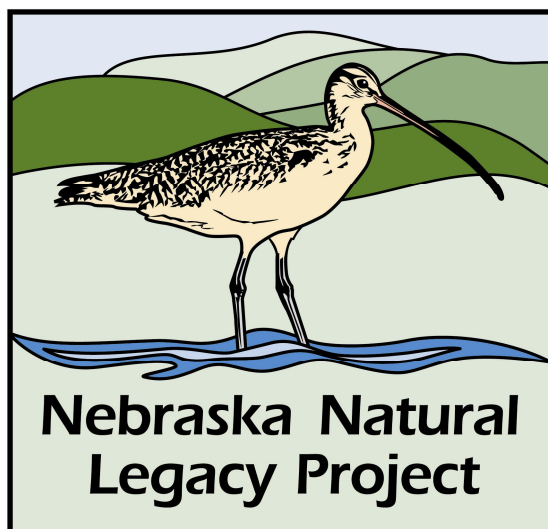


# Ghost Tiger Beetle

(*Cicindela lepida*)

A Species Conservation Assessment  
for  
The Nebraska Natural Legacy Project



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*The mission of the Nebraska Natural Legacy Project is to implement a blueprint for conserving Nebraska's flora, fauna and natural habitats through the proactive, voluntary conservation actions of partners, communities and individuals.*

**Purpose**

The primary goal in development of at-risk species conservation assessments is to compile biological and ecological information that may assist conservation practitioners in making decisions regarding the conservation of species of interest. The Nebraska Natural Legacy Project recognizes the ghost tiger beetle, a.k.a. white tiger beetle, (*Cicindela lepida*) as a Tier I at-risk species of high conservation priority. Some general management recommendations are made here regarding ghost tiger beetles; however, conservation practitioners will need to use professional judgment to make specific management decisions based on objectives, location, and a multitude of variables. This resource was designed to share available knowledge of ghost tiger beetles that will aid conservation practitioners in making decisions and in identifying research needs to benefit the species. Species conservation assessments should not be stagnant documents but rather will need to be updated as new relevant scientific information becomes available. The Nebraska Natural Legacy Project focuses efforts in the state's Biologically Unique Landscapes (BULs), but it is recommended that whenever possible, practitioners make considerations for a species throughout its range in order to increase the outcome of successful conservation efforts.

<b><u>Common Name</u></b>	Ghost Tiger Beetle	<b><u>Scientific Name</u></b>	<i>Cicindela lepida</i>
<b><u>Order</u></b>	Coleoptera	<b><u>Family</u></b>	Cicindelidae
<b><u>G-Rank</u></b>	G3G4	<b><u>S-Rank</u></b>	S2
		<b><u>Goal</u></b>	4
		<b><u>Distribution</u></b>	Widespread
<b><u>Criteria for selection as Tier I</u></b>	G3		
<b><u>Trends since 2005 in NE</u></b>	Declining		
<b><u>Range in NE</u></b>	Statewide in localized populations		
<b><u>Habitat</u></b>	Sparsely-vegetated areas with open, sandy soils		
<b><u>Threats</u></b>	Habitat succession, trampling, lights, off-road vehicle traffic		
	Climate Change Vulnerability Index: Not Vulnerable, Presumed Stable		
<b><u>Research/Inventory</u></b>	Conduct species and habitat-type specific surveys to determine distribution, abundance, and conservation status		
<b><u>Landscapes</u></b>	Cherry County Wetlands, Dismal River Headwaters, Elkhorn River Headwaters, Indian Cave Bluffs, Platte Confluence, Upper Loup Rivers and Tributaries, and Sandsage Prairie		

### **Status**

According to the last review in 2011, the ghost tiger beetle has a state Heritage status rank of S2, U.S. national status of N3N4, and global conservation rank of G3G4 (NatureServe 2009). The species is considered to be Vulnerable (NatureServe 2009). The Nebraska Natural Legacy Science Team set a goal of maintaining four populations in the state, assuming there is little movement between populations and fates of populations are not correlated. Moderate viability (40% chance of survival) of each population gives >99% probability of at least one population surviving 100 years (Morris et al. 1999).

### **Principal Threats**

The overall threat impact to ghost tiger beetles is high to very high; they have a long-term trend decline of 30-70% range-wide (NatureServe 2009). They may be nearly eliminated from Nebraska (Brust et al. 2005). They are highly vulnerable to anthropogenic disturbances (Laroche 1974). *C. lepida* is subject to trampling, as well as off-road vehicle traffic (Brust et al. 2005, Schneider et al. 2011), because the ghost tiger beetle is not a strong flyer and relies more on its cryptic features for defense (Brust et al. 2005). And, lights can disrupt normal nocturnal movement patterns of the tiger beetles (Bugbee 1942, Vaurie 1950, Kippenhan 1994, Brust et al. 2005). Habitat succession also reduces sandy areas that would normally support ghost tiger beetles (Shelford 1907, Brust et al. 2005, Schneider et al. 2011).

### **Species Description**

Ghost tiger beetles are pale and have a base bronze color (Brust et al. 2005). Heads and pronota of ghost tiger beetles may be pinkish, bluish-green, or brown and covered with whitish setae (Brust et al. 2005, Kippenhan 1994). The dorsal hue of ghost tiger beetles is variable, being green, blue, or brown-colored; ventral side is pale, bluish-green, occasionally with "copper on lateral portions of thorax" (Kippenhan 1994), but they are mostly distinguished by their predominately white elytra (i.e., outer wings) (Graves and Pearson 1973). Their elytral maculations (i.e., markings on the wing coverings) are distinct because the lunules (i.e., lines/bars) span across a large portion of each elytron (Brust et al. 2005). Like most tiger beetles, the ghost tiger beetle's elytra are widest behind the middle (White 1983). The ventral body surface and appendages are also covered with whitish setae (Brust et al. 2005). Ghost tiger beetles are 8.5-13.5 mm long (Kippenhan 1994, Brust et al. 2005, Spomer et al. 2008) with lengthy, slender legs (White 1983). In flight, they look somewhat like a "white fluffy seed" (Brust et al. 2005). The larvae have curved hooks on the fifth abdominal segment that are capable of grasping the sides of a burrow to prevent the insect from being extracted easily while it is hunting (White 1983).



FIGURE 1. The cryptic coloration of ghost tiger beetles (*Cicindela lepida*) paired with their nocturnal behavior, often in remote areas, during a short period of time in the summer make them challenging to locate. Photo courtesy of Mathew L. Brust.

### **Habitat and Range**

Although the ghost tiger beetle's distribution is declining, the range of the species in the interior of North America has historically been extensive, occurring in pockets from the Chesapeake Bay area west to eastern Colorado, from southern Manitoba and Saskatchewan south to Arizona and Texas (Brust et al. 2005). In Nebraska, they are most prevalent in the Sandhills (Carter 1989) (Fig. 2). Ghost tiger beetles are specialists (NatureServe 2009), inhabiting dry, loose, light-colored sand (Carter 1989, Kippenhan 1994). Sand dunes, blowouts, beaches, and stream sides are their preferred habitat (Spomer et al. 2008); the beetles may even use the sandy substrate resulting from sand and gravel mining operations (Brust et al. 2005). They may be found adjacent to water, but these just may be anecdotal observations because of locations of exposed, suitable sand (Graves and Pearson 1973). Instars of ghost tiger beetles burrow in the sand; openings are approximately 3-6 mm depending on size of developing insect (S. M. Spomer, pers. comm.). *C. lepida* may be found in habitats with *C. formosa formosa* (Kippenhan 1994) and *C. macra macra* (Graves 1963), as well as other tiger beetles well-suited to sandy environments.

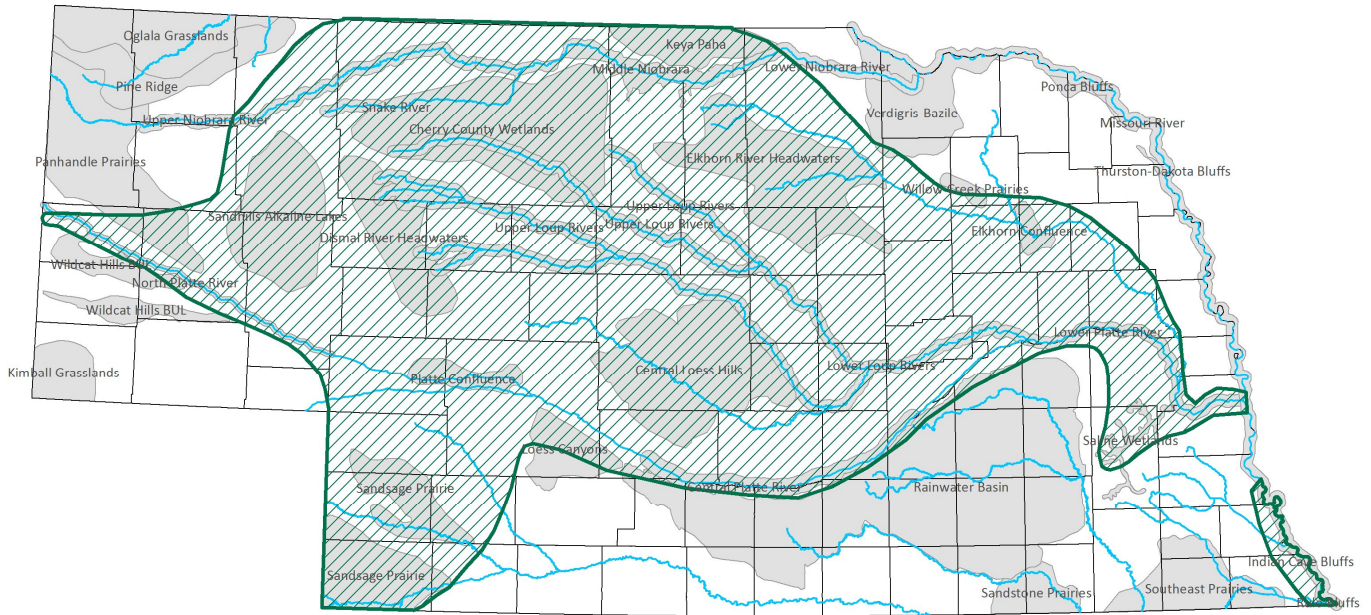


FIGURE 2. Current range of ghost tiger beetles in Nebraska based on field observations, museum specimens, and expert knowledge. Map courtesy of Nebraska Natural Heritage Program, Nebraska Game and Parks Commission.

### **Area Requirements**

Ghost tiger beetles may be present on patches of habitat <2 ha (Stanton and Kurczewski 1999). Most flights of ghost tiger beetles are not much more than 10 m (Spomer et al. 2008), but the beetles are capable of flying several km (Stanton and Kurczewski 1999). They have been found this relative distance from their appropriate habitat; likely they traveled there because of their attraction to lights (Brust et al. 2005). Spomer estimates that ghost tiger beetles have traveled approximately 0.5 km to collection points lighted with black lights and mercury vapor lamps at Indian Cave State Park, Nebraska (S. M. Spomer, unpubl. data).

### **Diet**

A tiger beetle belongs to a group of insects so named because of the markings on its body, quick movements, and predatory feeding (Brust et al. 2005). Tiger beetles have relatively strong mandibles for feeding (Borror and White 1970). Adults forage on loose sand for prey. Larvae wait in vertical tunnels to catch and devour unsuspecting insects (Borror and White 1970, White 1983).

### **Life Cycle**

Ghost tiger beetles can be found on beaches, blowouts, or sandy substrates during the summer months (peaking early Jul-Aug) (Carter 1989) after emergence from pupa. Adults lay eggs mostly in July. The larvae tunnel in loose, dry sand to overwinter 2 years in burrows (approximately 1.7 m deep) until pupation takes place the following May-June (Brust et al. 2005). Adult tiger beetles may only survive a few weeks (Brust et al. 2005).

## **Research and Conservation Strategies**

A multitude of factors should be considered before implementing any conservation actions for species. Within the guidelines of state and federal law, the Nebraska Natural Legacy Project recommends: 1) consider, but do not limit management to, scenarios that benefit both the species of interest and property owners, 2) consider species dispersal and landscape context, 3) plan for multiple years, and 4) do no harm. Conservation considerations should be made for ghost tiger beetles in several Biologically Unique Landscapes: Cherry County Wetlands, Dismal River Headwaters, Elkhorn River Headwaters, Indian Cave Bluffs, Platte Confluence, Upper Loup Rivers and Tributaries, and Sandsage Prairie. Based on current knowledge, these landscapes offer the best opportunities for ghost tiger beetles. Given the identified principal threats, conservation efforts for ghost tiger beetles may want to employ the following management strategies:

- 1) Tiger beetles are agile and often difficult to catch. Use an aerial net for capture (White 1983) at dusk or at night with lights (Spomer et al. 2008). It may help to look for shadows cast by the insects when they are under light, because they are so well camouflaged (Spomer et al. 2008). Prioritize surveying sites in areas of dry, deep, light-colored sand (Carter 1989, Kippenhan 1994). Inventory will help to determine the distribution and abundance of ghost tiger beetles in the state.
- 2) Ghost tiger beetles need open, sandy areas with little or no vegetative cover. In order to maintain their habitat, these locations need regular, moderate disturbance to impede the growth of vegetation (Stanton and Kurczewski 1999). Mechanical removal of vegetation, in conjunction with occasional prescribed fire and grazing, can help to keep areas open by delaying succession. Herbicides (containing imazapic and glyphosate) have been used with some success in reducing vegetation and not exhibiting toxicity to *C. repanda* (Bouffard et al. 2009), but I do not recommend widespread herbicide use specifically for ghost tiger beetle habitat improvement until we have a better understanding of side effects to *C. lepida*. Davis (1998) found beetles from the family Cicindelidae increased on burned areas on Conservation Reserve Program (CRP) grasslands in Lynn County, Texas ( $P = 0.083$ ). Grazing is a management tool already used to maintain habitat for the endangered Ohlone tiger beetle (*Cicindela ohlone*) endemic to Santa Cruz County, California (USFWS 2009). Grazing isn't likely to adversely affect ghost tiger beetles, because the adults will be in sandy, unvegetated areas not selected by grazers (S. M. Spomer, pers. comm.). Consider intensity, frequency, and timing of various disturbances carefully; moderation and before June is likely best.
- 3) Ghost tiger beetles are susceptible to trampling and off-road vehicle usage (Larochelle 1974, Brust et al. 2005, Schneider et al. 2011). Measures taken to reduce these impacts may involve posted signage and limited seasonal access. Because ghost tiger beetles are so vulnerable to impacts from human activities during the summer months in particular, increased public outreach efforts during this time frame may be beneficial in protecting the beetles.
- 4) Effective management actions for ghost tiger beetles may be similar to some of those implemented for the endangered Interior Least Tern (*Sternula antillarum athalassos*) and threatened Piping Plover (*Charadrius melodus*). Hairy-necked tiger beetles (*C.*

*hirticollis*) often occur with Piping Plovers and may be indicators of quality habitat (Brust et al. 2005). It is worthwhile to explore opportunities for combined management efforts for ghost tiger beetles, Least Terns, and Piping Plovers.

- 5) Artificial lighting can disrupt flight patterns of ghost tiger beetles (Bugbee 1942, Vaurie 1950, Kippenhan 1994, Brust et al. 2005). One should consider trying to avoid close proximity to night lighting when selecting locations for habitat maintenance and improvement for ghost tiger beetles.

### **Information Gaps**

Distribution and abundance of ghost tiger beetles in Nebraska may not be well-documented. Ghost tiger beetles are easily overlooked because of their cryptic coloration and the relative short period of time during summer that researchers would be able to observe adults in suitable habitat not easily accessed by humans (Brust et al. 2005). Will ghost tiger beetles utilize blowouts far from a water source? Is there a threshold of soil moisture content that ghost tiger beetles tolerate? It is believed that ghost tiger beetles can survive in their burrows during periods of brief water inundation (S. M. Spomer, pers. comm.). Additionally, management techniques for *C. lepida* are not well established. Response of ghost tiger beetles to herbicide treatments, prescribed fire, and grazing, as well as best timing of conservation practices are unknown.

### **Considerations for Additional Species**

At-risk species that inhabit the same Biologically Unique Landscapes as ghost tiger beetles may need to be considered when making management plans for the species. Table 1 lists a sample of at-risk species and other natives you may want to consider while making habitat plans on the landscape that can benefit ghost tiger beetles. This list will not apply to all sites that ghost tiger beetles occupy nor is the list all-inclusive.

TABLE 1. At-risk species and others likely to inhabit Biologically Unique Landscapes identified in the Nebraska Natural Legacy Project with ghost tiger beetles (Schneider et al. 2011) may necessitate consideration or benefit from habitat management plans for *C. lepida*.

**Animals**

Interior Least Tern (*Sternula antillarum athalassos*)  
Piping Plover (*Charadrius melodus*)  
Bell's Vireo (*Vireo bellii*)  
Burrowing Owl (*Athene cunicularia*)  
Greater Prairie-Chicken (*Tympanuchus cupido*)  
Short-eared Owl (*Asio flammeus*)  
American Burying Beetle (*Nicrophorus americanus*)  
Iowa Skipper (*Atrytone arogos iowa*)  
Mottled Duskywing (*Erynnis martialis*)  
Married Underwing (*Catocala nuptialis*)  
Regal Fritillary (*Speyeria idalia*)  
Whitney Underwing (*Catocala whitneyi*)  
Bronzed Tiger Beetle (*Cicindela repanda*)  
Coppery Tiger Beetle (*Cicindela cuprascens*)  
Sandy Tiger Beetle (*Cicindela limbata limbata*)  
Sandy Stream Tiger Beetle (*Cicindela macra macra*)  
Big Sand Tiger Beetle (*Cicindela formosa formosa*)

**Plants**

Blowout Penstemon (*Penstemon haydenii*)



TABLE 2. Summary of suggested management for ghost tiger beetles in Nebraska. The following should be interpreted as general guidelines based on the best available knowledge at the time of this publication. See the Research and Conservation Strategies section of this document for more detail and Reference section for sources of additional information.

FOCUS	STRATEGIES	MITIGATION and CONSIDERATIONS
Investigate distribution and abundance	Survey and inventory dry, light-colored sandy sites during peak activity (i.e., July) at dusk or at night	Use an insect net for capture. Pitfall traps are not a very effective sampling method for strong-flying ghost tiger beetles.
Limit vegetative cover to maintain habitat for ghost tiger beetles	Clear vegetation from sandy areas by mechanical means, prescribed fire, and grazing. Burns should be avoided during the beetles' peak above-ground activity in summer.	Intense, prolonged disturbance could harm the beetle population. Response to herbicide treatments unknown.
Discourage heavy impacts and ATV use in areas inhabited by ghost tiger beetles	Post signage and restrict access in areas when feasible; engage in positive outreach to the local public and businesses	Threat from trampling and ATV use is highest during the summer months
Evaluate pairing management practices for ghost tiger beetles with those for Least Tern and Piping Plover	Survey for ghost tiger beetles on sand and gravel mine sites and sandbars, limit seasonal access, restrict ATV use, clear vegetation, etc.	There may be considerable overlap in distribution, habitat, temporal patterns of initiating reproduction/egg-laying and increased vulnerability amongst the species
Limit opportunities for ghost tiger beetles to be influenced by artificial lighting and stray into unsuitable conditions	Prioritize conservation actions on habitats well-removed from artificial night lighting. Choose locations in the Sandhills and rural areas.	Ghost tiger beetles may fly several km toward light sources

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