

OFFICE OF RESOURCE CONSERVATION

State of Illinois

GRANT AGREEMENT

PROJECT NUMBER: T-32 P-1

PROJECT TITLE: A quantitative survey of land snail diversity across multiple habitat types in southern Illinois

OBJECTIVES

Job 1. Collect land snails throughout the six southwestern border counties of Illinois.

- 1.1. Survey land snails on federal and state lands throughout southwestern Illinois.
- 1.2. Compare utility of sampling techniques for assessing land snail diversity/abundance.

Job 2. Sort and identify land snails in the laboratory and distribute sampled land snails to appropriate state repositories.

- 2.1. Sieve soil/litter samples from sites.
- 2.2. Sort land snails by morphospecies initially; later identify to genus/species.
- 2.3. Distribute land snail collections to appropriate repositories.

Job 3. Record data and assess correlations between environmental variables and land snail species richness and abundance.

- 3.1. Record data in spreadsheets.
- 3.2. Analyze land snail data to test for correlations with environmental variables.
- 3.3. Provide results to IDNR to assist with conservation plan development.

EXPECTED RESULTS OR BENEFITS

Surveys of carbonate habitats in southern Illinois are likely to reveal sites with high levels of land snail species richness, and will probably result in new state records for some species, particularly microsnails. Tattersfield (1996) concluded that sites of <10 hectares with 24 or more land snail species are rare enough to be of global conservation concern. Nekola's (1999) preliminary work revealed three sites with more than 24 land snail species in the counties that I propose to survey. Thus, these habitats (and others that have yet to be surveyed) could constitute biological resources of global significance that are unique in Illinois.

It is also possible that a survey of the land snails of the southwestern counties of Illinois will reveal species new to science. In fact, a new species was recently described from material collected in southern Illinois—Fults Reserve, Monroe County, Illinois is the type locality of *Gastrocopta rogersensis*, a vertiginid microsnail (Nekola and Coles, 2001).

All data generated by this project will be delivered in hard copy and electronic formats to the Illinois Department of Natural Resources and will be made available to the public via the Internet on a web page based on the College of Science server at Southern Illinois University-Carbondale after publication. The findings from the two-year study will be summarized in a final report to be submitted with the data in hard copy and electronic versions to the Illinois DNR.

Other material results from this project will include 1) at least one publication (with student research assistants as coauthors) in a peer-reviewed journal such as *Malacologia*, *American Midland Naturalist* or *Southeastern Naturalist*, 2) a species list of macro- and microsnails of southwestern Illinois, 3) a voucher collection that would be deposited at the Illinois Natural History Survey and/or Field Museum of Natural History, 4) a collection of frozen or ethanol-preserved snails to be housed at Southern Illinois University for future genetic analyses and possibly 5) a key to the land snails of southwestern Illinois and 6) descriptions of any new species found in the surveys. The project would also result in the training of at least two students in land snail field sampling protocols, laboratory procedures, species identification and vouchersing methods. The proposed research would form the basis of a master's thesis project and perhaps an undergraduate honors thesis at SIU.

APPROACH

Job 1. Collect land snails throughout the six southwestern border counties of Illinois.

Surveys will take place at multiple sites in the southwestern Illinois border counties of Alexander, Union, Jackson, Randolph, Monroe and St. Clair (Figure 1; see also the **Location** section for more detailed maps of proposed survey sites). Survey efforts will be undertaken on protected state and federal lands and will focus on limestone cliffs or glades, but several habitats will be surveyed in an effort to recover species with unusual habitat preferences (Nekola, 1999). To assess land snail species richness, researchers have recommended timed searches, sampling and sorting of constant volumes of leaf litter or litter+soil (Emberton 1995; Emberton et al., 1996; Nekola, 1999) and deployment/recovery of cardboard sheets (Hawkins et al., 1998). During the first several months of the survey, all three of these sampling methods will be compared. At each sampling site, four 10 m x 10 m replicate plots will be searched for land snails for one half-hour each by two collectors, four leaf litter/soil samples of constant volume (4 liters each) will be collected, and cardboard sheets will be deployed. Sample collection areas will be focused on microhabitats of high probable micromollusk diversity, if such areas are available at the survey site. Surveys will begin in late August 2006 and will be completed in May 2008. Field work will generally not be performed during December and January. Four timed searches, cardboard sheets and litter/soil samples per site will allow an assessment of intersample variability, while allowing a large number of sites and habitats to be surveyed. Comparisons among the three sampling methods will allow a final sampling strategy to be chosen. The preferred method will maximize the number of species and individuals recovered per unit sampling effort. If the sampling methods are found to complement one another, two or more methods may be used throughout the survey. GPS coordinates of the survey site will be recorded, along with soil moisture measurements, soil calcium and pH measurements, sampling

date, time and weather conditions, predominant plant species. Digital photos will be taken at each site.

Job 2. Sort and identify land snails in the laboratory and distribute sampled land snails to appropriate state repositories.

Leaf litter and soil samples will be sieved to recover land snails in the laboratory. Land snails will be hand-picked from sieved samples and sorted initially by morphospecies and to genus/species later using standard land snail keys (perhaps with assistance from land snail researchers at the Field Museum of Natural History or the Carnegie Museum of Natural History). Most large live snails will be frozen at -80 degrees C and later removed from their shells. Small snails and soft tissues from large snails will be preserved in 90% ethanol; shells will be dried and retained in vials. All specimens will be labeled by sampling site, collection method and collection date. Sorting of samples will be done throughout the two-year duration of the project, particularly December and January (when weather conditions are not favorable for land snail collection). Specimens will be deposited at the Illinois Natural History Survey and/or the Field Museum of Natural History.

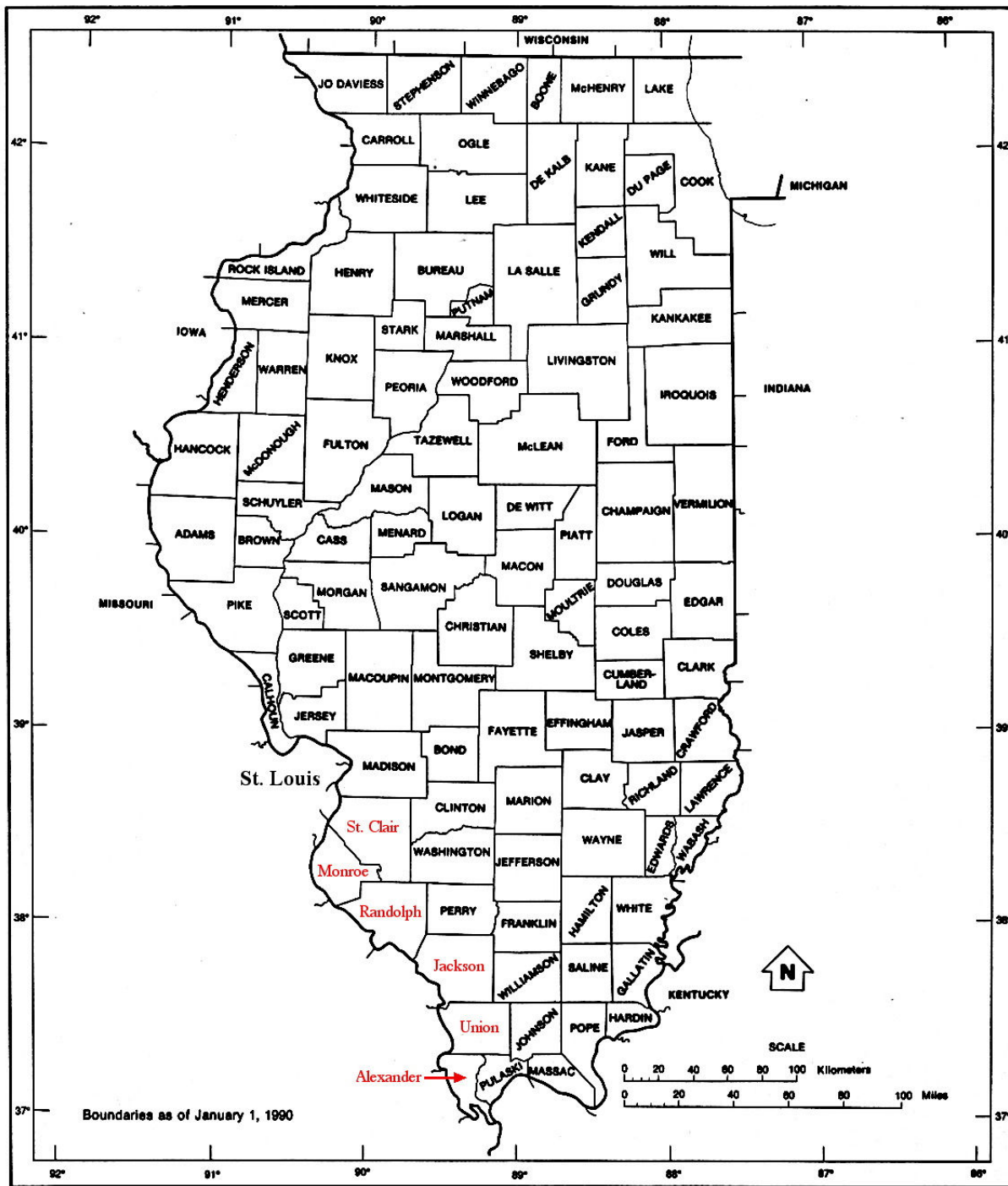
Job 3. Record and distribute data, assess correlations between environmental variables and land snail species richness and abundance, produce reports and publish findings.

Habitat and land snail distribution and abundance data will be recorded throughout the two-year duration of the project, and will consist of maps of sampling sites and Excel spreadsheets containing 1) sampling site presence/absence data for all land snail species found across all sites and 2) abundance data (numbers of individuals/empty shells encountered or collected) at all sites, with appended environmental data.

LOCATION

The surveys will be performed at several sites throughout the six southwestern border counties of Illinois. Forested carbonate cliff and limestone outcrop sites will be the focus of attention, as these will likely harbor the highest concentration of land snails (both in terms of abundance and species diversity). Other habitats—including open fields and forested areas that are not associated with high-calcium soils—will also be sampled for comparative purposes and to detect species with unusual habitat preferences. Surveys will be performed in all state forests, fish and wildlife areas, nature preserves and recreation areas overseen by the Illinois Department of Natural Resources within the six counties, as well as Shawnee National Forest areas (including the Larue-Pine Hills/Otter Pond RNA) (please see Table 1 and Figures 2-7 below). Precise survey sites within these natural areas remain to be determined; GPS coordinates and detailed location information for all survey sites will be recorded to allow the survey to be repeated in the future. Permit applications have been submitted for land snail survey work in all IDNR-administered and USDA Forest Service-administered areas.

Counties



U.S. DEPARTMENT OF COMMERCE Economics and Statistics Administration Bureau of the Census
MAPS

ILLINOIS G-1

Figure 1. Map of the state of Illinois, showing the six southwestern border counties (St. Clair, Monroe, Randolph, Jackson, Union and Alexander, in red) where the proposed surveys will be undertaken. More detailed maps of these counties can be found in the **Location** section (see below).

Survey Site	County	Administration
Berryville Shale Glade Nature Preserve (A)	Union	Illinois DNR
Brown Barrens Nature Preserve (B)	Union	Illinois DNR
Fern Rocks Nature Preserve (C)	Jackson	Illinois DNR
Fogelpole Cave Nature Preserve (D)	Monroe	Illinois DNR
Frank Holten State Recreation Area (E)	St. Clair	Illinois DNR
Fults Hill Prairie Nature Preserve (F)	Monroe	Illinois DNR
Giant City State Park (G)	Jackson	Illinois DNR
Horseshoe Lake Nature Preserve (H)	Alexander	Illinois DNR
Horseshoe Lake State Fish and Wildlife Area (I)	Alexander	Illinois DNR
Illinois Caverns State Natural Area (J)	Monroe	Illinois DNR
Julius J. Knobeloch Woods Nature Preserve (K)	St. Clair	Illinois DNR
Kaskaskia River State Fish and Wildlife Area (L)	Monroe/Randolph/St. Clair	Illinois DNR
Kidd Lake Marsh State Natural Area (M)	Monroe	Illinois DNR
Lake Murphysboro State Park (N)	Jackson	Illinois DNR
Marissa Woods Nature Preserve (O)	St. Clair	Illinois DNR
McClure Shale Glade Nature Preserve (P)	Union	Illinois DNR
Ozark Hills Nature Preserve (Q)	Union	Illinois DNR
Peabody River State Fish and Wildlife Area (R)	St. Clair	Illinois DNR
Piney Creek Ravine Nature Preserve (S)	Jackson/Randolph	Illinois DNR
Randolph County State Recreation Area (T)	Randolph	Illinois DNR
Stemler Cave Woods Nature Preserve (U)	St. Clair	Illinois DNR
Turkey Bluffs State Fish and Wildlife Area (V)	Randolph	Illinois DNR
Trail of Tears State Forest (W)	Union	Illinois DNR
Union County State Fish and Wildlife Area (X)	Union	Illinois DNR
Shawnee National Forest Sites		
Clear Springs (1)	Jackson	US Forest Service
Fountain Bluff (2)	Jackson	US Forest Service
Johnson Creek Recreation Area (3)	Jackson	US Forest Service
Larue-Pine Hills Ecological Area/RNA (4)	Union	US Forest Service
Little Grand Canyon (5)	Jackson	US Forest Service
Ripple Hollow (6)	Union	US Forest Service

Table 1. List of proposed survey sites arranged alphabetically by name. Number and letter codes in parentheses refer to approximate locations on the maps shown in Figures 2-7.

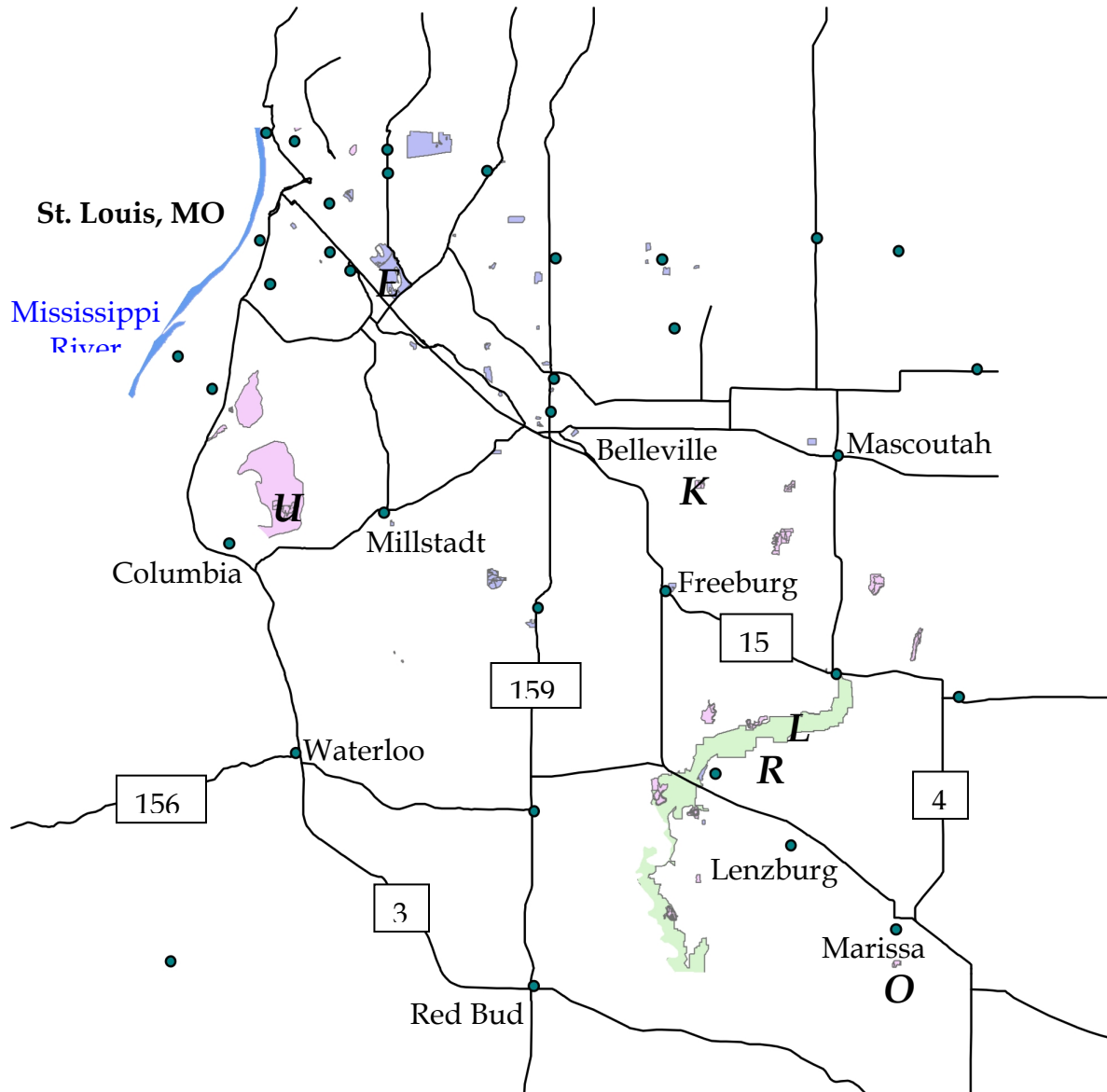


Figure 2. Map of St. Clair and northern Monroe Counties, Illinois, denoting several areas where the proposed surveys will be undertaken. Key features (some towns, rivers, and major roads) have been highlighted. Green points denote cities, towns or villages; black lines are highways or major roads. See codes in Table 1 for names of survey sites.

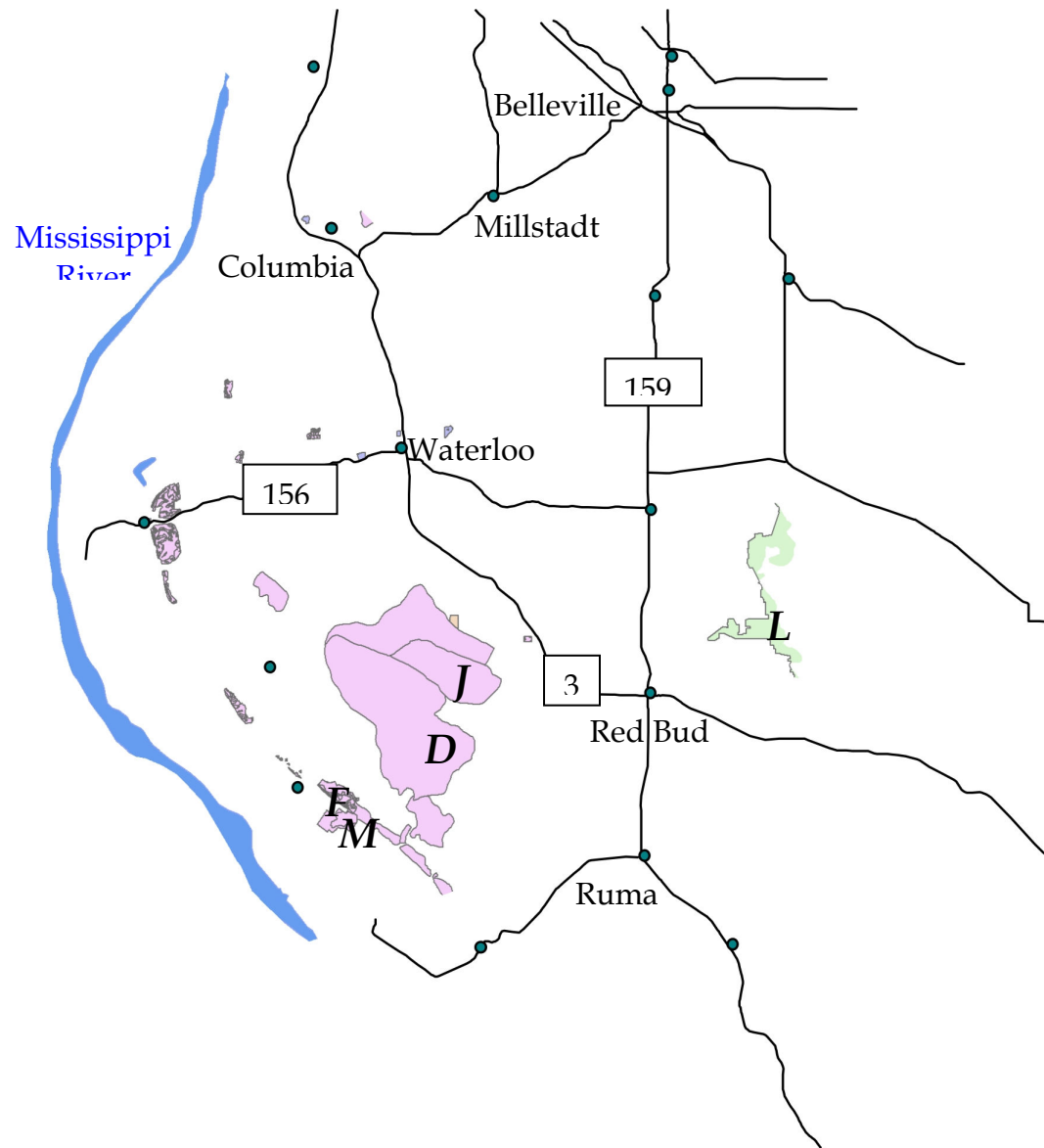


Figure 3. Map of southern St. Clair County, Monroe County and northwestern Randolph County, Illinois, denoting several areas where the proposed surveys will be undertaken.

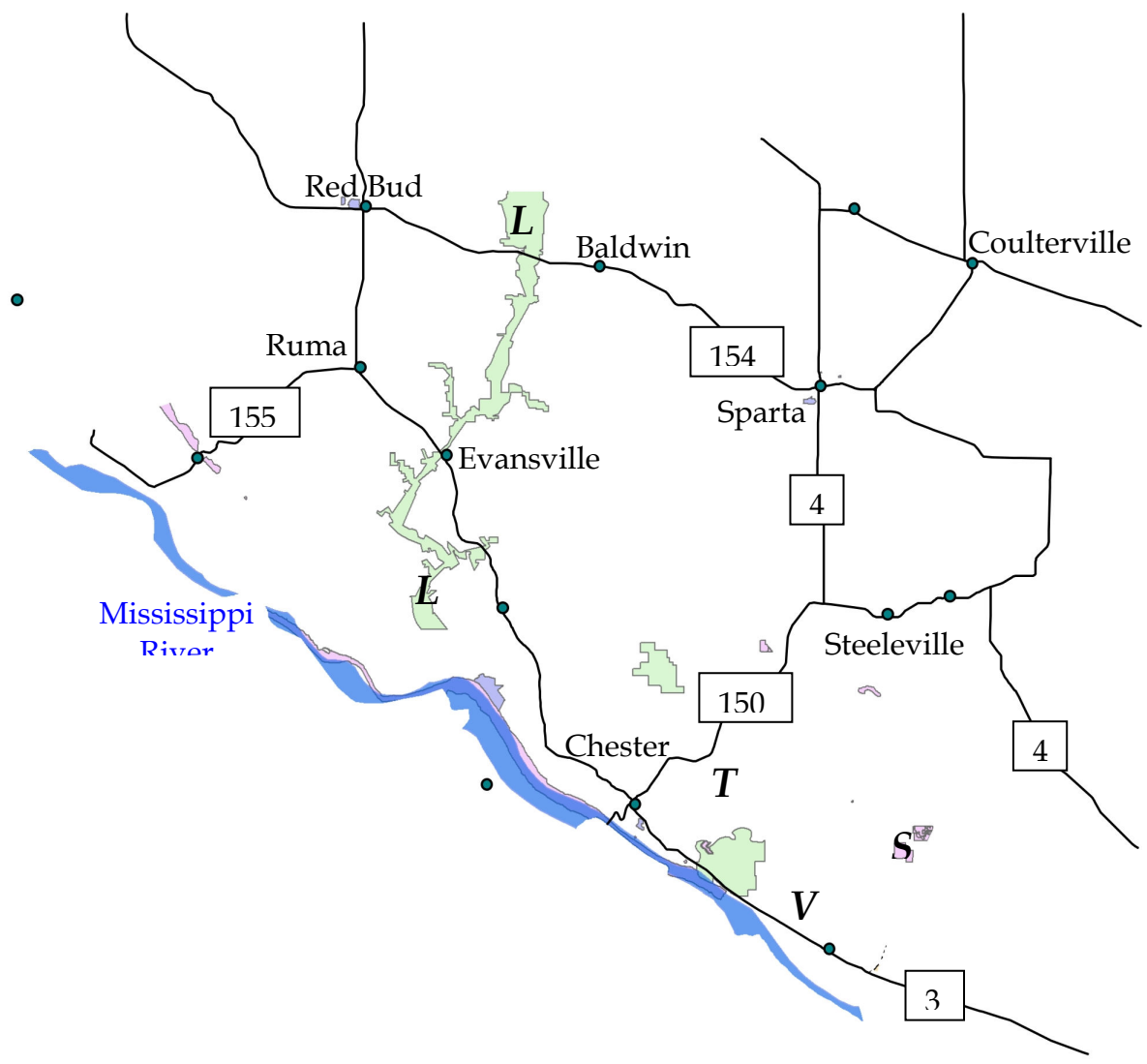


Figure 4. Map of Randolph County, Illinois, denoting several areas where the proposed surveys will be undertaken.

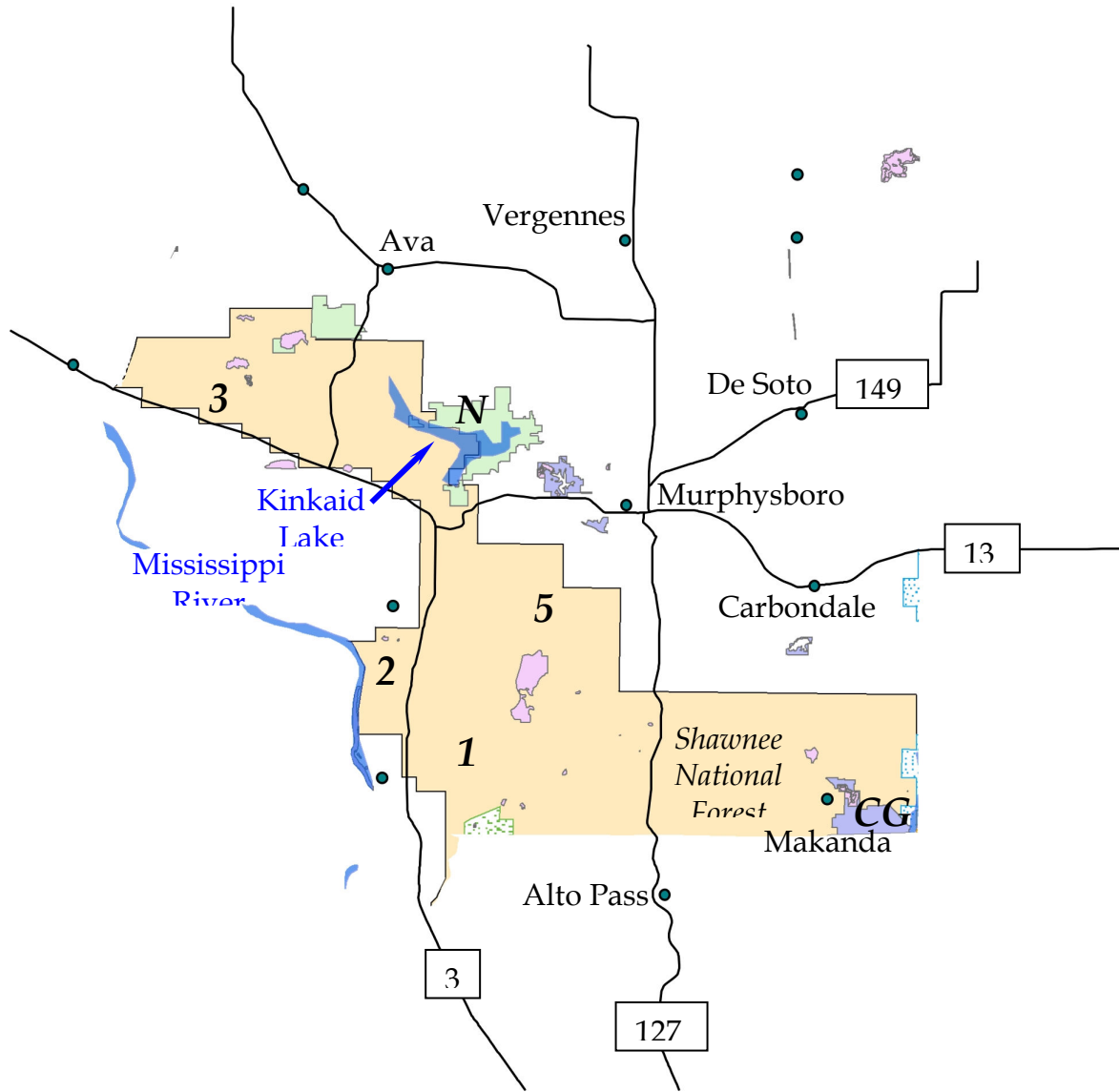


Figure 5. Map of Jackson County, Illinois, denoting several areas where the proposed surveys will be undertaken.

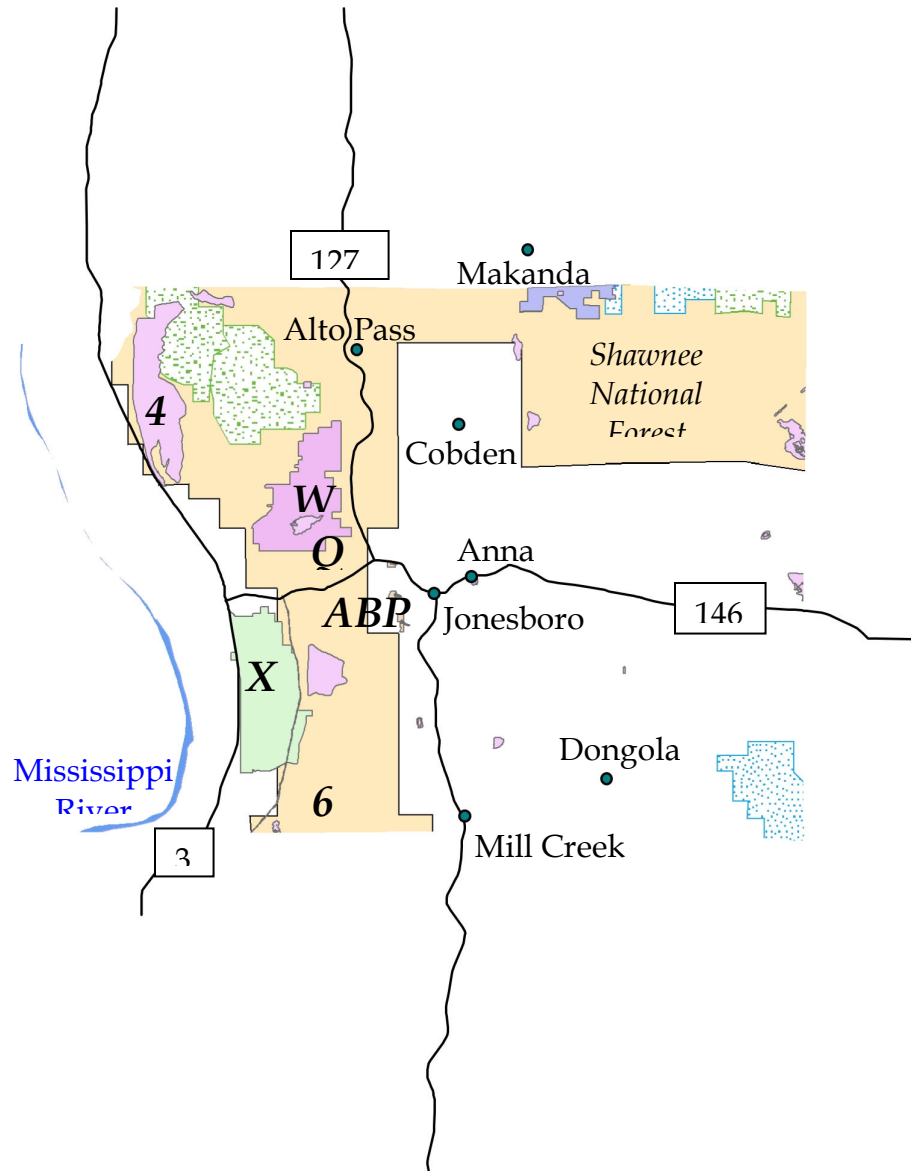


Figure 6. Map of Union County, Illinois, denoting several areas where the proposed surveys will be undertaken.

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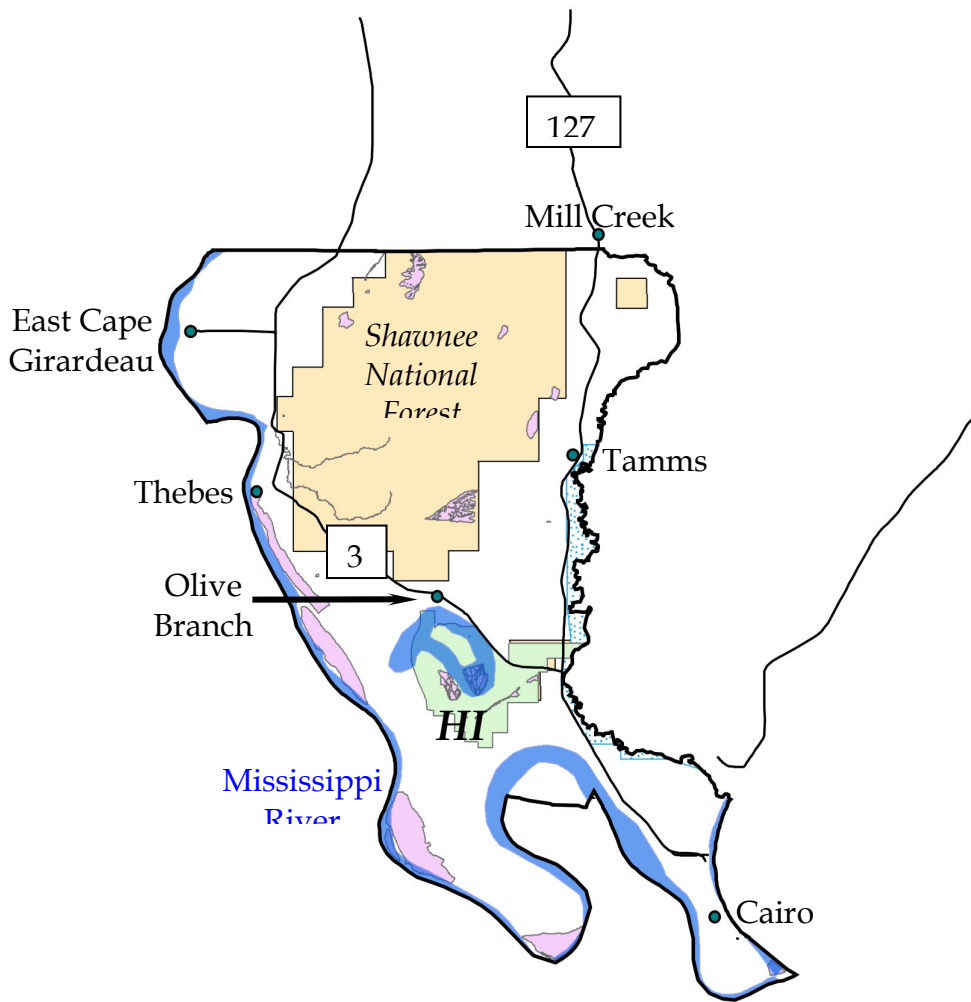


Figure 7. Map of Alexander County, Illinois, denoting several areas where the proposed surveys will be undertaken.

PROJECT SCHEDULE

TIMETABLE FOR FIRST YEAR OF PROJECT (August 15, 2006 – August 14, 2007)

August 2006	Orientation of student researchers, begin field surveys
September 2006	Survey work; sorting of specimens from initial surveys
October 2006	Survey work; sorting/cataloging of specimens
November 2006	Survey work; sorting/cataloging of specimens
December 2006	Survey work; sorting/cataloging of specimens
January 2007	Sorting/cataloging of specimens
February 2007	Sorting/cataloging of specimens
March 2007	Survey work; sorting of specimens
April 2007	Survey work; sorting/cataloging of specimens; preliminary analyses
May 2007	Survey work; sorting/cataloging of specimens; preliminary analyses
June 2007	Survey work; sorting/cataloging of specimens; national meeting
July 2007	Survey work; sorting/cataloging of specimens
August 2007	Survey work; sorting/cataloging of specimens

TIMETABLE FOR SECOND YEAR OF PROJECT (August 15, 2007 – August 14, 2008)

August 2007	Survey work; sorting/cataloging of specimens
September 2007	Survey work; sorting/cataloging of specimens
October 2007	Survey work; sorting/cataloging of specimens
November 2007	Survey work; sorting/cataloging of specimens
December 2007	Survey work; sorting/cataloging of specimens
January 2008	Sorting/cataloging of specimens
February 2008	Sorting/cataloging of specimens
March 2008	Survey work; sorting of specimens
April 2008	Survey work; sorting/cataloging of specimens; preliminary analyses
May 2008	Survey work; sorting/cataloging of specimens; preliminary analyses
June 2008	Analyses, writing up of manuscripts/reports; presentation at American Malacological Society meeting in Carbondale, Illinois
July 2008	Writing manuscripts/reports
August 2007	Writing manuscripts/submission of reports

PERSONNEL

The personnel funds requested in this project will fund one graduate research assistant and one undergraduate research assistant at Southern Illinois University in Carbondale (SIUC).

The project will include the following personnel from SIUC:

- Frank E. Anderson, Associate Professor of Zoology (PI)
- One Graduate Student Researcher (Marla Coppolino, M.S. student)
- One Undergraduate Research Assistant (to be determined)

The following IDNR personnel:

Jody Shimp, IDNR, Natural Heritage, Region 5, 11731 State Highway 37, Benton, IL 62812; (618) 435-8138; jshimp@dnrmail.state.il.us

COMPLIANCE

The findings from the two-year study will be summarized in a final report to be submitted with the data in hard copy and electronic versions to the Illinois DNR. Performance reports will be provided at the conclusion of the first year of the project (including a list of all sites sampled, along with all available data, to that point in the survey), and a final performance report will be provided at the conclusion of the project, along with the aforementioned reports, data and physical products.

BUDGET JUSTIFICATION

Personnel: Funding is requested to pay salaries for two research assistants (one graduate and one undergraduate) for two years to help with field work, sorting of samples in the laboratory, data entry as well as identification, preservation and documentation of collected land snails.

Travel: Funding is requested for gasoline for transportation to field sites throughout southwestern Illinois and travel to national meetings.

Supplies/Commodities: Funding is required for collection gear and sample sorting (e.g., litter bags, sieves, tweezers), soil chemistry measurement equipment, and vouchering materials (e.g., vials, ethanol).

LITERATURE CITED

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