

## **Appendix G. Terrestrial Invertebrates Technical Team Report**

**Prepared by Matt Elliott**

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This list reflects persons who have participated in email, telephone, or in-person discussions related to the State Wildlife Action Terrestrial Invertebrates update. A subset of the list participated in a group discussion at the Wildlife Resources Conservation Center in Social Circle on February 27, 2014. Others participated via email, telephone conversation, or individual meeting.

### **Approach**

Terrestrial invertebrates are the most diverse taxon to be considered in Georgia's State Wildlife Action Plan (SWAP) update, but the most poorly understood. Most species of terrestrial invertebrate lack fundamental information on abundance, range, population trend, threats, or protection needs. Especially in the past there have been relatively few professionals familiar with these taxa in the Southeast from a conservation (as opposed to pest-reduction) perspective, and many species groups remain unrepresented in data that have been acquired. Since completion of the initial SWAP, the situation has improved for many taxa. Lepidoptera remain the best-studied order, and interest in this taxon has exploded in recent years especially amongst birders. In addition, groups such as ants, tiger beetles, and grasshoppers have also seen growing interest, and a growing body of information related to their abundance and conservation.

In the previous iteration of the SWAP in 2004, committee team members developed and refined a list of special concern terrestrial invertebrates for Georgia, but did not attempt to designate high-priority species. An abbreviated list of high-priority habitats was also compiled. In the

second SWAP iteration we put together for the first time a list of high-priority terrestrial invertebrates, refined the special concern list, and have expanded the list of high-priority habitats as well as developed a preliminary list of threats.

### **High Priority Species**

A number of species were recognized as high-priorities for conservation in Georgia. These are listed in the Table 1 and include species endemic to Georgia or with a similarly restricted range, narrow habitat requirements, declining populations, or significant threats (of either direct mortality or to habitat). More detailed information regarding individual species may be found in Section IV.

<b>Scientific Name</b>	<b>Common Name</b>	<b>Order</b>
<i>Cyclocosmia torreya</i>	Torreya trap-door spider	Areneae
<i>Habronattus sabulosus</i>	Jumping spider (Heggie's Rock)	Areneae
<i>Sphodros abbotii</i>	Purse-web spider	Areneae
<i>Alloblackburneus troglodytes</i>	Little gopher tortoise scarab beetle	Coleoptera
<i>Aphodius aegrotus</i>	A dung beetle	Coleoptera
<i>Aphodius alabama</i>	A dung beetle	Coleoptera
<i>Aphodius baileyi</i>	A dung beetle	Coleoptera
<i>Aphodius bakeri</i>	A dung beetle	Coleoptera
<i>Aphodius dyspistus</i>	A dung beetle	Coleoptera
<i>Aphodius gambrinus</i>	Amber pocket gopher Aphodius beetle	Coleoptera
<i>Aphodius hubbelli</i>	A dung beetle	Coleoptera
<i>Aphodius laevigatus</i>	Large pocket gopher Aphodius beetle	Coleoptera
<i>Aphodius pholetus</i>	Rare pocket gopher Aphodius beetle	Coleoptera
<i>Aphodius platypleurus</i>	Broad-sided pocket gopher Aphodius beetle	Coleoptera
<i>Aphodius tanytarsus</i>	Long-clawed pocket gopher Aphodius beetle	Coleoptera
<i>Chelyoxenus xerobatis</i>	Gopher tortoise hister beetle	Coleoptera
<i>Cicindela nigrrior</i>	Autumn tiger beetle	Coleoptera

<i>Crossidius grahami</i>		Coleoptera
<i>Euphoria aesusutosa</i>	Pocket gopher flower beetle	Coleoptera
<i>Geopsammodius ohoopee</i>		Coleoptera
<i>Hypothyce osburni</i>		Coleoptera
<i>Mycotrupes cartwrighti</i>		Coleoptera
<i>Mycotrupes lethroides</i>		Coleoptera
<i>Onthophagus polyphemi polyphemi</i>	Onthophagus tortoise commensal scarab beetle	Coleoptera
<i>Polyphylla donaldsoni</i>	Donaldson's lined june beetle	Coleoptera
<i>Bryophaenocladus chrissichuckorum</i>	Midge (Heggie's Rock)	Diptera
<i>Machimus polyphemi</i>	Gopher tortoise robber fly	Diptera
<b><i>Bombus affinis</i></b>	<b>Rusty-patched bumblebee</b>	Hymenoptera
<i>Bombus borealis</i>	Northern amber bumble	Hymenoptera
<i>Caupolicana electa</i>	Plasterer bee	Hymenoptera
<i>Dorymyrmex bossutus</i>		Hymenoptera
<i>Dorymyrmex bossutus</i>		Hymenoptera
<i>Pheidole davisii</i>		Hymenoptera
<i>Pheidolie davisii</i>		Hymenoptera
<i>Temnothorax_GA_01</i>		Hymenoptera
<i>Temnothorax_GA_01</i>		Hymenoptera
<i>Amblyomma tuberculatum</i>	Gopher tortoise tick	Ixodida
<i>Acronicta albarufa</i>	Albarufan dagger moth	Lepidoptera
<i>Amblyscirtes alternata</i>	Dusky roadside-skipper	Lepidoptera

<i>Amblyscirtes belli</i>	Bell's Roadside-skipper	Lepidoptera
<i>Amblyscirtes carolina</i>	Carolina roadside-skipper	Lepidoptera
<i>Amblyscirtes reversa</i>	Reversed roadside-skipper	Lepidoptera
<i>Atrytone arogos arogos</i>	Eastern Aragos Skipper	Lepidoptera
<i>Autochton cellus</i>	Golden-banded skipper	Lepidoptera
<i>Callophrys hesselli</i>	Hessell's hairstreak	Lepidoptera
<i>Callophrys irus</i>	Frosted elfin	Lepidoptera
<i>Catocala grisatra</i>	Grisatra underwing moth	Lepidoptera
<i>Chlosyne gorgone gorgone</i>	Gorgone checkerspot	Lepidoptera
<b><i>Danaus plexippus</i></b>	<b>Monarch butterfly</b>	Lepidoptera
<i>Erora laeta</i>	Early hairstreak	Lepidoptera
<i>Erynnis martialis</i>	Mottled duskywing	Lepidoptera
<i>Euphydryas phaeton</i>	Baltimore checkerspot	Lepidoptera
<i>Euphyes berryi</i>	Berry's Skipper	Lepidoptera
<i>Euphyes bimacula arbogastii</i>	Two-spotted Skipper	Lepidoptera
<b><i>Euphyes dukesi</i></b>	<b>Duke's Skipper</b>	Lepidoptera
<b><i>Euphyes pilatka</i></b>	<b>Palatka Skipper</b>	Lepidoptera
<i>Fernaldella georgiana</i>	Ohoopee Geometer	Lepidoptera
<i>Hesperia attalus slossonae</i>	Dotted skipper	Lepidoptera
<i>Hesperia meskei</i>	Meske's skipper	Lepidoptera
<i>Idia gopheri</i>	Gopher tortoise burrow noctuid moth	Lepidoptera
<i>Neonympha areolatus</i>	Georgia Satyr	Lepidoptera
<i>Neonympha helicta</i>	Helicta satyr	Lepidoptera
<i>Phyciodes batesii maconensis</i>	Tawny crescent	Lepidoptera
<i>Pieris virginiensis</i>	West Virginia White	Lepidoptera

<i>Poanes aaroni howardi</i>	Aaron's skipper	Lepidoptera
<i>Polites baracoa</i>	Baracoa skipper	Lepidoptera
<i>Polygona faunus</i>	Green comma	Lepidoptera
<b><i>Problema bulenta</i></b>	<b>Rare Skipper</b>	Lepidoptera
<i>Satyrium edwardsii</i>	Edwards hairstreak	Lepidoptera
<i>Satyrium kingi</i>	King's hairstreak	Lepidoptera
<i>Speyeria diana</i>	Diana fritillary	Lepidoptera
<i>Zale perculata</i>	Okefenokee zale moth	Lepidoptera
<i>Aptenopedes apalachee</i>		Orthoptera
<i>Eotettix palustris</i>		Orthoptera
<i>Floritettix borealis</i>		Orthoptera
<i>Hesperotettix floridensis</i>		Orthoptera
<i>Melanoplus acidocercus</i>		Orthoptera
<i>Melanoplus clypeatus</i>	Shield-tailed Spur-throat Grasshopper	Orthoptera
<i>Melanoplus longicornis</i>		Orthoptera
<i>Melanoplus nossi</i>		Orthoptera
<i>Melanoplus sp nov 1</i>		Orthoptera
<i>Melanoplus sp nov 2</i>		Orthoptera
<i>Melanoplus stegocercus</i>		Orthoptera
<i>Melanoplus tumidicercus</i>		Orthoptera
<i>Trimerotropis saxatalis</i>	Lichen or rock grasshopper	Orthoptera

### High priority habitats and sites

The range of terrestrial invertebrates is so diverse that they occupy nearly every conceivable niche on the planet. A number of studies have focused on rare or declining habitats (e.g. caves or pocket gopher mounds) and identified threatened or unusual terrestrial invertebrate species associated with those habitats. The SWAP list of priority terrestrial invertebrate habitats includes a number of these rare habitats but also a few more common types that contain exceptional diversity for some taxa.

***Coastal Plain (including both Southeastern Plains and Southern Coastal Plain)***

Sandhills – Longleaf pine/scrub oak woodlands and xeric Aeolian dunes were identified as high priority habitats in Georgia’s 2005 SWAP and they remain so. They are found on excessively-drained sandy soils found along the Fall Line (of Cretaceous age) or in Pleistocene aeolian deposits along rivers (such as Oohoopee Dunes), or Pleistocene marine sand deposits at the site of former barrier islands (such as Trail Ridge). Vegetation is usually dominated by longleaf pine, xeric oak species such as turkey oak, and wiregrass, little bluestem, and other herbaceous groundcover species. Because species have evolved to adapt to the relatively harsh conditions of these habitats, and because the habitats themselves are rather narrowly distributed across the landscape, a large number of high-priority animals and plants are found on sandhill habitats in Georgia and throughout the Southeast.

Lepidoptera and Orthoptera have probably been the best-studied taxonomic Orders of terrestrial invertebrates on sandhill habitats in Georgia, although they are by no means the only high priority taxa. Amongst the Lepidoptera, the following species are typically found on sandhills: *Acronicta albarufa* (Albarufan dagger moth), *Atrytone arogos arogos* (Eastern Aragos skipper), *Callophrys irus* (frosted elfin), *Catocala grisatra* (Catocala underwing moth), *Chlosyne gorgone gorgone* (Gorgone checkerspot), *Fernaldella georgiana* (Oohoopee geometer, endemic to Oohoopee Dunes Aeolian sandhills), *Hesperia attalus slossonae* (dotted skipper), *Hesperia meskei* (Meske’s skipper), and *Polites baracoa* (Baracoa skipper). Amongst *Orthoptera*, the following are associated with sandhills: *Melanoplus acidocercus*, *Melanoplus sp nov 1*, *Melanoplus sp nov 2*, and *Melanoplus stegocercus* (a Georgia endemic restricted to Oohoopee and Canoochee Aeolian dunes with one occurrence at Yuchi WMA). In addition, a number of Coleoptera, *Cicindela nigrrior* (Autumn tiger beetle), *Polyphalla donaldsoni* (Donaldson’s lined june beetle, restricted to Oohoopee Dunes), *Crossidius grahami* (Oohoopee Dunes endemic associated with woody goldenrod as a host plant), *Geopsammodius oohoopee* (another Oohoopee Dunes endemic), *Hypothyce osburni*, and *Mycotrupes lethroides* are restricted to sandhills, as is the globally rare plasterer bee *Caupolicana electa*. A couple of other priority species are restricted to gopher tortoise burrows (often, though not exclusively, a sandhills associate) and some potential priority species are restricted to pocket gopher mounds (also often, though not exclusively, associated with sandhills). These sub-habitats are discussed below. One more Lepidoptera, *Callophrys hesselli* (Hessell’s hairstream), is restricted to Atlantic white cedar swamps, themselves found nearly exclusively (except for one occurrence at Dixon State Forest) in drainages amongst sandhills.

Ants (Order *Hymenoptera*) are of particular interest in sandhill habitats. Many species are restricted to sandy soils and species diversity may be quite high. In particular, 76 species of ants, including some unusual ones, are known from Oohoopee Dunes Natural Area. Although not enough information is available at present to identify many specific high-priority ant species in Georgia, ants undoubtedly serve as excellent site-quality indicators for sandhills. That said, two ant sandhill specialists, *Dorymyrmex bossutus* and *Pheidolie davisii*, have been recommended as high priority. They have been found only at Big Hammock Natural Area and Oohoopee Dunes Natural Area, respectively.

Although these are discussed in more detail under the “Threats” section, sandhill habitats are threatened by conversion to other land uses that may not be compatible with maintaining viable populations of native flora and fauna, including terrestrial invertebrates. Beyond conversion, permanent changes in wildfire regimes necessitating prescribed burning have complicated management for sandhills. Previously wildfires would burn in a patchy manner, leaving canebrakes along drains and some examples of fire-intolerant species such as hawthorn (critical to *Catocala grisatra*, the Grisatra underwing moth) untouched. Patchy burns are more challenging for prescribed burners.

**Longleaf pine woodlands** – This habitat type might include both dry and mesic upland longleaf pine woodlands as well as lower-lying pine flatwoods (of both slash and longleaf pine). Examples are found throughout both the Southeastern Plains and Southern Coastal Plain, but are particularly noteworthy in the Red Hills around Thomasville, GA (Thomas, Brooks, Grady, and Decatur counties), and on military bases, especially Fort Stewart and Fort Benning. Longleaf pine woodlands are well-known for requiring fire to maintain an open understory, lush herbaceous groundcover, and low-density forest canopy. They may be found on an array of soils from sand to clay, between well-drained and poorly-drained, as distinguished from the excessively-drained sands of sandhill habitats.

High-priority terrestrial invertebrate species found in longleaf pine woodlands includes: *Amblyscirtes alternata* (dusky roadside-skipper), *Atrytone arogos arogos* (Eastern Aragos skipper), *Erynnis martialis* (mottled duskywing), *Aptenopedes apalachee*, *Eotettix palustris*, *Floritettix borealis*, *Hesperotettix floridensis*, *Melanoplus clypeatus* (Shield-tailed spur-throat grasshopper, a Georgia endemic), *Melanoplus tumidicercus* (also a Georgia endemic), and *Mycotrupes cartwrighti* (a flightless scarab beetle). Longleaf woodlands with intact groundcover that have escaped tillage have also been found to be important to a number of ant species, though there is not enough information at present to identify high-priority ants.

**Freshwater marsh** – A significant number of high-priority Lepidoptera species are associated with fresh- or brackish-water marsh habitats found along coastal rivers (particularly larger examples such as the Altamaha or Savannah), other wet near-coastal environments, and in larger basin swamps, such as the Okefenokee. These marshes are dominated by emergent and submerged herbaceous vegetation of varying species.

Lepidoptera associated with freshwater marshes include: *Euphyes berryi* (Berry’s skipper), *Euphyes bimacula arbogastii* (Two-spotted Skipper), *Euphyes dukesi* (Dukes’ skipper), *Euphyes pilatka* (Palatka skipper), *Neonympha areolatus* (Georgia satyr), *Poanes aaroni howardi* (Aaron’s skipper), and *Problema bulenta* (rare skipper). Dukes’ skipper, the Palatka skipper, and the rare skipper have all been petitioned for federal listing.

Although legally protected under the Clean Water Act, freshwater marshes are still under some threats, including sea level rise due to climate change, and potentially due to saltwater intrusion from harbor deepening/dredging.

**Pocket gopher burrows** – A “micro-habitat” of sorts, these mounds are built by the Southeastern pocket gopher *Geomys pinetis*, itself a high-priority, State Threatened species in Georgia. Pocket gophers tunnel in loose, sandy or loamy soil at scattered locations across the

Coastal Plain. When they surface they push small mounds of dirt to the side. Their burrows are similar to a miniature cave system. A colonial species, Southeastern pocket gophers are often associated with longleaf pine savannas or sandhill habitats, though they are not restricted to these areas – they also often occur in pastures or are distributed along roadsides. They have demonstrably declined in Georgia in recent years, disappearing from a number of localities where they were once known.

A number of invertebrate species may be associated with pocket gopher burrows. At least 11 species of *Aphodius* (scarab, dung-eating) beetles, as well as one *Euphoria* species, are restricted to them, including some that were recently described. These species generally have G-ranks in the G2G3 range, and deserve consideration for high-priority status, especially since declines have been documented for pocket gophers across much of the Coastal Plain.

**Gopher tortoise burrows** – The gopher tortoise, *Gopherus polyphemus*, is found across the Georgia Coastal Plain in open pinewoods, sandhills, and dry flatwoods. It is a high-priority species, is listed as Threatened by the State, and is an official federal Candidate species for listing under the Endangered Species Act. Populations of tortoises, though still robust in many places, have demonstrably declined greatly from pre-European-settlement levels, and continue to be threatened primarily due to habitat loss. Individual gopher tortoises dig several burrows across their home range. The burrows usually have a wide sandy “apron” nearly devoid of vegetation, and may be up to 40 feet in length (though usually less than half that).

A wide array species are known as gopher tortoise “commensals”, being frequently found in association with tortoise burrows. Tortoise commensals include invertebrates, from the wide-ranging camel crickets to several that can be considered obligates. The latter group includes the gopher tortoise tick *Amblyomma tuberculatum*, found on the tortoise itself, as well as a dung-eating scarab *Onthophagus polyphemi polyphemi*, the little gopher tortoise scarab beetle *Alloblackburneus troglodytes*, the gopher tortoise hister beetle *Chelyoxenus xerob* *Atis*, a gopher tortoise robber fly *Machimus polyphemi*, and the gopher tortoise burrow Noctuid moth *Idia gopheri*. Although these species are at least as rare as the tortoise itself, their distributions are poorly known, and further surveys should be a priority.

### ***Southwestern Appalachians/Ridge and Valley***

**Caves and rock outcrops** – With funding from the Georgia Nongame tag a five year project exploring the caves of Georgia was begun in 1998, following up on previous work conducted by Kurt Buhlman. Some of these caves were previously known to house rare mammals such as Gray Myotis (*Myotis sodalis*) and rare amphibians such as Georgia Blind Salamander (*Haideotriton wallacei*). What was not well known was the invertebrate fauna that would be encountered. By collecting and limited trapping in 43 of the nearly 500 known caves in Georgia, eleven undescribed species of terrestrial invertebrate were encountered (Reeves et al. 2000). Six of these were new to science and one, a centipede, represents a new genus. Distributions and rarities of most invertebrate cave fauna are poorly understood, and vary widely even on very local levels.

Caves and rock outcrops can be completely destroyed by mining activities, which are becoming increasingly common in this region. Forest moisture required by terrestrial invertebrates may be compromised by significant logging or land clearing operations. Water quality of subterranean streams may be threatened by septic tanks and other sources of toxins from upslope developments.

***Mountains (including Blue Ridge, Ridge and Valley, and Southwestern Appalachians) and Piedmont***

Mesic hardwoods – Hardwood forests dominated by oaks, hickories, maples, yellow-poplar, beech, and other deciduous trees are common throughout Georgia, especially in the northern part of the state. Often they are associated with riparian areas, which affords them some legal protection (stream buffer ordinances), though not always. Some hardwood forests contain stands of river cane. Particularly in metropolitan Atlanta hardwood forests may be threatened by conversion to residential or other urban land use.

Hardwood forests are important habitat for a wide array of high-priority plant animal species in Georgia, including terrestrial invertebrates. High-priority species associated with these habitats include: *Amblyscirtes belli* (Bell's roadside-skipper), *Amblyscirtes carolina* (Carolina roadside-skipper), *Amblyscirtes reversa* (reversed roadside-skipper), *Erora laeta* (early hairstreak), *Euphydryas phaeton* (Baltimore checkerspot), *Pieris virginiensis* (West Virginia white), *Polygonia faunus* (green comma), *Speyeria diana* (Diana fritillary), and *Melanoplus longicornis*. Hardwood forests also have exceptionally high diversity of leaf litter-dwelling *Strumigenys* ants and likely litter-dwelling beetles.

***Piedmont***

Granite outcrops – The Piedmont ecoregion of Georgia contains many large exposed areas of granitic rock with sparse vegetation. These granitic exposures are typically flat, though not always. Due to the extremely harsh environments found on the surface of granite outcrops, they have a large number of endemic or nearly endemic species. Granite outcrops do not lend themselves to many land uses, but a very large number of them have and continue to be quarried for gravel, and recreational abuses (including vandalism) and illegal dumping plague many sites. The rock or lichen grasshopper *Trimerotropis saxatalis* is restricted to granite outcrops across its range. Known from only three locations in Georgia, it may occur on others but has not been adequately surveyed. Recently two very rare species were discovered on Heggie's Rock in Columbia County, GA: a jumping spider *Habronattus sabulosus*, and a midge *Bryophaenocladus chrissichuckorum* (only known from Heggie's Rock at present). It is quite likely that a number of other unusual invertebrate species will be found on other granite outcrops with increased surveys.

**Threats to Terrestrial Invertebrates**

The Terrestrial Invertebrates Taxa Team reviewed threats to high-priority species and habitats. Different species may face somewhat different sets of circumstances, but some of the most important threats overall are summarized below.

**Conversion to Agriculture or Silviculture** – This threat was mentioned for more species than any other. It is particularly acute for longleaf pine, sandhills, and other natural pine-dominated habitats. Conversion of these communities to agricultural fields or industrial silviculture is still taking place. Although planted pine stands may retain some canopy tree species, the loss of diverse herbaceous groundcover and shrub species may be extremely deleterious for invertebrate species that depend on particular plant hosts. In many agricultural fields application of broad spectrum herbicides eliminates formerly widespread host plants, and insecticides are suspected in declines of a number of bumblebees and other native pollinators.

**Altered Fire Regimes** – This threat was also mentioned for many priority species, especially those found in natural pine-dominated habitats or sandhills. Before widespread European settlement of Georgia and the Southeastern United States, large wildfires would spread across the landscape at frequent intervals, with a complex patchwork of fire effects, clearing the underbrush and woody shrubs in many areas but leaving others relatively intact. Today wildfires are nearly nonexistent (at least the uncontrolled variety) and the remaining fire-dependent habitats are maintained via prescribed burning. Although fire is absolutely essential to the maintenance of a large number of Georgia's priority habitats (and by extension, species), the complex mosaic of fire effects is equally important to many invertebrate species. This creates a challenge for prescribed burners in ensuring adequate burning to manage for species that require fire maintenance over large acreages, while also keeping that complex mosaic.

**Altered Hydrology** – This threat was noted for a number of Lepidoptera species associated with freshwater marsh habitats. Significant dredging could result in changes in salinity that could completely alter marsh ecosystems. An even more widespread threat is sea level rise due to climate change. Although marshes may migrate up river systems, the speed of sea level rise and ability of the marshes to migrate is in some doubt. Salinity changes due to sea level rise have the potential to largely eliminate the freshwater marsh ecosystem in Georgia.

**Global Warming/Climate Change** – As noted above, this threat has the potential to affect species found in freshwater marsh ecosystems (primarily butterflies). In addition, some species found in the Blue Ridge Mountains, especially those near the southern end of their range, may be impacted. Similar to the situation along the coast, communities or host plants may not be able to migrate upslope quickly enough as their current habitat/elevation range becomes unsuitable, or there may simply be no place for them to move up to.

**Residential Development** – This threat is lower at present than in 2005 due primarily to the economic downturn, but could return at any time. It is particularly acute in the northern part of the state (Piedmont and Blue Ridge especially) and in near-coastal areas. Residential development may not result in complete conversion of a habitat but often renders it unsuitable for priority species.

**Incompatible Mining/Mineral Extraction** – This threat is most pronounced for sandhills and granite outcrop-obligate species. Sand and kaolin mines along the Fall Line and elsewhere in the Coastal Plain, and gravel quarries on the Piedmont may result in complete alteration of habitats, though they usually cover smaller acreages than some of the other threats.

**Poaching or Commercial Collecting** – These activities, as well as excessive scientific collecting, have the potential to negatively impact some species, especially butterflies and tiger beetles (both very attractive to collectors). At present terrestrial invertebrates receive no protection from over-collection in Georgia.

### **High Priority Species Conservation Actions**

**State Listing of Species** – Twelve terrestrial invertebrate species have been proposed by the Taxa Team for state listing as protected species. This list includes nine butterflies, one moth, one grasshopper, and a tiger beetle. These species have been demonstrated to be under significant threat due to overcollecting, habitat loss, or restricted range. At present there are no terrestrial invertebrates protected by state law in Georgia. Protected status would confer some protection to their habitats on state lands, and require permits for their collection.

**More Inventory** - Although the pace of terrestrial invertebrate work has picked up greatly since 2005, there are still significant gaps and our knowledge of this taxonomic group is still well behind any other being considered in the SWAP. Lepidoptera and Orthoptera have received the most attention in Georgia but all taxa need work. In addition, a broader array of habitats across the state needs to be sampled in a somewhat systematic fashion.

**Updates to Biotics** - Even with recent survey efforts, there is still a lot of information that has been collected that has not made it into Biotics, our rare species tracking database. Our Biotics database allows us to make better conservation planning decisions by bringing rare species knowledge into a spatial format, and at present terrestrial invertebrates are not receiving the consideration they should.

**Terrestrial Invertebrates as Indicators of Habitat Quality** – A number of taxa, including ants, may as a group make excellent indicators of habitat quality. An Index of Biotic Integrity (IBI) incorporating characteristic, rare, and invasive species could be developed, particularly for sandhill habitats.

**Terrestrial Invertebrate Zoologist** – There is potentially a large volume of work on terrestrial invertebrate conservation in Georgia. We are a large, diverse state with relatively little previous inventory and a large backlog of data entry/management needs. Currently there are no terrestrial invertebrate experts on the staff of Georgia’s Nongame Conservation Section. Adding a Biologist to fill this role would improve our data and survey efforts, and free up other staff to work on other priorities. Funding would need to be secured.

**Monarch Butterfly** – The monarch butterfly (*Danaus plexippus*) is presented here as a special case. Still relatively common in comparison to the species listed as “high-priority” above, nonetheless the monarch is in trouble, with overwintering populations in Mexico having declined up to 90% from historic population levels (Monroe et al. 2015). It has recently been petitioned for listing under the ESA. The monarch is currently ranked as a G4 species. The importance of monarchs in Georgia to the overwintering populations in Mexico is not known, although at least some make the annual migration. In addition, efforts should be made to identify over-wintering sites for the monarch in Georgia. It is probably deserving of an S4 rarity rank in Georgia.

The monarch has received a great deal of attention in the popular press from a large number of groups across the nation. There is potentially a significant source of funding directed at the monarch to improve habitat for it and other “pollinators.” Such habitat improvements could have great benefit for other terrestrial invertebrate species, especially if efforts are directed at native plant species and habitats. Georgia’s State Parks Division is considering a number of state lands for pollinator plantings, and the Nongame Conservation Section will provide technical assistance.

**Other Native Pollinators** – In addition to the monarch, a number of other native pollinators are either known or suspected to have undergone drastic population declines in recent years. One group under particular stress appears to be native bumblebees. The rusty-patched bumblebee (*Bombus affinis*), once common throughout its range across the eastern United States, has apparently disappeared from over 90% of sites (Colla and Packer 2008), and now has a global rarity rank of G1. Its status in Georgia is unknown, although it is thought to be extirpated. Many other native bee species are also thought to have declines, but their status in Georgia is barely known, if at all. Inventory is acutely needed, and eventually a more complete review of the conservation status of the taxa. Reasons for declines are not completely clear, but are thought to include disease, loss of preferred host plants, and overuse of insecticides. Native pollinator habitat efforts for the monarch noted above would no doubt also provide help for bumblebees and other declining species.