Lawns in Urban Landscapes

- Turf grass is everywhere
  - 63,000 square miles
  - ≈ 25% of land cover in urban areas
- Green Carpet Syndrome
  - Ubiquitous - lawn in untenable places
  - Uniform – maintain at all costs

*Lawns influence our lives in ways we don’t consider*
Conventional Lawns: Inputs

- **Fossil fuel**
  - A one-third acre lawn consumes 18 gallons of fossil fuel per year

- **Fertilizer**
  - 70% of U.S. homeowners regularly fertilize their lawn
  - 3 million *tons* per year applied to residential lawns

- **Water**
  - Typical suburban lawn uses 10,000 gallons of irrigation water per year
  - Residential lawns consume 2.5 billion gallons per year

- **Pesticides**
  - 67 million lbs of synthetic pesticides on residential lawns each year
  - Homeowners use 3 times more pesticide per acre than farmers
Less than 50% of soluble fertilizers make it to the grass.

Fertilization is inherently inefficient process.

**Fate of Urea-based Water Soluble Fertilizers Applied to Turf**

- Grass utilization: 35%
- Ammonia volitalization: 43%
- Nitrate leaching: 4%
- Denitrification: 1%
- Runoff: 17%
Only 40% of applied pesticides make it to the turf within 7 days of application
If conventional lawn care is inefficient, what happens to the inputs?
Water Impacts

- **Quality**
  - MN
    - 25% to 90% of storm water samples found four lawn pesticides
    - range 0.7 to 6.8 μg/l
  - Nationwide
    - 100% of surface waters, 33% GW have pesticides
    - Average nitrate in residential stormwater - 0.6 mg/l
    - Average TP in residential stormwater - 0.30 mg/l

- **Ann Arbor Study**
  - Ordinance restricting phosphorous on lawns
  - One year later
    - 28% reduction in TP
    - 13% reduction in DP
  - Results not universal
Air Impacts

Pollution
- Lawnmower emissions in 1 hour = car driven between 20 to 100 miles.
- VOC’s - structural/landscape pesticides add 226 lbs/day
- Pesticides drift & evaporate
  - Increases inhalation, ingestion and tracking
  - Lawn /garden pesticide can persist indoors for up to one year post-application

Climate Change...
- 580 millions gallons of gasoline used in lawnmower
- Synthetic fertilizers and pesticides are manufactured using fossil fuels – additional environmental burden
Lawns: A Sea of ‘Not-So’ Green

Urban ‘green’ spaces may contribute to global warming, UCI study finds

Turfgrass management creates more greenhouse gas than plants remove from atmosphere

— Irvine, Calif., January 19, 2010 —

Dispelling the notion that urban “green” spaces help counteract greenhouse gas emissions, new research has found — in Southern California at least — that total emissions would be lower if lawns did not exist.

Turfgrass lawns help remove carbon dioxide from the atmosphere through photosynthesis and store it as organic carbon in soil, making them important “carbon sinks.” However, greenhouse gas emissions from fertilizer production, mowing, leaf blowing and other lawn management practices are four times greater than the amount of carbon stored by ornamental grass in parks, a UC Irvine study shows. These emissions include nitrous oxide released from soil after fertilization. Nitrous oxide is a greenhouse gas that’s 300 times more powerful than carbon dioxide, the Earth’s most problematic climate warmer.

*Lawns look great — they’re nice and green and healthy, and they’re photosynthesizing a lot of organic carbon. But the carbon-storing benefits of lawns are counteracted by fuel consumption,” said Amy Townsend-Small, Earth system science postdoctoral researcher, found that management of urban “green” lawns contribute significantly to atmospheric greenhouse gas levels.
Health Effects - Pesticides (acute)

- Accidental Poisoning
- Asthma
- Neurological Damage

- Cancer
- Immune System Damage
### Health Effects - Pesticides (chronic)

#### 30 Most Common Lawn Pesticides

<table>
<thead>
<tr>
<th>Effect</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probable/Possible Carcinogens</td>
<td>13</td>
</tr>
<tr>
<td>Birth Defects</td>
<td>13</td>
</tr>
<tr>
<td>Reproductive effects</td>
<td>21</td>
</tr>
<tr>
<td>Neurotoxicity</td>
<td>15</td>
</tr>
<tr>
<td>Kidney/Liver damage</td>
<td>26</td>
</tr>
<tr>
<td>Sensitizer/irritants</td>
<td>27</td>
</tr>
<tr>
<td>Potential endocrine disruptors</td>
<td>11</td>
</tr>
</tbody>
</table>

Adapted from Beyond Pesticides’ *Health Effects of 30 Commonly Used Lawn Pesticides*
Wildlife Toxicity

Wildlife toxicity of 30 common lawn pesticides

<table>
<thead>
<tr>
<th>Wildlife</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds</td>
<td>16</td>
</tr>
<tr>
<td>Fish/Aquatic Organisms</td>
<td>24</td>
</tr>
<tr>
<td>Bees</td>
<td>11</td>
</tr>
</tbody>
</table>

The American Society for Prevention of Cruelty to Animals reported over 30,000 pesticide-poisoned pets in a single year. 

Chemical Paradox – lawn “care” not “healthy” lawns

- Stunt turf growth
- Inhibit beneficial microbes
  - Recycle nutrients
  - Suppress disease & pests
- Kill beneficial insects
- Harms earthworms–nature’s aerators and fertilizers
  - Increases compaction
  - Compacted lawns contribute up to 40% to runoff volume
3 Things to Consider

Conventional lawn care is…

1. Inefficient
2. Potentially harmful
3. Unnecessary

There has to be a better way to both have a lawn and reduce its impacts.
Natural Lawn Care 101
A Systems Approach
Does Natural Lawn Care work?

What do you think?
NLC: First the soil...

- Biggest component of system is soil
- Healthy soil = healthy turf
- Strive to restore soil integrity
  - Organic matter
  - Soil biology
  - Chemistry
...and then the grass.
Soil Test First
Soil Chemistry

- **pH**: Lawns prefer close to neutral
  - 6.3 to 6.8 optimal
- **Nutrients**
  - Big Three (N-P-K)
  - Ca to Mg ratio (7:1)
  - Micronutrients
- Can effectively “halve” nutrient recommendations under a natural program - $$
Soil Structure

- Organic matter (OM)
  - Renewable resource
    - Plant/animals/insects add OM
    - Microbes recycle OM, feed plant
    - Healthy turf growth
  - Soil conditioner
    - Loosens clay - binds sand
  - Ideally 5% OM or more

- Clay – prone to compaction
- Sand – leaches easily
Soil Biology
Starting from Scratch
New Lawns

- Good top soil
- Cool season grasses
  - Always match grass to site conditions
  - Fescues (tall and fine) great
  - Perennial ryes establish quickly
  - Kentucky bluegrass = high maintenance
- Sod versus seed
- Low/No Maintenance alternatives

Existing lawns can be renovated…
Maintenance
Cultural Practices

*Deceptively simple, yet underappreciated:*

- Water Properly
- Mow Correctly
- Thatch, Aeration and Overseeding
Fertilizers - ‘Feed the Soil’

The Soil Food Web

- **Plants**: Roots, stems, and photosynthesis.
- **Organic Matter**: Waste, residues, and metabolites from plants, animals, and microorganisms.
- **Nematodes**: Root feeders.
- **Arthropods**: Shredders, predators.
- **Fungi**: Mycorrhizal fungi, saprophytic fungi.
- **Protozoa**: Amoebas, flagellates, and ciliates.
- **Bacteria**: Decomposers, mutualists, pathogens, parasites, root feeders.

First trophic level: Photosynthesizers
Second trophic level: Decomposers, mutualists, pathogens, parasites, root feeders
Third trophic level: Shredders, predators, grazers
Fourth trophic level: Higher level predators
Fifth and higher trophic levels: Higher level predators
Confusion: Organic vs Natural

- **Organic** – anything that contains carbon
  - All plastics are organic

- **Natural** – plant or animal based organic matter

- **Different levels of natural/organic**
  - Full natural: no synthetics
  - Bridge products: some synthetic
  - Biosolids: sustainable?

- **Application**

Styrofoam formula

Wastewater treatment plant
Natural-Based Fertilizers

Advantages
- Organic N less water soluble – locked into soil profile
- Restores soil OM – soil organisms convert as needed
- More product gets to plant – less total N required ($)
- Less salts – decreased salinization potential
- Fewer disease outbreaks
- Consistent feed overtime
- Slower growing = less mowing ($)

Drawbacks
- Slower acting (yet longer lasting)
- Microbial breakdown essential
- Cost – appears more expensive upfront
Clippings: Waste or Resource?

- Can reduce total N requirement by 50% or more
  - Fertilizer recommendation: 87 to 174 lbs or N/acre/year
  - One acre clippings = 235 lbs of N/acre/year
  - Implication - mature turf can often go without fertilizer
- No increase in ammonia volatilization
- Less likely to leach/runoff
- Recycled matter/energy – only in presence of microbes
Getting Microbes Back into Soil

1. Compost
   - Nutrients, OM & microbes
   - Improves soils structure & water retention
   - Smooth lawn surface

2. Teas
   - Just the microorganisms
   - Mycorrhizae: the fungal wonder of the turf world
Disease, Pests & Weeds
Dealing with Pests & Disease

- Best offense is a good defense – healthy, dense turf
- Cultural practices limit weeds, pests & disease
- Microbes
  - Endophytes – insect control
  - Nematodes – grub control
- Least-toxic/botanicals
  - Still pesticides…potentially hazardous
  - Often indiscriminate
Weed Control = Cultural Practices

- Fewer Weeds
  - Seeding
    - Increase plant surface
    - Improve photosynthesis
    - Reduce stress
    - Shade soil
    - Replace old grass
    - Eliminates bare spots
    - Increase turf density
  - Soil Health
    - Restore chemical balance
    - Improve nutrient availability
    - Reduce compaction
    - Eliminate 'weed' friendly conditions
  - Mowing Height
    - Mudings height

Fewer Weeds
What is a weed?

Historical perspective
- 60 years ago
- Today
- Dandelions

Weeding the natural way
1. Seed inhibitor: Corn Gluten
2. Spot treatment: vinegar sprays
3. Hand weeding (where feasible)
Benefits - Economic Savings

Costs Over 5 Years
Synthetic vs Natural

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic</td>
<td>$7,745</td>
<td>$8,319</td>
<td>$8,946</td>
<td>$9,631</td>
</tr>
<tr>
<td>Natural</td>
<td>$5,317</td>
<td>$5,789</td>
<td>$6,310</td>
<td>$6,377</td>
</tr>
</tbody>
</table>

Five Year Savings with Natural Program = $14,870 per acre
Benefits - Environmental & Social

- Reduced synthetic fertilizer, pesticides, irrigation, fossil fuel use

<table>
<thead>
<tr>
<th>Seattle Study – Environmental Value</th>
<th>Annual Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced soluble products</td>
<td>$16 - $21</td>
</tr>
<tr>
<td>Less fossil fuel for mowing</td>
<td>$8</td>
</tr>
<tr>
<td>Irrigation savings</td>
<td>$42</td>
</tr>
<tr>
<td>Lower hazardous waste disposal costs</td>
<td>$5 - $6</td>
</tr>
<tr>
<td>Decrease in storm water detention &amp; diversion capacity (one time)</td>
<td>$31</td>
</tr>
</tbody>
</table>

- Growing public demand for sustainability
Your choice....

...natural or conventional?
More resources

- Safer Pest Control Project – fact sheets, articles, videos
  - www.spcpweb.org

- Grow Smart, Grow Healthy
  - Consumer guide to least hazardous pesticides and fertilizers, overview of NLC

- Recommended reading
  - *The Organic Lawn Care Manual* – by Paul Tukey
THANK YOU

Steve Pincuspy
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