Urban Sustainability

John Randolph, Virginia Tech

Pathways to Urban Sustainability:
A Focus on Houston
The National Academies
January 17-18, 2012

Perspectives on Urban Sustainability

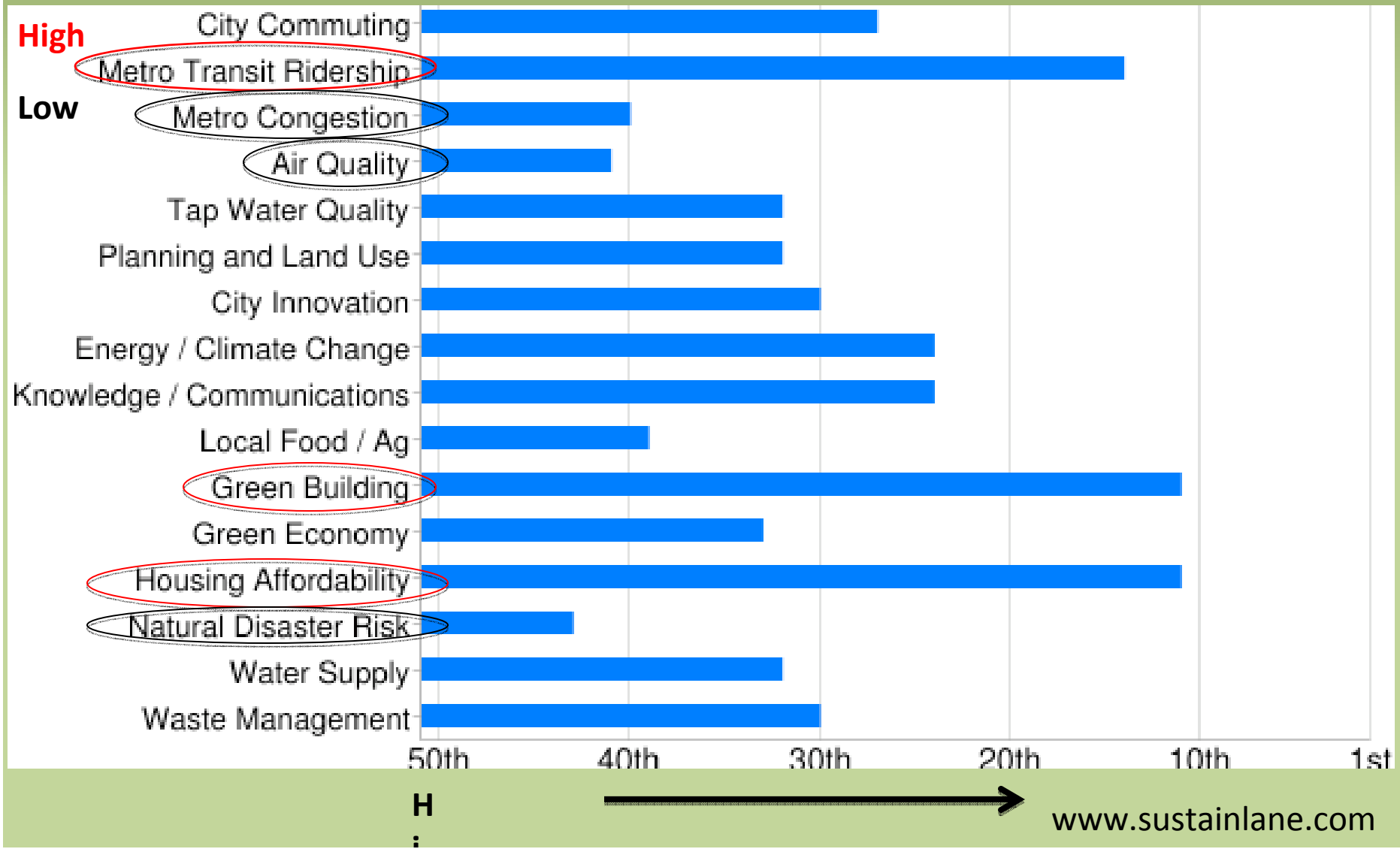
- What? Definition and Criteria
- Why? Driving forces and imperatives
- Resolving conflicts among sustainability criteria
- Pathways to Urban Sustainability

Sustainable Community Criteria: STAR Community Index

- Sustainable Community Rating System being developed by USGBC, ICLEI, Center for American Progress, National League of Cities
- Indicator categories:

Environment	*Economy*	*Society*
Natural Systems	Economic Prosperity	Education, Arts & Community
Planning & Design	Employment & Workforce Training	Health & Safety
Energy & Climate		Affordability & Social Equity

Sustainlane ranks cities on sustainability: Houston ranks 36 of 50 but "moving forward"



www.sustainlane.com

What is the Sustainable Community?

- **Livable:**
  - Stable economy
  - Livable, affordable, accessible community
  - Healthy environment
  - Engaged public
- **Green:**
  - Protection and restoration of natural waters, vegetative cover, biodiversity, air quality
  - Efficient use of land, energy, water, materials efficiently
  - Reduction of carbon emissions
- **Resilient:**
  - Mitigation of natural hazards
  - Adaptation to environmental change

Why do we need the Sustainable Communities?

To respond to non-sustainable trends in our patterns of urbanization:

- **The Affordable Livability Imperative**
- **The Water Imperative**
- **The Ecological Imperative**
- **The Land Use Sprawl Imperative**
- **The Energy-Climate Change Imperative**

Pathways to the Sustainable City

1. Urbanism
2. Green Infrastructure
3. Natural Hazard Mitigation
4. Clean Affordable Energy

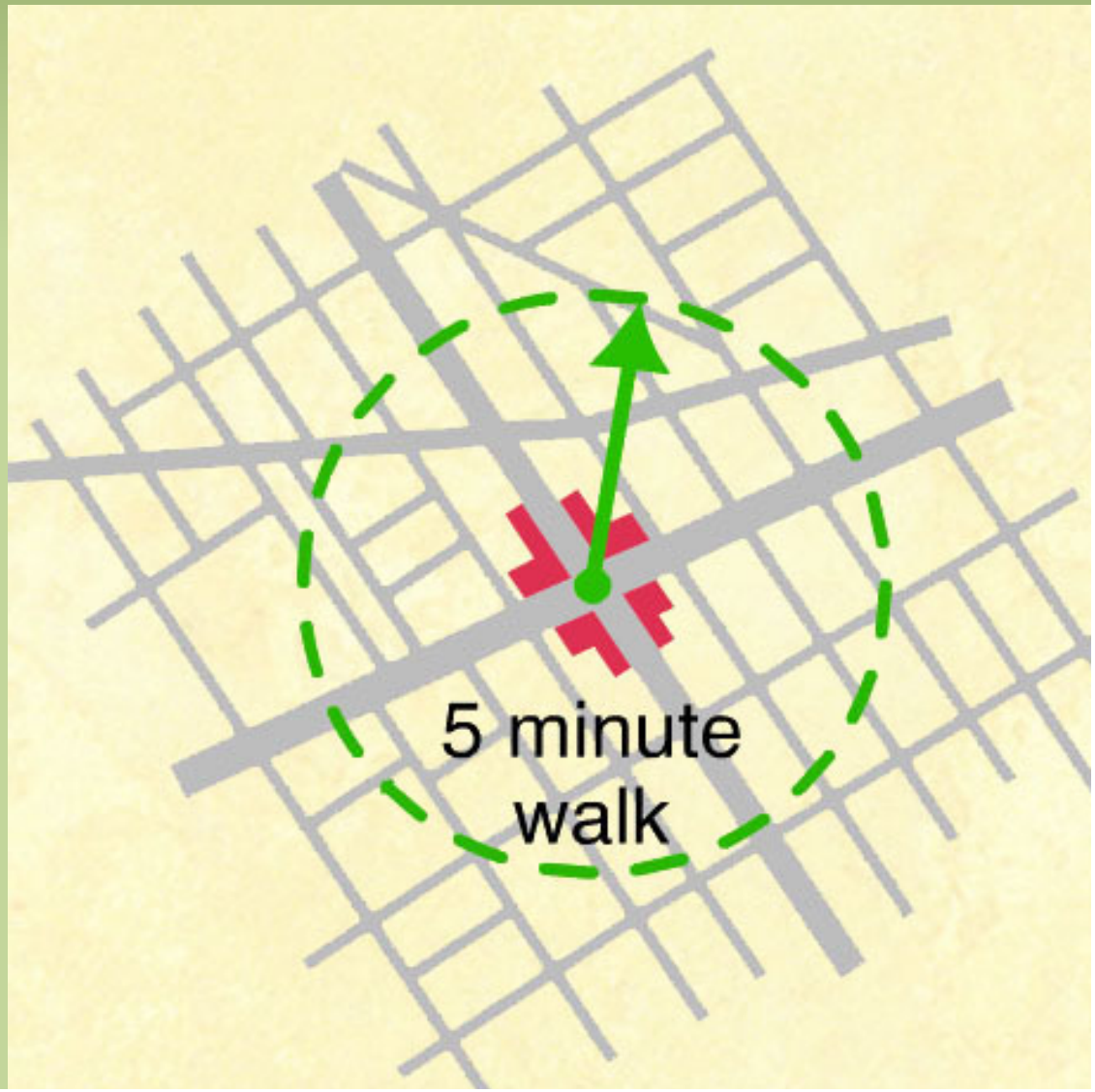
1. Urbanism and Sustainable Land Use

- **Smart Growth:**
  - Grow where infrastructure exists
  - Infill development and redevelopment
- **Urbanism Design:**
  - Compact, mixed use, walk-able neighborhoods
  - Neo-traditional neighborhoods
- **5 D's of Sustainable Land Use:**
  - **Density**: population/employment per acre
  - **Diversity**: mixed use residential/commercial/jobs
  - **Design**: aesthetics, sidewalks, street connectivity
  - **Destination accessibility**: ease of trip from pt. of origin
  - **Distance to Transit**: ¼ to ½ mile from home or work

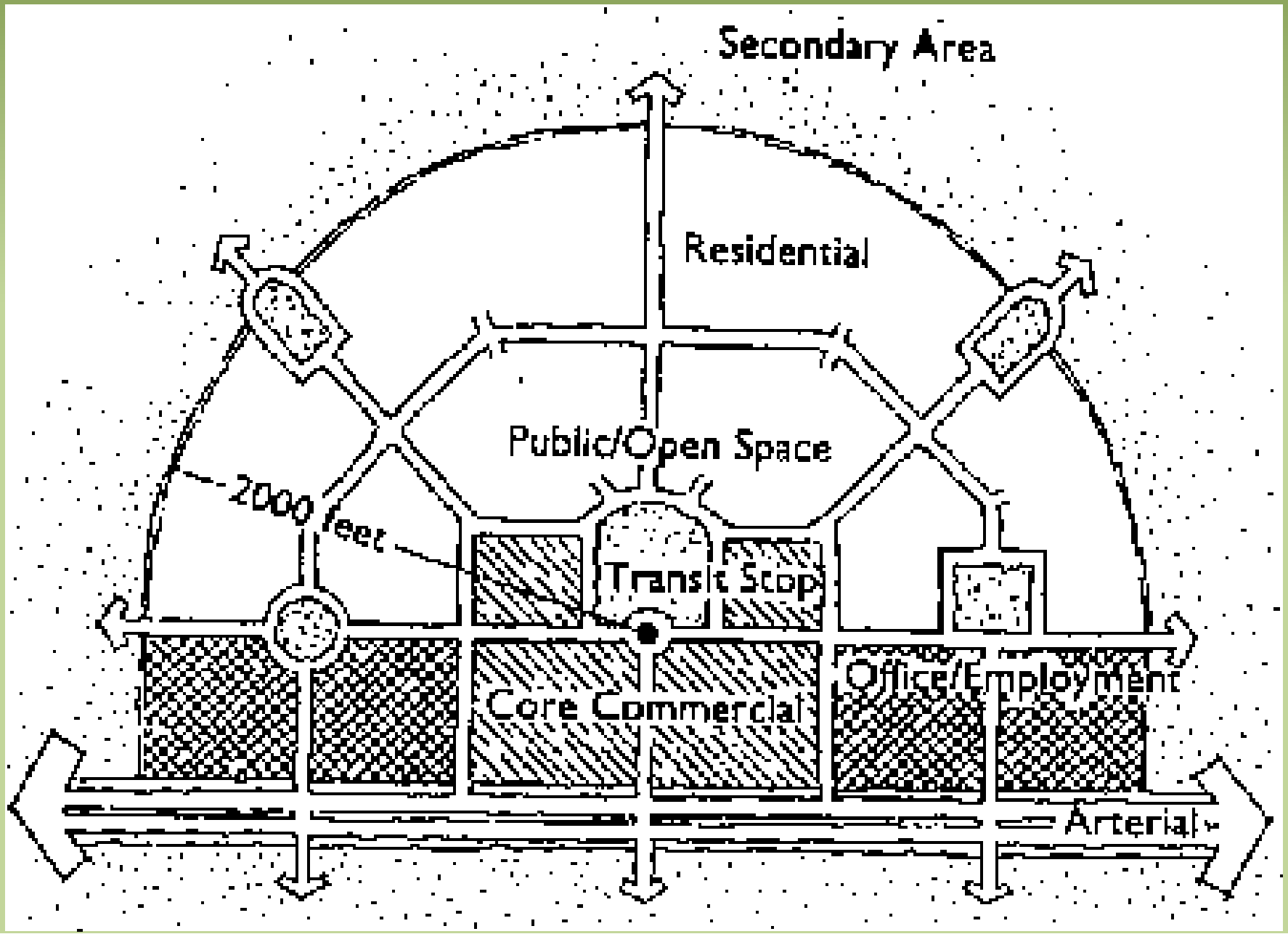
The Neighborhood

The optimal size of a neighborhood is a quarter-mile from center to edge, a **five-minute walk.**

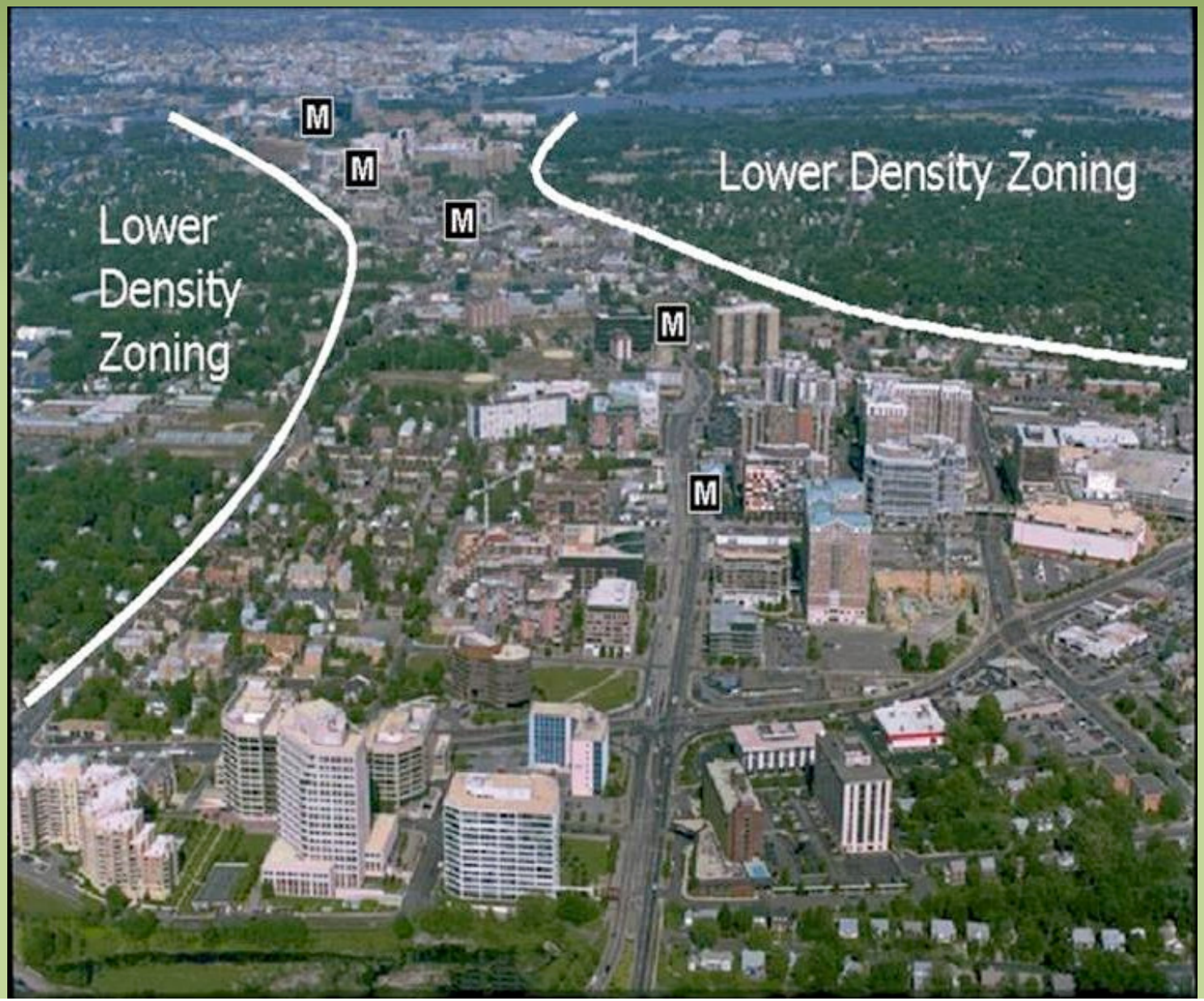
To feel walkable, many daily needs should be supplied within this five-minute walk.



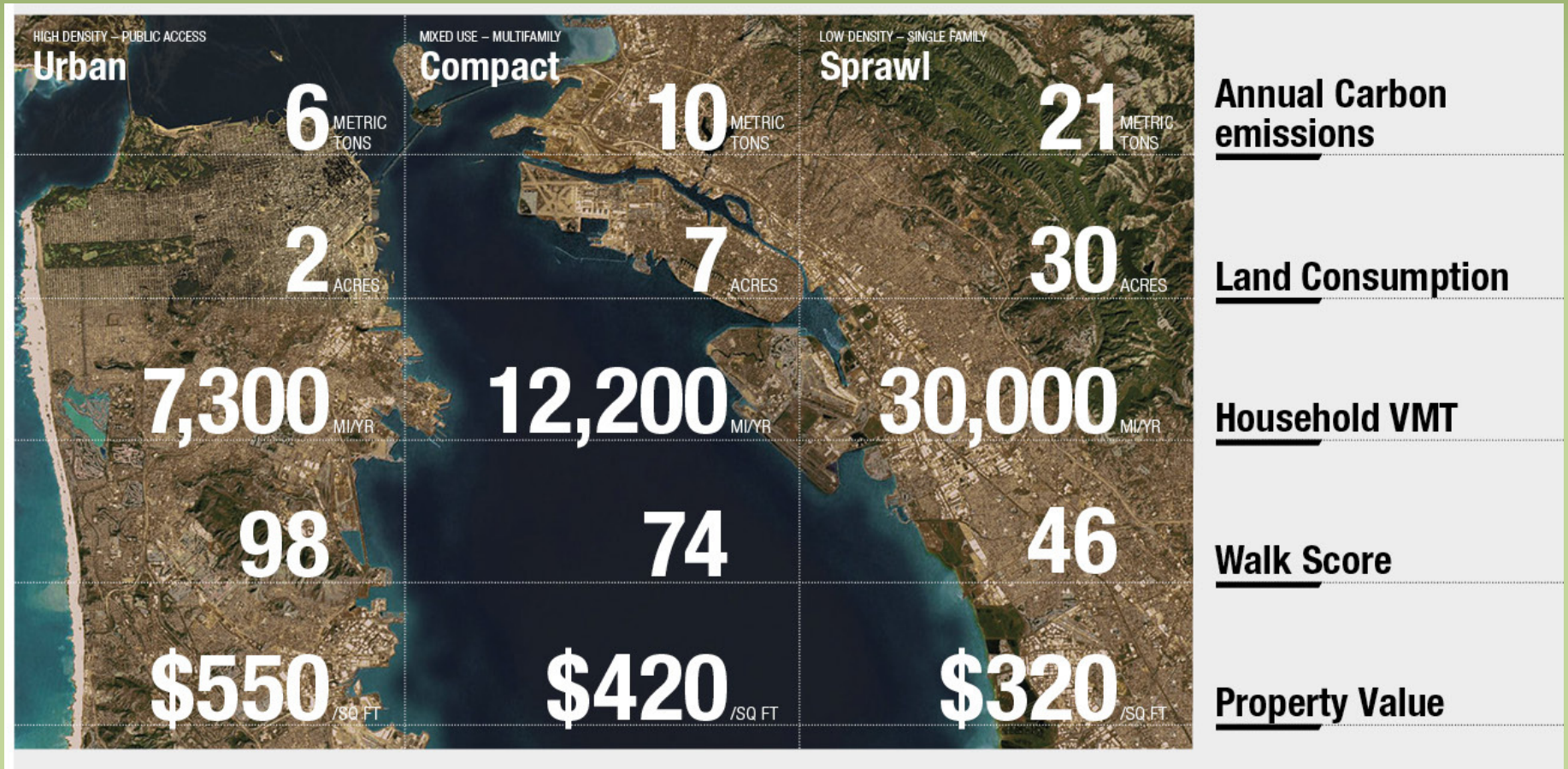
Transit Oriented Development (TOD)



TOD Arlington County, VA

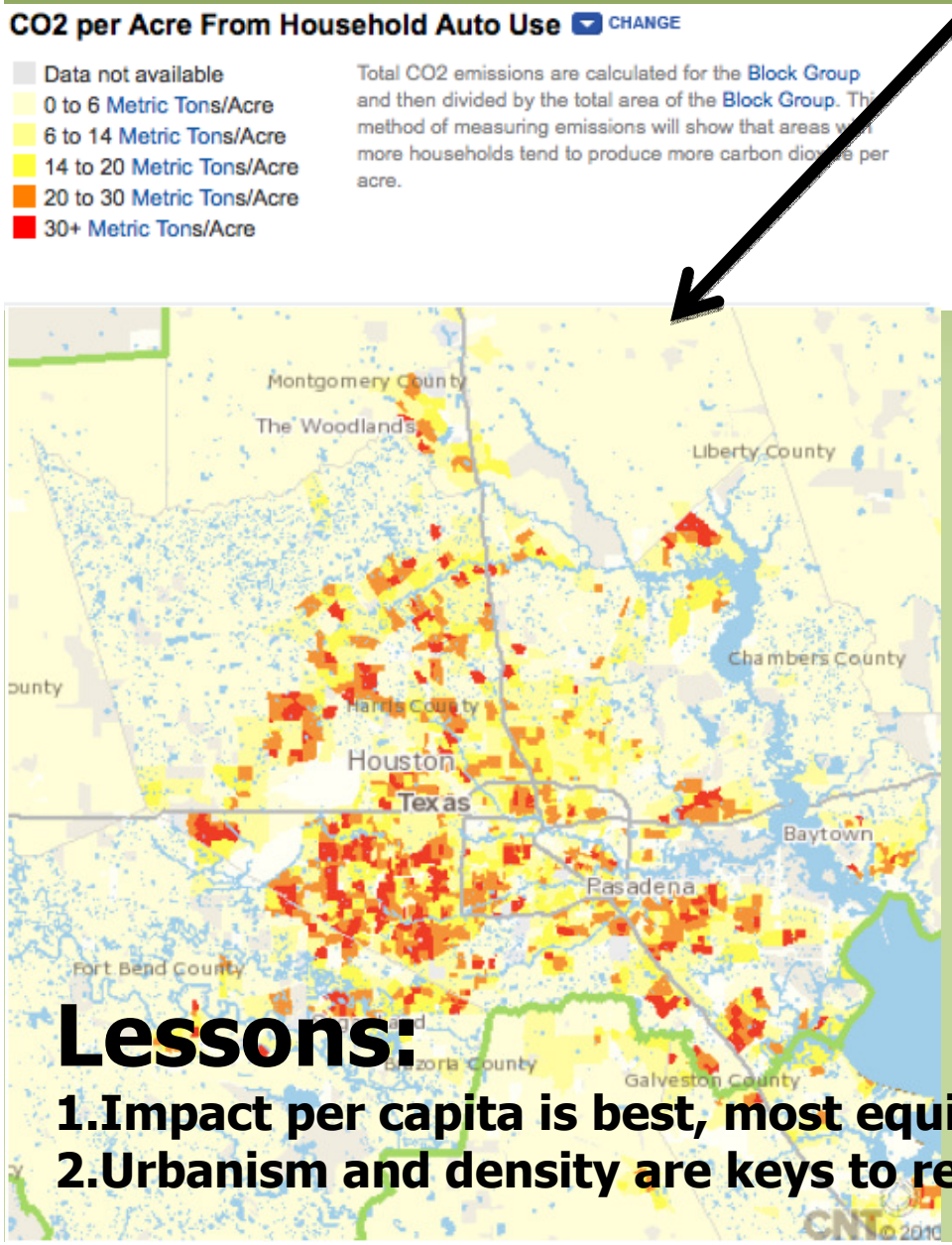


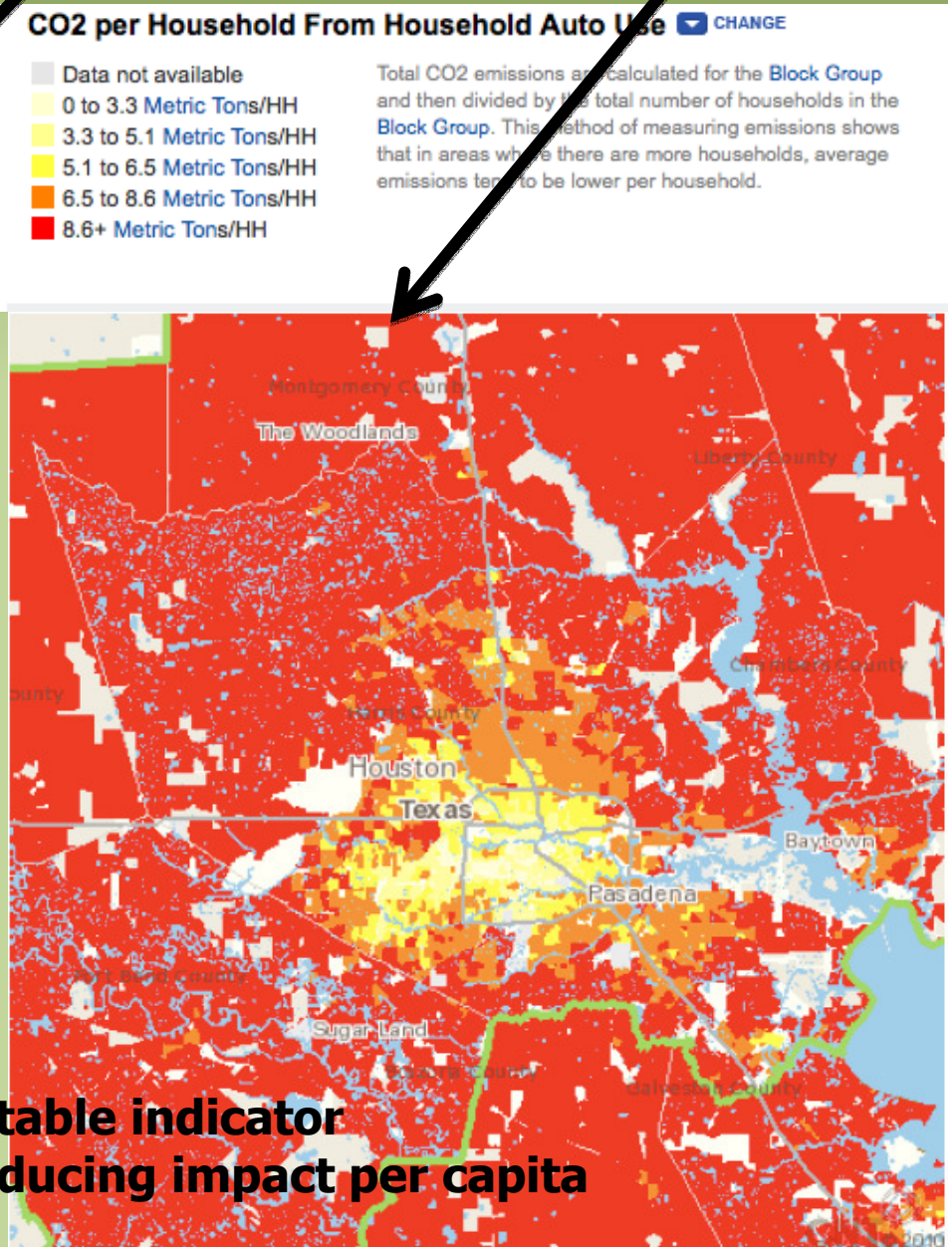
Comparing Neighborhoods



CALTHORPE ASSOCIATES

Houston: vehicle CO_2 per acre & per household

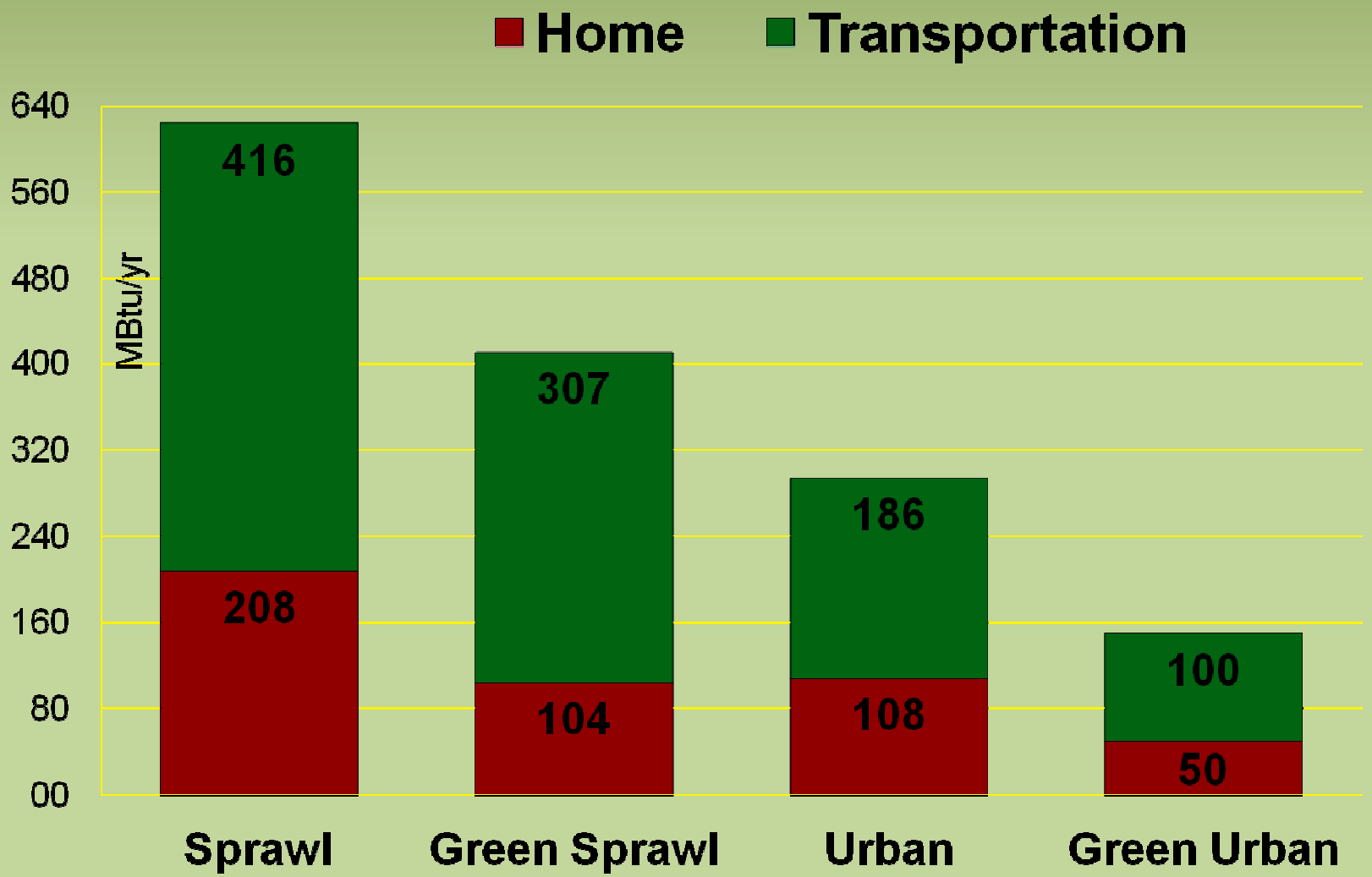




Lessons:

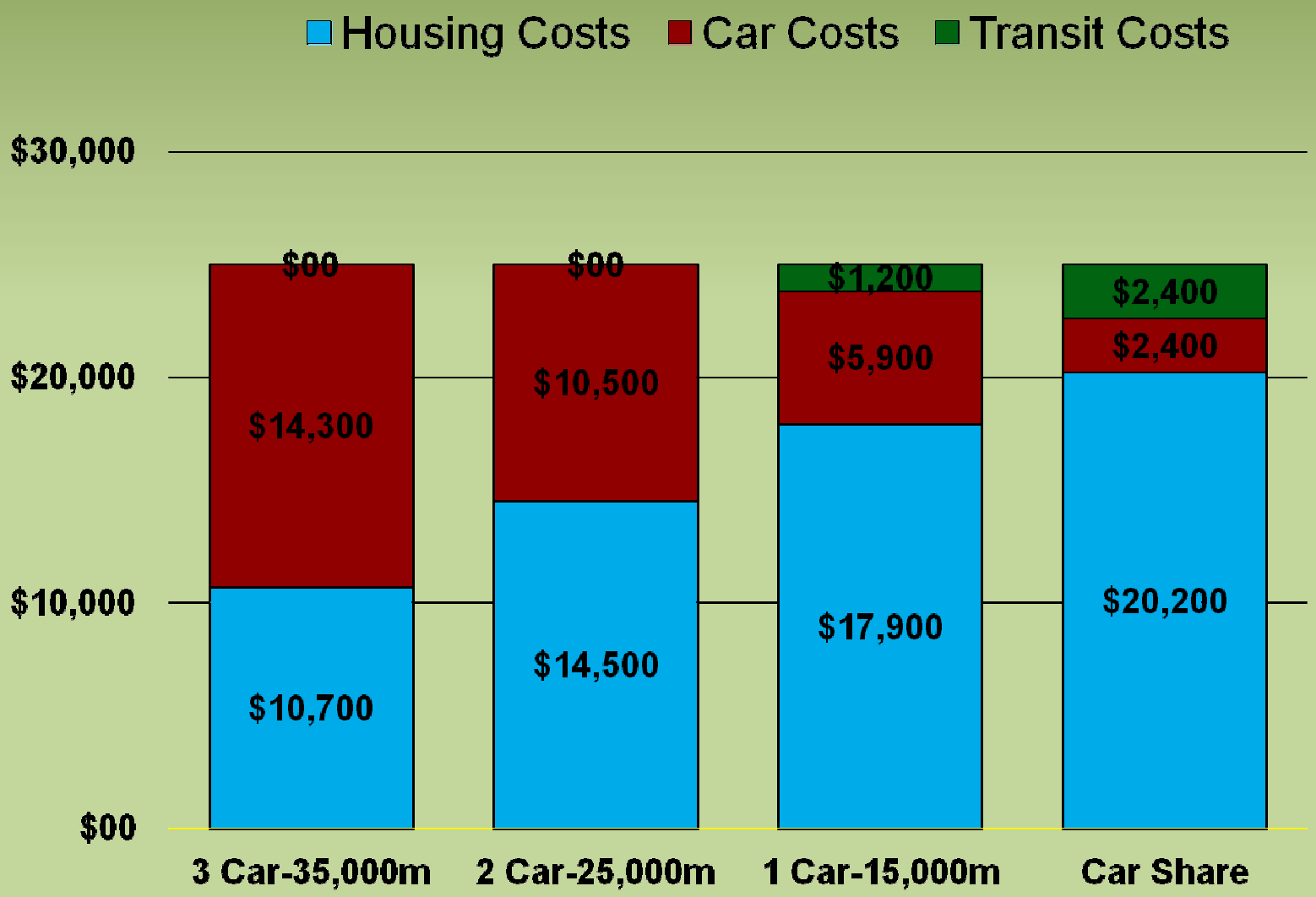
1. Impact per capita is best, most equitable indicator
2. Urbanism and density are keys to reducing impact per capita

Total Energy Consumption Per Household



Source: Energy Information Agency Table 2.1a

Annual Housing + Transit Affordability

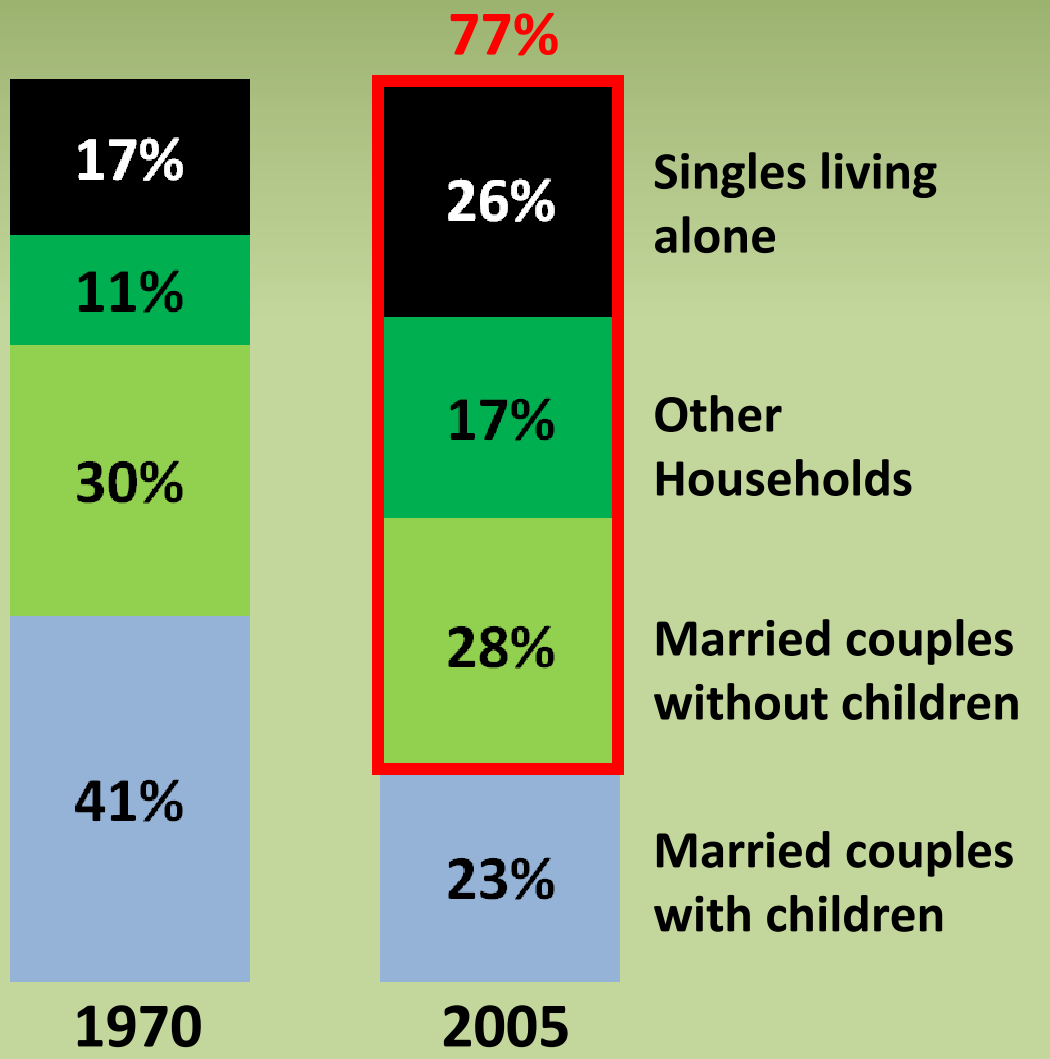


Source: Scott Bernstein "Creating Livable Communities": CALTHORPE ASSOCIATES

Future U.S. Housing Supply vs. Demand

Source: AC Nelson. Journal of the American Planning Association, Vol 72, Issue 4, 2006; CALTHORPE ASSOCIATES

Who We Are



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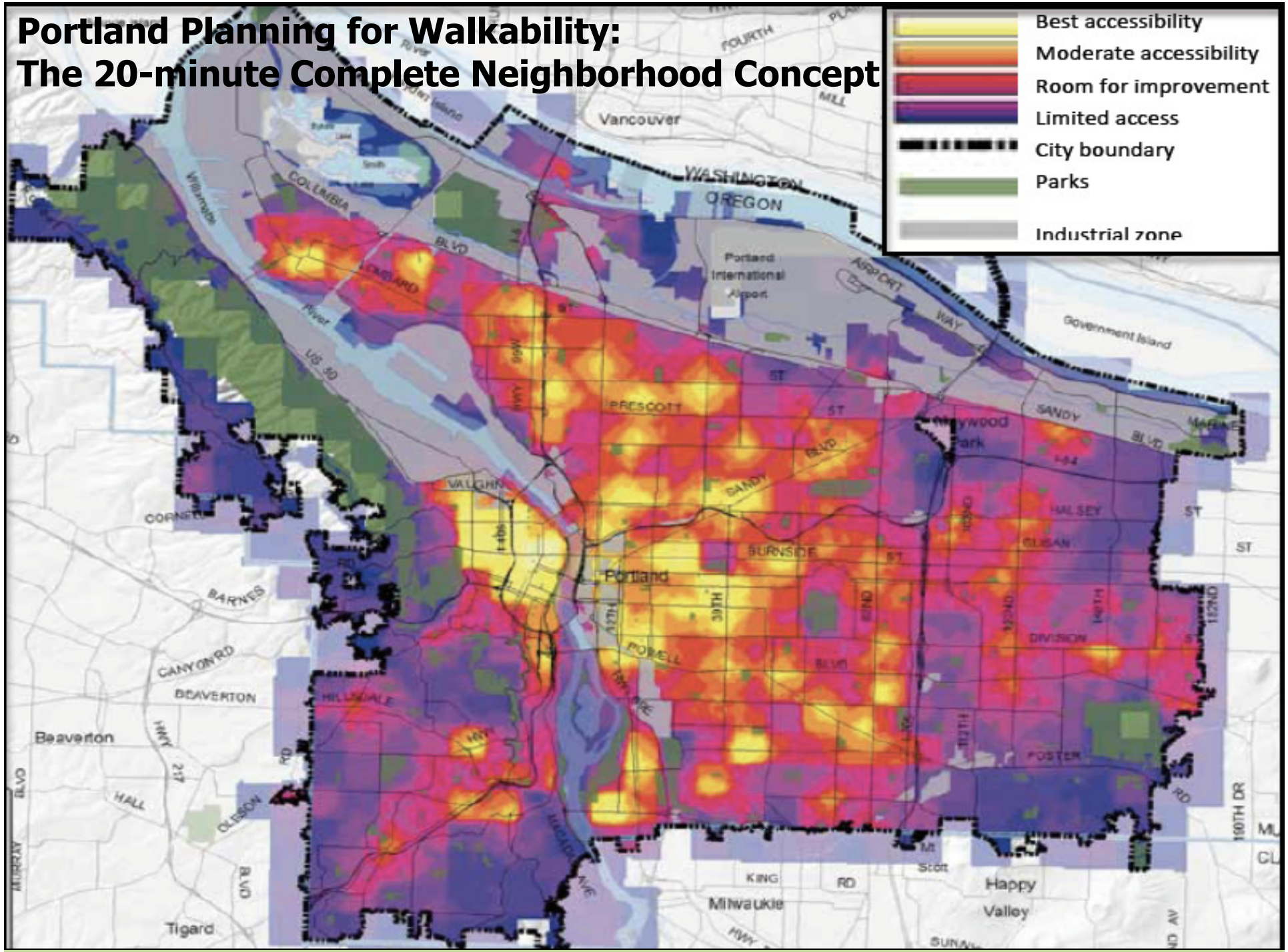
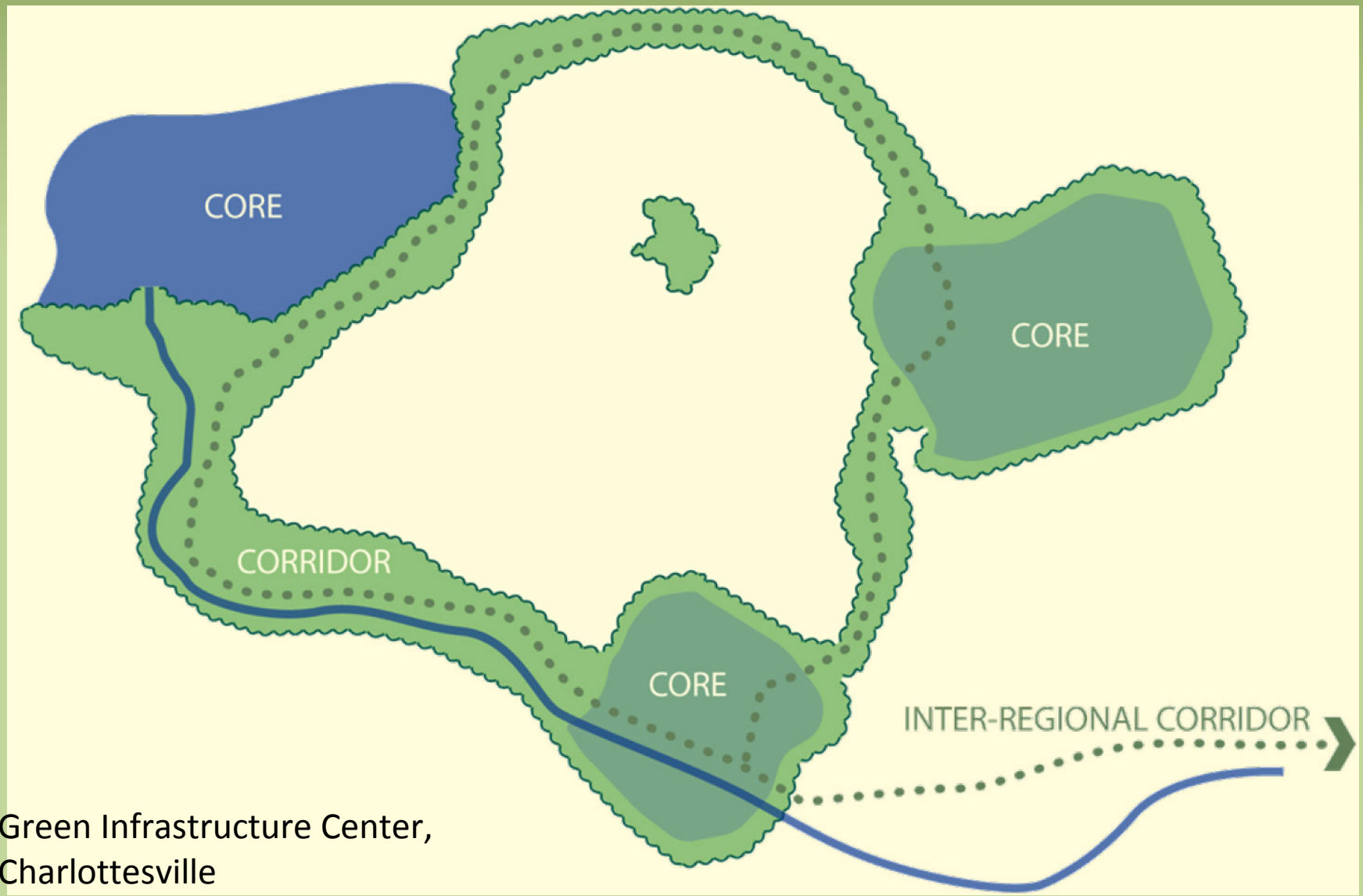
Portland Planning for Walkability:
The 20-minute Complete Neighborhood Concept



2. Green Infrastructure

- Network of conserved land the minimizes impervious surfaces, maximizes vegetative cover, maximizes natural drainage
- Green infrastructure includes:
  - **Cores** or **hubs**, such as habitat reserves, native landscapes, working lands, regional and community parks
  - **Corridors** or **links,** such as riparian floodplains, landscape linkages, conservation corridors, greenways, and greenbelts
- Integrates environmental and socio-economic land objectives
  - Watershed and stormwater management
  - Protection of open space and working landscapes
  - Provision of recreation parks and trails
  - Natural hazard mitigation for floodplains, steep slopes
  - Recovery of forest canopy
  - Preservation of habitats and biodiversity

Network of Landscape Cores and Connecting Corridors

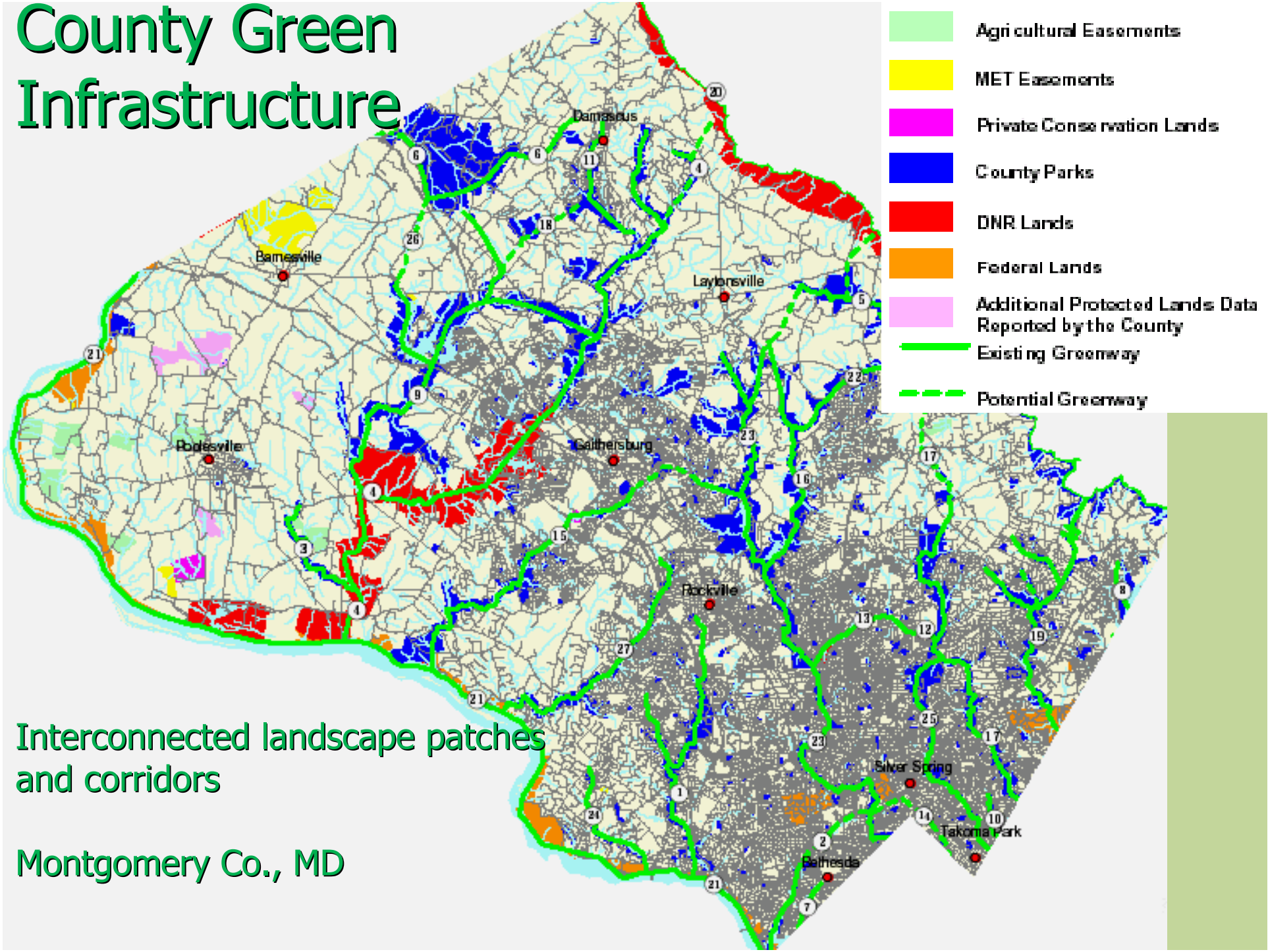


Green Infrastructure Center, Charlottesville

Regional Green Infrastructure: Chicago Wilderness

Chicago Wilderness touches four states and contains an extensive array of existing and recommended protection areas

County Green Infrastructure



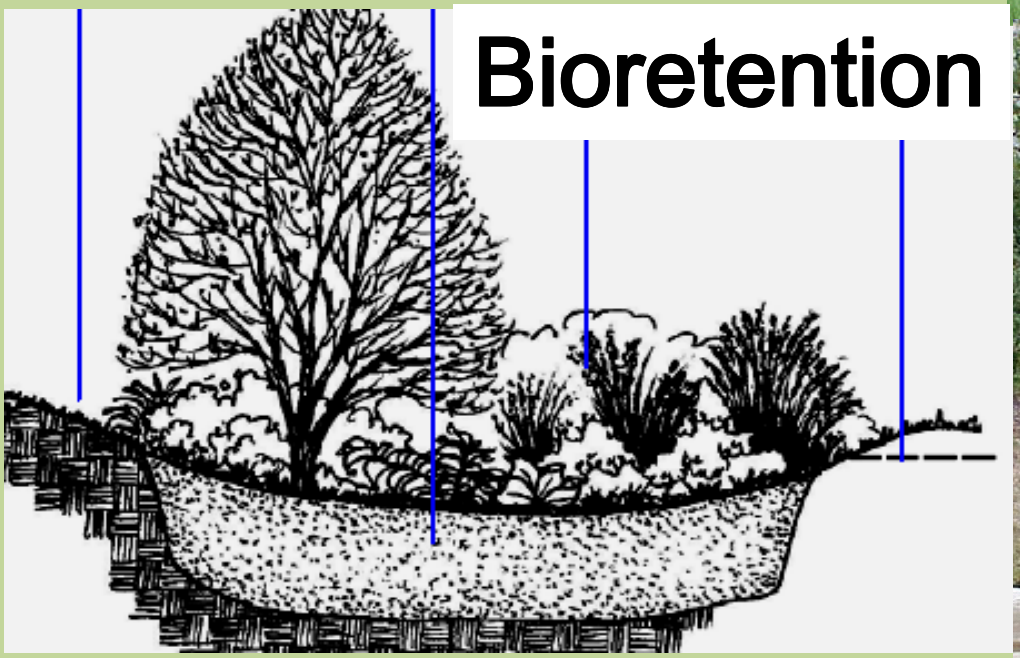
Interconnected landscape patches and corridors

Montgomery Co., MD

GI in Neighborhood Design: smaller lots, retained vegetation on-site water retention/infiltration

GI on Site: Low Impact Development (LID)

1. Retains, stores, infiltrates stormwater runoff
2. Restores vegetative cover
3. Reduces impact of impervious surface



LID + Urbanism = Light Imprint

- **Low Impact vs. Light Imprint Parking Lot for Managing Stormwater Runoff**
  - Excessive and “Gold Plated” Infrastructure
  - as compared to Infrastructure that Lies Lightly on the Land

LIGHT IMPRINT DESIGN, TOM LOW, DZP

Greening Sprawl vs. Urban Green

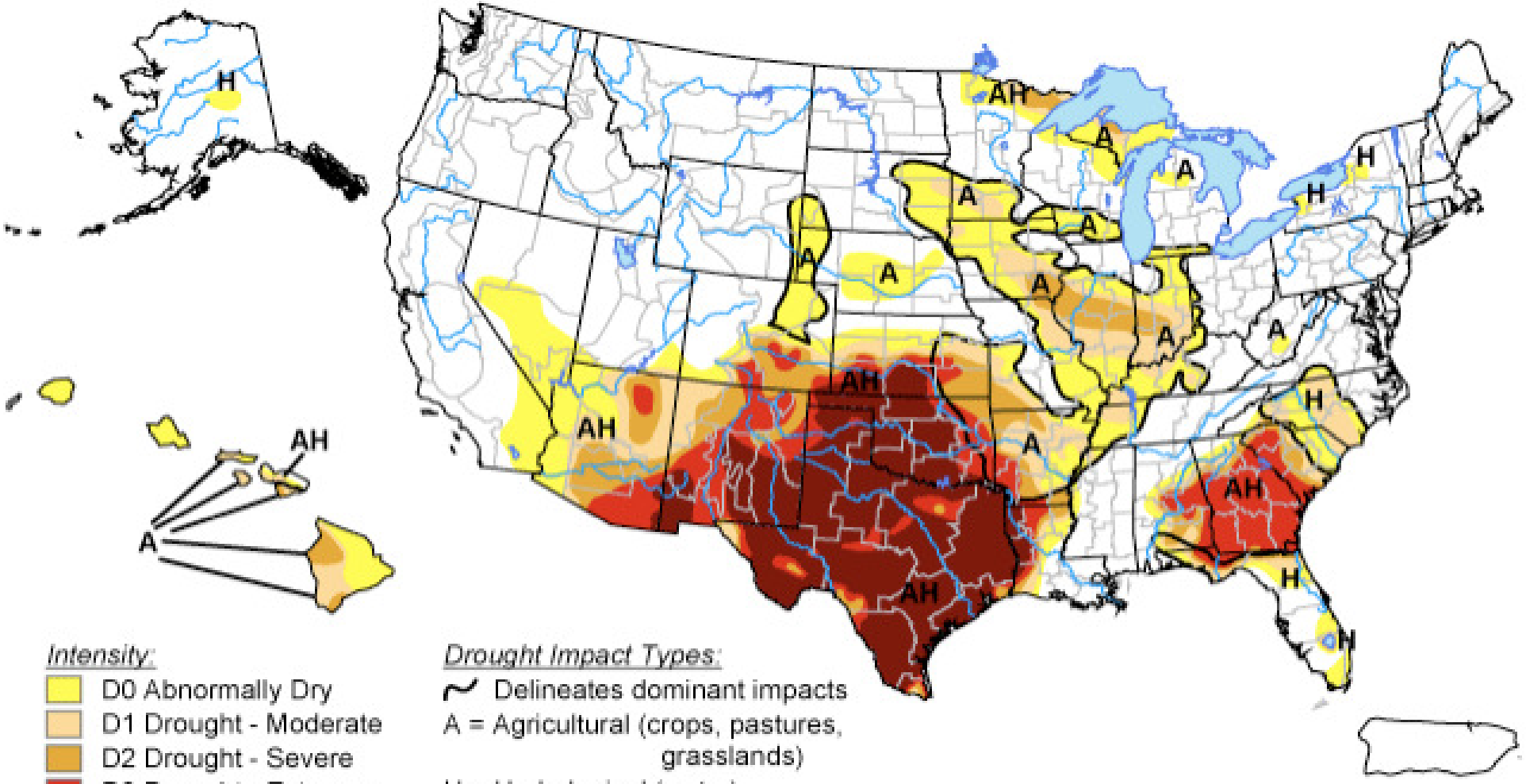
• Urban Moat Infrastructure to Manage Stormwater Runoff as compared to a Light Imprint Transit Greenway that also Functions as Open Space Park

LIGHT IMPRINT DESIGN, TOM LOW, DZP

3. Natural Hazard Mitigation

U.S. Drought Monitor

September 13, 2011
Valid 8 a.m. EDT



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- ~ Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

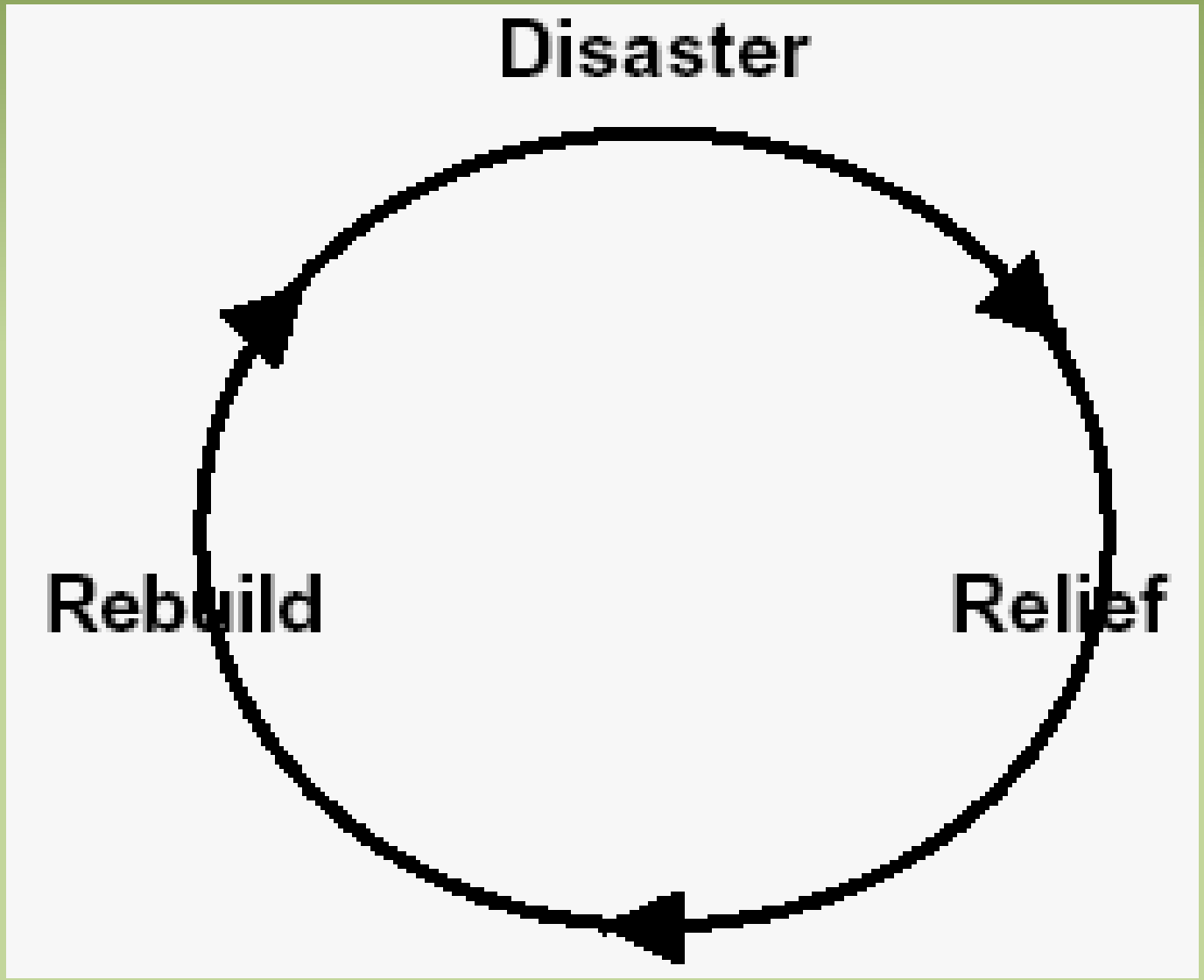
USDA National Drought Mitigation Center

Released Thursday, September 15, 2011


TEXAS WILDFIRES
TEXAS
AUSTIN

Flooding: Houston last week

Disaster-Relief-Rebuilt-Disaster Cycle

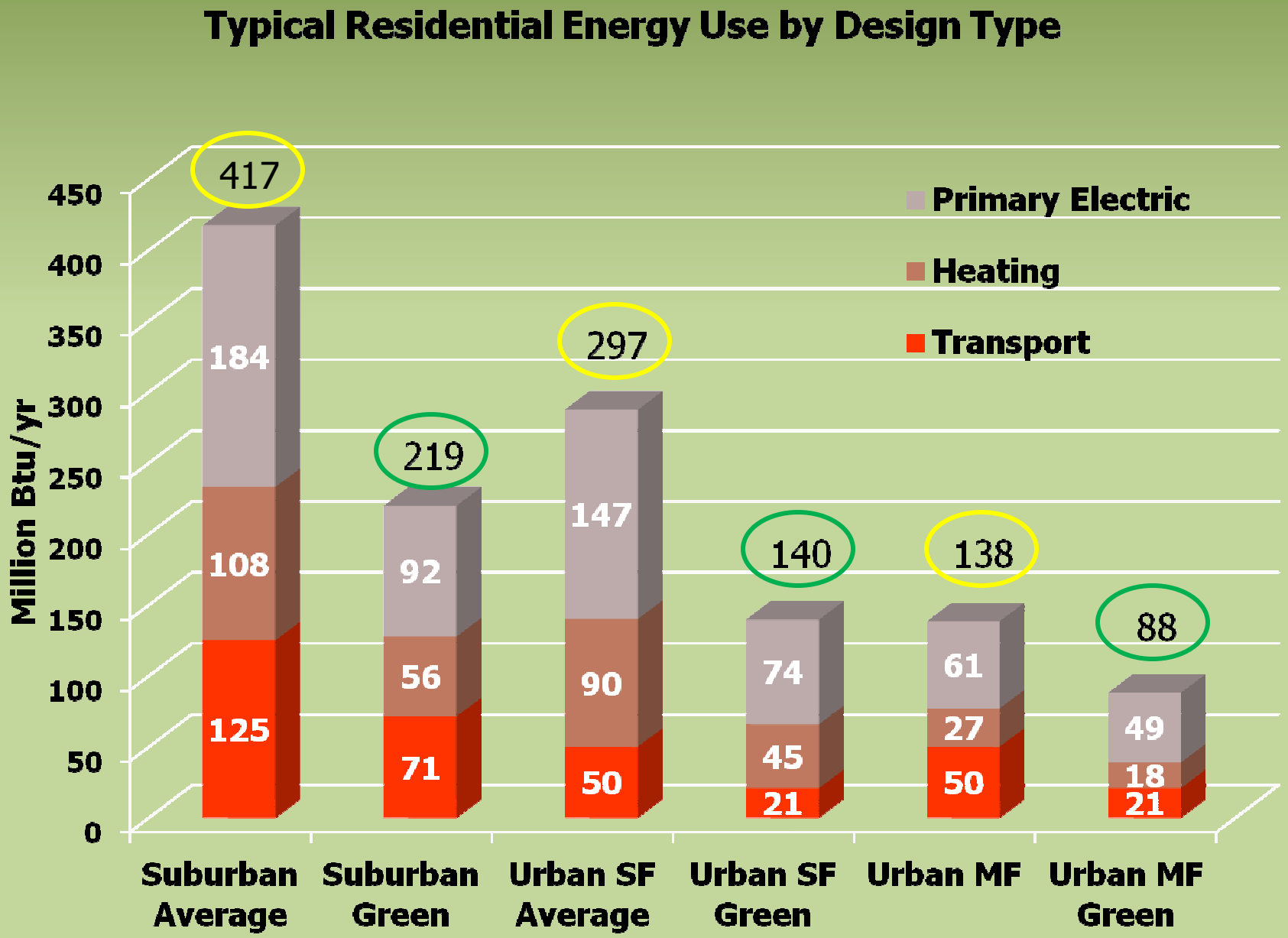


How many times do we rebuild before we think of another way?

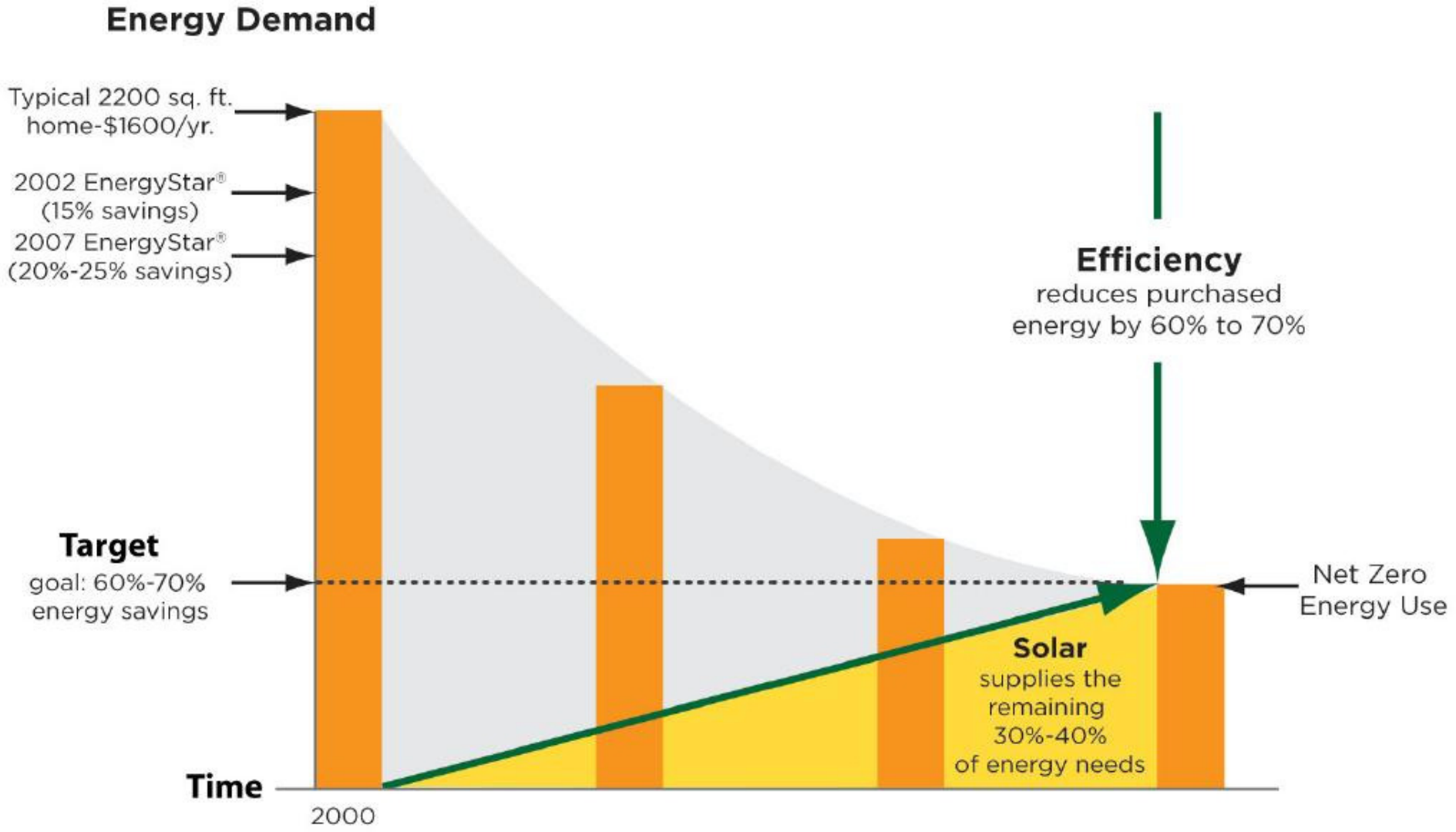
4. Clean, Affordable Community Energy

- Buildings
  - Increased efficiency
  - Green buildings: new and retrofit old
- Land Use and Transportation
  - Urbanism and Land Use Efficiency: 5 D's
  - Vehicle efficiency and electric drive
- Electricity
  - Distributed Energy and Smart Grid
  - On-site and regional renewables: solar, wind

Energy use depends on building design, size, location, consumer choice



Green Building Efficiency + On-site Generation = Net Zero Energy Building (NZEB)



Rooftop Photovoltaics (PV): Building and Sites as Powerplants

Electric Drive Vehicles:

Gas-equivalent "Price per Gallon" and CO_2 Emissions

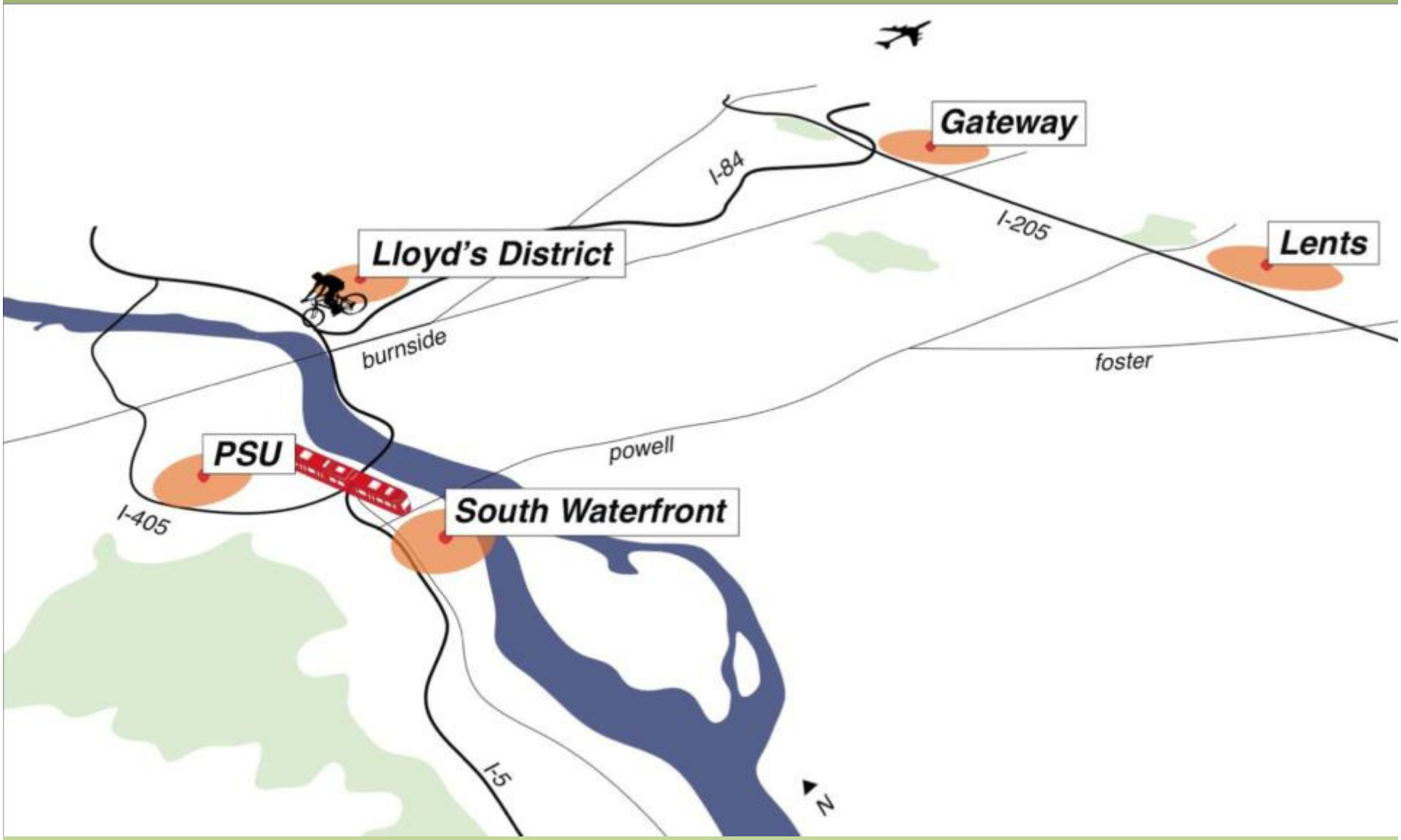
One-quarter the cost of gasoline

(12¢/kWh, $3.50/gal)

One-half the CO_2 emissions as gasoline

(average U.S. electricity sources: 50% coal)

Eco-districts:
focus on one neighborhood at a time



Portland Eco-district Designs and Technologies

PARK/OPEN SPACE/NATURAL AREA

LEED DEVELOPMENT PROJECT

"GREEN STREET"

STREETCAR

BIKE PATHS/LANES

TRAM

Thermal Energy

Water Reuse

Smart Grid

Green Streets

Diagrams courtesy of ZGF Architects

The Sustainable Community

- Planning, design and construction applied at different scales from building to site to neighborhood to community to region
- Resilience objectives:
  - Natural hazard mitigation and climate change adaptation
- Environmental objectives:
  - Energy, water, land and material efficiency; renewable energy; climate change mitigation
  - Water and air quality protection, waste minimization
  - Biodiversity preservation
- Affordable Livability objectives:
  - Affordable housing
  - Accessible mobility

Achieving Pathways to the Sustainable Community

- Advance sustainable energy & water & land **Technologies & Designs**
- Transform the **Market** for sustainable affordable designs attracting **Private Investment**
- Enhance consumer and community **Choice** for sustainable technologies and sustainable livability
- Community and Metropolitan **Planning**
- Public **Policies** for technology research, market transformation, institution building, and planning
- **Education** to retool professions, train workforce, and fuel the social movement for sustainable communities

Questions?

Lessons on Urban Ecosystems and Urban Sustainability

- Urban ecology:
  - Maximize vegetative cover, minimize impervious cover, protect natural drainage and riparian areas, reduce fragmentation
  - Understand changes along the urban gradient
- Community sustainability:
  - Livable, Green, Resilient
  - Resolve contradictions among livability, equity, economy and ecology through integrated solutions meeting multiple objectives and providing co-benefits

Resolving conflicts through integrated solutions, multiple co-benefits

- Can we achieve the multiple objectives of the sustainable community through innovations of planning, design, and governance?
- For example:
  - **Compact, walkable, transit-oriented, mixed use development** can provide affordable housing and mobility, smaller ecological footprint, vibrant economic conditions, and livable neighborhoods
  - **Community energy planning** can provide more affordable energy costs, green jobs, and air pollution and carbon emission reductions
  - **Innovative stormwater management** can improve water quality at lower cost, enhance green space, protect riparian areas and urban streams, and provide both linear recreation trails and wildlife connectivity corridors.
  - **Urban forestry and restoration of canopy cover** can help manage stormwater, reduce urban heat island effect, absorb air pollutants, increase property values, enhance community aesthetics, and provide wildlife habitat