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Contact: Mr. Terry Collins, +1-416-538-8712; +1-416-878-8712; [terrycollins@rogers.com](mailto:terrycollins@rogers.com)

*Experts are available for advance interviews.*

*The e-Biosphere 09 conference, at the Queen Elizabeth II Conference Centre, London, takes place June 1-3; for details: [www.e-biosphere09.org](http://www.e-biosphere09.org).*

## ***DNA Barcoding of Mosquito Species Deployed in Bid to End Elephantiasis***

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***Scientists shine light on hideouts of menacing species;  
First use of DNA barcoding in war against a major world disease;  
Major step in efforts to rid world of disfiguring infection threatening 1 billion people***

New biotechnologies that allow scientists to quickly and accurately distinguish species based on a simple DNA analysis are being creatively deployed for the first time in the war against a major global disease.

The Noguchi Memorial Institute for Medical Research at the University of Ghana, supported by the Philadelphia-based JRS Biodiversity Foundation, is pioneering the use of DNA “barcodes” to map menacing mosquito species in West Africa that spread lymphatic filariasis (LF), commonly known as elephantiasis. Using a short DNA sequence from a particular genome region, scientists can obtain a species’ ‘barcode’ identity. Barcodes are needed because closely-related species, with different capabilities to transmit LF, are otherwise hard to distinguish.

The ability to precisely identify mosquito species in this way is a promising advance in the battle against LF, an often disfiguring disease that today threatens 1 billion people across roughly 80 countries. Over 120 million people have the parasitic infection and more than 40 million have been permanently disabled or disfigured.

The research is identifying species spreading the worm larvae that clog the human lymph system, often causing grotesque swelling. By revealing the menace species' habitat and range, it also aids understanding of environmental factors that influence their breeding and abundance.

“The scientific breakthrough of DNA barcoding, which grew explosively from a single Canadian research paper in 2003, is shedding new light on LF – a horrific and entirely preventable health scourge in developing countries,” says principal investigator Prof. Daniel Boakye of the University of Ghana

“Beyond the immediate battle against this disease in West Africa, the value to human health of these important new tools will grow as the range and habitats of specific mosquito species shift due to climate change.”

LF is a leading cause of permanent and long-term disability worldwide and results from a microscopic, thread-like worm spread between humans through a mosquito's bite. Living within a human's blood, the worm larvae grow into adults which mate and produce other larvae, called microfilariae. Symptoms often appear years after infection. The disease can permanently damage the lymph system and kidneys, which results in fluid collecting and swelling in the arms, breasts, legs, and, for men, the genital area. The disease also makes it difficult for the body to fight germs and infections.

Poor sanitation and rapid growth in tropical and subtropical areas has created more places for mosquitoes to breed and thus to more LF infection.

World health authorities have earmarked the disease for eradication by 2020 through mass drug administration (MDA). Officials are identifying communities where LF is endemic and treating people at risk with annual doses of a combination drug therapy (albendazole / DEC or albendazole / ivermectin, freely donated by Merck and Co. and GSK respectively).

The drug reduces the density of worm larvae in humans. This LF elimination strategy relies on a belief that the region's main LF vector, the *Anopheles* mosquito, is incapable of transmitting low-density worm larvae.

But the *Anopheles* family is highly diverse and contains hundreds of species. And the new molecular studies reveal that not all *Anopheles* species are created equal. Some can transmit the disease despite the drugs' thinning of the worm larvae.

The research is pointing out places infested with the menace species and, therefore, where the drug strategy needs to be supplemented with insecticides to successfully eliminate LF.

Prof. Boakye also notes that blanket vector control using insecticides can have serious impact on non-target organisms, leading to biodiversity loss. The additional information and insights into specific mosquito species allows for those species and areas to be targeted, reducing the level of spraying and its effect on other organisms.

“The expertise to create databases is in short supply in Africa; the JRS Biodiversity Foundation is assisting science in very meaningful ways,” he says.

The ground-breaking work of the Ghana-based institute is one of 17 JRS-supported projects to be showcased at the e-Biosphere 09 Conference in London June 1-3, hosted by the [Natural History Museum](#). Co-sponsored by the [Encyclopedia of Life](#) and 12 other leading institutions, the event is an exposition of the latest biology-related informatics tools and technologies, as well as their potential linkages and applications.

JRS Board President James L. Edwards, Executive Director of the Encyclopedia of Life, based at the Smithsonian Institution, Washington, DC, says biodiversity information is often compiled for diverse purposes and stored in unique databases using different formats, making the task of effectively using it cumbersome and time-consuming.

The JRS Biodiversity Foundation works to aggregate, digitize, synthesize and make easily available important biodiversity information from developing countries that is often inaccessible to potential users, including conservation managers, policy makers and the public.

“Earth’s plant and animal species are declining at an alarming rate. An estimated 50,000 species disappear every year, mostly due to human impacts – population growth, industrial development, pollution and climate change,” says Dr. Edwards.

“Efforts to stabilize and reverse this trend are hampered by biodiversity knowledge banks that are incomplete, fragmented and not easily accessible to those who need them to set environmental priorities or create informed policies and decisions. In addition, biodiversity databases often cannot share information with each other due to incompatible formats.”

“Though endowed only in 2004, the JRS Biodiversity Foundation has already established itself as an important partner of developing-country scientists and organizations working in the new, rapidly growing field of biodiversity informatics,” says Dr. Edwards.

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## **Appendix: Other JRS projects in brief**

### AFRICA

#### **Wildlife Conservation Network – Save The Elephants** *Ewaso Tracking Project*

JRS is supporting the Wildlife Conservation Network and its partner Save the Elephants as they use mobile phone technology to tag and track wildlife, integrating the information with landscape features in the Ewaso watershed in northern Kenya.

Harmless electronic collars are deployed on elephants, lions, cheetahs, hyena, zebra and cattle to reveal how different species use the range, promoting understanding of the potential health risks posed by this overlap between wildlife and cattle. Preliminary results reveal key concentration areas and the tenuous corridors connecting them. The data also show how human activities, especially fences, influence wildlife distribution in the system.

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#### **Missouri Botanical Garden** *The Vahinala Project: Cataloguing Madagascar’s Plants*

Madagascar is a biodiversity hotspot of global importance, its remarkable flora and fauna the product of more than 100 million years of evolution in relative isolation. The diversity and uniqueness of Madagascar’s flora is without parallel, yet the description and inventory of the island nation’s plants is far from complete.

JRS is supporting the Missouri Botanical Garden (MBG) and its partners in the Vahinala Project: A Catalogue of the Vascular Plants of Madagascar. The goal: a practical, up-to-date, on-line synthesis of Madagascar's flora, useful to botanists, natural products chemists, natural resource and conservation managers, scientists and government agencies.

Over 25 years, MBG has compiled baseline information on Malagasy plants in its TROPICOS database. The new catalogue – available at [www.eFloras.org](http://www.eFloras.org) – profiles each species: its habitat, ecology, endemic status and distribution by province, bioclimatic zone, vegetation type, elevation and presence in protected areas, along with its rarity and conservation status. This authoritative database feeds directly into the Encyclopedia of Life, the Catalogue of Life, the Global Biodiversity Information Facility (GBIF) and other global databases.

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### **Botanic Gardens Conservation International US, Inc.**

#### *Plant Conservation in East Africa*

Rural communities in Kenya, Tanzania and Uganda depend on their rich diversity of 35,000 plant species for food, medicine, income and more. These benefits are threatened by unsustainable resource use, overexploitation, poor farming practices, land degradation and loss of soil fertility.

To help halt the loss of plant diversity, Botanic Gardens Conservation International US, with partial funding from JRS, is collecting and synthesizing baseline data to build an accessible working list of regional flora and fauna, and creating the needed information infrastructure. Outputs will include a synthesis of information on the region's medicinal plants, many of them threatened.

Experts say Africa's native fruits – so-called “lost crops” such as the baobab, marula and butterfruit – are a largely untapped resource that could combat malnutrition and promote environmental stability and rural development. Traditional fruits fed Africans for thousands of years before imported species such as banana, pineapple and papaya and, with renewed scientific and institutional support, could be due for a comeback.

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### **African Conservation Fund**

#### *Understanding wildlife in African savannas*

African wildlife struggles due to rising human population and development pressures, conflicts between people and animals, and changing climate patterns.

With JRS support, the African Conservation Fund (ACF) is constructing a database of rich information gathered over a 40-year study in southern Kenya, complemented by

remote imagery and a mathematical model of large herbivore dynamics. The goal: to support through better information a range of national and regional biodiversity conservation initiatives, mapping and planning.

The effort will facilitate the integration and sharing of scattered institutional data, making them freely available.

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**World Health Organization – African Programme for Onchocerciasis Control**  
*Renewing the use of river blindness-related data*

The African Programme for Onchocerciasis Control – part of an international partnership to eliminate river blindness (Onchocerciasis) from sub-Saharan Africa, has collected biological information from thousands of miles of rivers over almost three decades.

With a grant from JRS Biodiversity Foundation, APOC is convening scientists who collected the data and others likely to find it useful in regional biodiversity studies. They will identify which data can be improved and how, work to resolve data ownership issues, choose data formats that will make it useful to future research, and prepare a proposal for future funding.

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**University of Cape Town**  
*Southern African Reptile Conservation Assessment*

South Africa, Lesotho and Swaziland’s remarkable range of reptiles includes the Nile crocodile, black mamba, puff adder, Cape cobra and many less notorious species that nonetheless play vital roles as predators and prey in the region’s terrestrial, freshwater and marine ecosystems. Incomplete and inaccessible distribution information in many separate databases undermined the establishment of conservation priorities.

The University of Cape Town’s Southern African Reptile Conservation Assessment (SARCA), with funding from JRS and the South African National Biodiversity Institute, has assembled all known distributional data for the region’s reptiles – about 130,000 records for over 400 species – in one database. Data gaps were filled through 24 field surveys, yielding more than 4,220 new distribution records and through an online public appeal to contribute reptile photos and accompanying geo-reference data. Over 6,700 records were received from about 350 contributors.

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**South African National Biodiversity Institute**  
*Digitizing the Compton Herbarium collections*

The Greater Cape Floristic Region (GCFR), also called the Cape Floral Kingdom, is small but diverse, containing two of Africa's seven biodiversity hotspots. The venerable Compton Herbarium, part of the South African National Biodiversity Institute (SANBI), documents and studies GCFR flora and now boasts a collection of about 750,000 specimens spanning 170 years of research.

Only about 12.5 percent of the herbarium's vast collection is digitized, however, and fewer than half of the entries are geo-referenced. Vast amounts of valuable data appears only on herbarium labels largely inaccessible to researchers, conservation biologists or planners.

JRS Biodiversity Foundation is supporting a SANBI project to digitize and georeference the herbarium's collections of the GCFR's five largest plant families. Up to 100,000 records will be digitized and geo-referenced during the two year project, a process that will foster understanding of past and present species distribution, current and potential threats, and how they can be minimized.

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**University of Ghana**  
*Ghana Biodiversity Informatics Project*

Ineffective environmental management has been fingered as a major impediment to improving Ghana's standard of living. And efforts to conserve the nation's biodiversity are constrained by the lack of an accessible, accurate and up-to-date list of the country's flora and fauna.

JRS is funding a University of Ghana effort to establish a national node of the Global Biodiversity Information Facility, thus providing a focus for the collection, sharing and dissemination of biodiversity data.

Working with partner countries, international organizations, natural history museums, herbaria, the scientific and IT communities and the international biodiversity conventions, the country's existing biodiversity data will be digitized, information on medicinal plants will be collated and synthesized to support policy and decision making.

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**ETI Bioinformatics**  
*Expanding the Tanzanian Biodiversity Information Facility*

JRS is helping Netherlands-based ETI Bioinformatics to expand a recently-launched online information portal called the Tanzanian Biodiversity Information Facility (TanBIF) -- [www.tanbif.or.tz](http://www.tanbif.or.tz). It allows users to harvest data and maps from some 50 national as well as various international databases.

TanBIF aims to get as many Tanzanians and visitors as possible to help gather and upload biodiversity photographs, location details and other information. It will feature special learning materials and teacher training modules provided by a partner organization, Viafrica.

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## INDIA

### **Ashoka Trust for Research in Ecology and the Environment** *Eco-Informatics Centre*

With exceptionally rich biodiversity and almost one-fifth of humanity, India faces enormous environmental challenges, including rapidly shrinking biological resources. Reversing that trend requires easy access, retrieval, and application of integrated conservation and natural resource information.

The Eco-informatics Centre ([www.ecoinfoindia.org](http://www.ecoinfoindia.org)), recently created by the Ashoka Trust for Research in Ecology and the Environment (ARTEE) with support from JRS, is enriching databases while developing new tools and novel ways to process, analyze and disseminate information. The goal is to quickly bolster reliable data on the variety and distribution of India's biodiversity.

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## LATIN and SOUTH AMERICA

### **Inter-American Biodiversity Information Network** *Integrating Biodiversity and Geospatial Data*

JRS is supporting a new project by the Panama-based Inter-American Biodiversity Information Network (IABIN) to geo-reference digital biological data collections.

To demonstrate the effort's usefulness, IABIN created a model that draws on 27 datasets to assess the vulnerability of streams to invasion by an invasive fish (African tilapia). The model was developed for all of Belize's domestic streams, as well as international watersheds shared with Guatemala and Mexico.

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**Field Museum of Natural History**  
*Index for Conservation Compatibility*

Chicago's Field Museum of Natural History is using a JRS grant to refine a new tool developed to monitor central Peru's Parque Nacional Cordillera Azul (PNCAZ) and its buffer zone. This national park is the last remaining intact expanse of Andean foothills in Peru.

The Index for Conservation Compatibility (ICC) guides the park's management activities and measures success based on geo-referenced field information that is synthesized into maps immediately. The ICC is a composite measure of cultural assets, quality of human life, threats to cultural and biological diversity, operational (on the ground) and institutional mechanisms and biological diversity. Each park hectare is ranked on its conservation status according to adjustable parameters.

The pilot has been so successful that Peru is considering its adoption in all national parks and drawn the interest of conservation organizations elsewhere in Peru, as well as Ecuador and Bolivia.

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**Centro de Referência em Informação Ambiental**  
*Enhancing the 'speciesLink' network*

Brazil remains the planet's biodiversity treasure trove. Some scientists estimate its plant and animal species could number as many as 4 million.

To help shed light on the country's biodiversity, the Centro de Referência em Informação Ambiental developed the **speciesLink** network in 2002 to assemble data scattered across a host of institutions. Today, the network integrates data from 159 collections nationwide – almost 3 million online records spanning more than 260,000 species.

Access to this information underpins efforts related to health, agriculture, industry, and environmental management. With JRS support, **speciesLink** is consolidating and improving its systems with new tools to ensure that scientists and policy-makers have easy access to critical data.

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**National Biodiversity Institute of Costa Rica**  
*Towards a New Generation of Naturalist Citizens*

The pioneering biodiversity informatics work of Costa Rica's National Biodiversity Institute (INBio) has turned field data from professional taxonomists and talented amateurs into usable information for educators, policy makers and conservationists.

JRS is helping the Institute take advantage of new technology, scale up and streamline the generation and delivery of information, particularly multimedia (photographs, illustrations maps and videos), and to generate new outputs such as structured natural history descriptions.

The goal is to make biodiversity information so easy to access and use that a new generation of naturalists will be empowered, using PDAs or cell phone web browser to identify species quickly and accurately.

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### **New York Botanical Garden**

#### *Botanical Data for Conservation in the Southwestern Amazon*

Peru, Brazil and Bolivia in the southwestern Amazon share a rich variety of flora as well as serious conservation threats and challenges requiring coordinated regional action. Information on the region's estimated 15,000 plant species exists in various forms, incompatible and unconnected, in about 75,000 collections across four countries.

The New York Botanical Garden, supported by JRS and in partnership with 12 international organizations, is assembling the scattered data and building human capacity to use it to improve biodiversity conservation. Regional herbaria are receiving computer hardware and staff training to document their specimens electronically. Special software will speed data entry and geo-referencing, and detect and correct errors.

The project will also provide training in digital photography, integrating field images into databases and producing field guides.

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### **Pontificia Universidad Catolica del Ecuador**

#### *Developing a biodiversity information system in Ecuador*

Ecuador's 464 amphibians, 405 reptiles and 1,600 birds account for, respectively, seven, five and 16 percent of global diversity. But many species have disappeared, and many more, together with their habitats, are threatened by an ever-growing human footprint. An estimated 45 percent of Ecuador's lowland forests, 48 percent of highlands and eight percent of its Amazon basin have been lost. And deforestation claims about 680,000 acres every year. At that rate, Ecuador's remaining forests would be gone in 40 years.

JRS is supporting a partnership of the Museo de Zoología de Vertebrados, at Pontificia Universidad Católica del Ecuador, and the University of Kansas to construct a national Biodiversity Information System capable of integrating high quality biodiversity data from various sources.

It will accelerate species discovery and description by providing reliable and up-to-date taxonomic information and biodiversity tools and training through a user-friendly online interface. The system is designed for researchers, government and non-governmental organizations, indigenous and non-indigenous communities, conservation biologists, policy makers, educators, students, tourists and interested citizens alike.