

Sustainability Fee Project Grant Report Guidelines
for grants awarded during FY2019
Due by 5pm August 1, 2019
Email pdf or word doc to cfs@georgiasouthern.edu

Please provide the following information in order to help the Center for Sustainability document the success of the Sustainability Fee Grant Program.

Date: 1 August 2019

Name(s): Lance A. Durden, Jose A. Sanchez-Ruiz, Debra G. Albanese, Julien M. Buchbinder.

Unit/Department(s): Biology

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Project title: Assessing Insect Biodiversity and Promoting Sustainable Practices toward Pollinators on Campus.

Amount granted: \$27,560

Amount spent: \$20,627.87

I. Project Outcomes/Value

Detail the planned and actual outcomes of the project here.

In a continuing effort to assess biodiversity and promote sustainable practices on the GSU (Statesboro) campus, this project aimed to add arthropods, perhaps the most biodiverse group of animals on the planet, to the vertebrate biodiversity database created in 2015. We exposed faculty, staff, students and the general public to the benefits of arthropod diversity through field activities on campus and exhibitions by focusing on charismatic insect groups and their environmental importance. Additionally, the project took advantage of the already established “iNaturalist” smartphone application to promote citizen science. We concentrated our efforts on two groups of beneficial insects in an effort to educate people of their importance, to reduce pesticide and herbicide use on campus and elsewhere, and to protect these organisms. We promoted Lepidoptera (butterflies and moths) as important pollinators of flowering plants and Odonata (dragonflies and damselflies) as important predators of biting insects such as mosquitoes and biting midges. With the spread of reduced honey bee pollinator populations due to Colony Collapse Disorder and other detrimental factors (increased use of pesticides, etc.), secondary pollinators, especially butterflies and moths, are becoming increasingly important. Maintaining healthy populations of odonates could likewise reduce the indiscriminate use of insecticides that also kill beneficial, non-target organisms such as honey bees. Our planned outcome was to educate students and others about these sustainable initiatives.

Project Timeline – After the grant was approved, funding was slightly delayed and we encountered further delays in advertising and hiring students in order to adhere to GSU policy. Partly for this reason, we did not encumber student salaries for several weeks and the grant ended with a \$6,932.13 surplus on 30 June 2019. Nevertheless, the project has been successfully completed. Further, a paper is in preparation on the Lepidoptera data.

Project Outcomes -List the *proposed* project goals/objectives and *actual* outcomes of the grant. Describe any successes, challenges and observations.

Proposed goals are listed in the above section. The actual outcomes of this project have been highly successful in educating individuals about the benefits of protecting Lepidoptera for pollinator purposes. We achieved this by initiating a biodiversity inventory of all species of Lepidoptera on the Statesboro campus by weekly observations, recording and sampling. This effort also included citizen science and we set up an iNaturalist link for any interested individuals to submit photographs of insects on campus for identification and addition to our datasets. We also arranged several moth recording nights on campus (see flyer example below) by setting up light sheets to attract and record insects, especially moths. Everybody (GSU students, faculty, staff, and members of the public) were invited to these light sheet nights and attendance was generally good, especially from students. One light sheet night (5 April) was planned to coincide with the joint annual meeting of the Southern Lepidopterists' Society and Association for Tropical Lepidoptera (which convened at GSU) and almost 30 individuals joined the cause that night with several new campus moth records being added to the inventory. We also had dragonfly/damselfly/butterfly walks on campus to point out various species and their importance to interested individuals (all students, in this case). Invited demonstrations on catching, preparing, identifying and storing insects were also given at the Biological Collections Club and to REU students, for example.

Overall, we recorded 88 species of butterflies, at least 437 species of moths (some species still need to be identified and added to the list), and 19 species of Odonata on the GSU (Statesboro) campus (Appendices 1-3). All of these species should be considered to be beneficial through their pollination activities (butterflies and moths) or their predatory behavior on mosquito larvae (nymphs of Odonata) or adults (adults of Odonata). As such, every effort should be made to protect these species on campus and elsewhere. Through our outreach activities, we believe we were successful in educating the community (especially GSU students) about the beneficial nature of these insects.

Sustainability Improvements –

Based on the interest shown by GSU students and other individuals in our light sheet nights and other excursions and displays funded by this grant, we believe we have been able to educate these people on the widespread benefits of maintaining biodiversity, and the shortcomings of using large amounts of “quick-fix” broad-spectrum pesticides and herbicides. One of the co-PIs of this grant, Debra Albanese, completed her thesis research on the toxicity of 3 widely used herbicides on non-target invertebrates and is now being asked to present talks on this topic. Herbicides are not supposed to kill animals but at least some of them do. Whether or not our data will result in reduced spraying of pesticides and herbicides on the GSU campus remains to be seen.

Outreach –

This project was publicized by our participation in Greenfest, No Impact Week, the Sustainability Showcase, by a student talk in a conference (see below), by flyers (see below), and by our iNaturalist profile in the Georgia Southern University Biological Survey (<https://www.inaturalist.org/projects/georgia-southern-biological-survey>). The live butterflies and Odonata we took to Greenfest generated tremendous interest, especially from children – the very individuals who will be responsible for sustainable practices on the planet in the future. Children often handled the live insects and, towards the end of the day, we allowed butterflies to rest on their hands and then fly away to freedom and hopefully to pollinate as well. This seemed to create a lasting impression, especially on the next generation of potentially sustainable citizens. Posters and displays of pinned insects prepared for this project that were used in the above-mentioned public showcases and in the Biology Department are stored in the GSU Insect Collection for future use in similar endeavors.

Budget report- provide an explanation of how all funds were used and explain any deviation from the original budget.

The final approved budget is listed below. We were granted permission by Dr. Leege to make some small adjustments to our initially approved equipment and supplies purchases (mainly for insect display cases) in June 2018. We made these changes because we realized that purchasing insect drawer display cases would also cover a sustainable purpose, namely to use these drawers in the GSU insect collection where they currently reside, mostly filled with pinned insect displays for future use. We also realized that we could purchase ethanol much more economically through the Biology Department than through Fisher Scientific. In the Equipment and Supplies budget section below, the approved budget changes are shown in red and the previous budget requests are struck through.

Jose Sanchez-Ruiz was supported by the graduate student stipends (3 semesters) and he successfully graduated from GSU with an M.S. in Biology at the end of Spring Semester 2019. We requested 3 undergraduate student workers but hired a total of 5 throughout the project as some of these students graduated and needed to be replaced.

Budget: \$27,560

Personnel	\$22,680
Equipment and Supplies	\$4,880
Total	\$27,560

Personnel		
	Per semester/per student	Total cost
1 Graduate student, stipend, Fall '18/Spring '19	\$5,250	\$10,500
1 Graduate students, summer '18	\$4,500	\$4,500
3 Undergraduate students, field assistants, Fall '18/Spring '19	10 hrs/week X 16 weeks X \$8/hr= \$1,280	7,680
Total Personnel		\$22,680

Equipment and Supplies					
Item	Supplier	Quantity	Part number	Unit price	Cost
Insect display boxes, permanent collection and display	Bioquip	20 28	1006 1012APFP	\$41.05 \$61.38	\$821.00 1718.64
Insect display boxes, temporary exhibit	Bioquip	20	1042J	\$24.55	\$491.00
Fisherbrand™ 51 Expansion Glass Shell Vials with Plug Style Closures	Fisher Scientific	20	03-339-26B	\$57.00	\$1140.00
Acetone	Fisher Scientific	4L	A18P-4	\$216.46	216.46

Ethyl acetate	Fisher Scientific	4L	E195-4	\$185.70	185.70
Ethanol, 95%	Fisher Scientific GSU Biology Dept	4L	AC61509004 No part no.	\$289.33 \$50.00	289.33 \$50.00
Malaise trap	Bioquip	2 1	2875A	\$255.15 304.08	510.30 304.08
Sweep nets	Bioquip	2	7635HS	\$30.45 32.43	60.90 64.86
Bait traps	Bioquip	2	1420C	\$63.40 \$75.56	126.80 151.12
DC Pigtail adapter	Bioquip	2	2815A	\$12.10 \$14.43	24.20 28.86
Aspirators	Bioquip	2	11RBV00	\$40.50 \$45.97	80.10 91.94
AC/DC Night collecting black light	Bioquip	2	2804 2805	\$109.85 \$75.68	219.70 151.36
12 volt battery	Bioquip	2	2801 2863	\$138.45 \$134.25	276.90 268.50
Odonata envelopes	Bioquip	10 packs	1130DP	\$5.85	58.50
Flexible, retractable posters for displays	Vistaprint	3		131.45	394.35
Dragonflies and Damselflies of Georgia and the Southeast – book	Amazon	1		\$33.26	\$33.26
Total equipment and supplies					\$4,880 \$4857.63

II. Student and Community Impact

Because these grant funds come directly from a \$10 Student Sustainability Fee, it is important to document how they benefit students. Please provide information on the following:

#Undergraduate students employed by the grant, and length of employment (# hours/week for x weeks)
5 undergraduate students were employed on this grant as follows:

- 1) Riley Egan
- 2) Jacob Gilbert
- 3) Chloe Johnson
- 4) Khalil Carson
- 5) Lucia Sturges (she recently legally changed her name to Lucia Botnaru)

The weeks and hours these students worked are shown in the accompanying budget spreadsheet.

The first 4 listed students mostly worked with graduate student Jose Sanchez-Ruiz on Odonata whereas the fifth (last) listed student worked with Dr. Durden on Lepidoptera.

Graduate student Jose A. Sanchez-Ruiz was funded by stipends from this grant for 3 semesters. Graduate students Debra Albanese and Julien Buchbinder contributed to the project by joining field trips and helping to identify specimens at no cost.

volunteers involved in the project, including total # of volunteer hours
None recorded.

students reached through classes or other means
Hard to state but we believe at least 69 [12 students in the Biological Collections Club, 23 at moth light sheets, 18 in Entomology –BIOL 5442/G class, 8 REU students (see image below), 8 on campus field excursions, plus several not recorded at Greenfest and the Sustainability Showcase]

community members reached
32 (all at moth light sheet nights)

Grant Leverage

Were you able to leverage your work for additional outcomes?

Lance Durden has been discussing a similar Lepidoptera Biodiversity project with monthly moth light sheet recording with Georgia DNR personnel (Anna Yellin and others) in protected sites of special interest in Georgia.

Indicate the following if they apply.

Presentation given on grant work:

The following oral paper on this project was presented at the Southern Lepidopterists' Society/Association for Tropical Lepidoptera joint annual conference (5-7 April 2019), which convened at Georgia Southern University (Department of Biology) (regional conference):

*Botnaru, Lucia (presenter) and Durden, Lance, 6 April 2019, "Biodiversity of Lepidoptera on the Georgia Southern University campus."

Note: As an undergraduate, this was Lucia's very first conference presentation; she did a great job and the paper generated significant interest.

Papers published, in press or in preparation (indicate student authors with an asterisk):

Durden, L. A., and L. Botnaru*. Lepidoptera on a university campus in the southern United States: biodiversity, sustainability, and challenges. (in preparation).

Grants leveraged :

None yet but discussions have been initiated with Georgia DNR personnel for a similar project at a state-protected site.

Project abstract

Provide a one paragraph abstract of the completed project **and several photos** (preferably including some of the people involved with the project at work) to be posted on the CfS web page.

Also include links to all web pages on which this work is discussed or displayed

Insect biodiversity, particularly of Lepidoptera (butterflies and moths) and Odonata (dragonflies and damselflies) on the GSU (Statesboro) campus was assessed during this project by using a combination of faculty, graduate and undergraduate student training and expertise, as well as citizen science input. The importance of butterflies and moths as pollinators, especially in light of declining honey bee populations, and of dragonflies and damselflies as predators of biting insects such as mosquitoes, has been highlighted to the GSU and surrounding community through iNaturalist submissions and a series of university and Statesboro displays and events. Additional sustainability awareness of these insects was achieved through moth light sheet nights on campus and through campus insect walks. An impressive total of 88 species of butterflies, at least 347 species of moths and 19 species of dragonflies and damselflies was recorded on the Statesboro campus including some new moth records for the state of Georgia. Because of the environmental importance of these insects, we recommend that undisturbed terrestrial habitats and all wetlands on campus are preserved and that the current widespread on-campus use of pesticides and herbicides is reevaluated. We believe this study will serve as a model for insect biodiversity/sustainability initiatives on other university campuses.

MOTH RECORDING ON THE GSU CAMPUS

5 APRIL 2019



JOIN US TO RECORD THE MOTH FAUNA ON THE CAMPUS OF GEORGIA SOUTHERN UNIVERSITY AS PART OF A SUSTAINABILITY INITIATIVE!

MEET AT THE BIOLOGY BUILDING (4324 OLD REGISTER ROAD) MAIN ENTRANCE AT 7 PM.

BRING A NOTEPAD, MOSQUITO REPELLENT (WE WILL ALSO HAVE EXTRA), CAMERA, FLASHLIGHT (OR HEADLAMP OR SMARTPHONE WITH FLASHLIGHT), WATER AND SNACKS, IF NEEDED.

WE WILL RECORD MOTHS UNTIL ~MIDNIGHT.

CONTACT FOR FURTHER INFORMATION: Lance Durden (Department of Biology), ldurden@georgiasouthern.edu; phone: (912)478-5591

All are welcome (Students, Faculty, Staff, and Members of the Public).



<i>Everes comyntas</i>				X	X								
<i>Celastrina ladon</i>	X	X	X										
<i>Celastrina neglecta</i>					X	X	X	X					
Nymphalidae													
<i>Libytheana carinenta</i>					X	X		X					
<i>Agraulis vanilla</i> ^e					X	X	X	X	X	X	X	X	X
<i>Heliconius charithonius</i>									X	X	X	X	X
<i>Euptoieta claudia</i>				X	X	X	X	X	X	X			
<i>Phyciodes texana</i>										X	X		
<i>Phyciodes tharos</i>			X	X	X	X	X	X	X	X	X		
<i>Polygonia interrogationis</i>					X	X		X	X				
<i>Polygonia comma</i>					X	X		X					
<i>Nymphalis antiopa</i>					X								
<i>Vanessa atalanta</i>				X	X	X	X	X	X	X			
<i>Vanessa cardui</i>										X	X	X	
<i>Vanessa virginiensis</i>	X	X	X	X	X	X	X	X	X	X	X	X	
<i>Junonia coenia</i>					X	X	X	X	X	X	X	X	X
<i>Limenitis archippus</i>						X	X	X	X				
<i>Limenitis arthemis</i>						X	X	X	X				
<i>Cercyonis pegala</i>								X	X	X			
<i>Cyllopsis gemma</i>				X	X	X	X	X	X	X			
<i>Enodia portlandia</i>						X	X			X	X		
<i>Enodia creola</i>							X						
<i>Hermeuptychia sosybius</i>		X	X	X	X	X	X	X	X	X	X	X	X
<i>Megisto cymela</i>					X	X	X						
<i>Neonympha areolata</i>						X							
<i>Danaus gilippus</i>							X	X					
<i>Danaus plexippus</i>				X	X			X	X	X	X	X	
Hesperiidae													
<i>Epargyreus clarus</i>			X	X	X	X	X	X	X	X	X		
<i>Urbanus proteus</i>					X	X	X	X	X	X	X	X	
<i>Urbanus dorantes</i>									X	X			
<i>Achalaris lyciades</i>							X	X					
<i>Thorybes bathyllus</i>							X	X	X				
<i>Thorybes pylades</i>							X	X					

Givira anna	2668	640016					X		
Givira francesca	2671	640019						X	
Cossula magnifica	2674	640047					X		
Prionoxystus robiniae	2693	640029			X	X			
Paralobesia cyclopiana	2727	620509	X						X
Eumarozia malachitana	2749	620517						X	X
Zomaria interruptolineana	2750	620518				X			
Olethreutes griseoalbana	2828	620596						X	
Hedya separatana	2860	620634		X					
Rhyacionia rigidana	2868	620695		X					
Rhyacionia frustrana	2882	620710	X	X					
Retinia gemistrigulana	2898	620727				X	X		
Eucosma awemeana	2911	620767				X			
Eucosma raracana	2928	620837						X	
Eucosma parmatana	2937	620832	X	X					
Eucosma argutipunctana	3005.1	620795						X	
Epiblema tripartitana	3184	621078				X			
Epiblema otiosana	3202	621098						X	
Chimoptesis pennsylvaniana	3273	621181		X	X				
Cydia latiferreana	3494	621383						X	
Gymnandrosoma punctidiscanum	3495	621385	X						X
Pseudogalleria inimicella	3500	621391					X		
Argyrotaenia floridana	3599	620258		X					X
Argyrotaenia kimballi	3600	620259	X	X		X			X
Argyrotaenia quercifoliana	3623	6200282				X	X		
Sparganothis sulfureana	3695	620390				X		X	X
Platynota flavedana	3732	620443			X	X		X	X
Platynota idaeusalis	3740	620433		X					
Platynota exasperatana	3743	620434				X		X	
Amorbia humerosana	3748	620374		X					
Thaumatographa jonesi	3751	621395						X	
Eugnosta bimaculana	3763	620144				X		X	X

Eugnosta sartana	3764	620152								X
Acoloithus falsarius	4629	660069		X					X	
Megalopyge opercularis	4647	660063					X			
Lithacodes fasciola	4665	660023			X					
Apoda biguttata	4669	660027					X			
Prolimacodes badia	4671	660029			X				X	
Isochaetes beutenmuelleri	4675	660033							X	
Isa textula	4681	660039			X				X	X
Euclea nanina	4697.1	660052					X			
Acharia stimulea	4700	660055							X	
Elophila icciusalis	4748	800724					X		X	X
Elophila faulalis	4749	800725		X					X	
Elophila gyralis	4751	800727		X	X	X			X	X
Nymphuliella daeckealis	4753	800733					X			
Elophila tinealis	4754	800728	X	X	X	X				X
Elophila oblitalis	4755	800729	X	X	X	X			X	X
Parapoynx seminealis	4763	800738							X	X
Parapoynx allionealis	4764	800739	X	X	X	X			X	X
Parapoynx diminutalis	4765	800740								X
Eoparagyraetis irroratalis	4785	800766					X		X	
Eoparagyraetis floridalis	4786	800767							X	
Glaphyria sesquialis	4870	801024					X			
Xanthophysa psychialis	4879	801035								X
Dicymolomia julianalis	4889	801063							X	
Saucrobotys futilalis	4936	801407					X			
Fumibotys fumalis	4950	801424							X	
Hahncappsia mancalis	4967	801444				X				
Pyrausta subsequalis	5060	801540					X			
Udea rubigalis	5079	801230	X		X					X
Diacme elealis	5142	801349	X							
Diacme adipaloides	5143	801350	X						X	X
Samea ecclesialis	5150	801366	X						X	

<i>Samea multiplicalis</i>	5151	801367					X			X
<i>Nomophila nearctica</i>	5156	801365		X						
<i>Ategumia ebulealis</i>	5158	801348						X		X
<i>Desmia funeralis</i>	5159	801262				X				
<i>Anageshna primordialis</i>	5176	801254		X	X	X		X		
<i>Apogeshna stenialis</i>	5177	801255		X	X	X				
<i>Glyphodes sibillalis</i>	5198	801304					X			
<i>Diaphania nitidalis</i>	5202	801295								X
<i>Palpita arsaltealis</i>	5222	801321	X		X					
<i>Palpita magniferalis</i>	5226	801325	X			X		X		
<i>Pleuroptya silicalis</i>	5243	801188								X
<i>Psara obscuralis</i>	5268	801373							X	
<i>Herpetogramma phaeopteralis</i>	5274	801196		X				X	X	X
<i>Herpetogramma sphingialis</i>	5279.1	801192					X			
<i>Conchylodes ovulalis</i>	5292	801378				X				
<i>Donacaula unipunctellus</i>	5314	800708				X	X			
<i>Donacaula roscidellus</i>	5321	800716					X			
<i>Crambus praefectellus</i>	5355	800943		X						
<i>Crambus saltuellus</i>	5363	800951				X				
<i>Crambus satrapellus</i>	5372	800960				X		X		
<i>Raphiptera argillaceellus</i>	5393	800913	X							
<i>Pediasia trisecta</i>	5413	800900							X	X
<i>Microcrambus biguttellus</i>	5419	800874				X				
<i>Microcrambus elegans</i>	5420	800875				X		X		
<i>Fissicrambus profanellus</i>	5431	800866					X	X		
<i>Argyria lacteella</i>	5463	800815				X		X		
<i>Urola nivalis</i>	5464	800821				X		X		X
<i>Argyria critica</i>	5466	800820				X				
<i>Chilo erianthalis</i>	5471	800832				X				
<i>Diatraea lisetta</i>	5481	800841						X		
<i>Haimbachia squamulella</i>	5482	800795						X		
<i>Xubida panalope</i>	5500	800788				X	X	X		

<i>Glena cribrataria</i>	6449	910864		X	X					
<i>Tornos scolopacinaria</i>	6486	910898		X			X			X
<i>Tornos abjectarius</i>	6487	910902		X				X		
<i>Iridopsis vellivolata</i>	6582	911000		X	X	X				
<i>Iridopsis ephyraria</i>	6583	911001				X				
<i>Iridopsis humaria</i>	6584	911002		X						
<i>Iridopsis defectaria</i>	6586	911004	X	X	X			X		X
<i>Anavitrinella pampinaria</i>	6590	911009			X	X	X	X		X
<i>Ectropis crepuscularia</i>	6597	911016		X	X					X
<i>Protoboarmia porcelaria</i>	6598	911017			X	X	X	X	X	
<i>Epimecis hortaria</i>	6599	911018			X	X	X			
<i>Melanolophia canadaria</i>	6620	911059		X			X			X
<i>Lycia ypsilon</i>	6652	911073		X	X					
<i>Hypagyrtis esther</i>	6655	911076		X	X	X		X	X	
<i>Hypagyrtis piniata</i>	6656	911077				X				
<i>Phigalia titea</i>	6658	911079		X						
<i>Phigalia denticulata</i>	6659	911080	X	X	X					
<i>Phigalia strigataria</i>	6660	911081	X	X						
<i>Ilexia intractata</i>	6711	911132		X		X	X		X	X
<i>Episemasia solitaria</i>	6713	911137				X				
<i>Euchlaena obtusaria</i>	6726	911151				X				
<i>Euchlaena deplanaria</i>	6732	911157				X				
<i>Euchlaena amoenaria</i>	6733	911158			X	X		X		
<i>Cymatophora approximaria</i>	6745	911170							X	
<i>Pero ancetaria</i>	6748	911179	X	X	X		X			
<i>Phaeoura quernaria</i>	6763	911191		X	X	X				
<i>Tacparia zalissaria</i>	6805	911237		X	X	X				
<i>Metarranthis homuraria</i>	6828	911261				X				
<i>Metarranthis obfirmaria</i>	6832	911265		X	X	X				
<i>Besma quercivoraria</i>	6885	911324			X		X			
<i>Nepytia semiclusaria</i>	6908	911348					X			
<i>Eusarca fundaria</i>	6933	911376		X						

Tetracis crocallata	6963	911400							X	
Eutrapela clemataria	6966	911414		X	X	X	X			
Patalene olyzonaria	6974	911423								X
Prochoerodes lineola	6982	911432		X	X				X	X
Nematocampa baggettaria	7010.1	910678					X		X	
Nemoria elfa	7029	910609	X							
Nemoria lixaria	7033	910613	X	X	X	X				X
Synchlora frondaria	7059	910640			X		X		X	X
Chlorochlamys chloroleucaria	7071	910654			X					
Chloropteryx tepperaria	7075	910658			X					
Lobocleta ossularia	7094	910500						X		
Lobocleta peralbata	7100	910506						X		
Idaea demissaria	7114	910523						X		
Idaea takturata	7122	910531					X		X	
Pleuroprucha insulsaria	7132	910540								X
Cyclophora culicaria	7134	910542						X		
Cyclophora packardi	7136	910544			X					
Cyclophora myrtaria	7137	910545								X
Scopula lautaria	7149	910557				X	X		X	
Scopula aemulata	7151	910559			X					
Scopula limboundata	7159	910567				X				
Scopula timandrata	7160	910568				X		X		
Leptostales pannaria	7173	910583						X		
Lophosis labeculata	7181	910591			X	X				
Eulithis diversilineata	7196	910031					X			
Orthonama obstipata	7414	910258		X						
Costaconvexa centrostrigaria	7416	910260	X		X		X		X	
Disclisioprocta stellata	7417	910261							X	
Eupithecia miserulata	7474	910324		X	X	X	X		X	X
Cladara anguilinea	7638	910479		X						
Dyspteris abortivaria	7648	910489			X					
Tolype notialis	7674	870025		X						X

<i>Artace cribrarius</i>	7683	870036									X
<i>Phyllodesma occidentis</i>	7686	870002	X	X							
<i>Malacosoma americana</i>	7701	870017				X	X				
<i>Dryocampa rubicunda</i>	7715	890022		X	X				X		
<i>Anisota pellucida</i>	7723.1	890017.1					X				
<i>Automeris io</i>	7746	890055				X					
<i>Antheraea polyphemus</i>	7757	890070		X							
<i>Actias luna</i>	7758	890072				X					
<i>Ceratomia catalpae</i>	7789	890105								X	
<i>Enyo lugubris</i>	7851	890172							X	X	
<i>Eumorpha pandorus</i>	7859	890182							X		
<i>Amphion floridensis</i>	7873	890194		X		X					
<i>Darapsa myron</i>	7885	890207				X	X				
<i>Clostera inclusa</i>	7896	930004		X							
<i>Nadata gibbosa</i>	7915	930046		X	X	X					
<i>Peridea angulosa</i>	7920	930049							X		
<i>Furcula borealis</i>	7936	930028				X					
<i>Symmerista albifrons</i>	7951	930127	X						X		
<i>Heterocampa umbrata</i>	7990	930082		X	X						X
<i>Heterocampa guttivitta</i>	7994	930086		X	X						X
<i>Heterocampa biundata</i>	7995	930087		X	X						
<i>Crambidia pallida</i>	8045.1	930219								X	
<i>Crambidia uniformis</i>	8046	930220				X				X	
<i>Cisthene plumbea</i>	8067	930184				X					
<i>Cisthene subjecta</i>	8071	930188				X		X	X		
<i>Cisthene packardii</i>	8072	930189				X				X	
<i>Hypoprepia miniata</i>	8089	930204				X					
<i>Hypoprepia fucosa</i>	8090	930205				X		X			
<i>Clemensia albata</i>	8098	930215	X	X	X			X			X
<i>Comachara cadburyi</i>	8104	931499				X					
<i>Virbia laeta</i>	8114	930294				X	X		X		
<i>Virbia opella</i>	8118	930297					X				

<i>Virbia rubicundaria</i>	8122	930300								X			
<i>Estigmene acrea</i>	8131	930317					X						
<i>Spilosoma latipennis</i>	8133	930311									X		
<i>Spilosoma congrua</i>	8134	930309				X							
<i>Spilosoma virginica</i>	8137	930316		X			X				X		
<i>Hyphantria cunea</i>	8140	930319		X	X		X	X			X		
<i>Apantesis phalerata</i>	8169	930278					X						
<i>Apantesis vittata</i>	8170	930279					X				X		
<i>Halysidota tessellaris</i>	8203	930360				X	X				X		
<i>Dasychira tephra</i>	8292	930144							X				
<i>Orgyia definita</i>	8314	930166									X		
<i>Orgyia leucostigma</i>	8316	930168	X			X			X				X
<i>Idia americalis</i>	8322	930469	X	X	X	X					X	X	X
<i>Idia aemula</i>	8323	930471	X	X	X	X	X	X			X	X	X
<i>Idia rotundalis</i>	8326	930474					X	X			X	X	
<i>Idia diminuendis</i>	8329	930477					X						
<i>Idia lubricalis</i>	8334	930482					X					X	X
<i>Phalaenophana pyramusalis</i>	8338	930487									X		
<i>Zanclognatha lituralis</i>	8340	930489					X						
<i>Zanclognatha minoralis</i>	8343	930491										X	
<i>Zanclognatha obscuripennis</i>	8347	930494					X	X			X		
<i>Macrochilo hypocritalis</i>	8357.1	930509					X	X			X	X	
<i>Macrochilo orciferalis</i>	8360	930511							X			X	
<i>Phalaenostola larentioides</i>	8364	930514									X	X	
<i>Tetanolita mynesalis</i>	8366	930516				X	X				X	X	
<i>Tetanolita floridana</i>	8368	930518				X	X	X			X	X	X
<i>Bleptina caradrinalis</i>	8370	930520					X	X					
<i>Renia salusalis</i>	8378	930529					X						
<i>Renia discoloralis</i>	8381	930532				X	X						
<i>Renia flavipunctalis</i>	8384.1	930536				X		X				X	
<i>Renia fraternalis</i>	8385	930537					X				X		
<i>Renia adspersgillus</i>	8386	930538				X					X		

<i>Renia sobrialis</i>	8387	930539				X				
<i>Lascoria ambigualis</i>	8393	930547	X	X			X		X	X
<i>Palthis angulalis</i>	8397	930551				X			X	
<i>Palthis asopialis</i>	8398	930552		X	X	X			X	X
<i>Redectis pygmaea</i>	8400	930554						X	X	
<i>Redectis vitrea</i>	8401	930555		X						
<i>Rivula propinqualis</i>	8404	930592		X						
<i>Parahyphenodes quadralis</i>	8430	930667				X				
<i>Schrankia macula</i>	8431	930668	X				X		X	
<i>Sigela brauneata</i>	8432	930657	X					X		
<i>Abablemma brimleyana</i>	8437	930651				X				
<i>Hypena manalis</i>	8441	930561						X		
<i>Hypena baltimoralis</i>	8442	930562	X		X	X				
<i>Hypena bijugalis</i>	8443	930564	X							
<i>Hypena scabra</i>	8465	930588	X	X						X
<i>Hemeroplanis scopulepes</i>	8467	930700	X	X						
<i>Phytometra rhodarialis</i>	8481	930717				X				
<i>Pangrapta decoralis</i>	8490	930559				X	X			
<i>Ledaea perditalis</i>	8491	930560				X				
<i>Metalectra discalis</i>	8499	930679					X			
<i>Metalectra albilinea</i>	8504	930684	X							
<i>Arugisa latiorella</i>	8510	930635				X	X	X	X	
<i>Hypsoropha monilis</i>	8527	930628		X	X					
<i>Hypsoropha hormos</i>	8528	930629			X					
<i>Anticarsia gemmatalis</i>	8574	931077						X	X	X
<i>Epidromia rotundata</i>	8585.3	930977								X
<i>Panopoda rufimargo</i>	8587	931089					X	X		
<i>Phoberia atomaris</i>	8591	930862	X	X						
<i>Cissusa spadix</i>	8592	930864		X						
<i>Lesmone detrahens</i>	8651	930970				X		X	X	
<i>Lesmone hinna</i>	8653	930972	X	X	X	X				X
<i>Selenisa sueroides</i>	8658	930981						X	X	

Metria amella	8666	930992				X				
Zale fictilis	8687	931021								X
Zale lunata	8689	931023		X		X				X
Zale aeruginosa	8694	931029				X				
Zale squamularis	8700	931035		X						
Zale buchholzi	8706	931041				X				
Zale lunifera	8713	931048	X	X	X					
Zale intenta	8713.1	931049		X	X					
Allotria elonympha	8721	930962				X	X			
Parallelia bistrariis	8727	930961					X			
Caenurgia chloropha	8733	930938	X	X		X		X		
Mocis latipes	8743	930942				X		X	X	X
Mocis marcida	8744	930943				X	X		X	X
Mocis texana	8745	930944				X			X	X
Mocis disseverans	8746	930945				X				X
Argyrostrotis flavistriaria	8759	930951		X		X				
Catocala ilia	8801	930792						X		
Catocala andromedae	8849	930835						X		
Catocala ultronia	8857	930841						X		
Catocala clintonii	8872	930853				X	X			
Catocala similis	8873	930855						X		
Argyrogramma verruca	8885	931166							X	
Chrysodeixis includens	8890	931170						X		
Paectes abrostoloides	8962	931111		X	X	X				X
Meganola minuscula	8983	931121				X				
Meganola phylla	8983.1	931122		X	X	X				
Meganola spodia	8983.2	931123		X	X					
Nola cereella	8991	931131				X		X	X	
Cydosia aurivitta	8999	931254				X				
Ozarba nebula	9033	931305			X			X	X	
Hyperstrotia nana	9035	930727				X				
Hyperstrotia aetheria	9036	930728				X	X			

<i>Hyperstrotia pervertens</i>	9037	930729			X	X		
<i>Hyperstrotia flaviguttata</i>	9039	930731			X	X		
<i>Marimatha nigrofimbria</i>	9044	931284			X	X		
<i>Homophoberia apicosa</i>	9057	932025			X	X		
<i>Eublemma minima</i>	9076	930693			X		X	X
<i>Ponometia candefacta</i>	9090	931314			X			
<i>Acronicta americana</i>	9200	931421			X			
<i>Acronicta tritona</i>	9211	931432		X	X			
<i>Acronicta hasta</i>	9229	931445			X			
<i>Acronicta lobeliae</i>	9238	931455			X			
<i>Acronicta ovata</i>	9243	931463					X	
<i>Acronicta increta</i>	9249	931467			X	X		
<i>Acronicta retardata</i>	9251	931470			X			
<i>Acronicta brumosa</i>	9255	931472			X			
<i>Acronicta impleta</i>	9257	931474			X			
<i>Acronicta longa</i>	9264	931478		X	X			
<i>Acronicta oblinita</i>	9272	931485		X				
<i>Acronicta fallax</i>	9281	931442.1		X				
<i>Polygrammate hebraeicum</i>	9285	931497			X			
<i>Iodopepla u-album</i>	9522	932287		X	X			X
<i>Bellura brehmei</i>	9524	932515			X			
<i>Bellura anoa</i>	9525.1	932516			X			
<i>Bellura densa</i>	9526	932518		X				
<i>Chytonix palliatricula</i>	9556	932249.5		X				
<i>Phosphila turbulenta</i>	9618	932208	X					
<i>Phosphila miselioides</i>	9619	932209		X	X			
<i>Callopietria cordata</i>	9633	932194			X			
<i>Amphipyra pyramidoides</i>	9638	931544						X
<i>Athetis tarda</i>	9650	932269		X	X			X
<i>Balsa labecula</i>	9664	931419			X			
<i>Spodoptera frugiperda</i>	9666	932216					X	X
<i>Spodoptera ornithogalli</i>	9669	932219					X	

<i>Leucania scirpicola</i>	10455	932957					X			X
<i>Orthosia alurina</i>	10491	932774	X							
<i>Orthosia hibisci</i>	10495	932778	X							
<i>Egira alternans</i>	10517	932799	X	X						
<i>Morrisonia mucens</i>	10519	932801			X					
<i>Morrisonia confusa</i>	10521	932803			X	X				
<i>Ulolonche culea</i>	10567	933118	X	X	X					
<i>Ulolonche modesta</i>	10569	933120				X				
<i>Orthodes majuscula</i>	10585	933136		X	X					
<i>Agrotis venerabilis</i>	10651	933516				X				
<i>Agrotis ipsilon</i>	10663	933528				X				
<i>Feltia subterranea</i>	10664	933504				X				
<i>Anicla infecta</i>	10911	933212						X	X	
<i>Xestia dilucida</i>	10969	933586							X	X
<i>Helicoverpa zea</i>	11068	932045					X			
<i>Schinia bina</i>	11105	932150					X			
<i>Schinia sordidus</i>	11112	932116					X			
<i>Schinia siren</i>	11115	932123					X			
<i>Schinia lynx</i>	11117	932120					X	X		
<i>Schinia arcigera</i>	11128	932134						X		
<i>Schinia rivulosa</i>	11135	932091						X		
<i>Schinia nubila</i>	11137	932117					X	X		
<i>Schinia saturata</i>	11140	932135					X			
<i>Schinia trifascia</i>	11149	932096					X			
<i>Schinia nundina</i>	11177	932156					X			

**APPENDIX 3.
ODONATA (DRAGONFLIES AND DAMSELFLIES) RECORDED ON THE GEORGIA SOUTHERN UNIVERSITY
(STATESBORO) CAMPUS**

Family	Genus	Species	Common Name	Notes
			Common Green	
Aeshnidae	<i>Anax</i>	<i>julius</i>	Darter	
			Four-Spotted	
Libellulidae	<i>Brachymesia</i>	<i>gravida</i>	Pennant	
Libellulidae	<i>Celithemis</i>	<i>elisa</i>	Calico Pennant	
Libellulidae	<i>Celithemis</i>	<i>amanda</i>	Amanda's Pennant	
Libellulidae	<i>Celithemis</i>	<i>verta</i>	Red-veined Pennant	iNaturalist
Libellulidae	<i>Erythemis</i>	<i>simplicicollis</i>	Eastern Pondhawk	
Libellulidae	<i>Erythodiplax</i>	<i>minuscola</i>	Little Blue Dragonlet	
Libellulidae	<i>Libellula</i>	<i>cynea</i>	Spangled Skimmer	from collection
Libellulidae	<i>Libellula</i>	<i>axilana</i>	Bar-winged Skimmer	
Libellulidae	<i>Orthemis</i>	<i>ferruginea</i>	Roseate Skimmer	
Libellulidae	<i>Pachydiplax</i>	<i>longipennis</i>	Blue dasher	
Libellulidae	<i>Pantala</i>	<i>flavescens</i>	Wandering Glider	
Libellulidae	<i>Perithemis</i>	<i>tenera</i>	Eastern Amberwing	
Libellulidae	<i>Plathemis</i>	<i>lydia</i>	Common white tail	from collection
Libellulidae	<i>Tramea</i>	<i>lancelata</i>	Black Saddlebags	
Coenagrionidae	<i>Enallagma</i>	<i>doubledayi</i>	Atlantic Bluet	
Coenagrionidae	<i>Enallagma</i>	<i>signatum</i>	Orange Bluet	iNaturalist
Coenagrionidae	<i>Ichonura</i>	<i>prograta</i>	Furtive Forktail	
Coenagrionidae	<i>Ichonura</i>	<i>ramburi</i>	Rambur's Forktail	



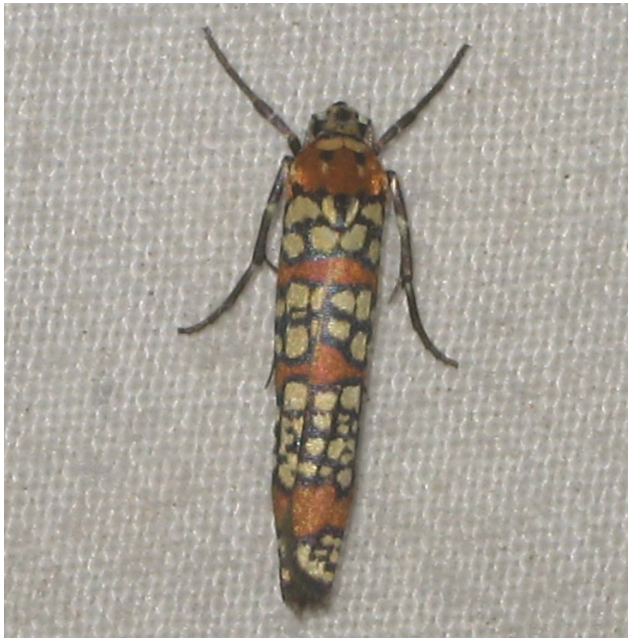
REU Students visiting GSU Insect Collection (with Lance Durden), June 2019.



Some participants during the moth sheet night on 5 April 2019 on GSU South Campus (just before dark). This moth night was combined with the Southern Lepidopterists' Society annual meeting that convened at GSU from 5-7 April 2019.



Moth sheet and battery operated U.V. light set up on GSU South Campus, just before dark (June 2019).



Atteva aurea (Attevidae) on light sheet on GSU South Campus.



Tosale oviplagalis (Pyralidae) on light sheet in rain on GSU South Campus



Phaeoura quernaria (Geometridae) on light sheet on GSU South Campus



Lycia ipsilon (Geometridae) on light sheet on GSU South Campus.



Nedra ramosula (Noctuidae) on light sheet behind GSU Biology building.



Marimatha nigrofimbria (Noctuidae) on light sheet behind Biology Building



Egira alternans (Noctuidae) on light sheet on GSU South Campus



A bait trap on GSU South Campus with hundreds of live moths (mostly *Catocala* spp.) and a few butterflies. These specimens were identified, recorded, and then released.



Cornell display drawers, of the type purchased with Sustainability Grant funds (glass tops removed), showing representative moths, dragonflies and damselfies in the GSU Insect Collection.