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Re-Evaluation and Improvement of the Woodland Garden Around the Widener Education Building

Kem-ok Kim

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Re-Evaluation and Improvement of the Woodland Garden Around the Widener Education Building
Title: Re-Evaluation and Improvement of the Woodland Garden Around the Widener Education Building

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Date: April 2005

Abstract:

The Woodland Garden around the Widener Education Building consists mostly of herbaceous plants that are native to Asia and North America. The original idea for this planting was to create a “trial” garden to evaluate these plants in a garden setting. As time passed, the herbaceous plantings of the Woodland Garden have changed. Some plants died or did not grow well for a variety of reasons. This situation has been a problem in the Woodland Garden.

It is possible to find the reason why some plants failed in the Woodland Garden by investigating basic environmental factors. Soil, location, water, etc. are important factors for garden plants. The problem is that plants cannot withstand changes to these factors even if the plant has been growing vigorously. Investigating the reason why some herbaceous plants in the Woodland Garden have disappeared will help to identify the type of plant that will grow well there and make this garden a valuable and attractive part of the Arboretum.
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THE IMPORTANCE OF THE WOODLAND GARDEN AROUND THE WIDENER EDUCATION BUILDING

Most visitors who come to the Morris Arboretum stop in or walk through the Widener Education Building. This is because it is the main entrance where visitors go to get information about the Morris Arboretum. Also, it can be a resting space for visitors.

The herbaceous plants of the Woodland Garden show people the unique characteristics of Asian and native North American herbaceous plants. It is important that this garden looks nice at all times and shows visitors the beauty of herbaceous plants. This can leave visitors with a good impression of the Morris Arboretum.

Presently, the Woodland Garden is not as beautiful as it could be. This is because many plants were planted in the original planting scheme, but not all have survived. Some of the survivors are not growing well. Problems frequently encountered in the Woodland Garden are plant disease, animal browsing, inadequate light and soil depth, and removal (stealing) of plants by humans. Some of these factors can change according to where the plant is placed or how much tolerance it has for tough conditions.

GENERAL PROBLEMS FOR GARDENS CONTAINING HERBACEOUS PLANTS

Many gardeners choose herbaceous plants for their gardens because of their advantages. But many gardens fail because they experience the disadvantages of herbaceous plants. The advantages are: 1) fast growing ground cover, 2) diverse genera, 3) diverse visual beauty according to the season, and 4) vigorous and speedy growth. The disadvantages are: 1) the numerous seeds are messy, 2) frequent and difficult upkeep, and 3) sensitive reaction to changes in environment.

When gardeners want to use herbaceous plants, they often confront three types of problems when the herbaceous plants settle in the garden, depending on how the plants adapt themselves to the circumstances. Of course, a general problem is that the plants can change according to the kind of environmental factors present. The first problem is that it is hard to control some garden plants because they have grown too well or too big, or they have become weedy because of rampant self-sowing. This is both a weakness as well as strength of herbaceous plants. Second, they may have done poorly due to environmental factors. It is possible that the environment was its own problem or the plant was in the wrong place. Finally, they may not survive at all. One reason is wild animals eat them or they cannot adapt to the soil, light, moisture of the immediate environment.
RE-EVALUATION IN THE WOODLAND GARDEN

Environmental Factors Affecting Plant Life in the Woodland Garden

Alkaline Soil
The site of the Woodland Garden broken down into 7 areas and soil tests were done in each one. A soil sample was taken on January 7, 2005 and sent to Penn State Agricultural Analytical Services Laboratory to be analyzed. There is not a big difference between the 7 soil samples. A characteristic of all samples is a high alkaline level with all areas having a pH above 7.3.

<table>
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<th>Common classes of soil</th>
<th>pH</th>
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<tr>
<td>Extremely acid</td>
<td>3.5-4.4</td>
</tr>
<tr>
<td>Very strongly acid</td>
<td>4.5-5.0</td>
</tr>
<tr>
<td>Strongly acid</td>
<td>5.1-5.5</td>
</tr>
<tr>
<td>Moderately acid</td>
<td>5.6-6.0</td>
</tr>
<tr>
<td>Slightly acid</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>Neutral</td>
<td>6.6-7.3</td>
</tr>
<tr>
<td>Slightly alkaline</td>
<td>7.4-7.8</td>
</tr>
<tr>
<td>Moderately alkaline</td>
<td>7.9-8.4</td>
</tr>
<tr>
<td>Strongly alkaline</td>
<td>8.5-9.0</td>
</tr>
</tbody>
</table>

In general, Penn State recommended a pH of 6.5 for landscape plants.

It is possible to estimate why the alkaline level of the soil is so high. According to the soil test, the sample included a lot of calcium. Calcium, or calcium and magnesium together, are only slightly soluble, and are the cause of most soil alkalinity. A limestone ridge that runs through the hill, creating the high calcium soils causes this. Lime is usually added to acid soils to increase soil pH. The addition of lime not only replaces hydrogen ions and raises soil pH, thereby eliminating most major problems associated with acid soils but it also provides two nutrients, calcium and magnesium to the soil. The underlying rock found in the Woodland Garden is composed of limestone and that causes the high calcium soils. Lime also makes phosphorus that is added to the soil. This aids plant growth and increases the availability of nitrogen by hastening the decomposition of organic matter. Liming materials are relatively inexpensive, comparatively mild to handle and leave no objectionable residues in the soil.

The Arboretum staff suspects that the woodland was used for a time as a garbage dump. Primarily ashes from fireplaces in both the Mansion and the Carriage House were dumped here, or perhaps pits for burning trash were located in the woods. In any event there are layers of ash throughout the Woodland soil profile. If you dig in the soil now, you can find trash or bottles or various broken shards of pottery. The ashes have high alkalinity, so this is a possible reason for the high pH level of the soil. According to some hypotheses, areas with alkaline soil often have alkaline irrigation water, too. If so, the soil will become more alkaline over time.
Following the result of the soil test, lowering pH levels in the soil is one of the important recommendations for improving the vigor of the plants in this garden. Although most plants grow well in slightly alkaline soils, with a pH level slightly above the neutral point of 7.0, only a few will thrive in a soil that is very alkaline, with a pH of 7.5 or above. At higher PH levels (8.0 or more), the plant nutrients iron and manganese become unavailable to plants because they are transformed into insoluble forms.

See Appendix B. Soil test results

**Sunlight and lack of rain**
The big trees in the Widener Woodland keep the sun off this area and that is not good for shrubs or other perennials. Partial shade under the big tree is good for the some but not all plants. Even if the plants can withstand shade, every plant needs a minimum amount of sunlight. The Widener Woodland is full shade. One more problem is that in the summer, tree canopies grow so thick with leaves that they keep rain as well as sun off of the plants underneath them. So even after rain, there is no moisture under the tree. The tree is just like an umbrella.

**Perched water tables**
Perched water tables are layers of saturated soil that form at elevated positions in a soil in association with abrupt changes in soil texture, from a region with finer texture (higher up) to a region of coarser texture (lower soil position). In such cases, the water capillary in each soil region is generally not continuous with that of the adjacent region, creating a hydraulic disconnect. At the base of the finer textured soil, the water tends to be held tightly by capillary forces (adhesion to the soil particles). The continued downward movement of this water into the lower, coarser textured soil layer requires the accumulation of sufficient gravitational water at the base of the finer textured layer to generate a positive pressure sufficient to overcome the tension holding the capillary water.

**Soil depth is variable**
Different parts of the woodland have different soil depths. Some places have a very thin soil layer and some places have a very thick soil layer. Some plants can survive on a thin soil layer. A thin particle layer on top of the bedrock layer can cause very fast drying of the soil and this will stress plants. It is difficult to predict how close the bedrock is under the soil and how deep the soil is in all places. It can be said that the woodlands in general has a very limited amount of soil volume. Therefore all of the plants in this area are competing for food, light and moisture in a limited growing medium. Even if the same species of plant were planted at the same time, some plants may die and some plants may grow very well.
Problem of human behavior in the Woodland Garden

Plant stealing
Some visitors who have no compassion or respect for the Morris Arboretum or have a lot of greed for plants sometimes make a mistake and remove plants from the garden. This happens not only at the Morris Arboretum but many Arboreta and botanical gardens suffer from this problem. Even if the staff reports the person who steals the plant that is only a temporary relief.

IMPROVEMENTS TO THE WOODLAND GARDEN

Alkaline Soil Improvement
According to which plant is chosen, plants can live in both alkaline and acid soil. A major problem in alkaline soils is the reduced nutrient availability--especially micronutrients. This lack of nutrients is bad for almost all plants chosen for the Widener Woodland. This site requires soil of pH 6.5 for landscape plants as recommended by Penn State. This is the average soil pH for landscape plants and it is a common standard for garden plants in general. A characteristic of all samples from the Woodland is an alkaline pH above 7.3. Here are some proposals on how to lower the pH level.

Alkaline soil is soil with a pH higher than 7.0. It is also sometimes called sweet or basic soil. Calcium, or calcium and magnesium together, are only slightly soluble, and are the causes of most soil alkalinity. Alkaline soils are common in areas where the base rock is limestone (calcium carbonate), or in arid regions, where calcium is not washed out of the soil. Regions that receive less than 20 inches of rain a year usually have alkaline soil.

The following step would help lower pH level.

Soil PH is made lower (more acidic) or less alkaline by adding sulfur. This may be added in different forms: sulfurous acid (which has a quick reaction), powdered elemental sulfur, ferrous sulfate, or aluminum sulfate. All forms are changed into sulfuric acid by soil bacteria. Soil bacteria take 6 to 8 weeks to change the sulfur to sulfuric acid. You should wait that long before re-testing the soil. As with all bacterial activity, the reaction goes faster in warm, moist soil and slower in dry or cold soils. During the last couple of years, the sulfur was applied during the winter (from November to December) every year. But in this season, it is difficult to get the natural moisture from snow or rain. Also it is cold, which means that it is difficult for the sulfur bacteria to react with the sulfur. In the case of the woodland, it would be helpful to promote bacterial activity and make sulfuric acid so that it spreads the sulfur during the warm season. Regular watering will also keep the moisture in the soil, which helps with the bacterial activity.

Soil can also be made more acidic by adding large amounts of peat moss, which is very acidic (PH of 3.0 to 4.5). Peat moss is quite expensive, so this isn’t practical for large-scale use, but is suitable for making acid potting mixes and to backfill around acid-loving plants like azaleas and rhododendrons. Instead of peat moss, you can use pine straw or pine bark mulch. This works much like peat moss. Pine straw is actually a leaf (needle) and thus benefits the landscape in much the same way as decomposing leaves benefit the
forest floor by recycling nutrients and maintaining soil organic matter. Pine needles were used by Kate Deregibus as a mulch when she managed this section. The effectiveness of it can be seen in the good condition of the Rhododendron. One thing to be careful about when using pine needles and sulfur is the order in which they are used. Sulfur should be spread first and then it should be covered with the pine straw. If the opposite is done and the sulfur is spread on the pine straw, the pine straw will change color and become gray. The changing color isn’t exactly harmful it just doesn’t look so good.

Pruning for sunlight, rainfall
The Woodland Garden area has many big trees with a lot of large branches. When the leaves come out, this area does not get much sunlight or rainfall through the tree canopy because of the dense leaves. Pruning not only makes enough room for development of trees but also makes a path for sunlight and rainfall, which the plants and soil under the trees need.

Layering
A perched water tables is the result of 1) the layering of mineral soils over gravel and 2) the layering of organic soils (top soils) over mineral soils. It would help to install a pipe in the gravel. The pipe would transfer the air under the soil. This may have been done already but the humus soil and small particles of mulching may have filled up the pipe.

Mulching
Mulching would maintain the moisture contained in the soil and also keep the soil in place. Otherwise, when a localized torrential downpour occurs, the surface soil erodes. Small particle mulch is now used, but bigger particle mulching would reduce the impact strength of rainfall and retain surface soil and moisture. Also, bigger particle mulch will not fill up the aeration pipe if the particles are bigger than pipe’s holes.

THE GOAL FOR LONG-TERM MAINTENANCE OF THE WOODLAND GARDEN SITE

The Widener Woodland garden site was once a location for the Japanese Tea House. At one point it became a location for Arboretum garbage. We believe that most of the garbage came from the Mansion, Carriage House or other areas of the Arboretum. If you dig in the soil now, you can find ash and some trash, bottles that are mostly small chemicals bottles. The available soil depth for plants is variable. Basically, under this area is limestone rock. As a result the soil in this area is quite thin. Also the area is very shaded and dry because of the canopy created by the big trees. Even plants that are vigorous growers cannot withstand the manmade and environmental stresses found in this area. For these reasons, this area became a trial garden where plants are grown and evaluated. If a plant can take the difficult conditions of the Woodland Garden, then it might be a good plant to grow. Many plants that were initially used were plants that were unknowns in the Arboretum. It was not understood if they would be good garden plants, terrible weeds, or sickly plants that would whither away. After many years of “trial” it is time to make the decision as to which plants are worth keeping, and which plants are to
be eliminated. In addition, it is now time to attempt to grow more plants than just the wild-collected herbaceous plants that were first planted in this garden. Now that we know more about the environmental factors in this area, we can make informed choices as to how to maintain this area, and which plants are best suited for it.

It is more important to improve the environment factors for long-term maintenance first. This will make the Woodland Garden easier to maintain. A plan for long-term maintenance should include: 1) Keep trying the soil improvements 2) Choose plants that are good for Alkaline soil and water stress 3) Prune branches of big trees to help care for lower layer plants.

**CONCLUSION**

Some gardens have good growing conditions to start with so they can be planted easily without big problems. But the Woodland Garden is not that case. Here, the need is to improve the garden conditions gradually. This will help create a beautiful woodland garden-- as good as natural woods. The effort to improve this environment and choose the right plants for the right place will help make the Woodland Garden a more beautiful garden.
APPENDIX A

FACTORS THAT INFLUENCE PLANT GROWTH

Disease- fungus

*Arisaema amurense*: Purchased from Seneca Hills Perennials, planted 1996. 6. 4. and removed in 2000 because of rust problem. (Accession# : 95-248*A)

*Arisaema sikokianum*: Same problem (Accession# : 94-378*A)

These plants usually bear long flowers with a hood (known as the spathe) surrounding a thick central column (the spadix). Spring or early summer blooms are followed by red berries in late summer in zones 3-9. Plant these woodland wildflowers in moist, humus-rich soil. Most Arisaema plants, except some species, like these conditions. Arisaema is not subject to many diseases or insect problems. There is one disease, however. Native populations of A. triphyllum are sometimes infected with a rust fungus, *Uromyces ari-triphylli* that shows up as orange spots on the undersides of the leaves, spathe, and stem. There is no known cure for this. There were 16 kinds of Arisaema, including Asian variety, in this the Woodland Garden. The Arisaema planted in 1995 disappeared 2004 except for two species. The two species were removed in 2000 because of rust fungus. Before removal the rust fungus in the area had already spread to the nearby Arisaema via rainfall so it will kill the other Arisaema. If the problem appears in the plant, just discard the tuber to prevent the spread.

Plant eating animals: rabbits, critters

*Actaea asiatica*: It was collected from expedition to Beijing in 1994 and planted in 1999. 5. 1 but it disappeared in 2000. Animals ate it (rabbits?) soon after planting. (Accession# 94-629*A)

*Actaea asiatica* grows in the shaded, moist ravines in its native South Korea and Japan. It has small mounds of alternately compound foliage and exquisite shiny black fruit held on thick, pinkish red pedicels; a white-fruited variant has also been reported. All Actaea species are hardy to zones 4-10. High heat and humidity, as is found in the South, may be a stumbling block in cultivation. Few ornamental plants can tolerate dank shade and still thrive like Actaea can, though that is not to say that baneberries are dependent on such low light to thrive---they happily blossom and fruit in full-sun if given adequate moisture. They perform best in a rich edaphic environment of humus soils and plenty of moisture.

Full shade

*Bletilla ochracea*: It was collected from U.S. National Arboretum, Washington, DC, and planted in 1996.6.4 then disappeared in 1999. (Accession# 96-136*A)

The *Bletilla ochracea* is an erect perennial with arching sword-shaped leaves and several pale yellow flowers on slender stem. Found in Vietnam and Yunnan Province in China around roads at elevations around 800 meters among short grasses that shade the pseudobulbs. The following text is from Dr. Clark Riley:
This *Bletilla ochracea* is an exchange plant from the National Arboretum. The parents were collected in Yunnan province of China. It has proven extremely hardy throughout the east coast of the U.S. *Bletilla ochracea* have shown itself to be very tolerant of heavy blizzards in the winter and extreme heat in the summer and does not appear to be affected by any diseases. As with *Bletillas striata* and *B. formosanum*, the inflorescence arises from the center of the leaves. In full sun, the plant is shorter and the flowers have a deep red under side. In shade, the plants are more graceful with mustard-yellow flowers.

Growing an orchid is difficult because of the maintenance of light and moisture. Most orchids grow in shaded, moist, and humus soil in the wild. When people cultivate orchids in the garden, they should provide the same conditions. I have experience in cultivating a similar species in the garden. There are similar species in Korea called *Bletilla striata*, which was discovered in a somewhat dry area with partial to full sun and well drained soil. To cultivate this species, place the young plant in full to partial shade. When the plant is mature it can be placed in partial to full sun. Previously, when I planted this orchid in shade, it died after one year. But the plant in full sun was growing well. At that time, my idea was that mostly the orchid should be placed in full or partial shade, but I realized that this species could do well in a sunny site.

The following text is from “Roy Lancaster Travels in China”:

“Where *Bletilla ochracea* was discovered the soil was stony, loose and naturally well-drained, with little in the way of organic matter.”

I am uncertain about the *Bletilla ochracea* and what kind of habitat they prefer, but I think the plant might prefer a habitat similar to *Bletilla striata*. When they were planted here the shade was not good for their growth and also might be a factor in their death.

*Pullsatila chinensis*

The *Pullsatila chinensis* was collected from WLPGR, USNA, Glenn Dale, MD in 1999.5.1. but unfortunately it disappeared in 2000. (Accession# 96-177*A)

This plant grows in sun to partial shade in China, Korea, and Siberia. The leaves are broadly ovate and tripartite. The whole plant has dense pilose. The flower blooms in spring and color is violet.

After the Korean War, *Pullsatila chinensis* was a very common perennial and was used as a disinfectant. It could be found anywhere in Korea. Although the mountains were bald from the war, time passed, and there is now a dense forest due to Korean policy and effort. As a result of environmental changes on the mountain, this plant was forced to adapt to the new environment of full shade. But it failed and the population decreased. A sun-loving plant like *Pulsatilla chinensis* died in the full shade. They were only found in sunny places, like those surrounding the tombs. That kind of case is a result of adapting to a transformed environment. A full shade or woodlands garden would be a very poor location for them.
Excessive Environment Factor

*Belamcanda chinensis*: It was collected from U.S. National Arboretum, Washington, DC and planted 1995.11.13. (Accession# : 92-030*A)

*Belamcanda chinensis*: It was collected from expedition to Hubei, China in 1994 and planted 1999.5.1. (Accession# : 94-417*A)

*Belamcanda chinensis*: It was collected from Xian Botanical Garden in China and planted 199.5.1. (Accession# : 98-088*A)

The *Belamcanda chinensis* is one of the most attractive perennials. The leaves are similar to an iris and the flower is somewhat like a lily. The flowers have 6 regular parts and bloom in late summer. The color is orange with a red dot. The fruit is a cluster of black seeds.

Mostly, they were discovered in rocky or dry areas and in full sun. It is a native plant of China, Japan, and Korea.

There are 3 types of *Belamcanda chinensis* that have been here. Their growth has been so good that it could be a defect sometimes. They grow extremely well in overly fertilized locations. They sometimes fall over because they are too tall or their fruit becomes too fat and heavy. On the other hand, there are shady places under the trees that are not good for very tall herbaceous plants like *Belamcanda chinensis*. This causes them to lose the aesthetic value in the garden. Sometimes, the gardener needs to control the fertility of the area to control the plant's appeal. If you give it too much of a good thing, it will become hard to control in your garden, even if you regularly divide it for replanting. The best way to control growth is to restrict its conditions. It can withstand partial shade but full sun is preferred, especially a wide flower border that is not overly fertile.

Wrong Place

*Astilbe chinensis*: It was from 1993 expedition to Heilongjiang and planted 1996. 6. 4. (Accession # : 93-323*A)

*Astilbe chinensis*: It was from 1993 expedition to Heilongjiang and planted 1996. 6. 4. (Accession# :93-323*B)

The English name is Chinese Astilbe. This plant likes full sun and soil should be moist. The height is 18” to 24”. It features pink and white flower that bloom in the summer. There were two plants of the same species planted at the same time at this site one of them died and one plant is still living. This is probably because each part of this area has a different soil depth. One plant was placed in a thin soil layer on top of the rock layer. As a result it loses moisture very fast and that may have stressed the plant root, especially *Astilbe chinensis* that is likes moist conditions.

On the other hand, the other plants of the same species have been growing well. Proper soil layer, moisture and shade created good conditions for the plant even the plant had same line placed at.
APPENDIX B

SOIL TEST RESULTS (7 PART FOR ONE PLACE)
APPENDIX C

PREVIOUS PLANT LIST OF THE WOODLAND GARDEN