Executive Summary

The mission of the All Species Foundation (ALL) is simple yet complex: within the span of one human generation, discover and describe every living species of life on Earth.

If we were to visit another planet the first thing we would do is conduct a systematic inventory of that planet's life. Oddly enough, we have never done that for our own planet. The All Species Foundation intends to discover, describe and disseminate information about every living organism on Earth within 25 years. At the present time, estimates of the number of living species on Earth, including microbes, range from 10 million to 200 million. This drastic range means we simply lack key evidence about the number, let alone types, of living creatures on Earth.

What is lacking and most needed is a concerted effort among taxonomists, scientists, biologists, technologists, and industry, something akin to the Human Genome Project, to complete a global biodiversity map from pole to pole, whales to bacteria, and in a reasonably short period of time. ALL will act as the catalyst to galvanize these interdisciplinary fields to do something never before attempted in modern times by utilizing the most innovative technologies.

Ecology and conservation biology are to the planet's health as genomic and biomedicine are to human health. Unfortunately, progress in these areas is hampered by our ignorance of most of the world's biodiversity, particularly at the level of individual species. To describe and classify all of the surviving species of the world will become one of the great scientific achievements of the new century made possible because of the current and emerging technological advancements. The discovery of life offers unsurpassable adventure: the exploration of a little-known planet.

Outcomes

> *"A conservation ethic is that which aims to pass on to future generations the best part of the nonhuman world. To know this world is to gain a proprietary attachment to it. To know it well is to love and take responsibility for it."*
>
> *– E.O. Wilson*

What an All Species Inventory Provides

- It will give us, for the first time, a complete list of 'who is here,' the roster of our fellow inhabitants.
- It will provide a reliable basis for population counts and the determination of endangered species.
- It will form the foundation for the development of a complete genome of all life and a new understanding of nature.
- It will uncover multitudes of new species, many of which could have immediate and significant economic, scientific, and cultural consequences.
- It will train many people as naturalists and scientists, who can further use these new skills in their own lives and that of society.
- It will distribute wealth from the developed world to emerging and developing countries across the globe through employment of indigenous observers and collectors.

Fixing the crucial figure of all species on Earth, and drawing up the list of all life, would enrich and enable the following fields of knowledge

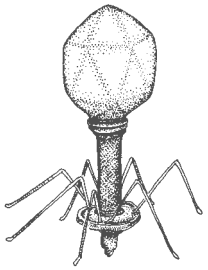
Natural History: The identification of a species triggers a whole field of inquiries into that species. What is not named does not get attention. Cataloging each species is the best thing in the world to do for every living thing in the world.

Conservation: While the concept of focusing limited conservation resources on a few species-rich hot spots is probably wise, there is no way to assess hot spots with complete confidence (are those spots really hot? are they really where we think they are?) unless we have an all species inventory first. Biocensus tallies can only follow inventory counts.

Ecology: The web of interactions between organisms and within each of their environments is woefully incomplete in every case if we cannot even list all organisms in each environment. Ecologists and others may be drawing incorrect conclusions, or at least approximate conclusions, because of incomplete sets of data.

Evolutionary and Molecular Biology: A complete understanding of evolution at the genetic level will require the full outline of genetic innovation provided by all species. Many insights in molecular evolution will depend on a snapshot of the entire range of genomic life, much as progress in deciphering human genetics require the sequencing of the entire human genome.

Biologic Wealth: The commercial benefit of the discovery of millions of new species is staggering based only on the pharmacological and biotech billions made from the few species already identified.



Viruses

Estimated: 400,000
Identified: 4,000

Adopt Innovative Technology for Species Discovery, Identification, and Description

The development of key partnerships between ALL and museums, natural history collections, land and resource managers, foundations, and technology innovators will help taxonomists (in the field and in the lab) leverage emerging technology, tools, and methodology.

Since the earliest days of the science-in the 18th century, when Linnaeus founded the modern binomial system of classifying plants and animals - taxonomists have dreamed of the ultimate goal: the classification of every living species on Earth. Despite tremendous efforts, scientists are decades, if not centuries, from this goal if discovery, identification and description continue at the current pace and groups continue to work in isolation. Technological advances have opened new opportunities that ensure the project's success. Modern researchers have tools that can greatly increase the sluggish pace of species identification. For example, three-dimensional imaging using microscopes and digital cameras makes it possible to share images of specimens instantly on the Web.

In the field, advances such as foggers for collecting insect species, the Global Positioning System (GPS), and remote-controlled undersea equipment allow teams to push research farther and faster than ever before. The four key goals of ALL are achievable in the next five years through effective consortia and the building of partnerships.

Scientists have identified most of the higher-order animals and plants, but the vast majority of bacteria, fungi, algae, and insects have yet to be discovered.

A sample of those life forms:

Group	Identified	Estimated
Insects	950,000	8,000,000
Fungi	72,000	1,500,000
Bacteria	4,000	1,000,000
Algae	40,000	400,000
Nematodes	25,000	400,000
Viruses	4,000	400,000
Plants	270,000	320,000
Mollusks	70,000	200,000
Protozoan	40,000	200,000
Arachnids	75,000	150,000
Crustaceans	40,000	150,000
Vertebrates & other close relatives	45,000	50,000
Others	115,000	250,000
Total	**1,750,000**	**13,020,000**

Source: Global Biodiversity Assessment, United Nations Environment Program, 1995

Goals

Five-Year Goals (2002 - 2007)

- Complete a comprehensive All Taxa Biodiversity Inventory (ATBI).
- Quadruple the rate of species description.
- Image 50% of type specimens ("holotypes") for the Web.
- Increase by twofold the taxonomic capacity of developing nations.

Opportunities for Taxonomic Innovation

Increase volume and practices in collecting, preserving, culturing, and curating.

Expand scale and quality of identified and collected materials by using technology and partnerships to build global capacity.

Develop interdisciplinary and technologically advanced ways of describing new species.

Database, organize, and disseminate information on biodiversity using new technology.

Measurement of Success

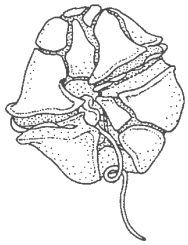
Complete Comprehensive ATBI

Our initial strategy is to initiate four inventory efforts - two in the northern hemisphere and two in the southern hemisphere within 5 years, with at least one of these resulting in a comprehensive ATBI. ALL will work with key strategic partners who will undertake the inventory work, in conjunction with a significant program to train and utilize local para-taxonomists and to build local capacity in developing countries.

ALL will look for strategic partners who already have existing programs underway or who have large land management responsibilities (e.g. World Heritage Sites, National Parks). In this way, any inventory effort conducted by All Species will contribute immediately to their conservation programs (e.g. monitoring invasive species, etc.).

Working criteria for any All Species Inventory (now under review with the Science Board) includes:

- Integrative (well blended with emerging tools and existing efforts, and multi-disciplinary participation).
- Efficient (cheap relative to other inventories).
- Expedient (fast rather than one that goes on for five to ten years).
- Effective (immediate outcomes through the use of technology and rapid publishing).
- End-result oriented (measured by the number of new species identified and published).
- Educational (immediate output via the web).



Protozoan
Estimated: 200,000
Identified: 40,000

Quadruple the Rate of Species Description

Currently under way is the ALL Species Toolkit which includes a global search engine, at the genus or species level. This is the single most essential tool needed to provide taxonomists access to the current state of knowledge about species. All Species is working in collaboration with the Global Biodiversity Information Facility (GBIF) and many other key organizations to provide immediate access to comprehensive species information currently stored in a myriad of databases and within a variety of storage media. Future product enhancements will include individual taxonomist pages, a taxonomist database (job listings), and collaborative tools for discussion. ALL is currently working in alliance with a number of institutions to ensure that vital communication and publishing solutions are in the hands of taxonomists worldwide.

Image 50% of Type Specimens ("holotypes") for the Web

A world-wide initiative will be launched in late 2002 called the Holotype Imaging Project. The Smithsonian Institution is currently the key institutional partner, although discussions are underway with: the Museum of Natural History in London, The American Museum of Natural History, Museum of Natural History in Paris, Kew Gardens, Harvard University, California Academy of Sciences, The Field Museum of Chicago, and the Natural History Museum and the Biodiversity Research Center at University of Kansas to develop a consortium with annual milestones for the imaging of 50% of the holotypes - a total of 750,000.

Initial goals:

- Establish baseline data for the actual number of holotypes (the primary type specimens for the 1.7 million known species, located at each institution.
- Establish a working coalition of key institutions with an agreed upon strategic plan.
- Mount a global campaign around the goal, benefits, and need for imaging.
- Create milestones for each participating institution.
- Begin digitizing holotypes so that they will be fully accessible via the Web.

Increase by Twofold the Taxonomic Capacity of Developing Nations

In collaboration with organizations such as the UN Foundation, Conservation International, National Park Service, National Park Foundation and others, ALL will develop appropriate curricula and training materials targeted at a lay audience so that they can better understand, conserve, and utilize their natural resources.

This capacity building initiative will focus on the training of local para-taxonomists: to collect and prepare specimens, to assist with basic taxonomy and monitoring for ecological and natural history purposes, and to learn digital imaging and basic computer skills, including how to populate databases and how to use the Web. Additional capacity building may include the procurement or development of key technologies or technology suites (various tools and technology providers uniquely grouped for taxonomic applications) for individuals and organizations worldwide to increase their ability to work effectively.

Systematics

Systematics is the science which builds upon the following tasks:

Taxonomy : The science of discovering, describing, and classifying species or groups of species (together termed taxa)

Phylogenetic analysis: The discovery of the evolutionary relationships among a group of species

Classification: The grouping of species, ultimately on the basis of evolutionary relationships.

Over the next twenty-five years the All Species Foundation will:

- Catalyze, establish, or strengthen networks.
- Strategically leverage funds.
- Increase taxonomic capacity worldwide.
- Increase public awareness.

The All Species Foundation is dedicated to the complete inventory of all species of life on Earth within the next 25 years - a human generation.

Fungi
Estimated: 1,5000,000
Identified: 72,000