Over 100 years ago, H.G. Hubbard discovered unique species of insects living in gopher tortoise burrows in Florida and Georgia, and similar burrows in California. Hubbard also studied pocket gopher burrows where he discovered over 60 species, many of them previously unrecorded, in the U.S. southeast. Hubbard’s research has been continued by Dr. Peter Kovarik and Dr. Paul Skelly, who have discovered a number of new insect species in the last decades. This study focuses on the U.S. southeast (Florida, Georgia, Alabama) but the research is expanding to other areas in the U.S., Mexico, and Central America.

Southeastern Pocket Gopher

The Southeastern Pocket Gopher (Geomys pinetis) has been described as a “harmless, beligerent savage.” It is found in Alabama, Florida, and Georgia. The pocket gopher has powerful front legs, claws and endless-like teeth for digging through soil and rock. Their nest burrow systems are also adobe to their subterranean habitat. They are tan to grey in color and range in length from 9-12 inches including tail. Pocket gophers get their name from their burrowing habits. Pocket gopher habitat is distinct and pocket gophers burrow in the vegetation and the insects that dwell in them.

Pocket Burrow Architecture

Animal burrows provide a unique environment which insect species have evolved. Burrow dwelling insects store some similar traits with our dwelling insects, such as underdeveloped vision and loss of pigment, but they are a distinct group of species. In particular, the symbiotic relationship between the insects and gophers is unique: the gophers provide habitat for the insects, including a constant temperature, shelter, and food (gopher dung). The insects process gopher dung in the burrows, providing a service to the gophers.

The Insects: Kovarik and Skelly Field Work

Sampling in the burrows of the southeastern pocket gopher was conducted during the 1990’s by Skelly and Kovarik. The unexpected discovery of several new species of beetles precipitated an extensive survey of insects within the entire range of the pocket gopher in Florida, Georgia and Alabama regions. While all insects collected in the burrows were preserved for study, the focus group for this study were scarab beetles, tiger beetles, and carabid beetles (mole crickets). The survey (ending in 2002) resulted in the discovery of additional species new to science and substantially increased the known distributions of described species. Some of the beetles were extremely common, widespread, and known to occur in the burrows of other species of pocket gophers in areas west of the Mississippi River. Other beetles were far less common, endemic to the southeast, and mainly confined to isolated locations of pocket gopher or gopher tortoise sand terrace. It is currently thought that each burrow type or burrow system may be inhabited by a unique assemblage of beetles.

Some of the southeastern burrow insects have close relatives in the Great Plains and this connection may indicate a migration event that happened during the last maximum glacial period. Each of the southeastern reliefs has an intriguing distribution pattern that likely stems from dynamic salination processes that occurred over thousands of years.

Preliminary Results and Future Research

Field Data Collection: Iowa

To understand pocket gopher habitat and the methods for collecting the burrow-dwelling insects, Kovarik traveled to Iowa to study sites in Iowa. Iowa’s soils currently are primarily prairies with limited human activity, with the exception of southern Iowa where gopher activity was present. The soils ranged from very sandy to moderately sandy in composition. Locations with recent heavy rains showed little gopher activity. The periodic burning of surface vegetation at several sites did not affect the long term health of known gopher populations.

Insect collection: Iowa samples were collected in the burrows by using a ‘bag a gopher fees and sugar mixture’ to lure the insects into the burrows, where a pitfall trap containing ethylene preservatives the specimens. Traps are left out for two weeks to ensure an accurate sample.

Current Research

Collecting burrow-dwelling insects is a significant challenge. Just as difficult is locating the gopher burrows. Historical records of burrows locations can be gathered from earlier field research, local knowledge (farmers) or fieldwalking (depending on inadvertent discovery of burrow complexes). Mapping and Geographic Information Systems (GIS) offer the potential for a more systematic and comprehensive approach to locating the gopher burrows. Maps of potential pocket gopher habitat can guide and focus fieldwork seeking additional burrow networks and the insects that dwell in them.

GIS Data Relevant to Pocket Gopher Habitat

Location, acclimating, processing and using GIS data corresponding to pocket gopher habitat is a complex and difficult process. Key data sources include: pocket gopher habitat

U.S. General Soil Map: Compiled by the U.S. Department of Agriculture. Data are grouped by state and are downloadable. The soil surveys provide GIS data with detailed soil characteristics in an ArcGIS database. Map data, right.

Web Soil Survey: Used in conjunction with the General Soil Map to compile detailed soil reports at the county level corresponding to individual soil types identified through the soil data. Mnner correlations to be made between soil types based on characteristics such as soil depth, composition, and drainage.

U.S. Geological Survey Digital Elevation Model & Contour Elevations: Digital elevation data has been useful for locating ancient sand ridges believed to be an important factor in gopher burrow generation and their locations.

Other Data: including terraces, escarpments, land use / land cover, climate, vegetation, etc. will be used in this research program.

Preliminary Results and Future Research

Once the involved task of assembling appropriate GIS data is complete, my multidisciplinary approach can begin. Kovarik and Skelly are presented with methods that help understand the spatial environmental characteristics of their samples, while also being able to predict potential area for future sample collection.

Project Abstract: Several distinct symbiotic associations with pocket gophers in their burrows. New species of burrow-sharing insects continue to be identified through fieldwork. A significant challenge is locating pocket gopher burrows. Mapping and Geographic Information Systems (GIS) is promising approach to locating gopher burrows by modeling the environmental factors favorable to burrow construction. Pocket gopher chooses particular habitats: wet, low-lying areas are usually saturated, while higher elevation well-drained areas trap pockets. GIS can be used to analyze pedologic, soil and physiographic data to determine particular areas suitable for pocket gopher burrows. The result, maps of potential pocket gopher habitats and the location of burrow complexes, allows fieldwork to proceed in the known pocket gopher burrow complexes. The nature of this research involves the coalescence of many disciplines. In addition to enhancing our understanding of the field of entomology, biology, GIS, ecology, soil science, others must be brought together. There is much to be gained by using GIS in such research, with the caveat that data collection and processing is time consuming and labor intensive.