

ALL TAXA BIODIVERSITY INVENTORY

HEARING
BEFORE THE
SUBCOMMITTEE ON NATIONAL PARKS
OF THE
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
ONE HUNDRED TENTH CONGRESS
SECOND SESSION

TO

RECEIVE TESTIMONY REGARDING THE ALL TAXA BIODIVERSITY INVENTORY OF ALL SPECIES WITHIN THE GREAT SMOKY MOUNTAINS NATIONAL PARK. SPECIFICALLY, THE HEARING WILL ADDRESS: (1) HOW MUCH HAS BEEN LEARNED UP TO THIS POINT AND AT WHAT COST? (2) WHAT IS LEFT TO BE DONE AND WHAT IS THE ESTIMATED TIME AND COST TO COMPLETE THE INVENTORY? (3) HOW HAS THE DATA BEEN USED AND ARE THERE OTHER WAYS TO USE IT? (4) WHAT CHANGES, IF ANY, SHOULD BE MADE IN THE PROGRAM AND (5) SHOULD THE PROGRAM BE EXPANDED TO INCLUDE OTHER NATIONAL PARKS?

ASHEVILLE, NC, JULY 21, 2008



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ALL TAXA BIODIVERSITY INVENTORY

MONDAY, JULY 21, 2008

U.S. SENATE,
SUBCOMMITTEE ON NATIONAL PARKS,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Asheville, NC.

The subcommittee met, pursuant to notice, at 9:32 a.m. at Alumni Hall, Highsmith Union, University of North Carolina Asheville, Hon. Richard Burr presiding.

OPENING STATEMENT OF HON. RICHARD BURR, U.S. SENATOR FROM NORTH CAROLINA

Senator BURR. Good morning. I'm Senator Richard Burr. I would like to officially start the field hearing this morning for the National Parks Subcommittee.

At the start of this I look out to see many friends of the Park. Both sides work. I'm reminded as I sit here, they wouldn't be here if North Carolina hadn't given that land to Tennessee.

[Laughter.]

Senator BURR. There is no dispute of how much of it lies in Tennessee but we share it with our neighbors.

Let me first and foremost publicly thank Senator Akaka, who is the chairman of this subcommittee. He has graciously agreed for this hearing to take place. I think when you have a national treasure, like the Great Smokies it's important that we publicly acknowledge all benefits that come out of it.

It's not only the largest visited park in the country. As we will find today, it is rich in biodiversity. It is a treasure for all to come see. Not for just its natural beauty, but for the things that we find and continue to find. This morning's hearing is about what we discovered in the last 10 years and more importantly why we should continue to address it, look for new species.

First let me thank Chancellor Anne Ponder and the University of North Carolina in Asheville for their gracious hospitality in hosting this hearing. They've done a fabulous job of preparing the room. We appreciate the hard work of everyone involved.

I also want to thank the witnesses today for agreeing to participate. We look forward to receiving their testimony. To our friends from the National Park Conservation Association and the Discover Life in America Organization, more importantly, thank you for hosting the reception this morning.

The purpose of this hearing is to receive testimony regarding the All Taxa Biodiversity Inventory, or ATBI, within the Great Smoky Mountains National Park. The ATBI is an ambitious project to

identify and catalog all nature of species in more than a half a million acres. A tremendous undertaking when you consider that the backyard of many homes in this country could have several hundred species.

The project has been going on for over 10 years. It's a good time to get an update on the progress that's been made. More importantly what lies ahead.

Specifically we have asked the witnesses to be prepared to address one, how much has been learned, up to this point, and at what cost?

Two, what is left to be done and what is the estimated time and cost to complete the inventory?

Three, how has the data been used and what might be the execution use?

Four, what changes should be made in the program?

Five, should the program be expanded to include other National Parks and public lands?

The Great Smoky Mountains and our other National Parks of this country are national treasures. They were established to preserve and protect the areas for the enjoyment of current and future generations. For that reason it's important that we understand the diversity of resources that are present and develop management plans that ensure a sustainable environment. Today we hope to learn about how ATBI supports that and to what extent, if any, ATBI should be expanded.

We have a talented group of witnesses with us today. I would ask our witnesses to please come forward and take your seats at the witness table. As they come forward, I will make a formal introduction of each one and their title.

Let me say to everybody in the room, if a Senate hearing can be informal, I'm going to attempt to do that. But as I learned several years ago when I went to the Senate and asked repeatedly why we do it this way? I was always told, this is the way we've always done it. So I've got some constraints as to how we do this because of the formality of an official hearing. I hope you won't find those too distracting.

Today we've got Dale Ditmanson, Superintendent of Great Smoky Mountain National Park.

Glen Bogart, Principal, Pi Beta Phi Elementary School, Gatlinburg, Tennessee.

Peter White, Professor of Biology and Director of the North Carolina Botanical Garden, University of North Carolina at Chapel Hill.

Tim Watkins, Program Officer, National Geographic Society, Office of Research, Conservation and Exploration of Washington, DC. Tim, I think you probably found the air traffic as challenging today as I find many things. I appreciate the fact that you made it.

For the official purposes of this hearing each witness will have five minutes to make a statement. I note there is not a clock. Therefore I will count extremely slow. I think the important thing is to make sure that you cover in your statements as thoroughly what you'd like to talk about. I will assure you that I will show that latitude.

Longer statements can be submitted for the record. A court reporter will be taking a transcript of this hearing. I'll refrain from

asking questions until all the witnesses have completed their statements.

With that I will turn to Dale for your opening statement.

STATEMENT OF DALE DITMANSON, SUPERINTENDENT, GREAT SMOKY MOUNTAINS NATIONAL PARK, NATIONAL PARK SERVICE, DEPARTMENT OF THE INTERIOR

Mr. DITMANSON. Good morning everyone. Senator Burr, thank you for the opportunity to appear before you today to provide the Department of the Interior's views on the All Taxa Biodiversity Inventory within Great Smoky Mountains National Park in North Carolina and partially in Tennessee.

[Laughter.]

Mr. DITMANSON. I will briefly summarize the testimony and ask that my written statement be submitted for the record.

Biological diversity is the hallmark of Great Smoky Mountains National Park which encompasses more than 800 square miles in the Southern Appalachian Mountains. Dominated by plant cover, gently contoured mountains, the crest of the Smokies forms the boundary between North Carolina and Tennessee. No other area of equal size and temperate climate can match the Smokies amazing diversity of plants, animals and invertebrates. More than 15,000 species have been documented in the Park. Scientists believe an additional 25 to 55,000 taxa may live there.

The All Taxa Biodiversity Inventory is a concentrated effort to determine all species within a given area over a given period. During a conference held in the fall of 1997, it was decided that the Great Smoky Mountains National Park was a good venue, actually an ideal venue to attempt a pilot ATBI. That the three major thrusts of the project would be stewardship, science, and education.

It was also agreed that the project was too large for any park, university or museum to plan and manage so, therefore, a private, non-profit organization would be created to manage significant elements of the project. Since the beginning of the ATBI we have nearly doubled the number of species known in the Great Smoky Mountains National Park.

Nearly every major group of life in the park has been examined at some level through the cooperative efforts of taxonomic experts. We have held 23 "bio-quests", or "bio-blitzes", which are intense, short term field experiences organized around particular biological groups. These events are popular, convey basic conservation messages to the public, and provide education, outreach and citizen science opportunities.

As many as 877 new species to science have been discovered. 5,251 species were found in the Smokies that we did not know were there or had not been known in the park before, bringing the total number of species known in the Smokies to 15,559. The park has prioritized over \$100,000 a year of operational funds to support the ATBI.

In addition, the park received a base increase in fiscal year 2005 of \$196,000. That is going to support the National Park Service portion of the ATBI. All together Federal funding over the last 10 years has exceeded \$1.7 million.

The park's partner, Discover Life in America received \$100,000 to \$150,000 annually over those same years in support of the ATBI through donations, largely from the Friends of Great Smoky Mountains National Park and the Great Smoky Mountains Association. Universities and colleges across the country also support the ATBI through various leverage and in kind donations.

One of the lessons learned over the first 10 years of the ATBI is that the project is much larger than originally thought. It's going to take us many years to complete. With that in mind we have set high priority tasks to be completed over the next 5 years.

Those priorities are: we will identify priority taxa so as to complete certain taxonomic groups.

We will address our data management backlogs.

We will prioritize structured sampling efforts based on a new draft protocol.

We will initiate peer review of the program.

We will collaborate with other emerging service wide ATBI projects in an effort to coordinate versus compete for similar resources.

We will continue "bio-blitz" programs to enhance outreach and education.

Parks are now coming together to ensure that the data collected through these ATBI efforts are identified, curated, managed and analyzed to ensure the park managers make the best possible decisions in the preservation and protection of these park resources.

Senator Burr, that concludes my prepared remarks. I'm available to answer any of your questions.

[The prepared statement of Mr. Ditmanson follows:]

PREPARED STATEMENT OF DALE DITMANSON, SUPERINTENDENT, GREAT SMOKY MOUNTAINS NATIONAL PARK, NATIONAL PARK SERVICE, DEPARTMENT OF THE INTERIOR

Mr. Chairman and members of the Subcommittee, thank you for the opportunity to appear before you today to present the Department of the Interior's views on the All Taxa Biodiversity Inventory within the Great Smoky Mountains National Park.

Biological diversity is the hallmark of Great Smoky Mountains National Park (Park), which encompasses more than 800 square miles in the Southern Appalachian Mountains. Dominated by plant-covered, gently contoured mountains, the crest of the Great Smoky Mountains forms the boundary between Tennessee and North Carolina, bisecting the Park from northeast to southwest in an unbroken chain that rises more than 5,000 feet for more than 36 miles. No other area of equal size in a temperate climate can match the Smokies amazing diversity of plants, animals, and invertebrates. More than 15,000 species have been documented in the Park: scientists believe an additional 25-55,000 taxa may live here.

The All Taxa Biodiversity Inventory (ATBI) concept stemmed from interest generated by inventories of biodiversity in Costa Rica. An ATBI is a concentrated effort to determine all species within a specific area over a given period. During a conference held in the fall of 1997, it was decided that the Great Smoky Mountains National Park was a good venue to attempt a pilot ATBI and that the three major thrusts of the project would be stewardship, science, and education. It was also agreed that the project was too large for any one park, university, or museum to plan and manage and that a private, non-profit organization would be created to manage significant elements of the project. The Smokies ATBI would test and design the most effective and efficient methods for conducting an ATBI.

A Science Plan was developed for the ATBI which presented the rationale for the project and the organizational themes and objectives that structure the work. Overall, the habitats and taxonomic groups to be addressed are diverse but, in general, the project-wide goals that the ATBI was to address are:

- Determine how an ATBI should be done (i.e., methods and design);

- Determine what species are present; as well as where they are and when they are present; and
- Explain the observed patterns of diversity, abundance and distribution.

To accomplish these goals, the Smokies ATBI Science Plan called for two approaches: traditional sampling and structured sampling. Traditional sampling and observing is defined as field surveys in the general sense. Collecting and observing is accomplished by individual investigators based on their experience, knowledge, time constraints, and methods. Structured sampling is defined as those activities that take place at predetermined sampling points (Biodiversity Reference Points) chosen to represent the diversity of environments and histories of the Park's landscape.

Many sampling events are also conducted as "bio-quests" or "bio-blitzes" which are intense, short-term field experiences organized around particular biological groups. These events are popular, convey basic conservation messages to the public, and provide education, outreach, and citizen science opportunities.

Since the beginning of the ATBI, we have nearly doubled the number of species known in the Park. Nearly every major group of life in the Park has been examined at some level through the cooperative efforts of taxonomic experts. Prior to the ATBI, the Park already had fairly complete lists of vascular plants and vertebrates. But, even in supposedly well-known groups, new records continued to show up.

We have held 23 bio-blitzes, and developed a wide array of supporting educational programs, products, and curricula. Scientifically, it is believed that as many as 877 species new to science have been discovered, and 5,251 species were found that were known in other areas, but had not been found before in the Smokies, bringing the total number of species known in the Smokies to 15,559. Of the projected 877 new species to science, 92 have been fully documented and published as new species to science.

Due to the anticipated value and ground-breaking nature of this project, the Park prioritized over \$100,000 a year of operational funds to support the ATBI. In addition the Park received a base increase of \$196,000 in FY 2005 to support the National Park Service (NPS) portion of the ATBI. All together, federal funding has exceeded \$1.8 million during the first 10 years of the inventory.

The Park's partner, Discover Life in America (DLIA), received \$100,000 to \$150,000 annually, over those same years, in support of the ATBI through donations, largely from the Friends of Great Smoky Mountains National Park and the Great Smoky Mountains Association. These funds have been directed at bio-blitz and volunteer operations and implementation, data management, taxonomic identifications and program support. Universities and colleges across the country also support the ATBI through various in-kind support efforts. DLIA estimates that each year more than \$400,000 of in-kind support is provided to the project through these partnerships.

The Park further supports the ATBI through adjunct operations such as the Parks as Classrooms Program, the Appalachian Highlands Research Learning Center and the Park's Inventory and Monitoring Program. In addition, the Park provides DLIA with office, classroom, museum curation and laboratory space, information technology/computer support, data management, and equipment and supplies in support of operations.

One of the lessons learned after completing 10 years of the ATBI, is that the project is much larger than originally thought and will take many more years to complete. With that in mind, the following high priority tasks have been identified to be completed over the next five years at Great Smoky Mountains National Park.

- Identify priority taxa so as to "complete" taxonomic groups;
- Address the data management backlog;
- Initiate structured sampling efforts based on new draft protocol;
- Initiate peer review of the overall program in order to stimulate interest in the ecological component of the project, draw new taxonomists to the project and improve program effectiveness;
- Collaborate with other emerging Servicewide ATBI projects in an effort to coordinate versus compete for similar resources; and
- Continue bio-blitz programs to enhance outreach/education programs.

Lessons learned from the Smokies and other projects need to be disseminated to avoid duplication of effort and to take advantage of efficiencies developed at the Great Smokies. These projects need to have summaries and data reported nationally to share information and resources.

Many parks have had ATBIs and bio-blitz efforts at varying degrees and scales for a nearly a decade. The Great Smoky Mountains ATBI and other ATBI projects

throughout the NPS will soon benefit from national coordination of their projects, allowing the sharing of results and the best utilization of the scarce resources that are available to carry out ATBIs. Parks and managers are now coming together to ensure that the data collected through these efforts are identified, curated, managed, and analyzed to inform park managers in making the best possible decisions in the preservation and protection of park resources, continuing to engage park visitors of all ages and walks of life.

Mr. Chairman, that concludes my prepared remarks. I would be happy to answer any questions that you or any other members of the subcommittee may have.

Senator BURR. Dale, thank you very much.
Glen.

**STATEMENT OF GLEN BOGART, PRINCIPAL, PI BETA PHI
ELEMENTARY, GATLINBURG, TN**

Mr. BOGART. Senator, what an honor to be here. I am most grateful for the invitation to testify before the Subcommittee on National Parks of the Senate Committee on Energy and Natural Resources. I'm entering my 20th year as principal of Pi Beta Phi Elementary, a K-8 school in the tourist town of Gatlinburg, Tennessee, and my 38th year in the education profession.

Our school has a unique partnership, relationship with the Great Smoky Mountains National Park. I would like to share some background information which I think has had and will continue to have a great impact on the All Taxa Biodiversity Inventory. In September 1990 our school asked the National Park leadership this basic, but far reaching question.

How can the natural and cultural resources of the Smokies be utilized to teach and reinforce the core curriculum of the State of Tennessee? That particular question, unknowingly, led to the beginning of a collaborative and contemplated partnership that has survived and thrived to this very day. Our partnership has spent exhaustive hours defining the project, establishing goals, developing curriculum units and lesson plans and most importantly, cultivating a mutual respect for the great missions of the National Park and Pi Beta Phi Elementary School. I am proud to add emphatically, I think we enjoy working with each other.

Since 1990 our partnership has developed 37 structured units of instruction including pre-site, onsite, post-site, that utilize the natural and cultural resources of the park. Approximately 72 percent of our students remain at our school for the full 9 years from Kindergarten through the eighth grade. I believe strongly, very strongly, that our utilization of park resources contributes significantly to the development of young people that academically excel as well as the cultivation of young people who will be future leaders of our community, our State and our Nation. I'd like to think that our type of education provides for the young people in our tourist community the kind of educational experiences that will shape and influence decisionmaking on the critical issues of the Great Smokies as well as other units of the National Park Service.

I am most appreciative of the past leadership of the Smokies, Randy Pope, Karen Wade, Mike Tollefson, Phil Francis and the current leadership of Dale Ditmanson and their staffs for their passion and cooperation and wisdom through the past 18 years. I also recognize with gratitude the financial support of the Gatlinburg Board of Education and our teaching staff who have faithfully de-

veloped and implemented, with the park staff, this unique curriculum. The teaching staff has been very tolerant of my agitation of the planning process which consists of continual updating and polishing the curriculum. The past and current project directors, coordinators have been exceptional with their leadership and dedication to the project.

Senator, I hope that this background information of our Parks as Classroom Project contributes in a supporting way to the questions of this hearing. I was fortunate to be a founding member of the Board of Directors of Discover Life in America. I enjoyed and mostly observed the debate among the scientists about this very unique model in the United States to identify all the living species within the park boundary.

During the formulative years of the DLIA board's organization growth and mission there was never any doubt among the educators, I was the Board Chairman of the Educational Committee at the time, that the ATBI would yield enormous information for us educators to develop instructional programs. Higher education especially and secondary and elementary education to a lesser extent, were about to witness an explosion of research data that had enormous impact on our school's Parks as Classrooms Project. Of the 37 curriculum units that we teach annually, 15 of those units focus on science which uses biodiversity information produced from the efforts and successes of ATBI.

Our students learn to separate groups of organisms. In Kindergarten students simply distinguish between invertebrate and vertebrate. But by the eighth grade the students sort insect orders.

They classify organisms. They use dichotomous keys. They identify specific adaptations for different species.

They observe habitat requirements. They identify threats from pollution and examine exotic invasions. Most importantly, students learn how our precious natural resources are protected. Statistically in our school alone during the past decade, approximately 9,000 student hours have been spent in instruction with information from ATBI.

As you can see from the data the implications for instruction, at all levels, the elementary, secondary, higher education and citizen education are enormously daunting. Eyebrows might be raised concerning the abilities of elementary students to engage in scientific study and research. I invite any skeptic to visit our school and observe our curriculum in action.

I predict that most doubters would soon discover that young students, especially at the upper middle school level, have great research potential and are eager to demonstrate their abilities and articulate their findings. The ATBI has provided numerous opportunities for our students to interact with scientists who have significant influence concerning career choices. One of my students credits his interest in science to his outing with a scientist on the Lepidoptern Blitz a few years ago.

The mentoring scientist invited the student to return the next day and cultivated a relationship with the student who was inspired to create award winning projects during the last 4 years. Once again the question might be asked, how in the world can a fifth grade student have such technical knowledge about Lepidop-

tera? I am certain that this student's parent would grant permission for their child to be interviewed concerning his significant knowledge in his potential career choices in scientific research.

I had another student, former student, who was influenced by the ATBI to study painstakingly the movements of the snail. At the most recent annual meeting of the ATBI, my former student, overwhelmed the questioning professors with her voluminous research. This student is now a summer intern for the National Park Service in Michigan at the age of 16 years.

Dana Soehn, our current Parks as Classroom Coordinator said this to me recently about ATBI. "Our students get hands on experiences participating in the project of national and global significance. Because of our poor air quality and threats from invasive species in the park, Pi Beta Phi students have the opportunities to examine cause and effect relationships and multiple challenges we face in protecting our biodiversity. I think all of this helps our students to gain a deeper appreciation of the Great Smokies and other units of the National Park Service."

Senator, it is our school's intent to continue aggressively to utilize the research from the ATBI realizing that instruction must be developmentally appropriate for all age groups and grade levels. I am convinced that our partnership with the Great Smokies will continue to produce instructional programs that will complement the vital ATBI research. I ask of our governmental and societal leadership, how can research exist without education or how can education exist without research?

In my opinion the equation of research and education are mutually dependent. The hopeful discovery of all species in the park gives us great cause to applaud the ATBI research and to contemplate how that research can be transformed into meaningful and exciting education. A quality curriculum to our students is never completed.

I would like to see the continuation of ATBI efforts and successes in our National Park, Smokies as well as other potential units of the National Park Service. It would be very beneficial to our educational profession to have dialog and staff development from the ATBI's specialists for these primary reasons:

- To provide input with what we teach and how we teach science.

- To support the creation of mentoring relationships between ATBI scientists and inspired students.

- To continue, aggressively, the dissemination of ATBI discoveries which will undoubtedly stimulate among scientists greater exploration in the park.

As scientists experience success with the inventory, I predict education will benefit tremendously.

Personally I want Pi Beta Phi students to know a great deal more about the nationwide National Park Service, than just to concentrate of the Smokies solely. It is important that Pi Beta Phi students grasp the significance of the vastness of lands, historical sites, monuments, and other National Parks managed by the National Park Service. Ironically and fortunately, our partnership is in the beginning stages of developing a curriculum unit which focuses on the National Park Service as a component of the Department of the Interior.

It is critically important that our students comprehend the mission and critical issues of the National Park Service. It is important that our students develop an understanding and appreciation of the diversity and history of our nation's great natural and cultural resources. Each summer I smile with great pride in receiving postcards from my students as they travel throughout the United States. I enjoy reading their brief comments of excitement and exploration.

We have at summer's end an impressive collection of postcards and pictures which are displayed in our main hallway that attracts considerable peer attention and inquiry. I have a very strong sense that our teaching and learning experiences within the Smokies are stimulating interest and family travel to other National Park Service units. Some of them, far away.

Our integration and inclusion of ATBI discoveries with the Tennessee curriculum are a direct result of the need to inform parents and citizens about the tremendous biodiversity that is nearby. It has been my observation throughout the past 18 years, that parents and community leaders are much more knowledgeable about the Smokies than ever before. The investment of time and structural development, community education, staff training, parent chaperone training, have awakened the populations, especially those that surround the Smokies, to the educational opportunities and issues that exist.

Several parents have told me through the years that they have learned more about the Smokies than in a lifetime as a result of chaperoning/volunteering in our projects. I believe that education is all about values and the experiences that young people must have in order to prepare them for leadership roles. Obtaining knowledge in direct hands-on experiences are values that will provide good, solid, decisionmaking for the future. The ATBI research contributes greatly to the prescribed values we desire for our students at Pi Beta Phi.

Not long ago, Secretary of the Interior, Dirk Kempthorne recognized our school when he presented in Washington to Superintendent Ditmanson and me the coveted award, "Take Pride in America." This award recognizes those schools and organizations in the country that have spent considerable time in volunteering to take care of our public lands. Soon afterward Secretary Kempthorne visited the Smokies and Gatlinburg to witness a sampling of our program that engages our youth in the Parks as Classroom Project.

He took me aside to say that "meeting the youth and observing their involvement in outdoor learning and stewardship was the highlight of the trip from Washington." With obvious pride and agreement I acknowledged his complement from an executive branch leader who obviously values the sacredness of our tremendous natural and cultural resources throughout the land. Our mission at Pi Beta Phi is to develop a foundation for life long learning and stewardship.

Since 2004 the students, teachers and parents have volunteered approximately 2,511 hours of stewardship projects to include trail rehabilitation, exotic plant removal, monarch tagging, salamander collection and other numerous endeavors. The accomplishments of

the ATBI have provided for our curriculum partnership essential information that enriches our students' awareness of the biodiversity of the Great Smokies. Learning about and experiencing the natural and cultural resources of the Smokies are a vital part of our school culture.

Most importantly it is my prayer that our students and community are aware and appreciative and protective of our biodiversity. I appreciate very much this subcommittee hearing on the ATBI and the inclusion of our school's partnership project that supports the equation of scientific research in education. Thank you.

[The prepared statement of Mr. Bogart follows:]

PREPARED STATEMENT OF GLENN BOGART, PRINCIPAL, PI BETA PHI ELEMENTARY
GATLINBURG, TN

I am most grateful for the invitation to testify before the Subcommittee on National Parks of the Senate Committee on Energy and Natural Resources. I am entering my 20th year as principal of Pi Beta Phi Elementary—a K-8 school in the tourist town of Gatlinburg, Tennessee—and my 38th year in the education profession. Our school has a unique partnership/relationship with the Great Smoky Mountains National Park; and, I would like to share some background information which I think has had and will continue to have a great impact on the All Taxa Biodiversity Inventory.

In September of 1990 our school asked the National Park leadership this basic but far-reaching question: "How can the natural and cultural resources of the Smokies be utilized to teach and to reinforce the core curriculum requirements of the State of Tennessee?" That particular question unknowingly led to the beginning of a collaborative partnership that has survived and thrived to this very day. Our partnership spent exhaustive and contemplative hours defining the project, establishing goals, developing curriculum units and lesson plans, and, most importantly, cultivating a mutual respect for the great missions of the National Park and Pi Beta Phi Elementary School. I am proud to add, emphatically, that we enjoy working together.

Since 1990 our partnership has developed 37 structured units of instruction—including pre-site, on-site, and post-site—that utilize the natural and cultural resources of the National Park. Approximately 72% of our students remain at our school for the full 9 years from kindergarten through the eighth grade. I believe very strongly that our utilization of Park resources contributes significantly to the development of young people who academically excel as well as to the cultivation of young people who will be future leaders of our community, our state, and our nation. I like to think that our type of education provides for the young people in our tourist community the kind of educational experiences that will shape and influence decision-making on the critical issues of the Great Smokies as well as other units of the National Park Service.

I am most appreciative of the past leadership of the Smokies—Randy Pope, Karen Wade, Mike Tollefson, Phil Francis—and the current leadership of Dale Ditmanson and their staffs for their passionate cooperation and wisdom throughout the past 18 years. I also recognize with gratitude the financial support of the Gatlinburg Board of Education and our teaching staff who have faithfully developed and implemented with the Park staff this unique curriculum. The teaching staff especially has been very tolerant of my agitation of the planning process which consists of continual updating and polishing the curriculum. The past and current Project coordinators have been exceptional with their leadership and dedication to the project.

Mr. Chairman, I hope that this background information of our Parks as Classroom Project contributes in a supportive way to the questions of this hearing. I was fortunate to be a founding member of the Board of Directors of Discover Life In America. I enjoyed, and mostly observed, the debate among the scientists about this very unique model in the United States to identify all of the living species within the Park boundary. During the formative years of the DLIA Board's organizational growth and mission, there was never any doubt among the educators—I was the Board chairman of the educational committee at the time—that the ATBI research would yield enormous information for us educators to develop instructional programs. Higher education especially and secondary and elementary education, to a lesser extent, were about to witness an explosion of research data that had enormous impact on our school's Parks as Classroom Project.

Of the 37 curriculum units that we teach annually, 15 of the units focus on science which uses biodiversity information produced from the efforts and successes of ATBI. Our students learn to separate groups of organisms (In kindergarten the students simply distinguish invertebrate from a vertebrate, but by 8th grade the students sort insect orders.), classify organisms, use dichotomous keys, identify specific adaptations for different species, observe habitat requirements, identify threats from pollution, and examine exotic invasions. Most importantly, students learn how our precious natural resources are protected. Statistically in our school alone during the past decade, approximately 9000 student hours have been spent in instruction with information from the ATBI. As you can see from the data, the implications for instruction at all levels—elementary, secondary, higher education, and citizen education—are enormously daunting. Eyebrows might be raised concerning the abilities of elementary students to engage in scientific study and research. I invite any skeptic to visit our school and observe our curriculum in action. I predict that most doubters will soon discover that young students, especially at the upper middle school level, have great research potential and are eager to demonstrate their abilities and to articulate their findings.

The ATBI has provided numerous opportunities for our students to interact with scientists who can have significant influence concerning career choices. One of my students credits his interest in science to his outing with a scientist on a Lepidoptern Blitz a few years ago. The mentoring scientist invited the student to return the next day and cultivated a relationship with the student who was inspired to create award winning projects during the last 4 years. Once again, the question might be asked: “How in the world can a 5th grade student have such technical knowledge about Lepidoptera?” I am certain that this student’s parents would grant permission for their child to be interviewed concerning his significant knowledge and his potential career choices in scientific research.

I have another former student who was influenced by the ATBI to study painstakingly the movements of the snail. At the most recent annual meeting of the ATBI, my former student overwhelmed the questioning professors with her voluminous research. This student is now a summer intern for the National Park Service in Michigan and is 16 years old!

Dana Soehn, our current Parks as Classroom Coordinator said this to me recently about the ATBI: “Our students get hands-on experiences participating in a project of national and global significance. Because of our poor air quality and threats from invasive species in the Park, Pi Beta Phi students have the opportunities to examine cause and effect relationships and the multiple challenges we face in protecting our biodiversity. I think all of this helps our students to gain a deeper appreciation of the Great Smokies and other units of the National Park Service.”

Mr. Chairman, it is our school’s intent to continue aggressively to utilize the research from the ATBI. Realizing that instruction must be developmentally appropriate for all age groups and grade levels, I am convinced that our partnership with the Great Smokies will continue to produce instructional programs that will complement the vital ATBI research. I ask of our governmental and societal leadership: “How can research exist without education OR how can education exist without research?” In my opinion the equation of research and education are mutually dependent. The hopeful discovery of all species in the Park gives us great cause to applaud ATBI research and to contemplate how that research can be transformed into meaningful and exciting education. A quality curriculum for our students is never completed.

I would like to see the continuation of ATBI efforts and successes in our National Park as well as other potential units of the National Park Service. It would be very beneficial to our educational profession to have dialogue and staff development from the ATBI specialists for these primary reasons: a) to provide input with what we teach and how we teach science, b) to support the creation of mentoring relationships between ATBI scientists and aspiring students, and c) to continue aggressively the dissemination of ATBI discoveries which will undoubtedly stimulate among scientists greater exploration in the Park. As scientists experience success with the Inventory, I predict education will benefit tremendously.

I want Pi Beta Phi students to know a great deal more about the nationwide National Park Service than just concentrate on the Smokies solely. It is important that Pi Phi students grasp the significance of the vastness of lands, historical sites, monuments, and other national parks managed by the National Park Service. Ironically and fortunately, our partnership is in the beginning stages of developing a curriculum unit which focuses on the National Park Service as a component of the Department of the Interior. It is critically important that our students comprehend the mission and critical issues of the National Park Service. It is important that our students develop an understanding and appreciation of the diversity and history of

our nation's great natural and cultural treasures. Each summer I smile with great pride in receiving postcards from my students as they travel throughout the United States. I enjoy reading their brief comments of excitement and exploration. We have at summer's end an impressive collection of postcards and pictures which are displayed in our main hallway that attracts considerable peer attention and inquiry. I have a very strong sense that our teaching and learning experiences within the Smokies are stimulating interest and family travel to other NPS units, some of them far away.

Our integration and inclusion of ATBI discoveries with the Tennessee curriculum are a direct result of the need to inform parents and citizens about the tremendous biodiversity that is nearby. It has been my observation throughout the past 18 years that parents and community leaders are much more knowledgeable about the Smokies than ever before. The investment of time, instructional development, community education, staff training, and parent/chaperone training have awakened the populations, especially those that surround the Smokies, to the educational opportunities and issues that exist. Several parents have told me through the years that they have learned more about the Smokies than in a lifetime as a result of chaperoning/volunteering in the Project. I believe that education is all about values and the experiences that young people must have in order to prepare them for leadership roles. Obtaining knowledge and direct hands-on experiences are values that will provide good solid decision-making for the future. The ATBI research contributes greatly to the prescribed values we desire for our students at Pi Beta Phi. Not long ago, Secretary of the Interior Dirk Kempthorne recognized our school when he presented in Washington to Superintendent Ditmanson and me the coveted award "Take Pride in America." This award recognizes those schools and organizations in the country that have spent considerable time in volunteering to take care of our public lands. Soon afterwards, Secretary Kempthorne visited the Smokies and Gatlinburg to witness a sampling of our program that engages our youth in the Parks as Classroom Project. He took me aside to say that "meeting the youth and observing their involvement in outdoor learning and stewardship was the high light of the trip from Washington." With obvious pride and agreement I acknowledged this compliment from an executive branch leader who obviously values the sacredness of our tremendous natural and cultural resources throughout the land.

Our mission at Pi Beta Phi Elementary is "to develop a foundation for life-long learning and stewardship." Since 2004 the students, teachers, and parents have volunteered approximately 10,511 hours in stewardship projects to include trail rehabilitation, exotic plant removal, monarch tagging, salamander collection, and other numerous endeavors. The accomplishments of the ATBI have provided for our curriculum partnership essential information that enriches our students' awareness of the biodiversity of the Great Smokies. Learning about and experiencing the natural and cultural resources of the Smokies are a vital part of our school culture. Most importantly, it is my prayer that our students and community are aware, appreciative, and protective of our biodiversity.

I appreciate very much this subcommittee hearing on the ATBI and the inclusion of our school's partnership Project that supports the equation of scientific research and education.

Senator BURR. Thank you, Glen.
Dr. White.

STATEMENT OF PETER WHITE, PROFESSOR, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL, DIRECTOR, NORTH CAROLINA BOTANICAL GARDEN, AND BOARD OF DIRECTORS, DISCOVER LIFE IN AMERICA, CHAPEL HILL, NC

Mr. WHITE. Senator Burr, I want to thank you and the Senate committee for the opportunity to share the excitement, the experience and the accomplishments of the Smokies All Taxa Biodiversity Inventory. I submitted a detailed statement that I hope will be part of the record.

Today I represent Discover Life in America where I am a board member. I hasten to add that I am from the University of North Carolina. I'm glad the hearing takes place today in North Carolina. Not only did North Carolina help form the State of Tennessee, the

citizens of North Carolina bought the land which is now part of Great Smoky Mountains National Park.

The Smokies is a treasure of both North Carolina and Tennessee. One of our best projects has been the Target Rate Project run by Paul Bartels of Warren Wilson College near Asheville. An example of our public citizen science is the Asheville Mushroom Club which has assisted in the inventory of the fungi of the park.

Discover Life in America has many important partners ranging from Great Smoky Mountains National Park and other Federal agencies like the USGS to non-profits, especially the Friends of the Smokies and the Great Smoky Mountains Association, two organizations that have supplied approximately 80 percent of the Discover Life annual budget. As Ed Wilson, the Harvard biologist has written, "we have done a lot on a shoestring." We are a grass roots organization.

We are made up of enthusiasts who have leveraged the support that we have received many fold. I'm personally excited by our project in the Smokies and by the prospect of expansion to other National Parks as we approach the centennial of the National Park Service. A centennial that represents an important and widely emulated American contribution to the idea of world conservation.

The All Taxa Biodiversity Inventory in the Smokies is the largest sustained natural history inventory in the United States and one of the largest in the world. The results have been remarkable. In my written testimony you'll see that I note that there are 877 species that have been discovered, previously unknown to science.

There is a scorecard at the back of the room today which has been updated by Becky Nichols of the National Park Service which gives the current number of 890 species new to science, 6,131 species previously unknown to the park, a quarter million data records, 10,000 images and a website with two million hits a year. It's a fast moving project with many discoveries and will be updated continually.

Great Smoky Mountains National Park rugged landscape of old growth forest, diverse climates, unglaciated history and diverse habitats produce a park that is teeming with biological diversity. The species new to science have included a roll call of interesting and beautiful species. Seventy-four new species of butterflies and moths, 41 new species of spiders, 70 different kinds of algae unknown to science, 34 kinds of beetles, 27 crayfish and crustaceans and 19 bees and their relatives. The scoreboard at the back presents information on many more taxonomic groups.

We are inventorying all of the park's habitats. Teams have searched the limestone caverns of the park deep underground. Tree climbing teams have been to the tops of the tallest old growth trees that harbor unique lichens, insects and other species.

We study all park organisms, large and small. Extend our research to the finest scale to species that are though tiny, important in an ecological function, like the flow of energy and the cycling of organic matter and nutrients. In many ways these species are the power plants and lungs of the ecosystem.

Our project is more than a list. In what habitats do the species live? How abundant are they?

How does this change seasonally? How do they take part in the web of life? Are they increasing, decreasing or stable?

How will they respond to anticipated changes? Like the climate that we're to undergo in the next decades? As a result we are recording data on location, distribution, seasonal changes, abundance and ecological relationships.

We are doing the ATBI for four basic reasons.

First, we conduct the ATBI for basic science and for the curiosity that drives that science.

Second, the ATBI supports the mission of Great Smoky Mountains National Park and the National Park Service which is charged with the conservation of the natural objects and wildlife of the park. The ATBI helps develop the idea that parks are an oases, storehouses and protectors of the nation's biological diversity in addition to being recreational areas or vacation destinations.

Third, ATBI's are important for society at large. Some species and some discoveries are important to human well being and the economy beyond park boundaries.

Fourth, biodiversity inventory is the cornerstone of environmental education and for connecting students of all ages and backgrounds and particularly children to the natural world.

At Discover Life in America we are pioneers in a proof that the All Taxa Biodiversity Inventory can be designed and organized and that it will gain support and attention. We have embedded biodiversity inventory in an ecological conservation and educational context. The phrase ATBI was once a foreign and awkward phrase, but has gained in popularity.

We look forward to your questions. We're here to answer all we can about this amazing project. Thank you.

[The prepared statement of Mr. White follows:]

PREPARED STATEMENT OF PETER WHITE, PROFESSOR, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL, DIRECTOR, NORTH CAROLINA BOTANICAL GARDEN, AND BOARD OF DIRECTORS, DISCOVER LIFE IN AMERICA

Discover Life in America (DLIA), Inc., is the non-profit organization coordinating the All Taxa Biodiversity Inventory in Great Smoky Mountains National Park. As a member of the Board of Directors of DLIA, I am happy to have the opportunity to share with you one of the most valuable and exciting projects that I have been involved with. We began planning the All Taxa Biodiversity Inventory (ATBI) in Great Smoky Mountains National Park in December, 1997, and, after time spent on organization and pilot projects, we now have logged eight full field seasons. We were pioneers when we started and have learned much. I am delighted to present our experience and success with you and to answer your questions. At the end of this statement I have addressed the five questions you have posed for this hearing.

The concept of National Parks owned by the people is a uniquely American and democratic contribution to world conservation, initiated in 1872 with the creation of Yellowstone National Park. In 2016, the National Park Service itself reaches its 100th Anniversary. The National Park Service Centennial Challenge includes the beginnings of the extension of the ATBI to additional national parks. We are very excited by this effort and the role of the National Park Service as America's premier federal agency for the stewardship of the Nation's biological diversity.

I thank DLIA Chair Ernest Bernard, DLIA Executive Director Todd Witcher, past DLIA Director Jeanie Hilten, NPS biologists Keith Langdon and Becky Nichols, and many fellow DLIA Board Members and fellow scientists for providing information for this statement which nonetheless remains my own statement to you.

The Largest Sustained Natural History Inventory in the United States

The All Taxa Biodiversity Inventory in Great Smoky Mountains National Park, North Carolina and Tennessee, is the largest sustained natural history inventory in

the United States and one of the largest in the world. We make this claim based on the number of individuals who have been involved (over 1,000 scientists and university students from 20 countries and more than half of the states of the U.S. and hundreds of educators). Dozens of universities and museums have taken part in the efforts. The effort has generated seven large National Science Foundation grants (totaling \$1,876,347) as well as many smaller grants and a large in-kind contribution of time and effort. We have trained over 800 volunteers (scientists, students, teachers, and citizens) in our Citizen Science project and have logged nearly 50,000 volunteer hours. In-kind support has averaged \$120,000 per year, and leveraged support has averaged \$400,000 per year.

The Results have been Remarkable: 877 species new to science, 5,251 species previously unknown from the Park, and 250,000 data records

The world around us is rich in undiscovered and unexplored biological diversity. Great Smoky Mountains National Park's rugged landscape, old growth forest, climate, unglaciated history, and diverse habitats produce a park that is teeming with biological diversity. Even though there is a time lag between field work and confirmation of species identities and relationships, we have found 877 species new to science and 5,251 species previously unknown from Great Smoky Mountains National Park. The species new to science have included 74 butterflies and moths, 41 spiders, 70 algae, 314 bacteria, 34 beetles, 27 crayfish and crustaceans, 37 fungi, 19 bees and their relatives, and 14 tardigrades.

Speaking of bacteria, let us remember that an inventory in hot springs of Yellowstone National Park produce the heat-tolerant bacteria that are the basis of all of the modern applications of DNA technology from forensics to genetic identity and disease treatment. One of our researchers, Sean O'Connell of Western Carolina University, is finding a wide array of bacteria in our samples, some with links to the Yellowstone species. Before we leave the subject of DNA technology, I want to note that we one of our researchers, Dave Wagner of the University of Connecticut, has been collaborating with the DNA Barcode project to create a DNA data base for the lepidopterans of the Park (this group is very diverse in the Smokies, with 1,367 species). I will describe the DNA Barcode project below. DNA technology is also used routinely in the survey of bacteria and other cryptic groups of organisms.

We are creating more than a list of species. We seek to discover not only which species are present in each taxonomic group in the Park, but also (1) which of these species are rare enough to be of management concern, (2) where each species is found in terms of natural community affinities (we will use this information to make predictive maps of species distributions), (3) the seasonal occurrences and changes in abundance of each species, and (4) what the ecological role and interactions of the species are. Some species groups are better known than others and thus we have been able to proceed past the simple listing of species to information on distribution, abundance, and ecology. For instance, bird species were well known in the Park when our work began. Ted Simons of USGS and North Carolina State University, along with his students and collaborators, have assisted us in producing detailed information on our web site about this taxonomic group (www.dlia.org/atbi/species/Animalia/Chordata/Aves/index.shtml). In addition to birds, you will see on the web site that we display ecological and distributional information, as well as high quality photographs, of many taxonomic groups.

We have produced many scientific publications (to date we count 107 peer-reviewed publications), a volume that synthesizes what we have found through 2006 (special issue, the *Southeastern Naturalist*), and an information-rich web site (www.dlia.org) which has over two million hits per year. The web site houses over 10,000 images donated by staff, photographers, scientists, and citizens. Our project seeks to make a list of the species known from the Park, but also to capture data on abundance, distribution, seasonal occurrence, and ecological relationships. Our database has now logged over 250,000 records.

We have conducted both sustained, structured, question-driven research and 24-hour to two-week BioQuests and BioBlitzes that bring together scientist, students, educators, and the public in intensive searches. Among those are Algal Forays, Millepede March, Diptera Blitz, Protista Pursuit, Ant Quest, Fern Forays, Lepidoptera Blitz, Snail Search, Team Odonate, Bat Blitz, Beetle Blitz, High Country Quest, Myxo Blitz, Fungi Foray, Springtail Bioquest, Fly Bioquest, Aquatic Insect Bioquest, Scorpion Fly Bioquest, Litter Blitz, and Sedge Search.

Who is involved in Discover Life in America and the ATBI?

We are scientists and this is a science-based project, but the project is also a deliberate weaving together of educators and conservation managers and involves students of all ages and volunteers who act as Citizen Scientists. Our project has even

inspired artists to join: photographers, painters, writers and even musicians have created works of art that illustrate and celebrate the diversity of life in the Smokies!

In addition to the universities and museums that have been involved, we have many partners. Among the major partners are Great Smoky Mountains National Park, Friends of the Smokies, the Great Smoky Mountains Association, the US Geological Survey (biologist Charles R. Parker has been a major organizer and participant in the ATBI), the Great Smoky Mountains Institute at Tremont, the Appalachian Highlands Learning Center, the Southern Appalachian Information Node of the National Biological Information Infrastructure of USGS, and the Alcoa Foundation.

One example of our partnerships, representative of our work with colleges and universities, is with Warren Wilson College very near Asheville, North Carolina. Professor Paul Bartels became involved in the inventory of Tardigrades at the earliest stages of our project. Tardigrades are minute invertebrates that live on mosses and other moist surfaces and are a poorly understood aspect of the biodiversity and ecology of the Smokies. Bartels worked with his students to develop one of the three most important centers for the study of these organisms globally (the others are in Italy and Poland). Bartels has also incorporated units for public school students. His research collaborations with international experts have expanded the knowledge of Tardigrades in the Park from three to 73 known species, of which 14 species are new to science. Are these animals important beyond their immediate habitat? Recently, a variety of international laboratories have proposed using this group as a new “model” organisms for the study of development and genetics.

Catching the Public's Imagination

Our project has taken root and intrigued the public. We have attracted attention both nationally and internationally. Stories have appeared in outlets as diverse as Newsweek, Southern Living, Scientific American, the Smithsonian, and Science.

What is the ATBI like?

We are inventorying all the Park's habitats. Teams have searched the limestone caverns of the western part of the Park deep below ground. Tree-climbing teams, primarily under the leadership of Harold Keller from Central Missouri University, have reached the tops of the tallest old growth trees that harbor unique lichens, insects, and other species. We are inventorying the soil, dry habitats, swamps, and rock faces that stay wet in our rain forest climate.

We study all Park organisms, large and small, and extend our research to the finest scale to the species that are, though tiny, important in ecological functions like the flow of energy and the cycling of organic matter and nutrients. In many ways, these species are the power plants and lungs of the ecosystems. In one gram of soil, for example, there are habitats that range from desert to swamp—and as a result hundreds of species of bacteria that can be identified through DNA analysis.

Our project is more than a list. Where do the species live? How abundant are they? How do they take part in the web of life? Are they increasing, decreasing, or stable? Are they threatened by acid rain, ozone exposure, or new diseases? How will they respond to anticipated climate change? As a result, we are recording data on location, distribution, seasonal changes, abundance, and ecological relationships. Early on we drafted a Science Plan that called for both traditional taxonomic inventory and structured observation at biodiversity reference points. The Plan discussed the questions that drive the work and outlined the breadth that would include science, management, and education.

DNA Barcoding for Lepidopterans in the Park

The Smokies ATBI has collaborated with Paul Hebert of the “DNA Barcodes of Life” project. Let me give a short introduction to the use of DNA segments in biodiversity inventory. Some segments of DNA are so invariant that humans and chimpanzees are identical, while other DNA segments in the same organisms are so variable that we can tell not only humans from chimpanzees, but also one individual human from another. In between these extremes are DNA segments that correlate with the species level of identification.

Professor David Wagner of the University of Connecticut is a leading researcher on the moths and butterflies of the Park. Work on this group has increased the Park list by 476 species (the total is currently 1,367 species of lepidopterans in the Park), of which 74 species are new to science. Wagner has worked with Paul Hebert to sample each species for DNA analysis to document the segments of DNA that correlate with species identifications. The DNA data then form a data base that will be extremely valuable to future discovery and to researchers studying lepidopterans in any park or other study area. The DNA data base has many applications. This information can be used to link caterpillars to the adult forms without the necessity

of raising each caterpillar to its adult stage. This technology will eventually develop to the point that small samples (including the traces and fragments that plants and animals leave behind) can be used to rapidly identify species and to estimate the probability that a new collection represents a species new to science, thus allowing taxonomists to prioritize their work.

DNA analysis is also being used in our project to identify cryptic but important microorganisms, such as non-sporulating soil fungi and bacteria that are hard to study from a classical morphological perspective.

The association of caterpillars and adults is an important application, but consider also that some aphids have seven morphologically distinct life stages that can be linked with this technology. DNA evidence can unmask lookalike species and show when different forms belong to the same species. DNA can also be harvested from museum specimens, thus allowing comparison of field collections and documented species. This technology can also be used to detect diseases carried by organisms. Some scientists even speak of a day perhaps only decades in the future when the public will be able to carry hand-held species identifiers that are based on DNA analysis from small samples and fragments.

Education: Giving children the opportunity to be biodiversity explorers and inquiry based learning for the public

Glenn Bogart will present a fuller statement on the educational value of this project. I simply want to state that this is a project that is putting children back in the woods to be first-hand explorers and discoverers. Children are innately curious about the living world and are closer to the ground that we are—and more ready to turn over rocks and logs. From the beginning we have envisioned that our project would support public education and would help recruit new generations of scientists, experts, and citizens informed about and interested in the national parks and other conservation areas. At all ages, there is an appetite for natural history information—and a basic interest and sympathy with other species with which we share our environment.

Why do an ATBI? Why discover life in America?

We are doing the ATBI for four basic reasons.

First, we conduct the ATBI for basic science and the curiosity that drives that science. E.O. Wilson has argued that the human brain has evolved in a diverse biological world and that humans have a basic desire to understand and name the species around us. He calls this “biophilia”, an intrinsic interest and curiosity in the living world. Basic curiosity is a strong motivator of the ATBI and leads to the joy of discovery of previously unknown species and the appreciation for the abundance of life in our back yards, under rocks, in drops of water, and in the soil and rocks below ground.

Second, the ATBI supports the mission of Great Smoky Mountains National Park and the National Park Service, which is charged with the conservation of the natural objects and wild life (NPS legislation uses two words, not “wildlife” as a single word that often refers to larger animal species). It follows that we have to understand the biodiversity of parks better than we do. In so doing, we also understand better the presence of undesirable invasive pest species, which species are rare enough to be of management concern, and which species are sensitive to environmental change. We will also understand better the web of life and how biodiversity underlies ecosystem function and resilience. We will gain information important to ecological restoration. The information will be essential to understanding the potential for global climate change to affect biodiversity on a national scale.

The ATBI helps develop the idea that Parks are oases, storehouses, and protectors of biological diversity, not just recreational areas or vacation destinations. The ATBI creates basic information for management—as many have said about protected areas, you cannot manage what you do not know. Information from the ATBI will be important for counteracting existing threats to the Park and for detecting and resisting new threats.

Third, ATBIs are important for society at large. Some species are important to human well-being and the economy beyond Park boundaries. While the DNA technology based on Yellowstone species of bacteria is an extreme example, and it is impossible to predict whether any similar cases will develop from our project, the potential is there. For instance, the Southern Appalachians were heavily damaged by soil erosion after the highly exploitive and non-sustainable logging of the early 1900s. While forest soils outside the Park have been affected by this erosion, the old growth forest soils of the Smokies may harbor organisms that are important to forest restoration on damaged sites. I cannot state this for a fact—but I think it is a question that deserves to be answered. But we don’t have to speculate on other

values, such as the understanding of new diseases such as the West Nile Virus and its distribution or connection between biodiversity and ecotourism.

Biological diversity benefits people (for example, pharmaceuticals and microbes that support forest productivity), but we must also inventory nature to understand potential threats to human well being (e.g., parasites and diseases). Knowledge about biological diversity is essential to society. Ecosystems and species provide for an early warning system for the health of the biosphere and the human habitat. Living things in Great Smoky Mountains National Park depend on clean air and water, just as people do. Understanding biological diversity supports our understanding of environmental change. Species in the Park have different sensitivities to environmental change—for example, soil fungi, which play a critical ecological role, may be essential to understanding pollutant effects on forest productivity. In studying the unknown, we are carrying out an activity in which serendipitous discovery is possible.

Fourth, biodiversity inventory is a cornerstone of environmental education and for connecting students of all ages, but particularly children, to the natural world. Some of those exposed to the inventory will go on to become the experts of tomorrow and all will be more informed participants in our democratic institutions.

Human beings have an innate love of distinguishing, identifying, and naming. This is especially true in terms of naming other living things. From wildlife watchers to birders to wildflower hunters to fall color enthusiasts, people repeatedly demonstrate enthusiasm for a diverse environment and for recognizing species. The act of identification leads to an interest in habitats, the physical environment, species interactions, and the history of life. The project draws people from the human scale to see the hidden, unknown, and obscure, but often beautiful, intricate, and ecologically important species of natural ecosystems. The ATBI seeks participation from people of all ages, educational backgrounds, and abilities and seeks to enthuse the public with biological science. The project has been very successful in welcoming non-scientists and making everyone feel that they are part of the exploration and discovery. The project has helped erase the gap between academic and public education.

Why an ATBI in Great Smoky Mountains National Park?

In the temperate zone, the Smokies are a hot spot of biological diversity because the Park has a great range in environmental conditions and because the land has been above sea level and unglaciated for millions of years. The Southern Appalachians harbor global high points, at least for the temperate zone, of diversity and endemics in several groups, including plants, amphibians, fish, land snails, and aquatic insects. The Park comprises 5% of the high peak region of the Southern Appalachians, a substantial portion of this biotic province. The Park supports diverse ecosystems that represent the major ecological gradients of the eastern United States, from warm and dry oak-pine forests to cold and wet spruce-fir forests. Mountain landscapes offer gradients over relatively small distances, allowing for assessment of climate change effects.

The Park contains the best old growth watersheds in the eastern United States. These old forests harbor species missing from more human affected lands and are essential for comparisons with human dominated landscapes and for understanding human impacts generally. These forests may hold the key to understanding forest productivity and the effects of soil erosion during the early 1900s on lands outside the Park.

The Park has substantial past taxonomic research and continuing interest and enthusiasm of the academic community.

The Park was set aside partly for its wildlife and rich array of species and continues to enjoy that image—people love the wildlife, fall color, and spring wildflowers of the Park.

The Park has and will continue to change. We study the Park now to understand future change.

Senator BURR. Peter, thank you very much.
Dr. Watkins.

STATEMENT OF TIM WATKINS, PROGRAM OFFICER, NATIONAL GEOGRAPHIC SOCIETY

Mr. WATKINS. Senator Burr, Dr. Lilly, members of the staff and the community, thank you for the opportunity to appear before you today to comment on All Taxa Biodiversity Inventory efforts within

the National Park Service. I represent the National Geographic Society which is collaborating with the National Park Service on a 10-year program of annual Bio Blitzes at urban NPS units around the country. Like ATBI, a Bio Blitz is an attempt to inventory the species that live within the borders of the park.

Unlike ATBI, a Bio Blitz inventory is short term, a single 24-hour period and is designed in such a way as to maximize the urban public's participation in the event, its access to professional biologists and its valuation of the park. For our purposes here today it may be useful to think of a Bio Blitz as an antecedent to a larger, longer term, more scientifically rigorous and costlier ATBI. Because our Bio Blitz program is a focal point of the National Geographic Society's interaction with the National Park Service on the issues relating to biodiversity, I will share some of our experiences and insights over the past 2 years of Bio Blitzes and how they may apply to ATBI.

Our Bio Blitz inventories are conducted by professional biologists who volunteer to sample organisms from diverse habitats in the park. Most of them lead teams of citizens who have an interest in biodiversity, science and the park. Apart from conducting the inventories the scientists also inform participants about species biology and provide the public with a positive experience of science in the parks. Many scientists also work with K-12 schools and other groups on structured activities focused on biodiversity education.

Our first Bio Blitz was held in May 2007 at Rock Creek Park in Washington DC. There were 82 scientists and other experts, drawn from diverse universities, museums, natural resource agencies and naturalist groups. There were about 1,000 participants, many of whom joined 84 inventory teams throughout the park. At this time, the official species count stands at 659, over 300 of which were not in the official park data base previously.

Our Bio Blitz this year was held in May at Santa Monica Mountains National Recreation Area outside of Los Angeles. There were 126 scientists and other experts, 181 field teams, 1,200 people who joined the teams, nearly 1,400 school children in organized field class activities, and about 6,000 participants overall. This was the largest event of its type in the National Recreation Area's history. At this time, the official species count stands at 1,716, many of which have not previously been recorded.

What does a Bio Blitz of this magnitude cost? National Geographic allocates \$200,000 per year for Bio Blitz, including staff travel, marketing and promotional materials, consultant fees and event equipment rental. SAMO, Santa Monica Mountains National Recreation Area, spent \$174,000 of Centennial Challenge funds, including transportation, staff overtime and an Incident Management Team. They also allocated an additional \$45,000 for post Bio Blitz research and inventories in the park by Bio Blitz scientists.

What have we learned? From a social standpoint, we've learned that there is tremendous enthusiasm for hands-on learning about biodiversity in National Parks. This is especially true among the non-scientist public.

I don't have time today to share feedback from participants or to describe their transformative experiences in the field. Suffice it to say that thousands of Angelenos and Washingtonians now feel bet-

ter connected to their local National Park and have a better understanding of them as places where diverse organisms thrive. ATBI organizers may do well to capitalize on this enthusiasm by involving the public in the science.

Scientists, too, are eager to participate in inventories and public outreach efforts. They are civic minded and eager to cultivate in others the wonder about the living world that first started them down their vocational paths. Whether through ATBI, Bio Blitz, or other mechanisms, field biologists are a valuable group of people to inspire National Park visitors of all ages. Their involvement provides a unique means by which the National Parks can contribute to the improvement of science education in this country and to the recruitment of the next generation of biologists.

From a scientific standpoint, we have learned that new confirmations of species presence can be obtained even over a mere 24 hour period. Such observations have the potential of documenting range expansions in our National Parks and of characterizing the biogeographic role of a given Park. Furthermore, from our use of GPS technology, we have some preliminary information on where species live in the park. I emphasize that the presence/absence data, as well as the spatial data, are preliminary because the inventories at a Bio Blitz are not intended to be exhaustive. Instead, these data suggest how future inventory efforts such as ATBI might best be focused.

One additional lesson we have learned is that some scientists are sufficiently frustrated by National Park Service policies concerning ownership of curated specimens that they are reluctant to participate in Bio Blitz projects within NPS units. This frustration is likely to affect ATBI inventories as well and given the importance of involving as many scientists as possible, steps should be taken to resolve the issue. I am encouraged that the policy is being re-visited, and I look forward to the resolution that is emerging.

Again Senator, I thank you for the opportunity to speak to you today.

[The prepared statement of Mr. Watkins follows:]

PREPARED STATEMENT OF TIM WATKINS, PROGRAM OFFICER, NATIONAL GEOGRAPHIC SOCIETY

Senator Akaka, Senator Burr, Dr. Lillie, members and staff of the committee, thank you for the opportunity to appear before you today to comment on All Taxa Biodiversity Inventory efforts within the National Park Service.

I represent the National Geographic Society, which is collaborating with the National Park Service on a 10 year program of annual BioBlitzes at urban NPS units around the country. Like ATBI, a BioBlitz is an attempt to inventory the species that live within the borders of a park. Unlike ATBI, a BioBlitz inventory is short term (a single 24-hour period) and is designed in such a way as to maximize the urban public's participation in the event, its access to professional biologists, and its valuation of the park. For our purposes here today, it may be useful to think of a BioBlitz as antecedent to a larger, longer-term, more scientifically rigorous, and costlier ATBI. Because our BioBlitz program is a focal point of the National Geographic Society's interaction with the National Park Service on issues relating to biodiversity, I will share some of our experiences and insights over the past two years of BioBlitzes and how they may apply to ATBI.

Our BioBlitz inventories are conducted by professional biologists who volunteer to sample organisms from diverse habitats in the park. Most of them lead teams of citizens who have an interest in biodiversity, science, and the park. Apart from conducting the inventory, the scientists also inform participants about species biology and provide the public with a positive experience of science in the parks. Many sci-

entists also work with K-12 schools and other groups on structured activities focused on biodiversity education.

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Our BioBlitz this year was held in May at Santa Monica Mountains National Recreation Area. There were 126 scientists and other experts, 181 field teams, 1200 people who joined the teams, nearly 1400 school children in organized field class activities, and about 6000 participants overall. This was the largest event of its type in the National Recreation Area's history. At this time, the official species count stands at 1716, many of which have not previously been recorded.

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Senator BURR. Tim, thank you. Again, I thank all of our witnesses for their willingness to testify this morning.

I've got a number of questions and I'll try to do this in as informal capacity as I can. There are going to be some things that we do need some direction. I'll make that we track, cover and duck.

But seriously, let me ask you as a group. I throw this out to any that want to take it. How long does it take to determine something that doesn't currently exist in the inventory?

Dr. White, I'm assuming that as a biologist you haven't memorized everything that exists. Take me through the process. I go out.

I participate either in inventory or in Bio Blitz. I see a spider. It triggers that this is not one that I've seen before.

What does one go through to participate? Is that work peer reviewed from a standpoint of certification that exists in new species?

Mr. WHITE. Yes, indeed. That's a very interesting question. It brings up a point about the score card at the back of the room which is there is a time lag between field work and the determination that a species is new.

So the number 890 species new to science, the specimens that have been collected to date 2 years from now will know they will have been through that process of documentation as to whether they are species new to science. Taxonomy is a cumulative science. The journals that fill the libraries document what biologists have found in the past.

So taxonomists will compare that newly collected specimen to other museum specimens, to the scientific literature. Then publish a peer review paper when they determine that that is a species new to science. In a sense that's the traditional taxonomic way.

It does take time. It does take a year or 2 years. If it's a really exciting and really different species that is obviously new, I think we'd accelerate that and get that peer review publication out even faster than that.

On the horizon one of the exciting dimensions of our project is the DNA barcodes of life component. Some of our DNA is so invariant that humans and chimpanzees are indistinguishable. Some DNA is so variable that we can tell one individual human being from another.

But in-between those extremes there are segments of DNA that correlate with the species level of identification. Our project on butterflies and moths has now created a DNA library. New specimens in the future can be compared graphically to that DNA library to accelerate the process of species discovery.

That's a really exciting component that has been incorporated into the Smokies Project. Which is gaining importance in the scientific world as well.

Senator BURR. Anybody else?

Tim, do you see it all over National Geographic if ATBI is expanded?

Mr. WATKINS. I do, in a number of different ways. First of all, of course, we can be a very effective and have been a very effective media partner for the National Park Service on a variety of issues including ATBI and by a very esteemed gentleman on the role of parks on biogeographics.

Another important goal that is just now emerging that we are very meekly stepping into is providing a particular stock or a package that we have now developed to our management division for managing and presenting and analyzing geo-referenced information. So these could be photographs. These could be species counts.

These could be species records. These could be the actual specimens. These could be pieces of DNA in which we know the actual latitude and longitude in which that information was obtained. We can put this into a very, very powerful software tool for presenting that information that's available to the public that tells very compelling stories about the biodiversity, the species diversity, the DNA diversity, the habitat diversity of Smoky Mountains National Park, even under the—

Senator BURR. Could we take for granted that this is not just inventorying species, but it is an attempt to try to figure out from the habitat where they're found whether that's a key as to where it ultimately might look in the United States in a similar habitat, assuming we can, in fact, find that same species?

Mr. WATKINS. Yes, absolutely.

Mr. WHITE. Senator, could I answer your first question to Tim? You asked about National Geographic's role. I just want to add on at a slightly different level than the science that the ATBI's, quite simply, would not happen without partners.

The National Park Service could not accomplish this level of detail, this level of study, this level of understanding in the parks without partnerships. We've modeled that from the very beginning with the creation of Discover Life in America. National Geographic's involvement is huge in engaging the public in the broader scientific community.

Senator BURR. Tim, let me ask for your experience. Do you see ways to improve ATBI?

Mr. WATKINS. I do. I can speak only of my personal experience which is only as a former biologist and not a media person's, for example. But of course, National Geographic has an immense media power in order to shine brighter lights on ATBI.

I speak on behalf of myself, my entire conclusion. One is I do believe that enormous strides can be made by being sure to include inventories of microbes and other organisms that typically, frequently, have not been inventoried in natural settings, certainly not in parks. I say that in part because the E.O. Wilson Foundation Committee, microbial Bio Blitz of Central Park in New York a couple of years ago and found several species and higher taxonomic categories of microbes that were completely new to science and that was just right in the heart of Manhattan.

I think it's going to be imperative that the data from ATBI be made very, very, very public. Not just generally available on a data base that the public can find on a website. But rather that those data be used as a basis for stories that people are able to celebrate the National Parks and what lives in them and that they're inspired to go to the parks and to find out more about the park that may very well be in their backyard.

Then third, and I'm hearing quite a bit more about ATBI than I previously knew. So maybe this is already been done quite well, but I think ATBI can be used very directly to engage visitors. People coming to the park can participate in ATBIs.

Perhaps can meet the scientists who are doing it, can go out into the field with scientists who are doing it. Try the methods. Can have some experiences, outreach experiences, perhaps at visitor centers, nature centers, ranger led walks, you name it, to engage them in the actual research project that's happening within the park.

Senator BURR. Dale, you brought up partnerships. With what you've learned from this effort to date, what would enable you to create partnerships easier from this point forward?

Mr. DITMANSON. That's a good question. I'd be interested for Peter to add to this question because I wasn't here at the beginning of this relationship. I've had the opportunity to work with Discover

Life in this program the last 4 years as Superintendent for Smokies.

But from the appearances, I don't know that Peter would use the word, it was an easy relationship from the beginning. But I think it was easy with all of the scientists and the leaders and the park coming together to recognize that on a basic level how do you manage a National Park without knowing what you have? It just seemed like a very basic question.

Here is a huge National Park. Wonderful biodiversity and we didn't know what we had. A great range of people, including Peter, were involved. Glen Bogart was involved, the Superintendent at that time, Karen Wade, and Assistant Superintendent Phil Francis were involved. So I don't know if I can say answering your question about what might make it easier because I think there's a large group of folks that recognized that issue and came together to be very successful with that.

So, Peter, I don't know if you'd like to add something about the beginning.

Mr. WHITE. Sure. Our relationship with Great Smoky Mountain National Park has always been really wonderful. The park has been really welcoming to us.

One of the things that's happened under Dale's leadership is the completion of a new science center within the National Park. A beautiful, expansive building to house the natural history collections and the data that are partly generated by Discover Life in America and ATBI partners. So the park has really been good to work with.

In our early years we discovered that we could really leverage our budget through simple logistics, a little bit of housing. Folks within the park who would assist the researchers know what was previously known about Great Smoky Mountains National Park and folks who would supply locations and maps. The Park Service would key find them and the USGS biologist, Charles Parker, established some pilot research locations in the park that researchers could use.

So we discovered through that relationship that we could leverage what we wanted to do with the Park Service support. We're very grateful for that.

Senator BURR. Tim mentioned that wouldn't it be nice if we present this in a way that people who access the park—that you alluded to. You said, students should know more about our active work. You're familiar with the National Park Passport Program?

What would happen if every student at your school was given a copy of that—given a passport and the instructions on how to use it? Can you expand and discuss the benefits of giving a copy of the passport to every elementary student in this country?

Mr. BOGART. I think that would be a wonderful addition, enrichment and a necessary component of an elementary education. We are already in the meeting stages, as I mentioned about developing a unit for that very purpose. To involve the youth in the awareness of our national treasures, I think is an imperative role for us educators and for parents.

Senator BURR. Let me ask you in a slightly different format, if I could. If we found a partnership with a supplier of education

today, either a book supplier or somebody who supplies those teaching aids, specifically to elementary school and we could put together a partnership where they do the distribution to the schools of the passport. We attempted to give every child in elementary school a passport and tried to institute this as a program for the future. Would you see that as an acceptable way to do it and eventually a successful venture?

Mr. BOGART. I do. Senator, there's got to be curriculum guidance. There's got to be the rationale, you know, the development of a collaborative sense of responsibility for that.

The key to educational achievement or one of the keys, the values that I alluded to was how you integrate that information and those resources into standard curriculum. I would certainly welcome that initiative.

Senator BURR. Dale, any comment on that?

Mr. DITMANSON. I do. I have several, that's a great question.

First off I'd like to give a little credit. The passport program was actually created by one of the park's partners, Eastern National Park and Monument Association. I guess they just go by Eastern National now.

They are a group that's been around for many years since the early days of parks and provide sales and support. In fact they provide the sale of books and interpretive materials here at the Blue Ridge Parkway. A great organization.

I think in addition to the passport you have to have a companion guide. That may be where Glen is talking about curriculum. Because just having the book about getting the passport stamped at a park, that assures you that they've been there and they've done something.

But I think a companion piece. That's where we've been working very hard, the National Park System, to improve Junior Ranger Programs and maybe it's a Junior Ranger Science Program or some element. So that in addition to just that passport being stamped, you actually engage in the park in an activity.

Interestingly enough in this day and age of children, getting them out into nature and getting them involved, we have seen a significant increase in our Junior Ranger activities in the Smokies because we start to advertise them as family programs, not just aimed at children.

One of the reasons they're so successful, I think, is we have to educate our parents as well. Sometimes they're hesitant to go out with their children because they may not know the answer. But in a group event with families, children, park rangers, there's a real opportunity for education. So the science element of that is very important.

Mr. WATKINS. Senator, I'd like to add a quick comment.

Senator BURR. Let me do one thing here. Dale, let me take you back here 16 years down the road. Tell me how technology potentially will play a role in the experience at the National Park, i.e. do you see people downloading to their I-pod before they come, a video that will take them on a tour of a given area, an experience through a given geographical point and additional information that is park specific?

Mr. DITMANSON. All of the above and sooner than 5 years. We are proceeding through the first year of the Centennial Challenge that Congress supported for the National Park Service this last year. As you're aware, \$25 million was made available for parks to match with their partners.

Our two most important partners are represented here today, the president of the Friends of the Smokies is here. The chairman and the executive director of the Great Smoky Mountains Association are here. Both those organizations have allowed us at the Smokies to move forward with some partnership projects.

Interestingly one of those is Podcasts. We're already developing them. So that there are ways to download them before you come to the park, to download them once you come to the visitor center, have them available to you so that as you travel through the park, you're going across one of the mountain highways or to an element of the park that you can bring that story up, interact with that while you're in the park, or, as you said, before you get there.

We heard last week in a National Park Service Superintendent's Conference that the children today are connected in some ways over 6 hours a day to media. While we don't want to add to those hours of media, we know that we have to get at them through that media. If that media means getting them excited to visit a part of the park and then actually get out of the car, unhook the ear-phones and interact with the natural environment or the cultural environment, we'll be successful.

Senator BURR. I now refer to Glen on how—you might want to comment on that.

[Laughter.]

Mr. BOGART. We struggle in education. In fact the hope and the interest of many of our students, I think, if you listen to the majority of the building, I think the case to put more personal money in K-12 education in any single entity, they would suggest and I think the data is there to prove that the more academically gifted students that we do academically challenge students. One can only point to a lack of interest in either book and teach or the way you teach.

It's amazing to me that for most in this room to pull this out, we automatically think a call has got to be made. But when our children or our students pull this out, they have no intentions of making a phone call. They have every intention of sending a text message or taking a picture or now, listening to music.

The fact that they communicate differently from the standpoint of transmission means we have to rethink how in fact we download information to them because they receive differently as well. If that did help doing means that their level of participation and the depth of their knowledge increases. I'm not scared to add to the hours that they might utilize it.

[Laughter.]

Senator BURR. Tim, why don't we come back to you?

Mr. WATKINS. Yes, I was just going to say that a lot of these issues we're discussing right now. Of course, are one of the many ways that National Geographic, that are in many, many ways would be appropriate for National Geographic to be a partner organization in supporting educational programs that the development

and delivery of materials, like in the passport, supporting materials that are related to the passport to people.

I think our education division, of course, is continuously active in developing background content and delivering it to the teachers around the country. We do some of that actually in partnership with the National Park Service already.

Then last there's some growing interest within National Geographic about partnering with organizations such as the National Park Service on development on the content of summer camp programs. The Junior Ranger Program, for example, has been brought up within our society as a modeling organization structure that is appealing to us and we see opportunities of partnership there. Certainly developing Junior Ranger programs and under summer camp sorts of activities within National Parks that are centered on ATBI or other aspects of biodiversity is an enriched area.

Mr. WHITE. I just want to say what's so exciting about new technology and educational delivery from the perspective of a scientist. I think there is intrinsic interest in the public and in students of all ages in identifying well, what kind of spider is that? Where does it live? Or what's that frog I hear singing or what's that bird?

One of the barriers is how you access that information. How you get from I saw something neat to here's some information about it, something about its ecology. I just saw advertised a software program that you put a microphone out in the environment and you record frog songs or bird songs and the software compares that to a data base of frog songs and bird songs and tells you what species that is singing.

From there you can go to ecology and conservation and understanding the importance of biodiversity. There's nothing a scientist likes better than a sense that the public will appreciate and understand they didn't have access to the information that we develop.

Senator BURR. Let me say about the passport and then go on. I've had several conversations as to how we collectively do an expansion of the passport program. I think in this case we always get back to the distribution challenges from a standpoint of the enormity of our education system and how you get it in.

So I think it is in some fashion partnerships with entities that currently have education tools and have a distribution network to do it.

Glen, let me turn to you for just a second. What can we do, and we, collectively, the Federal Government, the Park Service to help with teacher preparation relative to what you've experienced at your school and is there hope for us?

Mr. BOGART. I think so. Staff development, pre-service preparation, collegiate curriculum are all part of providing a qualified instructor to provide the unique experiences that young people should have. Certainly I think the involvement of the Federal Government's take on local, at all levels of staff development are crucial to get those messages and methodologies out there to prepare teachers.

As you know Senator, with No Child Left Behind and the great national debate that's occurring with that specific program, there is a real challenge as to what's being taught. What should be? What is accountable?

But ultimately, I believe that a school is as good as the community wants it to be. Part of that discovery, that experience for teachers and students, is how we prepare them to handle a range of information that connects with the real world.

Senator BARR. Clearly you found, I think a local tool to engage your students in science. We struggle in this country to try to figure out how to make science and math exciting again. You are right to give certain schools, certain systems find the book and outperform the rest of the country.

The challenge is how, I guess how we excite every system to look for the books because I think the last thing we want to do is play any role in local curriculum. I speak for myself, when I say that. It will not happen as long as I am there, if I've got anything to say about it.

Give all of us a sense of what types of courses? What types of units you've created that these teachers, went into the classroom presenting to students that got them involved?

Mr. BOGART. This has been a bit of an evolution over 18 years of developing units of instruction using the natural and cultural resources of the park. The units have to be age appropriate, you know, the content of what we teach. Of course the challenge, they, we want the students to be able to handle the information successfully, meaningfully, but to experience it first hand.

Now the variety of topics goes from plants to animals, environmental issues, pollution with it. We focused our instruction, our project on trying to address the critical issues that face the Smokies.

Senator BARR. Thinking outside of Pi Beta Phi other elementary schools that make aware of the parks somewhere in Tennessee or North Carolina that you're aware of? On the other end of it when they leave you and I'm not sure in Tennessee whether that's middle school or—

Mr. BOGART. Eighth grade.

Senator BARR. Is there an effort within your system to continue, to expand on what you've started.

Mr. BOGART. We struggle with that. Regrettably we don't take that to the secondary level, but perhaps the collegiate level. But I think is desirable and is necessary.

But certainly represents the challenge I think we face to see to it that integrated instruction carries on at least through the secondary level.

Mr. DITMANSON. May I add to that?

Senator BARR. Absolutely.

Mr. DITMANSON. First off, Glen has with him a publication on examples of what we call Parks as Classrooms in the National Park System across the country. There are six?

Mr. BOGART. Six.

Mr. DITMANSON [continuing]. Case studies of this national book of which Pi Beta Phi Elementary is one of those case studies. They're an example that we ourselves want to emulate. But it's not an easy task.

Just as we look to partners for the ATBI, we look to partners for education. Glen mentioned in his remarks his thanks to his school board because the Sevier County School District pays for half a

paid position and we pay for half of a position, making it a priority through our association to pay for a full time person at Glen's school to develop that program. It is a wonderful partnership that's built right into the school system.

We would love to do that around the park. We have six counties contiguous to the Great Smokies. Three in Tennessee, three in North Carolina, at least a dozen communities that are gateways to the National Park in one way or the other.

We had this last year an opportunity for a wonderful new partner to come to the table through the Friends of the Smokies. That is the Toyota Corporation. They have put forth 5\$ million to 5 National Parks around the country. We received \$1 million at the Smokies.

Glen, you might not be aware that we are already working with the high school in Gatlinburg to take our program into the secondary school. Also, our next elementary school that we are working very hard to develop a curriculum and to get to that level, it might take us a while, because we've had such long experience with Pi Beta Phi, is in Cherokee, North Carolina working with the Eastern Band of Cherokee Indians.

As their new schools are being developed our staff are already working with them to develop that same type of relationship. We hope it will be a long term one. The million dollar grant from Toyota will be extended over the next 3 years developing programs with additional schools and again which you touched on a little bit ago, multiple teacher workshops because it has to start within the school system and the teachers working together to say this is a mutual goal.

Senator BURR. Dale, counsel me. How does the goal change to fit all since the beginning of this process?

Mr. DITMANSON. I would say that the goals, if you remember, and I think each of us have hit on them in some ways, of determining how an ATBI should be accomplished. We've learned a lot. You've asked a couple of questions about how we might learn from those and do better through them.

Determining what species are present. But not just the inventory, where they are? What's their relative abundance in starting to deal with the patterns of diversity and distribution? So those overall, overarching goals, I do not believe have changed.

Senator BURR. Why was the Great Smokies chosen to be at the center of this project?

Mr. DITMANSON. I think Peter is probably the better one to answer that being around from the beginning.

Mr. WHITE. First of all the Great Smoky Mountains National Park is a hot spot of diversity in many groups of organisms. It's just a tremendous amount of biological diversity within this National Park. So partly it was for obvious reasons.

The park has always been known for its biodiversity. The public enjoys the salamanders, the synchronous fireflies, the fall color that represents that biological diversity. But there's also sort of a happenstance historical phenomenon which is that one of the National Park Service employees, Keith Langdon, who's head of the inventory monitoring program within the park became aware of a

project in Costa Rica, the first and the founding use of the phrase All Taxa Biodiversity Inventory was coined for that project.

But that project largely failed, but it planted an idea in Keith's head. He returned to the Smokies to organize our first discussion in December 1997. I will also say that the park, all parks, but Great Smokies in particular, has always attracted research attention. There's a long history of research here. So there was a good foundation on which to build.

Senator BURR. If ATBI were expanded outside of the Great Smokies what would you say there would be the three areas that you would recommend for expenditure?

Mr. WHITE. I would pick based on environmental contrast with the Smokies. The nation encompasses many environments. I would pick deserts. I would pick the Pacific Northwest. I'd pick a place in the Rocky Mountains.

Collectively then, we would learn a lot. Our DNA library would build faster. Our species lists would build faster. Our contribution to society would build faster.

I was part of a delegation to Washington a year ago that met at National Geographic to discuss proposing a nationwide ATBI program for National Parks as part of the Centennial Challenge of the National Park Service. This is a matching cash program between the National Park Service and outside partners. I am thrilled to say that that Centennial Challenge project was adopted by the National Park Service.

I believe there's something like nine parks right now that are getting some startup funding to design ATBIs under that matching cash program. I think that Centennial Challenge is funded year by year. So we all hope that line item remains in the Federal budget. The year 2016 is the centennial of the National Park Service. It's a major landmark in terms of all conservation. We'd love to see ATBIs become very much part of the celebration of why National Parks were created in this country.

Senator BURR. Peter, should any taxonomic proof be given priority for collection and identification and if so, why?

Mr. WHITE. Let me first of all state, honestly, that I don't think so. There may be others who disagree with me. I think one of the values of our project was that we felt all life forms were valuable and interesting. We didn't want to make it a some biodiversity taxonomic inventory, but an all biodiversity taxonomic inventory.

So, I'd have to say that many of the least known organisms probably play a very important ecological roles. It's part of the fascination of the project that you can discover things under a rock or in a drop of water or in the soil or up in the tree tops, now having said that, I have to now retreat to some practicalities. Some of the practicalities are that we have taxonomic experts for some groups, but not others.

Another part of the practicality is sort of the economy of scale. If we're going to do, as Keith Langdon reminded me this morning, if we're going to do lichens in several national parks, if we have a lichenologist willing to work with specimens from several national parks. Let's go with lichens. We'll get a lot from that investment in a short period of time.

So I think the ultimate goal is all and the short term is that we will race ahead on some groups faster than others.

Senator BURR. Knowing what can come about, what's next? Where do we go?

Mr. WHITE. I think that expansion to additional habitats across the country is very important. That will really build taxonomic knowledge very quickly. Another thing I think we've learned in this project is that we've always thought of two sampling strategies or collecting strategies. One we call traditional because a scientist will be out there, maybe with some volunteers, or a school group, some scouts or a summer camp and they will be exploring biodiversity in a traditional way which is based on their experience and knowledge and their intuition.

We've also, on the science plans, started what we call structured sampling which is finding some biodiversity reference points within the park, some sampling locations where we will study intensely. I think that intensive reference area section of the project is going to develop now more quickly. It will be a very important part of, scientifically, how we understand the results of our data.

Senator BURR. In December 2001 in an article in part the biologist stated that for every species of life in the park you want to answer three questions. What is it? Where is it? What's it do?

Of the species we've identified, have we answered those three questions?

Mr. WHITE. We've answered those questions for some of the best known groups. For example, our web pages on the birds of the Smokies are amazing. They give distribution within the park by elevation and habitat. They have a little link to the bird song. They talk about the neurology of the species and the abundance of the species.

At the other extreme we are recording data now on some groups that when we started the inventory we knew very little about them in the Smokies. We are capturing the data that will go into answering those three questions as we work. But there is a spectrum between those groups in which we are satisfied with lots of answers to those that we're just still discovering the answers to those questions.

I think those questions are still the right framework for the project.

Senator BURR. With 10 years of experience now, how would you modify those questions if you had to?

Mr. WHITE. I think the only way I would modify those questions is just with more detail. For example those questions when they say what is it doing in the park? We could talk about the interactions among species or the abundance.

In terms of where are the species? We could talk about those seasonal changes or seasonal abundance fluctuations. So, again as I look at those questions in the context of this hearing I felt they were the right framework, but they, in some cases, just can be clarified and made more detailed.

Senator BURR. That same article, again 2001, estimated that it would take 200 experts, 11 and one quarter years to deal with 90,000 species. How many experts have actually been involved up to this point? Again, remind us of how many species?

Mr. WHITE. Ok. We've now documented 15,000 species in the Smokies. As Dale reported we estimate that the number may be 40,000 total, maybe a bit more than that, maybe even twice that number. That's how little we know about biodiversity in our own backyards.

Now counting the scientists involved in the project turns out to be a tricky question. Over 1,000 scientists representing 20 countries and over half of the States of the United States have, at one time or another, been involved in this project. Some of them have just looked at a few exam specimens or reviewed a manuscript. Others have been in the park and worked intensely for years on the inventory.

The 2001 article, that was 7 years ago when really we had just had one or two field seasons of experience. I will say it's sort of an example of top-down design. Whereas what we've done has really been grass roots and build up from the bottom.

In any case, if you take our 1,000 researchers and you say well, how many come to our annual meetings and how many have published papers? Probably down to about 100. They aren't working full time, they're working part time.

So going from the equation of 200 full-time, 11 and a half years, to what we're actually doing in the ground, we've covered a lot of species with the largely leveraged in kind and volunteer support that we've had from the scientific community.

Senator BURR. Tim and Peter, could we pick a continent in the world and pick a spot within that continent and potentially learn as much in that given spot as we have in this given spot about species we knew nothing about?

Mr. WHITE. Would you like to start?

Mr. WATKINS. Yes, but I wouldn't make it on a continent. I would pick the ocean. That said, certainly tropical rain forests continue to be under studied, under inventoried, poorly understood in terms of even basic biodiversity.

Yet I think efforts over the past couple of decades on inventorying particular places that have gotten a lot of interest from United States based researchers who have the resources to do this have turned up enormous industries and biodiversity. I think of Barro Colorado Island, for example in the Panama Canal which was very well studied by U.S. scientists at the Smithsonian and other institutions. I think of La Selva and Monteverde in Costa Rica that define similar levels of attention from basic test comments.

I would consider it a given—I don't know the numbers off the top of my head but certainly in terms of the amount of effort that's been inciting in those places and the source of the revelations about biodiversity that have been produced in those various—timeliness, similarly with the Smokies.

Mr. WHITE. We have had teams come from other countries to study ATBI of the Smokies because they've been excited about the possibility of carrying out that sort of work in other parts of the world. I'll also say that one of our researchers reported at our annual meeting that a gram of soil has the same habitat diversity as the entire planet ranging from a swamp to a desert within that gram of soil. That within that gram of soil that there would be

many bacteria species have adapted to that wide range of environments just within that small area.

This again, tells me how little we know even here and because bacteria are so important in the metabolism of an ecosystem and may harbor some interesting species that have economic value outside of the conservation and environmental education and ecotourism context. That's very exciting to me, that we have that much to discover that might be potentially of great value.

Southern Appalachians, right before the National Park was created. The National Park was saved and has some of the best old growth forest in the East. But many of the forests were being logged at the time and not just by modern methods of logging which are benign. But rather by very large scale explosion logging that resulting in a lot of soil erosion.

I think the soils of the old growth sows of the Smokies have biodiversity that may be important in restoring the productivity of soil eroded lands beyond park boundaries. So basically I see so much of discovery in the park. I think all of us are so, part of the pleasure of working this project has been the folks that have come from other places in the world and other parts of the United States to study what we've done and to be inspired to carry out that work elsewhere.

Senator BURR. My last question to try to understand just how you need to know what a great opportunity this is to have this really in our backyard or front door depending on which State you're on.

Dale, what's the relationship between ATBI and the inventory efforts that are taken in the National Parks and how frequently is there communication between the two areas?

Mr. DITMANSON. You know, Peter may know more than I.

I don't know how frequent it has been, but we have exchanged information. I don't think there's any National Park unit in the country considering Bio Blitzes or ATBIs that our staff or members of the board or directors have discovered that we not spoken with. There's a good interchange of communication.

I know that an individual from Acadia has attended one of the Discover Life in America conferences. Dr. Nichols on our staff actually went up to Acadia in 2006 and participated with their first Bio Blitz, so there's certainly a back and forth communication.

Peter, I don't know if you'd add to that?

Mr. WHITE. As I remember there are something like 40 National Park Service units that have come to one of the annual meetings of ATBI to learn from what we're doing. I am quick to point out that some non-park service lands have also attended those ATBI meetings. One of the projects that's going right now is the Adirondack State Park ATBI.

The Tennessee State Parks have gotten on board and are doing ATBI activities. I would love to see North Carolina State Park get involved heavily in this as well.

Senator BURR. Today we've talked a lot about the identification of species, the collection of species. Where are collections stored? At what point do you anticipate the need for additional storage space?

Mr. DITMANSON. Peter got to jump the gun on my talking about the wonderful new science center we have at Great Smoky Moun-

tains National Park. It has been, as a lot of things in parks, supported and encouraged by a number of managers and leaders through the years. Fortunately that facility came to fruition last year. We cut a ribbon last November.

That facility has the storage facility in it for our natural history collections. As I understand somewhere between 250 and 300,000 entries have been made into our data base because of ATBI. Those are stored in that facility.

There is no need in the future that we can see, based on the current rate of collection and the number of items that we're going to have to add to that. That facility should accommodate a growing collection for some time to come.

Senator BURR. Have we collected these specimens from private property? If so, did we obtain prior approval from the property owners?

Mr. DITMANSON. Let's see if I can answer this appropriately. What I wish wasn't happening is private individuals collecting species in the National Park without permission. We have a lot poaching and other things that go on.

But the answer to your question is no. The ATBI is contained within the geographic boundary of Great Smoky Mountains National Park. No private land is involved.

Senator BURR. Let me just ask you what's left to be done with this that can be answered. How long do we estimate it will take, just a good faith number.

Mr. DITMANSON. It's been an interesting conversation. We have used words like complete and what does success look like? I think each of us up here might provide a different answer.

We have taken the approach of looking at what are our highest priority needs in the next 5 years? Where do we need to go and what resources do we need to put toward that?

There are some areas as Tim and Peter have spoken about, the excitement of science, the areas of discovery that continue to happen. But at some point in the ATBI, I think the park has to identify what are those priority areas where we are not learning as much as others or there's some holes in the species groups. Should we be focusing on those elements?

Peter mentioned about the development of structured sampling and how do we do that? Because our end goal is to be able to manage the park better, to have better indicators in some of these species that we can tell about the health of the park and that we are managing it for the long run. While we do want to know everything that's here, at a certain point in certain species areas maybe we've learned what scientists may project as 90 percent of those species in that particular area in the park.

For the park that may be where we say our efforts might need to be focused in another area. Whereas Discover Life in America, because of contact with scientists or National Geographic's interest, they may find someone who wants to do that 90 to 100 percent. That's ok. But our missions may diverge a little bit in where the park's focus is on wanting to fill those pieces in, focus on structured samplings so that we have better ecological data about the health of the park.

But to answer your question of how long? I don't know what that answer is. I think——

Senator BURR. I thought you were going to point to Peter, so——
[Laughter.]

Mr. DITMANSON. I am, but that's ok. In managing National Parks, they're dynamic systems. Whether it's the ATBI or other resource management elements we are going to continue to monitor our resources and go back where inventories were done and look for change, and that's going to go on in perpetuity.

Senator BURR. Let me go to him for how long. I going to come back to you with, specifically the Great Smokies and ask you to take us through how you go through the process of determining what your budget request is and how you break that down so that I can understand better the importance of this, if you're looking at it in the context of everything.

Mr. WHITE. Alrighty. I'll make a comment on that question that Dale will answer more fully. But the National Park needs more money. Smokies needs more money in general. The National Park Service needs more money in general.

Let me just say about the inventory that we are in a transition from the all horizons are being pushed out kind of inventory toward monitoring. Toward getting toward a place where we have gotten that 90 percent and the Park Service's interest and that ATBI interest is in getting to that level and seeing a transition toward monitoring and use of the data. Personally, I can make a guesstimate of the number of years that will take, maybe 5.

But again, I represent a large diverse organization there may be better numbers of years of estimates out there for that transition. We've learned a lot in these 7 years. I think that we are in a position of making that transition.

There's also something called the collector's curve. Whether you collect baseball cards or antique furniture or anything else, there are some things that are going to be common and easy to find. They won't cost much to find them.

As you accumulate the common species you begin to get into the occasional species and then get to the infrequent species and finally get to the rare species. That curve of, in a sense, the mission of curves is called the collector's curve. We need to get out on that collector's curve at as far as we can go. But there will be some rarities whose discovery will only happen over the decades and not in this initial inventory phase of the project.

So I think that's one of the benefits of having been part of the pioneer group here is that we've learned about that. We've learned about the importance of the structured sampling, the importance of that transition. As Dale has said the Park Service's attitude about biodiversity will go on forever.

I'll say that new generations of Americans won't need to be educated forever. So the biodiversity theme of Great Smoky National Park is a forever theme even as we transition from inventory to monitoring.

Senator BURR. Dale, I'm not trying to put you on the spot.

[Laughter.]

Senator BURR. If you want to decline to answer, that's fine. I think we all agree with what Peter said was we'd like to fund it,

if it went well. The realities are that we have, as everybody knows, a finite amount of money.

I'm just trying to understand the process that an individual would be in charge of the parks or all the different categories that you have to look at from the standpoint of the enjoyment, the protection of that treasure, the expansion of the treasure and how do you handle it?

Mr. DITMANSON. It is not an easy task. The first thing that makes it—well the first two things that make that easier is that we have a terrific management team at Great Smoky Mountains National Park. For a large park we have managers that have very in depth experiences, career and operate at a very professional level.

The division chiefs at the Smokies are equal to and actually operate with a budget complexity beyond most of the small National Parks in the system. We have five divisions. We have a Chief of Resources that are responsible for both natural and cultural resources in the park.

We have a Chief Ranger who is responsible for the protection of the resources, protection of visitor facilities and our visitors and of safety.

We have a Chief of Resource Education that is involved with our schools and our education programs as well as those 9 million people who come through the park, 900,000 of them stop in one of our visitor centers looking for information.

We have a Chief of Facilities Management, which of our \$18 million budget, about half is facility management in the park, of 300 miles of paved roads, another couple hundred miles of back country type roads, 800 miles of trails, 1,000 campsites. We're in the top 10 in the National Parks in the country of number of assets that we're managing and taking care of and facilitating in the park.

An Administrative Officer that keeps us all whole and provides for procurement, hiring, and staffing. We have about 250 permanent, year-round people. During this time of year we have another 150 youth and interns and seasonals and other folks who work in the park.

So it's a major operation.

Your first two words were just what I wrote down when you asked me the question. The balancing act of the National Park Service is protection of our resources while providing for the visitors, and we happen to have more of them than any other of the National Parks.

Our toilets are flushed more than anybody else's. Our trails are stepped on more than anybody else's and add to that the level of rainfall and the diversity in the park. It is a difficult task.

About 90 percent, our goal is to keep reducing that, but about 90 percent of our dollars are fixed costs, meaning they go to pay for personnel that we have on staff and utility systems, phones, electricity, all those types of things. Now we've been spending some time in the last few weeks adjusting our budget because we've already spent over \$200,000 more this year than last year for fuel.

The \$200,000 is a considerable impact. When you think that we're spending \$250,000 a year on the ATBI. That's an impact on our budget.

We do look at the resources as a primary issue when we're sitting down and talking about our needs. I think if you'd asked the representatives here from the Friends and the Association, which by the way adds significantly to our budget flexibility, one of the things we consider is the level of excellence in the park. Such as helping to do air quality studies, to do water quality studies, to help with bear management because those things may not get done if we're not successful in finding a source outside of our base. We often find a partner or supplemental source in order to get many of those types of things accomplished.

So we look at the resource issues in the park. What are the priorities as far as we are involved, with our cultural resources. In addition to these are our asset inventory. For example, we have the largest collection of log cabins of any National Park in the country.

We're looking at all the science in the park. But in that science program we're also competing for funding when we're looking at inventory. We're competing for funding for hours to invade in the fight to save the hemlocks in the park.

The hemlock woolly adelgid, the invasive species, is devastating the forests. We are preserving it or treating, I shouldn't say we're preserving because treatment doesn't mean that we're going to guarantee they'll be preserved forever. But we're treating about 70,000 trees in the park on over 1200 acres. There's over 70,000 acres of the Smokies that have some level of hemlock on them.

So I guess I could go on. There's just a number of competing priorities. We're trying to accomplish, even by saying we're going to preserve a certain percentage of the hemlocks was a decision that we can only go so far in preserving those.

Our Friends group actually encouraged us to go farther. This year they found a donor that added to that number. So we could increase those acres.

But we look at that across the board. We also have to realize, as we do every year, that there are nine million visitors coming into the park, and we want to make sure there's an adequate number of rangers out on the road dealing with visitor's safety and protection, responding to their needs as well. So there are a number of No. 1 priorities.

Senator BURR. Dale, I'm going to publicly thank you and your staff for what I think is a fabulous job at the Great Smokies. For a park that is challenged, not just in geography, but in visitors. You scared me a little bit because I knew Kevin, when you couldn't have.

[Laughter.]

Senator BURR [continuing]. Let's just say he's come a long way.

[Laughter.]

Mr. DITMANSON. We're working on him, sir.

[Laughter.]

Senator BURR. Peter, I'd like to answer a question you asked earlier with the caveat that this is my response, this is not a reflection of the subcommittee, the committee or either party. But it's my observations in conversations that I've had with the Secretary and with many of the national friends and supporters of the Park. I would also like to see that some bit of the challenge continue.

I think given the current challenges we have in Washington—I assured the Secretary that I would like to see the 10-year authorization of the program and the intent was that that was funding with \$100 million, so a total of a billion dollars over 10 years of which would be matched with grant money. I believe in today's fiscal challenges in Washington that the only way for such an authorization bill to pass is if we leave it up in the annual appropriations process to take place versus a mandatory 10-year program and then not be able to spend it.

Let's just say that the Secretary and I are not on the same page. The reality was that last year the program was funded \$25 million for 1 year program. This year the likelihood is we will not have an appropriations bill that passes before the end of our fiscal year. That continuing resolution may or may not have extensions of programs that are not authorized for the next fiscal year. Nobody probably knows yet.

I still think it's in the best, long term interest of our parks that we get a 10-year authorization. That we let the testimony of people like you and the success of parks like the Great Smokies be the ammunition that we need annually to go to the appropriations process and educate our colleagues on why this is a priority. I think the U.S. Congress should wake up and look at any program that has a private sector match of 50 percent and say if somebody cried to me when they're still in one against or whether it's the Friends of the National Parks believes in it enough to put up 50 percent of the money. We ought to wake up and pay attention to that and figure out how to leverage it in a way that is in the best interest of that treasure.

So I'm not sure that we're going to be there in the short term on an amendment toward program. I'm not sure that more mandatory programs are in fact healthy for the country. But I think, given what we've got to work with and the experiences that we have, this recipe is a very sellable recipe on an annual basis. I think if the architecture is there that assures us for the next 10 years that there is a national goal to establish and merger that partnership, I believe it is time for us to step up on Americans and do our part to bring the private sector to the table like they have.

So again, one person's observation from the standpoint of a very challenging atmosphere in Washington where Dale is not the only one that has to balance, to some degree, within the interagency itself. We balance between current maintenance and future maintenance and poise. I think we all agree that we can't sacrifice future plans because of the level of disrepair and the cost is incredibly high if in fact that we let it get to that point. So our attempt is to try to do everything we can to preserve that treasure—

I do want to give each one of you one minute to make any additional comments that you might want to make. There might have been a question you anticipated and didn't get it. You'd like to answer a question that was I had first for the official record.

I do want to state that I didn't, like my colleagues, Senator Corker, Senator Alexander, Senator Dole as well as my good friend in the House, Heath Shuler, all had scheduling conflicts that couldn't permit them to be here. I do want to note that Dale or Peter,

whichever is appropriate one, did we discover a bug that we named after Lamar Alexander?

[Laughter.]

Mr. WHITE. Yes, indeed. One of our researchers from the University of Tennessee found a wonderful little bug that is colored with patches of orange similar to the checkered shirt of Lamar Alexander wore as he walked across the State campaigning. Its scientific name ends in *lamaralexanderi*.

[Laughter.]

Mr. WHITE. We presented him with a picture, the researcher, Ernie Bernard from the University of Tennessee presented him with a picture and a plaque noting that.

Senator BURR. I will figure out the appropriate official capacity to break that news to his colleagues.

[Laughter.]

Senator BURR. Lamar Alexander really is the name for a bug.

[Laughter.]

Senator BURR. My version will be better than yours.

[Laughter.]

Senator BURR. They all thought I came for your comments.

Mr. DITMANSON. Yes, I'll try to match your minute request. First let me mention, I appreciate your comments on the Centennial Challenge that there are individuals and groups out there that want to do the right thing for the National Parks. As we approach the 75th anniversary of the Great Smoky Mountains next year a foundation in Knoxville has stepped forward with a \$2 million challenge grant to protect the trails in the park in perpetuity.

We are working through our internal process to approve the fund raising elements of that. Once done, the Friends will embark, on matching the \$2 million so that we will have a \$4 million endowment and if we're up to 5 percent interest that means we'll have about \$200,000 a year to hire an additional trail crew because maintaining 800 miles of trail in our climate is a difficult task and to keep doing that in the future.

So that's just one example of what you said of a group that's out there ready to step forward and recognize the needs of protecting this park.

My summary comment would be that everything we talked about today is tied to the two things that we're focusing on for the 75th anniversary of the Smokies. The first is a celebration of our heritage because as someone mentioned today this park was created because the citizens of North Carolina and Tennessee said it was a wonderful place and we ought to protect it. So we're celebrating that heritage by working with our communities around the park. We have over 100 events, heritage days and arts and crafts and other things that will happen outside the park in our communities in North Carolina and Tennessee to celebrate the park's history.

But the other piece of what today was about, is if you asked me what the biggest success of ATBI is, it's stewardship. If we are not good stewards across the board of our National Parks in taking care of it than I have failed in my responsibility to manage this park unimpaired for future generations.

But we just saw today that the reason that we are successful is all the partnerships that come to the table to make that happen. Thank you.

Senator BURR. Dale, thank you.

Glen.

Mr. BOGART. Senator, thank you for providing this forum for this discussion on the ATBI. I hope that you will continue to ask the question about the passport program because I believe that contains a base of information and experiences that will enrich and expand the knowledge of this country and its future leadership. It is so imperative that we prepare young people to be future leaders and to prepare them in a way that is based upon their experiences, their knowledge and certainly the research efforts and successes that come from the ATBI and our wonderful relationship with the park.

I think we are an example of how two agencies can work together meaningfully to improve the quality of life for our students. In doing so I think we improve the quality of life in the community and we expand that throughout the country. I thank you for your leadership efforts.

Senator BURR. Thank you, Glen.

Peter.

Mr. WHITE. Thank you very much for the opportunity to share this project with the U.S. Senate. Right here in North Carolina and Tennessee we've seen the origination of something that is really neat and wonderful. Starting with discussions in 1997, but our first field season was around 2000.

We've really developed something that is truly interesting, inspirational, different, it's captured public imagination, it's been in Scientific American and Newsweek and Smithsonian and Southern Living. It's really a project that at the very beginning we had no idea we'd be here in front of the U.S. Senate today. You see in front of you the four people that represent different parts of this sordid project and that we're all together and on the same page and in talking about the value that was created back then starting with that discussion in December 1997.

It's been a treat to be part of it. I thank you for the opportunity to describe it.

Senator BURR. Thank you, Peter.

Tim.

Mr. WATKINS. Likewise Senator, I'd like to thank you for having me and the rest of us here to participate in this whole process. I'll echo Glen's emphasis on the boundary of the parks for education and the need for not only cultivate future leaders who care deeply about biodiversity and know about biotechnology and also cultivating the next generation of scientists. I personally have always felt that it's right and appropriate that the National Parks are often described as America's greatest idea.

It wasn't just the greatest idea 100 years ago, just the greatest idea because of the spectacular amount invested in work on our famous geysers. But the greatest idea, in large part, due to the ongoing programs like this. I think we're in an era right now where young people, especially need to feel inspired about biodiversity

and the environment around them and about stewardship, other communities as well as steward in the plan.

ATBI's and the way the program is centered on biodiversity, I think give the parks, all of the parks an opportunity to play a very, very central, pivotal role in inspiring the next generation of stewards and scientists. So thank you again.

Senator BURR. Tim, thank you. Again I'd like to thank the entire panel. I'd like to thank those that did have enough interest to come out and spend, well two hours in this community today and this wonderful facility at the University of North Carolina at Asheville.

I know the Chancellor was with this earlier and I forgot and I'm remiss that I didn't recognize her. I'm sorry for that because this is a wonderful institution and we're proud of the work that they do here. I would like to thank the subcommittee staff that is with us from Washington today, our court reporter is gracious enough to be here with us this morning.

The hearing record will remain open for two additional weeks in the event that anyone has a statement to submit. I think this has been extremely helpful. I will assure all of our witnesses that we'll have an official document produced on this. We will do everything we can to coerce our colleagues to read it.

[Laughter.]

Senator BURR. In the event that we can't I will assure you that Lamar Alexander and I will make every attempt to make sure that our colleagues understand the importance of this inventory. More importantly, that they understand just how successful it's been to this point. Though I don't think any of us can look to the future and say here, what is the benefit from this particular climate? We know that this challenge has helped us in many ways in education and the likelihood is there that something that Peter will find that really does unlock the key to something unique that we never would have known had we not gone through this.

So, again, I thank all of you for your willingness to be with us today. This hearing is adjourned.

[Whereupon, at 11:27 a.m. the hearing was adjourned.]

APPENDIX

RESPONSES TO ADDITIONAL QUESTIONS

RESPONSES OF PETER WHITE TO QUESTIONS FROM SENATOR BURR

Question 1. How much has been learned and at what cost?

Answer. We were pioneers and have proved that an All Taxa Biodiversity Inventories can be designed and organized and that it will gain support and attention. We have validated the concept and created a successful and widely emulated model. We have embedded biodiversity inventory in a ecological, conservation, and educational context. We have established an inspirational and influential reference point for other parks interested in biodiversity studies.

We measure our accomplishments by 877 species new to science, 5,251 species previously unknown from the Park, 250,000 data records, 10,000 images of species, a web site with over 2 million hits, and 100s of participants that include scientists, conservation managers, educators, students of all ages, and artists. We have inspired the public with our enthusiasm for the living world and underscored the important of Great Smoky Mountains National Park and the National Park Service for caretaking the nation's biological diversity. We have learned that basic support through Great Smoky Mountains National Park (at first primarily from the Friends of the Smokies and the Great Smoky Mountains Association, and later through the NPS budget) has been multiplied at least four-fold by leveraged, in-kind, and external grant support.

We have shown that there is much to discover and much that is unknown about biological diversity. The five groups of vertebrates and higher plants were thought to be well known before we started, but we have made discoveries even in these groups and we have created a template for increasing the understanding and usefulness of information about even the groups that are better known from a taxonomic point of view. We have greatly expanded our knowledge of other, less known, groups of organisms.

Question 2. What is left to be done and what is the estimated time and cost to complete the inventory?

Answer. In the next few years we must capitalize on the development and evolution of our project over the last eight field seasons. Although the intensive inventory of the ATBI will wind down, our work will transform to modeling, monitoring, management, and education. In that sense, the importance of biodiversity inventory to Great Smoky Mountains National Park and the National Park Service will continue as central missions of these agencies in perpetuity, as in fact expressed in the legislation that established them. In addition, there will always be new generations to educate and to train and new citizens to affirm the importance of the national parks.

It is always hard to answer the question: when will the inventory be complete? As Phil Francis, then Assistant Superintendent of the Park and now Superintendent of the Blue Ridge Parkway, once remarked: How many species are there in the Smokies? It reminds me of the question we used to get at Mammoth Cave National Park: How many miles of unexplored cave are there? This is further complicated by the fact that cave mileage presumably remains constant, but the number of species will shift through time with environmental change and the invasion of new pest organisms from abroad.

Science and sampling design help us address this issue through what is called the "collector's curve". The collector's curve describes the phenomenon that it is relatively easy to find and list the common species, but as we hunt for the last and rarest species we have to invest more and more time. Thus, a biodiversity inventory proceeds up the collector's curve as far as time and budget allow. Ultimately, we use statistical tools to estimate the total numbers of species. To be able to use those statistical tools, though, we need to have explored all habitats in a series of seasons and years with standardized methods of observation. One of the shifts we have

made over the last several years is to focus on the structured sampling aspect of our inventory in which we are sampling standardized plots and processing backlogs of specimens from previous collections on those plots. In addition, there are a few understudied groups that we must find a way to add to our inventory. We must also document all of our methods and produce products that will be useful as the ATBI Alliance moves forward on a national scale.

Question 3. How has the data been used and are there other ways to use it?

Answer. Information developed by the ATBI has been used and has the potential for additional use by Park managers, environmental educators, society at large, and the scientific community, including contributions made to national and international data bases of DNA sequences.

The value to Park managers resides first in the principle that good decisions are based on scientific evidence. The project is helping us understand which species are rare and potentially threatened and which are not. The project is helping us detect new species invasions and the response of natural ecosystems to the damage caused by new pests and diseases. During the inventory, for example, the Chinese jumping worm was discovered in the Park. This is a worm that causes severe damage to soils by consumption of the upper organic layers of the soil that help recycle nutrients and retain moisture. The worm was likely released inadvertently by fishermen who had purchased the worms from bait shops. This species was detected before becoming widespread in the Park; further, this case shows how the National Park Service should work with local businesses to reduce threats to Park biodiversity. In all of its decisions, including land acquisition, fire management, species reintroductions, habitat restoration, and invasive species reductions, the Park needs the best possible information and the ATBI is helping to supply that information.

As we are able to transition from inventory to monitoring we note that the inventories undertaken are comprehensive, done in the same geographical study area, and contemporaneous. No current or future threats/changes will occur in a vacuum, so doing these inventories within a few years makes them more valuable than the same inventories done sporadically over a longer time period.

I believe that Glenn Bogart will speak more about the educational use of the project. Let me just comment that this project is helping to inspire children with natural history discovery and teaching about the living world that surrounds us. The project is also supporting and stimulating higher education in taxonomy and biodiversity studies, thus maintaining skills in society that are needed for the future.

Society at large will benefit through the conservation of biological diversity and education about the mission of the National Park Service, but there can be other benefits, as well. We are studying the diseases and parasites carried by species in the Park. This knowledge may one day be helpful in understanding the occurrence of new human diseases or the appearance of pests and diseases that can affect timber resources, crops, fish, wildlife, and livestock beyond Park borders.

The scientific community will benefit because taxonomic studies are cumulative—that is, the specimens collected in the Smokies, data bases, and the DNA sequence data bases will form a library of information that will be used by biodiversity inventories elsewhere as research seek to build a better understanding of the tree of life. The scientific community also benefits because the work is done in the same locations—thus building understanding across taxonomic groups and helping to put the work in an ecological context. We also seek to better understand the co-occurrences, interactions, and dependencies among species, thereby building an understanding of the web of interactions among species, and thus be better able to predict how biodiversity and ecosystem function are connected and how the populations of larger animals and plants are influenced by more obscure but functionally important species like bacteria, soil fungi, and insects. We have shown the importance and excitement of scientific discovery and the importance of natural history museums, universities, and national parks in the development of scientific understanding.

Question 4. What changes if any should be made in the program?

Answer. We are the pioneers of large scale, all taxa inventory and had to organize, write plans, develop structures, identify project needs, and coordinate the research of many individuals. We have therefore learned lessons to share with future projects. We have learned the importance of standardized data bases and the need to work with researchers to make sure data is efficiently captured. We have learned the interest of the scientific community and that facilitating work through small start-up grants and assistance with logistics, and especially assisting with housing and the processing and sort of collections and data in lab space, will result in a great return in leveraged and in-kind support so that dollars invested will be multiplied many times.

We have learned the importance of documenting methods, so that these can be repeated. We have learned the importance of trade-offs between intensive sampling at particular locations and less intensive but more extensive surveys across a full range of conditions that control the distribution of species. We have learned the need for both traditional and structured methods of observation and collecting. We are now in a phase of the project when we are making a transition to an emphasis, at least with our internal funding, on the structured sampling aspects of the work. We have learned the public appeal of intensive short-duration bioblitzes, while at the same time learning that these are ideally integrated with a long-term sustained effort. The structured sampling, capture of data, and archived methods will also allow the transition from intensive inventory to monitoring. As the work proceeds to additional sites, it will be important to develop economies of scale so that different projects aren't competing for, but coordinating the work of taxonomic experts, museums, and universities. Central coordination will facilitate a project that will be more than the sum of its parts. An important aspect of taxonomic information is, in fact, that its value lies in its accumulation across sites and time.

Question 5. Should the program be expanded to more National Parks?

Answer. We believe that the most important next step in ATBIs is to expand to a series of National Parks and other conservation areas, in order to better cover the biological diversity of the United States and to create more centers of learning and environmental education. We feel this is so central to the National Park Service mission, that the popularity and success of our project will be duplicated elsewhere. In fact, as I write these words we are pleased that the National Park Service Centennial Challenge has established ATBIs in additional parks. Nine new parks were included as Centennial Challenge projects this year. Some 70-80 parks have expressed interest in participating and engaging in taxonomic inventories at some level. Representatives from a variety of parks and other conservation areas have joined our annual meetings in the Smokies and contributed to discussions of the organization of a national ATBI Alliance. We are thrilled that our idea has generated interest and "caught fire" so widely. The expansion and creation of the ATBI Alliance will require us to coordinate data bases, funding sources, and the work of taxonomic experts at natural history museums and universities across the country.

We feel the National Park Service is positioned to lead and catalyze this expansion. The National Park Service is a premier guardian of America's biodiversity and natural ecosystems. National discussions and coordination are, in fact, essential to creating a project that has value that is more than the sum of the work in individual parks.

Discover Life in America has helped facilitate discussions of organization for the ATBI Alliance. Our name "Discover Life in America" was chosen to reflect our interest in biological discovery beyond the Smokies. We share with you the draft mission statement from discussions of the ATBI Alliance: To inventory and document the biodiversity of the United States, for all the branches of the tree of life by intensive, scientific sampling at selected reserves, parks, and other protected areas while infusing our citizenry with a strong awareness of biodiversity and an appreciation of the fragile complexity of our nation's resources.