The Impacts of Land Use on Stormwater

Rain Garden at UMass Amherst (Photo: Samantha Anderson)

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Land Use Change in Massachusetts: 1999-2005

Sprawl Development
- 22 acres of land developed every day
- 47,600 acres of land developed
- 40,000 acres for residential uses

Natural Resources Lost
- 30,000 acres forest
- 10,000 acres farmland
- 7,600 acres other open land

Source: LA 609, MetroWest Report, 2007

Source: Losing Ground, Massachusetts Audubon
South Shore Land Use – 1971

Legend
- Agriculture
- Undeveloped Land
- Developed Land
- Water

Data: Mass GIS
Maps: Dave Mitchell
South Shore Land Use – 2005

Legend
- Agriculture
- Undeveloped Land
- Developed Land
- Water
- Cranberry Bogs

Data: Mass GIS
Maps: Dave Mitchell
One parking lot, one store

Source: Samantha Anderson
Impact of urbanization on water quality and quantity

Paving and buildings leads to increased flooding and decreases in groundwater available for drinking water.

Reproduced from Massachusetts Smart Growth Toolkit 2005
Research Issues

Impacts on Water Resources
1. Increased demand on water resources.
2. Impairment of rivers and streams by non-point source pollution.

Urban Growth:
3. Increase in impervious surfaces: roofs, roads, paved areas.
4. Decrease in natural vegetation
5. Expansive lawns/ swimming pools.

Source: J. Stacy
What is the future of the Boston Metropolitan Area under different landscape change scenarios?

- Spatially explicit land cover scenarios for inner core
- Exploring relationship between land use, forest canopy and water impacts (selected watersheds)

The Boston Metropolitan Area Urban Long-term Ecological Research Area Project- www.umass.edu/urbaneco

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Understanding the Factors that Influence Outdoor Residential Water Conservation

Univ. of Massachusetts Center for Agriculture Grant #MAS00445
Robert Ryan, Anita Milman, Allison Roy, Paige Warren, Craig Nicolson, Mary Owen, Michael Davidsohn, Michael DiPasquale, Colin Polsky (Clark)

Research Goals
• To explore the factors that influence local residents’ decisions to engage in low-impact development strategies.
• To understand how variability in local policy and outreach across the watershed affects adoption of sustainable practices.
• To understand the connection between adoption of water conservation practices and actual water quantity savings.

Source: Homeowner’s Guide to Rain Garden Maintenance (MA DCR)
Ipswich River Watershed: A watershed in crisis

- Population: 130,000.
- Water supply: 330,000
- River runs dry in summer
- Lawn irrigation
- Basin transfer
- Ecological/human impacts
- EPA/DCR demonstrations

Source: http://www.mass.gov/dcr/watersupply/ipswichriver/watershed.htm
Water restrictions

- Seasonal water bans
- Voluntary/mandatory
- Varies by town.

Source: J. Stacy
Source: J. Stacy
Lawn area by town

Source: Polsky, et al., 2012
Impervious percentage by town

Woburn = 35% impervious

Essex = 5% impervious

Polsky, et al., 2012

Percentage of the town
Low-Impact Development Strategies

2. Alternatives to lawn: landscaping with native plants
3. Increasing infiltration: rain gardens/ porous paving.

Source: J. Stacy
Variables: adoption of conservation practices

Source: R. Ryan
• North Reading: Rain Garden project

Source: J. Stacy
Univ. of Massachusetts Studio in watershed

- Fall 2013, Ipswich River Watershed studio.
- Nine graduate landscape architecture students.
- Green infrastructure plan for the watershed along with focus area studies.

LA 607 Studio, Fall 2013
Univ. of Massachusetts, Amherst
Photo: R. Ryan
Green infrastructure plan

LA 607: Samantha Anderson, Alyssa Black, Ngoc Doan, Trudy Hall, Keith Hannon, Irene Miller, Colin O’Donnell, Amanda Rookey, Yan Xu

Source: LA 607 Studio, Fall 2013
Univ. of Massachusetts, Amherst
MEANDERING STREET

Proposed meandering and narrow path, and rain gardens to capture run offs

WHAT SIZE GARDEN DO I NEED?
AREA: 900 SQ FT
DEPTH: 6 INCH
RAIN CAPTURE: 700 GALLON
PLANTS: 160 COUNT
GARDEN COST: $1,283

http://raingardenalliance.org/tasks/calculator

- Design: Ngoc Doan
• Design: Ngoc Doan

Connect
Ipswich Town Center
Ipswich Watershed Association

Improve
Water quality
Replacing lawn with colorful native community plants

Educate
Raise awareness
Promote outdoor activities
Conclusion

• Land use change is incremental and cumulative.
• Current land use patterns predict water quality.
• Future plans could impact current trends in land use.
• Site scale low-impact development strategies can minimize, but not eliminate potential impacts.
• Need to combine alternative land use plans with on-site “innovation” within a watershed.