

Invasion of Exotic Species in Already Stressed Urban Ecosystems

Jessica Browning

Jamaica Bay Institute
Gateway National Recreation Area
National Park Service



Overview



- Definitions
- Invasive Strengths *for my purposes here*
- Urban Vulnerabilities *what makes them so capable of being or becoming invasive*
- Urban Effects *why urban ecosystems are vuln. susceptible for invasion*
- Management *how urban ecosys. are effected and ~~the cycle~~ how they effect invasives*
- Mitigation

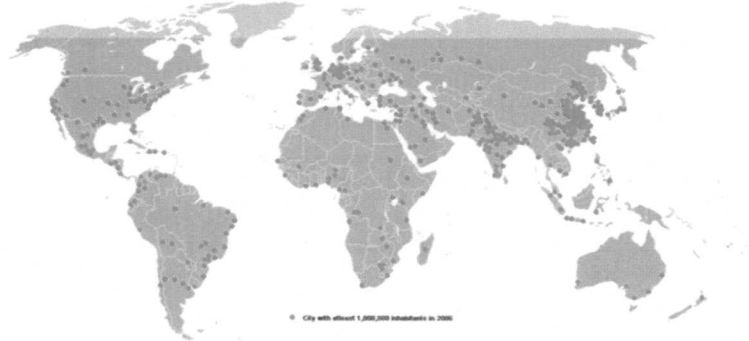
Definitions

◎ Invasive Species

- Non-native to the ecosystem
- Causes, or is likely to cause, economic or environmental harm, or harm to human health
- *Executive Order 13112*

◎ Urban Environment

- *Urban*- 1,000 people or more per square mile (US Census Bureau)



Invasive Strengths



- Lack natural predators
- Greater adaptability
 - Possess specific traits, or combination of traits that allow invasives to outcompete native species
 - Fast growth
 - Rapid reproduction
 - High dispersal ability
 - Facilitation (the ability to alter the environment through chemicals or manipulation of abiotic factors)
 - Phenotypic plasticity (ability to alter one's growth form to suit current conditions)
 - Tolerance for a wide range of environmental conditions
 - Ability to utilize various sources of nutrients
 - Ability to utilize resources that non-invasives can't
 - Asexual reproduction
 - Association with humans

Urban vulnerabilities

- Airports
- Seaports
- Overpopulation
- Decreased diversity of native species
- Decreased vegetation density
- Greenhouse effect
- Soil Degradation

Airports & Seaports — generally routes of trade, commerce and travel

Overpopulation — which goes hand in hand since people have always lived ^{in areas} ~~where~~ with easy access to goods and services.

Urban Vulnerabilities

Airports

18 Commercial airports in NY state

9 International airports in NY state (included in the 18)

73 international airports in the country

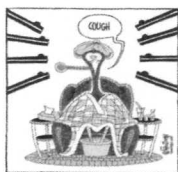


Cargo 846251 ramp with Air China 8382

Airport	Passengers (millions)
John F. Kennedy Int'l.	42.6
LaGuardia	25.8
Newark	35.7
Total	104.1

3 million tons of cargo annually

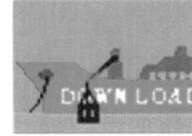
NYNJ_Highlights_2006[1].pdf



Placing HEPA filters (High Efficiency Particulate Filters) in new aircraft is standard practice but how often are we in NEW aircraft? It is especially apparent due to the recent stories in the news...

CDC meets planes (at 17 international airports) coming from areas known to be affected by disease and quarantine individuals presenting symptoms but some individuals may not be presenting symptoms just yet or may be carriers.

Seaports



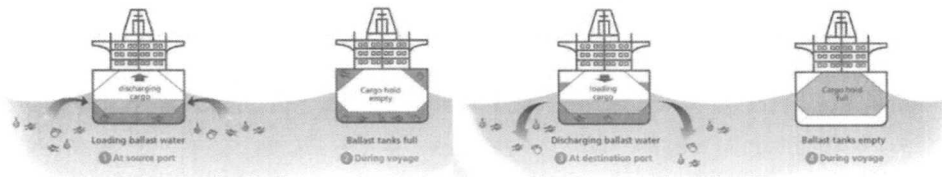
- 7 major ports in New York State
- 21 ferries
- 5.3 million loaded and unloaded 20-ft containers (NY)
- Nearly 45 million loaded and unloaded 20-ft containers (all US ports)
- Trade in 2007 exceeded \$166 billion
- Continued growth in trade with the Far East and Southeast Asia



http://www.panynj.gov/DoingBusinessWith/seaport/html/trade_statistics.html

Ballast Water

- An estimated 10,000 marine species are transported across oceans via ballast water
- National Ballast Information Clearinghouse (NBIC) jointly developed by the US Coast Guard and the Smithsonian Institute to synthesize, analyze and interpret data relating to ballast water management.

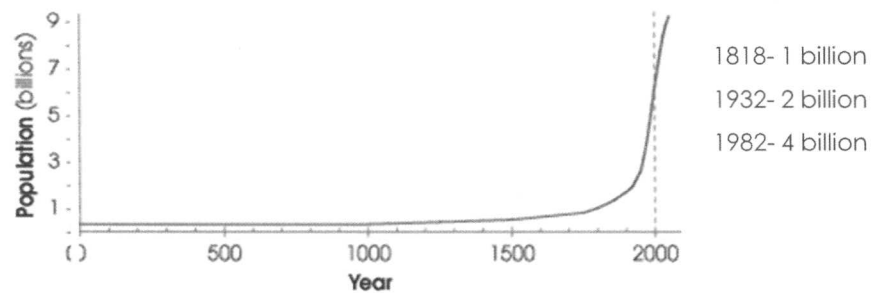


There are several different ways of managing ballast water. Currently, the most widely used is ballast water exchange. Ballast water exchange means that ships on their way to the next port release the lower-salinity coastal water they brought aboard in their last port and replace it with higher-salinity open-ocean water. Although this measure is not perfect, it reduces the number of potentially invasive species in the ballast tanks and replaces them with oceanic organisms that are less likely to survive in the lower-salinity near-shore waters of the ship's next port. However, organisms with a wide tolerance for differing salinities may survive ballast water exchange, especially any such organisms that may reside in the unpumpable residual water and sediment remaining in the tanks during any ballast water exchange.

Urban Vulnerabilities

Population

- Global population increased by more than 3 times- from 1.65 billion in 1900 to 6.06 billion in 2000.
- 10 billion people by 2050
- Movement toward urban centers is rising upward of 3 times faster than the general population growth.



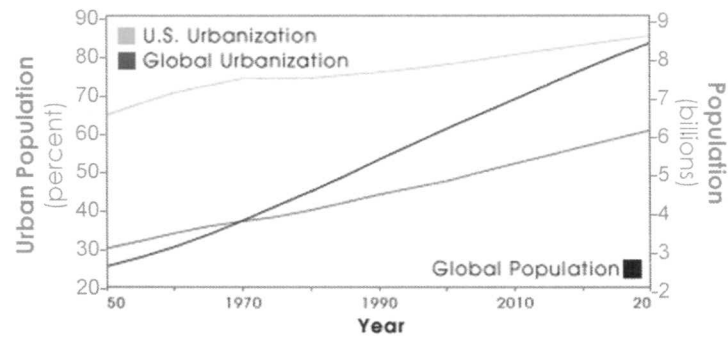
Graph by Robert Simmon, based on data from the United Nations

The sheer population in urban centers is enough to stress anyone or anything out. The global population has increased drastically since the 1800's hitting 1 billion in 1818 to finally making it to 2 billion in 1932 then skyrocketing to the current population. ~~If we continue at this rate the population is expected to soar to 10 billion by 2050.~~

As of April 1, 2000, 79% of Americans lived in urban environments and is expected to increase by 58% by 2020. This results in a more concentrated impact on their local environments.

Urban Sprawl/Continued Development

Between 1982 and 1992, 19,000 square miles of otherwise rural cropland and wilderness were urbanized in the United States.



Graph by Robert Simmon, based on data from the [UN Population Information Network](#)

Although the majority of the U. S. population lived in cities by 1950, the country continues to urbanize [yellow line (left axis)]. Worldwide, the percentage of people living in cities is expected to increase 15 to 20 percent from 2000 to 2030 (blue line (left axis)). At the same time, global population levels are steadily climbing [black line (right axis)]. As a result, cities are continually growing and consuming green space.

Soil Degradation

- Increased populations result in greater residual waste.
 - Landfills
 - Sewage
 - Household products
 - Automobile liquids

These add up to degrade the soil altering the bacteria, vegetation and ultimately the entire ecosystem making room for the highly adaptable invasives



Once an area has been urbanized, it is very difficult to bring the land back to its natural state.

http://images.google.com/imgres?imgurl=http://www.cetias.com/blog/images/soil-degradation-global.gif&imgrefurl=http://www.cetias.com/2007/01/22/soil-our-financial-institution/&h=239&w=440&sz=19&hl=en&start=10&um=1&ibid=dj6hm_UpFRF7h1&itbrih=69&itbw=127&prev=/images%3Fq%3Ddegraded%2Bsoil%26um%3D1%26hl%3Den%26t%3DGOGLL%3D2008-10%3DGOGLL-en%26v%3DH

Map of degraded soils throughout the world.

~~This map is probably does not take into account the urban soils as so much as farming and agriculture~~
image

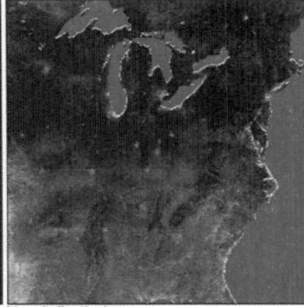
Urban Effects

Decreased Vegetation Density

- Buildings, parking lots, and roads have significantly decreased the vegetation cover.
- Decreased vegetation cover results in higher temperatures and an overall change in climate that native species may not be able to adapt to or strong enough to outcompete the invasive species that the change may favor



City Lights



Vegetation Index

City lights map:
White > urbanization

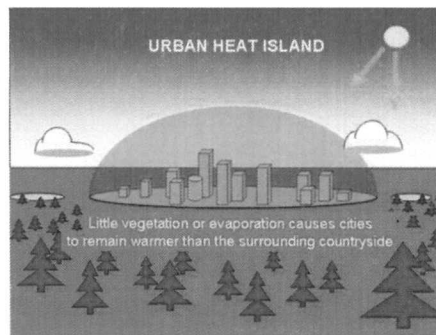
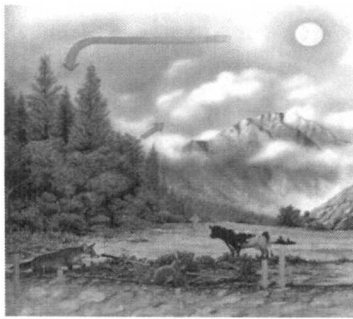
Photo: Marc Imhoff of NASA GSFC and
Christopher Elvidge of NOAA NGDC

Vegetation map:
Darker green > veg.
density

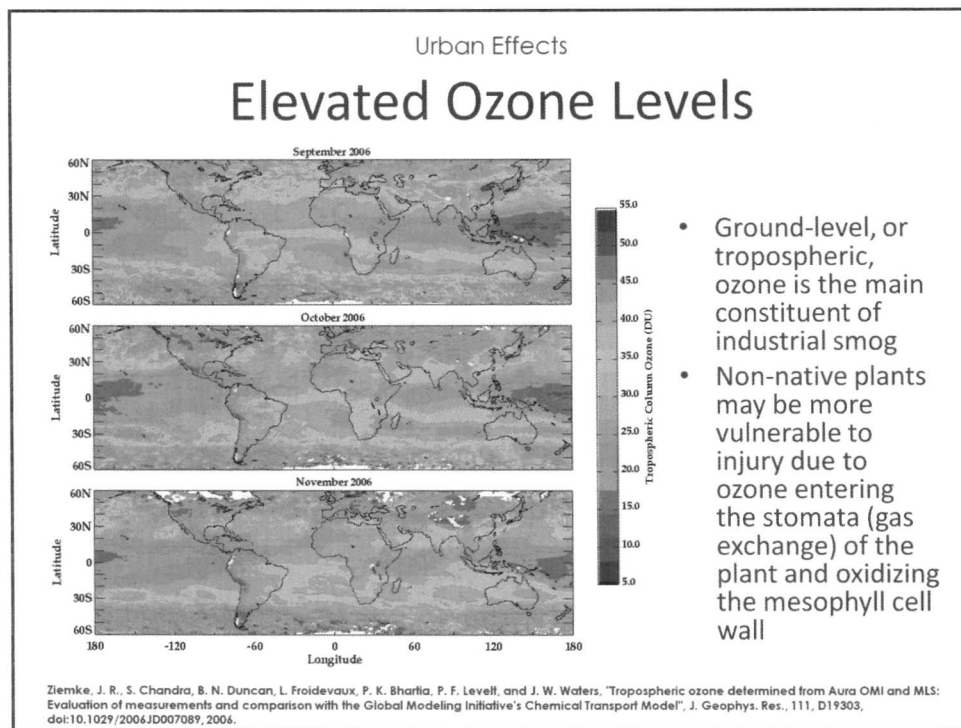
Photo: Compton Tucker and Bob Mahoney
of NASA GSFC

Carbon Cycling

- Less vegetation results in an increased greenhouse effect
- Instead of managing the CO₂ as vegetation does, concrete and blacktop reflect the sun's rays creating "heat islands"



Notice the correlation between the fact that trade is up with SE Asia and the Far East where average temps. are @ 80°? ~~AAA~~ This makes urban env. prime for invasion of species from these warmer climates.



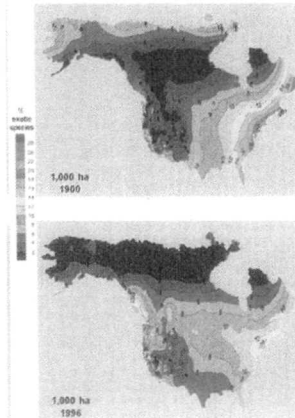
Ground-level, or tropospheric, ozone is the main constituent of industrial smog, formed by a chemical reaction of nitrous oxides (nitrogen, dioxide, nitric acid, nitrates, and nitric oxide) and volatile organic compounds (benzene, formaldehyde, toluene) in the presence of sunlight. When the stomata of a plant are left open for gas exchange, ozone enters the stoma cavity and oxidizes the mesophyll cell wall, creating increased permeability of the cell wall and making the cell more vulnerable to injury. Oxidation damage in a leaf results in decreased plant performance and growth after repeated exposures.

Zero-Sum Ecosystems

- Available resources are being used to their full capacity by native species
- Any gain for an invasive specie results in a loss for the native

Decreased Native Diversity

- Urban environments offer less diversity as natural areas or generally smaller and managed.



Due to limited spaces, soil degradation and various other factors urban ecosystems could follow the Zero-Sum ecosystem model. Though it could fall under this type of model, it is not the rule. Generally invasive species coexist with native species for quite a time, though eventually the superior competitive ability of the invasive will become apparent as the invasive population continues to increase. This usually occurs after the invasive has had time to adapt to it's new environment.

Management

- Multiple agencies working together
- General plan:
 - Prevention
 - Early detection
 - Control and Management
 - Restoration
 - Organizational Collaboration

Add thank you ↓



Kim Tripp

03/17/2008 10:02 AM
EDT

To: jessica_browning@nps.gov
cc:
Subject: Fw: NENHC Presentation Date and Time

Kim Tripp
Director/ Research Coordinator
Jamaica Bay Institute
Director/ Research Coordinator
Gateway National Recreation Area
HQ Building 69
Floyd Bennett Field
Brooklyn, New York 11234
phone: 718/ 338-3338 ext:222
fax: 718/338-3560
kim_tripp@nps.gov

----- Forwarded by Kim Tripp/GATE/NPS on 03/17/2008 10:02 AM -----



<rgill@mail.nysed.gov>

Sent by:

sendmail@oxfordabstrac
ts.com

To: Kim_Tripp@nps.gov

cc:

Subject: NENHC Presentation Date and Time

03/17/2008 05:02 AM

GMT

Please respond to rgill

Dear colleague,

Your presentation titled "Invasion of Exotic Species in Already Stressed Urban Ecosystems" (reference 0248) is scheduled on Friday, April 18 at 4:00 p.m. in "The Good, the Bad and the Neutral: Effects of Invaders on Native Organisms and Their Habitats" symposium in Meeting Room 4. All meeting rooms are located at the Empire State Plaza Convention Center in Albany, NY. For travel information, visit the conference web site at <http://www.nysm.nysed.gov/nhc/>.

Oral presentations must be limited to 15 minutes, with an additional 5 minutes between talks to allow for questions and to give the next speaker time to setup. Please plan to meet with the moderator 15 minutes before the start of your session to go over your introduction and the session protocol.

The overview schedule of conference sessions is attached and all abstracts are now available on our web site. The full speaker schedule will be posted soon. If you have not already registered for the conference, please visit our web site for registration information. The early registration deadline is Monday, March 17, 2008.

We look forward to seeing you in April at the Northeast Natural History Conference X.

Sincerely,

Ronald J. Gill
Conference Organizer

Northeast Natural History Conference X
NYS Biodiversity Research Institute
New York State Museum