



# Proposal for a Virginia Seed Bank



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## NATURE, VIRGINIA'S ECONOMY, AND THE CLIMATE THREAT

### Abstract

Climate change is causing the ranges of native species to shift northward at a pace that outstrips the ability of many plant species to migrate and adapt (Walther et al. 2002; Renwick & Rocca 2014). Although assisted migration, the process of relocating individuals or spread of seeds through human intervention, has been used successfully in some cases to preserve species, it comes saddled with potential ecological damage and legal complications arise when these ranges cross state lines. These complications threaten Virginia's biodiversity, especially among rare plants and those plants from habitat affected most by climate change. In order to preserve the genetic diversity of native species before populations become isolated and inbred, this project proposes that Virginia create a seed bank. Seed banks have been used for a variety of reasons worldwide to preserve the genes of plants species, including for the preservation of crop species and for research purposes (Laliberte 1997). For this proposed seed bank, Virginia would use information collected by the state Natural Heritage Program to identify eligible species that face the greatest threat from climate change in order to preserve biodiversity, establish a genetically diverse sample for research, and potentially reestablish these endangered species in the future.

### Climate Change Outpacing Plant Migration

Over a quarter of the world's plant species are under threat, largely because of human actions. In Virginia, the situation is no different and the state stands to lose rare species thanks to climate change.

- Almost 3,200 plants native to Virginia
- Plants provide ecological services such as carbon sequestration and water quality maintenance
- Plants migrate via reproduction
- Many native plants are unable to migrate north at the rate of climate change
- Problem compounded by increased habitat fragmentation

Seed banks are a relatively cheap, low volume method of preserving thousands of individual seeds for long periods of time. While in situ conservation, or conservation within a species native habitat, is ideal, the cost of land acquisition as well as owner cooperation can be a major barrier to conservation. Additionally, plants in nature are subject to threats such as climate change, over-exploitation, invasive species, disease, habitat fragmentation, and habitat degradation. There are over 1,500 seed banks worldwide.

The Bureau of Land Management has a program called Seeds of Success which was established in 2001 in partnership with the Kew Millennium Seed Bank to preserve native species across the United States. Seeds of Success aims to use its seeds for waterway and fire restoration, habitat and land restoration, amongst other uses. This prioritizes "work horse" plants suitable for restoration.

Other states such as California and North Carolina have established their own seed banks in addition to the national program. State programs have the ability to focus on more specific species and goals than the national program such as medical and academic research, and the protection of biodiversity.



Figure 1. The Bureau of Land Management's Seeds of Success program aims to preserve native species for restoration.

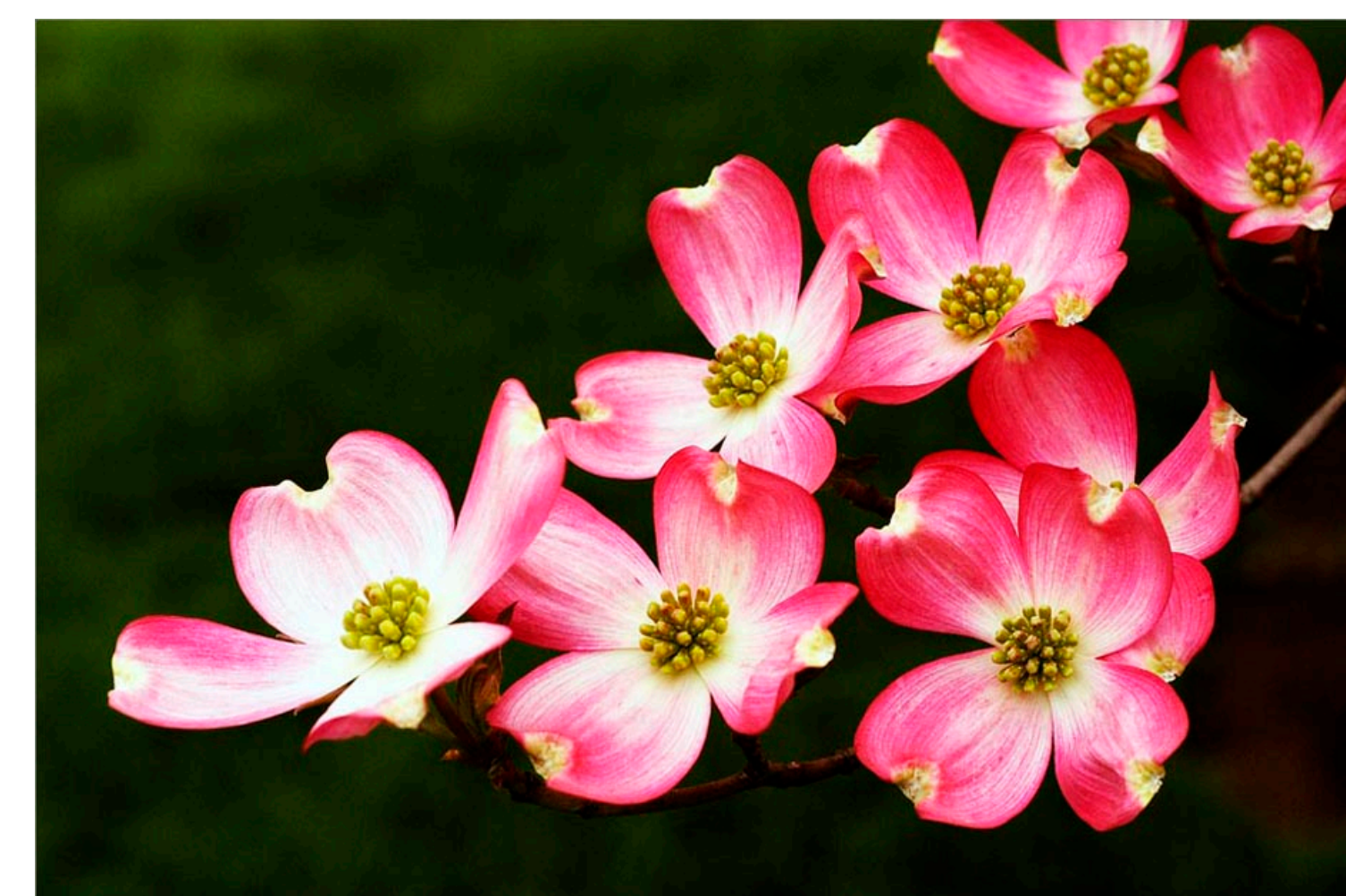


Figure 2: Flowering Dogwood (*Cornus florida*) is among the species currently common in Virginia that will lose significant amounts of viable habitat due to climate change. Flowering dogwoods have shallow root systems which cannot draw water from dry soil. Research predicts that the increased rainfall in Virginia will lead to more runoff and drier soil which will decrease the number of dogwoods (Kane et al. 2003). Dogwoods could be a viable candidate for preservation in a state seed bank. (Photo credit: Andres R. Alonso)

### An Insurance Plan Against Extinction

Virginia should create a state seed bank to preserve the genes of native and threatened species in order to protect species against threats such as invasive species, disease, and climate change, collection a controlled population for research, gather knowledge for wider plant conservation efforts, and to provide options for future repopulation or use.

#### Science of Seed Banks

- Seed banks replicate natural phenomenon in which seeds don't germinate until conditions are ideal
- Seeds are dried and stored in a controlled climate with low temperature and humidity to prevent germination
- Ideal species sample collections consist of 10,000-20,000 seeds from 100-500 individuals to prevent inbreeding
- Of the 7,000 species preserved worldwide, 89% are expected to remain viable for up to 200 years



Figure 3: The collection at the Millennium Seed Bank has 34,088 wild plant species and 1,980,405,036 seeds in storage. The seed bank met their goal of preserving 10% of species worldwide in 2010 (KEW).

### Responsible Collection

Seed banks provide the opportunity to preserve native species, but collection should not impact the sustainability of a species' wild population or its ability to migrate naturally.

In order to responsibly collect seeds, Virginia should consider implementing the Bureau of Land Management's protocol for seed collection for their Seeds of Success program. Additionally, the Virginia Natural Heritage Program should be responsible for determining which species are the best candidates.



Figure 4: Millennium Seed Bank facility in the United Kingdom (KEW).

The yearly funding for seed banks in other states have been provided by a combination of private and non-profit donations, and state and federal grants. Costs can be partially mitigated through the use of volunteers who can be trained for proper collection. Even if seeds of some target species are found to be recalcitrant, meaning we cannot induce dormancy and maintain viability, accurate information about range and population size. The following lists some of the protocol that should be followed in seed collection:

- No more than 10%-20% of seeds should be collected from a population at any given time
- Federally listed under the Endangered Species Act as endangered or threatened, or are listed as candidates should not be collected
- Species classified in categories 1 or 2, meaning they are considered critically endangered under state or global ranks, should not be collected
- Sampled populations should be at least 100 individuals in an area where cross pollination is possible
- Detailed data should be recorded about the sampled population including GPS coordinates, surrounding conditions, and time and date sampled
- The state seed bank should be in close communication with federal and surrounding state seed banks for collaboration and seed and information sharing

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