# Growing and Modernizing the Clemson University Arthropod Collection

Michael S. Caterino, Director
John and Suzanne Morse Chair of Arthropod Biodiversity
Clemson University - SAFES

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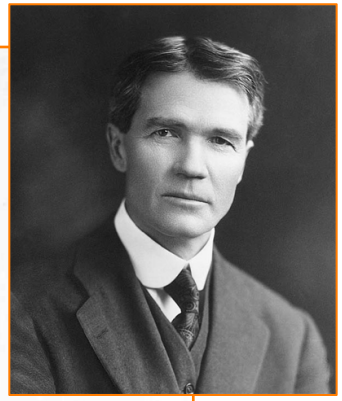
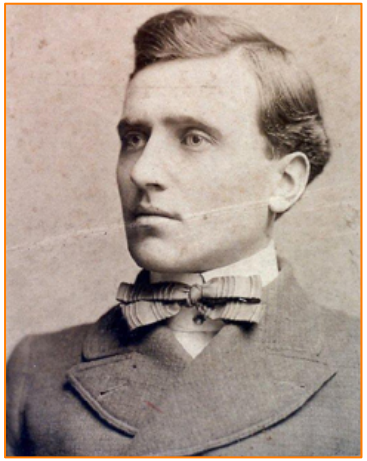
# History of the CUAC – In the beginning…

"There are no collections here, no equipment, so we had to start at the very ground." – Ernest Walker, 1897 (Clemson's first full-time entomologist)

Alexander Anderson





Albert Conradi

# History of the CUAC – Early days

Agriculture Hall – now Sikes Hall, burned April 2, 1925, and the original insect collection along with it.

# History of the CUAC – New building

**Franklin Sherman**

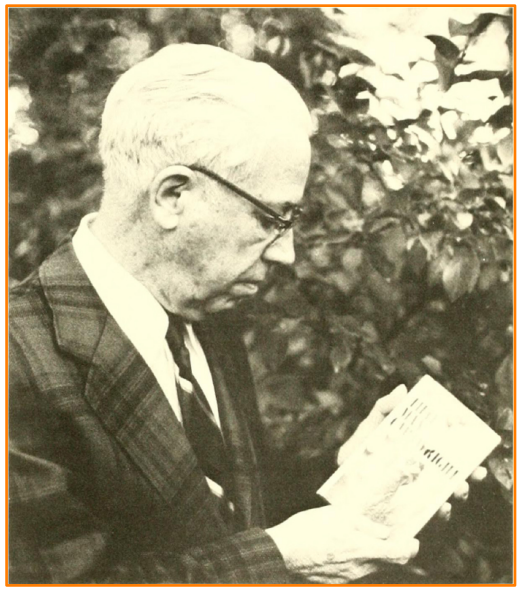
- North Carolina State Entomologist 1906-1925
- Professor in Entomology & Zoology at Clemson 1926-1947
- Rebuilt the Clemson arthropod collection from the ashes of the old

New Agriculture Hall, Long Hall, dedicated in 1937.

# History of the CUAC – Early contributors

**David Dunavan**

- Professor of Entomology – 1927-1956
  - Apparently tireless field collector
  - (Personal collection went to USNM)



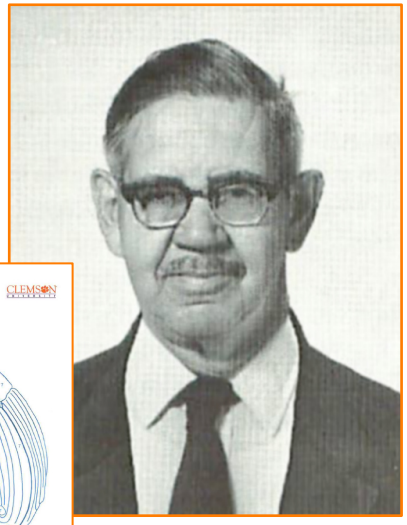
**Oscar Ling Cartwright**

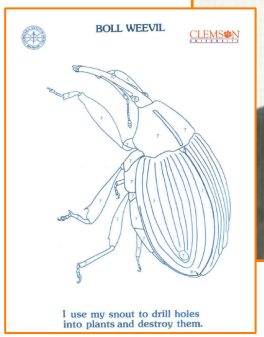
- Research Entomologist – 1925-1948
- Many agricultural pursuits, but also specialized in scarab beetles
- Moved on to USNM in 1948 for remainder of career

# History of the CUAC – Early contributors

**Frances McAlister**

- Associated with collection from 1930 to 1974
- Primarily responsible for collection from 1954 onward
- Major compiler of South Carolina insects 4x6 cardfile 'database'





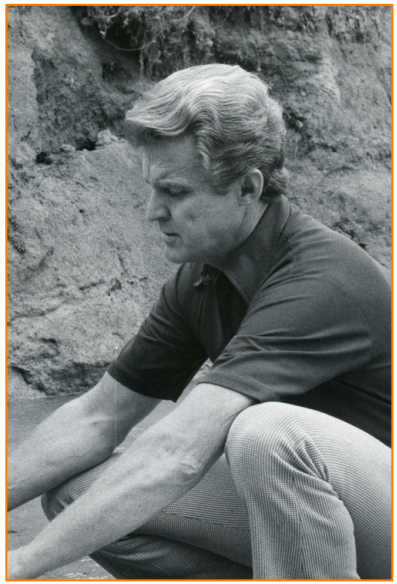

**Edwin King**

- At Clemson from 1957-1982
- Renowned instructor
- Interested in beetle phylogeny, particularly using wings
- Author of ESA's Insect Coloring Book

# History of the CUAC – Early contributors

**Vernon Kirk**

- Based at Pee-Dee REC from 1951-1970
- Great generalist collector
- *Beetles of South Carolina* (1969, 1970)



**Richard Fox**

- Forest Entomologist from 1958-1981
- Especially interested in immature insects
- Started building the alcohol collection in earnest

# History of the CUAC – The John Morse Era


**John Morse**

- Joined faculty in 1974
- Built outstanding aquatic insect collection, esp. Trichoptera
- Grew CUAC from a regional collection into one of global stature
- Has mentored 40 students whose specimens make up significant proportion of the collection

# Future of the CUAC – Morse Biodiversity Chair

The establishment of the John C. and Suzanne E. Morse Chair in Arthropod Biodiversity ushers in a new era of stability and solidity for the CUAC.

# CUAC faculty curators

**Dr. Al Wheeler**
- Miridae/Heteroptera

**Dr. Peter Adler**
- Simuliidae

**Dr. Juang-Horng Chong**
- Lampyridae citizen survey
- Turfgrass pests & invasive Scolytinae

**Dr. Joseph Culin**
- Lepidoptera of Congaree NP, other natural areas

# CUAC affiliate researchers

**Philip Harpootlian**

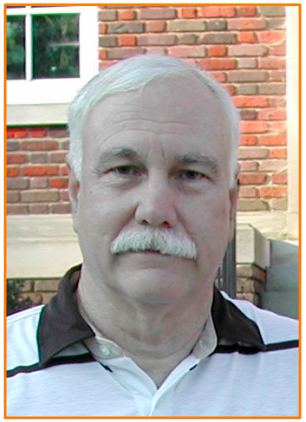
- Simpsonville, SC resident
- Scarab expert

**Janet Ciegler**

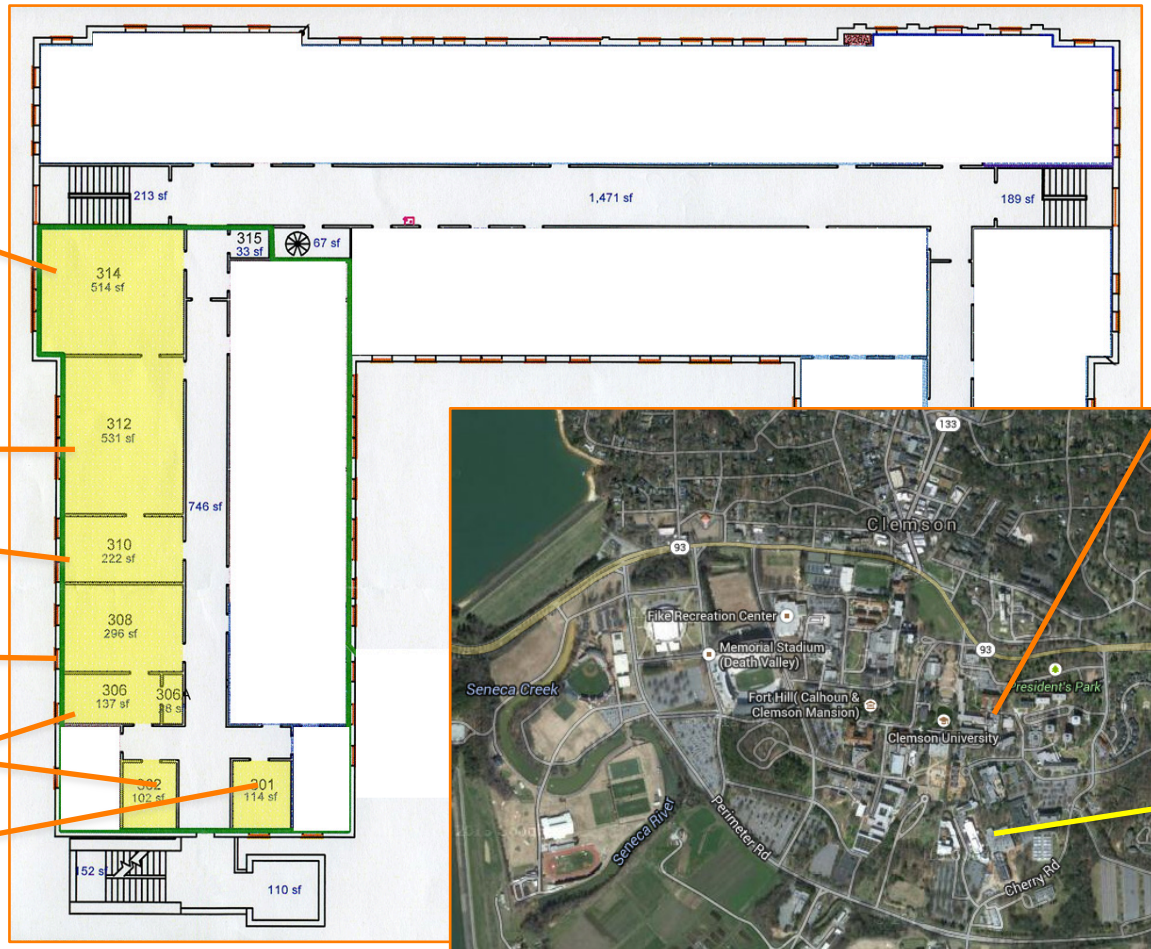
- Columbia, SC resident
- Beetler extraordinaire

**Dr. Ric Peigler**

- Saturniid expert at University of Incarnate Word
- Clemson alumnus (M.A., 1975)



# Current layout of the CUAC




Pinned collection

Alcohol collection

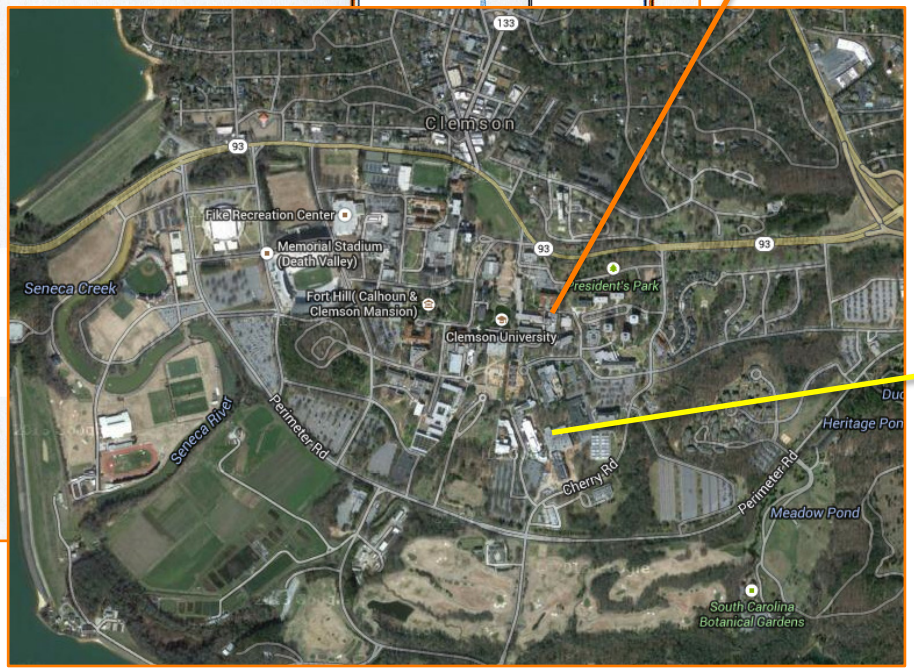
Morse office

Morse lab

Storage

Culin office

3rd Floor of Long Hall



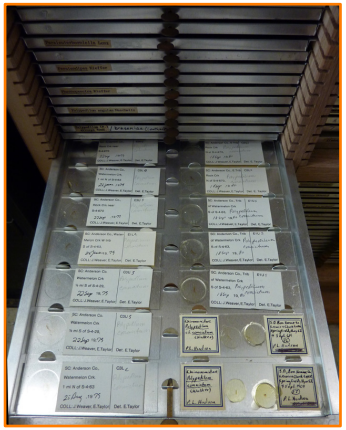

Poole

~1900 sq. ft.

# A current view of the CUAC – Wet collection


16 shelving units
~3800 Racks
~105,000 Vials
~650,000 Specimens

# A current view of the CUAC – Slide Collection





10 slide cabinets
+ 40 slide boxes
~5000 Slides

# A current view of the CUAC – Dry collection

70 Cabinets
973 Drawers
~450,000 Specimens

# Holdings - Strengths

## Trichoptera

- Dr. Morse's long-time focus
- Worldwide in scope
- Most North American species & excellent Asian representation
- Aquatic insects in general
    - Ephemeroptera, Plecoptera, Elmidae, Megaloptera, Odonata

## Simuliidae

- Dr. Adler's long-time focus
- Worldwide in scope
- Medically important arthropods in general
    - Culicidae, Ceratopogonidae, Tabanidae, Ixodidae

## Other

- South Carolina beetles (Cartwright, Kirk, Harpootlian, Ciegler)
- Southeastern Lepidoptera (Dunavan, Kirk, Culin, Scholtens, Peigler)
- Anything of agricultural importance

# Holdings - General

| Order | Main preservation | Identified species | Approx. specimens |
|---|---|---|---|
| Arachnida | EtOH | 480 | 10,000 |
| Ephemeroptera | dry + EtOH | 221 | 50,000 |
| Odonata | dry + EtOH | 180 | 17,000 |
| Plecoptera | dry + EtOH | 127 | 27,000 |
| Orthoptera | dry | 262 | 6,500 |
| Heteroptera | dry | 585 | 35,000 |
| Homoptera | dry + EtOH | 575 | 40,000 |
| Megaloptera | dry + EtOH | 21 | 2,500 |
| Neuroptera | dry + EtOH | 96 | 7,000 |
| Coleoptera | dry | 3825 | 71,000 |
| Trichoptera | EtOH | 811 | 500,000 |
| Lepidoptera | dry | 1035 | 47,000 |
| Diptera | dry + EtOH | 1971 | 75,000 |
| Hymenoptera | dry | 1132 | 50,000 |

# Issues – Suboptimal storage


Dry collection

- diversity of mostly poor cabinets
- many substandard drawers

Wet collection

- substantial number of aging neoprene stoppers

# Issues – Space/Backlog




# Issues – What's that smell?

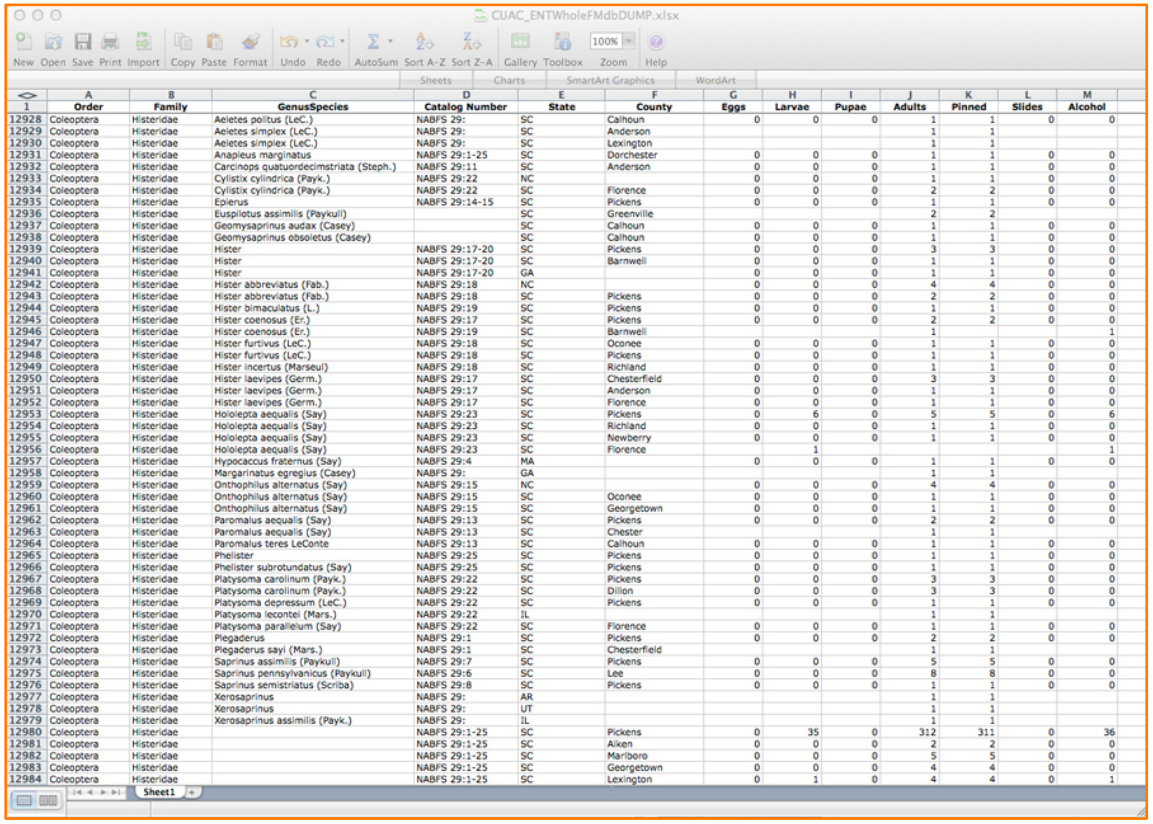
Naphthalene has been in use for much of the collection's history.

Repels people as well as dermestids.

# Database?

Yeah, kinda sorta

- John Morse began one in late 1980s
- 54,581 ‘records’ in a FileMaker Pro database



CUAC_ENTWholeFMdbDUMP.xlsx

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Order | Family | GenusSpecies | Catalog Number | State | County | Eggs | Larvae | Pupae | Adults | Pinned | Slides | Alcohol |
| 12928 | Coleoptera | Histeridae | Aeletes politus (LeC.) | NABFS 29: | SC | Calhoun | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12929 | Coleoptera | Histeridae | Aeletes simplex (LeC.) | NABFS 29: | SC | Anderson | | | | 1 | 1 | | |
| 12930 | Coleoptera | Histeridae | Aeletes simplex (LeC.) | NABFS 29: | SC | Lexington | | | | 1 | 1 | | |
| 12931 | Coleoptera | Histeridae | Anapleus marginatus | NABFS 29:1-25 | SC | Dorchester | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12932 | Coleoptera | Histeridae | Carcinops quatuordecimstriata (Steph.) | NABFS 29:11 | SC | Anderson | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12933 | Coleoptera | Histeridae | Cylistix cylindrica (Payk.) | NABFS 29:22 | NC | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12934 | Coleoptera | Histeridae | Cylistix cylindrica (Payk.) | NABFS 29:22 | SC | Florence | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 12935 | Coleoptera | Histeridae | Epierus | NABFS 29:14-15 | SC | Pickens | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12936 | Coleoptera | Histeridae | Euspilotus assimilis (Paykull) | | SC | Greenville | | | | 2 | 2 | | |
| 12937 | Coleoptera | Histeridae | Geomysaprinus audax (Casey) | | SC | Calhoun | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12938 | Coleoptera | Histeridae | Geomysaprinus obsoletus (Casey) | | SC | Calhoun | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12939 | Coleoptera | Histeridae | Hister | NABFS 29:17-20 | SC | Pickens | 0 | 0 | 0 | 3 | 3 | 0 | 0 |
| 12940 | Coleoptera | Histeridae | Hister | NABFS 29:17-20 | SC | Barnwell | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12941 | Coleoptera | Histeridae | Hister | NABFS 29:17-20 | GA | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12942 | Coleoptera | Histeridae | Hister abbreviatus (Fab.) | NABFS 29:18 | NC | | 0 | 0 | 0 | 4 | 4 | 0 | 0 |
| 12943 | Coleoptera | Histeridae | Hister abbreviatus (Fab.) | NABFS 29:18 | SC | Pickens | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 12944 | Coleoptera | Histeridae | Hister bimaculatus (L.) | NABFS 29:19 | SC | Pickens | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12945 | Coleoptera | Histeridae | Hister coenosus (Er.) | NABFS 29:17 | SC | Pickens | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 12946 | Coleoptera | Histeridae | Hister coenosus (Er.) | NABFS 29:19 | SC | Barnwell | | | | 1 | | | 1 |
| 12947 | Coleoptera | Histeridae | Hister furtivus (LeC.) | NABFS 29:18 | SC | Oconee | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12948 | Coleoptera | Histeridae | Hister furtivus (LeC.) | NABFS 29:18 | SC | Pickens | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12949 | Coleoptera | Histeridae | Hister incertus (Marseul) | NABFS 29:18 | SC | Richland | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12950 | Coleoptera | Histeridae | Hister laevipes (Germ.) | NABFS 29:17 | SC | Chesterfield | 0 | 0 | 0 | 3 | 3 | 0 | 0 |
| 12951 | Coleoptera | Histeridae | Hister laevipes (Germ.) | NABFS 29:17 | SC | Anderson | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12952 | Coleoptera | Histeridae | Hister laevipes (Germ.) | NABFS 29:17 | SC | Florence | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12953 | Coleoptera | Histeridae | Hololepta aequalis (Say) | NABFS 29:23 | SC | Pickens | 0 | 6 | 0 | 5 | 5 | 0 | 6 |
| 12954 | Coleoptera | Histeridae | Hololepta aequalis (Say) | NABFS 29:23 | SC | Richland | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12955 | Coleoptera | Histeridae | Hololepta aequalis (Say) | NABFS 29:23 | SC | Newberry | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12956 | Coleoptera | Histeridae | Hololepta aequalis (Say) | NABFS 29:23 | SC | Florence | | 1 | | | | | 1 |
| 12957 | Coleoptera | Histeridae | Hypocaccus fraternus (Say) | NABFS 29:4 | MA | | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12958 | Coleoptera | Histeridae | Margarinatus egregius (Casey) | NABFS 29: | GA | | | | | 1 | 1 | | |
| 12959 | Coleoptera | Histeridae | Onthophilus alternatus (Say) | NABFS 29:15 | NC | | 0 | 0 | 0 | 4 | 4 | 0 | 0 |
| 12960 | Coleoptera | Histeridae | Onthophilus alternatus (Say) | NABFS 29:15 | SC | Oconee | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12961 | Coleoptera | Histeridae | Onthophilus alternatus (Say) | NABFS 29:15 | SC | Georgetown | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12962 | Coleoptera | Histeridae | Paromalus aequalis (Say) | NABFS 29:13 | SC | Pickens | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 12963 | Coleoptera | Histeridae | Paromalus aequalis (Say) | NABFS 29:13 | SC | Chester | | | | 1 | 1 | | |
| 12964 | Coleoptera | Histeridae | Paromalus teres LeConte | NABFS 29:13 | SC | Calhoun | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12965 | Coleoptera | Histeridae | Phelister | NABFS 29:25 | SC | Pickens | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12966 | Coleoptera | Histeridae | Phelister subrotundatus (Say) | NABFS 29:25 | SC | Pickens | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12967 | Coleoptera | Histeridae | Platysoma carolinum (Payk.) | NABFS 29:22 | SC | Pickens | 0 | 0 | 0 | 3 | 3 | 0 | 0 |
| 12968 | Coleoptera | Histeridae | Platysoma carolinum (Payk.) | NABFS 29:22 | SC | Dillon | 0 | 0 | 0 | 3 | 3 | 0 | 0 |
| 12969 | Coleoptera | Histeridae | Platysoma depressum (LeC.) | NABFS 29:22 | SC | Pickens | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12970 | Coleoptera | Histeridae | Platysoma lecontei (Mars.) | NABFS 29:22 | IL | | | | | 1 | 1 | | |
| 12971 | Coleoptera | Histeridae | Platysoma parallelum (Say) | NABFS 29:22 | SC | Florence | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12972 | Coleoptera | Histeridae | Plegaderus | NABFS 29:1 | SC | Pickens | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 12973 | Coleoptera | Histeridae | Plegaderus sayi (Mars.) | NABFS 29:1 | SC | Chesterfield | | | | 1 | 1 | | |
| 12974 | Coleoptera | Histeridae | Saprinus assimilis (Paykull) | NABFS 29:7 | SC | Pickens | 0 | 0 | 0 | 5 | 5 | 0 | 0 |
| 12975 | Coleoptera | Histeridae | Saprinus pennsylvanicus (Paykull) | NABFS 29:6 | SC | Lee | 0 | 0 | 0 | 8 | 8 | 0 | 0 |
| 12976 | Coleoptera | Histeridae | Saprinus semistriatus (Scriba) | NABFS 29:8 | SC | Pickens | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 12977 | Coleoptera | Histeridae | Xerosaprinus | NABFS 29: | AR | | | | | 1 | 1 | | |
| 12978 | Coleoptera | Histeridae | Xerosaprinus | NABFS 29: | UT | | | | | 1 | 1 | | |
| 12979 | Coleoptera | Histeridae | Xerosaprinus assimilis (Payk.) | NABFS 29: | IL | | | | | 1 | 1 | | |
| 12980 | Coleoptera | Histeridae | | NABFS 29:1-25 | SC | Pickens | 0 | 35 | 0 | 312 | 311 | 0 | 36 |
| 12981 | Coleoptera | Histeridae | | NABFS 29:1-25 | SC | Aiken | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 12982 | Coleoptera | Histeridae | | NABFS 29:1-25 | SC | Marlboro | 0 | 0 | 0 | 5 | 5 | 0 | 0 |
| 12983 | Coleoptera | Histeridae | | NABFS 29:1-25 | SC | Georgetown | 0 | 0 | 0 | 4 | 4 | 0 | 0 |
| 12984 | Coleoptera | Histeridae | | NABFS 29:1-25 | SC | Lexington | 0 | 1 | 0 | 4 | 4 | 0 | 1 |

Sheet1

# What's happening at CUAC – Expansion!

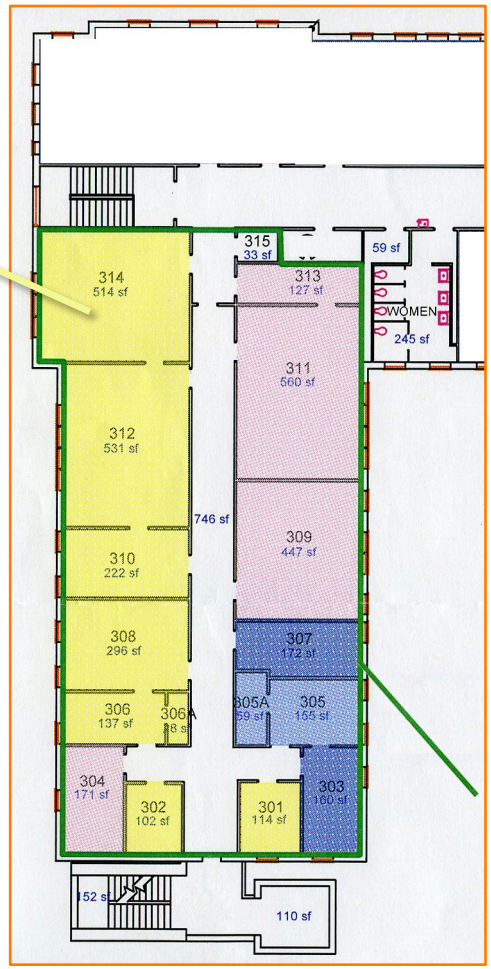
Current CUAC space in yellow

Total space increase:

from 1950 to 3800ft$^2$

Space specifically for collections:

from 1050 to 2200ft$^2$




Pink and blue spaces newly assigned

# What's happening at CUAC – NSF Proposal

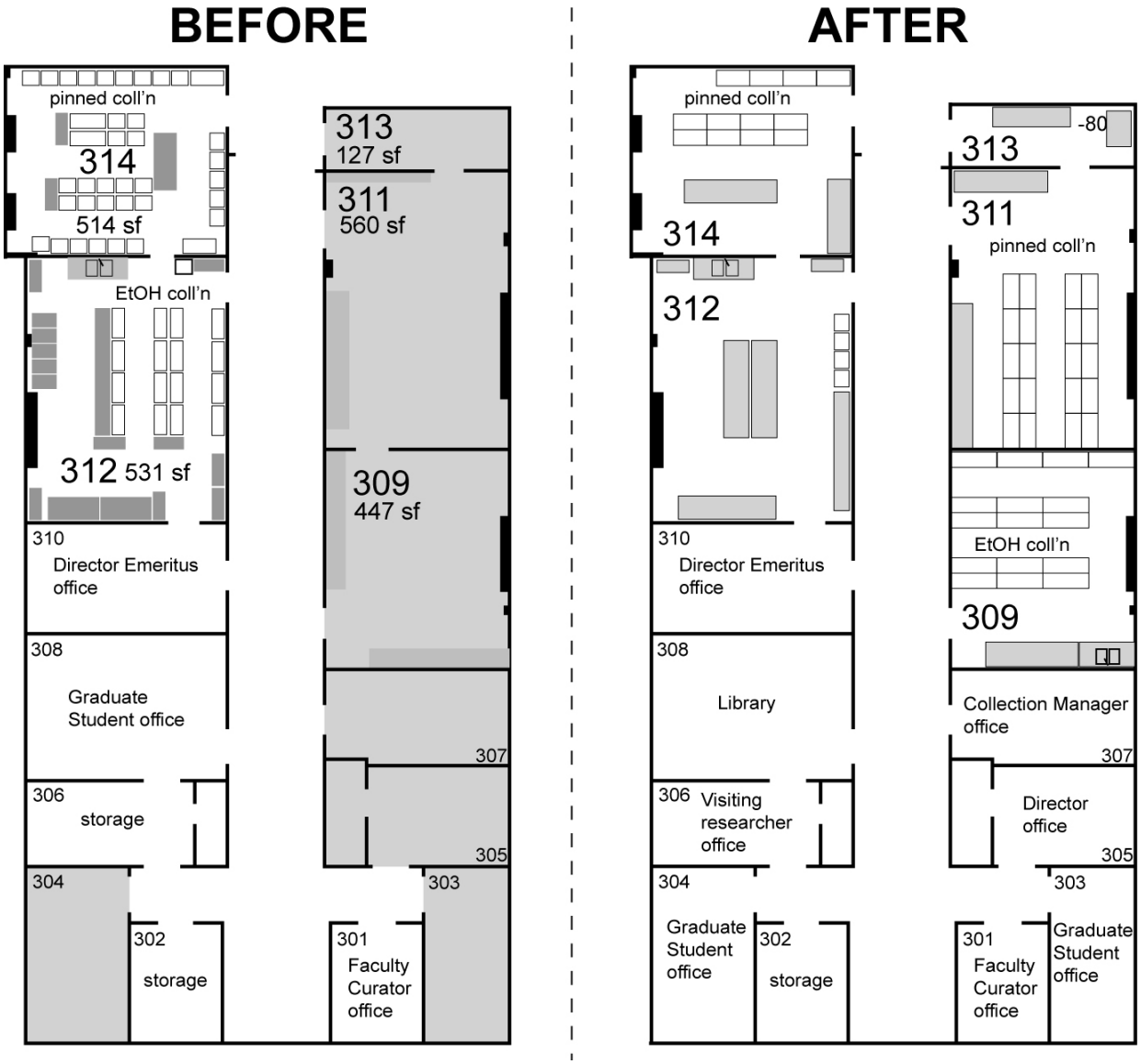
Expanding the footprint and the reach of the Clemson University Arthropod Collection

Submitted August, 2014

Would fund:

- 30 new Delta Design cabinets for pinned specimens
- 16 new Delta cabinets for alcohol specimens
- new foam unit trays to replace all hard-bottomed units
- new screw-cap vials to replace all neoprene stoppers
- establishment of vouchered specimen database
- remove all fumigants from the pinned collection
- graduate student assistant
- collections manager position
- 3400 hrs of undergraduate assistants

# What's happening at CUAC – Future floorplan




Capacity

- drawers
  - 973 currently
  - 1,440 if funded
- vials
  - 137,000 currently
  - 185,000 if funded
- working space
  - ~220 $ft^2$ now
  - ~800 $ft^2$ after
- naphthalene
  - ~150 kg now
  - 0.0 kg later!!!

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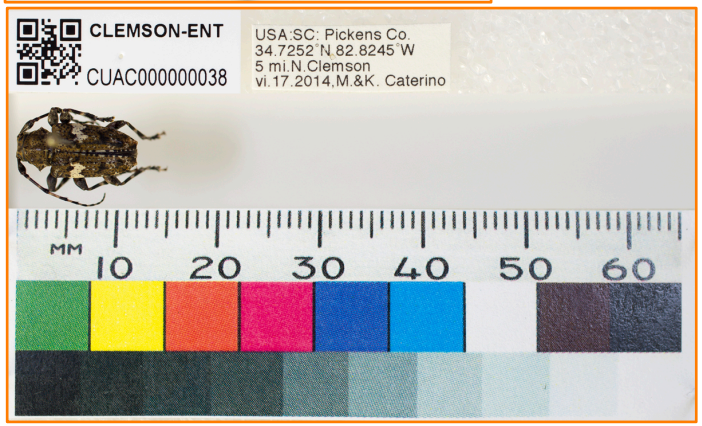
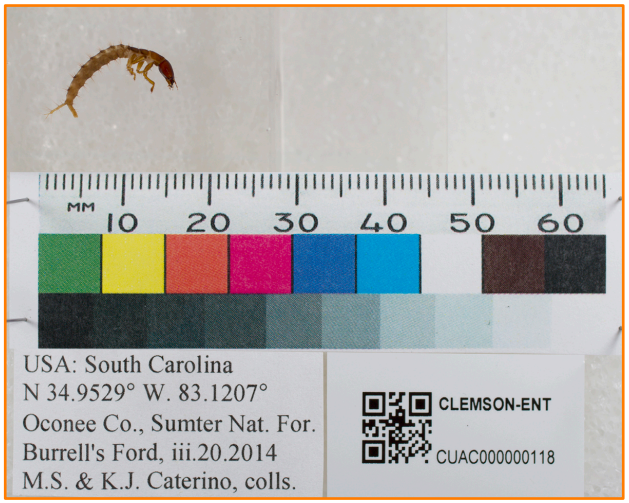
# Future expansion space, renovations underway

Room 311

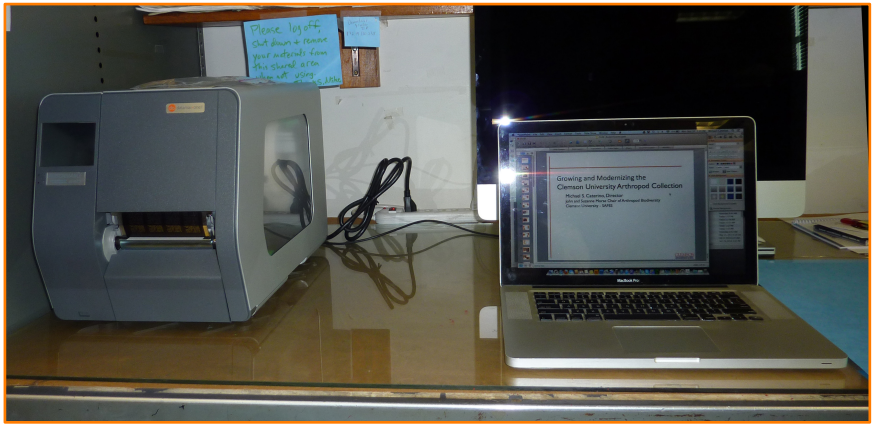
Room 309

# What's happening at CUAC – New digitization standards

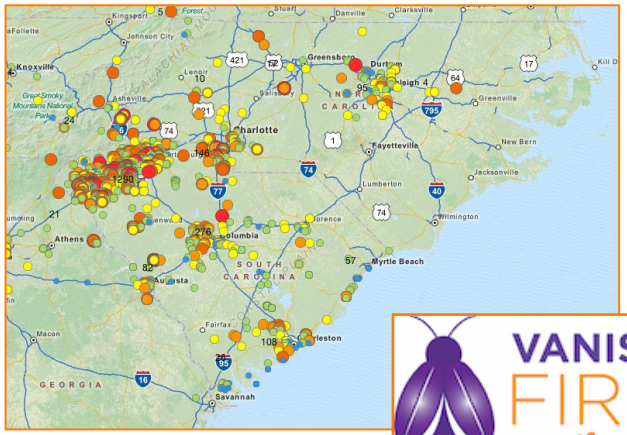







New Datamax p1115s, 600 dpi thermal transfer printer

# What's happening at CUAC – Research projects




VANISHING FIREFLY PROJECT


Biota of South Carolina

forthcoming volumes on EPT, Tenebrionoidea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# Caterino Arthropod Biodiversity Lab

March, 2014

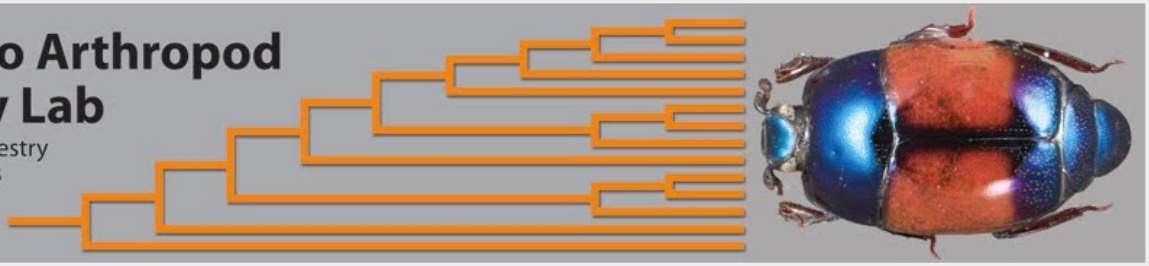
October 1, 2014

July, 2014

# The Caterino Arthropod Biodiversity Lab

School of Agriculture, Forestry & Environmental Sciences

CLEMSON UNIVERSITY





## OVERVIEW

The Caterino Arthropod Biodiversity Lab documents patterns of diversity in Arthropods, and examines the evolutionary processes that have generated this diversity. Using taxonomic, phylogenetic, and informatic tools, we aim to provide a fuller accounting of the diversity of arthropods on earth, and to provide the tools necessary for their effective conservation.

Our geographic emphases cover two megadiverse areas, the southeastern United States, and the Neotropical Region. Both of these areas are home to tens of thousands of arthropod species. But even so their faunas are poorly documented, with new species discovered regularly. Through active fieldwork and efficient taxonomic work, we hope to give citizens and conservationists the information needed to integrate arthropods into sustainable management plans.

Work in the lab focuses mainly on beetles, the most diverse and successful group of animals on the planet, but students interested in other Arthropod groups are welcomed.

Projects in the lab range from field surveys and specimen-based taxonomic revisionary taxonomy, to phylogeographic, species level, and higher phylogenetic studies. We utilize larval and adult morphological information as well as data from the genome to explore evolutionary patterns.

# The Clemson University Arthropod Collection

School of Agricultural, Forest & Environmental Sciences

CLEMSON UNIVERSITY



**MUSEUM INFORMATION**

OVERVIEW
PEOPLE
PROJECTS
DATABASES
RECENT PUBLICATIONS
LOANS AND VISITORS
INSECT INFORMATION
NEWS

**LINKS**

CATERINO LAB
SOUTHEASTERN BEETLE BLOG
SAFES
CALIFORNIA BEETLE PROJECT
COLEOPTERISTS SOCIETY

**CONTACT DETAILS**

Physical address: 312 & 314 Long Hall

## OVERVIEW

The Clemson University Arthropod Collection (CUAC) supports the teaching, research, and extension activities of the University. The Collection consists of approximately 1.3 million specimens from Classes Insecta, Arachnida, Branchipoda, Copepoda, Diplopoda, and Chilopoda. The wet, alcohol-preserved collection is exceptionally rich, with over 1,000,000 specimens, nearly half of which are Trichoptera, or caddisflies, resulting from 40 years of work by Director Emeritus Dr. John Morse. The pinned, dry collection comprises only about 200,000 specimens, but also has strong regional representation of all the major orders.

In addition, a collection of black flies (Simuliidae) is maintained under the direction of Dr. Peter H. Adler at the Cherry Farm Insectary, which is located 1 mile from the central Clemson University Arthropod Collection. It consists of more than 6,200 ethanol vials (holdings inventoried in this pdf: CUAC black flies), 5,000 acetic ethanol vials, several thousand pinned specimens, and a large photographic bank of polytene chromosomes. The collection contains representatives of nearly all North American species, is rich in Palearctic material, and also contains representatives from the Australasian, Neotropical, and Oriental Regions. Complementing the collection are 12 file cabinets containing about 8,000 reprints and books related to black flies. The world inventory of black flies can be accessed at the following web site: World black fly catalog (pdf)

# Southeastern Beetles

Periodic observations and discoveries from Michael Caterino's research and exploration in the southeastern United States

Wednesday, March 19, 2014

## My first southeastern beetle (in many years)

Following over 12 years as a curator at the Santa Barbara Museum of Natural History, where I specialized in the beetle fauna of California, an opportunity to move back to the southeastern United States presented itself, in the form of an endowed professorship at Clemson University. This move offered so many benefits to me and my family, both academic and personal that, despite Santa Barbara's unquestionable charms, I could not turn it down.

My years in a community-focused museum taught me the value of knowing and sharing information about the biota of one's immediate surroundings, and that belief has accompanied me to Clemson. So as I begin to learn more about my new local beetle fauna, I wanted to share this voyage of discovery with others who wish to learn a little more about the remarkable diversity of beetles of the southeastern U.S. No doubt I will encounter many species that long-time southeastern naturalists will consider dirt common and relatively uninteresting, but as my knowledge deepens I hope to repay readers' perseverance.

For my first post, it seemed to make sense to record the first beetle I encountered during my new residence. On our third or fourth day in town, following two weeks of a thoroughly enjoyable (smirk) cross-country move, we needed a break and some fresh air. We managed to find the box our disc golf frisbees were in, and headed out to the nearby University Beach course, just across Lake Hartwell from the Clemson campus. On the sixth hole a

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Caterino Lab website
Clemson University Arthropod Collection
Beetles in the Bush

# Conclusions

- We’re alive and well
- We’re growing and modernizing
- We’re well supported
- Watch this space for future developments!

# Acknowledgments

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