

COVER SHEET

**Final Report**

for

**Herpetological Inventory of Rare Limestone-Red Cedar Glades  
Harpers Ferry National Historical Park**

by

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### Acknowledgments

I would like to thank the following people for their time and assistance with this project. Bill Hebb and Dale Nisbet of the National Park Service provided information site access and relevant background material. I should also like to thank Stephanie Perles for her excellent report on the vegetation of the glades which provided critical background information. I was greatly assisted in the fieldwork by numerous individuals, including Chris Agard, Stevland Charles, Bruce Dahlin, Lisa Famolare, Emily Middendorf, and Chuck Verharen. My thanks to all of them for preserving through the sometimes difficult conditions encountered.

## Background

In 2004, Harpers Ferry National Park (HAFE) acquired land (Jacksons Right Flank) west of the Blue Ridge Mountains near Millville, West Virginia on the Ridge and Valley physiographic province from the U.S. Fish & Wildlife Service. HAFE had already been managing the property since 2003 and prior to this, in 2002, NPS botanist Chris Lea had walked the terrain and identified vegetation communities. At Jacksons Right Flank, he identified three rare West Virginia plant species that were not common to the park: grooved flax (*Linum sulcatum*), downy milkpea (*Galactia volubilis*) and Shumard oak (*Quercus shumardii*). Subsequent vegetation plot work showed that these plants were concentrated in one area of Jacksons Right Flank, and that this rare plant community is an example of a Limestone-Red cedar Glade.

In 2006, Perles (2007) surveyed the area for rare plants. Nine state listed species were found. She wrote: "Despite their small size and fair to poor quality, the Limestone-Red-cedar Glades of the Jackson's Right Flank parcel have conservation value because they: a) are examples of a global- and state- rare vegetation community, b) provide habitat for rare plant species, c) occur at a lower elevation than any other Limestone-Red-cedar Glades in the state, d) are the only Limestone Red-cedar Glades in the state known to occur on Tomstown Dolomite."

The Jacksons Right Flank site is located on rolling topography adjacent to an agriculture field with a stream bordering portions of the habitat. Invasive plants are present bordering the agriculture field and stream. The Limestone-Red cedar Glades, a portion of the larger site, is bordered by a stream, as well as railroad track. In 2004, a train derailment occurred on and near this habitat with unknown amounts of damage to the habitat. West of the railroad tracks about .8 km away is a working limestone quarry. Because of activity associated with the nearby, active quarry and the bordering railroad tracks, the habitat is potentially threatened by the possibility of invasive plant introductions.

As part of its mission, HAFE needed to identify the reptiles and amphibians (herps) found in the Limestone-Red cedar Glades. Field surveys began in early 2008 and continued through late spring 2009 with the goal of identifying and confirming the presence of the known herp species, with special attention to species known to be threatened, endangered, or of concern. The results of that field study are documented in this report and provide information on the species present and their locations, as well as creating a comprehensive herp species list for the rare Limestone-Red cedar Glades.

Figure 1. Location and extent of limestone red-cedar glades in the Jackson's Right Flank parcel of Harpers Ferry National Historic Site. Figure from Perles (2007).

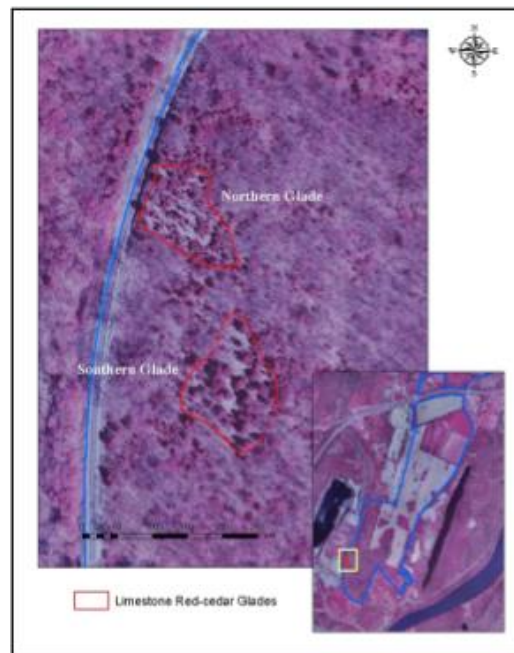
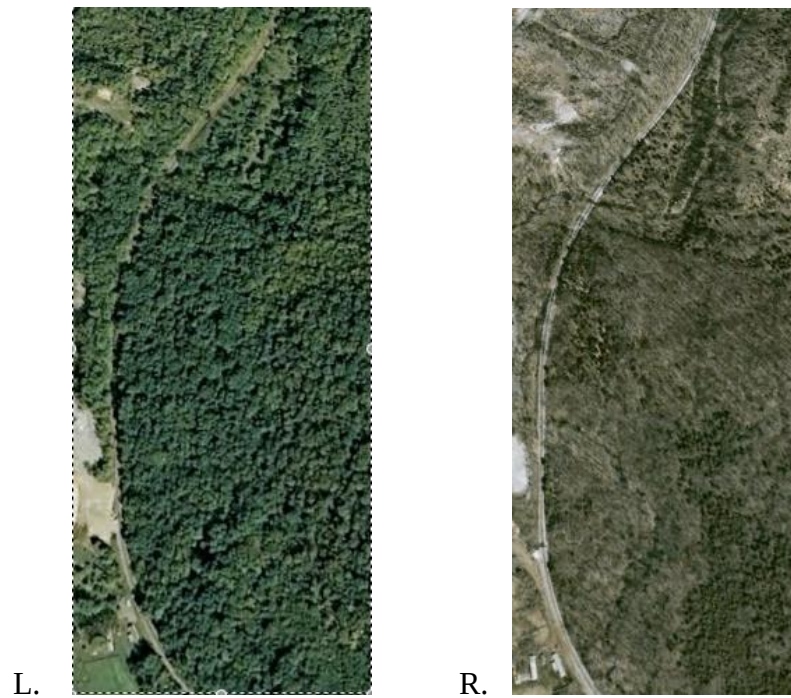


Figure 2. Satellite photograph of site showing seasonal differences in tree cover (L. September and R. December; from Google Earth - 3 September 2009).



## Objectives

The objectives of this project were to:

1. Document the species of reptiles and amphibians that currently occur in the rare Limestone-Red cedar Glades.
2. Describe the distribution and relative abundance of species of special concern, such as threatened and endangered species, occurring within or associated with the rare Limestone-Red cedar Glades.
3. Provide the baseline information needed to develop a general monitoring strategy and design that can be implemented by the park once inventories have been completed, tailored to specific park threats and resource issues.
4. Provide recommendations to address specific park threats to and resource issues of the herps within the rare Limestone-Red cedar Glades.

## Methodology

The project commenced 15 September 2007 with activities for the initial months of the project focused on establishing the grant and obtaining appropriate approvals and permits for the study, e.g. from the National Park Service Scientific Research and Collecting Permit, West Virginia Scientific Collecting Permit, and Howard University Institutional Animal Care and Use Committee. Once these were obtained, I visited the Natural Resource and Lands Program Manager's Office at Harpers Ferry National Park on 16 November 2007 to discuss the project with Mr Bill Hebb and to conduct an initial survey of the study site with Mr Dale Nisbet.

Following these initial steps, field surveys were begun in March 2008. The Limestone-Red Cedar Glades were sampled for amphibians and reptiles primarily using timed-visual surveys. Initial, preliminary surveys of the habitat in late 2007 and early 2008 revealed a lack of permanent aquatic habitat in the glades. Only a few areas of potential, ephemeral wetland were identified during these walk-throughs and as expected, they were subsequently not seen to hold water for any appreciable time or extent and no egg masses or calling frogs were subsequently located at any time. Thus, it was determined that primary emphasis should be on the use of time-constrained ground searches to document the amphibians and reptiles in terrestrial habitats. Nocturnal searches were only conducted in spring 2008 to assess for the presence of calling frogs and when none were heard, future searches were concentrated during the day. Over 45 person-hours of timed, visual survey inventories were conducted from March through June 2008, in August and September 2008, and from January through June 2009. Each survey lasted between 1-1.5 hrs and averaged 1.8 persons (1-3 persons) per survey.

During the timed, visual, diurnal ground searches, cover was turned over to search for reptiles and amphibians. Any herps spotted were caught by hand, identified by visual characteristics, measured, and photographs of selected, representative of all species were taken. Whenever possible GPS readings (UTM – WGS 84) were recorded. On several occasions of inclement weather, GPS readings were of such poor quality that they were not recorded. In addition, there was position for *Terepene carolina* that was incorrectly recorded and is not included in the report. No egg masses of frogs, toads, and salamanders were observed, probably because of the lack of aquatic habitat (see comments above). Because the adjacent stream was not considered to be a part of the site, surveys using dip nets or immersible funnel traps were not used. Appropriate measures were to be taken to eliminate transfer of contaminants between sites. All animals were released at the site of capture. No voucher specimens or specimens were collected.

This final report on the findings and recommendations includes: 1) an inventory of amphibian and reptilian species and associated habitats, 2) a matching set of photographs and/or voucher specimens, and 3) whenever possible, estimations of population size, expressed in terms of either surface abundance per site for lentic and lotic species or density for terrestrial species.

## Permits, Reports, and Specimens Deposition

Research permits were obtained from 1) the National Park Service (HAFE-SCI-0010), 2) the

State of West Virginia (Scientific Collecting Permits 2007.253, 2008.029 and 2009.012), and 3) Howard University Institutional Animal Care and Use Committee (IACUC-GSAS-07-13). Annual Progress Reports were submitted to HAFE for 2007 and 2008.

The present report constitutes the draft final report (in MS Word format), along with the appendix containing survey and collection information. Included in the report are supporting photographs, maps and satellite imagery showing capture locations.. Following review and approval by HAFE, five hardcopies will be sent to DS CESU Research Coordinator for distribution to NPS and partner libraries, as appropriate.

Because photographs were taken of representative, captured herps no reference or voucher specimens were collected.

## Results

The herpetofauna in the Limestone-Red Cedar Glades is limited in both numbers and diversity. In total, only three herp species were observed in the glades, two species of salamanders and one turtle species. Amphibians were limited to two plethodontid salamanders, the Redback salamander, *Plethodon cinereus*, and the Valley and Ridge salamander, *P. hoffmani*. No other salamanders and no frogs were observed. The total numbers of salamanders was not large; only

*Plethodon cinereus* (Fig. 1A) was the more numerous of the two salamander species. Fifty-two individuals ranging in snout-vent length from 19-51mm (mean SVL = 36mm) were observed (details in Appendix A). Activity varied considerably over the course of the year but appears to be primarily associated with cooler seasonal weather, e.g. individuals were seen in spring and fall, and not in either the cold (winter) or hot (summer) seasons (Table 1). Spring activity (March –June). *Plethodon cinereus* displayed two common morphs, the red and the lead-back forms with a single “yellow” morph observed (Appendix A). All individuals were found under logs and rocks. Individuals were observed throughout the study area (Fig. 2).

Table 1. Herpetofauna observed in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park by month and year. Parenthetical numbers indicate skeletal material observed.

| 2008                      | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug   | Sep | Oct   | Nov | Dec |
|---------------------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|-------|-----|-----|
| <i>Plethodon cinerius</i> |     |     | 5   | 5   | 0   | 0   |     | 0     |     | 23    |     | 2   |
| <i>Plethodon hoffmani</i> |     |     | 0   | 3   | 0   | 0   |     | 0     |     | 5     |     | 0   |
| <i>Terrepene carolina</i> |     |     | 0   | 0   | 0   | 0   |     | 1 (1) |     | 2 (1) |     | 0   |
| Person hrs                |     |     | 4.6 | 3.6 | 2.6 | 1.4 |     | 2.2   |     | 8.4   |     | 8.4 |
|                           |     |     |     |     |     |     |     |       |     |       |     |     |
|                           |     |     |     |     |     |     |     |       |     |       |     |     |
| 2009                      |     |     |     |     |     |     |     |       |     |       |     |     |
| <i>Plethodon cinerius</i> | 0   | 0   |     | 17  | 0   | 0   |     |       |     |       |     |     |
| <i>Plethodon hoffmani</i> | 0   | 0   |     | 3   | 0   | 0   |     |       |     |       |     |     |
| <i>Terrepene carolina</i> | 0   | 0   |     | (1) | 2   | 0   |     |       |     |       |     |     |
|                           |     |     |     |     |     |     |     |       |     |       |     |     |

Figure. 3. Herpetofauna located in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park. L. Red and lead morphs of *Plethodon cinereus* found in March 2008: red (top) and lead (bottom). R. *Plethodon hoffmani* found in April 2008.



Figure 4. Locations of *Plethodon cinereus* in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park. Individuals are identified in the figure by snout-vent and tail length, e.g. Pc 3740 was captured on 5 April 2008 with SVL = 37mm and TL = 40mm. Multiple captures at or near the same location are indicated by multiple listing of individuals.



*Plethodon hoffmani* (Fig. 3) was uncommon with only twelve individuals ranging in SVL from 20-47mm (mean SVL = 39mm) observed (details in Appendix A). As with *P. cinereus*, activity varied considerably over the year and was associated with cooler seasonal weather. Individuals were observed only in April and October (Table 1). All individuals were found under logs and

rocks (Appendix A) and . As noted above, fewer individuals of *P. hoffmani* were observed and all of these were located under rocks and logs toward the eastern side of the site where the density of red cedars appeared to be considerably reduced and nearby to the stream that runs adjacent to the site. Although individuals appear to be scattered throughout the site (Fig. 4), with the addition of locality information for three individuals without GPS locations are included, *P. hoffmani* appears to be more often found in the southeastern portion of the site.

Figure 5. Locations of *Plethodon hoffmani* in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park. Individuals are identified in the figure by snout-vent and tail length as above. Multiple captures at or near the same location are indicated by multiple listing of individuals.



Reptiles were scarce. No lizards and no snakes were observed and only five individuals of a single turtle species, the Eastern Box Turtle, *Terrepene carolina* (Fig. 1B), were seen. In addition to the five live adults, three incomplete skeletal remains were observed (Table 1). Of

the five live animals two were male (mean carapace length = 132mm; max = 132mm; min = 130mm) and three were female (carapace length = 130; max = 136; min = 124). Lengths of the three skeletal carapaces of undetermined gender ranged between 114, 124, and 150mm) (Table 3). Individuals were observed in spring, summer and fall (May, August and October; Table 2). No eggs or juveniles were observed. Activity, again, was seasonal with live individuals observed in spring and fall. There appears to be no particular pattern of distribution in the site (Fig. 5).

Figure 6. Herpetofauna located in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park. *Terepene carolina* (female) found in May 2009.



Figure 7. Locations of *Terepene carolina* in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park. Individuals are identified in the figure by sex and carapace length. Multiple captures at or near the same location are indicated by multiple listing of individuals.



Summary data for observations of herpetofaunal indicates very seasonal activity (Table 2), in part perhaps because of the very nature of the glades themselves. The openness of the glades in winter and absence of rock and log cover (Figure 6) provides little shelter and suggests exposure may well constrain occupation of the site.

Table 2. Summary of numbers of herpetofauna observed in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park by month. Parenthetical numbers indicate skeletal material observed.

|                           | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug   | Sep | Oct   | Nov | Dec |
|---------------------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|-------|-----|-----|
| <i>Plethodon cinerius</i> | 0   | 0   | 5   | 22  | 0   | 0   |     | 0     |     | 23    |     | 2   |
| <i>Plethodon hoffmani</i> | 0   | 0   | 0   | 6   | 0   | 0   |     | 0     |     | 5     |     | 0   |
| <i>Terrepene carolina</i> | 0   | 0   | 0   | (1) | 2   | 0   |     | 1 (1) |     | 2 (1) |     | 0   |
|                           |     |     |     |     |     |     |     |       |     |       |     |     |

Figure 8. Understory in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park in April 2008 (L) and May 2008 (R). Note absence of log and rock cover for much of the area limits habitat for salamanders despite prevalence of ground cover in late spring.



Although not part of the study, the impact of beaver on the site should be noted. The primary impact was the cutting and removal of numerous small trees (~25cm dbh) that not only altered the sun-shade regime, but also resulted in the creation of numerous drag paths from the site of cutting to the stream (Fig. 7).

Figure 9. Beaver impact in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park. L. Dam on stream adjacent to site (March 2008). R. Tree stumps and drag path resulting from beaver dam building activity.



## Discussion and Conclusions

Compared to regional herpetofaunal diversity, that of the rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park is severely limited. While Baldwin *et al.* (2006) note that of the 54 species of amphibians and reptiles occurring regionally, only 33 were observed in Harpers Ferry National Park—only three were observed in the glades. This difference is not surprising given the much larger regional area and the well-established relationship between area and diversity (Macarthur and Wilson, 1967). The park (HAFE) encompasses 931 ha (2300 acres), while the Rare Limestone-Red Cedar Glade site is only .27 ha in size—less than 3% the area of the park. Thus, it is entirely reasonable that the diversity of the park as a whole is considerably greater than that of the Limestone-Red Cedar Glades site.

Although the site is relatively impoverished with only two salamander and a single turtle species, it is none-the-less of considerable interest, especially as the area itself would appear fairly inhospitable for either amphibians or reptiles. In general, the site is rather xeric, the soils shallow and often compacted, and in many areas, litter absent and soil directly exposed. Further, site cover, e.g. logs and rocks, important for animals like salamanders is quite limited. With neither permanent nor ephemeral ponds or wetland present the site would appear fairly unattractive to frogs. As Perles (2007) noted, the vegetation is unique. Together, these features suggest that herps species likely to occur there are either habitat generalists or specialists adapted to limestone red cedar glade habitat. Given the small size of the glades and that they occur at a lower elevation and are quite distant from other, similar glades, it is unlikely that amphibian and reptile specialists will be present. Rather, herps occurring there will more likely be generalists—as are both the Red-backed salamander and Eastern Box Turtle. Interestingly, the very features that make the Limestone-Red Cedar Glades unique are the ones that make it relatively unlikely to be occupied by and attractive to herpetofauna.

From a management perspective, the most interesting species is *Plethodon hoffmani*, a relatively salamander that appeared to most frequently located in areas bordering the glades. Thus, managing for this species might require decisions opposite to the best management practices for the glades themselves. Perles (2007) noted that limestone red-cedar glades are highly susceptible to woody plant invasions and that the goal for managing the glades should be to reduce woody plant cover and to prevent encroachment by woody species so that sun-loving glade plants can thrive. Interestingly, the presence of beaver may well provide a mechanism for management—if its selection of trees for removal serves to prevent further colonization by woody species. Their behavior and impact are probably worth investigating. Unfortunately, at least one of the beaver was killed during the study (apparently while crossing the railroad tracks).

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Appendix A. Summary of collection data for herpetofauna observed in Rare Limestone-Red Cedar Glades of Jacksons Fork, Harpers Ferry National Park.

| Genus            | species         | color notes | Sex | SVL | TL | RT | mass | Date     | UTM N      | UTM E   | Air Temp | Humidity | Wind | Weather              | Microhabitat | Notes                                                                       |
|------------------|-----------------|-------------|-----|-----|----|----|------|----------|------------|---------|----------|----------|------|----------------------|--------------|-----------------------------------------------------------------------------|
| <i>Plethodon</i> | <i>cinereus</i> | red         | f   | 39  | 38 | 3  |      | 8-Mar-08 |            |         | 12.8     | 69.0     | 0.0  | overcast, light rain | under log    | gravid                                                                      |
| <i>Plethodon</i> | <i>cinereus</i> | lead        | m   | 39  | 48 |    |      | 8-Mar-08 |            |         | 12.8     | 69.0     | 0.0  | overcast, light rain | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | red         | ?   | 38  | 25 |    |      | 8-Mar-08 |            |         | 12.8     | 69.0     | 0.0  | overcast, light rain | under rock   | broken tail                                                                 |
| <i>Plethodon</i> | <i>cinereus</i> | lead        | m   | 44  | 50 |    |      | 8-Mar-08 |            |         | 12.8     | 69.0     | 0.0  | overcast, light rain | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | red         | m   |     |    |    |      | 8-Mar-08 |            |         | 12.8     | 69.0     | 0.0  | overcast, light rain | under log    | missed                                                                      |
| <i>Plethodon</i> | <i>cinereus</i> | red         | m   | 37  | 40 |    | 1    | 5-Apr-08 | 18S0259247 | 4353726 | 22.6     | 40.0     | 0.5  | wet and warm         | under rock   | rock associated with small rock outcrops in oak and other (non-cedar) trees |
| <i>Plethodon</i> | <i>cinereus</i> | red         | m   | 51  | 45 |    | 1.8  | 5-Apr-08 |            |         |          | 40.0     | 0.5  | wet and warm         | under rock   | rock associated with small rock outcrops in oak and other (non-cedar) trees |
| <i>Plethodon</i> | <i>cinereus</i> | lead        | m   | 46  | 43 |    | 1.3  | 5-Apr-08 |            |         | 22.6     | 40.0     | 0.5  | wet and warm         | under rock   | rock associated with small rock outcrops in oak and other (non-cedar) trees |
| <i>Plethodon</i> | <i>cinereus</i> | red         | ?   | 45  | 47 |    | 2    | 5-Apr-08 |            |         | 22.6     | 40.0     | 0.5  | wet and warm         | under rock   |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | lead        | ?   | 36  | 40 |    | 1.1  | 5-Apr-08 |            |         | 22.6     | 40.0     | 0.5  | wet and warm         | under rock   |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | red         |     | 28  | 55 |    | 0.3  | 4-Oct-08 | 18S0259185 | 4353691 | 16.8     | 73.0     | 0.0  | p cloudy; very quiet | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | red         |     | 31  | 56 |    | 0.3  | 4-Oct-08 | 18S0259185 | 4353691 | 16.8     | 73.0     | 0.0  | p cloudy; very quiet | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | lead        |     | 41  | 82 |    | 0.9  | 4-Oct-08 | 18S0259185 | 4353691 | 16.8     | 73.0     | 0.0  | p cloudy; very quiet | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | red         |     | 21  | 36 |    | 0.2  | 4-Oct-08 | 18S0259185 | 4353691 | 16.8     | 73.0     | 0.0  | p cloudy; very quiet | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | red         |     | 19  | 31 |    | 0.1  | 4-Oct-08 | 18S0259185 | 4353691 | 16.8     | 73.0     | 0.0  | p cloudy; very quiet | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | lead        |     | 21  | 39 |    | 0.2  | 4-Oct-08 | 18S0259185 | 4353691 | 16.8     | 73.0     | 0.0  | p cloudy; very quiet | under log    |                                                                             |
| <i>Plethodon</i> | <i>cinereus</i> | red         |     | 36  | 74 |    | 0.8  | 4-Oct-08 | 18S0259185 | 4353691 | 16.8     | 73.0     | 0.0  | p cloudy; very quiet | under rock   | under rock ~5m NW of GPS reading                                            |

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|                  |                 |      |  |     |     |  |     |           |            |         |      |      |     |                      |                 |                                              |
|------------------|-----------------|------|--|-----|-----|--|-----|-----------|------------|---------|------|------|-----|----------------------|-----------------|----------------------------------------------|
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 40  | 79  |  | 1   | 4-Oct-08  | 18S0259234 | 4353711 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       | tip of tail missing                          |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 40  | 82  |  | 0.8 | 4-Oct-08  | 18S0259234 | 4353711 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 35  | 70  |  | 0.8 | 4-Oct-08  | 18S0259234 | 4353711 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 36  | 55  |  | 0.7 | 4-Oct-08  | 18S0259234 | 4353711 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       | broken tail during capture                   |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 43  | 87  |  | 1   | 4-Oct-08  | 18S0259255 | 4353712 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> |      |  | 39  | 72  |  | 0.8 | 4-Oct-08  | 18S0259255 | 4353712 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> |      |  | 33  | 74  |  | 0.8 | 4-Oct-08  | 18S0259255 | 4353712 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       | under log 8m SE GPS reading                  |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 45  | 95  |  | 1.2 | 4-Oct-08  | 18S0259283 | 4353655 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under small log |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 41  | 88  |  | 1.1 | 4-Oct-08  | 18S0259276 | 4353646 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 433 | 92  |  | 1.2 | 4-Oct-08  | 18S0259276 | 4353646 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 49  | 105 |  | 1.5 | 4-Oct-08  | 18S0259276 | 4353646 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 33  | 70  |  | 0.7 | 4-Oct-08  | 18S0259248 | 4353629 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 38  | 76  |  | 1   | 4-Oct-08  | 18S0259248 | 4353629 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 31  | 59  |  |     | 4-Oct-08  | 18S0259198 | 4353600 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      | tip of tail a bit regrown but no measurement |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 22  | 58  |  |     | 4-Oct-08  | 18S0259198 | 4353600 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 29  | 64  |  |     | 4-Oct-08  | 18S0259198 | 4353600 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 34  | 37  |  | 0.6 | 18-Dec-08 | 18S0259269 | 4353622 | 6.2  | 61.0 | 0.3 | cool; overcast       | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 36  | 44  |  | 1   | 18-Dec-08 | 18S0259276 | 4353624 | 6.2  | 61.0 | 0.3 | cool; overcast       | under log       |                                              |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 33  | 58  |  | 0.5 | 4-Apr-09  | 18S0259214 | 4353709 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under dead tree | (~3cm dbh)                                   |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 33  | 75  |  | 0.8 | 4-Apr-09  | 18S0259227 | 4353711 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock      | under rock 3m NE GPS reading                 |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 43  | 83  |  | 1.7 | 4-Apr-09  | 18S0259227 | 4353711 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock      | under rock 3m NE GPS reading                 |
| <i>Plethodon</i> | <i>cinereus</i> | red  |  | 38  | 83  |  | 1.3 | 4-Apr-09  | 18S0259227 | 4353711 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock      | under rock 8m NE GPS reading                 |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 35  | 75  |  | 1   | 4-Apr-09  | 18S0259227 | 4353711 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       | under rock 9m NE GPS reading                 |
| <i>Plethodon</i> | <i>cinereus</i> | lead |  | 35  | 72  |  | 0.9 | 4-Apr-09  | 18S0259227 | 4353711 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       | under rock 10m NE GPS reading                |

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|                  |                 |        |   |    |    |  |     |          |            |         |      |      |     |                      |                 |                                                                                       |
|------------------|-----------------|--------|---|----|----|--|-----|----------|------------|---------|------|------|-----|----------------------|-----------------|---------------------------------------------------------------------------------------|
| <i>Plethodon</i> | <i>cinereus</i> | red    |   | 38 | 75 |  | 1.3 | 4-Apr-09 | 18S0259262 | 4050655 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       | UTM E seems off                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | red    |   | 31 | 61 |  | 0.7 | 4-Apr-09 | 18S0259262 | 4050655 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       | UTM E seems off                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | red    |   | 41 | 96 |  | 1.4 | 4-Apr-09 | 18S0259262 | 4050655 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       | UTM E seems off                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | lead   |   | 39 | 85 |  | 1.5 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       |                                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | lead   |   | 31 | 69 |  | 0.9 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       |                                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | lead   |   | 39 | 62 |  | 1.3 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       |                                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | yellow |   | 35 | 72 |  | 0.9 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       |                                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | lead   |   | 35 | 75 |  | 0.9 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       |                                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | red    |   | 31 | 66 |  | 0.7 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock      |                                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | red    |   | 23 | 38 |  | 0.3 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock      |                                                                                       |
| <i>Plethodon</i> | <i>cinereus</i> | red    |   | 44 | 96 |  | 1.6 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under log       |                                                                                       |
|                  |                 |        |   |    |    |  |     |          |            |         |      |      |     |                      |                 |                                                                                       |
| <i>Plethodon</i> | <i>hoffmani</i> |        | f | 47 | 55 |  | 1.2 | 5-Apr-08 |            |         | 22.6 | 40.0 | 0.5 | wet and warm         | under log       | in valley area at south end of site                                                   |
| <i>Plethodon</i> | <i>hoffmani</i> |        | ? | 45 | 53 |  |     | 5-Apr-08 |            |         | 22.6 | 40.0 | 0.5 | wet and warm         | under rock      | at east end of site about 20m from stream in rocky outcrop; sparse vegetation; photos |
| <i>Plethodon</i> | <i>hoffmani</i> |        | ? | 34 | 45 |  |     | 5-Apr-08 |            |         | 22.6 | 40.0 | 0.5 | wet and warm         | under log       | at east end of site about 50m north of tracks                                         |
| <i>Plethodon</i> | <i>hoffmani</i> |        |   | 42 | 89 |  | 1.3 | 4-Oct-08 | 18S0259185 | 4353691 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                                                                       |
| <i>Plethodon</i> | <i>hoffmani</i> |        |   | 42 | 89 |  | 1.1 | 4-Oct-08 | 18S0259185 | 4353691 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      | under rock ~5m NW of GPS reading                                                      |
| <i>Plethodon</i> | <i>hoffmani</i> |        |   | 37 | 67 |  | 0.7 | 4-Oct-08 | 18S0259255 | 4353712 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                                                                       |
| <i>Plethodon</i> | <i>hoffmani</i> |        |   | 43 | 93 |  | 1.4 | 4-Oct-08 | 18S0259283 | 4353655 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under small log | photos                                                                                |
| <i>Plethodon</i> | <i>hoffmani</i> |        |   | 42 | 89 |  | 1.2 | 4-Oct-08 | 18S0259263 | 4353621 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under log       |                                                                                       |
| <i>Plethodon</i> | <i>hoffmani</i> |        |   | 20 | 38 |  |     | 4-Oct-08 | 18S0259198 | 4353600 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | under rock      |                                                                                       |
| <i>Plethodon</i> | <i>hoffmani</i> |        |   | 38 | 75 |  | 1.4 | 4-Apr-09 | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock      |                                                                                       |

|                  |                 |  |   |                 |                |                 |                 |           |            |         |      |      |     |                      |                     |                                                                       |
|------------------|-----------------|--|---|-----------------|----------------|-----------------|-----------------|-----------|------------|---------|------|------|-----|----------------------|---------------------|-----------------------------------------------------------------------|
| <i>Plethodon</i> | <i>hoffmani</i> |  |   | 37              | 76             |                 | 1.3             | 4-Apr-09  | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock          |                                                                       |
| <i>Plethodon</i> | <i>hoffmani</i> |  |   | 45              | 99             |                 | 1.7             | 4-Apr-09  | 18S0259262 | 4353630 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   | under rock          |                                                                       |
|                  |                 |  |   |                 |                |                 |                 |           |            |         |      |      |     |                      |                     |                                                                       |
|                  |                 |  |   | carapace length | carapace width | carapace height | plastron length |           |            |         |      |      |     |                      |                     |                                                                       |
| <i>Terrepene</i> | <i>carolina</i> |  | m | 130             | 100            | 55              |                 | 28-Aug-08 | 18S0259373 | 4354270 | 19.6 | 92.0 | 0.3 | light rain           | on leaf litter      | photos                                                                |
| <i>Terrepene</i> | <i>carolina</i> |  | ? | 114             |                |                 |                 | 28-Aug-08 | 18S0259373 | 4354270 | 19.6 | 92.0 | 0.3 | light rain           | on leaf litter      | skeletal-carapace only; no plastron; no other skeletal remains-photos |
| <i>Terrepene</i> | <i>carolina</i> |  | f | 124             | 92             | 55              |                 | 4-Oct-08  | 18S0259148 | 4353522 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | on tracks near site | photos                                                                |
| <i>Terrepene</i> | <i>carolina</i> |  | ? | 127             | 100            | 53              |                 | 4-Oct-08  | 18S0259200 | 4353615 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | leaf litter         | skeletal-carapace only                                                |
| <i>Terrepene</i> | <i>carolina</i> |  | f | 136             | 99             | 63              |                 | 4-Oct-08  | 18S0259200 | 4353615 | 16.8 | 73.0 | 0.0 | p cloudy; very quiet | leaf litter         |                                                                       |
| <i>Terrepene</i> | <i>carolina</i> |  |   | 150             | 98             | 58              |                 | 4-Apr-09  | 18S0259227 | 4353711 | 11.7 | 38.0 | 1.4 | windy, cool, sunny   |                     | skeletal-carapace only                                                |
| <i>Terrepene</i> | <i>carolina</i> |  | f | 130             |                |                 | 124             | 16-May-09 | 18S0259250 | 4353714 | 25.3 | 82.0 | 0.0 | sunny & warm         | leaf litter         |                                                                       |
| <i>Terrepene</i> | <i>carolina</i> |  | m | 132             |                |                 | 122             | 16-May-09 | 18S0259218 | 4353571 | 25.3 | 82.0 | 0.0 | sunny & warm         | leaf litter         |                                                                       |