The USDA Natural Resources Conservation Service Plant Materials Program and the New Jersey Plant Materials Center

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Abstract

The New Jersey Plant Materials Center (NJPMC) has been providing plant solutions for natural resource conservation concerns since 1965. As one of 25 Plant Materials Centers (PMC) nationwide that constitute the U.S. Department of Agriculture, Natural Resources Conservation Service Plant Materials Program (PMP), the NJPMC is uniquely situated to focus on coastal ecosystem conservation concerns. The NJPMC and other PMCs achieve their shared task of developing and delivering vegetative solutions and conservation technology primarily via three products: conservation plant releases, published documents, and presentations/training sessions. The PMP benefits from internal partnerships between PMCs and external partnerships with other Federal/State agencies, nonprofit groups, and academia to achieve shared goals as efficiently as possible. This paper was presented at the 2019 Joint Annual Meeting of the Northeast and Southern Forest Conservation Nursery Associations (Atlantic City, NJ, July 23–25, 2019).

Introduction

The New Jersey Plant Materials Center (NJPMC) is one of 25 Plant Materials Centers (PMC) within the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Plant Materials Program (PMP), that form a nationwide network of strategically located PMCs based on soil and climatic conditions (figure 1) with a common mission and vision. The overall mission is to find plant solutions to solve conservation problems. This mission is achieved under the PMP's overall vision to function as the plant experts for the NRCS, fully integrated and coordinated with technical and field office staff, developing and delivering vegetative solutions and conservation technology for NRCS customers. The PMP conducts its plant evaluation activities under the guiding philosophy of Dr. Franklin J. Crider, first head of the PMP, who held the belief that nature has evolved a plant for almost every growing condition (Sharp 2013).

Plant Materials Program History

In the early 1930s, Congress responded to the "Dust Bowl" by creating the Soil Conservation Service (SCS) Division of Nurseries under the USDA in 1935. Over time, the agency's responsibilities increased, as did the types of resource concerns addressed. The program was later renamed the SCS Plant Materials Program, and in 1994, when the SCS was renamed NRCS to more accurately describe the increased scope of resource concerns addressed by the agency, it became the NRCS Plant Materials Program. The reorganization and renaming also acted as a sign of the continued commitment of the Federal Government to address a wide array of conservation challenges using science-based tools and standards.

Since its inception, the PMP had performed the function of a nursery program, producing hundreds of millions of plants annually while conducting observational trials for the purpose of plant selection and development. The 1954 USDA appropriations act designated PMCs as "observational nurseries," distinguishing them from "production nurseries," thereby relieving PMCs of the responsibility for mass production of plants and allowing them to concentrate their efforts on the development of plant technology in the form of varietal plant releases and other products (Helms 2008).

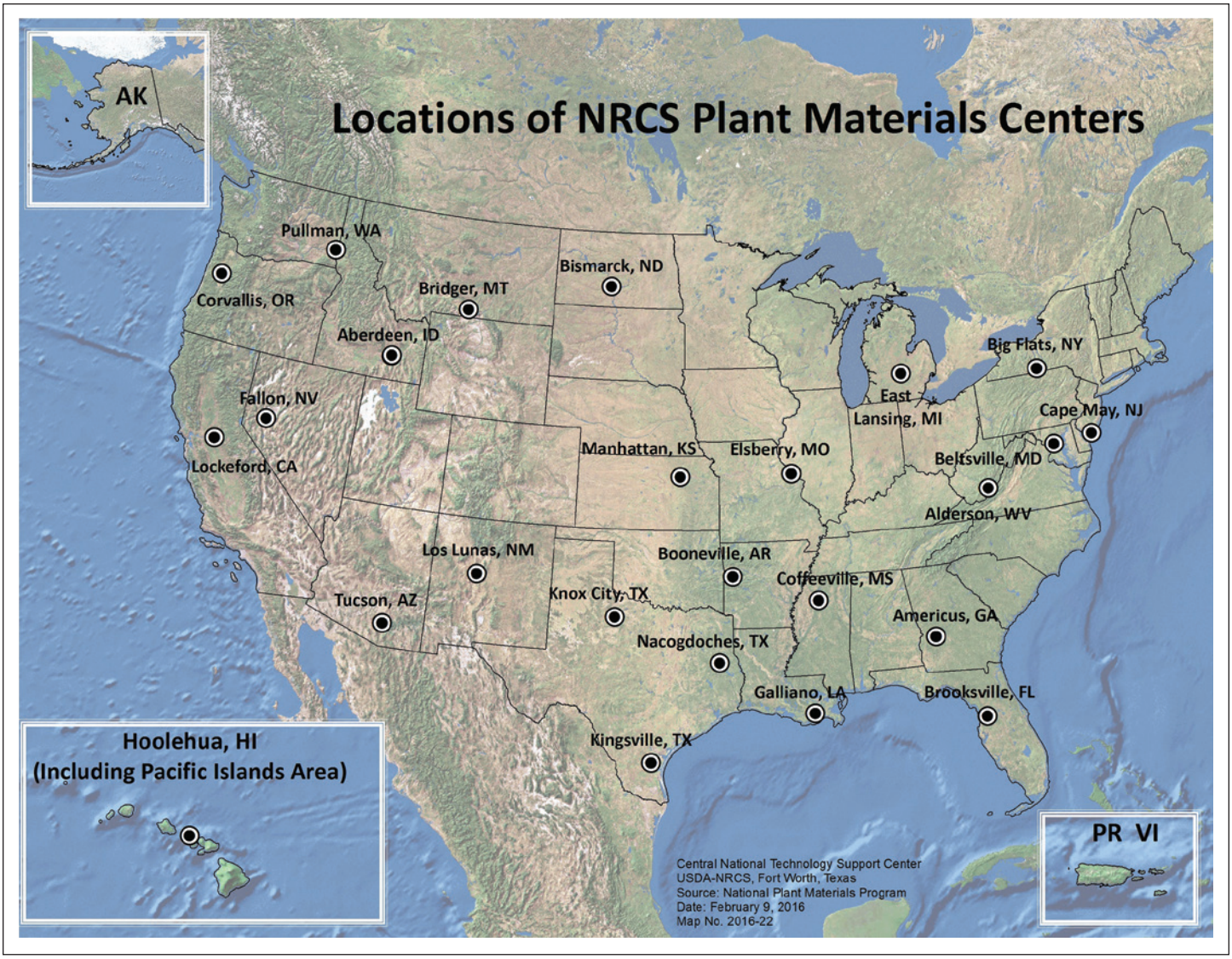

Figure 1. NRCS Plant Materials Centers are located throughout the United States. (Source: National Plant Materials Program, USDA-NRCS 2016)

Plant Materials Program Products

The major products offered by the PMP are conservation plant releases, published documents, and presentations/training sessions. The PMP has four levels of plant releases. Those levels in ascending order of the amount of testing required to meet the minimum criteria for each release level are source identified, selected, tested, and cultivar. On average, from the start of planning to the time of release to commercial growers, each level of release respectively takes 3, 5, 8, and 10 years.

Regardless of the release level, the release process is best described as a six-step process. The first step is to define the conservation need. The intention of the PMP is to have these needs percolate from private landowners and partners to NRCS staff and then be reported by the State's plant materials committee via the State plant materials needs assessment survey. The second step is germplasm collections. Depending on the scope and details of the defined need, these collections could be extensive over a large geographic area or concentrated on more site-specific conditions. The third step is to select from the germplasms collected based on desired traits (e.g., stem count, plant height, drought resistance, flower abundance, seed production) that are most applicable for addressing the conservation need. This step is usually conducted at a PMC. The fourth step is in situ testing of the selected germplasms to determine adaptation to the intended site conditions and evaluate the degree of success in addressing the resource concern. The fifth step is to increase the selected germplasm(s). This increase can be done vegetatively

or by seed, depending on the release level and plant species. The final step is to officially release the selection as a named release to commercial nurseries and seed producers for large-scale production and public availability. Public notice of a new conservation release is announced by a Notice of Release publication. Ultimately, the goal is for the plant release to be used for restoration projects and conservation practices on both private and public lands.

The PMP began to phase out the exploration of nonnative plants for conservation purposes during the 1970s and refocused efforts on native plant releases. Of more than 700 releases nationally from the PMP, 570 are still active and more than two-thirds are native to their intended areas of use. Stressing the importance of native plant releases was a forward-thinking and proactive move on the part of the PMP to combat the spread of invasive species, given that a miniscule amount of research existed on nonnative, invasive species until the mid-1990s (Lowry et al. 2013).

Published documents constitute another major PMP product. These documents range from technical, peer-reviewed articles in refereed journals to nontechnical newsletters and informational brochures or flyers intended for the general public. Other common PMP publications include plant guides (featured on the USDA Plants Database), release brochures, posters, final study reports, technical notes, and annual progress reports of activities. All publications can be found on the authoring PMC's website.

Presentations and trainings make up the PMP's third product area. They take a wide variety of forms, depending on the circumstances and intended audience. The PMP delivers formal speaking presentations and poster presentations at professional conferences, tours of PMC facilities for nursery and agriculture industry personnel, and field trainings and equipment demonstrations on specific conservation topics for NRCS, Conservation District, partner agency, and nonprofit groups.

New Jersey Plant Materials Center

The New Jersey PMC (NJPMC) was established in 1965, making it one of the more recent additions to the PMP—the majority of PMCs opened before 1960 and only six PMCs opened after the New Jersey Center. The NJPMC was mandated by Congress to test and develop plants for shoreline restoration and make them available to the public through the commercial nursery industry. A catalyst that motivated Congress to appropriate funding for the creation of the NJPMC was the devastation caused by a 1962 nor'easter storm, the Ash Wednesday Storm (Sharp 2013). Considered by the U.S. Geological Survey to be one of the most destructive storms ever to impact the Mid-Atlantic States, the Ash Wednesday Storm lasted 3 days (5 tide cycles) and caused hundreds of millions of dollars of property damage in 6 States, over 1,000 injuries, and 40 deaths on the Northeast Coast (Cooperman and Rosendal 1962, Morton 2003, Savadove and Buschholz 1993). According to Morton et al. (2003), the majority of property damage occurred where healthy dune systems were not established to protect structures from storm surges. To this day, minimizing the impacts of coastal storms via plant solutions on the dune systems is a task that falls within the realm of the NJPMC's responsibility to focus primarily on highly erodible critical areas of the Mid-Atlantic coastal plains.

The NJPMC is located in Swainton, NJ, (figure 2) on approximately 80 ac (approximately 32 ha) of land leased from the State of New Jersey for production and field studies; all infrastructure is situated on 4 ac (1.6 ha) of adjacent federally owned land. The NJPMC is ideally situated to focus on coastal ecosystem conservation concerns given its location near tidal marshes, coastal dune communities, and extensive wetlands. The NJPMC provides plant solutions for natural resource conservation concerns pertaining to coastal shorelines, sand dunes, mined lands, and coastal grassland habitat

Figure 2. An aerial view of the NJPMC facility located in Swainton, NJ. (Photo courtesy of USDA-NRCS Earth Team 2017)

serving a nine-State area, including all or portions of Connecticut, Delaware, Maryland, Massachusetts, New York, New Jersey, North Carolina, Rhode Island, and Virginia. Like its parent agency, the responsibilities and scope of resource concerns addressed by the NJPMC has altered and increased over time to become more applicable to, and in line with, NRCS programs. The NJPMC addresses many of the same concerns that affect agricultural lands in its service area. This primarily includes addressing erosion of the sandy soils of the coastal plains in cultivated fields, impacts due to saltwater intrusion, water quality degradation from nutrient runoff, and strategies for improvement and maintenance of soil health. To remedy conservation concerns, the NJPMC has developed and released 19 conservation plant releases, 15 of which are currently in active production (table 1; figure 3). Additionally, NJPMC staff have written or contributed to more than 85 publications addressing resource concerns. Recent publications from the NJPMC can be found in table 2.

The NJPMC recently hosted an all-day field training. Michael Yacovelli (biological science technician, NRCS-NJPMC) and Scott Snell (natural resource specialist, NRCS-NJPMC) covered native grass seeding considerations: site preparation, seed application options, drill calibration, use of nurse crops, and maintenance (figure 4a). Paul Salon (soil health specialist, NRCS [retired]) and Kaitlin Farbotnik (conservation agronomist, NRCS) led a session on cover crop mix species selection and soil health (figure 4b). Betsy McShane (New Jersey State biologist, NRCS) and Brittany Dobrzynski (stewardship specialist, New Jersey Audubon) led a session on creating pollinator habitat with an emphasis on pollinator hedgerows and species selection (figure 4c). Kaitlin Farbotnik and Michael Yacovelli demonstrated the operation of a spader and reviewed a variety of tillage equipment options, the recommended use for each piece of equipment, the level of soil disturbance and remaining residue cover expected with each, and the resulting soil health implications. In addition, Becky Watson (biological science technician, Cape Atlantic Conservation District partner employee) gave an overview and tour of the PMC seed cleaning facility, and the Cape May County Beach Plum Association and Jenny Carleo (county agriculture agent, Rutgers) staffed a table offering information and tastings of beach plums and beach plum value-added products. Lastly, David Steinmann (major land resource areas soil scientist, NRCS) presented information on the process of extracting subaqueous soil cores and displayed examples.

Table 1. Conservation plant releases by the New Jersey Plant Materials Center.

Release Name	Common Name	Scientific Name	Applications[1]	Origin
Cape	American beachgrass	*Ammophila breviligulata* Fernald	E, S, W	MA
Suther Germplasm	big bluestem	*Andropogon gerardii* Vitman	B, E, F, W	NC
Wildwood	northern bayberry	*Morella pensylvanica* (Mirb.) Kartesz	E, H, S, W	NJ, NC
Atlantic	coastal panicgrass	*Panicum amarum* Ell. var. amarulum (Hitchc. & Chase) P.G. Palmer	E, F, H, S, W	VA
Carthage	switchgrass	*Panicum virgatum* L.	E, F, W	NC
High Tide Germplasm	switchgrass	*Panicum virgatum* L.	B, E, F, H, ST, W, WL	MD
Timber Germplasm	switchgrass	*Panicum virgatum* L.	B, H	NC
Ocean View	beach plum	*Prunus maritima* Marshall	E, S, W	DE, MA, NJ
Dune Crest Germplasm	shore little bluestem	*Schizachyrium littorale* (Nash) E.P. Bicknell	E, W	DE, NJ
Suther Germplasm	little bluestem	*Schizachyrium scoparium* (Michx.) Nash	E, F, W	NC
Monarch Germplasm	seaside goldenrod	*Solidago sempervirens* L.	E, S, W	DE, NJ, VA
Coastal Germplasm	Indiangrass	*Sorghastrum nutans* (L.) Nash	E, F, W	CT, RI, MA
Suther Germplasm	Indiangrass	*Sorghastrum nutans* (L.) Nash	B, E, F, W	NC
Avalon	saltmeadow cordgrass	*Spartina patens* (Aiton) Muhl.	E, S, W, WL	NJ
Southampton Germplasm	prairie cordgrass	*Spartina pectinata* Bosc ex Link	B, E, S, ST, W, WL	NY

[1] Application codes: B = biomass; S = salt tolerant; E = erosion control; ST = streambank; F = forage; W = wildlife benefits; H = hedgerow; WL = wetland applications.

Strength in Partnerships

A major strength of the PMP is that it allows PMCs to form internal partnerships between PMCs as well as external partnerships with other Federal/State agencies, nonprofits, and academia working towards common goals. With 25 PMCs strategically located throughout the United States, the PMP has the unique ability to conduct replicated, consistent studies over widespread, diverse regions and conditions. The diversity of geographic locations of PMCs provides the means for each center to test the range of adaptability of their conservation plant releases by forming internal partnerships between PMCs. In recent years, PMCs implemented a national study to determine which areas of the country could effectively use 'Tropic Sun' sunn hemp (*Crotalaria juncea* L.) as a cover crop and green manure (Clark 2016). Currently, the PMP is conducting a national cool-season study to examine 59 varieties of nine common cover-crop species: cereal rye (*Secale cereale* L.); common oat (*Avena sativa* L.); black oats (*Avena strigosa* Schreb.);

Table 2. Publications produced by the New Jersey Plant Materials Center. All publications are available online at: https://www.nrcs.usda.gov/wps/portal/nrcs/publications/plantmaterials/pmc/northeast/njpmc/pub/

Publication type	Title	Year
Annual progress report of activities	Cape May Plant Materials Center 2019 Annual Progress Report of Activities	2020
Information brochure	New Jersey Plant Materials Center Conservation Plant Releases and Suppliers	2019
Annual progress report of activities	Cape May Plant Materials Center 2018 Annual Progress Report of Activities	2019
Newsletter	Conserving the Sweetgrass Tradition | Mashpee Wampanoag Tribe	2019
Plant guide	Northern Bayberry (*Morella pensylvanica*) Plant Guide	2019
Annual progress report of activities	Cape May Plant Materials Center 2017 Annual Progress Report of Activities	2018
Plant guide	Beach plum (*Prunus maritima*) Plant Guide	2018
Newsletter	Coastal Bluff Erosion in the Atlantic Coastal Plain-How are Shoreline Property Owners Coping with Bluff Erosion	2018
Newsletter	Developing Climate Change Resilience in Conservation Plants	2018
Poster	Developing Coastal Grassland Technologies	2018
Poster	Revegetation Success of Native Species Following Chemical and Mechanical Treatment of *Phragmites australis*	2018
Final study report	Monarch Germplasm seaside goldenrod (*Solidago sempervirens*) direct seeding trials	2018
Plant guide	Virginia saltmarsh mallow (*Kosteletzkya virginica*) Plant Guide	2018
Major publication	New Jersey Sea Grant Consortium - Dune Manual	2017
Poster	The Cape May PMC-Developing Plant Technologies for Coastal Ecosystem Restoration	2017

Figure 3. Conservation plants released by the NJPMC include (a) 'Ocean View' beach plum, (b) Virginia saltmarsh mallow (in development), and (c) 'Wildwood' northern bayberry. (Photos by Scott Snell 2017–19)

Figure 4. A 2018 NJPMC field day training included (a) native grass seeding considerations, (b) cover crop mix species selection and soil health, and (c) creating pollinator habitat. (Photos courtesy of Cape May Plant Materials Center 2018)

hairy vetch (*Vicia villosa* Roth); Austrian winter pea (*Pisum sativum* L.); daikon radish (*Raphanus sativus* L.); crimson clover (*Trifolium incarnatum* L.); red clover (*Trifolium pratense* L.); and Balansa clover (*Trifolium michelianum* Savi). Participating PMCs have completed the field trials, collected the necessary data, and transferred the data to the USDA Agricultural Research Service (ARS) for statistical analysis. Individual PMCs are in the process of writing final study reports. Several are already publicly available (Bullard 2019, Pickett et al. 2019, Young-Mathews 2019) and the remainder should be published later this year.

The NJPMC has worked with a diverse range of external partners as well. Most recently, an agreement was established with the Bureau of Land Management (BLM) and their Seeds of Success (SOS) program. The mission of SOS is to collect native seed for long-term storage and for the development of commercially available, ecologically appropriate germplasms (Haidet and Olwell 2015). The NJPMC's responsibility thus far with this project has been to process more than 2,100 unique seed collections of 359 plant species. NJPMC staff clean each collection to obtain high seed purity and then pull a sample from each collection to send to the ARS Western Regional Plant Introduction Station in Pullman, WA. ARS staff catalog and preserve each sample for long-term storage and provide samples upon request for basic and applied plant research. The remainder of each collection is either sent direct to a restoration project for immediate use or stored for future development/increase. The most noteworthy restoration project to receive SOS seed collections was a revegetation site at Prime Hook National Wildlife Refuge (NWR) managed by the U.S. Fish and Wildlife Service (USFWS). Superstorm Sandy severely altered the ecology of Prime Hook NWR by inundating managed freshwater wetlands with saline storm surges and damaging protective dune barrier systems. In 2017, the USFWS aerially applied a locally collected seed mix provided by the SOS program to restore about 4,000 ac (approximately 1,620 ha) of tidal marsh and barrier beach ecosystems (figure 5). Since the seeding, USFWS staff have reported excellent native vegetation recruitment.

Figure 5. Smooth cordgrass (*Spartina alterniflora* Loisel.) seed (lower left corner) being loaded for aerial seeding at Prime Hook National Wildlife Refuge. (Photo courtesy of U.S. Fish and Wildlife Service 2016)

The NJPMC has also partnered with Rutgers University in a series of studies focused on pollinator and plant interactions and plant species longevity. Rutgers led a pollinator specificity study at the NJPMC to examine pollinator preference and mutualistic relationships between pollinators and commonly recommended plant species for pollinator habitat (MacLeod 2016). In 2018, during his third year as a seasonal employee at the NJPMC, Luis Almeyda (biological science technician, Cape Atlantic Conservation District) completed his Master of Science in Environmental Science at Stockton University with his capstone project using the plots from the Rutgers study at NJPMC which had remained in place unmaintained for 5 years. In his study, Almeyda (2018) examined the longevity and long-term vigor of the pollinator plant species by assessing survival rates, spread, and stem counts of the remaining pollinator plant species. His findings showed distinct variations in the survival and vigor of the 20 plant species examined, with several species showing substantially greater stem counts, survival, and spread (figure 6). The information gained from this study could be of use to planners recommending flowering plant species for pollinator wildlife habitat in the Mid-Atlantic region.

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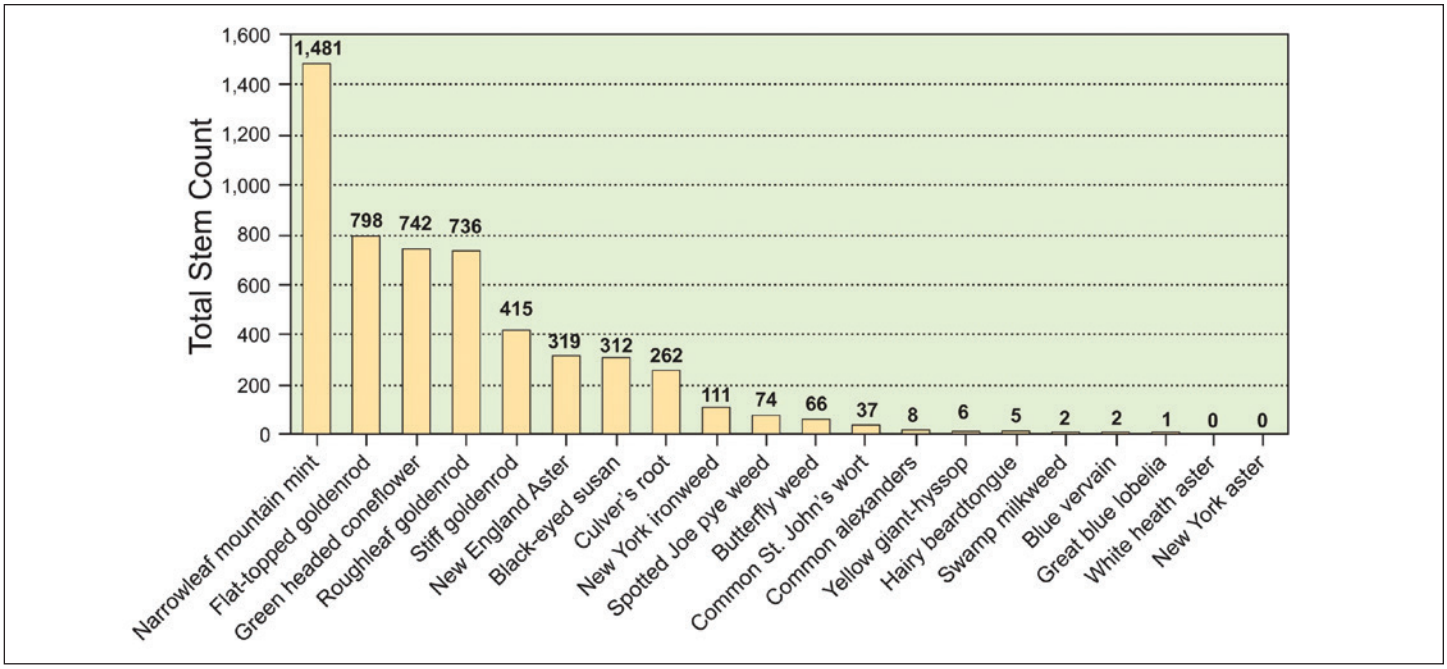

Figure 6. Total stem count data for 20 plant species examined in Almeyda's (2018) Capstone Project at the NJPMC.

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