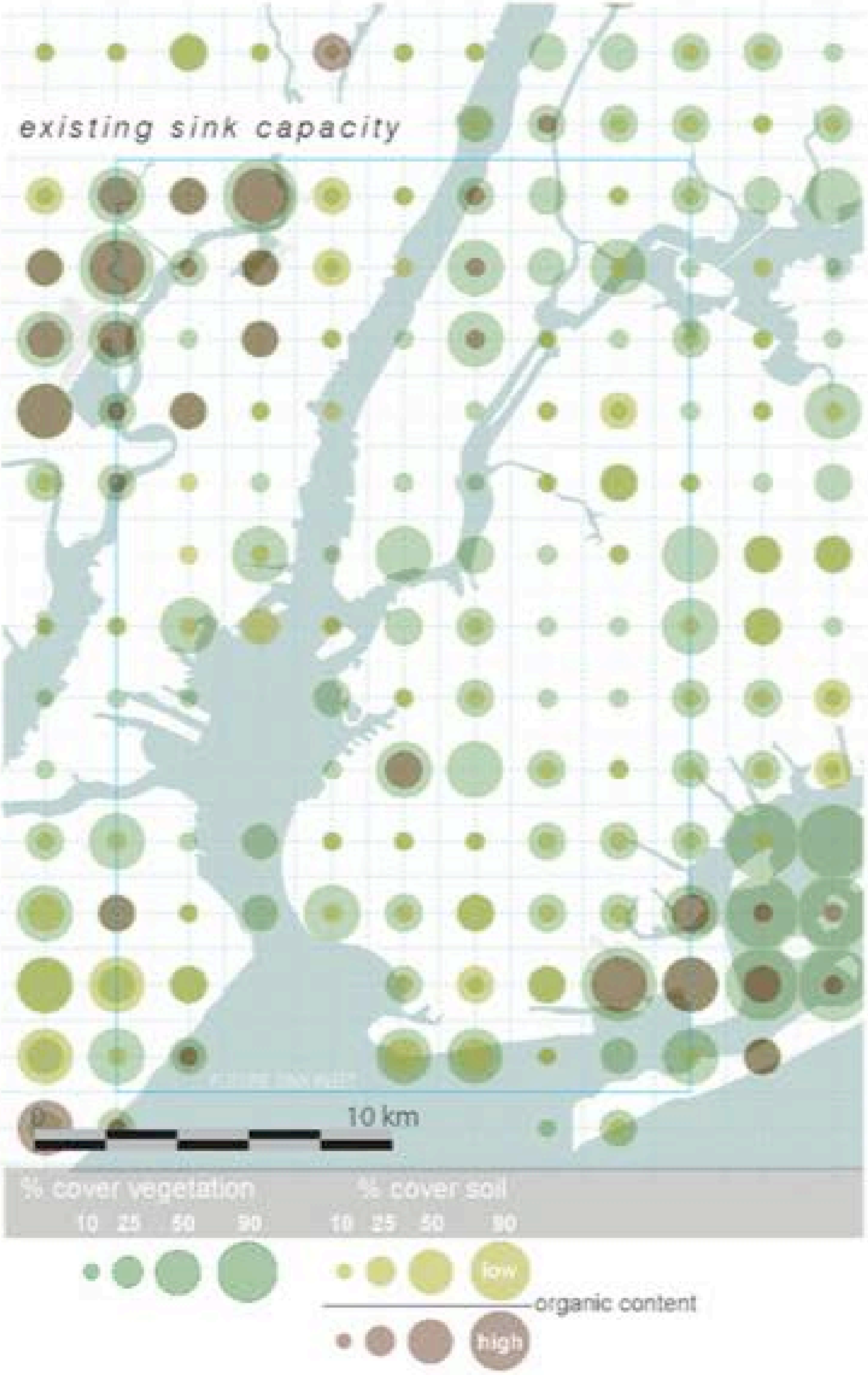


Point distribution map of existing sink capacity based on vegetative cover (green biomass points) and soil organic content (brown points).

The plot was interpolated from USDA Natural Resources Conservation Service Soil Reconnaissance Map and NASA Earth Observatory aerial image of vegetative cover. The plot shows relative sink capacity (not quantified volume of sink) to assess density and dispersal of existing sink areas.

CITY SINK:

DISTRIBUTES CARBON SINKS
within existing infrastructure networks to weave carbon storage capacity throughout the city.

ENGAGES CITIZENS
in sustaining environmental processes at civic, community and individual scales by recasting infrastructure for ecological recovery as meaningful civic landscapes.

ENGAGES DESIGN IN AN EXPANDED FIELD
by shifting urban design and planning objectives to orchestration of social systems within multi-scalar environmental processes.

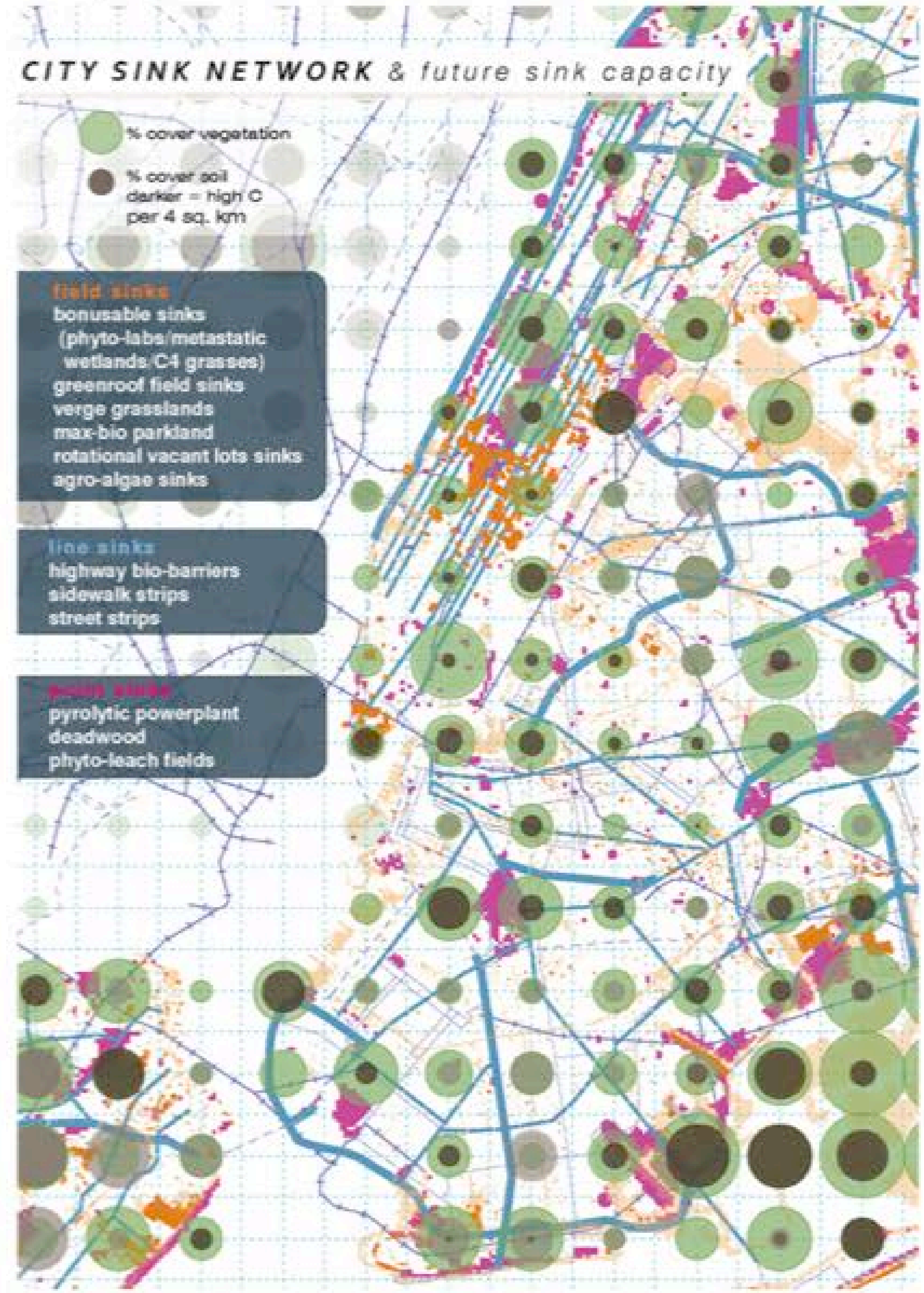
ACCESSES DIVERSE FUNDING
opportunities, tapping into carbon credit markets, and instigate planning policy changes to reduce urban net atmospheric carbon emissions.

EASTERN FORESTS:

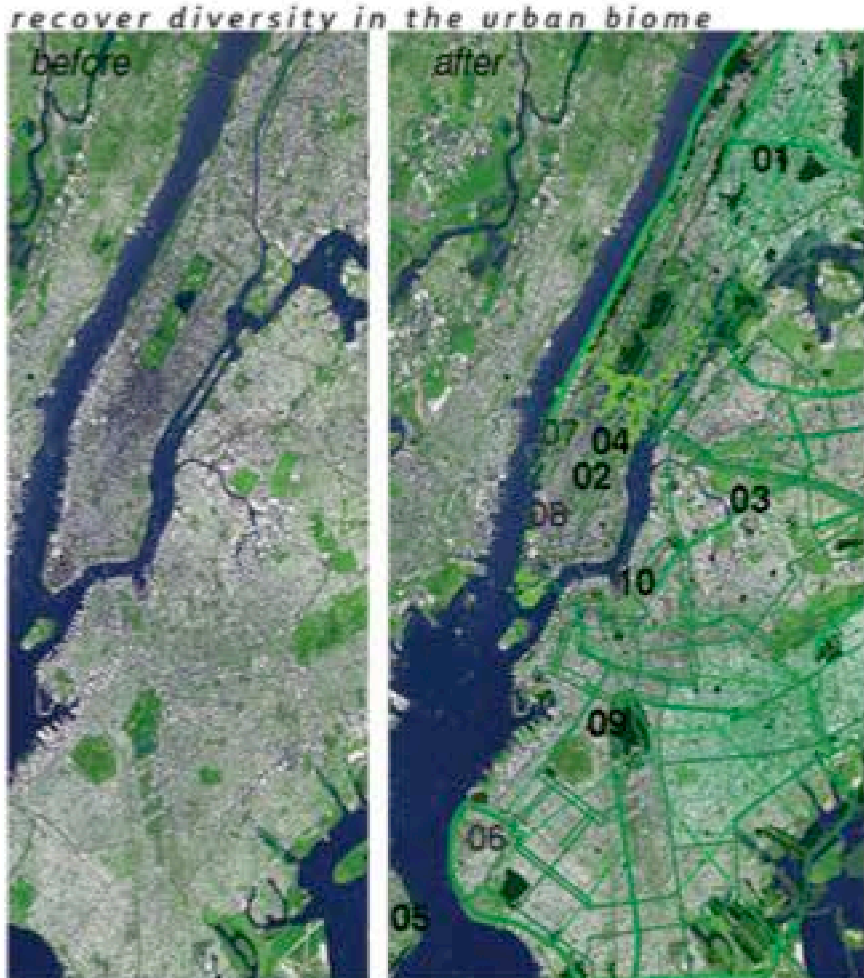
One prevalent theory asserts that some of the carbon storage capacity we currently benefit from is due to the re-forestation of agricultural land in the past century (Compton et al.) The fact that carbon exchange only occurs in growing plant material has led to a concern that future capacity will be lower as those forests mature.

ENGAGE URBAN ECOLOGIES SYSTEMICALLY. *Planners must revamp urban infrastructure systems to integrate human spatial practices and environmenal processes.*

OPPORTUNISTIC STRATEGIES *that disperse across the city to latch-onto existing physical structures, policy or funding mechanisms, are going to be inherently more robust than stand-alone projects.*

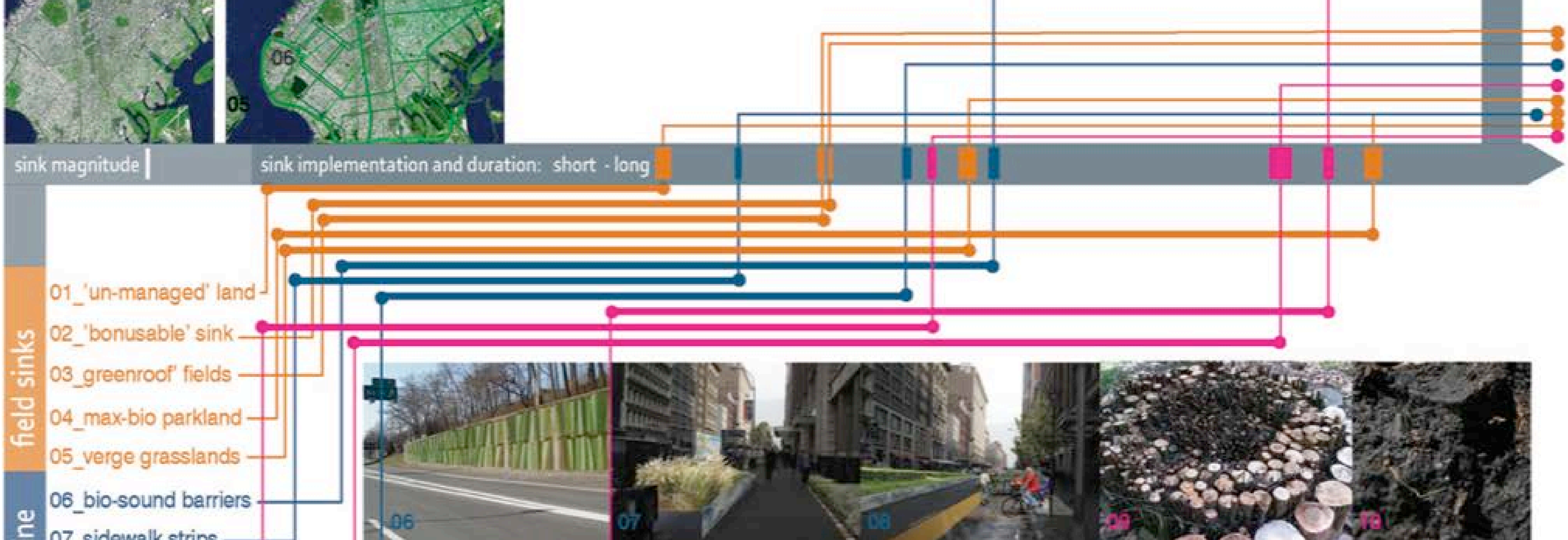



1500
1000
500
0
500
rivers/reservoirs
wetlands
agricultural soils
woody encroachment
wood products
forest
coastal ocean
source
sink
net carbon exchange within the atmosphere
www.60secondscience.com 2000/2004



CITY SINK *orchestrates urban land life-cycles and the carbon cycle*
No single remedy can effect ecological change, we need to systemetize many apparatus for transformation.

case study sites



field sinks
01_'un-managed' land
02_'bonusable' sink
03_greenroof' fields
04_max-bio parkland
05_verge grasslands

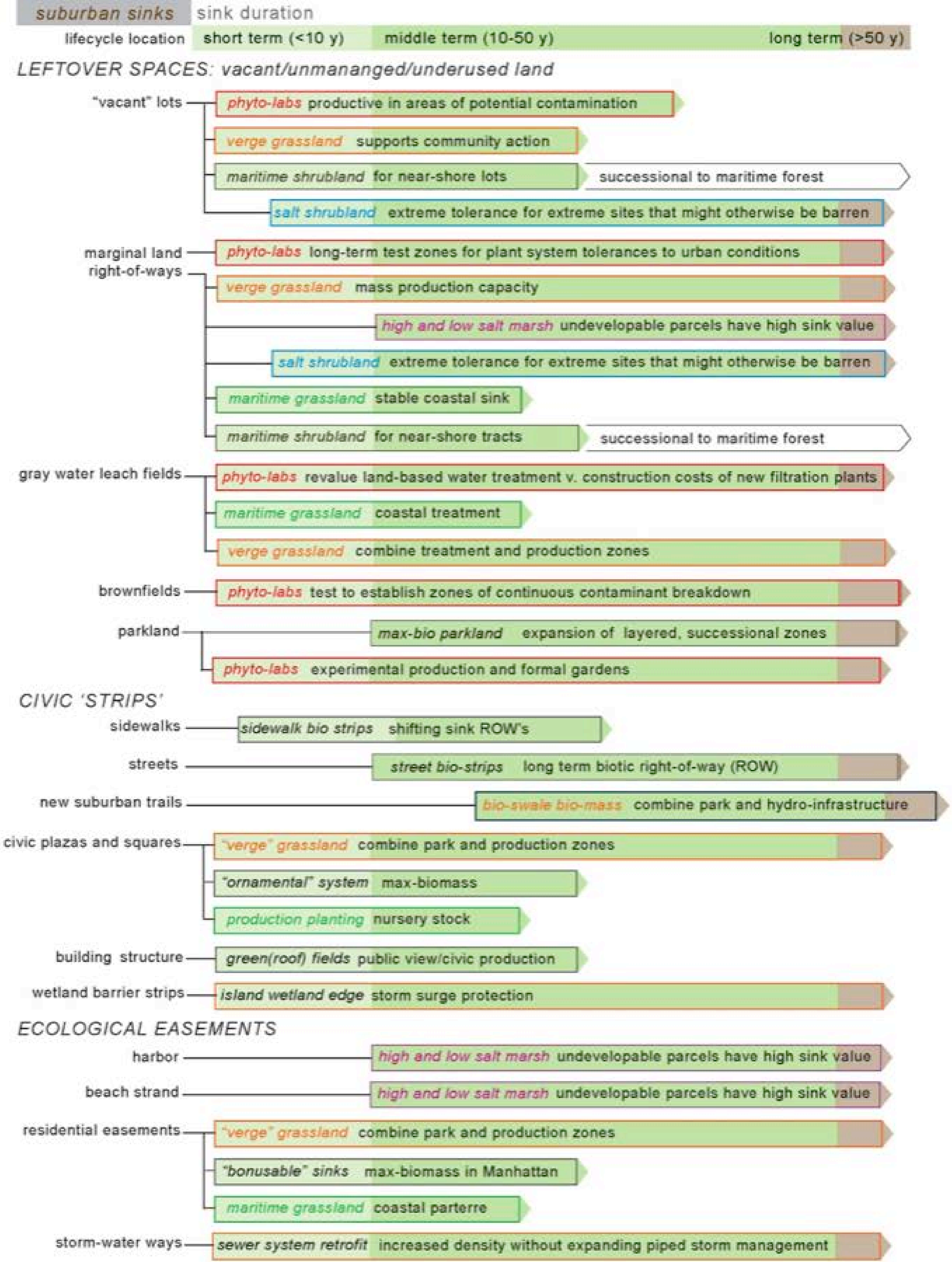
line
06_bio-sound barriers
07_sidewalk strips
08_street strips

point
09_deadwood
10_phyto-leach fields
11_pyrolysis power plants

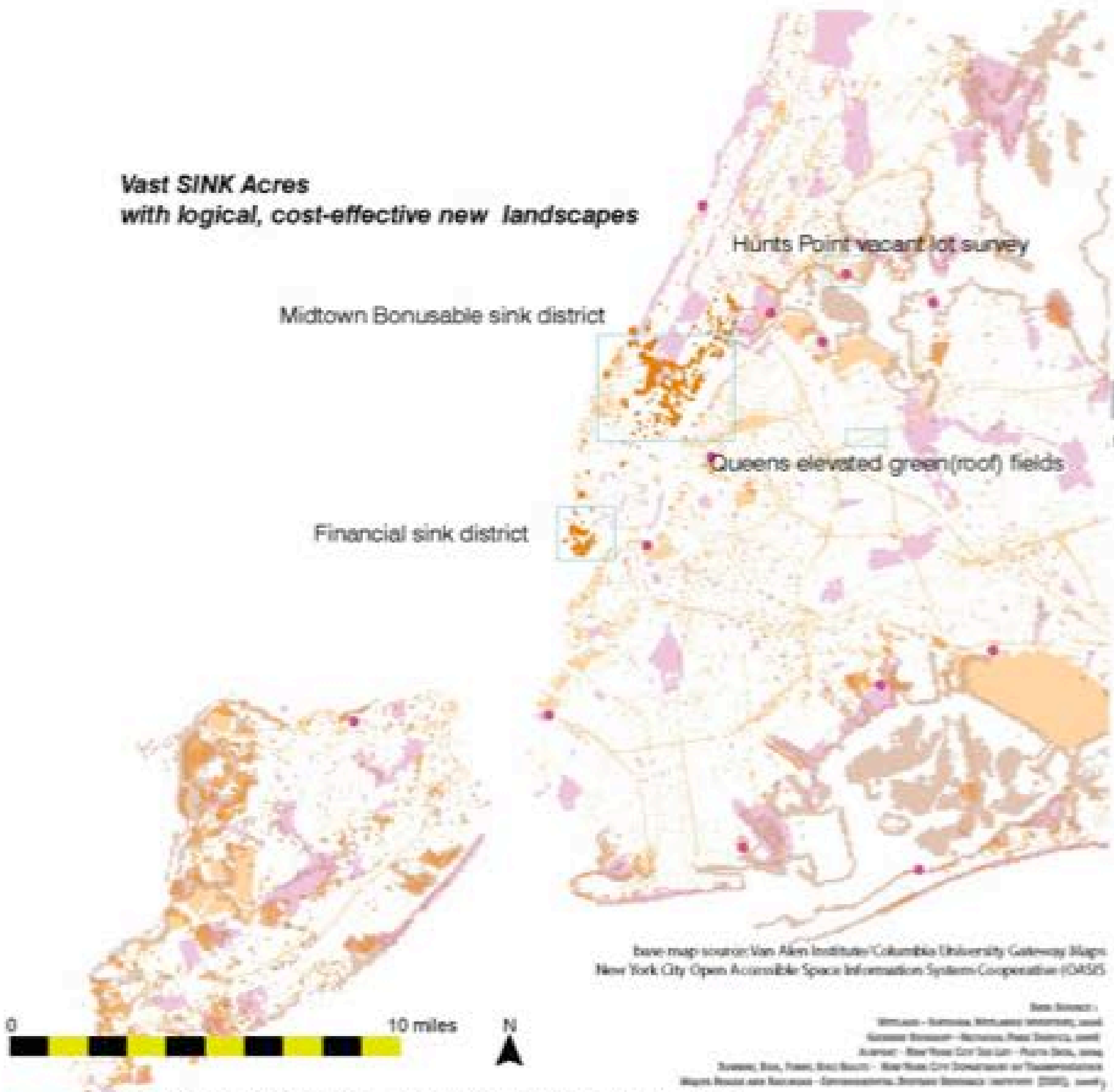
A soil carbon economy: a timely opportunity for all nations

"The economic value of soil carbon needs to be assessed with consideration for both on site and off site effects. Procedures are needed for a defensible soil carbon accounting system, and policies need to be established that provide incentives for net soil carbon sequestration at the global scale. Such policies can provide financial incentives for the restoration of degraded and impoverished soils, while achieving reductions in the rate of buildup of atmospheric CO2 levels."

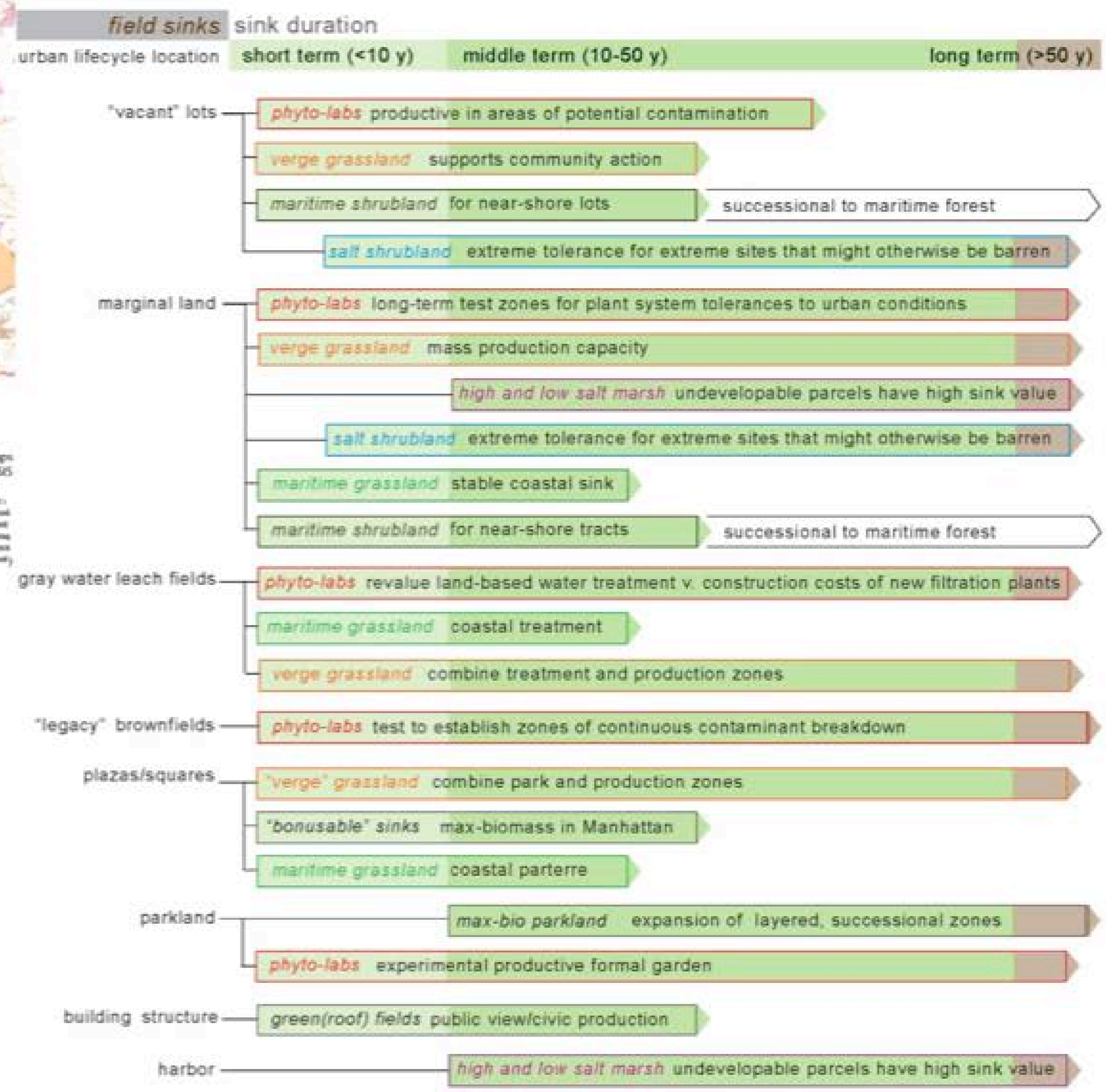
From: Carbon Sequestration: Position of the Soil Science Society of America, Prepared by SSSA Ad Hoc Committee S893.


suburban sinks
sink duration
lifecycle location
short term (<10 y)
middle term (10-50 y)
long term (>50 y)
LEFTOVER SPACES: vacant/unmananged/underused land
"vacant" lots
phyto-labs productive in areas of potential contamination
verge grassland supports community action
maritime shrubland for near-shore lots
successional to maritime forest
salt shrubland extreme tolerance for extreme sites that might otherwise be barren
marginal land
phyto-labs long-term test zones for plant system tolerances to urban conditions
right-of-ways
verge grassland mass production capacity
high and low salt marsh undevelopable parcels have high sink value
salt shrubland extreme tolerance for extreme sites that might otherwise be barren
maritime grassland stable coastal sink
maritime shrubland for near-shore tracts
successional to maritime forest
gray water leach fields
phyto-labs revalue land-based water treatment v. construction costs of new filtration plants
maritime grassland coastal treatment
verge grassland combine treatment and production zones
brownfields
phyto-labs test to establish zones of continuous contaminant breakdown
parkland
max-bio parkland expansion of layered, successional zones
phyto-labs experimental production and formal gardens
CIVIC 'STRIPS'
sidewalks
sidewalk bio strips shifting sink ROW's
streets
street bio-strips long term biotic right-of-way (ROW)
new suburban trails
bio-swale bio-mass combine park and hydro-infrastructure
civic plazas and squares
"verge" grassland combine park and production zones
"ornamental" system max-biomass
production planting nursery stock
building structure
green(roof) fields public view/civic production
wetland barrier strips
island wetland edge storm surge protection
ECOLOGICAL EASEMENTS
harbor
high and low salt marsh undevelopable parcels have high sink value
beach strand
high and low salt marsh undevelopable parcels have high sink value
residential easements
"verge" grassland combine park and production zones
"bonusable" sinks max-biomass in Manhattan
maritime grassland coastal parterre
storm-water ways
sewer system retrofit increased density without expanding piped storm management

CITY SINK is a mechanism for enrichment of urban ground, both in its organic chemistry and as everyday visceral experience. With investment in both the regulated and voluntary carbon markets rising, it is clear that carbon credit marketing protocols will be formalized across all sectors affecting net emissions in the near future. The current burst of research into quantifying carbon sink capacity will inevitably lead to metrics for calculating net emissions for even the most complex urban areas. This presents an opportunity to leverage investment to create compelling new urban landscape types.



- max-bio parkland/phyto-labs - experimental garden opportunities -*mapped as parkland*
- phyto-labs/maritime shrubland/salt shrubland/verge grassland opportunities -*mapped as vacant lots*
- phyto-labs/verge grasslands/high and low salt marsh/salt shrubland/maritime grassland/maritime shrubland opportunities -*mapped as marginal land*
- bonusable sinks/green(roof) fields -mapped as privately owned public space
- municipal leach fields - *mapped as sewage treatment plant sites*
- high and low salt marsh/preserved wetland zones - *mapped as NYC wetland areas*



CITY SINK - field sinks: urban 'unmanaged' land

Sink infrastructure leverages underused industrial lots and vacant city land as a pervasive carbon storage infrastructure that improves neighborhood character without burdening "the neighbors" with maintenance labor. Some lots are simpley planted to recover native eco-types and left to evolve, others are planted and managed by DEP to remediate toxins in the soil. The "wild" look of the native systems is offset by the formality of the phyto-remediation crops. Selection of plant type is contingent on assessment of the physical conditions of the lots and real-estate value life-cycles. Fields revert to development and new fields are folded into the system in accord with city land-use dynamics.

2

ADDRESS: 328 Barretto Street
Description: City of New York. Block 2774, lot 205
length: 391' width: 98' total area: 38,318 sf
Large lot. Vacant lot (1) lies along north side, auto stockpile lot lies along west side. Opportunistic weeds, shrubs and dead trees visible on lot.

degree of permeability	permeable / impervious
soil organic carbon	low / high
degree of detritus	high
degree of visual contaminants	low / high
degree of visual vegetation	low / high
degree of light	full sun
visual water	wet / dry
degree of compaction	high

6

ADDRESS: 1294 East Bay Street
Description: Privately owned. Block 2774, lot 331
length: 105' width: 96' total area: 10,080 sf
Large lot. Vacant lot (6) lies to the west. Opportunistic low weeds and shrubs visible on lot.

degree of permeability	permeable / impervious
soil organic carbon	low / high
degree of detritus	low / high
degree of visual contaminants	low / high
degree of visual vegetation	low / high
degree of light	full sun
visual water	wet / dry
degree of compaction	low / high

PHYTO-LABS
These lots show signs of contamination (mainly from adjacent auto and container stockpiling lots).

MARITIME SHRUBLAND
These lots have opportunistic woody plant growth in a zone with offshore winds. Potential for long-term successional storage.

MARITIME GRASSLAND
Proximity to sewage treatment and electrical infrastructure (leach fields and pyrolyitic powerplant opportunities) make this opportune for grass production.

SALT SHRUBLAND
Extreme conditions, wind, drought and salt spray, indicate need for a rugged type with little maintenance.

MARITIME FOREST
Existing woody vegetation in a zone with salt spray indicates potential for boosting existing successional processes to maximize sink growth.

VERGE GRASSLAND
Dried out medians can be converted to productive zones with verge grassland. Economic stimulus boosts maintenance and a more robust planting can be achieved.

total unmanaged land conversion in the Bronx study area equals 18 acres - regional potential is far greater

Green roof improvement districts are zoned based on public visual access - bang for the buck in provoking a reconsideration of urban terrain.

bonusable sinks

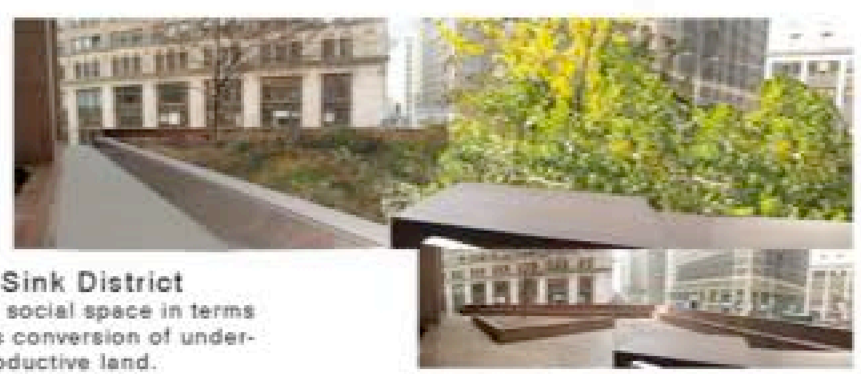
33 Acres of Private Public SINK AREA

bonusable plaza area
- 800-6667 sf
- 6667-13,333 sf
- 13,333-20,000 sf
- +20,000

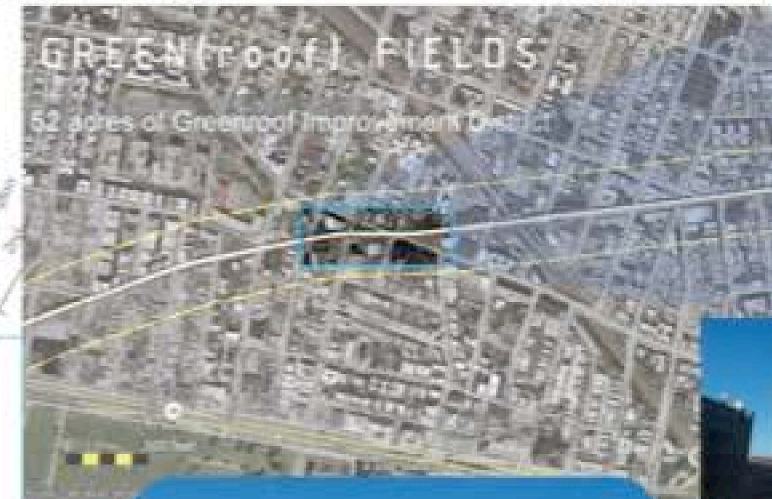
bonusable sink area equals 50% of mean plaza and sidewalk widening area in privately owned public spaces, plus 90% of all areas designated as "marginal"*

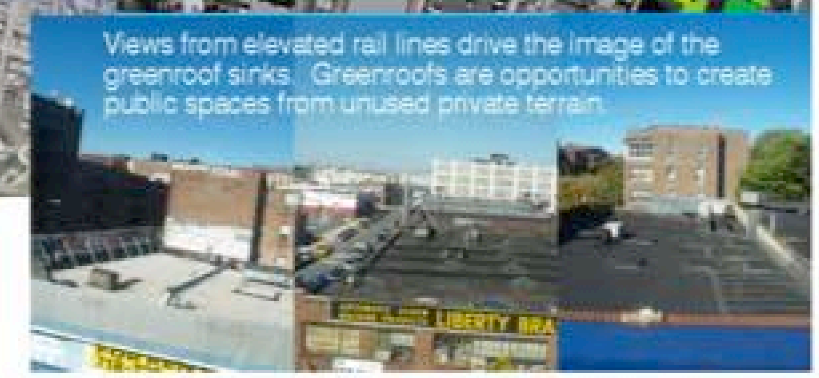
*privately owned public space (2000) data source: Jerold S. Kayden, *Privately Owned Public Space*, 2000.

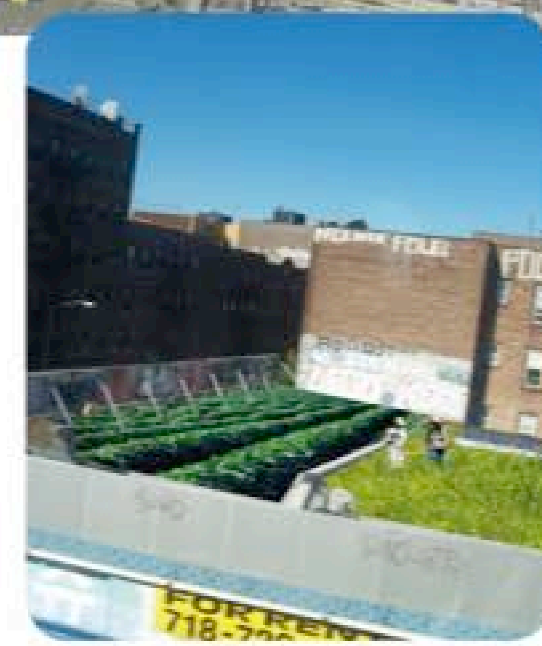
Financial Bonusable Sink District

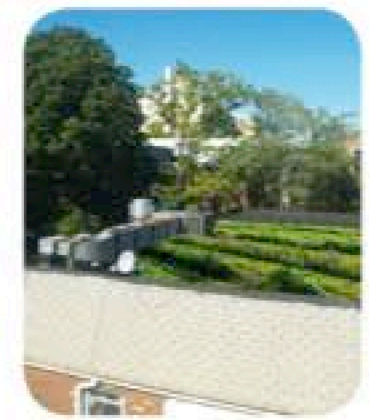


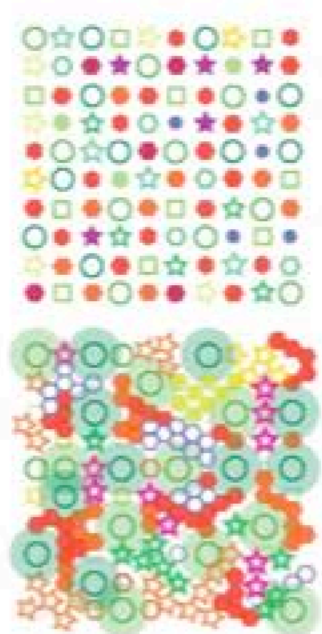
Midtown Bonusable Sink District
reconsideration of human social space in terms of sink-capacity mandates conversion of under-used spaces into civic productive land.







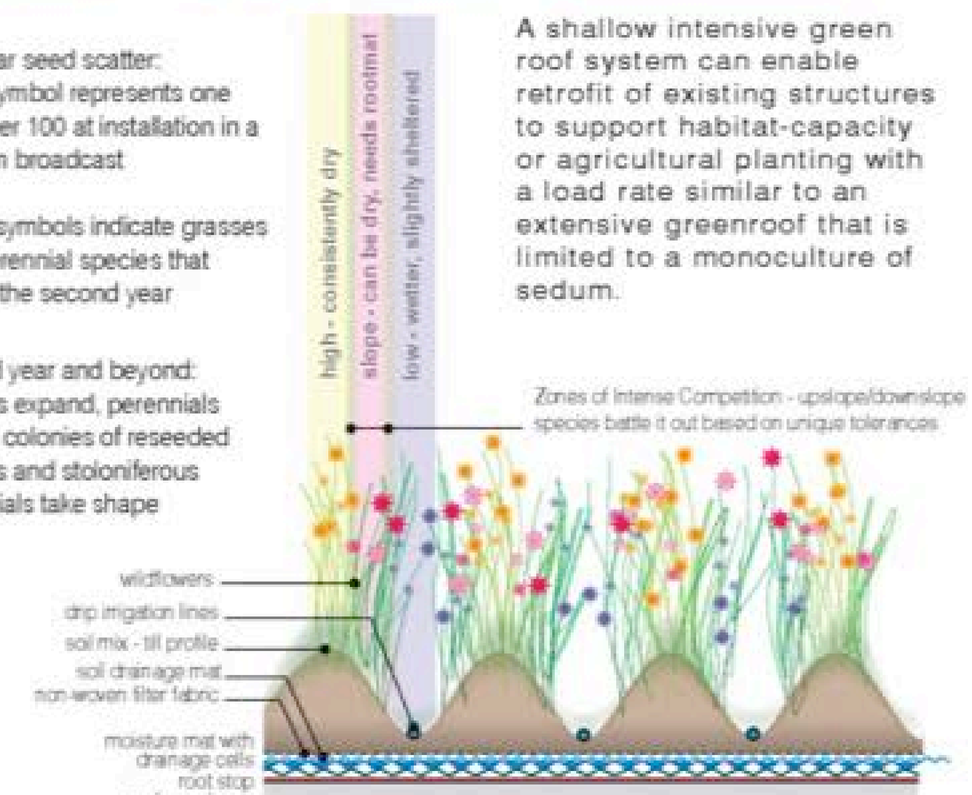




first year seed scatter: each symbol represents one seed per 100 at installation in a random broadcast

green symbols indicate grasses and perennial species that bloom the second year

second year and beyond: grasses expand, perennials bloom, colonies of reseeded annuals and stoloniferous perennials take shape

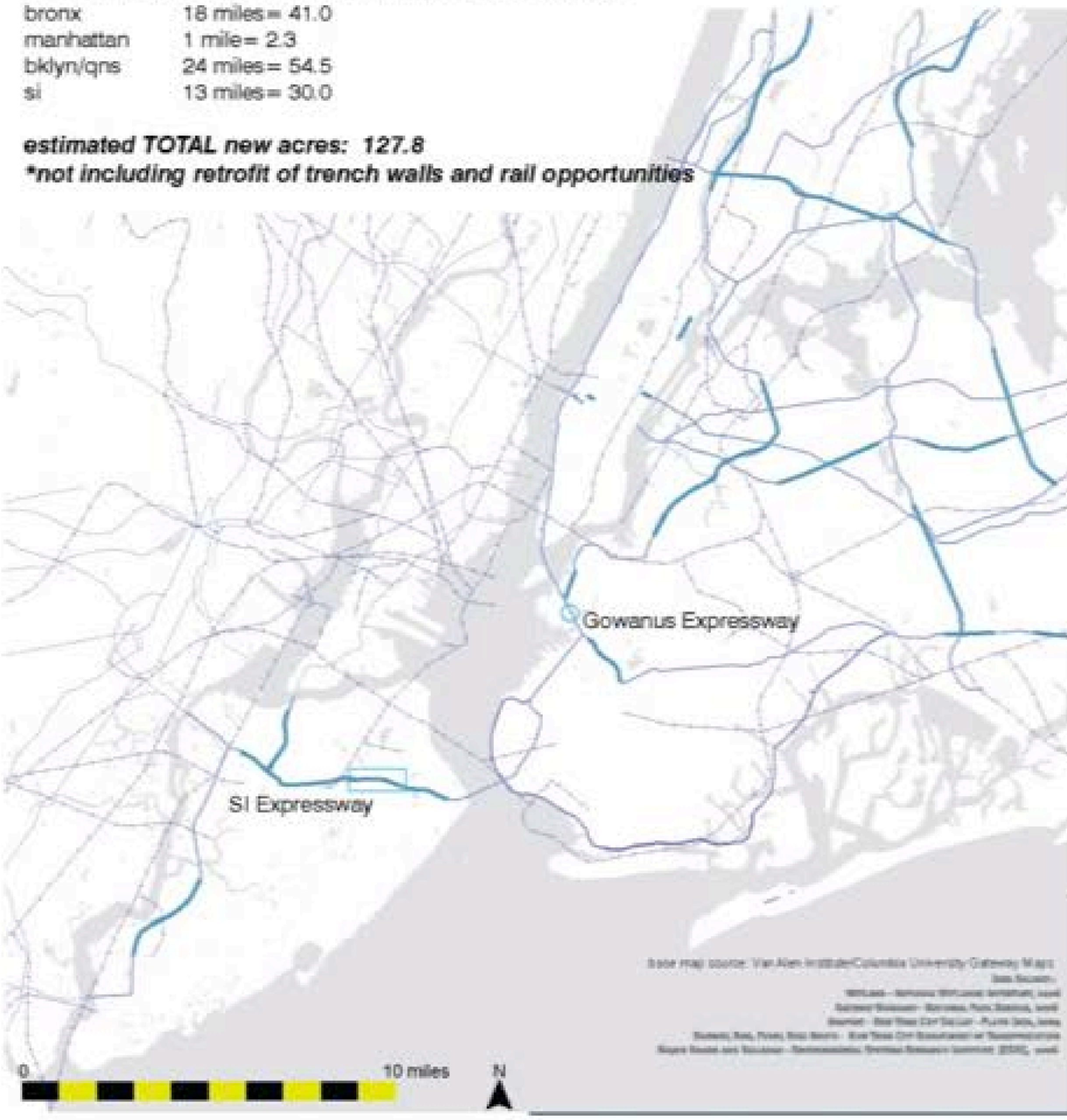


A shallow intensive green roof system can enable retrofit of existing structures to support habitat-capacity or agricultural planting with a load rate similar to an extensive greenroof that is limited to a monoculture of sedum.

interspecies competition and commensal relations animate green roof fields bio-barrier: 5280 ft x 25 ft area (H x 1.5-sides) x .75 coverage

bronx	18 miles= 41.0
manhattan	1 mile= 2.3
bklyn/qns	24 miles= 54.5
si	13 miles= 30.0

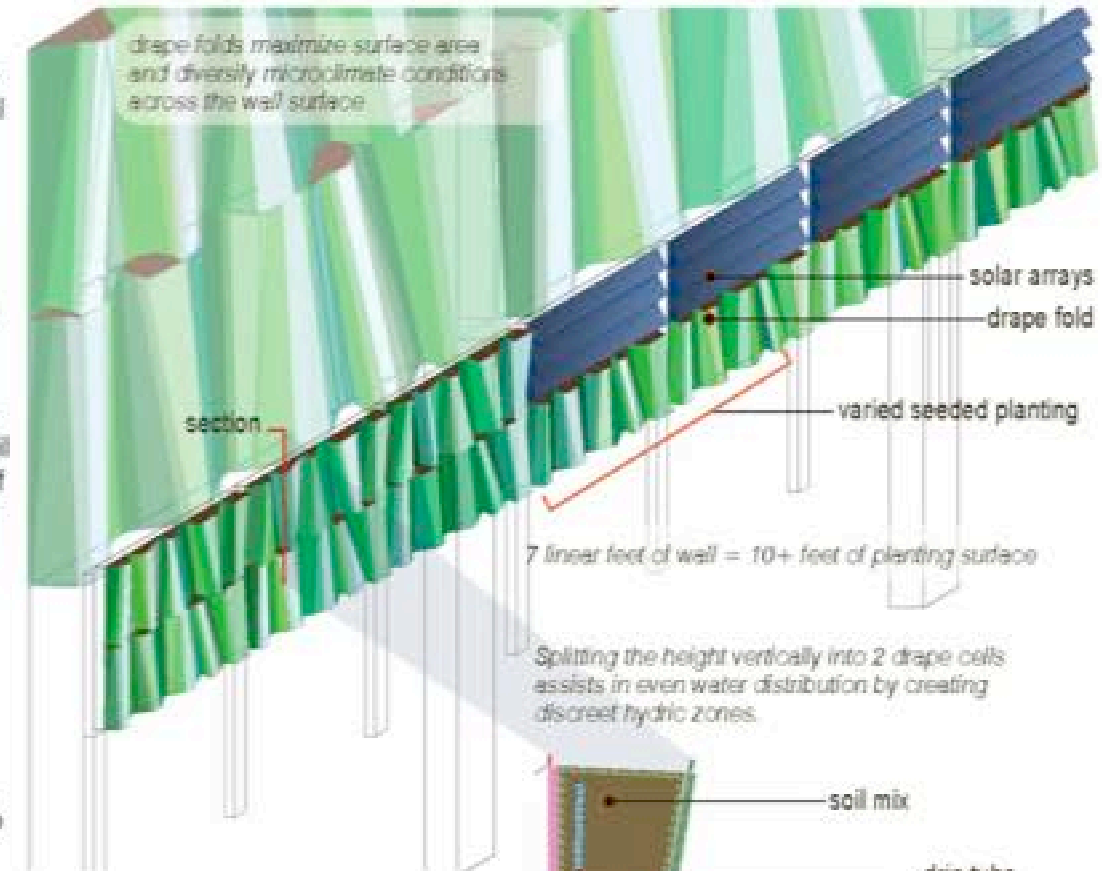
estimated TOTAL new acres: 127.8
****not including retrofit of trench walls and rail opportunities***

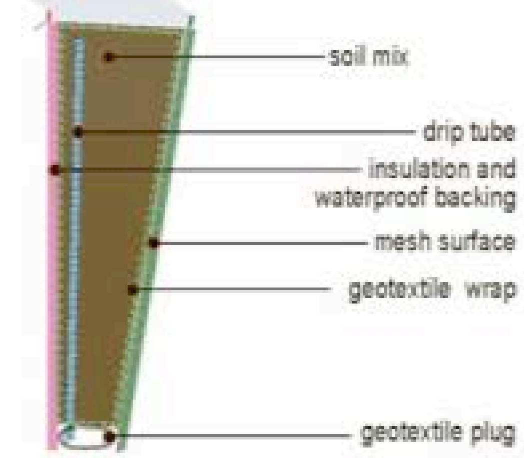


bio-sound barriers (new and retrofit)
other opportunities:
- urban rail corridors
- major roads

the drape

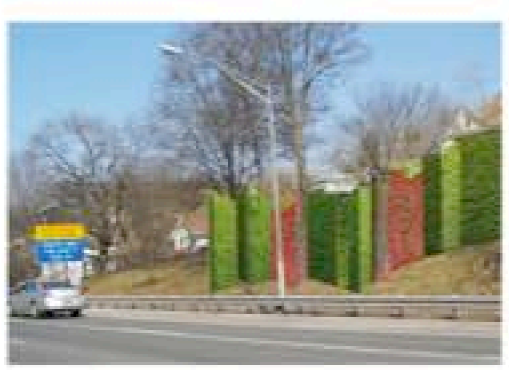
- enables retrofit of existing concrete soundwalls to carry vertical bio-mass without extensive rebuilding;
- can be combined with solar panels on south facing sound walls to generate 0 carbon electricity as well as sink capacity;
- is designed with a deep profile to incorporate a thick layer of soil mix for long-term plant growth of diverse plant species (and an insulation layer if necessary;
- creates shade and wind protected zones within the vertical folds to sustain plants in harsh conditions;
- uses folds to increase surface area for plant-soil contact and to increase growth (and therefore sink capacity) of biomass per square foot of ground area;
- can be installed on both sides of existing sound walls, and supported with additional vertical supports tied to the mesh if necessary.

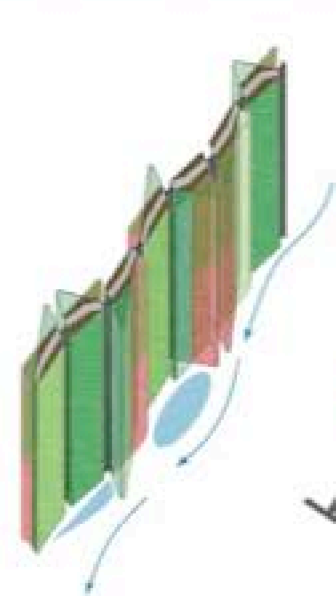


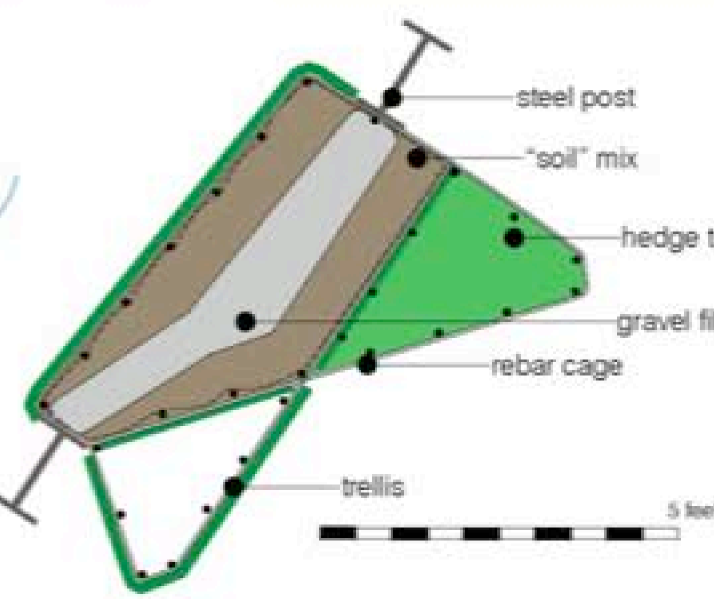


existing sound barrier retro-fit

new sound barrier construction







Bio-Cage Construction

New Bio Sound Barriers can be installed in any location a concrete barrier can be constructed. Steel columns support a rebar cage that contains a soil and gravel core - think **vertical berm.**

The rebar cage frames three biomass zones:

1) geotextile retained vertical soil plant bed,

2) a lattice frame that serves as a form for pruning a hedge, and

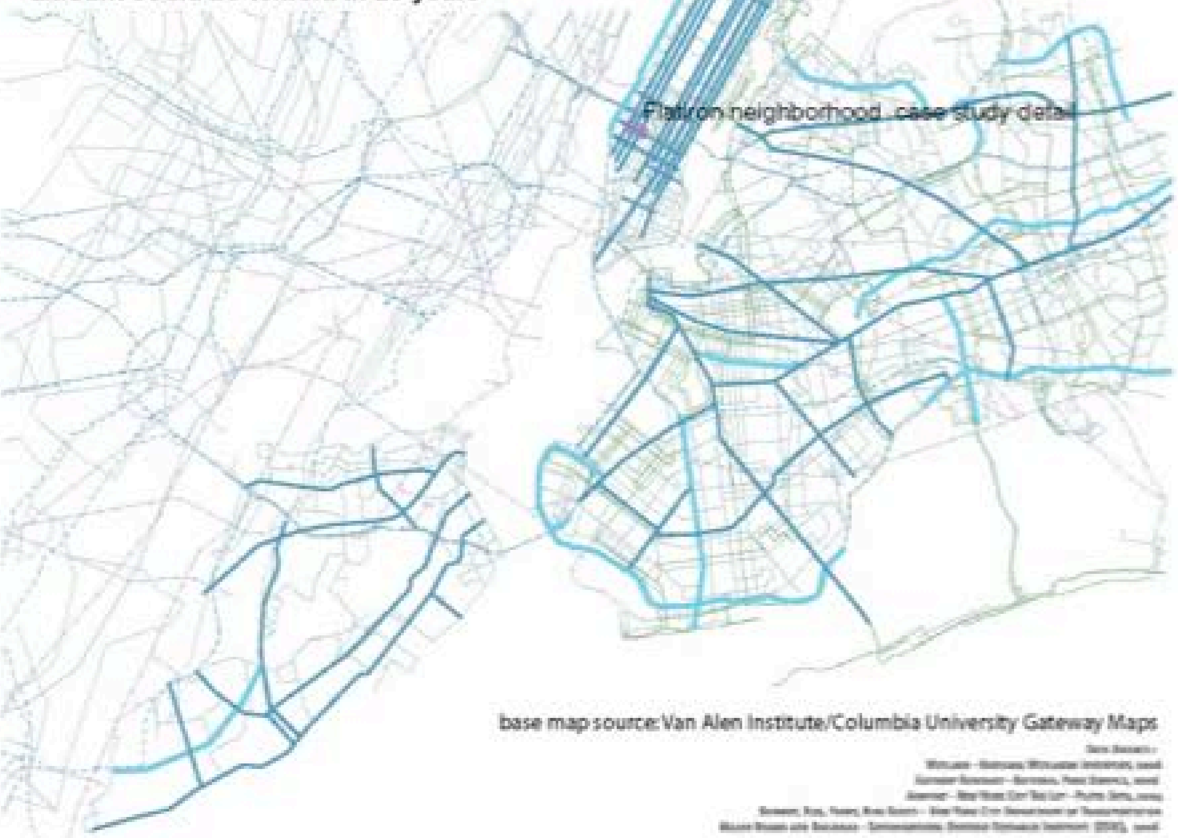
3) a trellis for climbing vines. Soil/gravel cores must link at steel columns to obstruct highway sound.

CITY SINK - *line sinks: sidewalk strips*

strip calculation:
1 mile @ 15 feet wide = 1.81 acre (x.6 coverage)

bronx	ex 17 + strip 37 =	54 acres
manhattan	ex 14 + strip 70 =	84 acres
bklyn/qns	ex 53 + strip 104 =	157 acres
si	ex 5 + strip 61 =	66 acres

easy-to-acheive estimated TOTAL new acres: 361
****not including other opportunities noted below - the amount could be tenfold in 20 years***



existing street strips
sidewalk and/or street strips
other opportunities:
- mapped as NY and NJ major roads, dashed to indicate sporadic implementation
- mapped as bus routes, which often have wider street/sidewalk profiles
- mapped as bike routes, which are sited in areas of less traffic congestion
- urban rail corridors – designated public transportation-ways

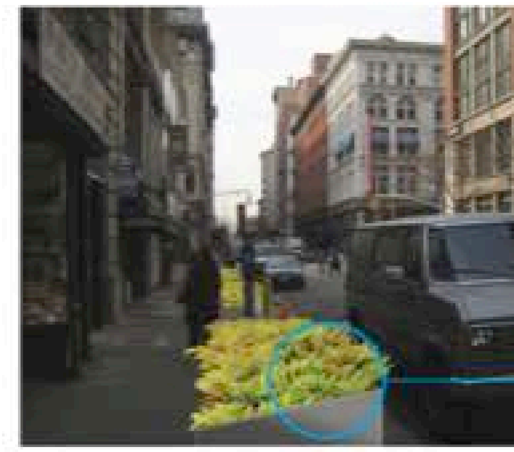
CITY SINK *directs our attention to the unseen – to the urban ground as substrate for strategic insertions of biotic processes that balance visible vegetative biomass with organic soil storage capacity.*

STRIP SINKS:

- support an array of urban landscape operations (bio-mass production, phyto-labs, nursery stock.)

- are able to pervasively colonise human habitat to boost plant and soil ecologic processes to amplify carbon sequestration.

- diversify the image of the city to accommodate lifecycles of disruption and decay, demanding a public re-evaluation of the urban landscape as civic investment and coordination of professionals across science, design, law, policy, and economics.



UTILITY SINKS

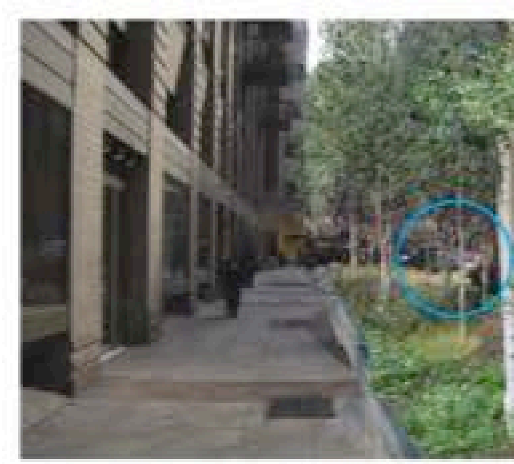
Low-cost sinks that can be infilled at regular intervals along sidewalks between 10 and 15 feet wide. The sinks can be large planters over structure, or simply sidewalls bolted to an expanded sidewalk slab over soil or fill subgrade. Subsurface utilities are indicated on the planter wall and if necessary the planters can be removed for large-scale sidewalk work.

BASIC STRIP SINKS

Shown in the detail at the top of the board, these sinks are linear plantings that re-engage urban soil processes in city circulation infrastructure. Located along articulated building facades or at the street curb edge, the strips insinuate themselves throughout the city. A consistent, minimal, aesthetic of utility reinforces the 'public-ness' of the sinks. Sinks do not reflect adjacent private property design values.

SEATING SINKS

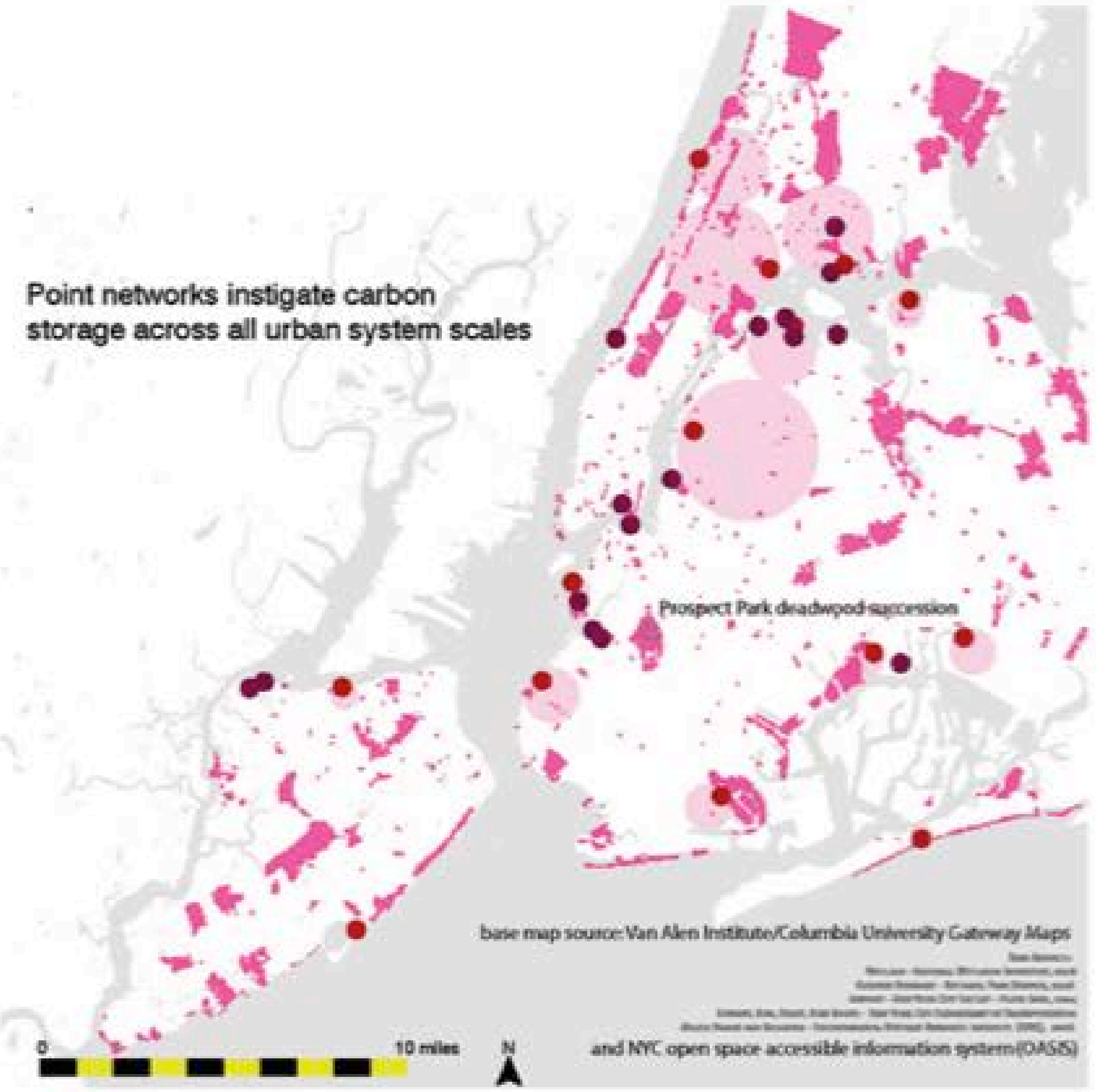
Social spaces are not diminished by sink infrastructure. Features latch onto the sinks and the sinks create a public backdrop for urban events and informal gatherings.



Agro-Sinks

Strip Sink maintenance regimes could evolve to be self-sustaining. Urban agriculture is getting a lot of attention - NYCDPR could integrate its urban forestry initiatives with sustainable forest economies.

CITY SINK - *point sinks:*



deadwood bench sink opportunity zones
- NYCDPR parkland

municipal leach field points
- mapped at sewage treatment plants and catchments

pyrolytic power plant points
- mapped at location of proposed power plants (Ascher 2005)

wetland sewage treatment magnitude mapped at 100 million gallons/day treatment per catchment (Ascher)

pyrolysis-biochar feedback loop

"Pyrolysis is a carbon negative process, meaning upwards of 90% of the CO2 that would be released through combustion is captured as biochar...

Combustion of bio-oil in an engine, boiler or turbine will release CO2. However, in general these emissions are more than offset by the carbon that is sequestered in the biochar. In addition, bio-oil combustion results in remarkably low emissions of NOx and SOx. Finally, remember that bio-oil is produced from waste which would otherwise decompose completely into CO2 and methane...

Biochar has been shown to be stable in soils for up to 2000 years. That is an order of magnitude longer than any other carbon storage technology."
from Disarming the Bio-Char Wars, www.re-char.com

Bio-energy produced by pyrolysis, an anaerobic low T burn, produces biochar as a by-product.
Biochar is a high-carbon content soil amendment that boosts bio-mass production.
Biochar is a two-prong attack on high atmospheric carbon counts:
1. STABLE SOIL CARBON SEQUESTRATION
2. ACCELERATED BIOMASS GAIN

VA mycorrizal fungi prefer to germinate on charcoal- biochar directly supports soil carbon transfer mechanisms

Trees are often objectified in urban landscapes, rather **than recognized as agents in ecological processes. Maintenance regimes that seek to neutralize environmental processes in order to retain a scenographic status quo must be replaced with temporally adjusted practices that reveal life-cycle processes. Revaluing deadwood means accepting that plant life-cycle and successional conditions are not always neat, and the mandate for maintenance often arises from a short-term desire to appear managed.**

Foresters estimate that carbon storage in urban trees is only 4.4% of the total stored carbon in non-urban forest eco-systems. **Urban forestry programs that seek to elevate that percentage in a meaningful way will have to alter management practices to achieve sink rather than produce source carbon emissions.**

A high percentage of street trees are short-lived. Mechanical harvesting, transport and mulching of dead trees negate the benefits of carbon storage in tree biomass. A paradigmatic study inferred that 50% of biomass stored carbon is released within three years of mulching, with the remainder lost over a period of 20 years. **Above-ground biomass that is land-filled however releases carbon much more slowly – at a rate of only 3.7% in the first five years. Alternatively, recycling deadwood can reduce the rate of carbon emissions – and depending on deployment, deadwood can be used to instigate new urban forest growth.**

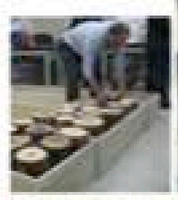
Maintenance regimes are generally designed to value only living trees. The significance of trees as part of environmental life-cycle processes is lost to the detriment of both human and non-human biotic habitat. Dead trees provide avian and small mammal habitat, and cycle nutrients back into soil. Pathogenic fungi cannot survive on deadwood, which protects germinating trees to establish forest eco-systems.

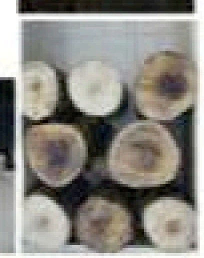
Reduction or elimination of production and transfer of soil amendments and fertilizers counts positively in carbon accounting. Utilizing deadwood in park landscape management plans would boost eco-system functions without emissions. **Deadwood can be used to instigate successional growth in parks, enabling woody encroachment into managed lawn areas that have high maintenance costs both in money and carbon emissions. In decomposition over time, deadwood can actively elevate carbon stocks in soil.**

deadwood installation Van Alen Institute gallery 04.09

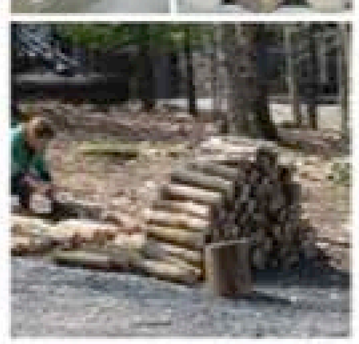
deadwood installation woodstock, NY 06.09

Attmepts to cut large material with hand saws to avoid the impact of power tools prooved frustrating. A combination of implements was determined.

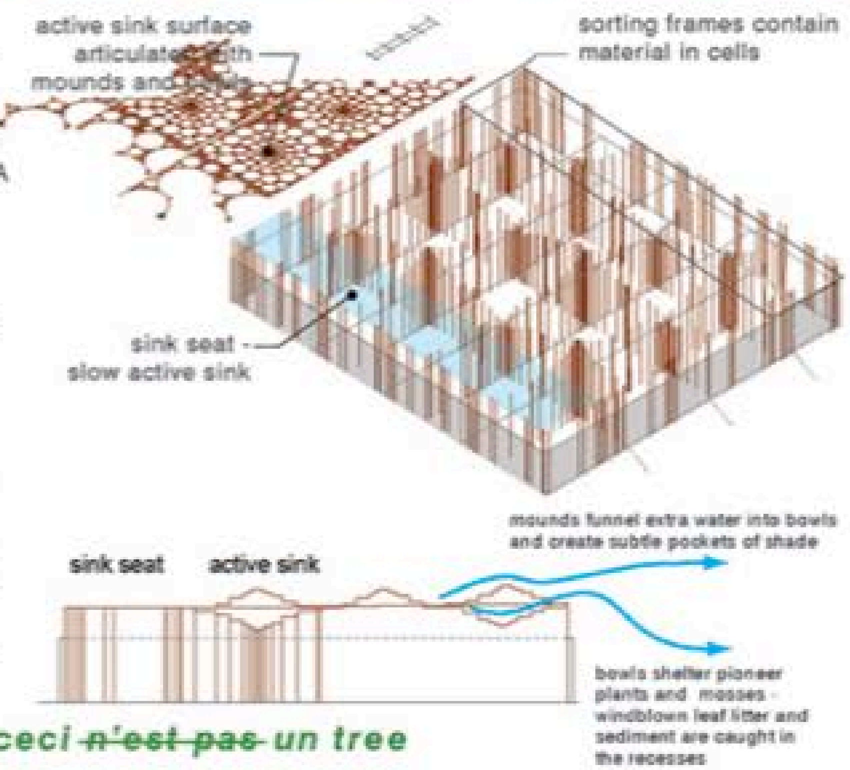


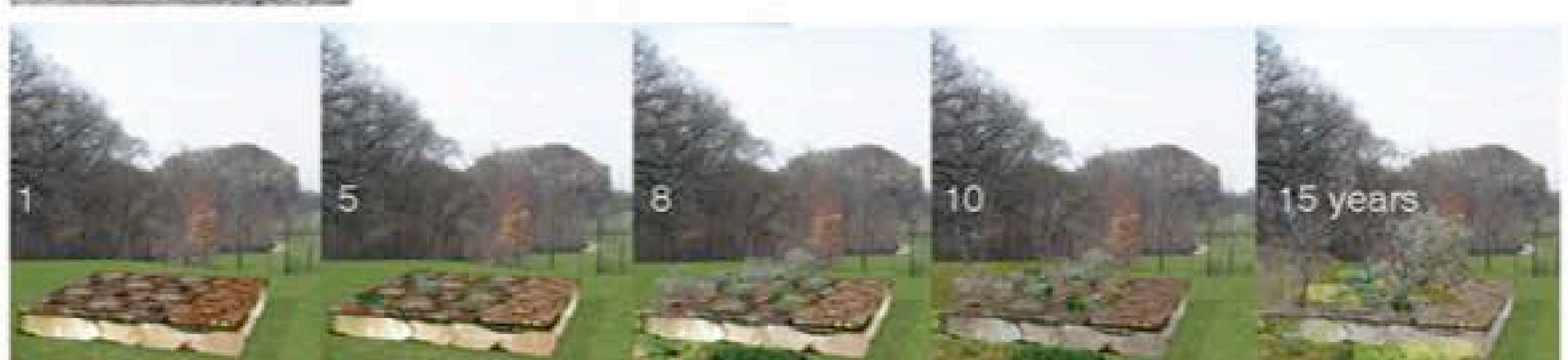


Seat wood ends were sanded and sealed with wax to slow weathering procersses and call out occupiable seat.



Dead Trees were cut, sorted and organized into bundles to construct the bench. The process is both measured and intuitive.





CITY SINK - *funding opportunities by sector*