

When is a weed a *weed*? Some critics of the Exotic Pest Plant Councils allege that the term "invasive" is a subjective, baseless term used to bolster weed management programs. Anyone who's ever walked through a melaleuca forest knows better. As the issue of invasive exotic plants gains more support and attention, we are bound to be met with naysayers who deem the cause unworthy and unnecessary.

Granted, the scientific literature devoted to ecological impacts of environmental weeds is not overwhelming. It pales in comparison to the amount of work that has been done for agricultural weeds, for example. But the nature of

the problem of invasive plants in natural areas often forces weed scientists into "triage research." Once a plant is detected and observed spreading in a natural area, it is often not possible or practical to conduct long-term research into the ecological effects of the species. There are exceptions, of course and we should encourage as many ecological studies as possible.

Dan Austin's article, "Caesar's Weed – An invasive exotic, or a Florida native?" (p. 13) walks us through the process by which a botanist deems a plant "invasive." It's based on professional judgement and the best available information. As Dan Ward (esteemed retired botanist, University of Florida) once said, "Invasiveness is like pornography, I know it when I see it!" Good enough for me. –Amy Ferriter

# Botanical Gardens, Arboreta, and Invasive Exotic Plants

By: Johnny Randall

Humans have a propensity for altering their environment in order to have easy access to various natural resources. The desire for ready access to food and medicinal plants ushered in agricultural and horticultural practices over 10,000 years ago. (Were not community gardens the first convenience and drug stores?) It is also reasonable to believe that positioning shade trees around a dwelling was practiced by early pre-air-conditioned humans. Evidence that early humans also appreciated the beauty of flowering plants exists by discovering wildflower remains in Cro Magnon cave burial sites. It is also generally known that early humans traded plants along with other commodities via long distance trade routes. Cultivating plants for beauty and pleasure, therefore, occurred at the cradle of humanity. The epitome of this affinity for growing plants solely for pleasure is surely the creation of botanical gardens and arboreta.

This article presents a brief history of botanical gardens and arboreta<sup>1</sup> (BG&A), how they have contributed

<sup>1</sup>For a more detailed account of the historical development of botanical gardens and arboreata, please refer to Moore, J.D., in Radford, A.E. et al., 1974, *Vascular Plant Systematics*, Harper & Row, New York, Chapter 32, pp. 775-790



Garden of Flowering Plant Families – This site in the North Carolina Botanical Garden shows flowering plant diversity and the evolutionary relationship among plant families. Numerous exotic plants are featured here, but only if they have not been identified as "invasive" within the southeastern United States.

and continue to contribute to the invasive exotic plant problem, and the steps that many gardens are taking to help solve the invasive exotic species problem through education and plant holdings evaluation. I use my own institution, the North Carolina Botanical Garden (NCBG) of the University of North Carolina at Chapel Hill, as the primary example of a conservation aware garden, although many other botanical gardens have equally aggressive conservation programs.

Determining *what* constitutes a botanical garden or arboretum and *when* the first one(s) occurred is problematic since these can range from a home-tended patch of pokeweed to the manicured displays of Longwood Gardens in Kennett Square, Pennsylvania. Botanical gardens and arboreta, according to at least one reference, have been around since Eden, "in the beginning." The first record of an intentionally cultivated collection of plants dates back to circa 3600 BC and the Pen ts'ao Garden of China (Hill 1915). Gardens of herbs, vegetables, and ornamentals were also common in ancient Egypt and Mesopotamia. The garden of the

"father of botany," Theophrastus (circa 300 BC), was a true botanical garden created for science and education (Hill 1915). And following this were the Roman gardens (of the first century AD) and the Monastic Gardens of the late eighth century (that are still used as a model for modern herb gardens, including the Mercer Reeves Hubbard Herb Garden at the NCBG).

What we now consider as modern BG&A date back to Luca Ghini (1490-1556), who designed the Italian gardens associated with universities in Bologna, Pisa, Padua, and Florence (Hill 1915). These gardens inspired other Europeans to include BG&A at their own universities, a tradition that continues today. These university gardens contained collections of indigenous European species from primarily southern and southeastern Europe and the Mediterranean, that were often container grown. This European Period lasted up until approximately 1560.

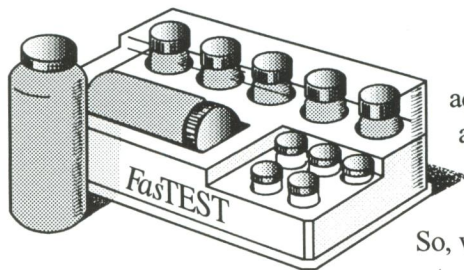
Carolus Clusius, garden director at Vienna and Leiden (The Netherlands), ushered in the Near East Period (ca. 1560-1620) that emphasized plants

from southeastern Europe and adjacent Asia. This could also be called the *bulb period* because of the popularization of tulips, hyacinths, and lilies (Stafleu 1969; this is also the reference for the following information on BG&A until 1818).

French exploration of Canada and the English exploration of "Virginia" (essentially the Mid-Atlantic US) began the Period of Canadian and Virginian herbaceous plants (ca. 1620-1687). The French Jardin du Roi/Jardin des Plantes was developed with North American introductions of arborvitae, sumac, poison ivy (*why?*), black locust, black-eye-susan, dutchman's britches, and goldenrods. It is interesting to note that our black locust (*Robinia pseudo-acacia*) is a serious invasive exotic in much of Europe, and our Eastern US native, Canada goldenrod (*Solidago canadensis*), is presently the scourge of Japanese wetlands.

The Cape Period (ca. 1687-1772) began after the Dutch exploration of South Africa and India, and required the construction of glasshouses in the gardens of Leiden and Amsterdam. (Linnaeus' position at Leiden, and later

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Upsalla, during this period certainly influenced these events.)

The Period of North American Native Trees and Shrubs (ca. 1687-1772) was characterized by the advent of an open landscape style (perhaps an outgrowth from incipient colonial independence) quite contrary to the traditional rectangular Monastic gardens. Englishman Peter Collinson's correspondences with Philadelphia's John Bartram led to a stream of North American introductions to the English gardens of Oxford, Chelsea and Kew.

The Australian Period (ca. 1772-1820) was influenced by the botanist, Sir Joseph Banks, the first Director at Kew Gardens, who accompanied Captain Cook on his maiden voyage to Australia. This and subsequent trips led to the introduction of many southern hemisphere species to England and the further establishment of botanical gardens in the British colonies.

The American Gardens started with the aforementioned garden of John Bartram in ca. 1731. Soon to follow were the larger institutional gardens of the Missouri Botanical Garden, New York Botanical Garden, and Harvard University's Arnold Arboretum. Not until after 1920, however, did BG&A become familiar sites in the United States. It is now difficult to find a college or university that *doesn't* have a botanical garden or arboretum.

This brief history illustrates the extent of the influence that BG&A have had on plant importations. The process of moving plants around to sites that they would not ordinarily find on their own has occurred for at least as long as humans began agricultural practices. It was not, however, un-

til inter-continental exploration and European colonization, that invasive exotics were first noted. Charles Darwin comments on the ecological consequences of invasive exotic plant species during his travels on the H.M.S. Beagle in the mid 1830s, and states in *On the Origin of Species* (1859, Chapter 3, page 64) that:

"...cases could be given of introduced plants which have become common throughout whole islands in a period of less than ten years. Several of the plants now most numerous over the wide plains of La Plata, clothing square leagues of surface almost to the exclusion of all other plants, have been introduced from Europe....In such cases the geometrical ratio of increase, the result of which never fails to be surprising, simply explains the extraordinarily rapid increase and wide diffusion of naturalized productions in their new homes."

And continues on page 78, that:

"...when a plant or animal is placed in a new country amongst new competitors, though the climate may be exactly the same as in its former home, yet the conditions of its life will generally be changed in an essential manner."

Darwin also pointed out that these species' eruptions occurred because the exotics do not generally have the competitor, predator, or pathogen load typically associated with indigenous species. Darwin deserves much credit for this observation since it is the general line given by today's ecologists for why certain exotics are invasive.

Darwin's prophetic observations did not change the course of exploration and introduction or alter the prime directives of BG&A: bring strange, wonderful, and *exotic* plants to home institutions and if suitable, ultimately introduce these into the public landscape. Sometimes this required glasshouses, but often times a suitable spot in the garden was possible. And in the best (*worst?*) of circumstances this exotic plant material might become naturalized — the phenomenon of "getting around," according to Frank Egler (1983) — adapting to the local conditions to the extent that survival and reproduction was not dependent upon human hands. A small percentage of these naturalized taxa *got around* so well that they jumped the fence, as it were, and took up residence outside the garden. Most of these waifs were, nevertheless, relegated to roadsides, abandoned agricultural fields, and other human disturbed sites. Of these taxa, an even smaller percentage found their way into natural communities.

The vast majority of our most serious invasive exotics in the southeast (excluding sub-tropical FL) were introduced during the Period of Japanese and Chinese Plants (1820-1930) (Stern 1971). Many of these introductions are "sister species," closely related taxa that are now geographically



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isolated, that occupy "matched communities in their respective continents" (Pilou 1979). In fact, many BG&A (including our own Coker Arboretum) prominently display North American natives with their Asian relatives. Many of these taxa are even interfertile (e.g., Tulip poplars: *Liriodendron tulipifera* and *L. chinense*, Catalpas: *Catalpa bignonioides* and *C. ovata*, and Sweetgums: *Liquidambar styraciflua* and *L. formosana*).

The ornamental horticulture industry in North America began with the fruit tree nursery in the Massachusetts Bay Colony around 1648 (Arena 1998).

By the turn of the century the ornamental horticulture industry was in high gear, producing roses, peonies, clematis, and other hardy woody ornamentals. The careless importation of foreign pests and diseases followed shortly thereafter: the Gypsy Moth in 1869 (a deliberate introduction), Chestnut Blight in 1904, and Dutch Elm Disease in 1930. (It is worth pointing out that the importation of nursery stock containing foreign soil introduced European and Asian earthworms to North America who are now displacing many of our native earthworm species. For more information on this ex-

otic pest see: *Earthworm Ecology and Biogeography in North America*, 1995, by Paul J. Hendrix.)

A close relationship currently exists between BG&A and the nursery industry in that much of the plant material carried by the nursery industry comes directly from cuttings and seeds gathered from BG&A collections. BG&A therefore have a tremendous responsibility for evaluating these collections for potentially invasive exotic plants. According to Reichard (1997) 80-85% of the North American woody invasives were originally introduced as ornamentals. In fact, it was David Fairchild who introduced kudzu (*Pueraria montana*) to the US as an ornamental woody vine (Orr, personal communication)! Moreover, virtually no BG&A yet engage in risk assessment analyses.

The American Association of Botanical Gardens and Arboreta (AABGA) *Plant Collections Directory* (Piacentini 1998) provides information on 170 institutional collections and personnel management data. I was particularly struck by the institutional purpose information. Generally speaking, there were two Institutional Purpose camps: the conservation and education minded gardens, and the display and ornamental introduction gardens. Below are examples of each camp's philosophy (using our garden for the former):

*The North Carolina Botanical Garden is a center for the study, conservation, interpretation, and display of plant diversity and for public education about the importance of plant diversity to human society. Its mission is to support the instructional and research programs of the University of North Carolina-Chapel Hill, to enhance the knowledge and appreciation of plants through a wide range of public service and interpretive programs, to present an attractive display of plants, and to work for the conservation of biological diversity.*

In contrast, the mission statement from a best-left-anonymous garden reads:

*Collect, evaluate, and encourage commercial production and use of a wider range of ornamental plants in the nursery/landscape industry.*

Conservation and education minded gardens, however, outnumber the latter.

## Southeast Exotic Pest Plant Council President's Message

By: Dan Brown, SE-EPPC  
President

We had an excellent first Board meeting at the Arboretum in Asheville, July 15-16. Thanks to all the 18 board members and five guests for attending, and thanks to those who made the arrangements. The Arboretum is a great place for a meeting.

Some of the many highlights of the meeting were:

We're happy to have Florida as a member of SE-EPPC. They're a great bunch of folks with years of solid and valuable experience relating to invasive exotics. Board members are Dan Thayer, Tony Pernas and Amy Ferriter. Welcome Florida!

Tennessee EPPC Board members agreed to contribute 50% of the profits from the 1999 Symposium in Oak Ridge to the SE-EPPC treasury. That's about \$1350 for SE-EPPC. Thanks Tennessee.

Guests Larry Fowler and Bob Eplee, with USDA / APHIS, gave us an extensive description of the Executive Order 13122 on Invasive Species, and the related National Council and Advisory Councils. We want to be represented on at least one of the Advisory Councils. Brian Bowen and others are pursuing

this. Another guest, Bill Hoffard with USDA Forest Service, Forest Health Protection (FHP) in Asheville, discussed the availability of incidence, and possibility trend, information on six major invasive exotic plants in five southeastern states. Bill, and Noel Cost with the USDA-FS Research Station in Asheville, have agreed to work with SE-EPPC to develop and print this information in map form. FHP will also cover the printing cost.

We've made major progress toward revising the TN Exotic Plant Management Manual as a SE-EPPC publication (a color publication covering about 50 species of invasive exotics). Kerry Britton, USDA-FS Research in Athens, GA is contributing \$10,000 toward the revision. Nick Simon, president of Publishers Printing in Shepherdsville, KY, has offered to print the publication at cost. Several Board members are attempting to raise the additional \$20,000 needed. Prospects are looking good!

And while we're talking about publications...congratulations to TN-EPPC on winning the Conversation Award for their three area brochures entitled; "Landscaping with Native Species". We need a lot of this kind of positive exposure.



The North Carolina Botanical Garden is in the process of eradicating English Ivy (*Hedra helix*) from the Coker Arboretum. Here you can see the dead vine on a large hackberry (*Celtis occidentalis*). English ivy is a serious invasive in the Chapel Hill area where seedlings are a regular occurrence in undisturbed areas.

Even conservation gardens may, however, participate in practices that can inadvertently lead to the release of potential or actual invasive exotics.

It is critical that an organization like the AABGA take the lead in slowing (or *preventing*) the flow of untested plant material to the public directly or to the nursery industry. This leadership is particularly important given the current plant exploration surge that is occurring primarily in Japan, Korea, and China. The AABGA, in cooperation with a host of BG&A and the nursery and landscape industries, addressed this current initiative by organizing the March, 1999 conference at the Chicago Botanic Garden entitled: *Plant Exploration: Protocols for the Present, Concerns for the Future*.

The AABGA is beginning to encourage BG&A to become more environmentally responsible, and a genuine sense of accountability seems to be emerging. This organization is hugely influential, with over 2,700 members, 480 of which are institutions. Conservation topics now share equal space in the *Public Garden* (the journal of the AABGA) with more "typical" articles. The April 1999 issue, for example, in-

cludes *Solving the Invasive Plant Problem* and *Ordering Away Invasives* by AABGA Executive Director Nancy Morin, and *A Method for Evaluating Plant Invasiveness* by Sara Reichard. Prior to these were the articles: *A Bill Falls Due: Botanical Gardens and Exotic Species Problem* (White 1997), and *Understanding Ecological Science to Understand the Spread of Exotic Species* (Donnell and Roy 1997).

Our director, Peter White, in a recent forum on invasive exotics at the July 1999 AABGA Annual Conference in Vancouver, posted the following manifesto and challenge to other BG&A:

*Do no harm to plant diversity and natural areas:*

- 1) *Perform risk assessment for introductions*
- 2) *Remove invasives from plant collections*
- 3) *Control invasives in natural areas*
- 4) *Develop non-invasive and native alternative plant material*
- 5) *Do not distribute plants and seeds that will be invasive elsewhere*
- 6) *Educate the public*
- 7) *Become partners with conservation organizations.*

Upcoming *Public Garden* issues will include articles on the NCBG and the Southeast-EPPC, and on our policy on exotic plant holdings. Included below are excerpts from both:

The North Carolina Botanical Garden was founded on conservation principles and continues in this tradition across various fronts. One particular conservation effort is to help prevent what is commonly called *biological pollution*. Some of the steps that we have taken to help prevent the biological pollution by plants include the following: 1) restricting seed distribution to the 12 states within the southeastern United States in order to prevent our natives from becoming someone else's invasive exotics, and to prevent the possible genetic pollution caused from southeastern genotypes interbreeding with their conspecific relatives in other regions, 2) installing an Exotic Plant Holdings Policy that forces us to scrutinize future accessions and re-evaluate current collections, and 3) creating educational materials on "plants to avoid," as well as recom-

mendations of native and *non-invasive* exotic landscape plants (that have passed a risk assessment evaluation).

The latest NCBG initiative on this broadly consequential subject was to organize and host an Exotic Pest Plant Conference (in February, 1999) where over 80 representatives from state and federal agencies, the plant nursery industry, public and private botanical gardens and arboreta, and conservation groups met to hear presentations, participate in a general discussion, and establish the North Carolina Chapter of the Southeastern Exotic Pest Plant Council (SE-EPPC/NC). A subsequent meeting this past June established a founding board of directors with representatives from the above mentioned stakeholders. The mission of the SE-EPPC/NC matches that of the EPPCs in general except that we seek to protect both natural and *managed* ecosystems from the harmful effects of invasive exotic plants.

A primary mission of the North Carolina Botanical Garden is "to participate in and promote the conservation of biological diversity." In accordance with this mission statement, our policy with regard to exotic plant species at the North Carolina Botanical Garden is to:

- possess plant collections that do not harm natural areas and the native plant diversity of North Carolina and the Southeast
- protect and restore our Garden's highest quality natural areas by eradicating invasive exotic species
- interpret and promote the natural diversity of North Carolina and the Southeast
- promote the preservation of native biodiversity

The year 2000 AABGA Annual Conference, billed as the first ever World Botanic Gardens Congress, at The North Carolina Arboretum in Asheville (June 25-30), will be integrated with the Center for Plant Conservation Annual Meeting and the 6<sup>th</sup> International Botanic Gardens Conservation Congress. The SE-EPPC is also planning to organize a symposium at this international meeting.

The invasive exotic plant issue has also caused a flurry of activity in nursery trade journals, conservation maga-

zines, and the popular gardening press. A sample of titles include: *Invasives Roundtable* (Ellis et al. 1999. American Nurseryman), *Alien Invasion* (Mirsky 1999. Audubon), *Out of the Garden and Out of Control* (Meier 1999. Fine Gardening). These articles suggest that the invasive exotic plant issue is gaining recognition in the public sector and nursery industry.

Human nature will continue to compel us to alter our anthropogenically-crafted landscapes and to seek plant material for these endeavors. Botanical gardens and arboreta can largely influence incipient plant species invasions by becoming more accountable for their own collections, taking more responsibility for public education, providing the nursery industry with plant material that has passed a risk assessment analysis and/or collaborating with them to produce ecologically safe plant material. Many BG&A already focus on conservation activities by protecting endangered and threatened species, propagating rare plants for restoration projects, and managing natural areas. Helping to protect managed and natural ecosystems from bio-



The Coker Arboretum is replacing the Asian wisteria (*Wisteria sinensis*) with the southeast native wisteria cultivar (*W. frutescens* 'amethyst falls'), shown above.

logical pollution is a vital next step. My wish is that botanical garden and arboreta historians will designate the 21<sup>st</sup> century as the Period of Environmental Enlightenment.

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## References

- Arena, M. 1998. The history of ornamental horticulture. *Nursery Notes* 32(5):97-99.
- Darwin, C. 1859. *The Origin of Species*. John Murray, London.
- Egler, F. E. 1983. *The Nature of Naturalization II*. Claude E. Phillips Herbarium, Dept. of Agriculture and Natural Resources, Delaware State College, Publication No. 6.
- Hill, A. W. 1915. The history and function of botanic gardens. *Annals of the Missouri Botanical Garden* 2:185-223.
- Moore, J. K., in Radford, A. E. et al., 1974, *Vascular Plant Systematics*, Harper & Row, New York, Chapter 32, pp. 775-790.
- Piacentini, R. V., ed. 1998. *Plant Collections Directory*. Association of Botanical Gardens and Arboreta, Inc., Kennett Square, PA.
- Pilou, E. C. 1979. *Biogeography*. John Wiley & Sons, New York.
- Reichard, S. H. 1997. Learning from the past. *Public Garden* 12(2):25-27.
- Stafleu, F. A. 1969. Botanical gardens before 1818. *Biossiera* 14:31-46.
- Stern, W. T. 1971. Sources about botanic gardens and herbaria. *Biological Journal of the Linnean Society* 3(3):225-233.

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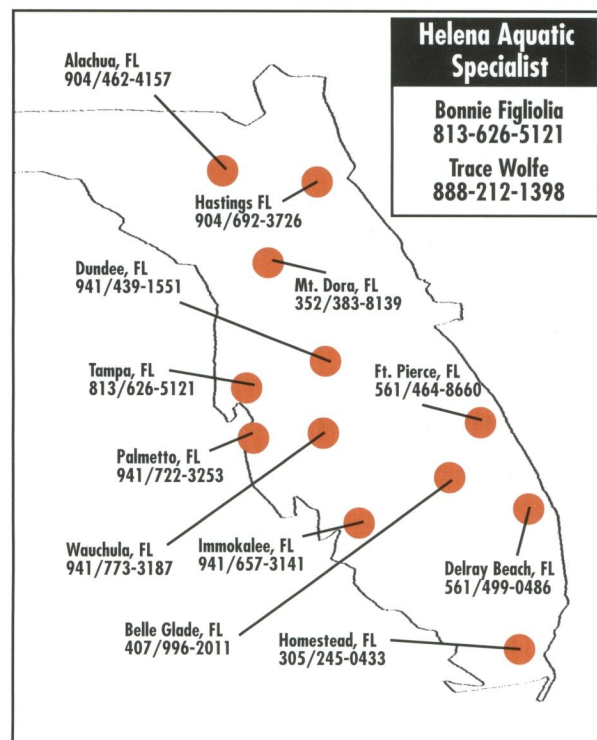
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