Independent Study Report for the North Carolina Botanical Garden Certificate in Native Plant Studies Program

“Seed Propagation of Six Native Southeastern United States Wildflowers”

Prepared by Sandy Young & Paul Young

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INTRODUCTION

This report is for the Independent Study Project (ISP) which finalizes the learning experience of the team members for the North Carolina Botanical Garden (NCBG) Certificate in the Native Plant Studies Program.

The project deals with a key interest of the NCBG - the critical issue of native plant conservation through propagation. We investigate and report in this project some of the methods and issues related to plant propagation. The NCBG has earned a reputation as a location for seed storage for plants of Southeastern USA. This means that, if propagation techniques are standardized and well documented, native plants can become more readily available to the general public and there will be less pressure on wild plant harvesting.

A comment on this problem was made in the second addition of the North Carolina Native Plant Propagation Handbook, NC Wildflower Preservation Society …

“At the time of the original manual [of this society] many native species offered to the public were collected from wild populations, often with disastrous results. In many cases both the native populations and plants collected failed to survive this commercial assault. It was recognized that reducing the collecting pressure could help preserve the native populations. One way to do this was to develop propagation procedures that would allow plants to be produced in nursery conditions. This allows many more people to learn more about the cultivation requirements of unique native plants and to provide a plant supply and advice to the public.” [Ref #13]

There are several other types of plant propagation methods available that have their advantages and disadvantages. We will not report on these, other than to mention them:

- **Propagation by division** is conducted typically between the Fall and Spring. For some plants this division will often rejuvenate the plant. (Plant examples: White Wild Indigo, the Mallows and Blue-eyed Grass.) This method is also used to quickly multiply ('bulk up') the number of plants of that species and will often rejuvenate older plants, like Iris.

- **Propagation by root cuttings** is done at the end of the dormant season, usually in late February and March. It is relatively easy, reliable, inexpensive, and requires little of the plant material. (Plant examples: Stokes’ Aster and Butterfly Weed.)

- **Propagation by stem cuttings** is more demanding in terms of environmental requirements during the propagation. [Ref #17, pages 48-52]

PROJECT ADVISOR & TEAM MEMBERS

**Project Advisor**  
Mr. Matt Gocke: MS Forestry, BA Social Studies, Greenhouse and Nursery Mgr NCBG. Interests: Music, tennis, traveling, gardening, the Tropics

**Team Members:**  
Ms. Sandy Young: MS Science Education, BS Elementary Education; Native Plant Certificate Program since 2009  
Interests: Nature, drawing, yoga  
Mr. Paul Young: BS Engineering Physics, Native Plant Certificate Program since 2008  
Interests: Bio-conservancy, SCUBA diving, motorbike touring.
ABSTRACT

In this ISP best practices were developed for the propagation of a select number of native southeastern species of wildflowers from seeds. To this end, a germination trial was conducted for the following plants: *Anemone virginiana; Chrysopsis mariana; Eurybia macrophylla; Liatris spicata; Rudbeckia triloba* and *Vernonia acaulis*. Three treatments were selected to be followed during this trial, the results of this trial were analyzed and summarized. Recommendations for future trials were made.

Additionally, this effort was to be a learning experience and become a potential teaching/training aid. To this end, all protocols that were conducted were recorded in detail.

SCOPE OF PROJECT

The project covers the entire seed-propagation process, from plant selection to potting for sale at NCBG. We describe the most significant steps of the process in detail in the *PROCEDURES* sections of this report. This section presents a brief overview of the elements of the process that were followed:

**Plant Selection:**
- The plants to propagate were selected by the Project Advisor for their rarity, salability, and interest.

**Seed Collection:**
- The seeds for this project were provided by NCBG.

**Seed Cleaning:**
- This aspect of the project describes how we cleaned the seeds presented and what we learned through discussions with NCBG staff.

**Seed Storage & Retention:**
- This aspect of the project is reported based upon our handling of the collected seeds complemented by observations at the NCBG and discussions with NCBG staff.

**Seed Counting:**
- For a meaningful comparison of results, it was necessary to know, to a high level of accuracy, the number of seeds used in each phase of the procedure. We reported on the methodologies used for counting seeds.

**Growing Medium Preparation:**
- We reported on the preparation methods used to create the media determined to be optimal for the chosen plants.

**Sowing:**
- We reported on the sowing methods used to prepare the plant trays for the various treatments they would receive in the following months. (See next section.)

**Treatments:**
- Many species of plants produce seeds that require special conditions to germinate. These occur in nature. For our propagation we refer to these conditions as ‘Treatments’. We reported on the three treatments we used to improve germination results.

**Germination Oversight:**
- We monitored and recorded germination activity for the various seed flats.
- On April 15th, all of the flats went into the greenhouse. During their time in the greenhouse we continued to monitor germination, water, and fertilize as required.

**Plant Harvesting:**
- Viable plants were extracted from the germination trays and moved to pots, ready for presentation at a future plant sale.
Overview of the entire project process

**SELECTION**
- Choose
- Collect

**PREPARATION**
- Clean
- Count
- Prepare soil
- Sow

**TREATMENTS**
- Control
  - 3-month
  - 1-month

**GERMINATION**
- Monitor & count
- Water
- Fertilize
PROCEDURES

Plant Selection
The plants for the propagation were primarily selected by the Project Advisor. We selected these plants based upon the following criteria:

- Availability of viable seeds
- Sufficient space in refrigerator/greenhouse/other resources and the number of species planned
- Germination in less than one year
- Salable species for the daily and fall plant sales.
- Species of interest
- Some seeds needing cleaning (to provide experience for the team members)

In consultation with the Project Advisor, we decided to have six plants for the project. This number was determined based primarily on the availability of greenhouse space that could be committed for this project and the level of effort required. This calculation was as follows:

Number of species (6) X Number of Treatments(3) X Number of Replications (3) = 54

This calculation meant that there would be space needed for 54 germination/growth trays. The Project advisor who also manages the greenhouse, determined that he could commit to this amount of space and the timeframe for which it would be needed.

Final plants for the project:

- Anemone virginiana (Tall thimbleweed)
- Chrysopsis mariana (Maryland goldenaster)
- Eurybia macrophylla (Bigleaf aster)
- Liatris spicata (Dense blazing star)
- Rudbeckia triloba (Brown-eyed susan)
- Vernonia acaulis (Stemless ironweed)

Seed Collection
NCBG staff performed the seed collection.

Seed Cleaning
We took the collected plants and extracted (cleaned) the seeds from them. We used various techniques to perform these tasks:

GENERAL DIRECTIVES

- We thoroughly dried the plant material before attempting separation.
- We placed plant material into paper bag, crushing entire contents to help separation of gross material, or 'chaff' - see PHOTOS 5 & 8.
- We then placed the crushed material onto large white surface (i.e. poster board). (Note: If seeds were predominantly white or light-colored, we used a black surface.)
We used a variety of sieve sizes; at times more than one size was used per plant (PHOTO 1)

We used the seed blower (PHOTO 2) to separate chaff from the seeds but it could not be used with seeds still attached to their pappus because aerodynamics of the combination of pappus and seed head did not allow differentiation.

We used a “Fennel test” to determine the presence of a fennel-like object which indicated to us a viable seed. This test involved rolling a seed under the finger to. (Although we acknowledge that this was not the most scientific approach, it gave us a level of confidence when selecting the 270 seeds for each species.)

SPECIFIC DIRECTIVES

_Vernonia acaulis_ (Paul):

- We pulled seed from receptacle leaving pappus in place. (PHOTO 3)
- We noticed that many of the seeds had already detached from their pappus

_Rudbeckia triloba_ (Paul):

- When seeds were still firmly embedded in the flower head; we placed the flower heads into a ‘fire bucket’ (plastic outside, cloth inside => low static electric charge); and then struck the bag against a hard surface vigorously to dislodge the seeds (PHOTO 4)
- We used a combination of two sieves to separate major pieces from seeds and chaff
- We used the seed blower to further clean seeds

_Liatris spicata_ (Sandy):

- We pulled the seed from receptacle leaving pappus in place. (PHOTO 5)
- We used the ‘fennel test’ to identify viability

_Eurybia macrophylla_ (Sandy):

- We pulled the seed from receptacle leaving pappus in place.
- Using the 'fennel test' to identify viability we estimated that as much as 2/3 of the seeds were not viable.

_Anemone virginiana_ (Sandy):

- We rolled seed one at a time on mouse pad to remove fur-like pappus. (PHOTO 6)  **We also tried several unsuccessful methods to remove the pappus** (PHOTO 7)

_Chryopsis mariana_ (Paul):

- We were fortunate here, as the seeds were already separated from receptacle. (PHOTO 8)
- We used the ‘fennel test’ to identify viability (See below SEED VIABILITY TESTING below.)

Seed Storage & Retention

We put our collected seeds in brown grocery bags and held them in a low temperature (65°F) and low humidity room especially built for holding seeds when they were not in NCBG’s long term refrigeration units. Once cleaning and counting had occurred, we put the seeds were into smaller envelopes where they awaited use in one of the treatments used. (See SOWING and TREATMENTS.)

Seed Counting

SEED VIABILITY TESTING

Seeds rechecked for viability before counting using the following techniques:

- We used naked-eye examination
- We also used microscopic examination (PHOTO 9)
- We tried tactile pressure to detect presence of a seed (we referred to this as the ‘fennel seed’ test)
GENERAL DIRECTIVES

Whenever feasible, we counted the seeds individually by pulling them from the mass. We used either our bare fingers or a straight-edged object which would not create a static electric charge, e.g. metal ruler. This was particularly critical for the Asteraceae plants which had very light seeds. (For example, PHOTO 5.)

It should be noted that for seeds that were too small to count without employing a microscope (For example with Mimulus ringens and the Penstemon smalli), we used a special technique we call the “Sandy count”. (For a ‘visual’ on this, see PHOTOS 10 & 11). We describe this method as follows:

- prepare an envelope or any container that will hold about one tablespoon of sand and can be sealed;
- on the white side of the dissecting microscope's pad, mark a small circle (about 1/2 inch in diameter);
  (NOTE: If counting lightly colored seeds, the black side of the pad may be more useful for viewing the seeds.)
- pour the seeds onto the pad a little away from the circle previously drawn;
- using an object that resists a static electrical charge (e.g. a metal probe), carefully move the desired number of seeds into the area of the circle;
- press a finger tip against the circle and raise it up (there may be a need here to dampen the finger slightly);
- rotate the finger so that the tip is now upwards and can be seen through the microscope;
- confirm that the correct number of seeds are still attached to the finger;
- carefully move the finger into the sand prepared above and stir the finger slightly.

Growing Medium Preparation

The growing medium selected for this project was one that was generally used for other seed propagation at NCBG.

The medium preparation involved the following steps:

- We brought the growing medium* that was stored at the NCBG near the greenhouse and it brought into the Totten Center in a plastic garbage can;
- We sifted the soil to remove large pieces of bark that would have inhibited close contact with the germinating seed's roots. (The sieves used were of a 0.25 inch and then a 0.132 inch mesh size. The results of the first sifting is referred to as a 'single sieve' and the results of the second a 'second sieve'.)
- We selected the second sieve material and filled 18 new germination trays (6 species X 3 replications).
  (PHOTO 12)
- We put six trays in each flat, giving 3 flats.

* The Growing Medium used was pine bark that had been purchased from <<Sands & Soils; 1414 Stallings Rd, Durham, NC 27703; (919) 596-0801 >>. This company grinds/chops pine bark taken from lumbering operations. In addition, this material is often left to ‘age’ so as to reduce its acidity. This material is purchased for the garden on a regular basis.

Sowing

Sowing involved the following steps:

- We created three plant tags for each plant species as shown below;
- We set out three flats with drainage holes and air troughs;
- We set out three sets of six trays and placed each set in one of the three flats;
- We inserted one plant tag almost horizontally along the edge of the long side of each tray (PHOTO 13)
- We counted out (or recounted, if previously counted and in separate envelopes) the 30 seeds for each
species being sown;
- We evenly distributed the seed on the soil surface making no attempt to push them into the soil;
- We covered the surface of the tray with coarse sand, ensuring that no part of the seed was visible (PHOTO 14). This was done for several reasons: to assure seed contact with the soil; to protect against the seeds being blown away (This was of particular concern with Asteraceae seeds.); and, lastly, to provide some protection against pathogens.
- We sprayed the entire surface with a fine mist of water;
- We soaked the tray in a sub-irrigation flat (a flat that has a solid floor) for about one hour; *
- We removed the trays from the sub-irrigation flats and let them drain;
- We performed the Post-sowing actions of the Treatment Type*** being followed, as described below.

Creating a Plant Tag:
- Take a white plant tag and, using a pencil, write on the front, the following information shown in the diagram below;
- On the back of each plant tag write the Replication number****

<table>
<thead>
<tr>
<th>Scientific name of the Plant</th>
<th>Treatment type **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location where plant collected</td>
<td>Date when plant was collected</td>
</tr>
</tbody>
</table>

* Soaking of the trays is always the best way to water the plants and it is especially important for the very first watering. Moisture coming from below forces young seedlings to search down into the soil for water; watering from above will sometimes force the un-germinated seeds to come above the surface.

** Treatment Type refers to one of the treatments described in the next section

*** Replication number refers to a ‘1’, ‘2’ or ‘3’ assigned randomly to each of the three sets of seeds sown. As discussed above in Plant Selection, the three replications X the six species X the three treatments gave the number 54 as the number of trays needed. Each replication appeared in only one tray. Note: No attempt was made among the six species to place the tray in a particular order within the flat.

Treatments

After discussions with the Project Advisor, we decided that the propagation methodology would entail the following treatments: Control, Three-month Stratification and One-month Stratification. (See Project Timeline.) We followed the same Sowing procedures described above, preceding the treatments described here:

Post-sowing actions for Control Treatment:
We took the prepared flats out into the Garden. The area selected in the Garden by the Project Advisor represents a typical, but safe location. We place a mesh cover over the enclosed area to protect against animals and severe weather. (PHOTOS 15 & 16) Also, we monitored germination and the trays were watered if needed. This “treatment” was meant to simulate the action of seeds falling on the ground and being left to basically ‘fend for themselves’.

Post-sowing actions for Three-month Stratification Treatment:
We moved the prepared flats into a refrigerator. Before moving into the refrigerator, we sprayed the top of each tray again with water again. This was done to assure that a relatively high humidity would exist around the seeds. To minimize the space needed in the refrigerator, we stacked the flats vertically. Additionally, we put the flats into a black garbage bag that was loosely folded about them. This was done to help prevent desiccation of the soil medium during refrigeration.

Post-sowing actions for One-month Stratification Treatment:
We followed the same steps as we did for the Three-month Stratification procedure.
Germination Oversight

As identified below in Project Timeline, we brought all treatments together on April 15, 2012. (PHOTO 17) We put all of the flats on one table for ease of oversight. The various treatments were laid out as the diagram shows to create a more random environment in the greenhouse. We were able to record the germination results of these 54 flats with the aid of this diagram.

Layout of the flats on the greenhouse table (Key: Treatment-Rep):

<table>
<thead>
<tr>
<th>C-3</th>
<th>1-3</th>
<th>3-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-2</td>
<td>C-2</td>
<td>1-2</td>
</tr>
<tr>
<td>1-1</td>
<td>3-1</td>
<td>C-1</td>
</tr>
</tbody>
</table>

Before April 15, when all treatments were brought into the greenhouse, we took various steps to help make the germination process more successful:

- On March 30 and April 11, we fertilized the control flats with 25ppm N (25 parts per million Nitrogen). Within approximately 30 minutes these flats were then sprayed with water to flush the fertilizer from the seedlings' leaves and to move the fertilizer into the soil. Notes: Henceforth, we used this procedure to fertilize the seedlings. We intend to increase concentration to 50ppm when the seedlings are more robust.
- On April 5, we sprayed Hydrogen peroxide (0.75%) on the three control flats to reduce the chance of ‘damping off’. The solution was sprayed so as to totally wet the surface of the flat and thus sterilize the surface soil.

After April 15, when all treatments were in the greenhouse, we performed oversight to assure the greatest likelihood of success. Our activities while the seedlings were in the greenhouse were as follows:

- April 19 - we again sprayed the flats with hydrogen peroxide.
- April 20 – we fertilized (25ppm N) and watered the flats
- May 1 - we fertilized (25ppm N) the flats
- May 3 – we soaked the flats for approximately 20 minutes in water.
- We soaked the flats weekly until May 31
- We fertilized (25ppm N) the flats May 15 and May 30.

RESULTS

**Project Timeline**

<table>
<thead>
<tr>
<th>Date</th>
<th>Milestone</th>
<th>Action and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/1/11</td>
<td>Control Treatment</td>
<td>Moved trays directly outside</td>
</tr>
<tr>
<td>01/12/12</td>
<td>Three-month Stratification Treatment</td>
<td>Moved trays into refrigerator</td>
</tr>
<tr>
<td>3/15/12</td>
<td>One-month Stratification Treatment</td>
<td>Moved trays into refrigerator</td>
</tr>
<tr>
<td>3/15/12</td>
<td>First treatment into greenhouse</td>
<td>Begin weekly monitoring of all treatments and recording germination results</td>
</tr>
<tr>
<td>3/29/12</td>
<td></td>
<td>Moved control treatment into greenhouse</td>
</tr>
</tbody>
</table>
**Project Results – All Species Germination**

In this section of the document we show the results of our endeavours. Here, we present charts that give an excellent view of progress over the almost six months of the project, from creation of the Control Treatment to the final reading at the end of May. Additionally, for those who want to see numerical results, we have included in Appendix 3 the spreadsheet of recorded counts.

![All Species Germination vs. Treatment](image-url)
**Project Results – Individual Species Germination (Anemone virginiana)**

In this and the following sections we show germination results for each species. We have provided two types of charts: the bar chart provides a histogram of results; the line chart gives a clearer view to the reader of the change in germination rate.
Project Results – Individual Species Germination (Chrysopsis mariana)

**Chrysopsis germination over time**

![Graph showing germination over time for Chrysopsis mariana, with data for control, 3-month, and 1-Month treatments.](image)

Dates measurements were made

**Chrysopsis germination over time**

![Graph showing germination over time for Chrysopsis mariana, with data for control, 3-month, and 1-Month treatments.](image)

Dates measurements were made
Project Results – Individual Species Germination (Eurybia macrophylla)

Eurybia Germination over time

% Germination

Date measurements were made

Eurybia Germination over time

% Germination

Date measurements were made
Project Results – Individual Species Germination (Liatris spicata)

Liatris Germination over Time

Liatris Germination over time

Dates measurements were made

Control 3-month 1-Month

Dates measurements were made
Project Results – Individual Species Germination (Rudbeckia triloba)

Rudbeckia Germination over time

Dates measurements were made

Rudbeckia Germination over time

Dates measurements were made
Project Results – Individual Species Germination (Vernonia acaulis)

Vernonia Germination over time

![Germination graph showing data for Control, 3-month, and 1-Month treatments over time.]

Dates measurements were made

Vernonia Germination over time

![Germination graph showing trend lines for Control, 3-month, and 1-Month treatments over time.]

Dates measurements were made
OBSERVATIONS, CONCLUSIONS AND RECOMMENDATIONS

Observations
Our observations summarize the results shown above and in Appendix 3 – Result Data Sheets. The number of seeds that germinated from our project (the ‘yield’) fell into three categories:

1. the high above 50% for Chrysopsis and Liatris;
2. around 40% for Anemone and Eurybia; and
3. under 10% for Rudbeckia and Vernonia.

Chrysopsis and Liatris were also consistent in having an over 40% yield in all treatments.

We offer the following separate observations for each species.

Anemone:
The Control treatment produced the largest yield; followed closely by the One-month treatment.

Chrysopsis:
There was high yield in all treatments.

Eurybia:
The Control, closely followed by the three-month treatment produced the largest yield.

Liatris:
The Control treatment produced the largest yield; the other two treatments were above 40%.

Rudbeckia:
There was generally low yield, but a somewhat higher yield in the Control treatment.

Vernonia:
There was generally low yield, but a somewhat higher yield in the three-month treatment.

Conclusions and Recommendations
The conclusions we present here are based on the results shown and observations, both given above. We want to emphasize that an attempt to reproduce this study may produce different results.

The Control treatment produced a better yield for all species, except Vernonia. For this reason, we recommend planting Anemone, Chrysopsis, Eurybia, Liatris, and Rudbeckia in the Fall without any stratification process. They should be sown in a well-drained soil medium such as the one we used; watering when. Then they should be moved into a greenhouse or equivalent mid-April to early-May. As a general comment, North Carolina had a very mild Winter and Spring this year. This might have been a factor in the success of the Control treatment.

Rudbeckia and Vernonia had a very poor yield. We suspect that the batch of seeds collected for these species may have been somewhat ‘defective’ (insufficiently mature). We recommend that the seeds for these two species be collected from a wider set of plants in the wild. (It should be noted, that the plants growing in the site where the seeds were collected are naturalizing well.) Another explanation of such a poor showing was that our ‘viability testing’ was ineffective.

The yield of the three-month stratification of Anemone was 5.56% compared to the average yield of the other two treatments of 50%. Though other factors may have been at play, we believe that the data suggests that Anemone in this study didn’t like the long time in the refrigerator. (We also note that Anemone grows in NC in our Mountain, but does prefer well-drained soil.)
THINGS WE WOULD DO DIFFERENTLY

Ensure for each species that we collect seeds from a large community of plants to assure a greater genetic mix.

We should track each species as an individual unit. This may seem obvious, but we had the tendency to think in terms of best practice for germinating all native plants. This is unrealistic because each species has its own individual requirements and preferences. In our trials we very deliberately used identical materials and procedures for all plants for ease of study.

We should take into account the seed viability of each species. For example, *Liatris* has 60% seed viability, whereas *Eurybia* has only 37%. The natural viability percentages of each species obviously have a stronger impact on germination than the variables we used.

We should use a larger sample. We were aware of this problem from the beginning but were restricted by the amount of refrigeration, greenhouse and outdoor space for control that was available to us.

We should use plants from different families. The plants we chose were drawn heavily from the *Asteraceae* family (all but one, the *Anemone*). We may have been able to generate more varying information using other families.
REFERENCES

1. US Department of Agriculture, Natural Resources Conservation Service, Plants Database
2. USDA Growth Habit Definitions
3. USDA Native Status
6. Missouri Botanical Garden
7. Great Plants for Attracting Butterflies in Central NC
8. Mt. Cuba Center Inc
11. American Beauties, Native Plants
12. US Forestry Service
14. University of Florida, School of Forestry Resources and Conservation
15. NatureServe, a non-profit conservation organization
16. Illinois Wildflowers
17. Growing & Propagating Wildflowers, Harry Phillips
18. Plant Identification Terminology, James G. Harris and Melinda Woolf Harris

Note on References
Wikipedia was used extensively, especially to get a first-cut overview of the plant. When information was extracted, sometimes verbatim, from Wikipedia the symbol <W> is used to notify this.

APPENDICES

Appendix 1 – Plant Descriptions
The following section describes the plants we propagated along with a photo of each one. Unfortunately, we do not have photos of our own flowering plants due the fact that the project ran from Dec, 2011 to June, 2012 and no plants had developed blossoms at that time.

Additionally, for the reader of this document in electronic form (MicroSoft® Word), we have included in this section of the document many HyperText Mark-up Language (HTML) links to web locations both for the references, and also for further information to the reader.

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Photo credits

<table>
<thead>
<tr>
<th>Plant</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liatris spicata</td>
<td>Larry Allain @ USDA-NRCS PLANTS Database</td>
</tr>
<tr>
<td>Eurybia macrophylla</td>
<td>Thomas G. Barnes @ USDA-NRCS PLANTS Database / Barnes, T.G., and</td>
</tr>
</tbody>
</table>
Independent Study Report for NCBG Certificate in Native Plant Studies Program
“Seed Propagation of Six Native Southeastern United States Wildflowers”


All other plants William S. Justice @ USDA-NRCS PLANTS Database
**Anemone virginiana L.**  
[Tall thimbleweed]

**Family:** *Ranunculaceae*

**Duration & Growth Habit [Ref #1]:**  
Perennial, Herb/Forb

**Native Status & Range (Ref #1,3):** Native to the US from the Atlantic east to CO and WY, excluding MN, NM and TX; plus all of Canada below the Territories (Map).

**Height:** 1 to 2.5 ft

**Bloom Time:** May - July

**Bloom color:** White with thimble-like, center mound of yellowish stamens

**Inflorescence type:** Solitary capitulum

**Fruit:** Diaspora (“achene wrapped in woolies”)

**Exposure:** Full sun to Part shade

**Soil type:** Dry, Shallow, Rocky Soil

**Water needs:** Low to medium (Drought tolerant)

**Conservation Status [Ref #15]:** Secure

**INTERESTING ASPECTS OF PLANT**

- In NC, this plant occurs principally in the Mountains and the Piedmont and the Tar-Pamlico
- Present in dry woody slopes
- When the fruits, called achenes, are ripe they have gray-white colored, densely woolly styles, that allow them to blow away in the wind and tumble, similar to a tumbleweed; this type of achene is sometimes called a "tumble fruit" or **diaspore**. <W>
- Thimbleweed gets its name from its fruit which looks like a thimble.
- Excellent spring flower for the shaded or woodland garden. *Anemone virginiana* is also a good choice for naturalized areas or native wildflower gardens.
- Medicinally, this plant is an expectorant, an emetic, and an astringent.
- Natives used the caudex, the thickened, usually underground base of the stem, in many forms to cure many ailments.
- Smoke from roasting seeds was used to revive the unconscious by being blown into the nostrils of the patient.
- As with many medicinal plants, all parts are poisonous when fresh but only if eaten in large quantities.
**Chrysopsis mariana (L.) Elliot**  

**[Maryland goldenaster]**

**Family:** Asteraceae

**Duration & Growth Habit [Ref #1]:**  
Perennial, Herb/Forb

**Native Status & Range (Ref #1,3):** Present in the US along the Eastern Seabord excluding CT north, west to approximately the Appalachina Mountains, west along Gulf states to LA and TX, absent from Canada (Map).

**Height:** 1 to 2 ft

**Bloom Time:** Late Summer into Fall

**Bloom color:** Yellow petals and centre

**Inflorescence type:** A loose cluster of solitary capitulum

**Fruit:** Cypsela (1/8” achene with 1/4” pappus of bristles

**Exposure:** Full sun to Part shade

**Soil type:** Dry, Shallow, Rocky Soil

**Water needs:** Low to medium (Drought tolerant)

**Conservation Status [Ref #15]:** Secure

**INTERESTING ASPECTS OF PLANT**

- In NC, this plant occurs throughout the state.
- This is not a true aster. *(Ref #5)*
- Common in old fields, woods and roadsides. *(Ref #5)*
- Because of its silky stems, the Maryland golden-asters are also known as *silkgrass* <W>
- Goldenaster is an important food for gopher tortoises. *(Ref #14)*
Eurybia macrophylla [Bigleaf aster, largeleaf wood aster]

Family: Asteraceae

Duration & Growth Habit [Ref #1]:
Perennial, Herb/Forb

Native Status & Range (Ref #1,3): Native to the entire Eastern USA to Missouri River, excluding Arkansas and the southern coastal states east of Texas (Map).

Height: 4.5 ft
Bloom Time: Late Summer
Bloom color: Violet to pale blue rays with yellow centers
Inflorescence type: Solitary capitulum flower
Fruit: Cypsela (1/4” achene + 1/4” pappus of bristles)
Exposure: Part shade to full shade
Soil type: dry to moist, well-drained, sandy loams
Water needs: Medium
Conservation Status [Ref #15]: Secure

INTERESTING ASPECTS OF PLANT

• In NC, this plant occurs only in our mountain counties
• The large, thick young leaves can be cooked and eaten as greens <W>
• It is rhizomatous, native to woods and clearings and colonial, often forming dense patches measuring up to 19 × 16 feet (Ref #12)
• Regeneration is largely by vegetative means from rhizomes and root crown sprouts (Ref #12)
• Can persist in high light environments because of its ability to control stomatal conductance (Ref #12)
Liatris spicata (L.) Willdenow  [dense blazing star, dense gayfeather, marsh blazing star]

Family: Asteraceae

Duration & Growth Habit [Ref #1]:
Perennial, Herb/Forb

Native Status & Range (Ref #1,3): Native to the entire Eastern USA excluding Vermont, New Hampshire, Maine and the Canadian Maritime provinces; west principally to Mississippi River (Map).

Height: 2 to 4 ft (may be up to 6ft)

Bloom Time: July to August

Bloom color: Rose-purple (sometimes white)

Inflorescence type: A long, dense spike

Fruit: Cypsela (1/4” achene + 1/4” pappus of bristles) (PHOTO 5)

Exposure: Full sun

Soil type: Moist and fertile

Water needs: Medium

Conservation Status [Ref #15]: Secure

INTERESTING ASPECTS OF PLANT

- In NC, this plant occurs throughout the state, although more frequently in the mountain and southern coastal counties
- Individual flowers are rayless
- Native to moist prairies and sedge meadows <W>
- Tolerates clay soil, but performs better in moist soils than most other species of Liatris. However, it is intolerant of wet soils in winter. Tolerant of summer heat and humidity. (Ref #6)
- May be grown from seed, but is slow to establish. (Ref #6)
Rudbeckia triloba  
[Brown-eyed Susan]

Family: Asteraceae

Duration & Growth Habit [Ref #1]:  
Perennial, Herb/Forb

Native Status & Range (Ref #1,3): Native to the entire Eastern USA excluding Vermont, Maine and the Canadian Maritime provinces; west to Missouri River and south to Texas (Map).

Height: 3 to 4 feet  
Bloom Time: June to August  
Bloom color: Yellow

Inflorescence type: Solitary capitulum; with a 'woody' crown

Fruit: 1/4” achene with a scale pappus

Exposure: Full sun to part shade (a few hours a day)

Soil type: Moist, well-drained

Water needs: Dry to medium (tolerates drought)

Conservation Status [Ref #15]: Secure

INTERESTING ASPECTS OF PLANT

• In NC, this plant is common in the mountain counties and occurs in Warren county
• A herbaceous biennial to weak perennial <W>
• This plant is, in part, distinguished from black-eyed Susan (R. hirta) by having a more profuse bloom of smaller flowers that usually have fewer rays per flowerhead. <W>
• Basal leaves are often trifoliate (three leaflets, sometimes each of the three also divided.) <W>
• Great nectar source for butterflies and other pollinators (Ref #11)
• Produces lots of seeds for songbirds (Ref #11)
• Spent flowers should be removed to encourage additional bloom and/or to prevent any unwanted self-seeding (unless you want to feed the birds).  (Ref #11)
**Vernonia acaulis (Walter) Gleason**

**Family:** Asteraceae

**Duration & Growth Habit [Ref #1]:**
Perennial, Herb/Forb

**Native Status & Range (Ref #1,3):** Native to only North & South Carolina and Georgia. (However, a 'vouchered' siting is reported in Polk county Florida. Ref #9)

**Height:** 3 to 3.5 feet

**Bloom Time:** July to August

**Bloom color:** Purple-blue

**Inflorescence type:** Loose, corymbiform arrays

**Fruit:** Cypsela (1/4” achene + 1/4” pappus of bristles)

**Exposure:** Full sun to part shade

**Soil type:** Dry, sandy soils.

**Water needs:** Dry to medium (tolerates drought)

**Conservation Status [Ref #15]:** Apparently secure

**INTERESTING ASPECTS OF PLANT**

1. In NC, this plant is common in only the southern Piedmont counties and on the coast in Carteret county (Map)
2. In late summer, when many perennials have lost their shine, stemless ironweed delights us with refreshingly bright reddish purple flowers. Although the name ironweed is said to refer to the rusty colored seed clusters, this plant is also tough as iron, undemanding and easy-to-grow. Stemless ironweed forms a basal rosette of absolutely flat leaves with 36”-42” tall stems rising from its center. It performs well in situations from partial shade to sun and well-drained to dry soils. (Ref #8)
3. “The term, ‘Stemless’ comes from the fact that much of the year it grows only as a rosette of ground-hugging deep green leaves. In July it sends up a tall branched stalk and blooms its heart out. (Ref #5)
4. Some hybridization is noted in several NC counties: (Ref #10)
Appendix 2 – Photos of our Procedures

Photo 1. Sample sieve and collection pan
Photo 2. Seed blower
Photo 3. *Vernonia acaulis* – seeds and flower heads
Photo 4. Cleaning method – strike bag full of flowerheads
Photo 5. *Liatris spicata* – seeds and chaff
Photo 6. *Anemone Virginia* – seeds with and without blanket
Photo 7. Cleaning method - unsuccessful
Photo 8. *Chrysopsis mariana* – seeds and chaff
Photo 9. Microscopic view of viable vs. non-viable seeds
Photo 10. Sandy count method – step 1
Photo 11. Sandy count method – step 2
Photo 12. Soil preparation - three sieve steps
Photo 13. Control plants ready – showing plant tag
Photo 14. Light dusting of sand
Photo 15. Control plants in their outside home – 1
Photo 16. Control plants in their outside home – 2
Photo 17. All plants together in greenhouse

Photo Credits
All photos in this section were taken by either Sandy Young or Paul Young.
Photo 3 - *Vernonia acaulis* seeds and chaff

Photo 4 - Cleaning method - strike bag full of flowerheads

Photo 5 - *Liatris spicata* – seeds and chaff

Photo 6 - *Anemone Virginia* – seeds with and without blanket
Photo 7 – Unsuccessful cleaning methods  

Photo 8 – *Chrysopsis mariana* – seeds & chaff  

Photo 9 – Microscope view of viable seed
Photo 10 – Sandy count method – Step 1

Photo 11 – Sandy count method – Step 2

Photo 12 Soil preparation three sieves

Photo 13 Control plants showing plant tags
Photo 14 Light dusting of sand

Photo 15 Control plants outside home – 1

Photo 16 Control plants’ outside home -2

Photo 17 All plants now in greenhouse
Appendix 3 – Results Data Sheets

In the following charts the shaded area represents the period when plants were in one of the three ‘treatment’ periods: Control, Three-month stratification or One-month stratification. On April 15 all of the plants were brought together in the garden greenhouse and placed on one table. All of the readings after that time, up to the end of the project (March 31) were taken in the greenhouse.

Anemone Results

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Independent Study Report for NCBG Certificate in Native Plant Studies Program
“Seed Propagation of Six Native Southeastern United States Wildflowers”

DOC: NCBG Final Project Report
Page: 35 of 38
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