

BIOLOGICAL DIVERSITY OF THE GUIANA SHIELD PROGRAM (BDG)
FY2012 SUMMARY REPORT
(<http://botany.si.edu/bdg/index.html>)

The goals for BDG during FY 2012:

1. to start the analysis of over 25 years of specimen data collected by the BDG program;
2. to conduct the last major botanical expedition (mostly funded by National Geographic) to an unexplored tepui in Guyana, focusing on poorly studied organisms;
3. to begin a discussion on overall goals for the program in the next few years as we plan for cleaning up all the backlog of specimens; and
4. to open discussions with Botany informatics on moving over 150,000 plant records to EMu.

Overall Narrative Summary for 2012 – BDG seeks to document, understand, and conserve the biological diversity of the Guiana Shield area. **Research.** A plant collecting expedition to an unexplored tepui (Kamakusa) was successfully completed and over a thousand numbers were collected. Two entomology expeditions to Guyana were also supported resulting in over 15,100 collections of Odonates, ants, bees, and wasps. BDG assisted Entomology with the processing of ant collections from the Shield. At least 26 peer-reviewed publications related to the Shield were published. Two notable ones are a book by Cole et al. (2012) on the Amphibians and Reptiles of Guyana, and the latest volume of our collector series (Kelloff et al. 2011). **Collections.** A contractor is now working on preparing the plant records for conversion to EMu. The regular flow of specimens for identification and exchange was maintained. **Outreach.** One Guyanese collaborator was brought to the Smithsonian; one Guyanese and one Research Associate were supported to attend the *Flora of Guianas* Meeting. Talks were presented and interns were hosted including one from UDC (Historically Black Public University). Quite a few tours of the BDG operation at MSC and NH-Botany were given at the request of the Directors Office, Smithsonian Associates and the Chairman of Botany. One PhD student graduated and one postdoctoral Fellow was mentored. We participated in the “More than meets the eye” exhibit at NH. An internal review of the BDG program resulted in the development of a plan for the next 4 years. This was particularly detailed to include a gradual closing down of the program keeping in mind our overall goal. Our full report and application for funding for the next three years (probably due January 2013) will include additional information on all these and other topics.

Research

For most of its history BDG maintained a resident collector in Guyana and supported large expeditions across the Shield. These efforts resulted in a large number of collections, photos, and associated materials. All of the collections and most of the trip reports can be found on our website (Alexander et al. 2007). We are now making those data available in the Smithsonian Plant collections series. This year we published the reports of H. David Clarke: the volume includes maps, georeferenced localities and a list of the taxa he collected (Kelloff et al. 2011). Available in December will be the *Amphibians and Reptiles of Guyana* (Cole et al. 2012). This publication was the product of a collaboration of the American Museum of Natural History, Smithsonian Institution, and Royal Ontario Museum and it has keys, annotated species accounts, type specimens & localities, geographic distribution, voucher specimens from Guyana, coloration in life (and often a color photograph), and comments pointing out interesting subjects for future research.

Data from approximately 150,000 plant collections have been obtained during the more than 25 years of BDG research on the Shield; we have also collected about 9,000 bird records. These data offer a unique opportunity to examine patterns of diversity across the Shield. Several preliminary papers on this have been published over the years (Funk 1997; Funk et al. 2002; Funk et al. 2005). However, since their publication more data have been collected and newer programs developed to analyze those data. A postdoctoral Fellow is currently working with BDG is setting up the data to model species distributions across the shield and to look at the effects of climate change on future diversity. An NSF grant to support monographic research was declined.

EXPEDITIONS

Entomology. An expedition to the Upper Essequibo Region of Guyana in the Conservation International Concession was organized by Jeffrey Sosa-Calvo (Entomology) and students from University of Maryland, Towson University, and USGS Patuxent Wildlife Research Center. The expedition resulted in 9820 individual ant collections, 27 entire ant colonies and 5010 bees and wasps. They collected ca 25 genera of ants with probably two new species in *Nylanderia*. Among the bees there were four new records of *Lasioglossum* (Halictidae) and a very interesting record of *Ptilothrix* (Apidae: Emphorini) not previously reported from Guyana. A second entomology expedition organized by Dr. Jessica Ware (Rutgers University) was conducted at CEIBA Biological Station and along the Guyana coast to Mahaica, Mahaicony, and Santa Mission with five graduate students (Elizabeth Ballare, Dominic Evangelista, Manpreet Kaur Kohli, Melissa Sanchez Herrera, and Nicole Sroczynski) and one undergraduate, (Ian Biazzo). They collected over 300 specimens, from 29 genera of dragonflies and damselflies with additional collections of cockroaches and termites, from the genera *Nasutitermes*, *Blaberus* and *Blatella*. The expedition may have collected a new species of dragonfly.

Plants. With funds from the National Geographic Society and BDG Karen Redden continued documenting the plants of the Guiana Shield. **Redden** (UDC) along with Ken **Wurdack** (SI-Botany), Erin **Tripp** (Rancho Santa Ana Botanic Garden) and A. **Radosavljevic** (graduate student – Chicago Botanical Garden), collected in the rugged terrain of the Kamakusa tepui, Guyana from 11 May – 16 June 2012. They were assisted by C. Jacobis, J. Ralph, and C. Austin (Guyanese Amerindians) and were able to make 1109 collections for a total of 4015 individual specimens.

Collections

Specimen Handling: After over 25 years of activity, BDG has a substantial backlog of specimens that are not identified and therefore are neither mounted nor placed into the SI collections and as a result the duplicates cannot be distributed. Most of the backlog is the result of experts failing to do identifications after they agreed or they are in plant families that do not have an expert. Part of the plan to phase out BDG includes cleaning up this backlog. So this year we spent time working on identifying some them at least to genus, although most were identified to species. Collections are identified by the name of the senior collector. Work on the *Mutchnick* collection has been completed and all specimens distributed. *Gillespie* and *McDowell* collections are almost finished and work began on the *Hoffman* collection. Overall, ca. 900 identifications were added to the LABELS database. The collections have been distributed to the various herbaria on our exchange list and are waiting to be shipped. To date, over 50,000 plant specimens have been shipped to the Biodiversity Centre (CSBD) in Guyana and 24 boxes with ca. 2,800 specimens are being stored until requested by CSBD. Currently the herbarium at CSBD is incorporating the Jenman Collection into the Guyana National Herbarium (GNH) so the freezer is engaged. In addition to our work with the University of Guyana we helped support the Walter Roth Museum of Anthropology and the Georgetown Main Library by donating over 40 boxes of books.

Specimens from the 2012 expedition have been dried and sorted. The labels are in draft. However, we lack the geographical coordinates so the labels cannot be printed and specimens cannot be sent to specialists. Efforts to obtain the needed information from one of our staff have so far been futile.

The BDG Program acquired a historically important plant collection from the Buffalo Museum of Science (BUF). Over 2700 specimens, many collected by Thomas F. Lucy, were found still in the original newspapers with little or no documentation or labels. As an undergraduate, Kelloff worked on the original herbarium at Elmira College so she was able to generate labels based on her knowledge of the collector. In collaboration with the Elmira College Herbarium (ECH) curator a database was developed and labels produced; distribution plans are underway.

A BDG grant was awarded to SI-Entomology to assist with the processing of ants collecting from Guyana. These leaf-litter and hand collected specimens of ants are being sorted, identified, mounted, and made ready to be incorporated in the NMNH collections. Without this extra assistance the collect would wait years before it could be processed.

Outreach

The BDG sponsored a visit to the Smithsonian by Kaslyn Holder-Collins, Scientific Officer, University of Guyana. Kaslyn is in charge of the Guyana National Herbarium and she wanted to see how a large herbarium handles specimens and how the Library is organized. Hopefully her trip will help in the re-organization of the CSBD. The visit also gave her an opportunity to verify orchid identifications from specimens collected at Kaieteur National Park.

Christian Feuillet (SI-Research Associate) as acting SI Representative and Philip DaSilva (Guyanese Representative) were sponsored by the BDG to attend the Flora of the Guianas Advisory Board meeting, 22-23 October 2012 in Leiden, Netherlands. During this meeting a summary report was given by each member of the consortium and decisions are made about the future direction of the Flora of the Guiana publication series.

Hayley Hamilton (undergraduate, UDC) along with Camila Uribe-Holguin (undergraduate, Colombia) worked with the BDG on the imaging project, with the focus of digitizing the photographic collections. Camila was very interested in Botany and her training with us helped her gain acceptance into a PhD program in Barcelona, Spain.

The Future

Our efforts in the next few years will take several paths: publishing synthesis papers, cleaning up the backlog, making the data available, and creating a phased shut down of BDG. First we want to synthesize the data that we have collected over the last 26 years. These data include many different groups of organisms but the best representation is found in plants and birds. We currently have a postdoctoral fellow, Mauricio Diazgranados, working on using the data to study the patterns of diversity across the shield using modeling and climate layers. These analyses will take two additional years and will seek funds for a continuation of our current postdoc for that period of time.

Second, progress is planned on the backlog of plant specimens collected by BDG. Once specimens are identified to genus or species they move into our regular processing stream and are mounted, placed into the US National Herbarium and duplicates are distributed.

Third, we want to insure that all our work and the work of our collectors and colleagues is left in excellent condition and is freely available on the web. This includes images and specimens records. Currently we have a very detailed [website](#) (Alexander et al. 2007) that includes mapping features, expedition descriptions, pdfs of our publications, etc. and we don't want to lose this information. In addition we need to migrate the data to EMu and add photographs. All of this will take time and contractors.

Finally, BDG is currently working on a detailed 4-year plan to accomplish our goals and allow us to publish our synthetic papers and insure that all specimens and data are housed appropriately.

Explicit FY2013 goals:

1. to use BDG plant and bird data to study the non-directional species variation in community structure among a set of sample units within habitats and ecological niches;
2. to fund one expedition to Guyana to collect Odonates (processing paid for by collector);
3. to fund one fish expedition to Suriname (processing paid for by VZ);
4. to continue to fund the processing of ant specimens (final installment);
5. to publish two volumes of the BDG collector series;
6. to finish 20% of the plant backlog; and
7. to produce a grant proposal for three years of funding to complete research and implement a phased shut down of BDG.

Literature Cited in Report not found in the Appendix

- Alexander, S., V.A. Funk, & C. Kelloff. 2007 to present. Biological Diversity of the Guiana Shield Program <http://botany.si.edu/bdg/index.html>
- Cole, C.J., Carol R. Townsend, Robert P. Reynolds, Ross D. MacCulloch, and Amy Lathrop. (2012). Amphibians and Reptiles of Guyana, South America: An Annotated and Illustrated Checklist with Keys. *The Bulletin of the American Museum of Natural History* 125 (4):x-xxx.
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- Funk, V., A. K. Sakai and K. S. Richardson (2002). Biodiversity: the interface between systematics and conservation. *Systematic Biology* 51(2): 235-316.

APPENDIX

List of publications by NH staff and Research Associates for FY2012

- Armbruster, W. S. and D. C. Taphorn (2011). A new genus and species of weakly armored catfish from the Upper Mazaruni River, Guyana (Siluriformes: Loricariidae). *Copeia* 2011(1): 46-52.
- Barrio-Amorós, C. L., J. C. Señaris, R. D. MacCulloch, A. Lathrop, J. M. Guayasamin and W. E. Duellman (2011). Distribution, vocalization and taxonomic status of *Hypsiboas roraima* and *H. angelicus* (Amphibia: Anura: Hylidae). *Papeís Avulsos de Zoologia* 51: 21-28.
- Biazzo, I., G. R. Bourne, D. Evangelista, J. Evangelista, V. Funk, M. Sanchez-Herrera, C. L. Kelloff, M. K. Kohli, W. Kuhn, N. Sroszynski and J. Ware (2012). Guyana Days: Collecting in the Northern Guyana Shield. *Argia* 24(1): 12-14.
- Barneby, R. C., J. W. Grimes and O. Poncy (2011). Leguminosae subfamily Mimosoideae (taxonomic update by G. P. Lewis). In: M. J. Jansen-Jacobs, *Flora of the Guianas, series A: Phanerogams fascicle 28*: 1-384.
- Castellano, M.A., T.W. Henkel, S.L. Miller, and M.C. Aime (2012). Two new *Elaphomyces* species (Elaphomycetaceae, Eurotiales, Ascomycota) from Guyana associated with Caesalpinioideae (Fabaceae, Fabales). *Mycologia* doi:10.3852/12-061.
- Cole, C.J., Carol R. Townsend, Robert P. Reynolds, Ross D. MacCulloch, and Amy Lathrop. (2012). Amphibians and Reptiles of Guyana, South America: An Annotated and Illustrated Checklist with Keys. *The Bulletin of the American Museum of Natural History* 125 (4). In press. (MS over 600 pages)
- Croat, T. B., J. J. Grib and C. V. Kostelac (2012). New Species of *Philodendron* (Araceae) in the Guianas. *Aroideana* 35: 65-71.
- Fonty, E., J.-F. Molino, M.-F. Provost and D. Sabatier (2011). A new case of neotropical monodominant forest: *Spirotropis longifolia* (Leguminosae-Papilionoideae) in French Guiana. *Journal of Tropical Ecology* 27: 641-644.
- Henkel, T. W., M.C. Aime, J. K. Uehling and M. E. Smith (2011). New species and distribution records of *Clavulina* (Cantharellales, Basidiomycota) from the Guiana Shield. *Mycologia* 103(4): 883-894.
- Henkel, T.W., M.C. Aime, M. Chin, S.L. Miller, R. Vilgalys, M.E. Smith. (2012). Ectomycorrhizal fungal sporocarp diversity and discovery of new taxa in *Dicymbe* monodominant forests of the Guiana Shield. *Biodiversity and Conservation* 21: 2195-2220. doi: 10.1007/s10531-011-0166-1
- Kelloff, C.L., S.N. Alexander, H.D. Clarke, & V.A. Funk. (2011). Smithsonian Plant Collections, Guyana: 1995-2004, H. David Clarke. *Smithsonian Contribution to Botany* 97: viii-307.
- Kok, P. J. R., R. D. MacCulloch, D. B. Means, K. Roelants, I. Van Bocxlaer and F. Bossuyt (2012). Low genetic diversity in tepui summit vertebrates. *Current Biology* 22(15): 589-590.
- LaPolla, J.S., Kallal, Brady, S.G. (2012). A new ant genus from the Greater Antilles and Central America, *Zatania* (Hymenoptera: Formicidae), exemplifies the utility of male and molecular character systems. *Systematic Entomology* 37(1): 200-214.
- MacCulloch, R. D. (2012). Status of Amphibian Conservation in Guyana. In: H. Heatwole, J.W. Wilkinson and C.L. Barrio-Amorós (eds.). *Amphibian Biology* 9 (4). Surrey Beatty, Australia.
- MacCulloch, R.D. and R.P. Reynolds. (2012). Amphibians and reptiles from Paramakatoi and Kato, Guyana. *Check List* 8(2): 207-210.
- Matheny, P.B., M.C. Aime, M.E. Smith, T.W. Henkel TW (2012). New species and reports of *Inocybe* (Agraicales) from Guyana. *Kurtziana* 37: 23-39.

- Mathis, Wayne N. & Tadeusz Zdzienicka. (2012). A Revision of the New World Species of *Polytrichophora* Cresson and *Facitrichophora*, new genus (Diptera, Ephydriidae). *ZooKeys* 231: 1-116.
- Mol, J. H., R. V. Vari, R. Covain, P. W. Willink and S. Fisch-Muller (2012). Annotated checklist of the freshwater fishes of Suriname. *Cybium* 36(1): 263-292.
- Reynolds, R.P. and R.D. MacCulloch. (2012). Preliminary Checklist of Amphibians and Reptiles from Baramita, Guyana. *Check List* 8(2): 211-214.
- Sidlauskas, B. L. and R. P. Vari (2012). Diversity and distribution of anostomoid fishes (Teleostei: Characiformes) throughout the Guianas. *Cybium* 36(1): 71-103.
- Uehling, J.K. T.W. Henkel, M.C. Aime, M.E. Smith. (2012). New species of *Clavulina* (Cantharellales, Basidiomycota) with effused or resupinate basidiomata from the Guiana Shield. *Mycologia* 147 (2): 547-556.
- Wilson, A.W., M.C. Aimes, J. Dierks, G.M. Mueller, T.W. Henkel. (2012) *Craterellus* and *Cantharellus* in Guyana I. New species, distribution records, and a synopsis of known taxa. *Mycologia* doi: 10.3852/11- 412.

Publications by NH staff and Research Associates (missed in previous years reports)

- Heinicke, M. P., W. E. Duellman, L. Trueb, D. B. Means, R. D. MacCulloch and S. B. Hedges (2009). A new frog family (Anura: Terrarana) from South America and an expanded direct-developing clade revealed by molecular phylogeny. *Zootaxa* 2211: 1-35.
- Kok, P. J. R., R. D. MacCulloch, A. Lathrap, B. Willaert and F. Bossuyt (2010). A new species of *Anomaloglossus* (Anura: Aromobatidae) from the Pakaraima mountains of Guyana. *Zootaxa* 2660: 18-32.
- MacCulloch, R. D. and A. Lathrap (2009). Herpetofauna of Mount Ayanganna, Guyana. Results of the Royal Ontario Museum Ayanganna Expedition 2000. *Royal Ontario Museum Science Contributions* 4: 36.
- MacCulloch, R. D., A. Lathrap, P. J. R. Kok, R. Ernst and M. Kalamandeen (2009). The genus *Oxyrhopus* (Serpentes: Dipsadidae: Xenodontinae) in Guyana: morphology, distributions and comments on taxonomy. *Papéis Avulsos de Zoologia* 49(36): 487-495.