



NATIONAL TROPICAL BOTANICAL GARDEN

Chartered by Congress to Create a National Resource in Conservation, Research, and Education

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November 5, 2007

To the Honorable Senator Daniel K. Akaka, Chairman, and Senator Richard Burr, Ranking Member, and the Members of the Subcommittee on National Parks of the Senate Committee on Energy and Natural Resources,

**Subject: Written Testimony from Charles "Chipper" Wichman, Jr.,
Director and CEO of the National Tropical Botanical Garden, regarding
S. 2220: A bill to amend the Outdoor Recreation Act of 1963 to authorize
certain appropriations**

Mr. Chairman, my name is Chipper Wichman, and I am the Chief Executive Officer and Director of the Congressionally chartered National Tropical Botanical Garden (NTBG). I testify before you in strong support of Senate Bill 2220: A bill to Amend the Outdoor Recreation Act of 1963 to Authorize Certain Appropriations.

The need for this legislation is enormous as the NTBG is today facing a greater and greater need to conserve vanishing tropical flora for the people of the United States and to fulfill the mandate from the United States Congress to NTBG to operate beneficial facilities that "contribute to the education, instruction, and recreation of the people of the United States."

The time is urgent and the stakes are high. Over 30 percent of the world's tropical plants are currently facing extinction – in many cases before they are even documented and classified. The NTBG is working closely with many state and federal agencies, as well as other non-governmental organizations, to stem this tide of extinction, but the magnitude of the work before us is daunting and more resources are needed.

By amending Public Law 88-29 (commonly known as the 'Outdoor Recreation Act of 1963') to authorize appropriations "to match donations made to the National Tropical Botanical Garden by State and local governments and private

persons” you are leveraging our federal tax dollars and directing them toward supporting a Congressionally chartered organization that is addressing these critical national needs.

The following testimony seeks to familiarize you with the work of the National Tropical Botanical Garden and to underscore the importance of S. 2220 as a vehicle to assist with our Congressionally mandated work.

Executive Summary

The move to seek a Congressional Charter for what would become the National Tropical Botanical Garden was started by leading botanists and concerned conservationists committed to the notion that there should be a botanical garden in Hawai‘i dedicated to fostering horticultural research, education, and plant preservation for the benefit of the people of all the United States. In 1964, under the leadership of Hawai‘i’s Congressional Members Senator Daniel K. Inouye and Senator Hiram Fong and the late Representative Spark M. Matsunaga, the United States Congress confirmed this need and chartered the **Pacific Tropical Botanical Garden** (“PTBG”) (36 U.S.C. §15354601 et. seq).

However, the 1964 Congressional Charter provided PTBG no federal funding, and it was not until 1970 that funds were raised from private sources for the initial land acquisition and the first garden was started in a sugar cane field in the Lāwa‘i Valley on the south shore of the island of Kaua‘i, Hawai‘i.

The purposes of the Pacific Tropical Botanical Garden were set forth in the 1964 Congressional Charter, as quoted below:

- “To establish, develop, operate and maintain an educational and scientific center with libraries, herbaria, laboratories and museums which are appropriate and necessary for encouraging and conducting research in basic and applied tropical botany;
- To foster and encourage fundamental research with respect to tropical plant life and to encourage research and study the uses of tropical flora in agriculture, forestry, horticulture, medicine and other sciences;
- To disseminate through publications and other media the knowledge acquired at the gardens relative to basic and applied tropical botany;

- To collect and cultivate tropical flora of every nature and origin and to preserve for the people of the United States species of tropical plant life threatened with extinction.
- To provide a beneficial facility which will contribute to the education, instruction, and recreation of the people of the United States.”

In 1988, twenty-four years after the granting of our Congressional Charter, the organization’s name was changed by an Act of Congress to the **National Tropical Botanical Garden**, a name that gives effect to the agreement to transfer to NTBG title and operation of The Kampong Garden in Miami, Florida, and symbolizes the NTBG’s scientific leadership well beyond Hawai‘i.

The NTBG is the only tropical botanical garden with a Congressional Charter. In the 43 years since its inception, the NTBG has been supported almost exclusively by contributions from generous individuals and foundations. In fact, operating support of nearly \$100 million has been contributed from private sources during this period, and an additional \$50 million in assets, including endowments, trusts, land, buildings, and rare books, currently appear on our balance sheet. We estimate that during this same period of time less than \$5 million in government grants and contracts has been awarded to the NTBG. Per the terms of our Congressional Charter, we file each year with the Senate and with the House a copy of an audit report by an independent auditing firm reporting NTBG’s operations during the prior year.

The National Tropical Botanical Garden currently administers five tropical botanical gardens and three preserves totaling over 1,800 acres of land on three of the major Hawaiian Islands and in the Coconut Grove section of Miami. These include:

McBryde Garden - Situated on the south shore of Kaua‘i, the McBryde Garden, in the picturesque Lāwa‘i Valley, is over 250 acres of garden and preserve. The site of this first garden of the National Tropical Botanical Garden, the Lāwa‘i Valley was chosen for its diversity of climate, soils, and topography. The area affords a kaleidoscope of distinct micro-environments which include cool, hot, wet, dry, lake, cliff, and meadow.

Over the years, the McBryde Garden has become a veritable botanical ark of tropical flora comprised of nearly 4,000 plant species gathered from around the world. It is home to the largest *ex situ* collection of native Hawaiian flora in existence, as well as extensive plantings of palms, flowering

trees, heliconias, orchids, and many other plants that have been collected from the tropical regions of the world. NTBG's Conservation Program is based at this site, and this garden contains a state-of-the-art horticulture and micropropagation facility that was dedicated in 2005.

NTBG's administrative headquarters is located here on a 10-acre campus, overlooking this magnificent garden oasis. Also located on this site are major research and education facilities.

Allerton Garden - Visitors to the National Tropical Botanical Garden on Kaua'i's south shore typically begin their tropical tour at the nearby 80-acre Allerton Garden, located in the Lāwa'i Valley adjacent to McBryde Garden. This historic garden was artistically designed by Robert and John Allerton and is internationally recognized as a masterwork of landscape architecture. Noted for its lush landscape design, gravity-fed fountains and pools, statuary, and other surprise features hidden among tropical foliage, Allerton Garden effectively displays the once-private estate's tropical flora. The Allerton Garden is home to nearly 2,000 tropical plant species as well as one of the largest endangered Green Sea Turtle nesting sites in the main Hawaiian Islands.

Limahuli Garden - Set in a narrow valley framed by soaring cliffs, Limahuli Garden and Preserve evokes the history of Kaua'i, and of the Hawaiian Islands. Located on Kaua'i's wet north shore in Hā'ena, Limahuli Garden and Preserve extends over 1,000 acres in a verdant tropical valley covering three distinct ecological zones. Ongoing programs in watershed protection and studies in plant and animal stream life are conducted at this site. Archaeological evidence substantiates that the Limahuli Valley on Kaua'i was one of Hawai'i's earliest settlements.

In 1997, Limahuli Garden was selected by the American Horticultural Society as the best natural botanical garden in the United States, noting that its research, teaching, and educational programs have demonstrated the best sound environmental practices of water, soil, and rare plant conservation in an overall garden design. In choosing Limahuli Garden, the AHS researched the various programs being conducted by the Garden and specifically noted that Limahuli Garden's use of the *ahupua'a* system as a holistic management tool was one of the many reasons for the award.

In 2007, Limahuli Garden and Preserve received the coveted Koa Award at the Hawai'i Tourism Authority's 16th Annual *Keep It Hawai'i* Awards Program, recognizing our exemplary commitment to helping preserve and perpetuate Hawai'i's host culture.

Kahanu Garden - On the Hāna coast, along the far eastern shores of the Hawaiian island of Maui, lies Kahanu Garden. Its 294 expansive acres encompass plant collections from the Pacific Islands, concentrating on plants of value to the people of Polynesia, Micronesia, and Melanesia.

Fringed by a vast native pandanus forest, Kahanu Garden contains the world's largest and diverse collection of breadfruit cultivars. This collection serves as a germplasm repository for this important South Pacific food crop, housing cultivars from over 20 different Pacific island groups.

Kahanu Garden is also home to the Pi'ilanihale heiau, one of the largest and most culturally significant archaeological structures in Hawai'i. Designated as a National Historic Landmark in 1965, this 15th century structure was painstakingly restored by National Tropical Botanical Garden over a 20-year period. In 1999, the House of Representatives of the State of Hawai'i passed a resolution honoring the NTBG for its restoration and stewardship of this national treasure.

The Kampong - Located on Biscayne Bay in Coconut Grove, Florida, The Kampong garden contains a wide array of flowering trees and tropical fruit cultivars. In the early 1900s, noted plant explorer David Fairchild searched the world for plants of economic and aesthetic value that could be cultivated in the United States. He and his wife Marian (daughter of Alexander Graham Bell) took up residence here amid his extraordinary plant collections, borrowing the Malaysian word *kampong* for this garden home.

Catherine Hauberg Sweeney, who had also traveled extensively in Indonesia and Malaysia, purchased The Kampong from the Fairchilds in the 1960s. She later gifted this then nine-acre property to the National Tropical Botanical Garden to continue the tradition of promoting work in horticulture, of providing a valuable germplasm resource, and of preserving the property for posterity. The Kampong is listed on the National Register of Historic Places.

Science teachers and college biology professors come to The Kampong Garden to learn about tropical plants and conservation, and to develop teaching modules to be implemented in their classrooms, which invigorate science instruction. Key among National Tropical Botanical Garden's educational opportunities is the *Environmental Journalism* course which affords journalists much needed information about tropical ecosystems, providing an understanding of environmental science and tropical ecology to enhance the accuracy and depth of reporting on environmental issues. The

Physicians course focuses physicians on the medicinal qualities of plants. Both these courses are taught at The Kampong.

National Tropical Botanical Garden: A National Resource for Biological Science

Significant aspects of the National Tropical Botanical Garden's research initiatives include the Garden's living collections and the dried, mounted collections in its herbarium. The herbarium was established at the Garden's headquarters in 1971 to serve as a permanent record of the flora of the Hawaiian Islands, and to include specimens from other Pacific Islands and throughout the tropical world. National Tropical Botanical Garden's herbarium currently holds more than 57,000 preserved, dried and pressed plant specimens.

Because of its strategic location in the Central Pacific Ocean, the National Tropical Botanical Garden has made a long-term commitment to conduct biodiversity research and inventory projects throughout the region. NTBG's herbarium is the most actively growing regional herbarium. It represents an important national heritage and international resource focusing on plants of Hawai'i and other Pacific islands, unique floristic areas not typically represented in other America-based herbaria. Many specimens have supplementary ancillary materials (leaf tissue in silica gel for molecular studies, liquid-preserved collections, a seed reference collection), and many are mirrored in National Tropical Botanical Garden's diverse living collections. These specimens are critical to scientific research, education, and ultimately conservation of species. The current herbarium growth rate is addition of over 2,200 new specimens annually. Present and anticipated future growth derives from active biotic surveys and collection programs in Hawai'i and the Pacific regions, as well as staff research and inter-institution exchanges.

This major regional herbarium is the most active in the Pacific, with a broad impact for many regional users and purposes including National Tropical Botanical Garden staff and other Hawai'i residents who depend upon it for numerous uses including: identifying specimens of native, naturalized, cultivated, Hawaiian cultural, and poisonous or toxic plants; gathering ecological and distributional data from specimens; compiling data for federal listing packages; evaluating status of Threatened and Endangered species; and taxonomic, floristic, evolutionary, and biodiversity studies of Pacific Island plants. A broader spectrum of users includes botanists worldwide who borrow specimens or use specimen data in the virtual herbarium.

Thus, National Tropical Botanical Garden's herbarium has a much broader impact than would otherwise be anticipated for a collection of comparable size. If this resource were not well curated and available and accessible to its users, they would not be able to carry out this critical work. The collections hold and preserve a unique, permanent record of Pacific Island biodiversity and are constantly utilized for identification and research by scientists locally, nationally, and internationally. In addition, this collection is regularly utilized for education and community outreach purposes, including teaching of regularly scheduled classes, workshops, and student internships, thus providing training opportunities in tropical botany for students and teachers including women, minorities, and economically disadvantaged groups. This long-term investment in the infrastructure of Pacific plant systematics will provide great scientific benefits by improving our ability to document, study, and ultimately conserve the poorly known Pacific Island floras for future generations.

The National Tropical Botanical Garden's Loy McCandless Marks Botanical Library is the largest and most important botanical/horticultural library collection in Hawai'i, with more than 20,000 books, journals, botanical prints, and archival materials. The main reference library comprises 11,000 titles, over 15,000 physical volumes, 1,200 serials, 2,500 reprints, and close to 3,000 botanical prints. National Tropical Botanical Garden's library is particularly strong in regional floras and Hawaiian and Pacific botany. The recently acquired Marks library of more than 5,000 titles, with an emphasis on tropical and subtropical botany and horticulture, has been combined with NTBG's main library, except for approximately 600 rare books that are stored in another secure, climate-controlled vault (pending completion of the new Botanical Research Center ("BRC")). A small botanical reference library is housed in the herbarium (ca. 45 ft. of bookshelf space). Slide and photographic print collections include roughly 8,000 historical images and 16,000 images of Hawaiian and Pacific Island plants and people. NTBG also owns and cares for 600 world-class rare botanical volumes.

Many national and international collaborators use our library collection. For example, Jim Space, former director (retired) of the USDA Forestry Service Pacific Division including California, Hawai'i, and American territories in the Pacific, spent two weeks at National Tropical Botanical Garden in 2005. Mr. Space, Manager for the Pacific Island Ecosystems at Risk (PIER) project primarily used our library for his work, stating that it was the best in Hawai'i for the type of research he was conducting because of our rich and complete collections of floras, monographs, and botanical journals. Mr. Space has developed the PIER as an online resource (also CD format) for documenting the impact and extent of invasive alien plant species on various Pacific Islands. It contains digital images, descriptions,

distribution and possible control measures for alien species and enables resource managers, agriculturists, foresters, conservationists and others to identify, assess and control invasive species on their islands.

National Tropical Botanical Garden: A National Resource for Conservation

Ninety percent of all biodiversity on the planet exists in the tropics, the warm moist belt that circles the earth, bordered by the Tropic of Cancer on the north and by the Tropic of Capricorn on the south. Within the borders of the United States, Hawai‘i is the only state that falls within the tropics and, because of its high biodiversity, it is also home to more endangered plants and animals than almost all the other states combined. Many of these priceless plant resources are becoming extinct before the scientific community has discovered their relationship to other plant species and animals and the benefits they might yield. Effective conservation relies on public understanding and participation. The National Tropical Botanical Garden is an active partner in the protection, revitalization, and perpetuation of tropical ecosystems.

To serve as a national resource, the National Tropical Botanical Garden has established five tropical botanical sanctuaries which include unique collections of tropical flora made up of some of the most endangered plant species known to science. Because of Hawai‘i’s geographic isolation, the plant species that evolved in Hawai‘i and many other tropical areas over millions of years are highly endemic. In Hawai‘i, nearly 1,300 endemic species have been scientifically designated. Of these, more than 100 today are considered to be extinct, with an additional 273 classified by federal standards as Threatened and Endangered, and 85 as Candidate species. Over the past 30 years, roughly two dozen species in Hawai‘i that were thought to be extinct have been rediscovered by National Tropical Botanical Garden botanists, and about 30 new species that were previously unknown to science have been discovered. Hawai‘i and the greater Pacific region are considered “hotspots of extinction,” and it is here that the National Tropical Botanical Garden is focusing its conservation initiatives.

The National Tropical Botanical Garden is a recognized leader in the conservation of Hawai‘i’s highly endemic and severely threatened tropical plants, as well as of flora and ethnobotanical knowledge of the greater Pacific and other regions, and conservation is at the core of its operations. Its Conservation Program conducts a wide range of activities that support its primary plant conservation strategies, including the conservation of living plants, genetic- and community-level diversity, invaluable collections of herbarium specimens, historic garden properties, and indigenous cultural practices. It is

also involved in restoration ecology, controlling invasive species, watershed management, ecological monitoring, and conservation education programs, and it oversees the world's largest collection of breadfruit, assembled by scientists of the National Tropical Botanical Garden.

Conservation efforts at the National Tropical Botanical Garden began quite simply, with the passage of a resolution at the initial meeting of NTBG's Garden Scientific Advisory Committees in 1976, at which it was formally agreed that preserving and cultivating native Hawaiian plants was of the utmost urgency. Extensive botanical surveys of all of the islands were undertaken, resulting in the discovery of new plant species. The Conservation Program soon expanded beyond Hawai'i, as Garden scientists began participating in research expeditions to islands throughout the Pacific and collaborating with experts from around the globe on conservation challenges.

The determination to locate and collect specimens from the rarest tropical plants led National Tropical Botanical Garden scientists to specialize in rough-terrain botany, which involves rappelling off cliffs to reach otherwise inaccessible niches that hold the few remaining examples of plants like *Brighamia insignis*, which was successfully cultivated for the first time in the Garden in 1977. The plants grew from seeds that had been collected on the steep cliffs of the Na Pali coastline of northern Kaua'i. I was personally involved in these first expeditions to hand-pollinate these unusual plants. The importance of this work is evidenced today by the fact that while only one plant currently exists in the wild, hundreds of these plants are growing at institutions with which NTBG collaborates, including several specimens at the U.S. Botanic Garden in Washington DC. This plant has been saved from extinction by the work of the NTBG.

Success in the arduous and sometimes dangerous work of collecting rare plant material is only the first phase of the Garden's conservation story. The second phase is ensuring their survival by propagating them in the varied growing environments found in the National Tropical Botanical Garden's five gardens and three preserves. Among all the botanical gardens focused on tropical plants, the National Tropical Botanical Garden is recognized as uniquely suited to the creation of living collections for conservation, research, education, and public enjoyment. No other garden organization has the National Tropical Botanical Garden's diversity of landmass and cultivation potential. The National Tropical Botanical Garden has pioneered propagation techniques and established growing protocols for over 45% of the existing Hawaiian flora, including 248 rare and endangered species. Through these efforts, the NTBG has assembled what is believed to be the largest collection of federally listed

endangered plant species anywhere, including the largest collection of native Hawaiian flora in existence.

The Conservation Program at National Tropical Botanical Garden has made saving Hawai'i's endangered and threatened flora its highest priority. Collecting and curating propagules from the rarest Hawaiian plants, including the 118 Genetic Safety Net (currently known as Plant Extinction Prevention Program or PEPP) species that have 50 or fewer individuals remaining in the wild, provides material for the Garden's expanded native plant nurseries. Nursery operations produce large quantities of native plant seedlings for planting in ecological restoration projects in National Tropical Botanical Garden's gardens and preserves, as well as those of collaborating owners with large public or private land tracts suitable for restoration. The goal is to create and enhance habitats dominated by native species, thus closing the loop between the discovery and collection of rare plant propagules and their ultimate recovery in suitable habitats. The National Tropical Botanical Garden also supports recovery efforts throughout the tropics by maintaining extensive living collections of rare and useful plants from many tropical regions.

Land Conservation - Equally significant is the National Tropical Botanical Garden's national land preservation efforts. Since 1970, the National Tropical Botanical Garden has acquired substantial land acreage totaling over 1,800 acres with the intent of preserving these natural and open spaces for future generations. Most recently, in 2006, the National Tropical Botanical Garden secured \$1.5 million through the State of Hawai'i's Legacy Land Conservation Program to purchase an additional 170 acres in Hāna on the island of Maui. This and future land acquisitions by the National Tropical Botanical Garden was and will continue to be conducted in the name of conservation, ensuring the survival of pristine open spaces for future generations.

Cultural Conservation - Our native host culture is one of the most significant treasures in Hawai'i. It is through aural tradition that our kupuna (elders) have passed down their knowledge, history, understanding, spirituality and methods to care for the 'āina (land) and one another. Today, many Hawaiian communities are experiencing a cultural renaissance, with cultural practitioners serving as both a guiding light and linchpin to our past. Hawaiian practitioners perpetuate traditional protocols to the keiki (children), tried and true methods of caring for and protecting our 'āina – our most precious natural resources, strengthening our cultural and spiritual connections with our ancestors, and strengthening the bonds between the people of Hawai'i.

Plants play a critical role in ensuring the survival and perpetuation of indigenous cultures and languages throughout the world. In fact, the loss of plant species is equivalent to the loss of cultures and languages of these people who have experimented and used plants in many creative ways for thousands of years. Like in many indigenous cultures, ancient Hawaiians have become experts in the use of plants for food, construction materials, textiles, medicine, voyaging, ceremonies, and more. This invaluable traditional wisdom can be compared to modern scientific understanding of plant taxonomy and systematics, pharmacology, and medicine, and such could become the basis for new scientific discoveries in today's world particularly in the area of ethnomedicine.

The National Tropical Botanical Garden's culture-based initiatives include lectures by well-known cultural practitioners, educators, ethnobotanists, horticulturalists, and other scientists from varying fields of study. Recent hands-on workshops have enlightened participants on a wide array of cultural knowledge, practices, skills, and art forms including hula, traditional weaving with native plants, traditional methods of plant care, native 'o'opu (Hawaiian goby fish) and stream health, herbal healing, the importance of kalo (taro), lei-making, and landscaping with native plants. It is our aim with these cultural initiatives to perpetuate Hawai'i's host culture by connecting the hands from our island's past to the hands of our island's future.

National Tropical Botanical Garden: A National Resource for Education

Education programs are central to National Tropical Botanical Garden's mission. The first high school and college students arrived for projects and internships while the initial Garden site was still being established in Kaua'i's Lāwa'i Valley. Over the past four decades, the National Tropical Botanical Garden has developed a full spectrum of educational offerings that provide opportunities for individuals from many backgrounds.

National Tropical Botanical Garden's Education Program reaches a wide variety of participants. At the K-12 grade level the *Garden As Classroom* program is provided to any local school that wishes to involve their students in experiential learning. Students from elementary, middle, high, and head start schools participate in the program, in addition to summer school students from Kamehameha Schools and Association for Retarded Citizens (ARC) clients. The *Junior Restoration Team* program builds on the fundamentals established in the *Garden As Classroom* program and takes conservation education to the next level of hands-on participation. The *Tropical Ethnobotany* course provides hands-on experience and course work in ethnobotanical field techniques.

An important aspect of National Tropical Botanical Garden's commitment to education is training future botanists, ethnobotanists, and horticulturists. College- and university-level horticultural interns participate in a 10-12 week work-study program for students intending to pursue careers in horticulture, botany, conservation, and other related fields. The *Horticultural Internship Program* features a combination of classroom and hands-on study, with students spending 10-12 weeks learning in the gardens. Many past graduates of the National Tropical Botanical Garden's horticulture programs now have leadership positions in all of these areas. An ethnobotany course for graduate-level students explores the role of plants in indigenous societies and provides training in practical techniques for ethnobotanical research. Planning is underway to expand this program to accommodate more students.

A revived and expanded job training initiative is the *Apprentice Program*, which focuses on career development at the local level. Apprentices work two days per week as an assistant to one of National Tropical Botanical Garden's highly skilled employees, with the balance of their time spent taking college or technical courses.

The Garden's *Science Teachers' Enrichment Program* enhances teachers' knowledge of tropical biology and equips them with innovative techniques to inspire student interest in science education. Visiting scientists regularly use the Garden's living collections for their various research projects, and well over 100 national and international institutions benefit from the National Tropical Botanical Garden's library exchange program and herbarium exchange and loan program.

National Alliances

Alliances are a key component necessary to advance successfully a field of interest. The administration of the National Tropical Botanical Garden embraces this concept and has made major strides, creating mutually beneficial alliances with federal and state agencies and national organizations with similar focuses and objectives. National alliances include the National Parks Service, National Oceanic and Atmospheric Administration, United States Department of Agriculture, the State of Hawai'i Department of Land and Natural Resources, the Smithsonian Institution, The Nature Conservancy, United States Botanic Garden, New York Botanical Garden, Missouri Botanical Garden, Santa Barbara Botanic Garden, Bishop Museum, University of Hawai'i, Florida International University, Cornell University, University of Michigan, University of California-Riverside, and other

notable institutions who regularly collaborate with the National Tropical Botanical Garden on conservation, scientific, and educational initiatives.

The National Tropical Botanical Garden: An Outstanding Science Program

The National Tropical Botanical Garden is committed to world-class, state-of-the-art tropical biodiversity research and conservation, which fundamentally distinguishes the organization from numerous display-oriented gardens and parks in the United States and abroad. National Tropical Botanical Garden's Science Program focuses primarily on tropical plants and habitats of the Pacific Region and is headed by botanist Dr. David H. Lorence, a specialist in tropical plant classification, floristics (the study of plants defining a geographic or political region), and island floras.

In addition to a prominent and dedicated team of researchers, the Science Program possesses specialized facilities at its Kaua'i headquarters, including: a research library containing rare and valuable historic volumes as well as a breadth of modern reference collections; a comprehensive herbarium of preserved, dried and pressed plant specimens collected for discovery and documentation; and research laboratories.

The National Tropical Botanical Garden's scientific reach spans the globe through the development of international alliances including the Royal Botanical Gardens, The Eden Project, University of Zurich-Institute for Systematic Botany, Centre International de Recherches Agronomiques pour le Developpement, Universidad Nacional Autónoma de México, Sonoral Desert Museum, Instituto de Ecología, the French Polynesian Délégation à la Recherche, Sustainable Harvest International, Secretariat of the Pacific Community, Tropical Agriculture Research and Higher Education Centre, Technical Centre for Agriculture and Rural Cooperation, and other notable organizations and institutions. The National Tropical Botanical Garden, through a program of having scientists from other organizations serve for a period at NTBG as a McBryde Chair appointee, develops scientific alliances with the aim of advancing science on both national and international stages. These alliances allow for and promote international, intellectual interchange and collaboration.

The core goals of National Tropical Botanical Garden's Science Program are to:

- Conduct field research, including discovering new species, documenting and conserving ecosystems, endangered species and cultural knowledge, and addressing invasive species and restoration ecology issues;

- Develop and maintain botanical research collections and printed and digital resource materials;
- Examine, document, propagate, and disseminate collected materials and data for conservation and education purposes;
- Investigate the relationships between plants and cultures;
- Create partnerships with other national and international scientific institutions, as well as fund science fellowships and post-doctoral positions;
- Publish *Allertonia*, an informative periodic, peer-reviewed scientific publication. The Garden's Publications Program includes *Allertonia* as well as *The Bulletin* and various books focusing on tropical botany. These publications reach a large national and international audience through exchange programs and subscriptions.

Science Programs and Projects with International Impact

Botanical research at National Tropical Botanical Garden focuses on systematic, biogeographic, and ethnobotanical studies of tropical plants, especially those of the Pacific Basin region. Over the years, many of the Garden's specimen collectors have created one of the best research collections on the plants of Kaua'i and the Hawaiian Islands.

Flora of the Marquesas Islands

The Flora of the Marquesas Islands project is a collaborative effort between the National Tropical Botanical Garden, the Smithsonian Institution, and the French Polynesian D el egation   la Recherche. The Marquesas are critical to understanding Pacific Island biogeography, but have until now been poorly explored. Currently the Marquesan vascular flora, including ferns, fern allies, and flowering plants, is estimated to comprise 360 species, of which 45 percent are endemic, or found nowhere else in the world. This project's collecting expeditions have yielded over 11,000 herbarium specimens to date, comprising 714 vascular plant species and 61 species new to science since the project's inception in 1988. Most of these new species represent the endangered and critically endangered flora of the Marquesas. National Tropical Botanical Garden scientists always collaborate with the French Polynesian Government's Delegation for the Environment and provide essential field data critical for establishing protected areas for conserving endangered species and habitats. Additional products of

this program are an Internet-based flora hosted by the Smithsonian Institution that provides access to a searchable database of specimens, plant images, checklists, island distributions, and literature. In addition, a two-volume illustrated flora is slated to be published.

The Micronesian Flora Project

The National Tropical Botanical Garden and New York Botanical Garden have been collaborating since 1998 on botanical surveys of the Micronesian volcanic high islands of Pohnpei, Kosrae, and Belau. Because of their greater size and elevation, the high islands harbor the greatest habitat diversity and highest species richness of any in the region. Due to the islands' steep and rugged mountainous terrain, the islands have not been thoroughly explored or surveyed biologically. Additional botanical exploration of these areas will certainly yield new species and records. Habitat modification to grow crops has resulted in the destruction of much lowland native vegetation and threatens the vegetation even at higher elevations. Previous botanical collecting expeditions to Micronesia have already been conducted by NTBG staff members Lorence, Ragone, and Flynn and collaborators in 1996, 1997, 2005, 2006, and 2007. The primary purpose of these expeditions has been to: 1) conduct extensive field work in botanically poorly explored or unexplored areas; and 2) collect herbarium specimens to document permanently the islands' vascular flora (ferns and fern allies, gymnosperms, and flowering plants). The first phase of this project proposes to produce an annotated checklist of the Pohnpean vascular plants (flowering plants and ferns) in published book and online electronic formats. Together these products will provide a solid foundation for understanding, managing, and conserving the fragile flora and botanical resources of this Micronesian island. The botanical surveys and inventories conducted will greatly expand our baseline knowledge of species-level biodiversity of the Micronesian high islands, which are the most species diverse in the region.

Hawaiian and Pacific Island Rubiaceae Living Collections

The primarily tropical Rubiaceae contains approximately 637 genera and 11,000 species – many poorly known or understudied. The best known member of the family is coffee, the family's most important commercial crop. Others include *Cinchona*, whose bark is the source of quinine and other anti-malarial compounds that have saved millions of lives; and *Psychotria ipecacuanha*, whose roots yield ipecac syrup, used medicinally as an expectorant in cough syrups and as an emetic in cases of poisoning. Noni, from Hawai'i and other Pacific islands, is widely used as a medicinal plant. Through field collecting and exchange with other national and international botanical gardens, an important

research and conservation collection of Rubiaceae has been established at the National Tropical Botanical Garden. More than 400 accessions have been assembled, including numerous species from Pacific Islands, as well as rare or endangered Hawaiian species. A well-designed living collection of Rubiaceae at a botanical garden can have a multiplicity of uses for research, conservation, education, and display.

Conservation. Botanical gardens can serve as a genetic repository for rare and endangered species. This requires scrupulous documentation of origin and appropriate genetic sampling of representative populations and numbers of individuals. For example, the Garden's collection of *Gardenia brighamii* comprises part of the Center for Plant Conservation's National Collection of endangered species.

Education. An important role of botanical gardens is to educate the public through interpretation and display. Interpretive plantings and displays can be designed to teach about the importance of the Rubiaceae, especially tropical species having economic importance (coffee, natural dyes); medicinal uses (quinine, ipecac, *Morinda*); horticulture and landscape uses (*Gardenia*, *Ixora*, *Mussaenda*); basic phylogeny and relationships of the family; evolutionary adaptations in growth habit, floral biology and pollination, and fruit dispersal.

Horticultural display. Attractive or unusual Rubiaceae can be used for landscaping purposes in the public garden. Botanical gardens can introduce unusual and new plants into the horticultural trade, e.g. *Mussaenda raiateensis*.

Research collections. Living collections supply an important and readily available source of plant materials for systematics research studies including:

- Cytology: chromosome counts from seeds, root tips, flower buds
- Palynology: pollen from flower buds
- Anatomy and morphology from wood, vegetative and floral tissues
- Molecular studies including DNA and RNA analysis from fresh or dried leaves
- Phenological observations (flowering and fruiting behavior)
- Breeding and hybridization experiments

The National Tropical Botanical Garden fulfills dozens of requests for research materials by national and international institutions each year. In many cases, the National Tropical Botanical Garden is the only botanical garden in the United States with these tropical plants in cultivation.

Rubiaceae Research

Dr. Lorence's taxonomic specialty is the large and floristically important Rubiaceae family. He has studied and named numerous new species from Mexico, Central America, Hawai'i, and the Pacific Islands and collaborated nationally and internationally with many institutions and projects. He provides an important service to the world scientific community by identifying specimens from diverse tropical regions and has built up an important herbarium reference collection numbering over 9,000 specimens of Rubiaceae at the National Tropical Botanical Garden. He has studied and named numerous new species from Mexico and Central America and collaborated nationally and internationally with many institutions. Rubiaceae research at the National Tropical Botanical Garden includes:

- Systematic studies (classification/taxonomy) and evolutionary studies of genera such as *Psychotria*, *Hedyotis* in Hawai'i and the Pacific;
- Floristics (studies of plants of a given geographical or political regions) including Hawai'i and other Pacific islands including the *Vascular Flora of the Marquesas Islands* project;
- Studies of Neotropical Rubiaceae for the *Flora Mesoamericana* project (encompassing S. Mexico and Central America) in collaboration with the Missouri Botanical Garden and Universidad Nacional Autónoma de México (UNAM);
- Diverse projects including *Flora de Oaxaca* (with UNAM), *Flora de Veracruz* and *Flora del Bajío* (with Instituto de Ecología, Mexico), and *Flora of the Sonoran Desert* (with Sonoral Desert Museum).

Pacific Island Ethnobotany

Ethnobotany is the study of how particular cultures use indigenous plants. Many native peoples have extensive and intimate knowledge of the habitats, habits, and properties of the plants where they live.

Unfortunately, the traditional knowledge that had once been passed from generation to generation is rapidly disappearing as a result of modernization.

National Tropical Botanical Garden teams conduct ethnobotanical research in the Pacific Islands integral to a number of research initiatives, including potential plant medicines, conservation of traditional cultivars, and breadfruit studies. Traditional knowledge is widely used as a tool for teaching in the Garden's educational courses as well.

Ethnobotanical plants have long been part of the Garden's living collections and research interests and, in 1998, the National Tropical Botanical Garden formed a center for ethnobotany (the study of how indigenous peoples use plants) to reflect an increased emphasis in this area of research. The Garden believes this work to be critical because it seeks to capture how plants can heal – a field with growing urgency because some of the most important medicinal species may have already become extinct, while others are threatened and traditional knowledge is rapidly disappearing. Ethnobotanical fieldwork is augmented by laboratory studies using state-of-the-art technology to determine a plant's molecular composition and medicinal properties. This research has yielded potential new anti-HIV medication and provided clues to the genesis of ALS and Parkinson's disease.

Breadfruit Institute

The study of breadfruit has been an essential component of the National Tropical Botanical Garden's conservation platform for over two decades. Breadfruit has been an important and highly nutritious staple food crop in the Pacific for more than 3,000 years. Although it now is found in nearly 90 countries worldwide, it has been underutilized because of the limited distribution of varieties and the difficulty of importing viable plant material into other countries.

The world's largest and most diverse collection of breadfruit species and varieties was assembled by NTBG researchers and is being maintained at Kahanu Garden: 120 varieties from 18 Pacific nations, the Seychelles, the Philippines, and Indonesia. Breadfruit diversity is declining throughout the tropics because of damage from storms, drought, and loss of cultural knowledge. National Tropical Botanical Garden's unique breadfruit collection is an important global resource, intimately connected with assisting to feed the people of the Pacific, Africa, the Caribbean, etc.

National Tropical Botanical Garden's Breadfruit Institute is investigating the potential of tissue culturing breadfruit to address malnutrition and hunger in a number of tropical countries. The

Breadfruit Institute is dedicated to promoting the conservation and use of breadfruit for food and reforestation, and is striving to mass propagate superior varieties using in vitro techniques so that thousands of breadfruit plants can be distributed to tropical nations as a long-term source of food for growing populations threatened with starvation and malnutrition.

A major accomplishment of the NTBG's Breadfruit Institute was the First International Symposium on Breadfruit Research and Development held in Fiji in April 2007. The Symposium was organized by the NTBG and the Secretariat of the Pacific Community-Land Resources Division, in collaboration with international partners: the Technical Centre for Agriculture and Rural Cooperation, German Technical Cooperation, International Centre for Underutilized Crops, Global Facilitation Unit for Under-Utilized Species, and the Global Crop Diversity Trust. Participants included researchers from national, regional, and international organizations, universities, government ministries, NGOs, and the private sector. A major outcome of this symposium was the creation of an international network of breadfruit researchers who will work collaboratively to promote the conservation and sustainable use of breadfruit in the tropics.

Internationally, hunger is one of the most pressing crises of our era. Through scientific research and earnest compassion, the Breadfruit Institute of the National Tropical Botanical Garden has committed its resources to developing sustainable breadfruit farms within hunger-stricken countries around the world. For thousands of years, breadfruit agroforests have supplied Pacific Islanders with an abundance of food and useful products and protected mountain slopes from erosion. Through scientific research, cultivar production, education initiatives, and international alliances, Breadfruit Institute Director Diane Ragone Ph.D. is on a mission to eradicate hunger.

The National Tropical Botanical Garden's New Botanical Research Center

Over the past 15 years the NTBG has progressively outgrown its existing research and education facilities. To address the problem the NTBG has embarked on the construction of a world-class Botanical Research Center building at its administrative headquarters. For the first time in its 40-year history, the Garden's significant botanical, research and rare book libraries, and its unique and ever-growing herbarium collections, will be brought together under one roof, along with research labs and offices and dedicated space for use of students and visiting researchers.

The combination and synergy of having these collections and facilities in a single climate-controlled “clean” building that will allow complete interchange and use of the resources contained within it will create unprecedented opportunities for botanical research and education. This facility will serve not only the national and international research communities, but it will also become a significant resource for our local community. Through NTBG’s education and outreach programs, students will have an opportunity to learn first hand about tropical botany, horticulture, and ethnobotany as well as the importance of traditional ecological knowledge and natural and cultural resource management. The BRC will thus provide the local community with an unprecedented resource that will help engage and train future generations of stewards of our nation’s tropical ecosystems.

The Design - The design for the BRC is high performance and environmentally sensitive. As a statement to our institutional commitment to conservation and our environment, the BRC project has been registered with the U.S. Green Building Council’s LEED (Leadership in Energy and Environmental Design) Program and a Silver LEED Certification is being pursued as part of its sustainable design.

Due to the invaluable collections contained within the building, it is being designed as a hurricane-proof structure with 50 years of planned growth. The two-story reinforced concrete building will include nearly 20,000 square feet of interior and exterior spaces. Mechanical and electrical systems will provide multiple back-ups for short- and long-term operation during any emergency. The roof of the building will host an integrated photovoltaic panel that will produce 30 kW (thousand watts) of power. All the rainwater that falls on the building will be transferred to an underground storage system and used to irrigate the collections in the garden below the building. All aspects of the building have been engineered to meet stringent wind-load speeds as well as comply with the standards established by the Green Building Council.

The BRC is the first LEED building being built on Kaua’i and construction firms working on the BRC have retooled their operations to comply with LEED standards. As a result, these firms have discovered and implemented new environmentally conscious construction practices, including innovative ways of recycling waste products resulting in less construction waste in our landfills. We believe that environmentally friendly construction is not only possible, but that it will become the direction that the construction industry will pursue in the near future.

To fund this critically important project the NTBG launched a \$21 million capital campaign that was anchored by a lead gift of \$4.5 million in November 2005. Since then the NTBG has raised \$14 million and has several million in grant applications outstanding. Senate Bill 2220 is intended to provide \$1 million in federal funding in fiscal year 2009 for this transformational project that will advance botanical research both nationally and internationally.

Conclusion

The National Tropical Botanical Garden serves as a national tropical botanical resource, operating and maintaining five tropical botanical gardens and three preserves that contribute to the education, instruction, and recreation of the people of the United States. Its botanical gardens, its /*collections of rare and endangered plant life, its library and herbarium collections, its scientific research, conservation initiatives, and education programs are all contributions made by the National Tropical Botanical Garden, for the education, instruction, and recreation of the people of the United States.

I urge Congress to enact Senate Bill 2220: a bill to amend the Outdoor Recreation Act of 1963. An annual appropriation in the amount of \$1,000,000 for fiscal year 2009 and appropriations no greater than \$500,000 as necessary for fiscal year 2010 and each subsequent fiscal year will further assist the National Tropical Botanical Garden in the fulfillment of our Congressional mandate.

Over the past four decades the NTBG has grown and developed almost exclusively with private funding. This trend will continue. In 2008 our approved operating budget is \$ 9.0 million, of which 95 percent will come from private sources. We expect our 2009 and 2010 budgets to be modest increases over 2008. The federal support that S. 2220 will provide to the NTBG will be thus matched many times over with private funding and represents an appropriate level of federal support to an organization that is fulfilling a congressional mandate.

I thank you for your time and consideration of my testimony.

Sincerely,

A handwritten signature in black ink, appearing to read "Chipper Wichman". The signature is fluid and cursive, with a long horizontal flourish extending to the right.

Chipper Wichman, Director and CEO