

PRIMARY OBJECTIVES: Development of a cyberinfrastructure for the herbarium sciences is an ongoing endeavor. Over the past 20 years groups of herbaria have organized to develop regional projects. Some of the large and small herbaria, botanical gardens, regional networks and individual scientists have engaged in the development of data acquisition methods and software, computational software, web-based toolkits, and on-line digital resources. The purpose of this proposed meeting is to bring domain scientists from the herbarium community and the information technologists associated with this community together to discuss ways to build on the existing work to facilitate data acquisition, utilization and dissemination.

The herbarium community is currently organized into regional networks. We will bring representatives from each of these networks and representatives from the large “stand-alone” collections to this meeting. We will recruit from the current infrastructure of networks and societies to ensure that we include representatives of underrepresented groups at this meeting. We will use this infrastructure to disseminate meeting results, in a white paper and in regional presentations.

INTELLECTUAL MERIT: A recent survey conducted by SERNEC, representing 65 of the 220 herbaria in southeastern US, provides a snapshot of the national community. This survey has identified curatorial expertise at herbaria that vary greatly in size and resource availability. The disparity in resources ranges from those collections with little maintenance, expansion, or IT support, to those collections with endowments and/or strong institutional support in all of these areas. As we develop a cyberinfrastructure for this community, we will work to be cognizant of these disparities and to develop plans to meet these varying needs.

Cyberinfrastructure development involves four main categories of infrastructure (Stein 2008), and the meeting will be conducted to address these four areas:

1. Data infrastructure development, including data submission and acquisition. We will include representatives of SPECIFY and GBIF to help inform this effort. There is a need to develop methods to automate data acquisition and provide means of direct data submission, such as the developing IPT generated by GBIF and collaborators. There is also a need to provide means for specimen annotation, to use available global scientific expertise to enhance the value of specimen data. We will assess the potential for ongoing projects to meet these needs.
2. Computational infrastructure development, including access to appropriate hardware and software. There is extreme disparity in resource availability across the community in IT support, and a major objective is to develop a plan for sharing of expertise across the community.
3. Communication infrastructure development, involving bandwidth needs for effective data transfer, and also the development of common formats and ontologies. Biodiversity Information Standards, or TDWG, is making great progress on some of these issues, but a major aspect is the development of community best practices to encourage the use of these common formats. We will include representatives from BIS/TDWG in our efforts, and develop plans to integrate communication infrastructure in the community.
4. Human infrastructure is a fundamental aspect of cyberinfrastructure development that has been overlooked in many efforts to date. In order to mobilize information across the community, curators and associated IT support teams need to take ownership of the goals. This involves “buy-in” from the community, including a willingness to share protocols and data sets, coupled with community training.

BROADER IMPACTS: We have four main long term goals: 1) digitize all the herbarium collections in the country by the year 2020, 2) enhance research, teaching and service potentials of herbarium curators and affiliates, 3) recruit students from underrepresented groups to consider careers in the herbarium sciences, to provide a continuing brain trust in the 21st century, and 4) provide information to the public, K-12 teachers and students, college and university faculty and students, scientists, corporations and decision-makers in effective and useful formats. In order to meet these goals, we need to 1) develop a strategic plan for project sustainability, 2) develop a plan to seek funds to meet our goals, and 3) develop a plan to mobilize the community to meet our goals. The herbarium community offers a tremendous potential database for systematists, ecologists, and evolutionary biologists. We need to act now to mobilize this community to make these data available. This meeting will nationalize this effort and integrate local and regional progress to provide these data at a continental scale.

Objectives

Development of a cyberinfrastructure for the herbarium sciences is an ongoing endeavor. Over the past 20 years groups of herbaria have organized to develop regional projects. Some of the large and small herbaria, botanical gardens, regional networks and individual scientists have engaged in the development of data acquisition methods and software, computational software, web-based toolkits, and on-line digital resources. The purpose of this proposed meeting is to bring domain scientists from the herbarium community and the information technologists associated with this community together to discuss ways to build on the existing work to facilitate data acquisition, utilization and dissemination.

The herbarium community is currently organized into regional networks. We will bring representatives from each of these networks and representatives from the large “stand-alone” collections to this meeting. We will recruit from the current infrastructure of networks and societies to ensure that we include representatives of underrepresented groups at this meeting. We will use this infrastructure to disseminate meeting results, in a white paper and in regional presentations.

A recent survey conducted by SERNEC, representing 65 of the 220 herbaria in southeastern US, provides a snapshot of the national community. This survey has identified curatorial expertise at herbaria that vary greatly in size and resource availability. The disparity in resources ranges from those collections with little maintenance, expansion, or IT support, to those collections with endowments and/or strong institutional support in all of these areas. As we develop a cyberinfrastructure for this community, we will work to be cognizant of these disparities and to develop plans to meet these varying needs.

Cyberinfrastructure development involves four main categories of infrastructure (Stein 2008), and the meeting will be conducted to address these four areas:

1. Data infrastructure development, including data submission and acquisition. We will include representatives of SPECIFY and GBIF to help inform this effort. There is a need to develop methods to automate data acquisition and provide means of direct data submission, such as the developing IPT generated by GBIF and collaborators. There is also a need to provide means for specimen annotation, to use available global scientific expertise to enhance the value of specimen data. We will assess the potential for ongoing projects to meet these needs.
2. Computational infrastructure development, including access to appropriate hardware and software. There is extreme disparity in resource availability across the community in IT support, and a major objective is to develop a plan for sharing of expertise across the community.
3. Communication infrastructure development, involving bandwidth needs for effective data transfer, and also the development of common formats and ontologies. Biodiversity Information Standards, or TDWG, is making great progress on some of these issues, but a major aspect is the development of community best practices to encourage the use of these common formats. We will include representatives from BIS/TDWG in our efforts, and develop plans to integrate communication infrastructure in the community.
4. Human infrastructure is a fundamental aspect of cyberinfrastructure development that has been overlooked in many efforts to date. In order to mobilize information across the community, curators and associated IT support teams need to take ownership of the goals. This involves buy-in from the community, including a willingness to share protocols and data sets, coupled with community training.

We have four main long term goals: 1) digitize all the herbarium collections in the country by the year 2020, 2) enhance research, teaching and service potentials of herbarium curators and affiliates, 3) recruit students from underrepresented groups to consider careers in the herbarium sciences, to provide a continuing brain trust in the 21st century, and 4) provide information to the public, K-12 teachers and students, college and university faculty and students, scientists, corporations and decision-makers in effective and useful formats. In order to meet these goals, we need to 1) develop a strategic plan for project sustainability, 2) develop a plan to seek funds to meet our goals, and 3) develop a plan to mobilize the community to meet our goals. The herbarium community offers a tremendous potential database for systematists, ecologists, and evolutionary biologists. We need to act now to mobilize this community to make these data available. This meeting will nationalize this effort and integrate local and regional progress to provide these data at a continental scale.

Need for the meeting

Current digital technologies have revolutionized access to primary sources of information. For the biological sciences, these technologies have opened the door for sharing resources and data that have been accumulated over centuries of observation, reporting, and discussion by biologists. In 2000, the Organization for Economic Cooperation and Development (OECD), recognizing that natural history collections, such as herbaria, are superb sources of primary information about the global distribution of organisms, authorized formation of the Global Biodiversity Information Facility (GBIF), charged with providing free and open access to biodiversity information. The National Biological Information Infrastructure (NBII) Program of the U.S. Geological Service (USGS) represents the US to GBIF.

Individual US herbaria have been contributing data to GBIF since its inception. Today, they provide more than two million records, but this is a small proportion of the approximately 79 million specimens of plants, fungi, and algae held in US institutions (data from Index Herbariorum, 09/12/09). Most of these herbaria, as well as many that do not provide data to GBIF, also enable searching of their data through their own web sites and a few provide access through regional sites (e.g., California, SEINet, SERNEC, Pacific Northwest). This reflects the enthusiastic support of those working in the almost 600 US herbaria for increasing access to the nation's herbarium resources. Many of these herbarium web sites provide tools for using specimen data that go far beyond what is available through GBIF.

This support for making herbarium specimen resources available is also reflected in the formation of the US Virtual Herbarium Project (USVH), with the goal of accelerating the creation of a national herbarium network. This network will provide free and open access to collection data and images from all vascular plant specimens in US herbaria by 2020. The ubiquity of plants across the landscape, the number and distribution of herbaria across the continent, and the efforts of two centuries of plant collecting, means that the resulting resource will provide information on plant distributions, migrations, phenology, and ecology that is unmatched in quality and scale by any other biological dataset.

USVH's goal is ambitious, but realistic. The basic technology needed already exists. What is not well developed at this time is a clear road map for its construction. This is the purpose of the proposed workshop. It will bring together, for the first time, curators and information technologists from each region and the largest free-standing herbaria along with representatives of NBII, GBIF, and other major projects that are important to development of USVH, e.g., Specify, IPNI, Tropicos, and Morphbank. The goals of the workshop are to identify 1) areas in which modifications of existing technology could greatly accelerate the process of imaging and databasing [digitizing] individual specimens, 2) improved tools for cleaning and sharing specimen data, 3) effective mechanisms for creating state-of-the-art nodes for all the regional networks, 4) the costs involved in all aspects of the project, and 5) plans for securing the funding necessary to complete the project. For each major need identified, individuals to spearhead initiatives in the area will be identified and charged with contributing to an overall proposal.

In endorsing formation of a national herbarium network, the goals of the herbarium community reach far beyond the 2020 goal of digitizing collections. We seek to enhance the study of organismal biology, increase interest and capability in biodiversity analysis, recruit under-represented groups into the plant sciences, and mobilize the herbarium community into an effective cybercommunity. Digitizing collections and making their information available via a national network will be a major contribution toward achievement of these goals.

Individual herbaria in the US have been working towards digitizing their collections for some time. One of the earliest meetings on the topic was held at the University of California-Berkeley in 1992. This spread awareness of the need for standards and the value of relational databases among the participants, many of whom had little background in computer science. Early efforts to create regional resources include those by Haynes at the University of Alabama (SERFIS; 1988) and Duncan at the University of California- Berkeley (SMASCH; 1992). Many other curators began databasing their own herbarium collections, but there were relatively few efforts to create regional networks that would provide access to the holdings for multiple herbaria. There were many reasons for this, including the need to develop reliable and fast internet access throughout the country, to reach agreement on the standards to be followed in capturing data, and to establish effective protocols for sharing specimen data.

Today, almost all parts of the country, and certainly academic institutions, have fast and reliable access to the internet. Members of Biodiversity Information Standards (formerly TDWG), have worked since the early 1990s to establish international standards and protocols for exchanging many kinds of taxonomic data. In 2001, 21 individuals working with collections networks in different parts of the world came together to start development of what became DiGIR, a program for Distributed Generic Information Retrieval. This software is now being replaced with TAPIR (TDWG Access Protocol for Information Retrieval) that integrates DiGIR and BioCAsE. Thanks to such efforts there are now international standards for presenting and sharing collections data. In 2009, GBIF published its Integrated Publishing Toolkit, a software program designed to make it even easier to publish collection information to the web and, at the same time, obtain summary information, including distribution maps, of the records in a collection.

Within the US, a meeting held at Michigan State University in 2004, sponsored by the National Science Foundation, renewed interest in expanding the digitization of herbarium collections. The participants decided there was a need for the community to include not only databasing the label information but also imaging the specimens, and creating regional herbarium networks in an attempt to build collaborations and develop business models to support these efforts. The 25 curators attending the meeting agreed that digitizing all US vascular plant collections by 2020 was feasible and encouraged formation of regional networks for sharing expertise and information as well as providing access to the collections within the region.

The USVH project was initiated originally as a Coordinating Committee under the auspices of the Western Association of Agricultural Experiment Station Directors (WAAESD), building on the long-term involvement of some Agricultural Experiment Stations (AES) with the herbaria at land grant institutions. The original Coordinating Committee (Barkworth, Carlino, Liston, Mayfield, and Murrell), which was formed in late 2007, organized a national meeting of curators at the 2008 BSA/ASPT meeting. A clear consensus from this meeting was support for formation of a national herbarium network, one that would build on and strengthen regional networks. After this meeting, the Coordinating Committee developed a proposal for a standard WAAESD Project that was submitted in the fall of 2008 and approved in the spring of 2009.

In 2009, the committee was expanded to include three additional members, Gilbert, Moe, and Dyreson, all of whom brought greater knowledge of the technological challenges involved in building the USVH to the committee. After several online and telephone discussions, the expanded committee agreed that it was necessary to hold a workshop for the critical players to establish what would be required in terms of technology, infrastructure, and funding. This proposal reflects that decision.

The second annual meeting of the USVH project was held in conjunction with the annual BSA/ASPT meeting in August 2009 in Snowbird, Utah. At this meeting Dr. Stella Coakley, the WAAESD's administrative advisor to the project, discussed the sponsorship by WAAESD and what this sponsorship could provide, including 1) forum within which to hold discussions, 2) an identity to use in approaching funding sources, administrators, and the public, 3) a structure that requires identifying goals and milestones, and 4) potentially, funding for one individual per state (at the discretion of each state AES director) to attend the project's annual meeting. The meeting continued with presentations on how to digitize specimens (in response to questions that had been raised at the first meeting) and a presentation by Giri Palanisamy of the NBII. At this meeting the decision was made to seek funding for a workshop. It was decided that Murrell, with his experience organizing the SERNEC RCN, would lead the development of the workshop proposal, in collaboration with Barkworth, with both serving as co-chairs of the organizing committee.

List of recent meetings

2004	Michigan State University, Lansing, Michigan	State of US Herbaria
Aug. 2008	Vancouver, BC	USVH Coordinating Committee and US Curators
Aug. 2009	Snowbird, Utah	USVH Coordinating Committee and US Curators
Aug. 2009	Snowbird, Utah	USVH Coordinating Committee

Chairpersons and Organizing Committee

Zack Murrell – co-chair	Appalachian State University
Mark Barkworth – co-chair	Utah State University
Mark Mayfield	Kansas State University
Jennifer Carlino	National Biological Information Infrastructure
Curtis Dyreson	Utah State University
Edward Gilbert	Arizona State University
Richard Moe	University of California-Berkeley

Location, probable dates for the meeting, and method of announcement/invitation

The Missouri Botanical Garden has agreed to host the meeting on their campus in St. Louis, MO. We have tentatively planned for meeting January 26-28, but we realize this may be overly optimistic.

The location is central for the whole country, is readily accessible from a major airport, and hotel accommodations in the area are relatively inexpensive. In addition, the Garden is home to one of the US' largest herbaria and has been deeply involved in the global informatics effort. In addition, the executive offices of the Botanical Society of America are located on the grounds of the Garden.

We have contacted each of the regional herbarium networks and each of the large stand-alone herbaria. These groups have committed a curator representative and an Information Technology representative to the meeting. We plan to invite at least five graduate students to the meetings and will also commit at least five invitees to select from the curatorial and associated IT community to ensure diversity in traditionally underrepresented groups.

Workshop organization and participants

Herbaria. - The regional networks will each be represented by two individuals, one with strength in the curatorial domain, the other with strength in the technology domain. These individuals are clearly critical to construction of USVH. They will be responsible for helping the herbaria in their regions acquire the ability to become part of the national network. For some of the smallest herbaria, this may mean that a larger institution takes responsibility for helping accomplish this goal but many larger herbaria will wish to be independent, contributing records to a regional node while maintaining their own web site, perhaps because it is integrated into various research applications being developed at that institution. Regional representatives, in addition to being knowledgeable, will need to determine how best to serve such disparate needs.

In addition, we have recruited representatives from the eight herbaria not affiliated with universities that house more than a million specimens (PH, CAS, BRIT, NY, MO, US, F, and RSA). Between them, they hold 34% of the specimens in US herbaria thus their inclusion in USVH is essential.

Their impact will be somewhat less than this number suggests because Index Herbariorum, from which the numbers on which the 34% is based were obtained, provides only the total number of specimens, not the total number of vascular plant specimens. Nevertheless, USVH without the large free standing herbaria would be travesty. More importantly, the fact that they are free standing means that they have different concerns and needs from the majority of US herbaria which are either part of an academic institution or a federal or state agency.

Related groups: The NBII is of particular importance to USVH because it is the US representative to GBIF and it mirrors the GBIF node. Under current protocols, all US collection records, like those of other countries, are harvested by GBIF, indexes the records, and then posts them to the master site. In order to protect and preserve this information, it is then mirrored by agencies such as NBII. Within the US, NBII has worked with various groups to make their information, and that from GBIF, more useful to policy makers and more visible to the public. It is also working with multiple communities, including the herbarium community, to share their biodiversity resources both so they can more easily be combined in powerful, multidimensional analyses and used in education programs directed toward students of all ages as well as being more accessible to the general public. These emphases were evident in NBII's inclusion of representatives from several collections-oriented groups to a GBIF-sponsored meeting in Washington, D.C. in April 2009 as well as their participation in Botany and Mycology 2009 both during the USVH meeting and afterwards, in the exhibitors hall.

Because NBII works through GBIF, representatives of the GBIF secretariat will also be invited to participate in the workshop but, because of financial restraints, their travel, like that of the NBII representatives, will not be funded.

Other resources that are critical to USVH are Specify, Index Herbariorum, International Plants Name Index (IPNI), International Taxonomic Information System (ITS), TROPICOS, databases of botanists and publications maintained by HUH and MO, and Morphbank.

The importance of curated databases of names, botanists, and publications to the provision of clean data is difficult to underestimate. The resources listed above are basically "in house" resources. It would benefit USVH and the regional networks if they could become community resources, but such a change would have to be supported by their owners and ensure their continued integrity. Morphbank, unlike the resources just mentioned, was designed as a universally accessible resource for biological images. At present (09/14/09) it holds 227,422 images, a number that would be dwarfed if it were to incorporate specimen images from all US herbaria. Nevertheless, its experience would be beneficial in discussions of the relative merits of centralization to image handling.

To ensure that the participants are diverse, we are allocating five openings specifically for this task. It is unfortunately true that there are few minorities working in herbaria, even women being most conspicuous as non-tenured curators or collection managers.

Methods to disseminate results of meeting

We will provide results to sponsoring agencies, with modified versions being submitted to appropriate journals, the Herbarium Listserv and regional listservs. We will also make the results available for publicity and fundraising.

Recruitment and support of speakers and other attendees

We have recruited from each of the 12 regional herbarium networks and the largest stand-alone herbaria in the country. Our speakers will largely come from this group. We have invited Dr. Peter Raven, Director of the Missouri Botanical Garden, to take part in the meeting and he has agreed to provide welcoming remarks and to take part in our discussion on Day 2 concerning funding issues and development of a business model for the national effort. We are working closely with NBII and GBIF on this effort (an NBII representative is a member of the Organizing Committee) and we have identified

representatives from these two groups to help lead discussions. Dr. Stella Coakley, WAAESD Administrative Advisor to the project has also agreed to take a part in the meeting.

We will use the current regional network structure, along with various affiliated organizations, such as ASPT, Society of Herbarium Curators, and Society for the Preservation of Natural History Collections, to help identify representatives from underrepresented groups to invite to this meeting. We have already begun this effort.

Agenda

Day I

- 8.00 Welcome by Peter Raven
- 8.15 Opening remarks (NSF, WAAES, NBII, and USVH Committee)
- 9.15 Outline of program and purpose of meeting
- 9.25 Newly funded BRC and ABI awards relating to herbaria
- 9.50 SERNEC NSF Research Coordination Network: social network development
- 10.15 SEINet, Symbiota, and the US Virtual Federal Herbarium
- 10.35 Break
- 10.35 NBII national efforts
- 10.55 GBIF and NBII efforts.
- 11.15 Biodiversity Information Standards. Progress/needs from the herbarium community
- 11.35 Specify, present and future
- 11.55 Building community resources – names, collectors, concept maps
- 12.15 Lunch

01.30 Discussion topic 1. Building regional networks: challenges, solutions, and costs.

Seed the discussion groups – Ed Gilbert from SEINet, Dick Moe from California Consortium, and Ben Legler from PNW Herbaria.

Stress the role of networks to be responsible for assisting individuals in their region in acquiring the ability to digitizing their specimens and make them available to the network; for ensuring the network provides clean data to GBIF and for providing access to clean data from outside the region to those that access the network through their portal.

- 3.15 Break
 - 3.45 Desirable tools for regional portals, both existing and new. What tools are/will be most effective in encouraging wider use of the data?
 - 4.30 Group summaries and related discussion
 - 5.00 Topics for Day II – invite comments and suggestions
- Suggestions: Digitizing herbaria – cost effective procedures, needed resources. Lobbying and fund-raising. Developing a unified image and voice. Efforts beyond specimen digitization.
- 6.00 Reception followed by dinner (at MO).

Day II.

[May be revised based on previous day comments received]

- 8:30 Fund raising – Congress, legislatures, and foundations (Peter Raven will assist in discussion)
- 10.00 Break
- 10.20 Digitizing and linking in herbaria – including those that are not currently part of “the system” (agencies, teaching institutions, private companies). Technology, logistics, sociology.
- 11.10 What should a national portal offer?
- 12.00 Lunch catered in house.
- 1.30 Community resources – What is needed and how can we use community involvement constructively? Some suggestions: names, people, concepts, gazetteers, others, automated notification of new treatments/names/geographic records/ecological records?

- 3.00 Break
- 3.20 Organization. The current organization is ad hoc, within the WAAESD. We strongly recommend keeping that connection, but we need to decide on a way of passing on the leadership – and bringing different individuals on board if USVH is to maintain a coherent presence.
- 4.00 Creating a road map: Identifying tasks and task forces, milestones, outcomes. [If we have this day 2, people can start working on it on day 3].
- 5.30 Dinner – open but with transportation to a restaurant that provides meals for all sensitivities.

Day III

- 8.30 Overview
- 9.00 Break into task force groups to initiate detailed planning.
- 10.00 Questions, answers
- 10.15 Break
- 10.35 Preparation of report – with statement of goals to be achieved by April 30 and June 30.
- 11.30 Presentation of reports.
- 12.00 Lunch catered in house
- 1.00 Meeting summary and discussion.
- 1.45 Final summation and adjourn.
Evaluation and written suggestions/comments/ etc.

Outcomes:

Develop milestones for each of up to five areas by which progress can be monitored.

Describe activities and identify responsible individuals for achieving milestones up to submitting funding proposals.

Report to sponsoring agencies, with modified versions being submitted to appropriate journals, the Herbarium Listserv and regional listservs and made available for publicity and fundraising.

Budget

NOTE: Prices for food at MO are based upon estimates provided by Catering St. Louis at the Missouri Botanical Garden. Any savings that can be made in travel for those that are closer to the meeting site will be used to invite more attendees to the meeting. Per diem for meals not provided at the meeting, price is ASU out-of state price for dinner.

PI, STUDENT ASSISTANT AND FACILITIES AND ADMINISTRATIVE INDIRECT

PI travel and housing	\$800.00
Student worker to assist Murrell with logistics and process paperwork	\$607.00
Facilities and Administrative Indirect to ASU (based upon PI travel and student worker salary = \$1407 @ 32.4%)	\$456

PARTICIPANT TRAVEL AND SUBSISTANCE

Continental breakfast Days I, II and II	\$385 X 3 =	\$1155.00
---	-------------	-----------

AM Coffee and tea Days I, II and III	$\$250 \times 3 =$	\$750.00
Box lunches Days I, II and III	$\$535 \times 3 =$	\$1605.00
Dinner Day I at MO	$\$80 \times 55 \times 22\% =$	\$5368.00
Linens for registration and food tables		\$50.00
Travel 48 participants	$\$485 \times 48 =$	\$23,280.00
Housing 48 participants	$\$90\text{night} \times 3 \times 48 =$	\$12960.00
Per diem (excluding meals offered at the meeting) (three dinners at \$19.65/meal)	$\$19.65 \times 3 \times 50 =$	\$2948.00
TOTAL		\$49,979.00
Computers and projectors (provided by ASU)		

SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION Appalachian State University				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Zack E Murrell				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
				CAL	ACAD	SUMR	
1. Zack E Murrell - none				0.00	0.00	0.00	\$ 0 \$
2.							
3.							
4.							
5.							
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.00	0
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (1) UNDERGRADUATE STUDENTS							550
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							550
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							57
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							607
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							800
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____ 0							
2. TRAVEL _____ 23,280							
3. SUBSISTENCE _____ 24,836							
4. OTHER _____ 0							
TOTAL NUMBER OF PARTICIPANTS (0) TOTAL PARTICIPANT COSTS							48,116
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							0
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							0
H. TOTAL DIRECT COSTS (A THROUGH G)							49,523
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) PI travel and housing (Rate: 32.4000, Base: 800) (Cont. on Comments Page)							
TOTAL INDIRECT COSTS (F&A)							456
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							49,979
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 49,979 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME Zack E Murrell				FOR NSF USE ONLY			
ORG. REP. NAME* Susan Mccracken				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

**** I- Indirect Costs
student salary and fringe (Rate: 32.4000, Base 607)**

SUMMARY PROPOSAL BUDGET Cumulative

ORGANIZATION Appalachian State University				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Zack E Murrell				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
				CAL	ACAD	SUMR	
1. Zack E Murrell - none				0.00	0.00	0.00	\$ 0 \$
2.							
3.							
4.							
5.							
6. () OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.00	0
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (1) UNDERGRADUATE STUDENTS							550
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							550
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							57
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							607
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							800
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____ 0							
2. TRAVEL _____ 23,280							
3. SUBSISTENCE _____ 24,836							
4. OTHER _____ 0							
TOTAL NUMBER OF PARTICIPANTS (0) TOTAL PARTICIPANT COSTS							48,116
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							0
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							0
H. TOTAL DIRECT COSTS (A THROUGH G)							49,523
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							456
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							49,979
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 49,979 \$
M. COST SHARING PROPOSED LEVEL \$ 0 AGREED LEVEL IF DIFFERENT \$							
PI/PI NAME Zack E Murrell				FOR NSF USE ONLY			
ORG. REP. NAME* Susan Mccracken				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

C *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Budget

NOTE: Prices for food at MO are based upon estimates provided by Catering St. Louis at the Missouri Botanical Garden. Any savings that can be made in travel for those that are closer to the meeting site will be used to invite more attendees to the meeting. Per diem for meals not provided at the meeting, price is ASU out-of state price for dinner.

PI, STUDENT ASSISTANT AND FACILITIES AND ADMINISTRATIVE INDIRECT

PI travel and housing		\$800.00
Student worker to assist Murrell with logistics and process paperwork		\$607.00
Facilities and Administrative Indirect to ASU (based upon PI travel and student worker salary = \$1407 @ 32.4%)		\$456

PARTICIPANT TRAVEL AND SUBSISTANCE

Continental breakfast Days I, II and II	$\$385 \times 3 =$	\$1155.00
AM Coffee and tea Days I, II and III	$\$250 \times 3 =$	\$750.00
Box lunches Days I, II and III	$\$535 \times 3 =$	\$1605.00
Dinner Day I at MO	$\$80 \times 55 \times 22\% =$	\$5368.00
Linens for registration and food tables		\$50.00
Travel 48 participants	$\$485 \times 48 =$	\$23,280.00
Housing 48 participants	$\$90\text{night} \times 3 \times 48 =$	\$12960.00
Per diem (excluding meals offered at the meeting) (three dinners at \$19.65/meal)	$\$19.65 \times 3 \times 50 =$	\$2948.00
TOTAL		\$49,979.00