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# Geographic Information Systems (GIS) for Public Gardens: The Geospatial Revolution

*Why Ubiquitous Location-Awareness Changes Everything*

“Geospatial information influences nearly everything. Digital mapping is changing the way we think, behave, and interact. Seamless layers of satellites, surveillance, and location-based technologies create a worldwide geographic knowledge base vital to the interconnected global community.”

—National Geographic Society © 2011

## Overview

Practically overnight, access to terabytes of geographical information has changed the way people work, live and play. At work and at home, we now rely on a host of location-based technologies via our desktop computers, laptops, mobile tablets, and smart phones. GIS is one of the key technologies powering this new ecosystem of information about our world.

Along with other mobile technologies, GIS is being adopted by many botanical gardens, zoos, and other public gardens. Several market changes are driving this change:

- GIS is becoming simpler to use and more user-friendly
- GIS is rapidly moving to fast, affordable cloud-based platforms
- Mobile technology is now widely available, faster, and affordable
- Easy-to-use mobile devices (smartphones, iPads, etc.) link seamlessly with cloud-based GIS
- A free GIS template for mapping public gardens is now available
- Esri provides free GIS software, training, books, and conference registration through the American Public Gardens Association (APGA)
- An international collaborative consortium, the Alliance for Public Gardens GIS, provides peer-to-peer support, advice, and encouragement for public garden staff.

Location-aware platforms like GIS are powerful tools that leverage decades of national investment into new practices and workflows to help run your botanical garden, zoo, or other public garden more effectively and efficiently. This whitepaper summarizes key points about the geospatial revolution and examines ways that public gardens use GIS to manage collections and facilities and to connect with local schools, communities, and supporters.

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## Background

A National Priority

People pausing on a street corners to consult smart phones is one of the more familiar sights in today’s busy cities. When in an unfamiliar city or town, it is now commonplace to immediately check where you are on a digital map and then use the location-aware software on a mobile device to help you decide where to eat, where to meet friends, or what direction to head next as you go about your day. How is this possible?

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During the past 30 years, the United States made massive investments in technology—designed and constructed the Internet, expanded communications infrastructure, assembled detailed national data sets for digital maps, and provided robust data management standards, along with a constellation of global positioning system (GPS) satellites— that have made this new way of connecting with the world possible. And, thanks to enlightened public policies, these innovations are available to everyone.

Hundreds of thousands of organizations have adopted GIS to make planning and management more efficient. Many are already using GIS as a unifying framework to connect and integrate all the digital information that organizations rely upon to work effectively..

This trend shows no signs of slowing. By 2015, the geospatial market is expected to contribute \$100 million/year to the world economy and it already represents a major center of economic activity in business, technology, military, and industrial sectors globally.

GIS professionals are almost certainly already at work in your own county, city, or town— they are employed by IT departments of city or county government, or work within the information technology departments of public utilities, regional transportation, and fire districts, in the facilities departments of local campuses and at military bases, and at commercial outfits such as surveying companies or the environmental monitoring firms and in the regional headquarters of large nonprofit organizations or local advocacy groups for political or environmental change.

In 2010, the US Department of Labor calculated that nearly 425,000 geospatial professionals are employed in the United States, with another 150,000 new geospatial positions projected to be created by 2020. Outside the United States, reliable or comparable figures are more difficult to determine exactly but well-informed estimates suggest that there were about two million professional GIS users worldwide in 2005 (Longley et al. 2005).

Yet the greatest achievement of GIS is likely to be ahead: new cloud-based tools are changing how people think about maps

## **What is GIS?**

### **GIS helps you understand your place. And the world.**

A geographic information system (GIS) combines layers of information about a place to give you a better understanding of the place. What layers of information you combine depends on your purpose— tracking tree or site work that needs to be done, planning new collections and facilities, or recording research underway in the garden, and so on. Unlike working with paper maps, which are limited to a single use, GIS maps can combine many layers of information, as you need them, and new maps can be produced, instantly, on the fly.

### **GIS is people, tools, and information, all connected and in motion at once.**

A geographic information system is an integrated system of online resources, national datasets, mobile technology, computer hardware, desktop and server software, and trained GIS personnel for capturing, managing, analysing, and

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displaying an enormous variety of location-based (spatial) information as easy-to-understand colorful maps, detailed reports, and executive dashboards. Whatever information you track, GIS can help you manage it.

**GIS is a problem solving tool.**

GIS helps to answer questions and solve real-world problems. With new ways to look at your world—and the information you have gathered about that world—you can quickly see and understand important patterns and trends. Relationships previously hidden in tables of data are suddenly revealed at a glance and easily shared with others.

**GIS is an Ecosystem**

GIS is now at a major turning point. Many forces are accelerating this change: the increasing speed of the internet, widespread adoption of mobile technology, quick download times of location information to small hand-held devices, ever-faster mobile networks, GPS enabled phones, and the emergence of GIS in the cloud.

**GIS is a Platform.**

ArcGIS Online is a new cloud-based platform, closely integrated with traditional desktop GIS tools, that greatly simplifies the use of GIS. This new online platform allows people—with few technical skills but important real-world problems to solve—to easily imagine and create dynamic, web based maps. The simultaneous release of an ecosystem of rich content— spatial data collected over decades by governments, NGOs, and commercial enterprises— and mapping “apps”, along with the attractive ArcGIS Online map templates designed by professional cartographers and graphic designers, provides a new powerful communication tool for anyone with a mission to accomplish or important messages to convey.

**Drag and Drop Your Information into ArcGIS Online.**

Through the familiar “drag and drop” process, people with few technical skills and no GIS experience can now “drag” Excel or Word charts straight onto free ArcGIS Online basemaps—created with the spatial data and sophisticated mapping templates also available online—and automatically generate maps to tell compelling stories or solve problems.

**Go Live.**

Best of all, these new ArcGIS Online maps are “live maps” rather than static images: by simply clicking simple-to-use “on/off” boxes or by adjusting “moving sliders” tied to key metrics, alternative scenarios can be quickly compared, new ideas tested, and potential impacts evaluated.

**What good is GIS?**

**The Power of Place.**

“Place” turns out to be a great way of organizing information, especially for living research collections which are housed, not in cabinets or in drawers, but as living plants cared for and growing at a physical site—a site that is embedded in a climatic zone, within a bioregion, and in a particular location.

Botanical gardens and zoos date back many hundreds of years. From the start, detailed maps and inventories have been a critical tool for managing these scientific collections and much-loved public gardens. Botanical gardens, arboreta,

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and zoos use maps in a variety of ways to meet the needs of diverse user groups—for example, schematic maps provide simple way-finding for visitors; detailed maps of physical features like irrigation systems are required by facilities managers; and complex collection maps rich with specimen and site information are intensively used by the scientific, horticultural, and curatorial staff.

**It's About More Than Maps— GIS can help you tell your story.**

However, GIS can also help you produce visual images that go far beyond maps, and help you communicate important stories through executive dashboards, animated digital globes, or illustrated reports. Maps are incredibly powerful devices for storytelling. People understand your point at a glance.

And although GIS is unrivaled in its ability to create maps, the true power of GIS lies in its ability to query, analyze, and report on data to assist with the decision-making process. GIS reduces complexity and helps us quickly understand the most important dimensions of a situation, as we experiment with dynamic, on-the-fly testing of possible alternative solutions.

By harnessing the power of this emerging ecosystem of people, mobile apps, software, and shared communication infrastructure, GIS can help public gardens:

- **Inform Executives**
- **Connect Workers**
- **Empower Staff**
- **Engage Community**
- **Reach Donors**

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## **How Can GIS Help Your Garden?**

### **Inform Executives**

When leaders have a clear view of what is going on, at all levels in an organization, they can easily weigh alternatives and make informed choices about where and when to invest the critical time and money needed to meet the important strategic goals of public gardens. Good, accurate, and timely information, then, is the foundation for all good decisions.

GIS executive dashboards—sometimes called “an app beyond maps”— offer a high-level, visually compelling, map-based views of key performance indicators (KPIs) and can be powerful visual tools that summarize the most critical information that senior management need to run their organization effectively.

Executive Directors and board members use GIS dashboards to view critical metrics, identify trends, raise questions, and devise new management strategies. The reporting layers nested under the attractive “front page” of an attractive executive dashboard can help decision-makers visualize where concentrations of activities are occurring, review trends associated with each activity, and determine how effectively their strategic initiatives are working. Work is underway at the UC Davis Arboretum to develop a executive dashboard for directors of public gardens.

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## Connect Workers

### **GIS can help to consolidate knowledge about a place.**

GIS holds much promise for integrating information management in botanical gardens, zoos, and other public gardens. When a GIS is used across many departments in an botanical garden or zoo, shared data can be collected once and then used many times, and one department can benefit from the work of another.

New cloud-based GIS tools, when connected with cell phones, tablets, and other mobile technologies, can consolidate related information about a multitude of diverse garden and museum work tasks—now lost in hard-to-find files, scattered across many departments—into a single, streamlined workflow. This is revolutionizing how, where, and to whom information is available—for example, a staff person in the field can now have real-time critical project information at their fingertips without leaving the work site.

### **Improve workflow.**

Deciding to implement GIS in your public garden sometimes daylight long-standing problems in staff work flow, along with some complicated work-arounds your staff may have devised over time as they ‘worked on the fly’ to get projects done on time and on budget. Although helpful at the time, these work-arounds often become accidentally embedded in the daily and weekly workflow. Fixing some of these issues can relieve a tremendous burden as duplication of effort and convoluted work flows are eliminated and a new streamlined system is put in place.

### **GIS can improve communication.**

Communication and collaboration improves across the entire zoo and botanical garden as maps, reports, estimates and lists scattered across projects and departments are consolidated into a GIS. Errors jump out as the information is consolidated and can then be easily corrected, greatly improving the accuracy of details about projects and places that are available to facility managers.

New information never before mapped or perhaps known only by a few staff who originally installed or repaired equipment, managed the construction or the renovation of a site, learned by long-term staff who were mentored by now retired facilities managers, or through accidental discovery can now be captured, included in the GIS, and shared with everyone. Accurate and up-to-date information is critical to support decision-making and cost estimating.

### **GIS can reduce costs caused by lost information.**

This is not a problem that public gardens alone face. Commercial businesses are moving rapidly to eliminate the hidden costs driven by lost information and poor communication and to find solutions to help manage today’s crippling information overload. In large commercial institutions, research shows that, on average, staff:

- spend almost 9 hours each week searching for lost information;
- often, staff duplicate and re-create content that already exists;
- overall, **nearly 30% of the work week** is spent handling the vast amounts of incoming information as staff struggle to use inefficient tools and methods that were not designed for elegant, rapid information delivery.

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The cost savings resulting from integrating all information in one place can be considerable and is well recognized across many industries: the return on investment (ROI) is 38% for upgrading an existing information system, to over 600% ROI for putting in a new integrated knowledge management system that eliminates costly work-arounds that staff have independently devised to track information. Once cloud-based information management systems are in place, a new vision of what an efficient information-driven organization looks like will emerge.

**Empower  
Your Staff**  
  
FACILITIES MANAGERS

**Reduce Maintenance Costs.**

Online maps shared via GIS dashboards help facilities managers see where the money is going and why, and when work is scheduled for a particular project that is still in the queue. Facilities managers can save money and reduce costs when they can see the status of new construction and maintenance work underway at-a-glance, as well as the work planned for the near horizon. Many work order systems easily integrate with GIS, increasing the productivity of the maintenance and repair staff by routing specialized work teams in more efficient ways. The maintenance department can detect trends related to service requests, equipment management, graffiti removal requests, road and sidewalk pavement repairs and resurfacing, and asset inventories.

Once mapped, whole systems—irrigation, roadways, electrical systems—can be shared to help trace back problems to points of origin when there is a problem: no longer will only supervisors know where the valve to shut off that broken pipe is. Facilities crews also link begin easily misplaced documents about critical equipment—e.g. user manuals for irrigation control systems; original invoices with date of purchase, vendor, SKU, original price, etc.— to the GIS to assist future maintenance/repair crews.

SUSTAINABILITY  
MANAGERS

**Go Green.**

GIS is an invaluable tool for environmental management: for example, managers of stormwater and storm sewer systems can use GIS to track water quality, detect and eliminate illegal discharge, and devise systems to better understand and then properly control stormwater runoff. A network of smart sensors can be integrated with GIS to help track evapotranspiration, rainfall, and temperatures to inform proper settings for irrigation systems, as well sound levels, air quality, and other environmental metrics that can be informative for managers of public spaces. Metrics for LEED are easily quantifiable and can be incorporated into GIS modeling tools to give designers feedback during the design process. GIS can also incorporate the guidelines and metrics of the Sustainability Sites Initiative that address site selection, connection to community, pollution prevention during construction, protection and restoration of habitat, and maximizing open space. A sustainability dashboard, linked to the GIS, would make a powerful communication and planning tool for public gardens.

PLANNERS AND  
ARCHITECTS

**Speed Planning.**

Thanks to GIS, what was once an overwhelming task—creating multiple maps to explore multiple alternatives and competing outcomes— has become a more intuitive scenario planning process. Highly fluid, live maps generated by the GIS

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can be used during community planning meetings to help guide the conversation. Map layers can be turned on or off, and features highlighted or hidden during siting discussions—flat areas can be easily identified, for example, along with shady and sunny exposures, natural water features, and sensitive cultural and biological areas. With the help of GIS, landscape architects are also able to provide clear metrics about project alternatives, and compare the costs and ecological, economic, functional, and scenic benefits of competing ideas.

**Integrate Planning With Construction and Maintenance.**

Planners and architects use GIS to plan garden infrastructure, design major exhibits, and new garden construction. GIS can be the repository for the archive of all the architectural and engineering reports, sketches, and maps used for both the design and build—engineering reports, soils, topography, archeological surveys, construction drawings, etc. Construction crews can integrate mobile devices linked to GIS into the construction workflow to capture dimensions of newly built or installed infrastructure and equipment, materials used, and the date of construction or installation. Some gardens upload photographs of construction just completed that will later be underground or enclosed in walls in order to help with maintenance and repair tasks later.

RISK MANAGEMENT

**Reduce Risks.**

GIS is widely used at botanical gardens and zoos to help with tree canopy management and risk assessment. Throughout the garden, potential safety risks on paths, sidewalks, and roads, or elsewhere, are easily highlighted on maps and tied to costs estimates. With prioritized work plans in place, management teams can be efficiently scheduled to complete work that will reduce risks to visitors in cost-effective ways.

**Improve Emergency Management.**

Many large zoos and botanical gardens host thousands of people in a single day; as major public event spaces, they are required to have emergency management plans in place. GIS simplifies the planning for major emergencies, including ways to move visitors to safe locations and to plan emergency routes into and out of the facility for regional emergency medical and fire teams.

CURATORS

**Meet high standards of museum curation.**

GIS helps curators manage the complex information management needs of a living plant collection: tracking conservation care, source histories and accessioning, herbarium and image vouchers, plant maintenance records, as well as other data related to use by classes, scientists, and educators, for many thousands of plants. Curators can use GIS to prepare accurate plant labels, inventories, maps, and reports; track changes in plant nomenclature; support research; and collaborate with national and international data-sharing efforts. Analytical GIS tools help curators understand and address collection gaps in own collection, as well plan and manage national collections that cross institutional boundaries (e.g., the North American Plant Collections Consortium’s multi-site national oak collection).

**Support research in the collection.**

Within the public garden, by using GIS as a central file system, curators can also easily track which plant specimens have been used by researchers. Published journal articles, scientific reports, and other academic work that used the collections in their research, along with required federal, state and local permits and approvals, researcher contact information, projected timelines, and any other details that curators track about research in the collection, can be linked to individual specimens or to entire collections, easing the task of retrieving and reporting on this information when it is needed. By providing simple search tools to curators and communication staff at public gardens, GIS can help to ‘daylight’ and share the stories of the many research efforts already underway at botanical gardens and zoos, and inspire new research that makes use of these valuable but sometimes underused *ex situ* plant collections.

**Inspire Visitors.**

Just as facilities and curatorial staff with mobile devices can now update GIS data in the field, garden educators can use the GIS as a foundation to create cloud-based, content-rich mobile tours linked to audio, video, and photographic resources for your visitors, or engage garden visitors with location-aware citizen science activities and science-adventure games in the botanical garden and zoo by using the mobile devices that many people already have in their pockets. Audio, video, and photographs, as well as online resources, can be integrated into the dynamic GIS maps created as visitor-centered maps that enhance the visitor’s experience in the garden. Other botanical gardens and zoos have experimented with geocaching and customized GIS/GPS tools provided by commercial vendors to invent adventure games, focused on conservation education, for their K-12 or family visitors.

**Engage Your Community**ENGAGE THE  
COMMUNITY**Tell Your Story.**

GIS executive dashboards that feature your garden and tell your story can be shared with the public. Innovative nonprofits like the Puget Sound Partnership have created inspiring models of executive dashboards that share progress on restoration projects underway in the Puget Sound in Washington State. The [Puget Sound Partnership “Vital Signs” dashboard](#) highlights key indicators of Puget Sound’s ecosystem health— as well as current restoration project locations, project details, progress toward completion, and project costs. Project staff use the dashboard to report comprehensively on all work underway, integrating project management with monitoring data on ecosystems indicators to support the decision-making process.

**Create a Community Map.**

The increasing ease-of-use of powerful online mapping tools like ArcGIS Online and Google Maps has led to a relatively new phenomenon: *crowd-mapping*, a new kind of crowdsourcing where important community mapping tasks are outsourced to citizen volunteers to ensure that decision-makers have critical information that more accurately portrays the world and how it is changing *before* making decisions. Everyone from 4H to the United Nations and the International Union for Conservation (IUCN) are now use cloud-based mapping to make a difference. Once public garden staff are comfortable with GIS skills, they have a new way to engage with their local community to help lead efforts to



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restore nearby natural areas or improve the quality of life for their neighbors.

Community Mapping is the creation of a map via a community-driven process. Projects usually are launched to map city or town features that are much valued by people, such as safe biking or walking routes, local trees and parks, and other aspects of community life, that are sometimes left out of city decision making discussions. Preparing community maps can have real impact on neighborhoods: for example, the Creek Mapping Project is an Oakland Museum program that mobilized citizens in Berkeley and Oakland, in the East Bay area of the San Francisco Bay region, to map the freshwater creeks and minor waterways that run off from surrounding hills. Many of these drainages still existed but were invisible and buried in underground pipes. The maps and guides produced by this community mapping project inspired local citizens to begin multiple projects throughout the East Bay to restore or renovate these long-forgotten waterways and creeks, and create mini-green spaces for neighborhoods throughout the community.

#### ENGAGE KIDS

##### **Work with a school.**

Students learn best when working on real world problems, especially those that can make a difference in their own lives, like community mapping. GIS is widely used for STEM (Science, Technology, Engineering, and Math) education projects in school and museum collaborative projects because it is a powerful tool for discovery, invention and creation, and communication:

GIS allows students to collect and visualize authoritative data about the question of interest, adding their own data to the map before performing a wide range of analyses on the data in question. GIS problems are steeped in both critical thinking and spatial thinking elements, motivating learners as they learn work-force ready skills. In short, GIS allows STEM students to do exactly what STEM professionals do in thousands of career fields daily.

- Tom Baker, in "Advancing STEM Education with GIS"

#### ENGAGE CITIZEN SCIENTISTS

##### **Do Science.**

With the advent of free online mapping, more GIS-centered citizen science tools are emerging each month. Daniel Edelson, Vice President for Education, National Geographic, writes: "Citizen science is the name for scientific research projects that engage members of the public in some aspect of their research. The overwhelming majority of citizen science projects involve crowdsourced data collection. In community geography projects, the data is georeferenced and used for spatial analysis. Community geography can be a boon for researchers. Volunteer data collectors provide investigators with the opportunity to obtain a quantity and geographic range of data that would not be practical through any other mechanism. They are also a boon to participants, who get to join a community; participate in something meaningful; and in many cases, learn some new science. National Geographic has created a web-based platform, Field Scope, to provide citizen scientists with the ability to visualize and analyze their own data with GIS."

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## Reach Out to Your Donors

Although we are not aware of any public garden that has integrated GIS into fundraising strategy, it is evident that GIS holds tremendous promise for fundraising, outreach, marketing, and development.

### **Have a smart membership drive.**

The real power of GIS, however, lies in the integration with “business analytics” or “location analytics”—in short, the power of predicting behavior based on current customer patterns that can be mapped onto smart maps and then integrated with the rich data sets, gathered by credit card companies, banks, and other entities, that are available for any household in the US. A case study from political fundraising illustrates how GIS can be used to generate new donations:

In the mid-1990s, the Republican Party of Wisconsin began with data about existing donors. Precise information about the purchasing behavior of the donors was mapped, along with the “geo-location” of existing donors and the political boundaries. From this information, the fundraising team extrapolated to identify other people in the district— not yet on the list of supporters— who were most likely to give a donation. Over a two year period, the Republican Party of Wisconsin fundraising program grew from 4,000 donors to over 40,000 donors; the yields from prospecting went from 1-2% success to 18% success; and the *revenue grew from \$200,000 to \$1,200,000.*

### **Plan Donor Visits.**

Individual fundraising provides a major portion of most public gardens fundraising revenues: over 90% of support for nonprofits nationwide comes directly from individual gifts. Getting to know members and donors, cultivating them through meaningful visits and garden experiences, and identifying new prospects are all critical parts of an overall fundraising strategy. Although rarely used in fundraising in public gardens, GIS has the potential to be a powerful tool to help the staff develop strategic approaches to this complex and time-consuming task. For example, when planning donor visits, an efficient route map can be quickly created by dragging addresses onto a secure ArcGIS Online map, and a customized secure mobile dashboard can deliver a 360-view of a donor for development staff person to review on an iPad as they prepare for the visit.

### **Connect with Volunteers. Raise Money Online.**

Innovative online services like [Thrd Place](#) use GIS as a platform to help you share your projects, tell your story, and reach out to your community to get involved or contribute—donate funds to your project, volunteer their time, or loan materials to projects you host on their website.

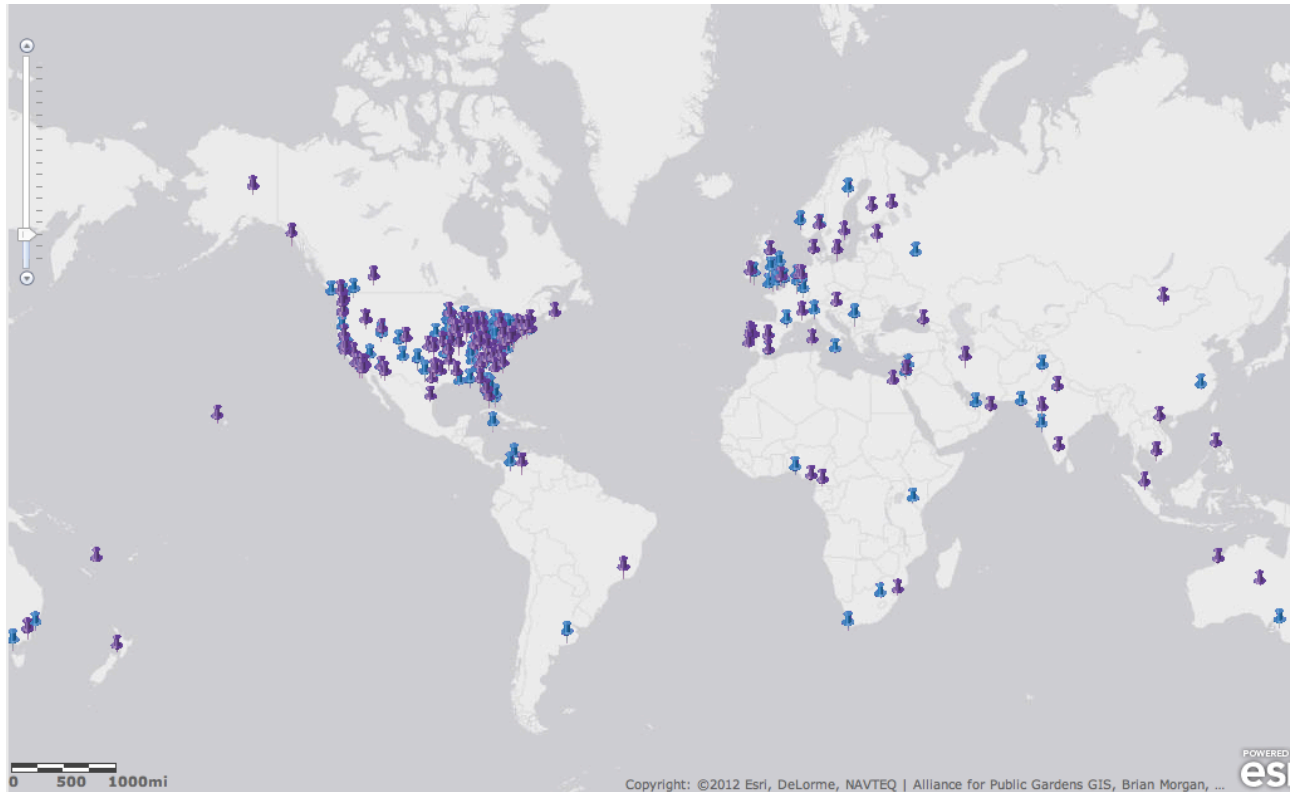
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## Join Us!

THE ALLIANCE FOR  
PUBLIC GARDENS GIS

The **Alliance for Public Gardens GIS** is a worldwide consortium of biological collection managers and GIS professionals who are dedicated to making geographic information systems (GIS) more accessible to arboreta, botanical gardens, zoos, and other managed landscapes for use in asset management, biodiversity conservation, education, and scientific research.

With a current membership of nearly **400 people**, the [Alliance for Public Gardens GIS LinkedIn Group](#) has become a convenient place for zoo and botanical garden staff working with GIS to ask questions, exchange ideas, and explore alternatives



## OUR CHAMPIONS

Since 2004, the **UC Davis Arboretum** has led a nationwide team of botanical gardens and zoos staff— with funding provided in part by the Institute of Museum and Library Services (IMLS)— to develop GIS as a tool to help garden staff manage public gardens more effectively. Key partners include the San Diego Zoo and Wild Safari, the Missouri Botanical Garden, the Arnold Arboretum at Harvard University, the Montgomery Botanical Garden, the San Francisco Zoo, the University of San Francisco, the Center for Integrated Spatial Research at University of California, Santa Cruz, and the Chicago Botanical Garden, among many other gardens. The Alliance for Public Gardens GIS grew out of these efforts.

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For more than 20 years, Jack Dangermond and Peter Raven have enthusiastically advanced the use of GIS for global plant conservation and supported efforts to develop this technology as a powerful management tool for living scientific collections at botanical gardens and zoos. Together, they have worked to directly support or advocate for the national teams developing data models, customized applications, and training materials for GIS in Gardens. Their vision and leadership has been a powerful force behind the success of these national collaborative efforts.



Dr. Jack Dangermond and Dr. Peter Raven, September 2012 ©Esri 2012

**Dr. Jack Dangermond** is the President and Founder of Esri, Inc., the world's largest geographic information system (GIS) software company. Esri has an installed base of over a million users in more than 350,000 organizations in 200 countries, including most US federal agencies, national mapping agencies, all 50 US state health departments, transportation agencies, forestry companies, utilities, state and local government, schools and universities, NGOs, and commercial businesses. Esri is headquartered in Redlands, CA.

**Dr. Peter Raven** is a world leader in botany and ecology and advocates for global biodiversity conservation. He was appointed Director of the Missouri Botanical Garden in 1971, subsequently its President, and, following his retirement in 2010, is now the Garden's President Emeritus. During his tenure and through his leadership, the Garden became a world-class center for botanical research, conservation, education, and horticultural display. In 2001, Dr. Raven received from the President of the United States the National Medal of Science, the highest award for scientific accomplishment in this country. He served for 12 years as Home Secretary of the National Academy of Sciences, is a member of the academies of science in Argentina, Brazil, China, Denmark, India, Italy, Mexico, Russia, Sweden, the U.K., and the Pontifical Academy of Sciences.

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## Why We Use ArcGIS

Esri's ArcGIS mapping software is the industry standard for geographic information systems. ArcGIS is used by both organizations and individuals to manipulate and study large data sets visually in order to grapple with increasingly complex social, economic and environmental problems and:

- has a user base of **over one million users worldwide**
- is used by government agencies and NGOs in over **200 countries**
- is currently used by **82% of the world's cities** (Dangermond, Nov. 2007).
- holds **over 40% of the global market share** for digital mapping/geographic information systems
- is **widely adopted by the federal, state, and regional governments in the United States**, including:
  - most US federal agencies and national mapping agencies,
  - all 50 US state health departments,
  - state, regional, and local governments,
  - transportation agencies and
  - public utilities
- is **the industry standard for mapping by most commercial and nonprofit enterprises**, including:
  - forestry companies,
  - schools and universities,
  - many commercial business that use or analyze location information to conduct business
  - many nonprofit organizations, who work to make change across a broad range of public health, environmental, political action, and human services.

## More Information?

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