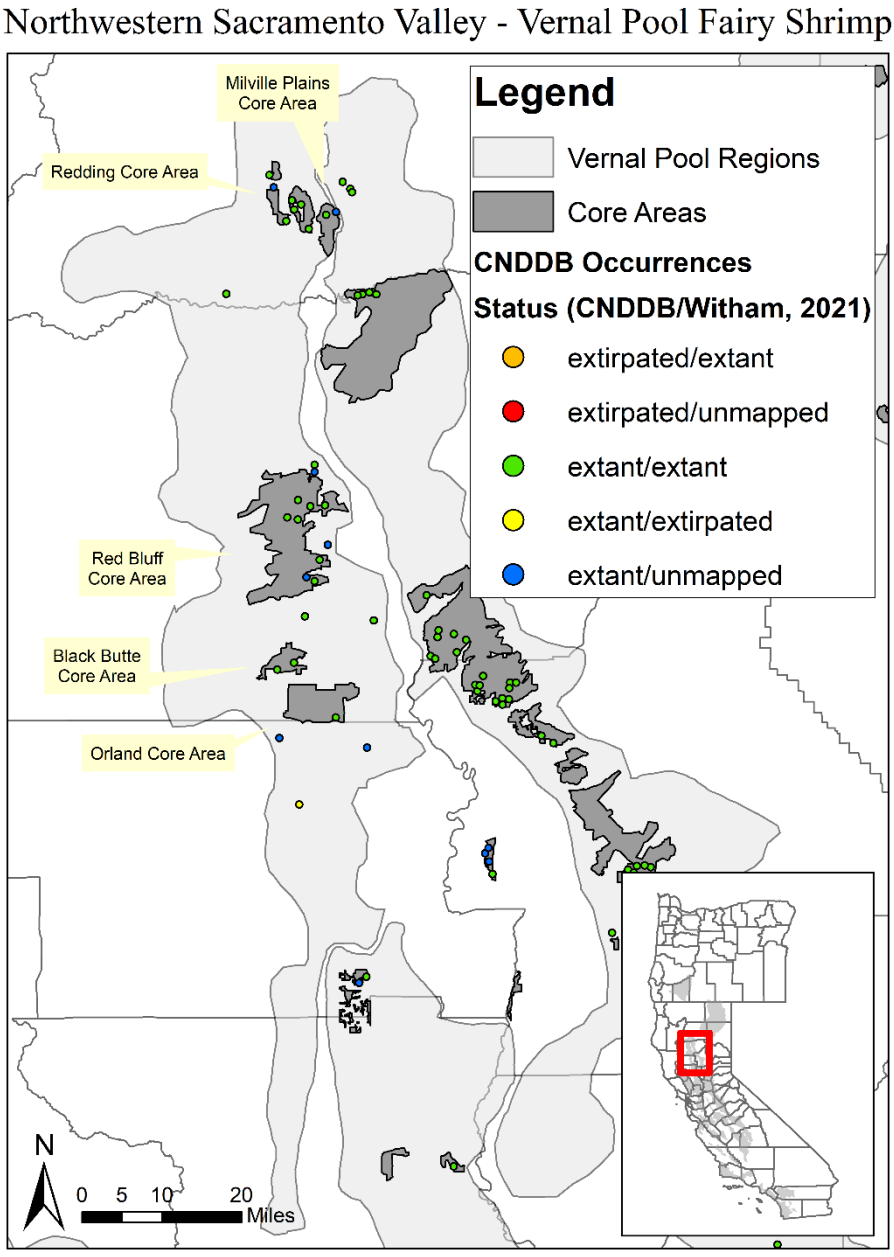


**Figure 8.3.** Map of known occurrences of vernal pool fairy shrimp recorded in the Diversity Database (2022) in the Northwestern Sacramento Valley Vernal Pool Region. Points may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both Diversity Database occurrence records and Witham's (2021) map of vernal pool habitat.

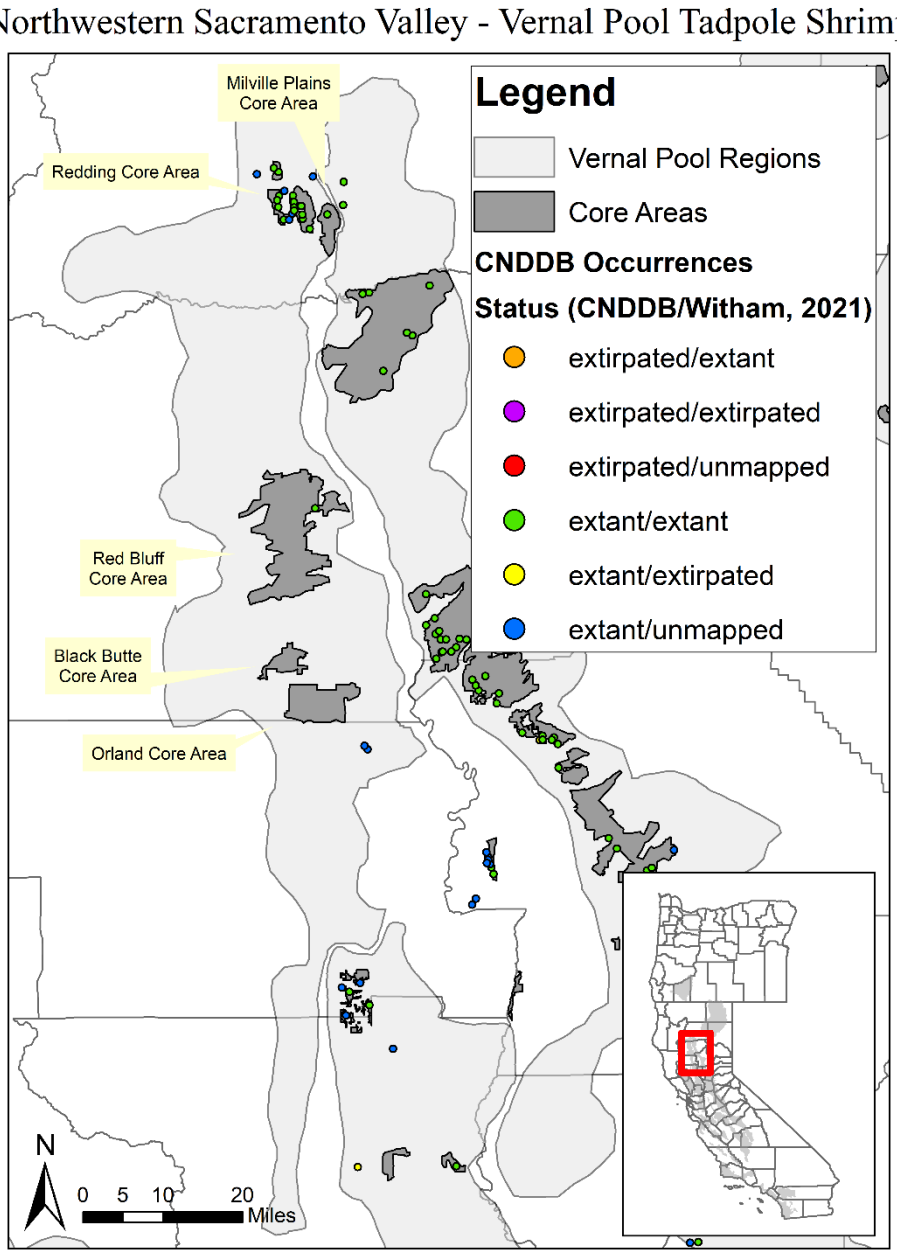


**Figure 8.4.** Map of known occurrences of vernal pool tadpole shrimp recorded in the Diversity Database (2022) in the Northwestern Sacramento Valley Vernal Pool Region. Points may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both Diversity Database occurrence records and Witham's (2021) map of vernal pool habitat. All 5 core areas in the region are displayed, though not all core areas are designated for the vernal pool tadpole shrimp.

**Table 8.1.** Acreage of vernal pool habitat and habitat converted within the Northwestern Sacramento Valley Vernal Pool Region mapped by Witham (2021). All habitat labeled as not converted, altered, or new was considered extant. Protected acreage is based on Vollmar et al. (2017).

| Core Area | 2005 Acres | 2018 Acres Total | 2018 Acres Extant (% of Total) | 2018 Acres Converted – Agriculture (% of Total) | 2018 Acres Converted – Urban Development (% of Total) | 2018 Acres Protected (% of Total) |
|---|---|---|---|---|---|---|
| Black Butte | 1,360.5 | 1,360.5 | 1,360.5 (100.0%) | 0.0 (0.0%) | 0.0 (0.0%) | 625.4 (46.0%) |
| Millville Plains | 1,751.8 | 1,751.8 | 1,751.8 (100.0%) | 0.0 (0.0%) | 0.0 (0.0%) | 268.8 (15.3%) |
| Orland | 10,173.2 | 10,173.2 | 9,913.2 (97.4%) | 260.0 (2.6%) | 0.0 (0.0%) | 389.8 (3.8%) |
| Red Bluff | 17,078.8 | 17,078.8 | 14,965.1 (87.6%) | 2,111.8 (12.4%) | 1.8 (<0.1%) | 903.1 (5.3%) |
| Redding | 1,812.3 | 1,812.8 | 1,766.8 (97.5%) | 44.8 (2.5%) | 1.2 (0.1%) | 425.3 (23.5%) |
| **Northwestern Sacramento Valley Vernal Pool Region Total** | **50,313.9** | **50,350.6** | **42,521.1 (84.5%)** | **7,237.9 (14.4%)** | **591.7 (1.2%)** | **4,017.8 (8.0%)** |

**Table 8.2.** Acreage of vernal pool habitat losses within the Northwestern Sacramento Valley Vernal Pool Region between 2005 and 2018 mapped by Witham (2021), broken down by what the land use was converted to. All categories besides urban development and managed wetlands are considered agricultural conversions.

| Core Area | Urban, Commercial, & Industrial | Orchards, Vineyards, Eucalyptus | Alfalfa and Irrigated Pasture | Bare Plowed Agricultural Lands | Other Ag (Rice, Row Crops, Dairy, | Agricultural Residential | Managed Wetlands | Total Losses | % Losses Urban Development | % Losses Agricultural Conversions |
|---|---|---|---|---|---|---|---|---|---|---|
| Black Butte | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | N/A | N/A |
| Millville Plains | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | N/A | N/A |
| Orland | 0.0 | 230.4 | 0.0 | 29.6 | 0.0 | 0.0 | 0.0 | 260.0 | 0.0% | 100.0% |
| Red Bluff | 1.8 | 1,905.9 | 17.6 | 180.9 | 0.0 | 7.4 | 0.0 | 2,113.6 | 0.1% | 99.9% |
| Redding | 1.2 | 0.0 | 0.0 | 44.8 | 0.0 | 0.0 | 0.0 | 45.9 | 2.6% | 97.4% |
| **Northwestern Sacramento Valley Vernal Pool Region Total** | **591.7** | **6,458.8** | **24.7** | **708.5** | **31.5** | **14.3** | **0.0** | **7,829.5** | **7.6%** | **92.4%** |

## 8.3. Federal Lands

### 8.3.1. National Wildlife Refuges

There are no National Wildlife Refuges with known occurrences of the vernal pool fairy shrimp or vernal pool tadpole shrimp in the Northwestern Sacramento Valley Vernal Pool Region.

### 8.3.2. Military Lands

There are no military lands with known occurrences of the vernal pool fairy shrimp or vernal pool tadpole shrimp in the Northwestern Sacramento Valley Vernal Pool Region.

### 8.3.3. Bureau of Land Management

There are three small parcels of land owned by the Bureau of Land Management (BLM) within this vernal pool region that contain vernal pool grasslands (**Figure 8.2**). Two small parcels, approximately 42 acres each, are located in southern Shasta County, one in the Redding Core Area and one in the Millville Core Area. The parcel within the Redding Core Area has been designated as the Hawes Corner Area of Critical Environmental Concern and contains a vernal pool fairy shrimp occurrence from 1988 and a vernal pool tadpole shrimp occurrence that was documented in 1938 and again in 1988 (Diversity Database 2022). Two vernal pools have been mapped by BLM within the Hawes Corner parcel, but they were not surveyed during BLM surveys in 2017-2019 (BLM 2017b; BLM 2018; BLM 2019b). The third parcel is located in southern Tehama County within the Black Butte Core Area, is approximately 163 acres in size, and is called the Corning Parcel. The vernal pool fairy shrimp was documented here for the first time within 24 pools in 2019 during BLM surveys (BLM 2019b). The vernal pool tadpole shrimp has not been documented on the Corning Parcel (BLM 2019b). The BLM's Redding Field Office, which covers Butte, Tehama, Shasta, Trinity, and Siskiyou Counties, is currently revising its Resource Management Plan and will be proposing the Corning Parcel for designation as an Area of Critical Environmental Concern due to the high concentration of vernal pools with vernal pool fairy shrimp (Laymon, *in litt*. 2022).

### 8.3.4. Other Federal Lands

There are no other federal lands with known occurrences of the vernal pool fairy shrimp or vernal pool tadpole shrimp in the Northwestern Sacramento Valley Vernal Pool Region.

## 8.4. Conservation Banks

There are two conservation banks within the Northwestern Sacramento Valley Vernal Pool Region that provides credits for preserved or created vernal pools that support the vernal pool fairy shrimp: Blackburn Vernal Pool Conservation Bank and Stillwater Plains Mitigation Bank (see **Figure 8.2**; RIBITS 2021). The Stillwater Plains Mitigation Bank also provides credits for preserved and created vernal pools that support the vernal pool tadpole shrimp.

Blackburn is a 631-acre bank located in southern Tehama County, west of Interstate 5. The bank was established in 2006 and is currently operating under its long-term management plan; monitoring for the vernal pool fairy shrimp was last conducted in 2016 and will occur every 10

years (Wildlands 2016). Surveys in 2016 found the vernal pool fairy shrimp in 45 vernal pools (60%) of the 75 pools sampled throughout the bank, which is a higher occupancy rate than the 33% occupancy observed during baseline monitoring. Overall management of the bank consists of livestock grazing in addition to the long-term monitoring, and vernal pool hydrology and floristics demonstrate continuing successful ecosystem function (Wildlands 2016). The bank has sold 2.226 of its 36.24 total vernal pool fairy shrimp preservation credits (RIBITS 2021).

Stillwater Plains Mitigation Bank is an 834-acre multi-phase bank located in southern Shasta County south of Redding. The first phase of the bank was established in 2000 and the second and third phases were established in 2006. Parts of the bank are dedicated to vernal pool complexes and other parts to elderberry shrubs for the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). Unlike other banks, the credits are not designated as species credits for the vernal pool shrimp species, but the vernal pool complexes are known to support the vernal pool fairy shrimp and vernal pool tadpole shrimp (Diversity Database 2022). The long-term management goal for various types of wetlands within the bank, including vernal pools and swales, is to maintain the biological integrity and diversity of the wetland systems in terms of plant species composition and cover, hydrology, and the absence of invasive species (May Consulting Services 2000). Grazing is the primary management tool, with the option for using prescribed fire or herbicides in limited instances. Monitoring for vernal pool shrimp species will occur every three years. The bank has sold 29.1 of its 70.4 vernal pool or swale preservation credits and 40.8 of its 47.9 vernal pool or swale creation credits (RIBITS 2021).

## 8.5. Habitat Conservation Plans

There is one regional Habitat Conservation Plan (HCP) within the Northwestern Sacramento Valley Vernal Pool Region that includes the three shrimp species as Covered Species.

### 8.5.1. PG&E Multiple Region Operations and Maintenance HCP

See section 2.5.1 for a description of this HCP.

## 8.6. Other Preserves

The California Department of Fish and Wildlife (CDFW) owns the 443-acre Thomes Creek Ecological Reserve in Tehama County located on the south side of Gyle Road just west of the intersection with I-5. The entire property consists of small vernal pools less than 0.1-acre in size on either side of Thomes Creek (Lis, *in litt*. 2023), though Witham's (2021) mapping only identified 346 acres as vernal pool grassland. The vernal pool fairy shrimp was identified within this area during multiple years throughout the 1990's, and the most recent detection was in 2012; the vernal pool tadpole shrimp has not been identified within this Ecological Reserve (Diversity Database 2022). Due to the small size of the pools, the pools did not fill with water during the 2018-2022 drought years (Lis, *in litt*. 2023). There is no management plan for the Ecological Reserve, and regular monitoring has been difficult due to difficulty accessing the site and the short time period that these small vernal pools hold water (Lis, *in litt*. 2023). CDFW also holds conservation easements on three properties in Shasta County southeast of the City of Redding and northeast of the City of Anderson: Shaw, Honker Way, and Millville Plains. These easements are 9 acres, 83 acres, and 116 acres in size, respectively, and are all mapped entirely

as vernal pool grasslands (Witham 2021). The vernal pool fairy shrimp and vernal pool tadpole shrimp have not been documented within these easements (Diversity Database 2022) and CDFW staff have not visited these sites since 2008 or 2009 and are not aware of when the vernal pools were most recently sampled (Lis, *in litt*. 2023). Technically, one Diversity Database occurrence for the vernal pool tadpole shrimp does overlap the eastern edge of the Millville Plains conservation easement; however, this was an occurrence that was reported as along Millville Plains Road, and, because there was no more detail, the occurrence was mapped to include all 7 miles of Millville Plains Road. There is one other occurrence immediately north of the easements as well as several occurrences of the vernal pool fairy shrimp nearby (Diversity Database 2022), so it is possible that the vernal pool fairy shrimp and vernal pool tadpole shrimp are present within these easements.

The Shasta Land Trust holds conservation easements over one property in this region that has vernal pool grasslands mapped by Witham (2021): Fenwood Ranch. The 2,242-acre Fenwood Ranch is mostly within this vernal pool region, although it does extend slightly into the Northeastern Sacramento Valley Vernal Pool Region as well. This property is verified by Shasta Land Trust to have vernal pool habitat onsite, while the other properties in the area have wetland features, but not distinctively vernal pool habitat (Blevins, *in litt*. 2022). There is no specific management plan for this property, and species monitoring is not typically conducted (Blevins, *in litt*. 2022). Fenwood Ranch was not included in Vollmar et al.'s (2017) database of protected lands; thus, an additional 444 acres of vernal pool habitat mapped by Witham (2021) is estimated to be protected in the Northwestern Sacramento Valley Vernal Pool Region within Fenwood Ranch.

Vollmar et al. (2017) identified 12 other protected properties within the Northwestern Sacramento Valley Vernal Pool Region, all of which are protected by a conservation easement. There are four mitigation properties that have been protected, likely as part of proposed conservation measures during Section 7 interagency consultations; three of the conservation easements are held by Wildlife Heritage Foundation and one is held by the City of Redding. There are also seven properties that have a conservation easement held by the Natural Resources Conservation Service (NRCS) and one that has a conservation easement held by the U.S. Bureau of Reclamation (BOR). Vollmar et al. (2017) also depict the entire 791-acre Blackburn property as protected, although the Service is only aware of the 631-acre Blackburn Vernal Pool Conservation Bank being protected, and not the additional 160 acres.

### 8.7. Vernal Pool Core Areas

There are three Core Areas within the Northwestern Sacramento Valley Vernal Pool Region that are designated in the Recovery Plan for the vernal pool fairy shrimp: Orland, Red Bluff, and Redding. There are also two additional Core Areas that were not designated for the vernal pool fairy shrimp in the Recovery Plan, but that have known occurrences of the species in the Diversity Database: Black Butte and Millville Plains (Diversity Database 2022). For both of these two core areas, at least one of the Diversity Database occurrences includes information about surveys that occurred before 2005, so the two core areas likely should have been designated for the vernal pool fairy shrimp in the Recovery Plan; however, it is possible that these occurrence records were not uploaded to the Diversity Database until after 2005. None of the five core areas have met the target of 85% of vernal pool habitat protected, but as of 2018

none had lost more than 13% of the baseline level of habitat that was present in 2005 (see **Table 8.1**; Vollmar et al. 2017; Witham 2021).

There are two Core Areas within the Northwestern Sacramento Valley Vernal Pool Region that are designated in the Recovery Plan for the vernal pool tadpole shrimp: Red Bluff and Redding. There is also one additional Core Area that was not designated for the vernal pool tadpole shrimp in the Recovery Plan, but that has known occurrences of the species in the Diversity Database: Millville Plains (Diversity Database 2022). The vernal pool tadpole shrimp was not definitively identified in the Millville Plains Core Area until 2012, which is why this core area was not designated for the vernal pool tadpole shrimp in the Recovery Plan. None of the three core areas have met the target of 85% of vernal pool habitat protected, but as of 2018 none had lost more than 13% of the baseline level of habitat that was present in 2005 (see **Table 8.1**; Vollmar et al. 2017; Witham 2021).

### 8.7.1. Black Butte

This is a zone 2 core area, but it was not designated for the vernal pool fairy shrimp in the Recovery Plan. It was designated for Boggs Lake hedge-hyssop (*Gratiola heterosepala*) and legenere (*Legenere limosa*), with a goal of protecting 85% of vernal pool habitat. The core area is located in southern Tehama County west of Interstate 5 between the cities of Orland and Corning.

There were approximately 1,361 acres of vernal pool grassland within this core area when the Recovery Plan was published in 2005 (Witham et al. 2013). As of 2018, there were still 1,361 acres of vernal pool grassland remaining, with no habitat losses occurring since 2005 (see **Figure 8.5**, **Table 8.1**; Witham 2021). Roughly 625 acres of vernal pool grassland were protected within this core area as of 2017 (Vollmar et al. 2017), representing 46% of the 2005 baseline.

Protected areas within this core area include the Blackburn Vernal Pool Conservation Bank and BLM's Corning Parcel (**Figure 8.6**). Vollmar et al.'s (2017) database depicts the entire 791-acre Blackburn property as protected, although the Conservation Bank is only composed of a 631-acre portion of the property. The Service is unaware if the remaining parcel is in fact protected as depicted by Vollmar et al. (2017) or if this was simply a mistake.

#### *8.7.1.1.Vernal Pool Fairy Shrimp Occurrences*

There are two Diversity Database occurrence records for the vernal pool fairy shrimp within this core area (see **Figure 8.7**; Diversity Database 2022). As of 2018, both of these occurrences were at least partially within protected areas (Vollmar et al. 2017). Both occurrences are presumed extant by the Diversity Database and are within extant vernal pool grasslands (Witham 2021). The western occurrence is almost entirely within the Blackburn Vernal Pool Conservation Bank and the vernal pool fairy shrimp was most recently found here in 2016 (Wildlands 2016). This occurrence was first documented in 1992 (Diversity Database 2022), and thus the Recovery Plan likely should have designated this core area for the vernal pool fairy shrimp. The eastern occurrence is within the Corning Parcel owned by BLM, and the vernal pool fairy shrimp was first documented here during BLM surveys in 2019 (BLM 2019b).

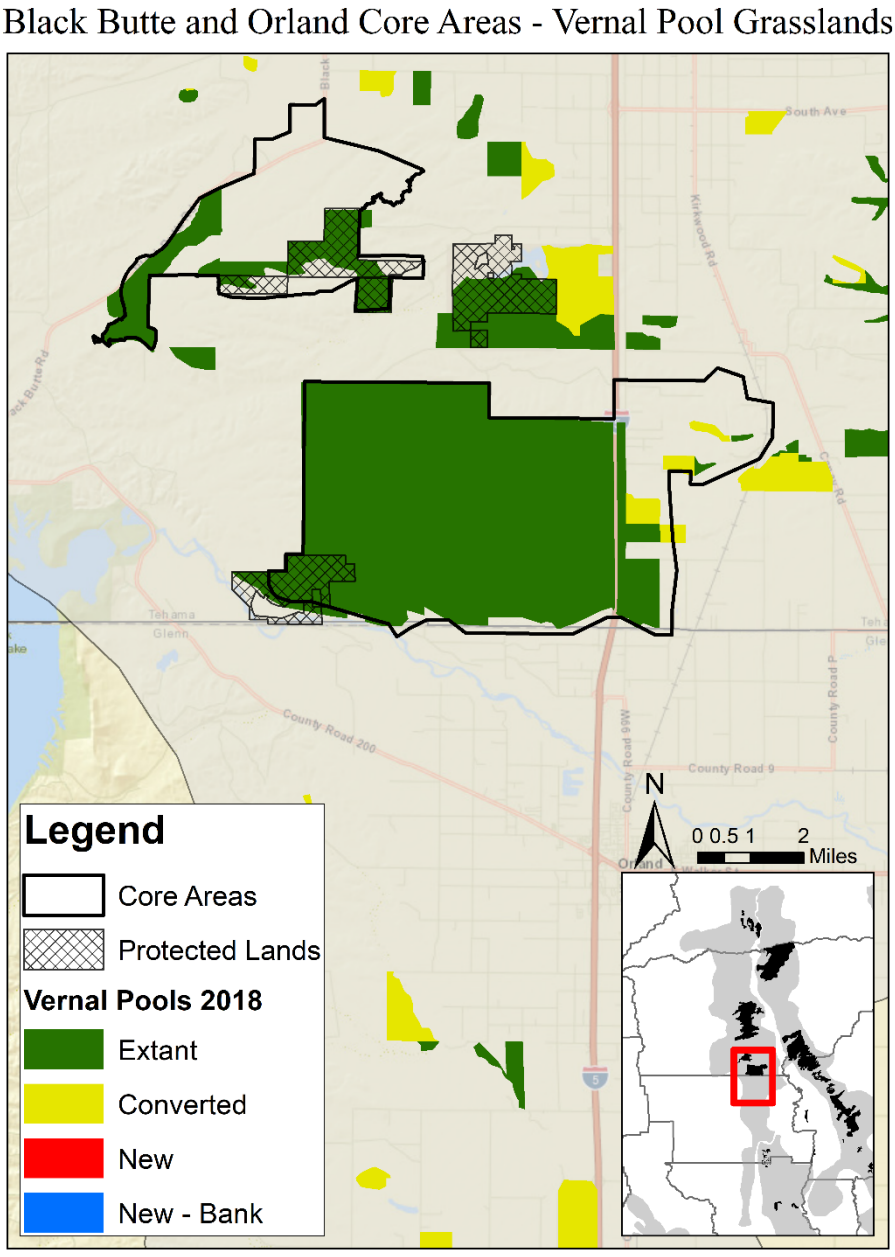


**Figure 8.5.** Map of vernal pool grassland habitat within the Black Butte (north) and Orland (south) Core Areas mapped by Witham (2021) created using aerial imagery from 2018 compared to 2005 and 2012. "New" vernal pool habitat refers to areas not seen in the 2005 or 2012 aerial imagery (either missed or restored). "New - bank" refers to newly created vernal pool habitat on mitigation lands. Converted habitat refers to vernal pool habitat that was seen in 2005 or 2012 aerial imagery and by 2018 was converted to other land uses. Modified habitat as described by Witham (2021) was altered but still provides suitable vernal pool habitat (e.g., mitigation banks, lands managed for waterfowl), and so is mapped as extant. Zoom in for finer resolution.

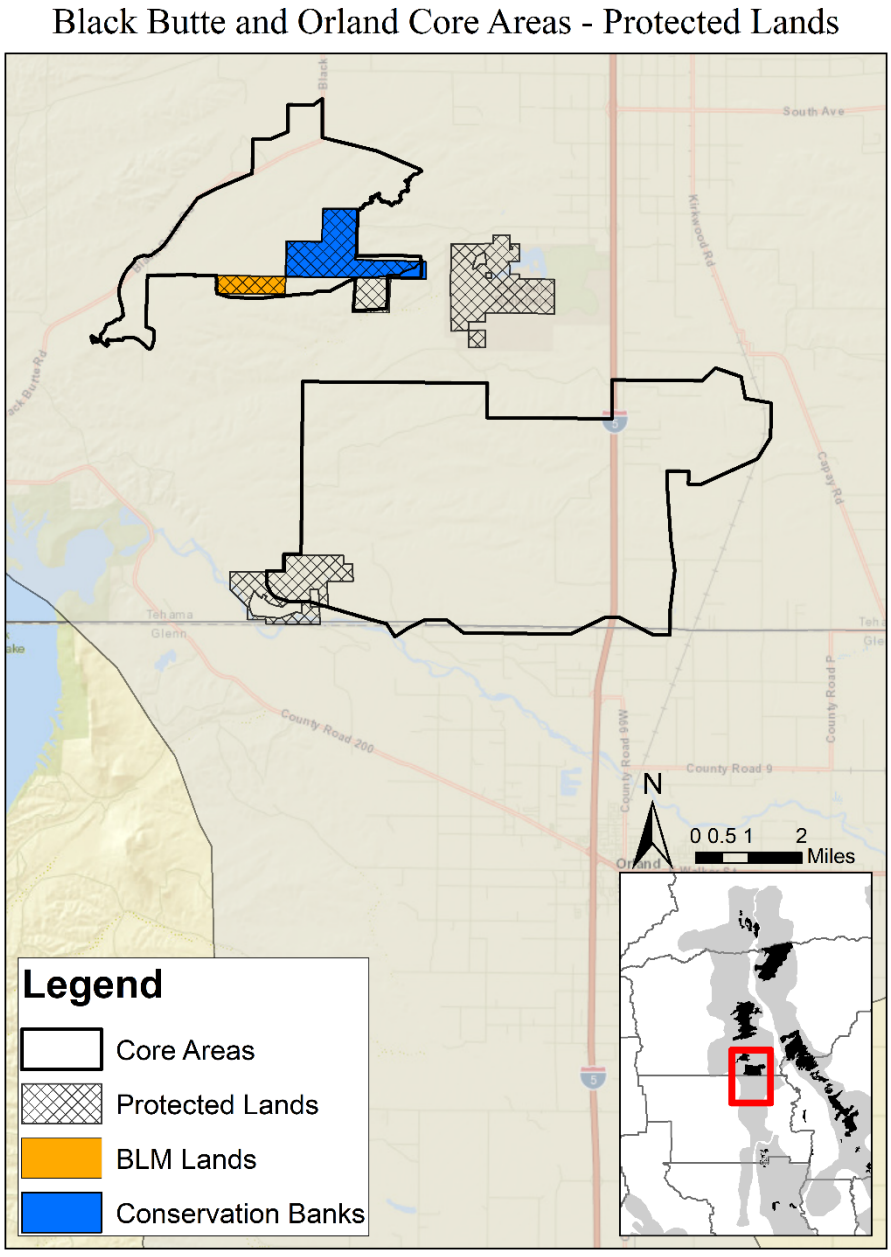


**Figure 8.6.** Map of protected areas within the Black Butte (north) and Orland (south) Core Areas**.** Protected lands are based on Vollmar et al. (2017) and include various preserves. BLM = Bureau of Land Management.

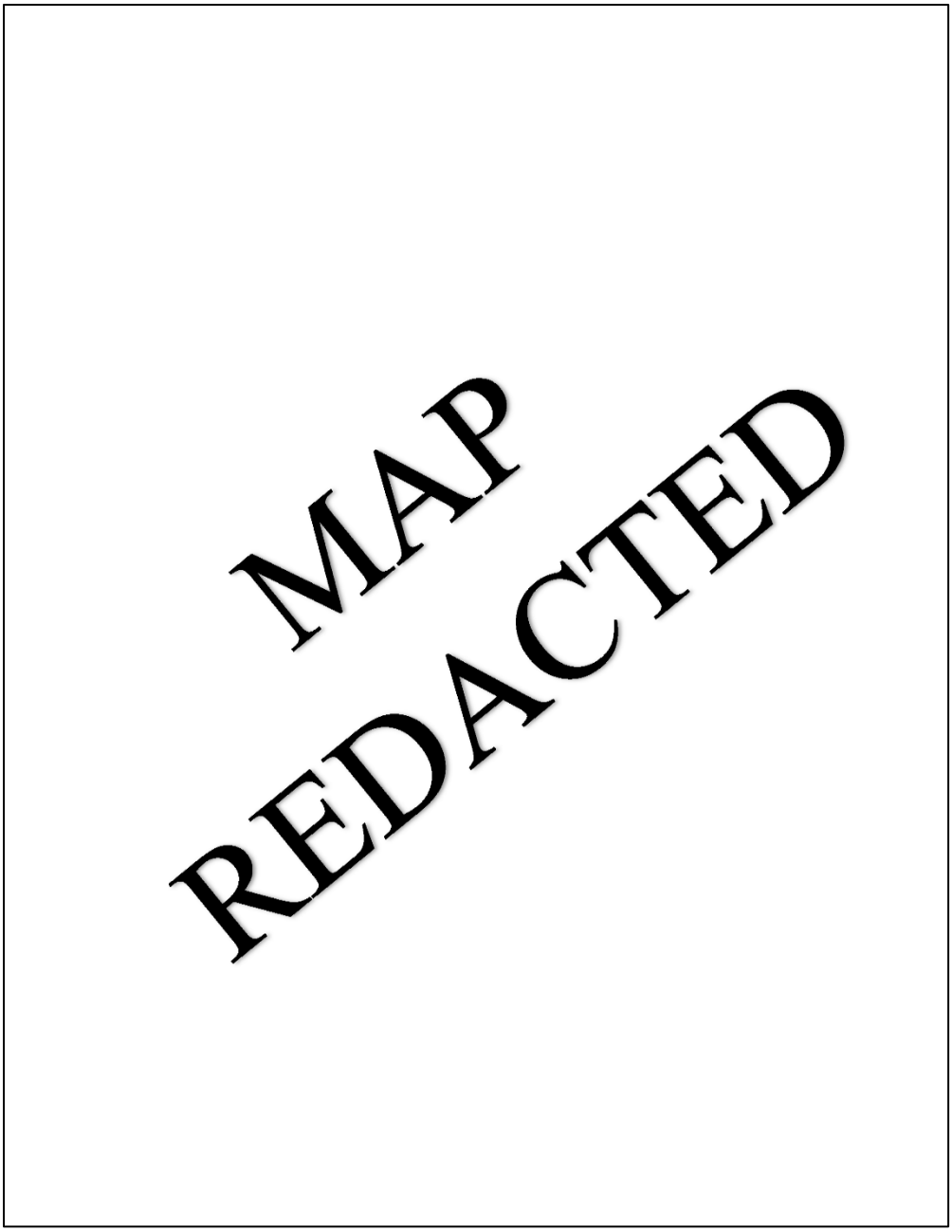


**Figure 8.7.** Map of known occurrences of vernal pool fairy shrimp recorded in the Diversity Database (2022) within the Black Butte (north) and Orland (south) Core Areas. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.

### 8.7.2. Millville Plains

This is a zone 2 core area, but it was not designated for the vernal pool fairy shrimp or vernal pool tadpole shrimp in the Recovery Plan. It was designated for slender Orcutt grass (*Orcuttia tenuis*), with a goal of protecting 85% of vernal pool habitat. The core area is located in Shasta County southeast of the City of Redding.

There were approximately 1,752 acres of vernal pool grassland within this core area when the Recovery Plan was published in 2005 (Witham et al. 2013). As of 2018, there were still 1,752 acres of vernal pool grassland remaining, with no habitat losses occurring since 2005 (see **Figure 8.8**, **Table 8.1**; Witham 2021). Vollmar et al. (2017) estimated that there were roughly 269 acres of vernal pool grassland were protected within this core area as of 2017 (Vollmar et al. 2017), representing 15.3% of the 2005 baseline. An additional 444 acres of vernal pool grassland mapped by Witham (2021) is protected within the Fenwood Ranch conservation easement held by Shasta Land Trust, for a total of 713 acres protected, representing 40.7% of the 2005 baseline.

Protected areas within this core area include the Fenwood Ranch conservation easement held by Shasta Land Trust, the 42-acre BLM parcel, and the Millville Plains and Honker Way conservation easements held by CDFW (**Figure 8.9**).

#### *8.7.2.1. Vernal Pool Fairy Shrimp Occurrences*

There are two Diversity Database occurrence records for the vernal pool fairy shrimp within this core area (see **Figure 8.10**; Diversity Database 2022). As of 2018, neither of these occurrences were within protected areas (Vollmar et al. 2017). Both occurrences are presumed extant by the Diversity Database; one is within extant mapped vernal pool grasslands and one is outside of mapped vernal pool grasslands (Witham 2021). The vernal pool fairy shrimp was documented within the eastern occurrence in 1993 and 1994 (Diversity Database 2022), and thus the Recovery Plan likely should have designated this core area for the vernal pool fairy shrimp. This occurrence has not been surveyed since 1994. The western occurrence was first documented in 2012 (Diversity Database 2022) and has not been surveyed since, to the Service's knowledge.

#### *8.7.2.2. Vernal Pool Tadpole Shrimp Occurrences*

There are two Diversity Database occurrence records for the vernal pool tadpole shrimp within this core area (see **Figure 8.11**; Diversity Database 2022). As of 2018, neither of these occurrences were within protected areas (Vollmar et al. 2017). Both occurrences are presumed extant by the Diversity Database; one is within extant mapped vernal pool grasslands and one is outside of mapped vernal pool grasslands (Witham 2021). One occurrence spans the entire length of Millville Plains Road across the Northwestern and Northeastern Sacramento Valley Vernal Pool Regions; the description of the location was only "along Millville Plains Road", so the Diversity Database mapped the occurrence to the entirety of the road (Diversity Database 2022). This occurrence was documented in 1994 (Diversity Database 2022), but the Recovery Plan likely did not designate this core area for the vernal pool tadpole shrimp at the time due to the vagueness of the occurrence's location. The other occurrence was first documented in 2012 just north of CDFW's Honker Way and Millville Plains conservation easements; at the time of the survey the property was proposed as a mitigation bank (Diversity Database 2022).

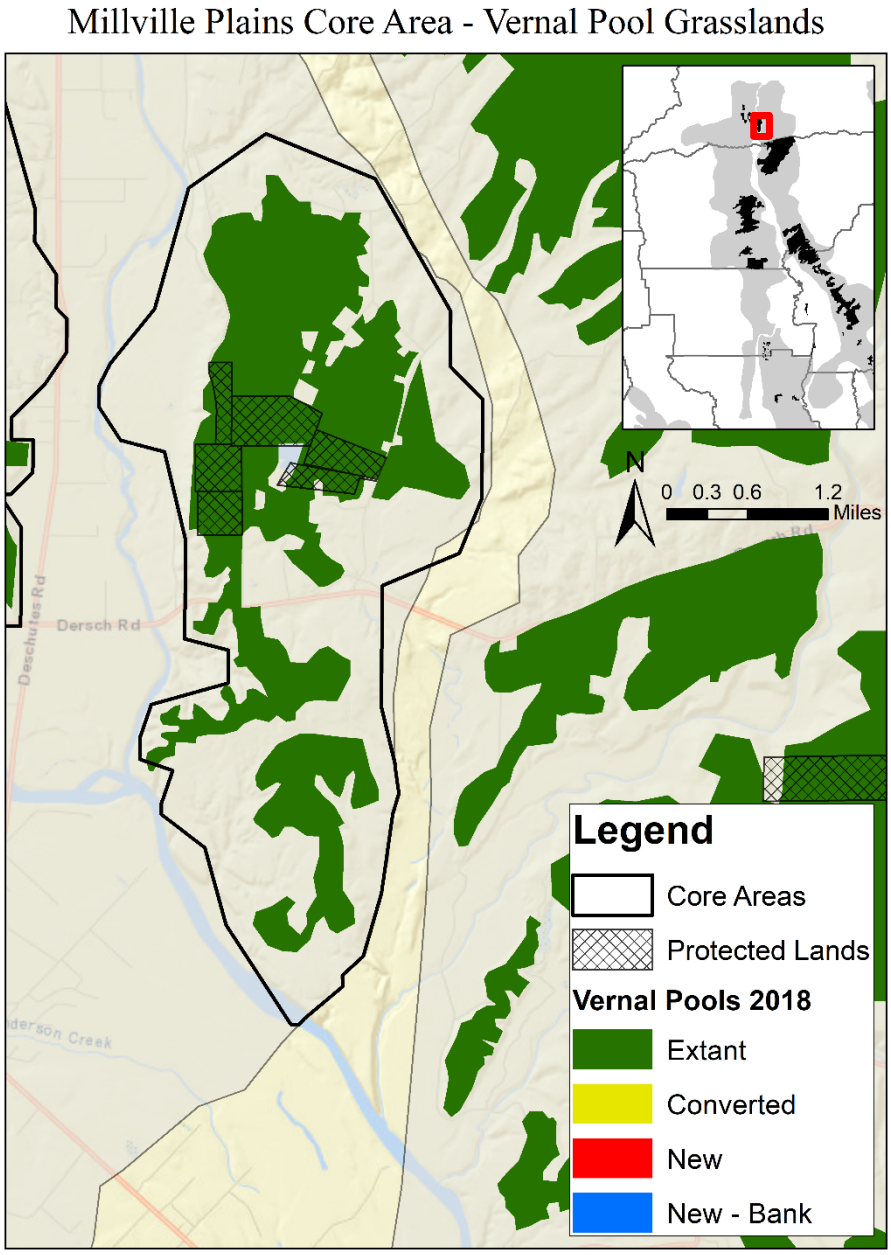


**Figure 8.8.** Map of vernal pool grassland habitat within the Millville Plains Core Area mapped by Witham (2021) created using aerial imagery from 2018 compared to 2005 and 2012. "New" vernal pool habitat refers to areas not seen in the 2005 or 2012 aerial imagery (either missed or restored). "New - bank" refers to newly created vernal pool habitat on mitigation lands. Converted habitat refers to vernal pool habitat that was seen in 2005 or 2012 aerial imagery and by 2018 was converted to other land uses. Modified habitat as described by Witham (2021) was altered but still provides suitable vernal pool habitat (e.g., mitigation banks, lands managed for waterfowl), and so is mapped as extant. Zoom in for finer resolution.

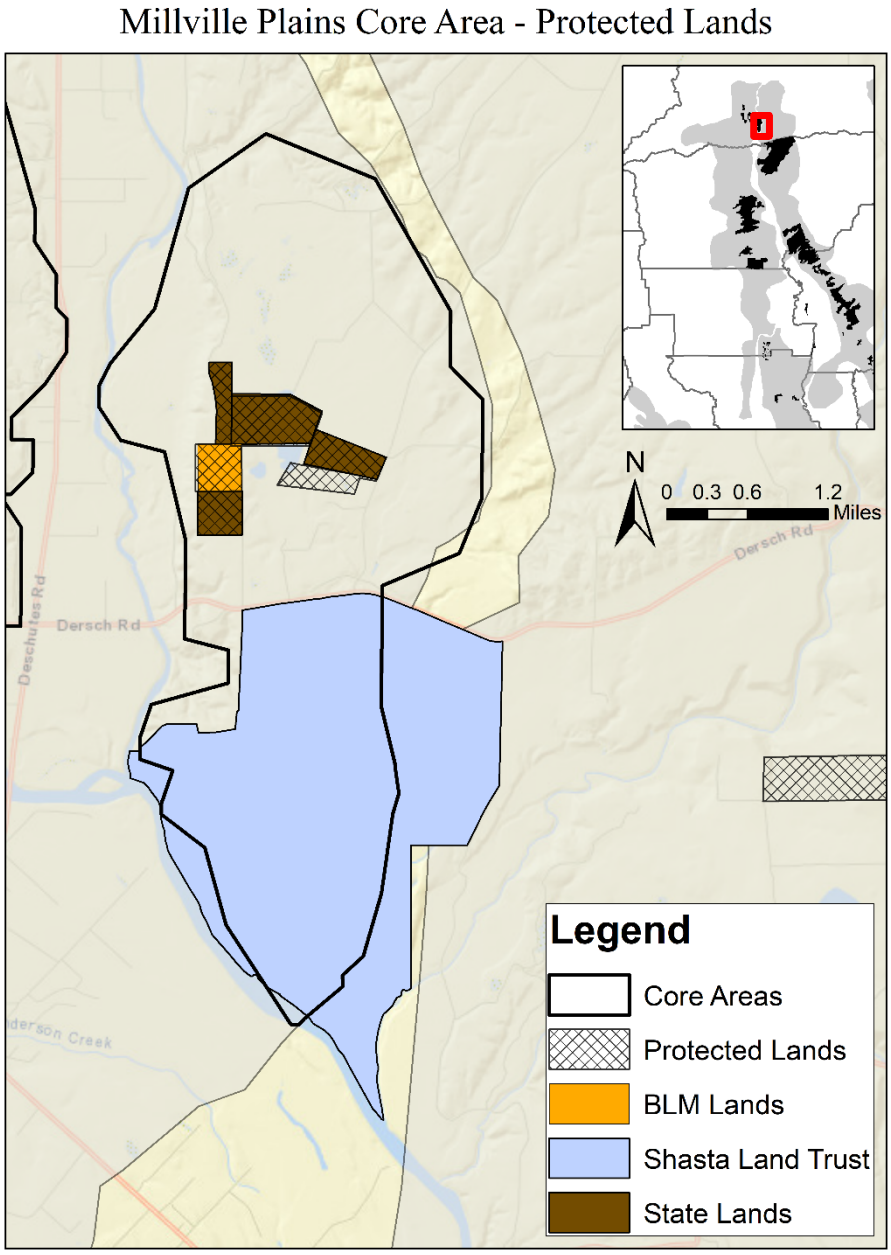


**Figure 8.9.** Map of protected areas within the Millville Plains Core Area**.** Protected lands are based on Vollmar et al. (2017) and include various preserves. BLM = Bureau Land Management.

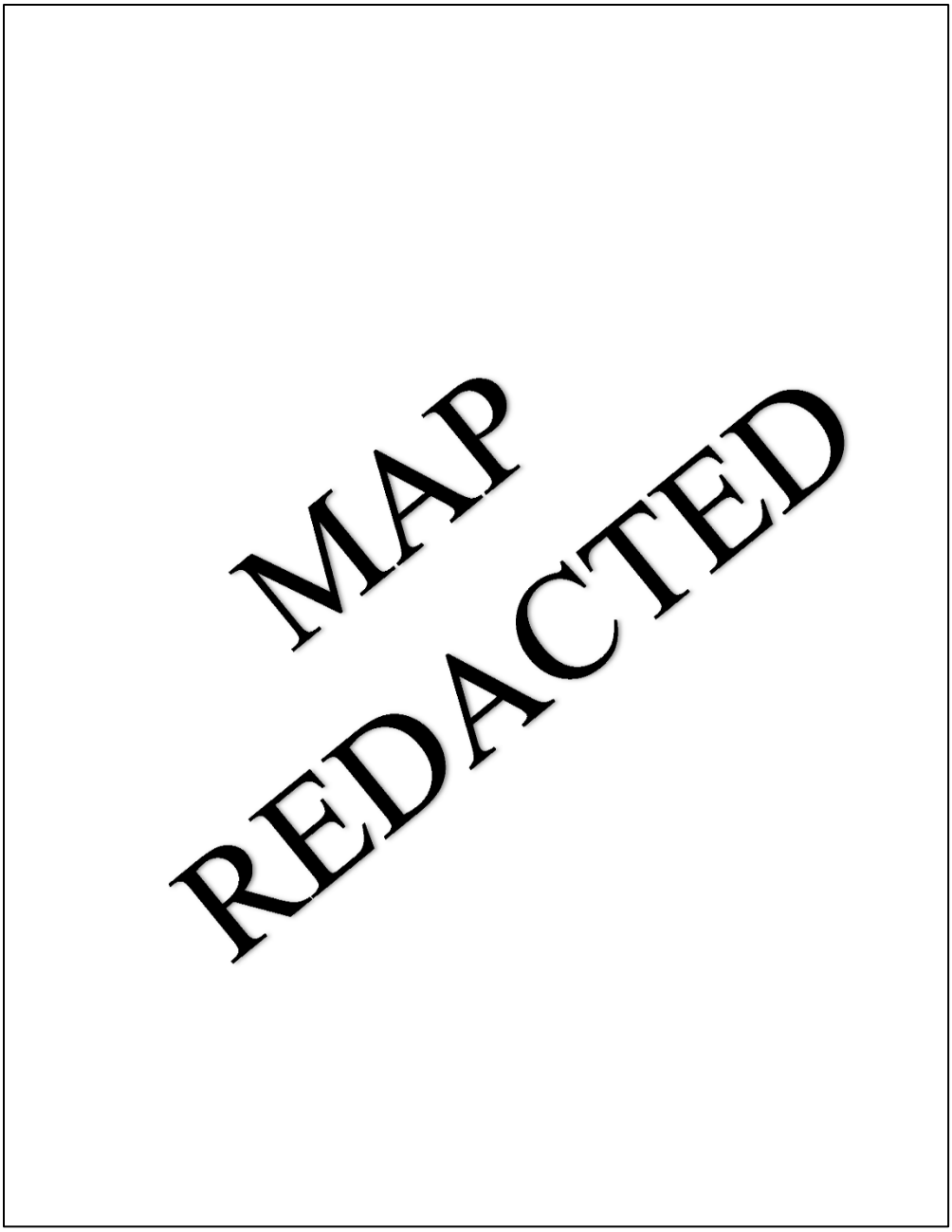


**Figure 8.10.** Map of known occurrences of vernal pool fairy shrimp recorded in the Diversity Database (2022) within the Millville Plains Core Area. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.

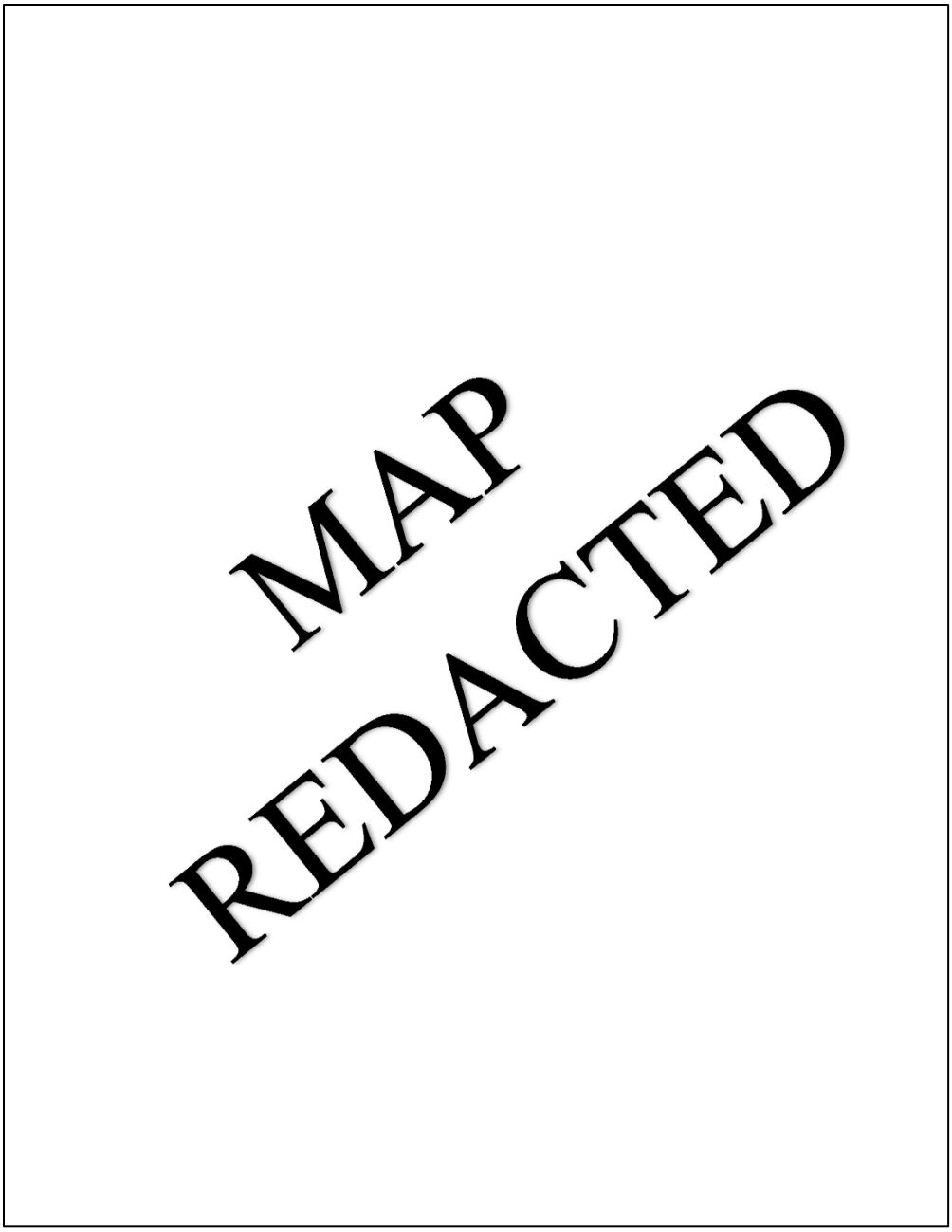


**Figure 8.11.** Map of known occurrences of vernal pool tadpole shrimp recorded in the Diversity Database (2022) within the Millville Plains Core Area. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.

### 8.7.3. Orland

This is a zone 2 core area with a goal of protecting 85% of vernal pool habitat for the vernal pool fairy shrimp. The core area is located in southern Tehama County between the cities of Orland and Corning.

There were approximately 10,173 acres of vernal pool grassland within this core area when the Recovery Plan was published in 2005 (Witham et al. 2013). As of 2018, there were 9,913 acres of vernal pool grassland remaining, with 260 acres lost since 2005 (see **Figure 8.5**, **Table 8.1**; Witham 2021). All losses were due to agricultural conversion, with the majority being converted to orchards (230 acres, 89%) and the remainder converted to bare plowed agricultural land (30 acres, 11%) (see **Table 8.2**; Witham 2021). Roughly 390 acres of vernal pool grassland were protected within this core area as of 2017 (Vollmar et al. 2017), representing 3.8% of the 2005 baseline.

The only known protected area within this core area is a conservation easement held by the Natural Resources Conservation Service (NRCS) on private ranch land (**Figure 8.6**; Vollmar et al. 2017).

#### *8.7.3.1. Vernal Pool Fairy Shrimp Occurrences*

There is one Diversity Database occurrence record for the vernal pool fairy shrimp within this core area (see **Figure 8.7**; Diversity Database 2022). As of 2018, this occurrence was not protected (Vollmar et al. 2017). It is presumed extant by the Diversity Database and is within extant vernal pool grasslands (Witham 2021). This occurrence was first documented in 1980 (Diversity Database 2022), and the Service is not aware of any surveys of this occurrence that have occurred since 1980.

### 8.7.4. Red Bluff

This is a zone 2 core area with a goal of protecting 85% of vernal pool habitat for the vernal pool fairy shrimp and vernal pool tadpole shrimp. The core area is located in Tehama County between the cities of Corning and Red Bluff.

There were approximately 17,079 acres of vernal pool grassland within this core area when the Recovery Plan was published in 2005 (Witham et al. 2013). As of 2018, there were 14,965 acres of vernal pool grassland remaining, with 2,114 acres lost since 2005 (see **Figure 8.12**, **Table 8.1**; Witham 2021). The majority of losses were due to agricultural conversion to orchards (1,906 acres, 90.2%), with other losses due to conversion to bare plowed agricultural land (181 acres, 8.6%), alfalfa or irrigated pasture (18 acres, <0.01%), agricultural residences (7 acres, <0.01%), and urban development (2 acres, <0.01%) (see **Table 8.2**; Witham 2021). Roughly 903 acres of vernal pool grassland were protected within this core area as of 2017 (Vollmar et al. 2017), representing 5.3% of the 2005 baseline.

Protected areas within this core area include CDFW's Thomes Creek Ecological Reserve and three properties that have conservation easements held by NRCS (**Figure 8.13**).

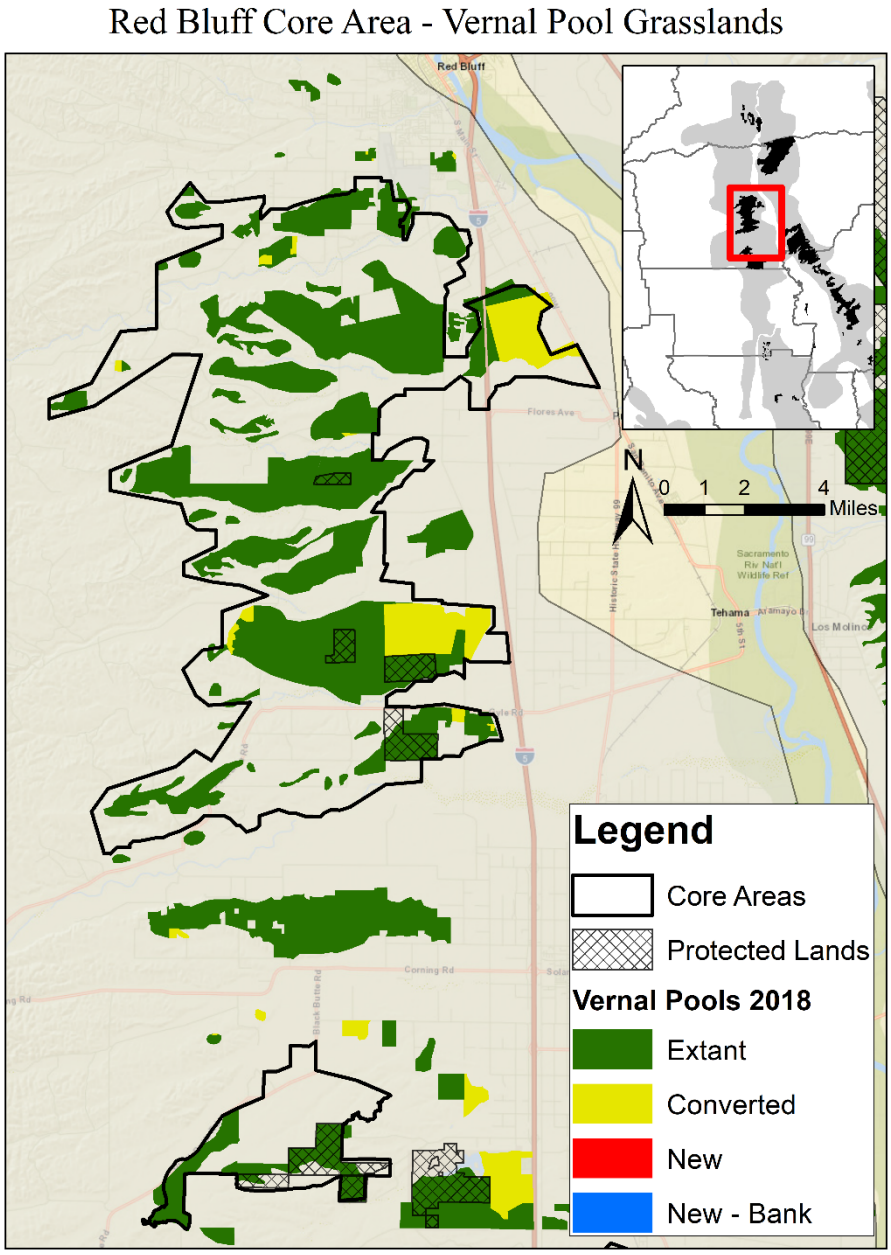


**Figure 8.12.** Map of vernal pool grassland habitat within the Red Bluff Core Area mapped by Witham (2021) created using aerial imagery from 2018 compared to 2005 and 2012. "New" vernal pool habitat refers to areas not seen in the 2005 or 2012 aerial imagery (either missed or restored). "New - bank" refers to newly created vernal pool habitat on mitigation lands. Converted habitat refers to vernal pool habitat that was seen in 2005 or 2012 aerial imagery and by 2018 was converted to other land uses. Modified habitat as described by Witham (2021) was altered but still provides suitable vernal pool habitat (e.g., mitigation banks, lands managed for waterfowl), and so is mapped as extant. Zoom in for finer resolution.

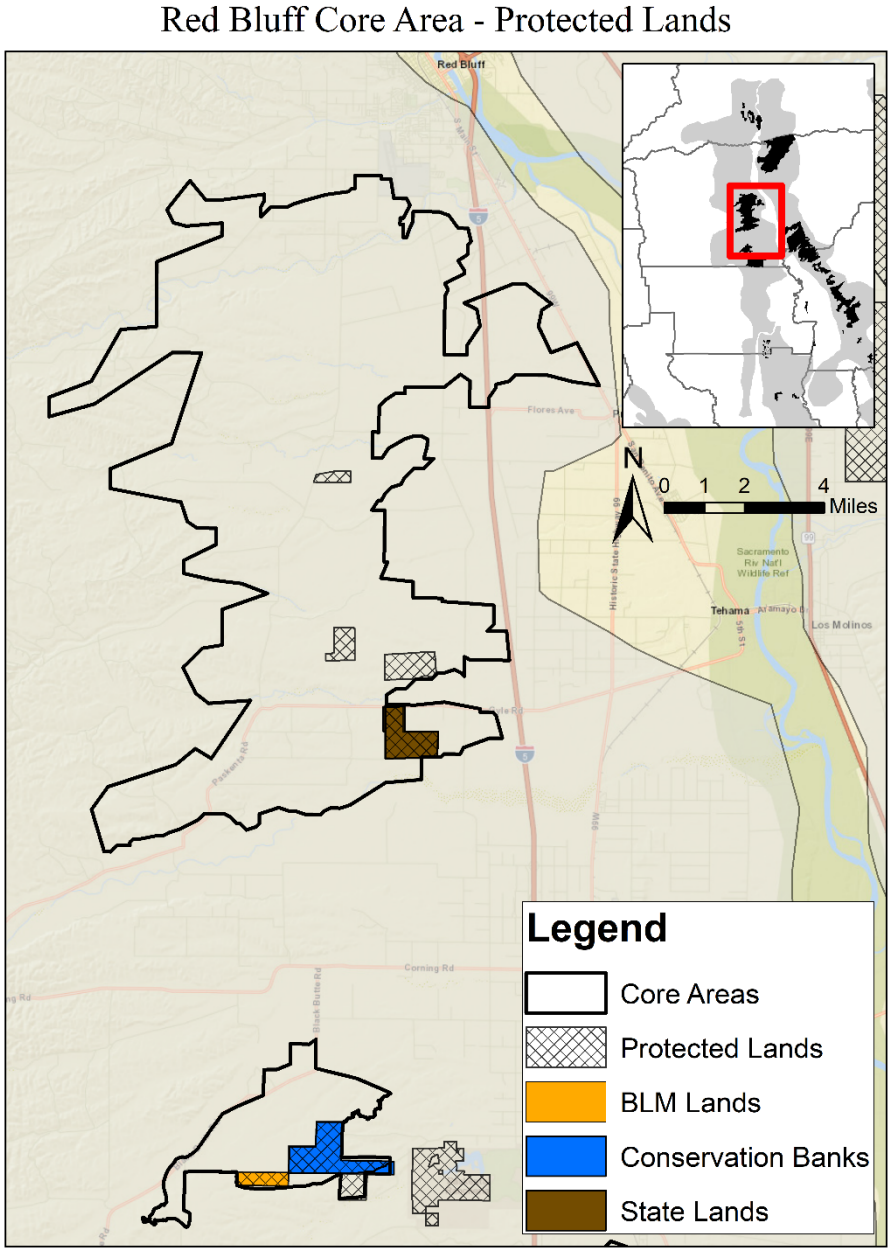


**Figure 8.13.** Map of protected areas within the Red Bluff Core Area**.** Protected lands are based on Vollmar et al. (2017) and include various preserves. BLM = Bureau Land Management.

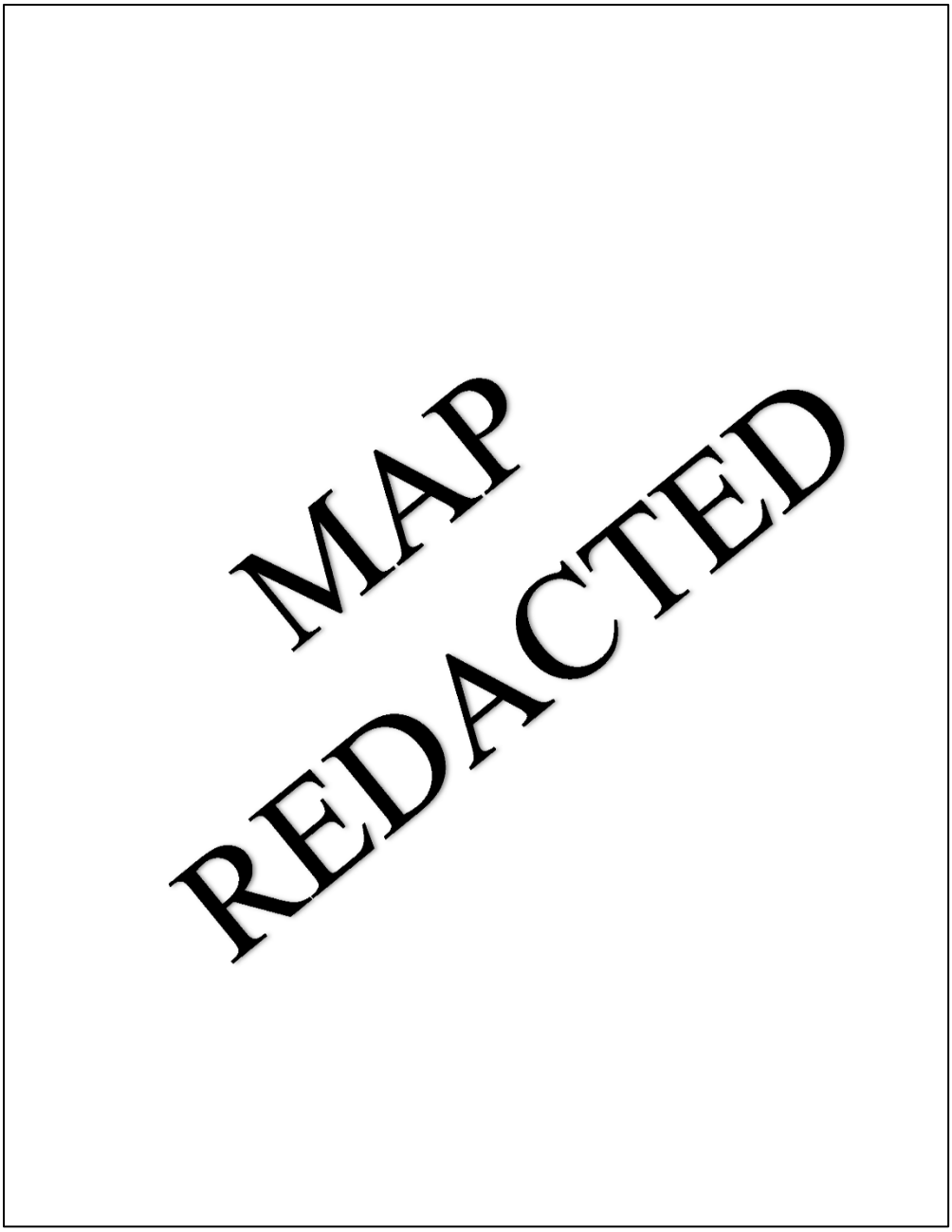


**Figure 8.14.** Map of known occurrences of vernal pool fairy shrimp recorded in the Diversity Database (2022) within the Red Bluff Core Area. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.

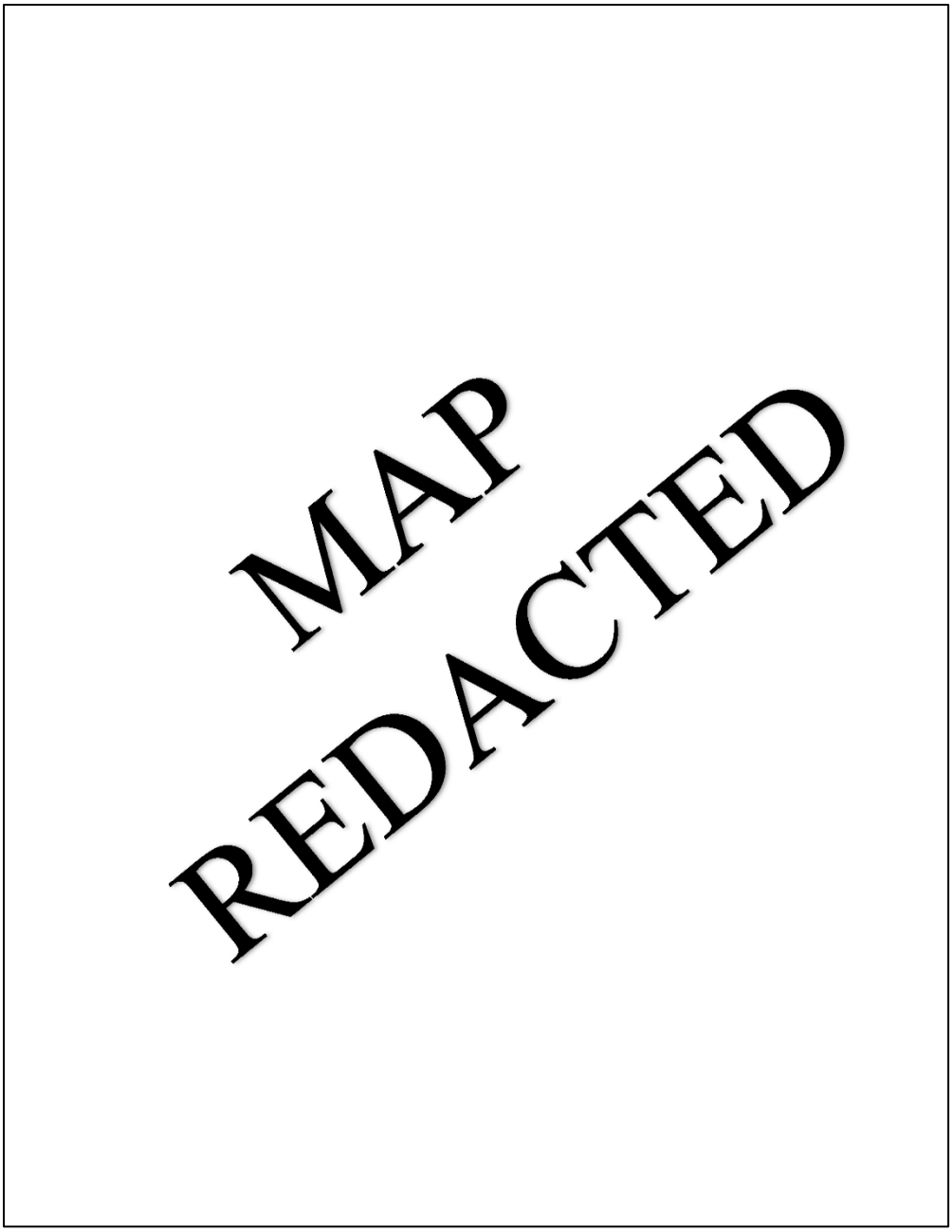


**Figure 8.15.** Map of known occurrences of vernal pool tadpole shrimp recorded in the Diversity Database (2022) within the Red Bluff Core Area. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.

*8.7.4.1.Vernal Pool Fairy Shrimp Occurrences*

There are eight Diversity Database occurrence records for the vernal pool fairy shrimp within this core area (see **Figure 8.14**; Diversity Database 2022). As of 2018, two of the eight occurrences were at least partially within protected areas (Vollmar et al. 2017). All occurrences are presumed extant by the Diversity Database; seven are within extant mapped vernal pool grasslands and one is outside of mapped vernal pool grasslands (Witham 2021). Of the eight records, two were known at the time of listing in 1994 and seven were known at the time the Recovery Plan was published in 2005. The one newer occurrence was first documented in 2012 within the Thomes Creek Ecological Reserve. A majority of these occurrences were documented in more than one year, but only two occurrences have been documented more recently than 2001: the newer occurrence within Thomes Creek Ecological Reserve in 2012 and the northeastern occurrence on either side of Interstate 5 in 2014, partly within the proposed Coyote Creek Mitigation Bank (Diversity Database 2022).

*8.7.4.1.Vernal Pool Tadpole Shrimp Occurrences*

There is one Diversity Database occurrence record for the vernal pool tadpole shrimp within this core area (see **Figure 8.15**; Diversity Database 2022). As of 2018, was not protected (Vollmar et al. 2017). The occurrence is presumed extant by the Diversity Database and within extant mapped vernal pool grasslands (Witham 2021). It was observed in 2001 and the Service is not aware of any surveys since; the vernal pool fairy shrimp occurrence that overlaps this occurrence also has not been updated since 2001 (Diversity Database 2022).

8.7.5. Redding

This is a zone 2 core area with a goal of protecting 85% of vernal pool habitat for the vernal pool fairy shrimp and vernal pool tadpole shrimp. The core area is located in Shasta County on the southeastern edge of the City of Redding.

There were approximately 1,813 acres of vernal pool grassland within this core area when the Recovery Plan was published in 2005 (Witham et al. 2013). As of 2018, there were 1,767 acres of vernal pool grassland remaining, with 45 acres lost since 2005 (see **Figure 8.16**, **Table 8.1**; Witham 2021). The majority of losses were due to conversion to bare plowed agricultural land (44.8 acres, 97.4%), with a small amount of loss due to urban development (1.2 acres, 2.6%) (see **Table 8.2**; Witham 2021). Roughly 425 acres of vernal pool grassland were protected within this core area as of 2017 (Vollmar et al. 2017), representing 23.5% of the 2005 baseline.

Protected areas within this core area include part of the Stillwater Plains Mitigation Bank (although most of the bank is cut out of the core area), BLM's Hawes Corner parcel, CDFW's Shaw conservation easement, four mitigation properties with conservation easements (one held by the City of Redding, two held by Wildlife Heritage Foundation, and one with the easement holder unknown), and one property with a conservation easement held by NRCS (**Figure 8.17**).

*8.7.5.1.Vernal Pool Fairy Shrimp Occurrences*

There are four Diversity Database occurrence records for the vernal pool fairy shrimp within this core area, as well as two Diversity Database records immediately adjacent to the core area (see

**Figure 8.18**; Diversity Database 2022). As of 2018, two of the four occurrences were at least partially within protected areas (Vollmar et al. 2017). All occurrences are presumed extant by the Diversity Database and are within extant vernal pool grasslands (Witham 2021). Of the four records, two were known at the time of listing in 1994 and three were known at the time the Recovery Plan was published in 2005. The one newer occurrence was first documented in 2009 in the Stillwater Plains northeast of the Redding Municipal Airport and northwest of the Stillwater Plains Mitigation Bank. The two occurrences in the Stillwater Plains were most recently detected in 2011 and 2016 (Diversity Database 2022). The two more southern occurrences have not been surveyed, to the Service's knowledge, since they were originally documented in 1988 and 1993 (Diversity Database 2022).

*8.7.5.2.Vernal Pool Tadpole Shrimp Occurrences*

There are 14 Diversity Database occurrence records for the vernal pool tadpole shrimp within this core area, as well as 5 Diversity Database records immediately adjacent to the core area (see **Figure 8.19**; Diversity Database 2022). As of 2018, 9 of the 14 occurrences within the core area and one of the adjacent occurrences were at least partially within protected areas (Vollmar et al. 2017). All occurrences are presumed extant by the Diversity Database; 14 are within extant vernal pool grasslands and 5 are outside of mapped vernal pool grasslands (Witham 2021). Of the 19 total records, 5 were known at the time of listing in 1994 and 18 were known at the time the Recovery Plan was published in 2005. The one newer occurrence was first documented in 2006 in the Stillwater Plains northeast of the Redding Municipal Airport and northwest of the Stillwater Plains Mitigation Bank. The majority of occurrences have not been observed since they were first documented (Diversity Database 2022).

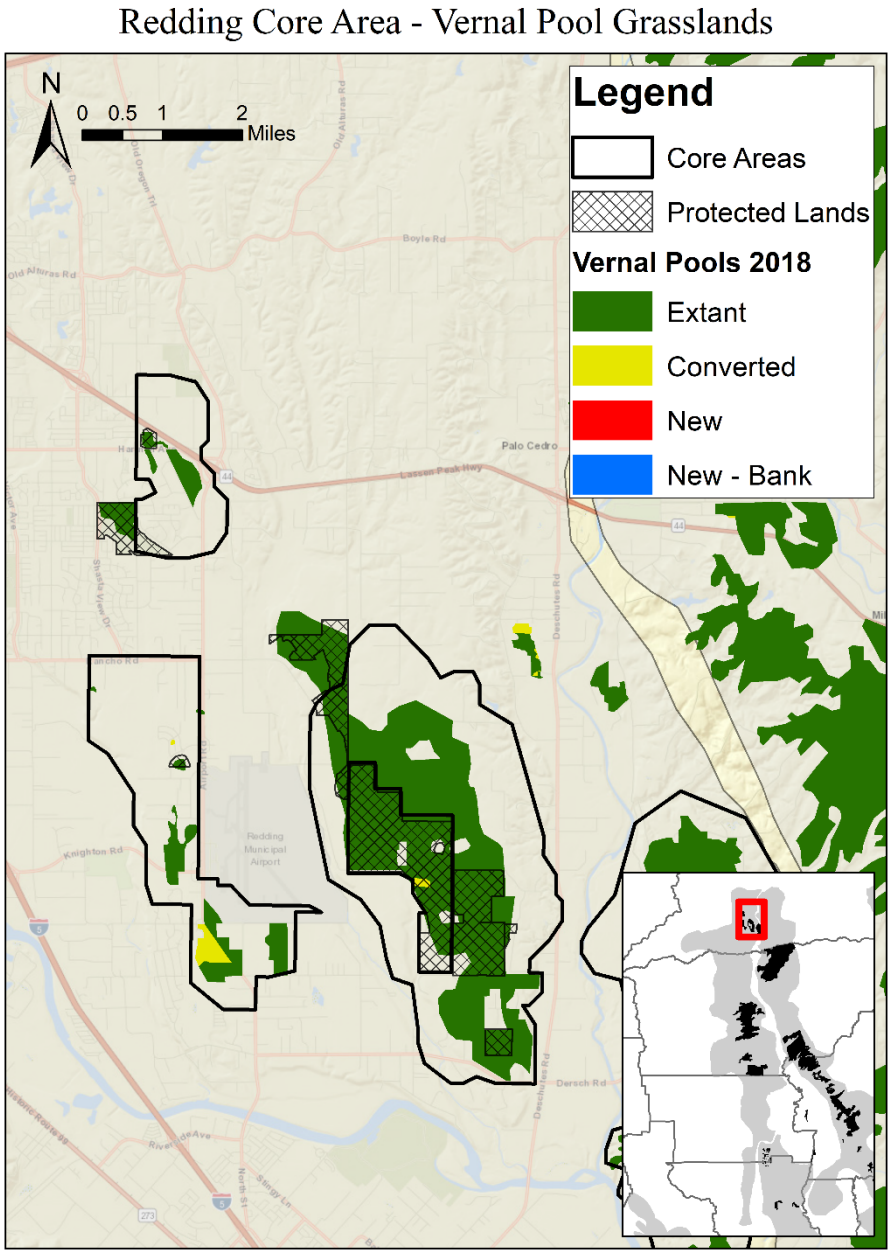


**Figure 8.16.** Map of vernal pool grassland habitat within the Redding Core Area mapped by Witham (2021) created using aerial imagery from 2018 compared to 2005 and 2012. "New" vernal pool habitat refers to areas not seen in the 2005 or 2012 aerial imagery (either missed or restored). "New - bank" refers to newly created vernal pool habitat on mitigation lands. Converted habitat refers to vernal pool habitat that was seen in 2005 or 2012 aerial imagery and by 2018 was converted to other land uses. Modified habitat as described by Witham (2021) was altered but still provides suitable vernal pool habitat (e.g., mitigation banks, lands managed for waterfowl), and so is mapped as extant. Zoom in for finer resolution.

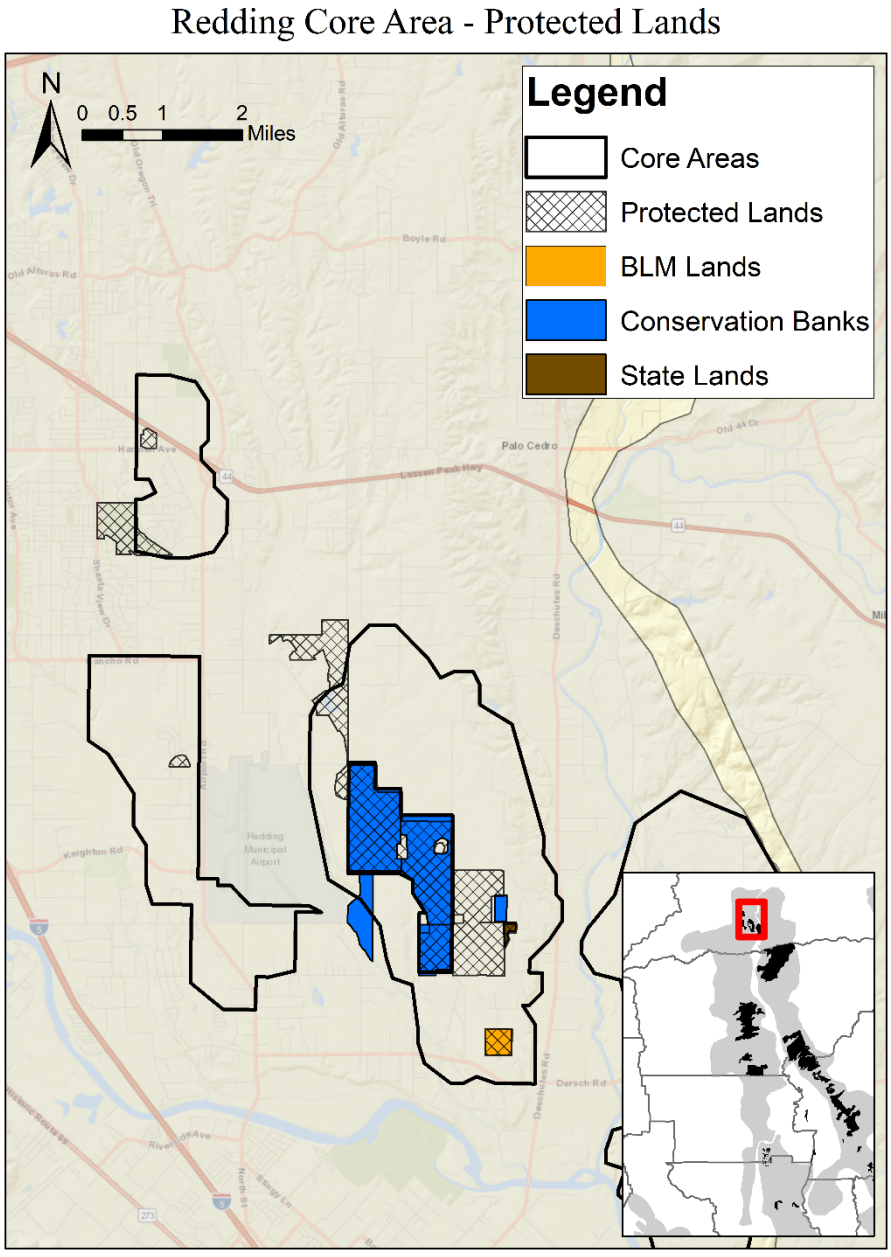


**Figure 8.17.** Map of protected areas within the Redding Core Area**.** Protected lands are based on Vollmar et al. (2017) and include various preserves. BLM = Bureau Land Management.

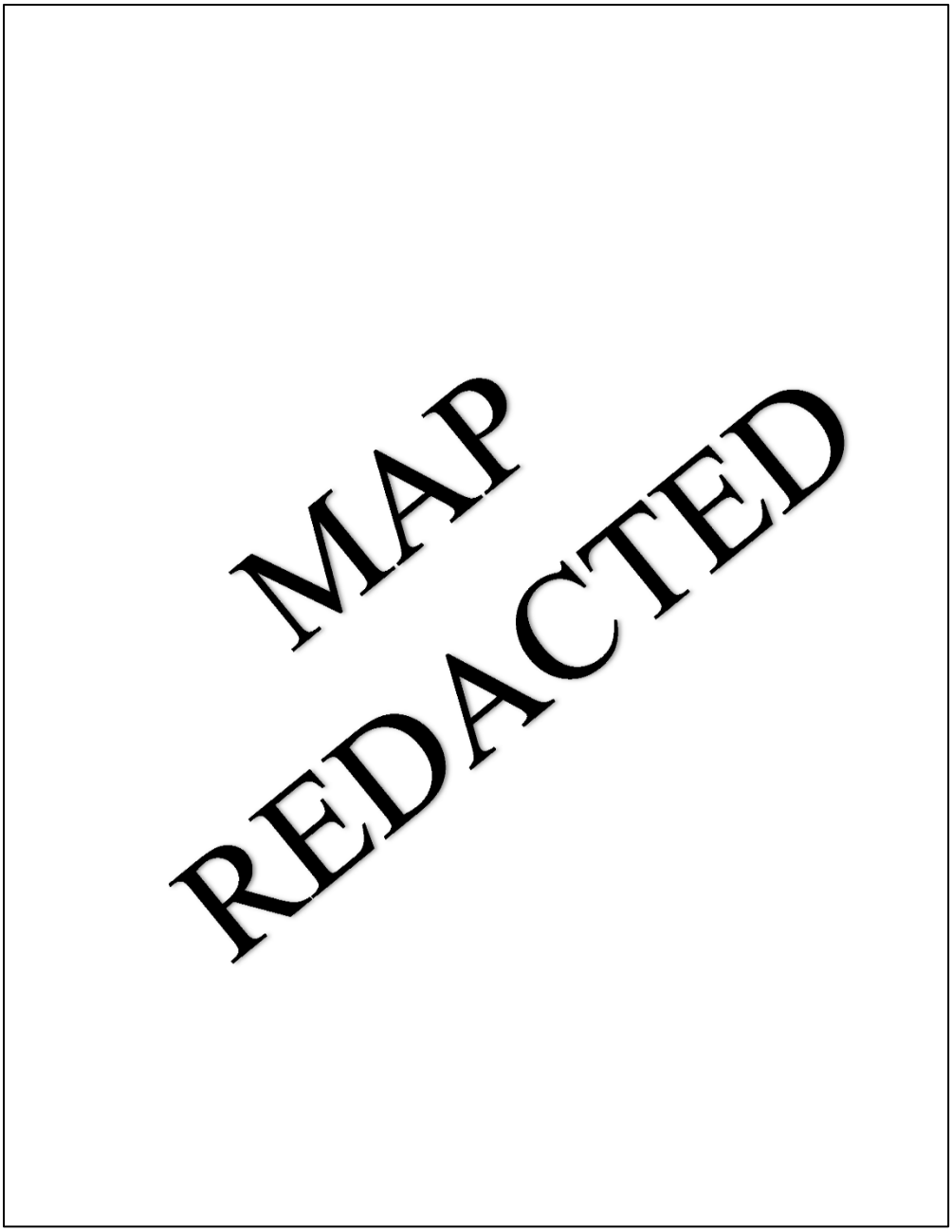


**Figure 8.18.** Map of known occurrences of vernal pool fairy shrimp recorded in the Diversity Database (2022) within the Redding Core Area. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.

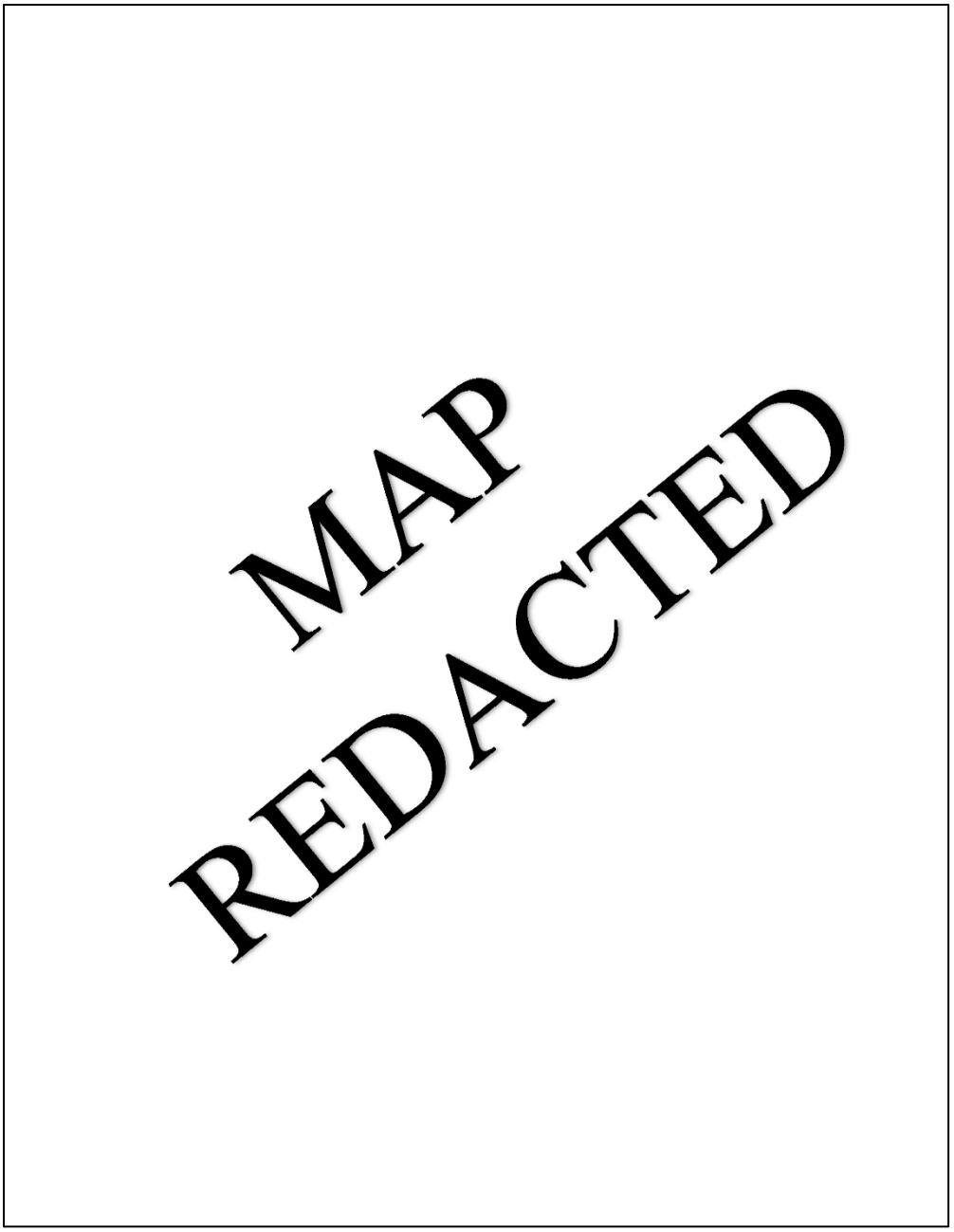


**Figure 8.19.** Map of known occurrences of vernal pool tadpole shrimp recorded in the Diversity Database (2022) within the Redding Core Area. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.