“Restoring Brooklyn’s Pennsylvania and Fountain Landfills”

NYC Environmental Protection

FreshKills Park Talks

Metropolitan Exchange
January 26, 2010

Presentation Overview

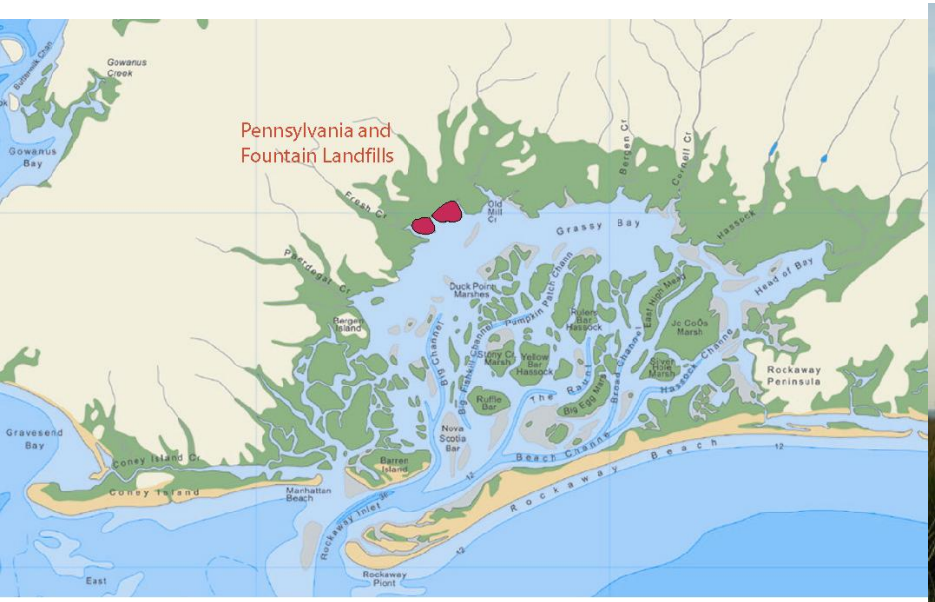
- Background information
  - Class 2 Inactive Hazardous Waste Sites
- Development of Ecological Design
- Features of the Design
- Implementation Issues
- Post restoration maintenance issues

Background Information

Landfills in 1950

The site and ecology have changed

Background Information



Green shading is shoreline in late 1800's. These are no longer naturally occurring systems

NYC Environmental Protection

Background Information

Background Information

- **Pennsylvania Avenue Landfill (PAL) - 110 acre site in Jamaica Bay**
- **Fountain Avenue Landfill (FAL) - 297 acre site in Jamaica Bay**
  - **Operational History**
    - **1956 – Both Sites opened by NYC Department of Sanitation for receipt of residential and commercial waste**
    - **1962-1968 - Landfilling at PAL was temporarily suspended**
    - **1968 - Disposal of construction and demolition debris resumed at PAL**
    - **1974 – Both Sites deeded to National Park Service as part of Gateway National Recreation Area**
    - **1980 - Disposal of all wastes ceased at PAL by New York State Department of Environmental Conservation (NYSDEC)**
    - **1983 - Disposal of all wastes ceased at FAL by NYSDEC**
    - **Both sites are Class 2 Inactive Hazardous Waste Sites**

Background Information Schedule

Pennsylvania Avenue Landfill

- **Construction started March 6, 2002**
- **Landfill cap to be complete Spring 2005**
- **Seeding began Spring 2005**
- **First Trees and shrubs planted Spring 2006**
- **Planting maintenance ended Spring 2009**

Fountain Avenue Landfill

- **Construction started March 27, 2002**
- **Landfill cap to be complete Fall 2006**
- **Seeding began Fall 2006**
- **First Trees and shrubs planted Fall 2007**
- **Planting maintenance ended Fall 2009**

Development of Ecological Design

- The Biggest Problem to Overcome

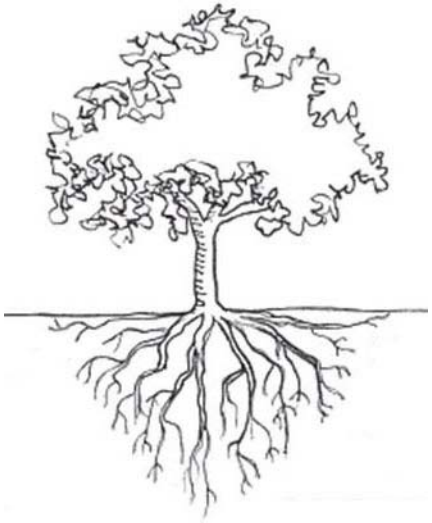


Photo Credits: Presenting You.com

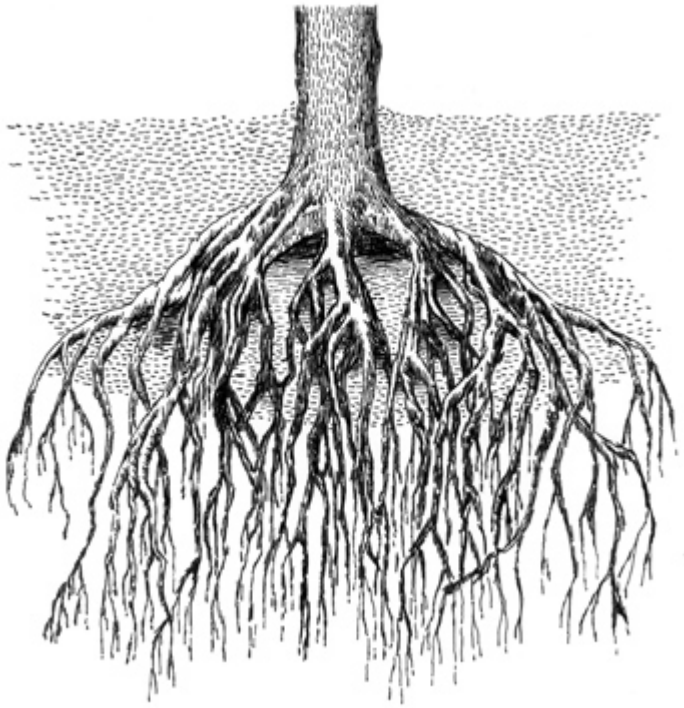


Photo Credit: 4loge.net

Development of Ecological Design

- True representation of tree roots

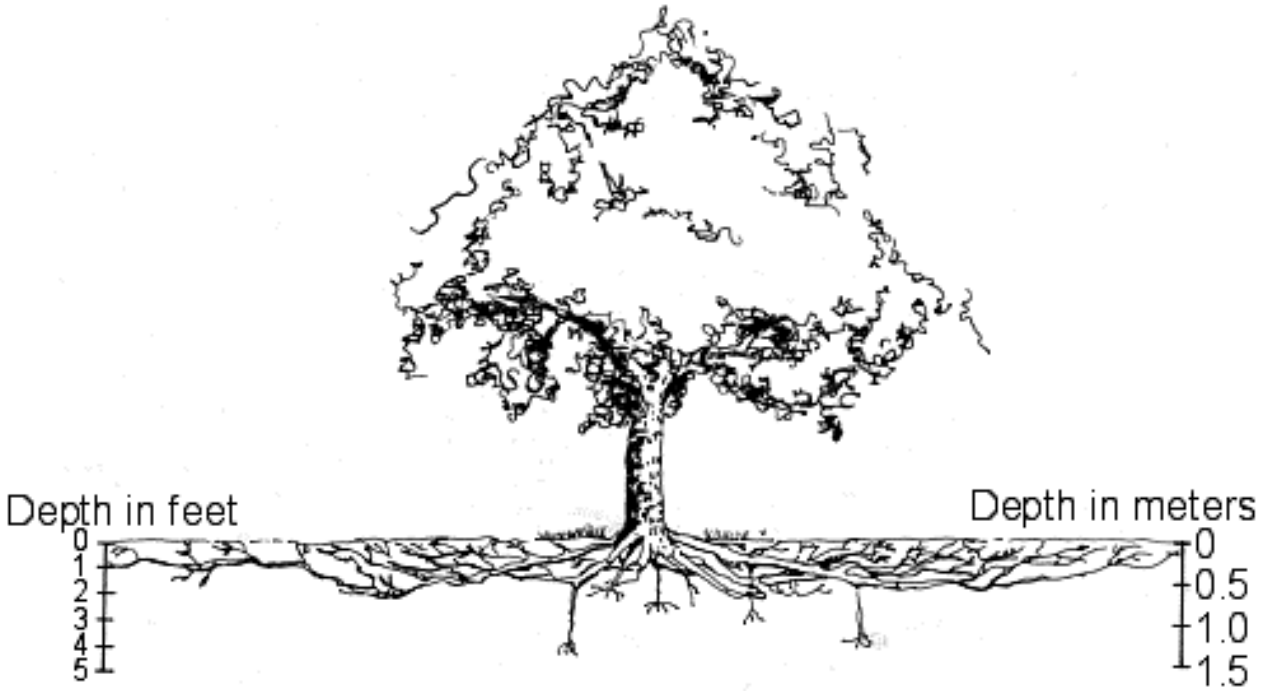


Photo Credit: Hellis Consultants

Development of Ecological Design

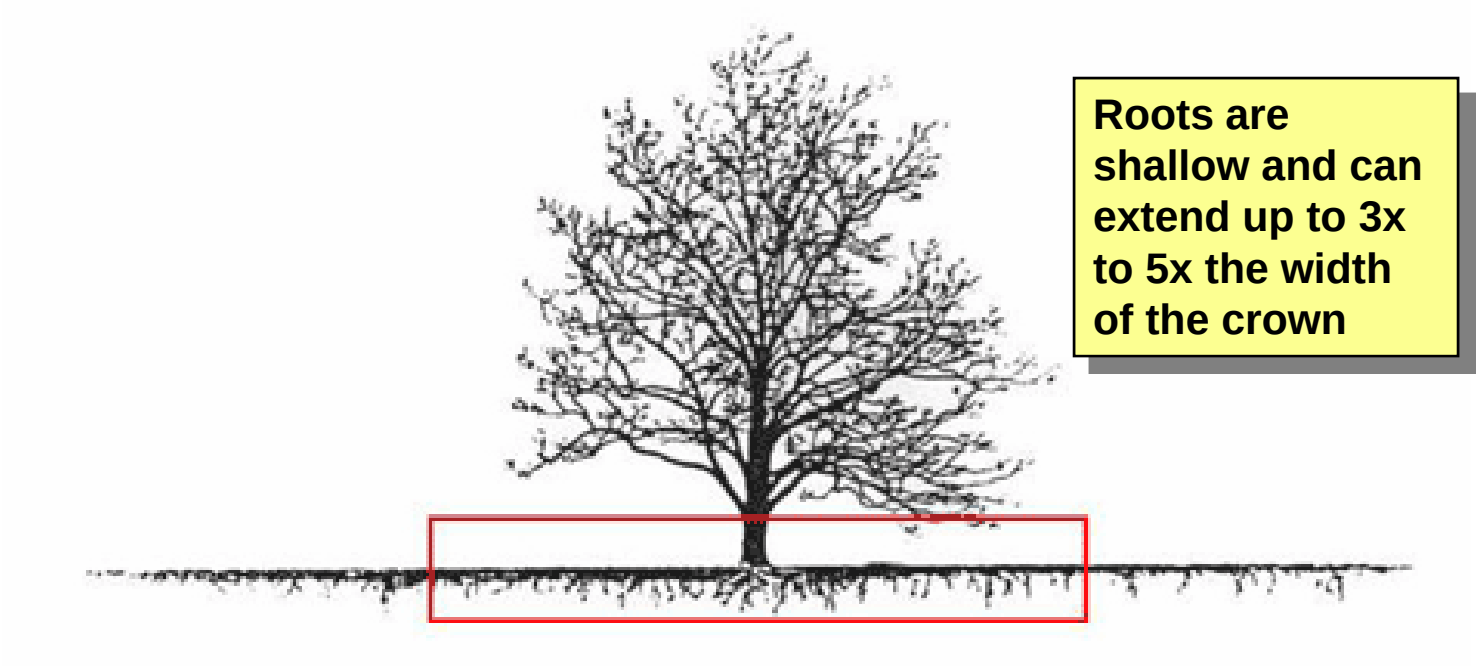


Image Credit: City of Fort Collins

Development of Ecological Design

Photo Credit: TLC for Trees

Living Proof!

Development of Ecological Design

- Driven by plant community associations
- Protect existing sensitive natural areas
- Utilize minimally invasive construction methods.
- Require a thorough understanding of the detailed requirements (e.g., soils, light, moisture, exposure, aspect, etc…) of the particular ecosystem being restored.
- Increase the genetic diversity of local indigenous plants
- When possible, re-introduce extirpated and rare plant communities.

Development of Ecological Design

- Improve and protect wildlife habitat, shelter and food sources.
- Eliminate or minimize the need for supplemental watering, fertilizers, herbicides and insecticides and associated harmful effects.
- Reduce soil erosion and sediment loading into local water bodies.
- Where applicable, attenuate pollution through effective stormwater management and treatment of upland runoff

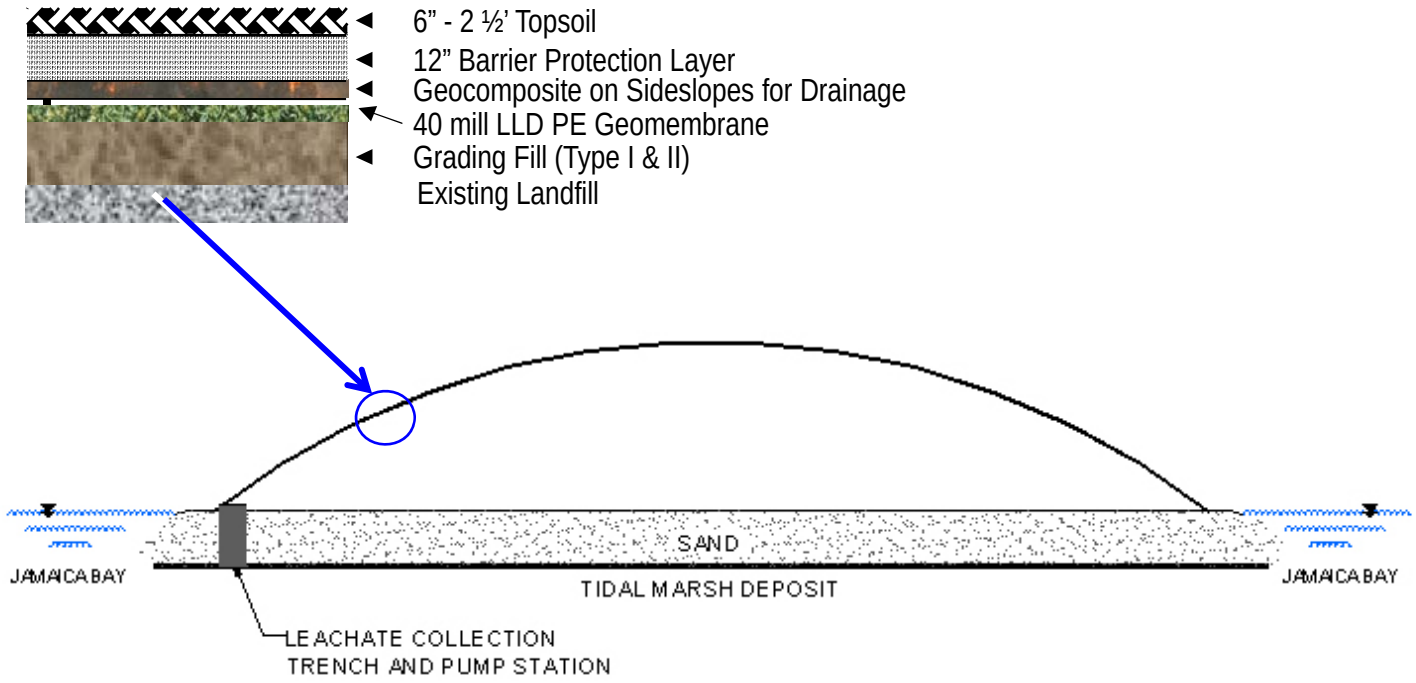
Typical Landfill Closure Look

Photo Credit: Capital Region

“Grassy Knoll’s”

Photo Credit:: Jonathan Marshall

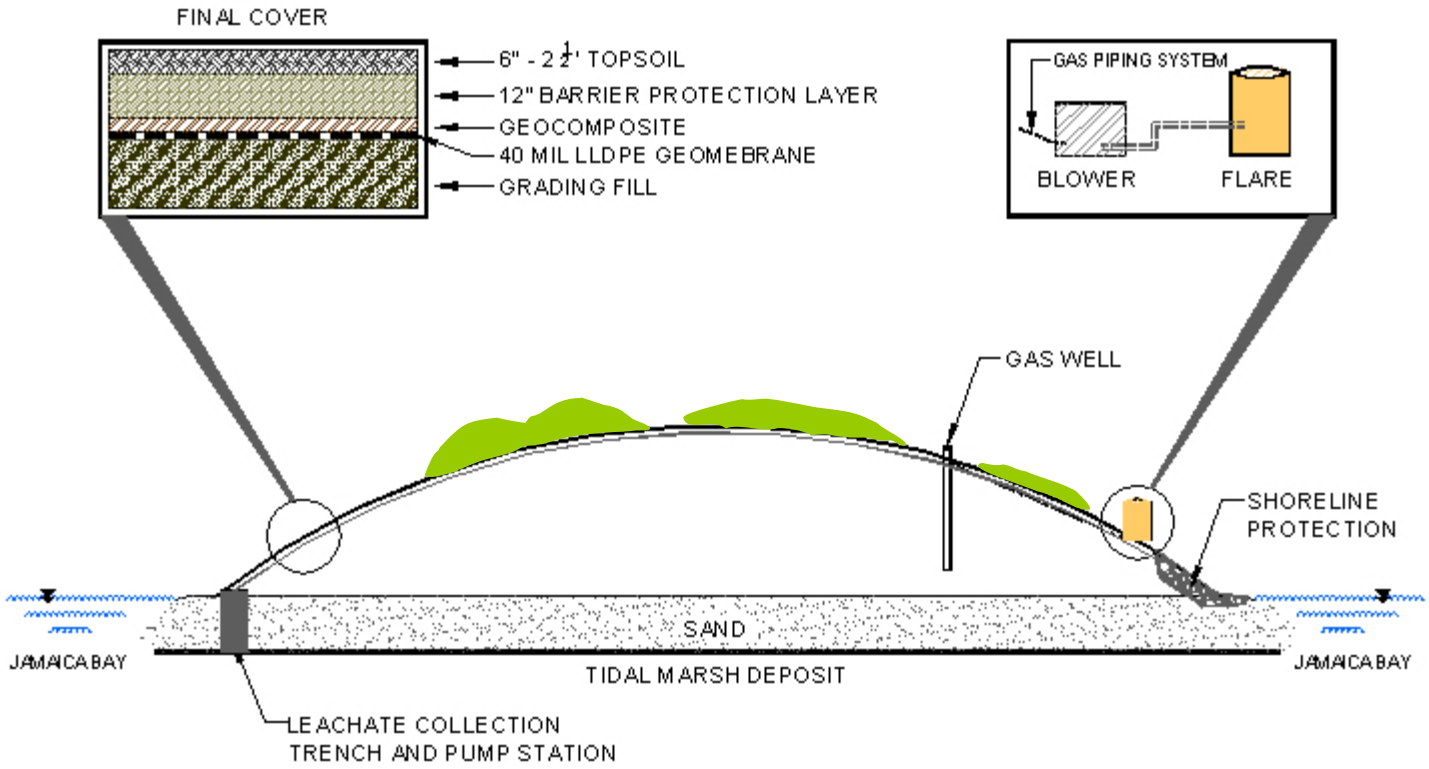
Capping Cross Section



A real challenge to not make it look like this…

Environmental Protection

Modified Cross Section



Development of Ecological Design

Many Different Activities Running Concurrently
BIG CHALLENGE!

1 – Active Landfill Gas Collection Well (typical)
2 – Polyethylene Liner (typical)
3 – Barrier Protection Soil with Erosion Control Grasses
4 – Newly constructed on-site Wetlands Area

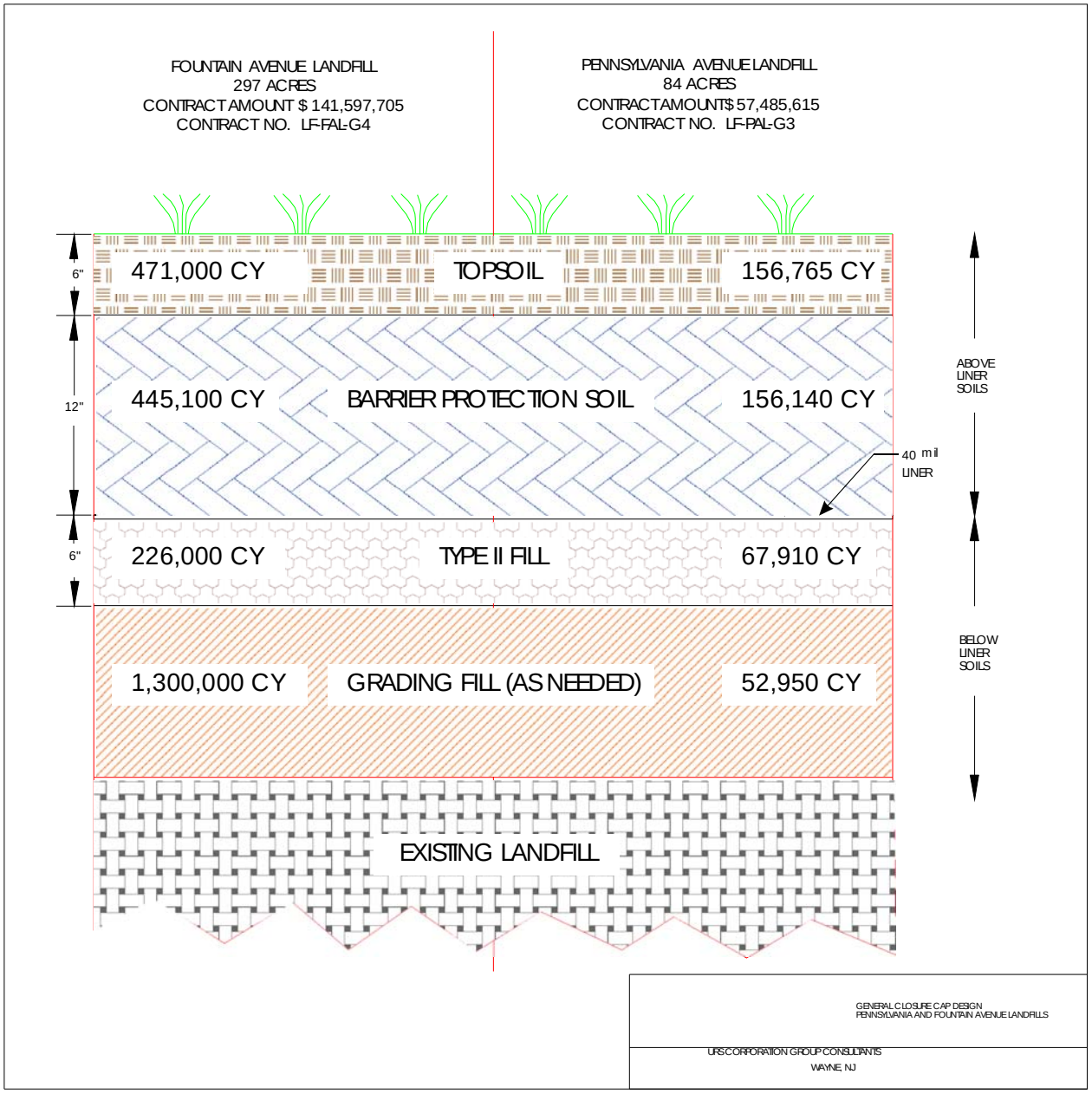
Development of Ecological Design

- Ecological Restoration and Restoration Ecology

- "**Ecological Restoration** is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. It is the practice of restoring ecosystems as performed by practitioners at a specific site."

- "**Restoration Ecology** is the science upon which the practice is based. Provides the knowledge, methodologies and the tools for practitioners in support of their practice."

Environmental Protection



Environmental Protection

Development of Ecological Design

Better make your own soil!

Development of Ecological Design

LOCATION	**pH**	**P** (lbs./acre)	**K** (lbs./acre)	**Mg** (lbs./acre)	**Ca** (lbs./acre)
IDLE-1	4.5	40	21	43	125
IDLE-2	6.0	51	98	189	687
MD-up	4.8	12	20	57	163
MD-low	4.7	17	21	48	122
MM-MH-low	3.9	30	34	41	99
MM-MH-up	3.8	45	77	104	373
MM-MO-up	3.3	29	122	317	496
MM-MO-low	3.5	30	33	39	97
MP-MS-up	5.2	27	58	285	1306
MP-MS-low	5.6	28	27	85	435

Development of Ecological Design

LOCATION	MECHANICAL SAND	MECHANICAL SILT	MECHANICAL CLAY	ORGANIC MATTER	AMMONIUM (N) (ppm)	NITRATE (N) (ppm)
MD-up	98.0%	0.0%	2.0%	1.13%	4.6	1.1
MD-low	98.0%	0.0%	2.0%	0.35%	1.1	1.2
MM-MH-low	91.0%	5.0%	3.0%	-	0.7	1.1
MM-MH-up	94.0%	4.0%	2.0%	7.49%	1.8	1.2
MM-MO-up				92.83%	7.8	1.4
MM-MO-low	93.0%	6.0%	2.0%	2.34%	2.2	1.6
MP-MS-up	96.0%	2.0%	2.0%	2.30%	0.8	3.3
MP-MS-low	99.0%	0.0%	1.0%	0.35%	14.3	10.7

Soils – Critical – too often overlooked

Description	*Ecological*	*Traditional*
Soil Testing Laboratory	Agricultural Soil Labs (e.g., Rutgers, Cornell, etc…) – turnaround times long	Engineering Labs test for strength and durability
Soil Testing Methods	Soil Testing Procedures for The Northeastern United States, 2nd Edition.	Not American Society for Testing and Materials (ASTM) – pH test very different, soil gradations different
Test For (min. and varies with project):	Organic content, soil gradation, sands fraction analysis, pH, soluble salts, nutrients (micro and macro), Inorganic and total Kjedahl nitrogen, iron sulfides and calcium carbonates.	Typically sand, silt and clay and pH
Soil Testing Frequency	Volume Dependent – landfill projects – every 2,000 cys – (~1 barge) – over 600 tests	Once – recipe for disaster
Mapping Soil Placement	Track and map placement of every load with corresponding test results – ability to observe changes over time	None
Bulk Density	Depends on soil type used – sandy loam, < 1.4 g cm^{-3}	None
Restrict Equipment Use	Only low ground pressure equipment - especially under moist conditions	None – the heavier the better
Tailor Specifications	Mimic targeted plant communities (e.g., maritime – high sand, low organic, low fertility, etc…)	One soil fits all

The tipping point…

- **Qualified contractors need to have a minimum understanding of the intent of the ecological restoration design…and not just simply saying that they have used "native plants" in past projects**

- **Not the contractor (or his progeny) that claim:**
  - **"I cannot guarantee the survival of the Spartina plugs, because when the tide comes back in, they are going to get wet."**
  - **"This plant is native, it is a Juniperus chinensis 'San Jose', from San Jose, California."**
  - **"I'll plant carrots to prevent soil erosion."**
  - **You don't want them native oaks, these English Oaks grow much faster and are much better."**
  - **"Do I need to remove the container before planting?"**

Successes

Challenges

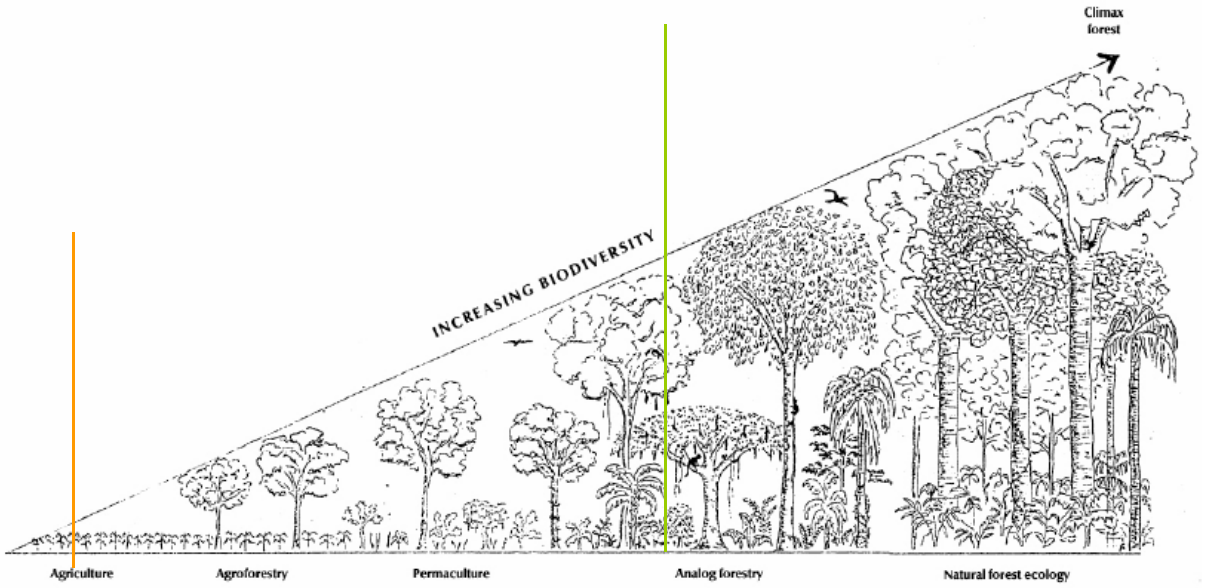
Development of Ecological Design

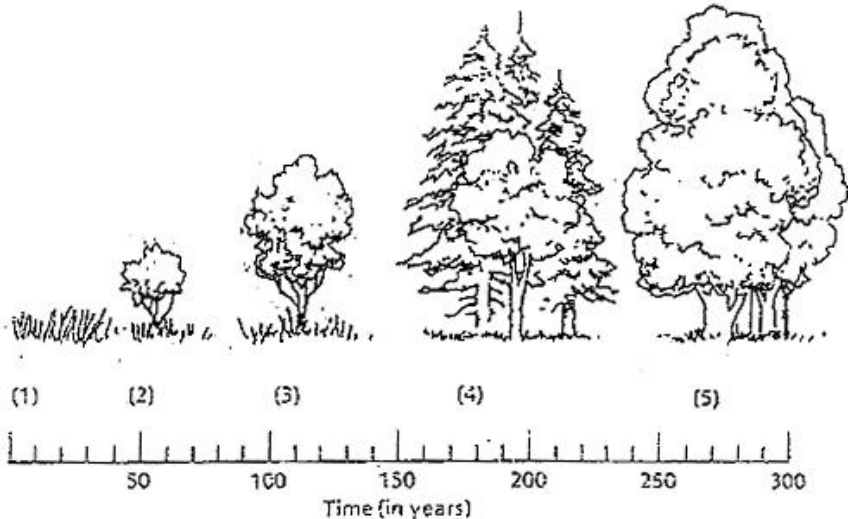
Description	Ecological	Traditional
Qualifications of Key Personnel	Degree in Nat. Resources field and technically proficient (at least 1 at all times)	Bait and Switch – 3:1 foreman, driver and backhoe operator
Working Staff	Prior experience in restoration of similar habitats of project	Seeding perennial rye is not the same as warm-season grasses and wildflowers
References	From designers of project – provides better sense if goals of restoration were met	Not the supervising engineer
Experience with government agencies	Tend to be larger and more complex projects with several restored systems	Contractors have a tendency to separate out the components
Environmental Memberships	Member of appropriate environmental organizations (e.g., Society for Ecological Restoration, National Wildflower Research Center, Society of Wetland Scientists, etc…	General Contractors Association is not sufficient
Pre-Bid Meeting	Make it Mandatory	Typically inappropriate company representative is sent
Photographic Record	Photographic record of similar restorations that are at least 3 years old from the date of completion of project	Small landscape projects usually taken at the start of the project

NYC Environmental Protection

Development of Ecological Design

Development of Ecological Design





Development of Ecological Design

Description	*Ecological*	*Traditional*
Plant	Seed grown to the greatest extent possible	Cultivars and clones
Source of plant material	Distribute over several nurseries to avoid catastrophic loss – if possible pay as stored material	From one nursery - all of same origin
Size	Use smaller sizes – increases survivability and availability – vary sizes of same species	Larger is better – all one size
Seasonal Windows for Planting	Species dependent – stick to them	Whenever - frozen or scorching – does not matter
Provenance	Request certification from nursery of provenance of material – limit to 150 miles from site – go to County level if possible	From wherever
Contract Grow	Helps to ensure availability, quantity and use of non-commercial material – not foolproof – construction delays can wreak havoc with this – 3 years minimum – visit nurseries often	None
Plant Communities	Use “plant communities” rather than individual specimen and out of context plants – just because it is native does not mean that it belongs there	Whatever is available

Environmental Protection

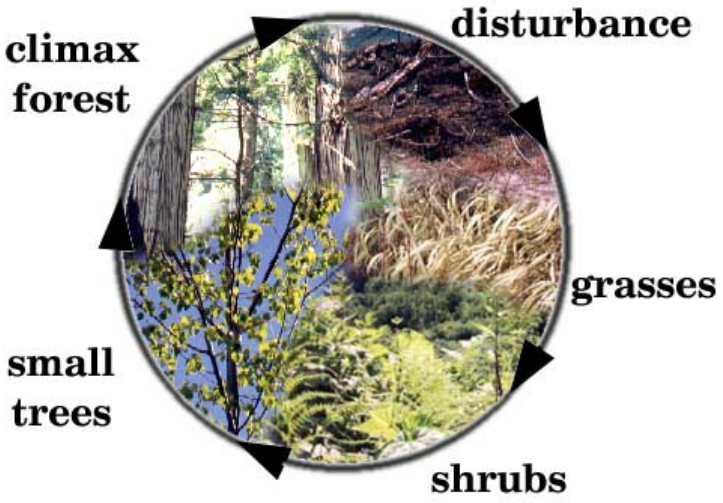
Development of Ecological Design

Seeding of warm and cool season grasses

Development of Ecological Design

Description	*Ecological*	*Traditional*
Germination Test	Run germination test on grasses for each crop year and supplier – adjust rate accordingly – wildflowers take too long	Labels do not tell the whole story
Purity and Germination	Provide purity and germination rates for each component of the mix – including wildflowers – can be notoriously low purity and germination	Labels do not tell the whole story
Nurse Crops	Use ***Avena sativa*** (Oats) or *Elymus canadensis* (Canada Wild Rye) or *Festuca longifolia* (Hard Fescue)	Alleopathic influences of winter wheat and winter rye and aggressive nature of perennial rye
Seasonal Windows for Planting	Species dependent – stick to them	Whenever - frozen or scorching – does not matter
Seeding Equipment	Use Brillion or Trillion seeders – specially adapted for “fluffy” seeds and to place seed at proper planting depth	Hydroseeding

Maintenance, Monitoring and Adaptive Management



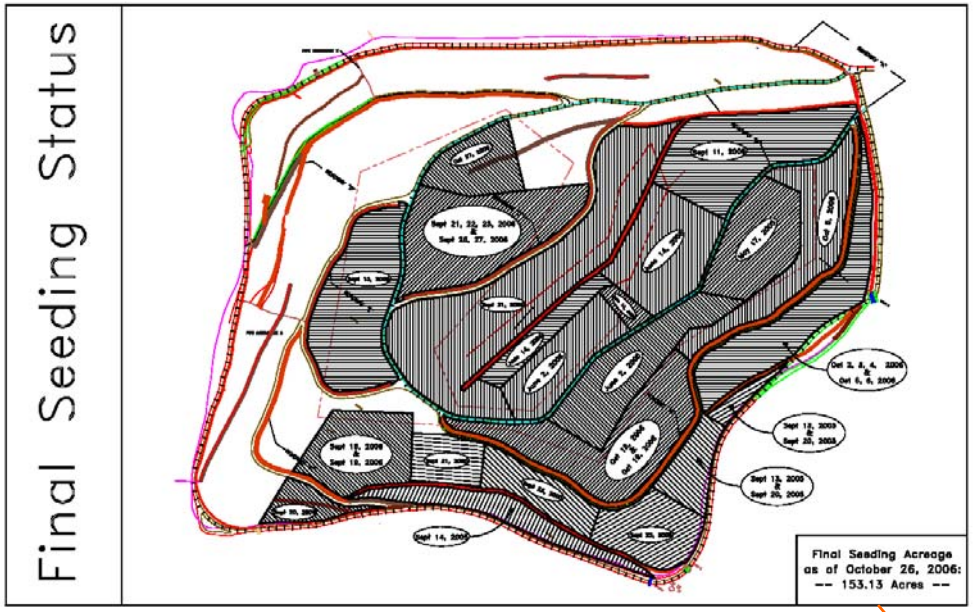
- Planting and seeding were the easy part
- Observe what the site is telling us
  - Set up of micro-climates
  - Adjustment of plant community composition
- Monitoring changes to the site over time more difficult in highly urbanized setting
  - Intense pressure of invasive vegetation from adjacent areas
  - Site is vulnerable due to “pioneer” like conditions
- Site is slowly maturing and experiencing less “growing pains” and is adjusting to site conditions
- Planted 800 to 1,000 plants per acre – will thin to around 400 to 500 plants per acre

Monitoring Plant Material

-Bar-code scanning software enables detailed monitoring of growth of plants from various nurseries, counties compared with seasonal planting windows

-Replaces older version of outdated software

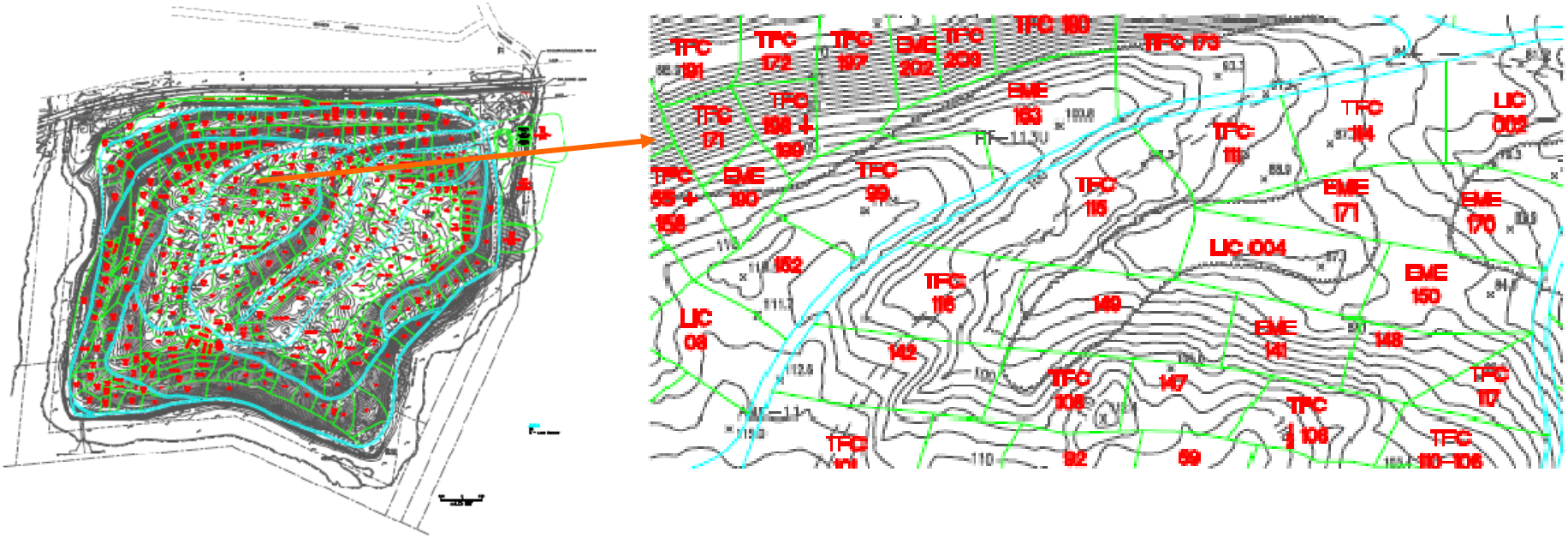
Environmental Protection



Seeding Window Monitoring

Environmental Protection

Soil Modification Monitoring



Environmental Protection

He may look cute, but…..

Environmental Protection

Post Restoration Issues

Post Restoration Issues

Lespedeza cuneata
Chinese Lespedeza

FACT SHEET: CHINESE LESPEDEZA

Chinese Lespedeza
Lespedeza cuneata (Dumont) G. Don
Pea family (Fabaceae)

NATIVE RANGE
Eastern Asia

DESCRIPTION
Chinese lespedeza is a warm season, perennial herbaceous plant. It has an erect growth form, ranging from about 3 to 5½ feet in height, and leaves that alternate along the stem. Each leaf is divided into three smaller leaflets, about ½ to 1 inch long, which are narrowly oblong and pointed, with awl-shaped spines. Leaflets are covered with densely flattened hairs, giving a grayish-green or silvery appearance. Mature stems are somewhat woody and fibrous with sharp, stiff, flattened bristles. Small (about ¼ in.) creamy white to pale yellow flowers emerge either singly or in clusters of 2-4, from the axils of the upper and median leaves.

ECOLOGICAL THREAT
Chinese lespedeza, sometimes called sericea lespedeza, is primarily a threat to open areas such as meadows, prairies, open woodlands, wetland borders and fields. Once it gains a foothold, it can crowd out native plants and develop an extensive seed bank in the soil, ensuring its long residence at a site. Established dense stands of lespedeza suppress native flora and its high tannin content makes it unpalatable to native wildlife as well as livestock.

DISTRIBUTION IN THE UNITED STATES
Chinese lespedeza is now found throughout the U.S.

HABITAT IN THE UNITED STATES
Chinese lespedeza can grow in a variety of habitats including severely eroded sterile soils. It will invade open woodlands, fields, prairies, borders of ponds and swamps, meadows, and open disturbed ground, but is intolerant of shade.

BACKGROUND
Chinese lespedeza is native to eastern Asia and was first introduced to the southern United States. Widespread use of lespedeza by federal and state agencies for bank stabilization, soil improvement, wildlife and forage and cover, and hay facilitated its spread throughout the eastern United States.

BIOLOGY & SPREAD
Chinese lespedeza begins growth from root crown buds at the base of last year's stem. The flowers begin to develop in late July and continue through October. Within the Lespedeza genus there are no specialized structures for seed dispersal. Dispersal is aided by animals consuming the fruits and passing the seeds. A study on natural populations found that several species of Lespedeza comprise 1.5% to 86.8% of the annual diet of bobwhite quail in the southeastern U.S. Autumn dispersal is aided by the haying of infested fields.

Scarification is necessary for the germination of lespedeza seeds. Mature seeds of this genus remain viable for up to twenty years; one study found a germination rate of 60% after cold storage for 55 years. Seedlings may represent only 1% of the seeds actually available in the soil.

MANAGEMENT OPTIONS
Mechanical and chemical methods are the most effective options currently available for Chinese lespedeza. Hand pulling is impractical due to lespedza's extensive perennial root system. Mowing plants in the flower bud stage for two or three

Plant Conservation Alliance's Alien Plant Working Group
Weeds Gone Wild: Alien Plant Invaders of Natural Areas
http://www.nps.gov/plants/alien/

Environmental Protection

Post Restoration Issues

It's Working

Beginnings of maritime woodland….

Environmental Protection

It’s working








Environmental Protection

It’s working