

Ballast dumps from the late 1800's

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Throughout history non-native plant species have been spread to new regions by many different vectors. Prior to the 20th century a significant method of introduction may have been due to the use of solid ballast on ships. In 1860's-1880's ballast heaps in PA, NJ and NY became common botanizing areas due to the uncommon and interesting species that could be found growing on and among them. The publication of "On the colonies of plants observed near Philadelphia"¹, by Aubrey H. Smith in 1867 was the first of a series of papers devoted to cataloging the introduced flora found on ballast heaps. Subsequent papers catalogued the species found on ballast heaps at the ports and wharves of Philadelphia, New Jersey and New York. Many of these species did not survive past the initial introduction period. In *The vascular flora of Pennsylvania: Annotated Checklist and Atlas*², 81 species on record are known only from the few specimens collected on the ballast heaps³. Ballast heaps are most often recognized for having provided the odd species occurrence for the state checklist. To our knowledge the herbarium records have never been thoroughly studied to investigate the introduction and persistence of species listed in these early papers. A preliminary search for specimens of the species collected on ballast heaps, held at the Rutgers University Chrysler Herbarium (CHRB), has shown that many of the ballast specimens are the first record for certain non-native species in the local area and that there are specimens of these species collected over the last 120 years from a wide distribution of localities. This preliminary data provides evidence that the ballast heaps may have served as the point of entry for species still persisting in the local flora.

SPECIES INVESTIGATED

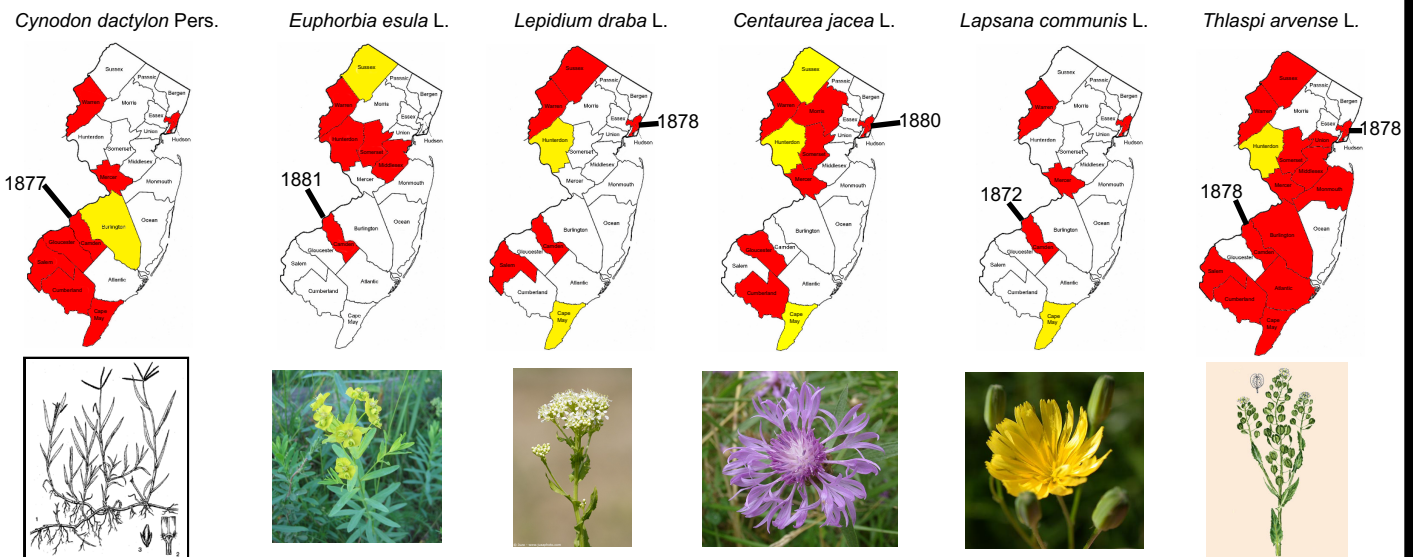
Species were selected from those listed in Addison Brown's articles in the Bulletin of the Torrey Botanical Club^{4,5,6}. Brown's list consisted of species found on made land and ballast grounds in southern and northern NJ (Camden and Jersey City) and New York City. Brown provided valuable notes as to which species were not mentioned in the fifth edition of Gray's Manual, those not recorded in the local catalogue of the Torrey Botanical Club (unknown in the local flora at that time) and those previously unknown in the U.S. All selected species were noted as being unknown in the local flora or unknown in the U.S.

Alopecurus bulbosus L. (POACEAE)
Amaranthus hypochondriacus L. (AMARANTHACEAE)
Amaranthus spinosus L. (AMARANTHACEAE)
Amsinckia intermedia F. & M. (BORAGINACEAE)
Bupleurum protractum Link. (APIACEAE)
Caucalis infesta Curtis (APIACEAE)
Centaurea austriaca DC. (ASTERACEAE)
Centaurea jacea L. (ASTERACEAE)
Chenopodium obovatum DC. (AMARANTHACEAE)
Colutea arborescens L. (FABACEAE)
Crypsis schoenoides Lam. (POACEAE)
Cynodon dactylon Pers (POACEAE)
Dactyloctenium aegyptium Willd. (POACEAE)

Euphorbia esula L. (EUPHORBIACEAE)
Fumaria officinalis L. (PAPAVERACEAE)
Gilia achillaeifolia Benth. (POLEMONIACEAE)
Hemizonia rammosissima Benth. (ASTERACEAE)
Lapsana communis L. (ASTERACEAE)
Lepidium (Cardaria) draba L. (BRASSICAEAE)
Matricaria discoidea DC. (ASTERACEAE)
Sysimbrium sophia L. (BRASSICAEAE)
Thlaspi arvense L. (BRASSICAEAE)
Trifolium ochroleucum L. (FABACEAE)
Trifolium lappaceum L. (FABACEAE)
Verbascum sinuatum L. (SCROPHULARIACEAE)
Wahlenbergia linarioides DC. (CAMPANULACEAE)

RESULTS

Most investigated species had only a few early specimens collected at ballast sites. The species mapped below had multiple specimens collected from various locations in NJ. The dates of these collections range over the last 100 years. Additional county records, marked in yellow, are taken from Hough's *New Jersey Wild Plants*⁷. The date and location of the earliest collection for each species are also noted.



BALLAST SITES INVESTIGATED IN NJ



CONCLUSIONS

Even in the 19th century most authors dismissed that ballast soil would be a starting ground for introduced species and noxious weeds and noted that a majority of ballast species existed only briefly in one location, due to the difficulty of obtaining the perfect, undisturbed conditions for germination and flowering³. Still, due to the constant arrival of ships and the continuous introduction of non-native species into the United States via ballast, some botanists speculated that at least some species would persist⁸. It is difficult to determine if ballast was the only source for introduction of the species found to be persisting in the flora of NJ. Although the earliest records for these species are from ballast heaps there may have been other avenues of introduction. *Cynodon dactylon* Pers. may have been introduced in southern NJ as a possible forage crop and/or turf grass, while other species may have been introduced as weeds in seed stock or as escaped ornamentals. Further investigation of specimens held in other local herbaria (PH, NY, BKL) will provide additional insight into the history of introduction of these species.

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ACKNOWLEDGEMENTS

We would like to thank Jacqueline Heads, Director, Undergraduate Programs, Douglass Project for Rutgers Women in Math, Science, and Engineering and Douglass College project SUPER "Science for Undergraduates: A Program for Excellence in Research" for providing students to assist with this work.

