

**FIREFLY SPECIES FACT SHEET:**  
**Ant-loving scrub firefly (*Pleotomodes needhami*)**



*Male and female ant-loving scrub fireflies (©Jay L. Keller, used with permission; Richard Joyce/Xerces Society)*

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**Scientific Name:**

*Pleotomodes needhami* Green, 1948

Phylum: Arthropoda

Class: Insecta

Order: Coleoptera

Family: Lampyridae

Subfamily: Lampyrinae

Tribe: Pleotomini

(ITIS 2023)

Synonyms: *Lampyris needhami* Green, 1948

**Common Name:**

Ant-loving scrub firefly

**Taxonomic Note:**

After describing the genus *Pleotomodes* in 1948, Green later merged this taxon under the European genus *Lampyris* (Fallon et al., 2021). In 1986, Geisthardt restored *Pleotomodes* as a valid genus based on differences in features of the genitalia, antennae, and pubescence.

**Conservation Status:**

Global Status: G1G2 – Critically Imperiled (last reviewed 6 January 2022)

National Status (United States): N1N2 – Critically Imperiled

State Status: S1S2 (FL) – Critically Imperiled

(Almquist et al., 2022)

IUCN Red List: Endangered (Cicero & Walker, 2022; Fallon et al., 2021)

Species of Greatest Conservation Need: Florida (Florida Fish and Wildlife Conservation Commission (FWC), 2019)

### Technical Description:

*Pleotomodes needhami* adults are sexually dimorphic. Males are winged with gray elytra with yellow margins, a yellowish pronotum with a dark central marking, and small transparent windows above the eyes (Figure 1a). In his initial description, Green (1948) reported the range of adult male lengths to be 6.75-7.25 mm, but Deyrup and Carrell described them as “conspicuously variable in size” (2007).

*Pleotomodes needhami* is closely related to *Pleotomodes knullii*, which is found in areas of Florida other than the Lake Wales Ridge, where *P. needhami* is endemic. The two species are not known to be sympatric, although it is possible they could co-occur. Morphologically, males of *Pleotomodes needhami* can be distinguished by the **narrowly separated eyes** (versus touching in *knullii*), **less dense elytral pubescence** (versus denser in *knullii*), a **pygidium that ends somewhat abruptly and has two wavy indentations** (see Figure 2), and slight differences in antennae (Geisthardt, 1986; Green, 1949). While light organs are not visibly apparent on *P. needhami* specimens, the males do emit a faint glow from vestigial lanterns (Sivinski et al., 1998).

Adult females are flightless and brachypterous, meaning that the elytra and hindwings are reduced in length. Females are a pale cream color with a large pinkish spot on the pronotum. (Figure 1b).

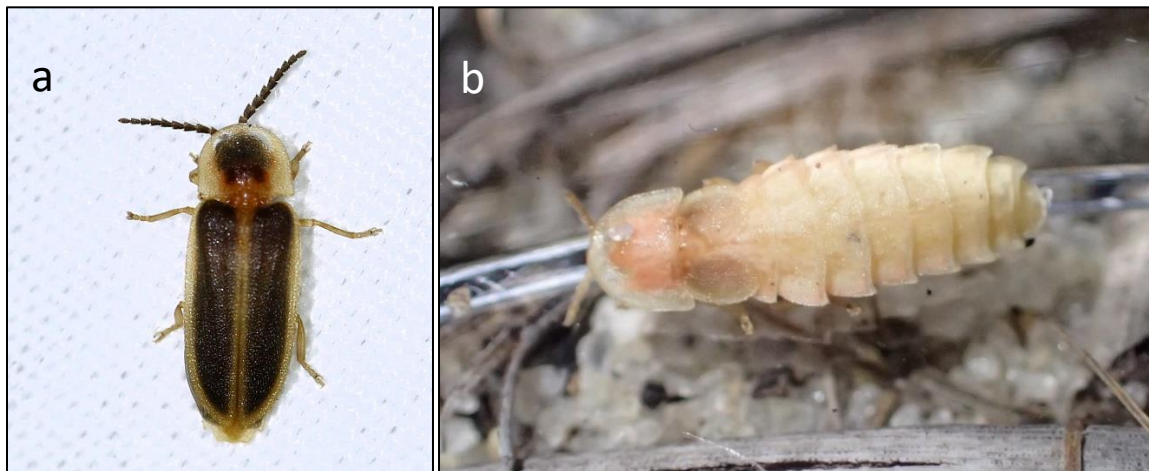


Figure 1. (a) Adult male *Pleotomodes needhami* at a UV light, (Photo © Jay L. Keller, used with permission) (b) Adult female *Pleotomodes needhami* photographed at Archbold Biological Station in early May (Richard Joyce/Xerces Society).



Figure 2. Image showing the subtruncate, bisinuate pygidium (rearmost dorsal segment) in an adult male *Pleotomodes needhami*. The pygidium in adult male *Pleotomodes knulli* lacks these lobes and notches. (©Jay L.Keller, used with permission).

### **Life History:**

#### *Life cycle*

Like all beetles, ant-loving scrub fireflies have four distinct life stages: egg, larva, pupa, and adult. Egg-laying by adult females likely occurs in April and May inside ant colonies. Larvae have been observed in March and April, both inside nests of *Trachymyrmex septentrionalis* and crawling on the ground surface in Florida scrub (Sivinski et al., 1998). The larval stage is presumably the longest life stage, lasting close to a year. Like in the majority of firefly species, the larvae are luminescent. Pupation seems to occur inside ant nests, and pupae have been found inside excavated ant colonies in early to mid- April. The length of pupation in *Pleotomodes needhami* is unknown, but 1-3 weeks is typical in most fireflies (Faust, 2017).

#### *Bioluminescence*

Larvae, adult females, and adult males all emit light in the form of continuous greenish yellow glows. The signaling period for females begins about 30 minutes after sunset and continues for about an hour. Females continue to glow during copulation, and after their evening light signaling period, females return to their ant colony (Sivinski et al., 1998).

#### *Diet*

The larval food sources of *Pleotomodes needhami* remain a mystery. In captivity, larvae fed feed on crushed freshwater snails and did not eat ant larvae (Sivinski et al., 1998). However, given the scarcity of mollusks in the sandy scrub habitat, it is unlikely that snails or slugs are the principal prey items of this species. It is possible that they are generalist predators or scavengers, emerging from ant colonies to forage on the ground at night. As adults, *Pleotomodes* have very small mouthparts (Green, 1948) and likely do not feed.

### *Phenology*

Adult males are primarily captured or observed in April and May, peaking between about the last week of April and the first two weeks of May (Deyrup & Carrel, 2012; GBIF.org, 2023).

### *Dispersal Capacity*

Because females are flightless and adult males are small-bodied, it is likely that *Pleotomodes needhami* is very limited in its dispersal capacity. It has been speculated that it is larvae, not adult females, that disperse between ant nests, based on the observation of larvae on the forest floor (Sivinski et al., 1998). In general, fireflies are thought to be poor dispersers (Lewis, 2016), with some species dispersing just a few meters during their larval stage (Kakehashi et al., 2014).

### **Range, Distribution, and Abundance:**

Type locality: Archbold Biological Station, Lake Placid, Florida (Green, 1948)

Range: *Pleotomodes needhami* is found on the Lake Wales Ridge of central Florida in Highlands and Polk Counties.

Distribution: This species has only been documented from 9 sites on federal, state, and private lands in a Highlands and Polk Counties. The distance between the northernmost and southernmost localities is approximately 40 miles (65 km). While some of the sites are relatively clustered, others are separated by distances of 9-12 miles (15-20 km). See Table 1 and Figure 3.

Table 1. Sites where the ant-loving scrub firefly, *Pleotomodes needhami*, has been documented.

Site	County	Management Entity
Archbold Biological Station	Highlands	Archbold Biological Station
Carter Creek National Wildlife Refuge	Highlands	United States Fish and Wildlife Service
Jack Creek Preserve	Highlands	Southwest Florida Water Management District
Lake Wales Ridge Wildlife and Environmental Area- Henscratch 27	Highlands	Florida Fish and Wildlife Conservation Commission
Lake Wales Ridge Wildlife and Environmental Area- Royce Unit	Highlands	Florida Fish and Wildlife Conservation Commission
Lake Wales Ridge Wildlife and Environmental Area- Lake Placid Scrub	Highlands	Florida Fish and Wildlife Conservation Commission
Lake Wales Ridge Wildlife and Environmental Area- Gould Road Tract	Highlands	Florida Fish and Wildlife Conservation Commission
Lake Wales Ridge Wildlife and Environmental Area, Sun Ray Tract	Polk	Florida Fish and Wildlife Conservation Commission
Lake Wales Ridge State Forest- Arbuckle Tract	Polk	Florida Department of Agriculture and Consumer Services

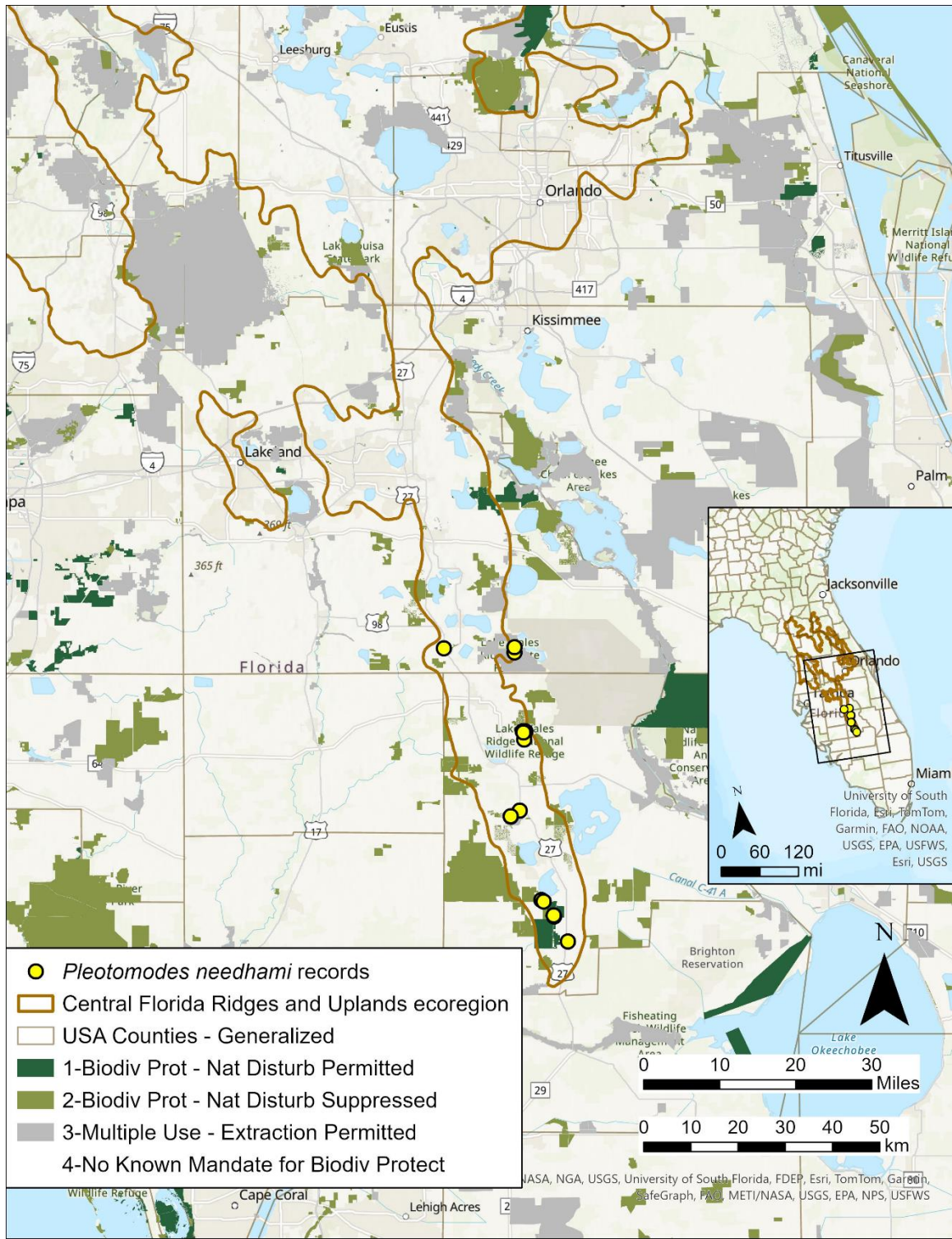


Figure 3. Map of *Pleotomodes needhami* localities (yellow circles) from GBIF (GBIF.org, 2023). The brown outline corresponds to the Central Florida Ridges and Uplands Level IV ecoregion, and protected areas are mapped by Gap Status (degree of protection).

**Abundance:** Extensive flight intercept trapping carried out at 23 preserves on the Lake Wales Ridge led to the capture of just 64 individuals at 8 protected sites (Deyrup & Carrel, 2012). In visual searches for adult females, the most adult females found on a single night was 6 individuals (Sivinski et al., 1998). A 1.6 km walk at Archbold Biological station in early May 2022 resulted in the observation of a single female (Joyce & Fallon, 2022).

**Habitat Associations:**

The ant-loving scrub firefly is found in association with colonies of northern fungus growing ants (*Trachymyrmex septentrionalis*, Figure 4), trap-jaw ants (*Odontomachus clarus*), and cone ants (*Dorymyrmex* spp) in Florida scrub (Figure 5). These ant species vary widely in their food sources, including fungus grown on plant matter and insect frass, insects, nectar, and honeydew. Plants in the scrub habitats of *P. needhami* include sand pine (*Pinus clausa*) and scrub oaks (*Quercus* spp ). One of the subtypes of scrub in which *Pleotomodes needhami* is found is yellow sand scrub, which occurs in the southern portion of the Lake Wales Ridge and contains scrub hickory (*Carya floridana*) and various endemic plants. Florida scrub habitats are fire adapted and fire-maintained, though with longer fire return intervals than some other fire-adapted systems (FNAI, 2010).



Figure 4. The entrance mound of a northern fungus-growing ant (*Trachymyrmex septentrionalis*) colony. (Photo by Don Abrams, licensed under CC BY-NC).



Figure 5. Scrub habitat at the Lake Wales Ridge Wildlife and Environmental Area- Lake Placid Unit (Richard Joyce/Xerces Society).



## **Threats:**

The primary threat to *Pleotomodes needhami* is thought to be habitat loss due to conversion of scrub and sandhill habitats to agriculture and residential and commercial development. The Lake Wales Ridge has already lost approximately 85% of its original coverage of these habitats due to these threats (Turner et al., 2006). Because females are flightless and larvae likely have limited dispersal range, habitat loss and fragmentation from road construction likely limits the recovery of populations after disturbance or extirpation. Additional potential threats include climate change, trampling by humans or livestock, pesticide exposure from citrus groves, and artificial light at night (Cicero & Walker, 2022). Artificial light at night could interfere with reproduction by drawing adult males away from females or by making adult females less visible to males (Owens & Lewis, 2018; Van den Broeck et al., 2021).

## **Conservation Considerations:**

*Pleotomodes needhami* is a habitat specialist endemic to the Lake Wales Ridge in Florida. This species is vulnerable to extinction because it has a very limited distribution, its population size is suspected to be small, and it faces numerous threats to its persistence, including habitat loss, climate change, pesticides, and light pollution. There are no specific conservation measures in place to protect this species. Conservation measures are needed on multiple fronts, from answering basic research questions to continued inventorying, long-term monitoring, and species-specific management actions.

### *Research Needs*

While the adult phenology and microhabitat use by adults and larvae were explored by Sivinski et al. (1998), and various localities for the species were discovered as part of a Lake Wales Ridge scrub sampling effort (Deyrup & Carrel, 2012), *Pleotomodes needhami* has not been studied in over a decade. Critical data gaps must be addressed to inform conservation efforts for this species, including:

### *Natural history*

- What is the larval diet? Are they generalists or specialists?
- What is the dispersal capacity of larvae, adult males, and adult females?
- Are larvae active on the ground surface during all instars? What microhabitats other than ant colonies do they use?
- Are there other ant species with which they are associated?

### *Species range and distribution*

- What is the northern limit of *Pleotomodes needhami* on the Lake Wales Ridge?
- Can we use occupancy modeling to determine the survey- and site-level variables that influence the detection and presence of fireflies at known sites?
- Do specimens identified to the genus level in collections represent this species or *P. knulli*?

### *Population size, trends, and abundance*

- What are the global and local population sizes and trends for this species?
- What monitoring protocols and/or programs do we need to develop to answer this question?
- What is the most reliable index of abundance for this species: males caught in glow-lure live traps, males encountered at blacklights, or females found using systematic visual search sampling ?
- What is the geographic pattern of genetic differentiation?

#### *Threats*

- What are the relative impacts of the known threats to the species (habitat loss, artificial light at night, pesticides, climate change)?
- Can we model the impacts of climate change impacts on their populations? What about the impacts of increasing development and light pollution?
- Given the extreme loss and fragmentation of habitat, how viable are remaining populations?

#### *Conservation impacts*

- How do different management activities, such as prescribed burning impact firefly populations?
- How can we use this information to guide conservation and restoration activities?

#### *Inventory and monitoring*

While flight intercept trap sampling over a two-year period caught 64 individuals at 8 sites, the species was not detected in the northern portion of the Lake Wales Ridge (Deyrup & Carrel, 2012). Targeted searches, black lighting, and deploying LED glow-lure traps at sandy sites with *Trachymyrmex septentrionalis* ant colonies in April and May would help to clarify the distribution of *Pleotomodes needhami*. At known sites, annual monitoring using active searches for glowing females or arrays of glow-lure live traps could provide insight into trends in density and abundance while limiting lethal collection.

#### *Management actions*

Land managers can play a key role in ensuring that known and potential habitat is not disturbed by recreation, development, harmful pesticide applications, light pollution, or other management activities. Key actions that could help this firefly include:

- rerouting roads and trails around sensitive habitat areas
- removing or modifying artificial light sources such as streetlights that may be negatively impacting populations (e.g., using motion sensors on existing lights, or replacing bright LEDs with dim red bulbs that don't interfere with firefly flash communication)
- protecting occupied sites from excessive or unnecessary pesticide application
- setting up long-term monitoring programs at a subset of occupied sites to gather baseline population data to better understand population trends and conservation status of this

species over time, as well as insights into the impacts that various management activities have on firefly health and abundance.

### **Survey Protocols:**

#### Where:

- Sandy scrub, oak, and pine habitats of the Lake Wales Ridge in central Florida.

#### When:

- Surveys should occur shortly after dark (about 30 minutes after sunset) from late March through July, but especially April and May.
- Air temperature should be at least 60° Fahrenheit.

#### How:

- Review survey protocols and print data sheets from the Firefly Atlas ([www.fireflyatlas.org](http://www.fireflyatlas.org))
- If needed, secure the appropriate permits and/or site access permissions prior to conducting surveys

#### *Visual search for adult females and larvae*

- Walk slowly through sandy habitat with ant mounds using a dim, red-filtered light to navigate, and periodically turn off the light to scan for the greenish yellow glows of adult females and larvae on the surface of the ground.
- Consider recording observations using a voice memo app on a cell phone or voice recorder, using the data sheet as a guide.
- If handling of fireflies is permitted, place fireflies in a transparent petri dish to take high quality dorsal and ventral photos, including a scale to show the length of the firefly. Photos will enable validation of species identification by a Firefly Atlas administrator or relevant species expert.
- Submit survey data and photographs to the Firefly Atlas (regardless of whether fireflies were observed).

#### *Light-sheeting for adult males*

- Male *Pleotomodes* are attracted at least occasionally to artificial lights such as ultraviolet moth lights.
- Be sure to take close-up photos showing the eyes, antennae and pygidium. If permitted, temporarily placing the firefly in a transparent petri dish will facilitate images of the ventral side.

Photographs of *Pleotomodes* males should be submitted as incidental observations to the Firefly Atlas, along with any data collected on habitat or weather conditions.

#### *Live glow-lure trapping for adult males*

- Live glow-lure traps can be built from plastic beverage containers and battery-powered LEDs.
- Deploying these traps at dusk allows for the non-lethal capture of male glow-worm fireflies, which can be identified, counted, photographed, and released unharmed. Traps should be retrieved at the end of the evening to prevent mortality of captured male fireflies.
- As of 2023, this method has not been tested on *Pleotomodes needhami*, so different color spectrums and intensities should be trialed.

#### **Additional Resources:**

- Conserving the Jewels of the Night: Firefly-Friendly Lighting Practices: <https://xerces.org/publications/fact-sheets/firefly-friendly-lighting>
- Conserving the Jewels of the Night: Guidelines for Protecting Fireflies in the United States and Canada: <https://xerces.org/publications/guidelines/conserving-jewels-of-night>
- State of the Fireflies of the United States and Canada: Distributions, Threats, and Conservation Recommendations: <https://xerces.org/publications/scientific-reports/state-of-fireflies-of-united-states-and-canada>

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#### **Recommended citation:**

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