Sustainability Roundtable Series – Summary

Incorporating Sustainable Design into Infrastructure

Wednesday, March 3, 2010

SeaTac City Hall

Presenters

Dan Williams – DWA Design
Nancy Rottle – Director, Green Futures Lab, University of Washington

Attendees

See attendee roster at end of document.

Meeting Summary

Introductions/Welcome – Patti Southard

- Book Giveaways – 10 participants received copies of Dan William's book, "Sustainable Design: Ecology, Architecture and Planning."
  Resource See attached flyer to learn more about the book!
- Moving forward Ric Cochrane will lead the Roundtable series effort, though Patti will remain an active participant!

Sub-Urbanism: Sustainable Infrastructure - Dan Williams

Resource See attached Power Point for details and references.

Abbreviated Biography

Daniel Williams, is a Fellow in the American Institute of Architects and is an internationally recognized expert in sustainable architecture and watershed planning. Mr. Williams is a member of the experts team for the Clinton Climate + Initiative, advising on projects in Toronto and London. He participated in the development the 2010 Council of Mayor's resolution that will reduce carbon emissions by 50%; presented Watershed Planning Initiatives at the Center for Neighborhood Technologies in Chicago; co-wrote the Barcelona Declaration on Sustainability; and has worked with dozens of communities around the country, creating master plans with the residents – specifically to assist in the rebuilding of towns and cities after natural disasters.

"When things are going well, we don't do much. When things aren't going well, there are a lot of opportunities to jump in, and this is where we are right now."

- New book is expanding to include climate change – will include big calls to change.
- 20 years planning in South Florida provided many unique experiences for learning about infrastructure, post-disaster recovery and planning, and innovative ways to reconnect natural systems.
- Definition of infrastructure – formally became vocabulary in planning in 1960s. There are several definitions – basic foundation to more specific, but ~William D. Ruckehaus
- Challenge: What does sustainability mean? How do you design a structure to make use of commonly missing is the ecological component, and giving real numbers to economic value of nature.

- What are the advantages of a natural place? How do you make sure that systems like LEED are they 'counting the right beans'?
    - Regionally specific architecture is critical as are the impacts from neighborhood and community scale.
    - ***"Environmental protection and economic development are complementary"***

"Sustainable Design: Ecology, Architecture and Planning"

- Book is on the ecological model – about connectivity. Waste not being waste, because it has a place to go. When we redesign systems so the 'waste' has a place to go, it is no longer considered waste.
- 'Reconnect the Disconnected' – Livable and healthy systems = putting the 3 Es (Environment, Economy, Social Equity) together, but they are 3-dimensional in how they connect with one another – so there are many different models for how they connect.
- Land use planning – often has no correlation that connects energy and infrastructure, even with mixed use planning. Linkages need to be 3-dimensional. (Think of Haiti and Chile!)
    - Post-earthquake in SF, the largest deconstructive force was fires, because of lack of water infrastructure. This is still a problem in Haiti, Chile, Hurricane Andrew, etc. In San Francisco, infrastructure planning post earthquake built on that knowledge. But what are we doing now to be prepared for other missing linkages?
    - Post hurricane Andrew – leveled 500 sq miles. In post disaster long term planning, Williams learned that agriculture was draining parts of the everglades, killing 500 sq. miles of the bay (a multi million dollar fishing industry). As a result, he suggested watershed study of entire region. Found that the area with the most impervious surface is where the most people live and where the most rainfall falls. Challenge was to look at natural system, which stopped saltwater intrusion, to current system where it was being mechanically drained through canals, and they are now running out of water. The carrying capacity is critical – how much water lands there is the budget – it's a savings account, not a checking account.
    - Look at number of hurricanes that have happened in last hundred years – Pretty likely that they will happen again!!
- Systems that took thousands of years to develop are now being reworked by infrastructure, with results that have a negative impact (such as poor water quality

- Look at hidden Infrastructure – wherever there is a road there is infrastructure below – many more miles of infrastructure than road. Transition this to a resource instead of a burden or conflict, to create an opportunity.
    - Ex. Establish water supply. Create. "greenways and blueways" Recreate gravity fed agriculture, re-expose lake edge to become an amenity,
    - Hawaii example – a lake that 1000 years ago supported 65,000 people - now only 20,000 people live there but almost everything is imported. What happened to the lake as a resource?
    - Create infrastructure for people and salmon: Think of the region as a storage system – flooding is a function of things not getting stored + pervious surfaces.
    - Develop communities that work as whole systems. Salmon friendly street uses water to organize the street, self irrigating, creates own microclimate.
    - Create green right of ways – also creates much higher real estate values, lowers air conditioning through microclimate.
        - Example of Seattle – Daylighting streams from Lake Union to Eliot Bay through Seattle Center to SAM Outdoor Sculpture Park – huge potential for ecological amenity, but also an aesthetic draw!

Next Steps/Call to Action: Design and plan our region as a blue/green infrastructure; help lead the creation of post disaster plans for regions and communities, help lead the reconnection with biological climatic systems bio-urbanism, help lead and educate public officials.

Green Infrastructure for Climate Benefit: Green Futures Research and Design Lab – Nancy Rottle

Resource See attached Power Point for details and references.

Abbreviated Biography

Nancy Rottle is an Associate Professor of Landscape Architecture in the UW's College of Built Environments where she teaches ecological design theory, sustainable landscape construction, and design and planning studios. She directs the College's Green Futures Research and Design Lab (GFL) which develops innovative approaches to the planning and design of public space, conducts research that informs urban policy and design questions, and works with communities to envision and enact sustainable futures. A registered landscape architect with over fifteen years of professional experience, Professor Rottle has led numerous award-winning design and planning projects in the Pacific Northwest. Nancy has augmented her in-depth Pacific Northwest experience with study of international examples of exemplary city design.

- Practice experience has largely been in Seattle with suburban communities and Cedar River Watershed. Research work now is more focused on urban places.
- What is Urban Green Infrastructure? Urban = any community that is 2000 people or more. Green infrastructure was originally for outside of communities, but now is used to talk about inside communities. Green Infrastructure = Green Spaces, Sustainable Infrastructure (drainage, urban forests, both natural and semi natural)

5 Systems of Green Infrastructure

1. **Community and Open Spaces** –successful compact urban areas integrate liveability access to parks and nature and things that people crave when they move to the suburbs
2. **Low Impact Mobility** – getting around with less impact, "active transport"

3. **Habitat** – forests, prairies, shorelines – these are the rich places for people in cities to have meaningful contact with nature.
4. **Water** – source, stormwater, graywater, black water, aquatic environments: Think about water as a complete system.
5. **Energy/Food/Climate (Metabolism)** – we need and we produce energy. Systems such as gardens give us energy, with a low carbon imprint. Local food = less energy. Local energy production = wind turbines.

- Hallmark of green infrastructure is that the five systems interlap. Layered mapping (High Point example)
    - Trees as an example: traditional infrastructure is thought of as one thing, but green infrastructure pulls together multiple services and functions.

Green Futures Research and Design Lab at UW – focuses on green infrastructure.

- Open Space Seattle 2100 – Visions for Seattle's green infrastructure, supported by students, mapped resources, looked at city by watershed – came up with 100 year vision for what green infrastructure could look like.

  Resource www.open2100 (all resources handed out at Roundtable are available here)

Planning for Climate Change Challenges in our region

- 2050 – 2-4 degrees warmer, spiking heat island effect in urban areas, less water supply because water comes from snow pack (largely), salmon impacts, stress from exotic plants invading urban forests, reduction in biodiversity, 'climate chaos' = stronger winter storms, rising sea levels. IPCC continues to revise estimates.
- How do we reduce and prepare for inevitable impacts? Mitigate and prepare for adaptation to climate change – both need to be done.
    - Protecting climate through green infrastructure (community space, low impact mobility, urban greening, water conservation and natural drainage, metabolism)
    - Adapating/minimizing = building resilience, social resilience, urban mobility,
    - Look at systems that both mitigate and adapt
        - Study: adding 10% of tree cover could maintain temperatures at 1990 levels
        - Examples: Copenahagen (city laid out like a hand with green webbing in between fingers, transit connects between the dense living areas)
        - Urban greening – providing stepping stones for all species that need to move. Resilient connected forests (where there is the most pavement there is typically the greatest need for urban forests).
- How do we get there?
    - Visioning – the real and the possible
    - Municipal investment - result of open space seattle = Parks Levy 100 year Green Legacy Plan
    - Small interventions spread widely (how can people garden differently, parking strips)
- Ex. Seattle's new code: Green Factor – commercial and residential districts to reestablish predevelopment hydrology. 30% needs to be open space.
    - Building practices can help achieve green open spaces (green walls, permeable paving, increasing density with green strategies)

- Gehl Walkability Report - will be ready soon.
- Break down silos, and use a multi-level approach that coordinates capital improvement projects around green infrastructure using triple bottom line metrics

Call to Action: Nancy and Green Lab want to partner with cities to opportunities for sustainable green infrastructure integrated with waterfronts – to create prototypes for other communities. .

Questions/Discussion

Q: How can policy and decision makers push this forward quickly, but how do we get Nancy and Dan in front of these people? Suburban cities are interested in partnerships and solving challenges as a bioregion, not individual places.

- Nancy: Tackle from top down and bottom up simultaneously. How can public officials educate the public? Use students as a resource - Public gets really excited, needs to be genuinely participatory
- Dan: Every community when coming up with plan, should draw out all the elements and amenities, and share with public to create a teaching moment.
- Both: Break down silos and get government to work together.

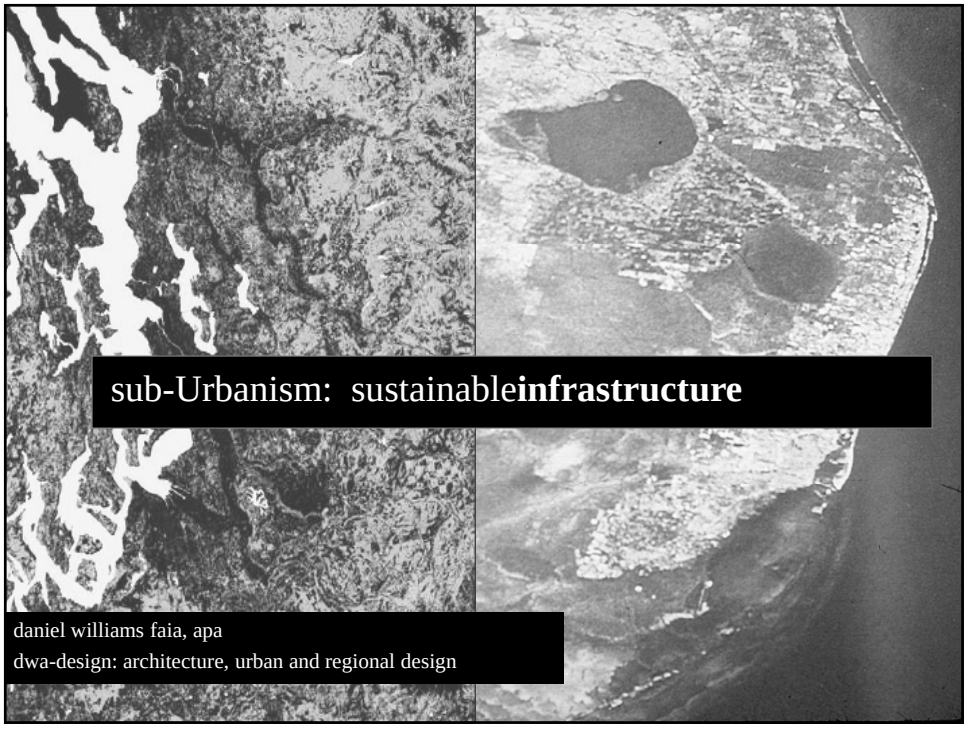
Events/Announcements

May 5th : Government Confluence – encourage participants to spread the word to elected to attend!

This fall – King County will do a tour of Cedar River Watershed.
Cedar River Watershed is a really good example of sustainable and ecological management. Additionally, FSC certified forest and education center built with primarily FSC wood. Plus, it ties into the region's history. 100 years ago the city's 'mothers and fathers' mada a gesture that fresh water would be available for the next 100 years, this is an example of how we can live up to that gesture and extend to the future.

Attendees

First Name	Last Name	Job Title	City	Email Address
Chris	Anderson	Environmental Protection Manager	Auburn	candersen@auburnwa.gov
David	Barnes	Planner	Kirkland	dbarnes@ci.kirkland.wa.us
Rachel	Berryessa	Senior Engineer Program Manager	King County	rachel.berryessa@kingcounty.gov
Donna	Burris	Internal Services Manager	Kirkland	dburris@ci.kirkland.wa.us
Nori	Catabay	Project Manager	King County	nori.catabay@kingcounty.gov
Ric	Cochrane	Project Manager	King County	ric.cochrane@kingcounty.gov
Scott	Guter	Planner	Kirkland	sguter@ci.kirkland.wa.us
Tom	Hinman	Planning Commissioner	Redmond	tom@thinmanassoc.com
Eric	Jensen	Project/Program Manager	King County	eric.jensen@kingcounty.gov
Tiffancy	McClaskey	Engineer	King County DNRP WTD	tiffancy.mcclaskey@kingcounty.gov
Juniper	Nammi	Associate Planner	Shoreline	jnammi@shorelinewa.gov
Doug	Peters	Senior Planner	Washington State	doug.peters@commerce.wa.gov
John	Phillips	Prject Manager	King County DNRP WTD	john.phillips@kingcounty.gov
Dieu	Quach	DOT Roads Maintenance	King County	dieu.quach@kingcounty.gov
Tom	Radford	Plans Examiner	Kirkland	tradford@ci.kirkland.wa.us
Deborah	Reilly	Owner/Architect	Vashon	reilly.deborah1@gmail.com
Robert	Renouard	Capital Projects Manager	King County	robert.renouard@kingcounty.gov
Don	Robinett	Stormwater Compliance Manager	SeaTac	drobinett@ci.seatac.wa.us
Peter	Rosen	Environmental Planner	Issaquah	peterr@ci.issaquah.wa.us
Janet	Shull	Senior Planner	Federal Way	janet.shull@cityoffederalway.com
Patti	Southard	Program Manager	King County	patti.southard@kingcounty.gov
Liz	Stead	Planning Manager	Bellevue	estead@bellevue.wa.gov
Jim	Sussex	Engineer	KC DOT	jim.sussex@kingcounty.gov
Kathy	Tremper	Community Development Coordinator	King County	kathy.tremper@kingcounty.gov
Mike	Usen	Senior Environmnetal Planner	King County Metro	mike.usen@kingcounty.gov



sub-Urbanism: sustainable**infrastructure**

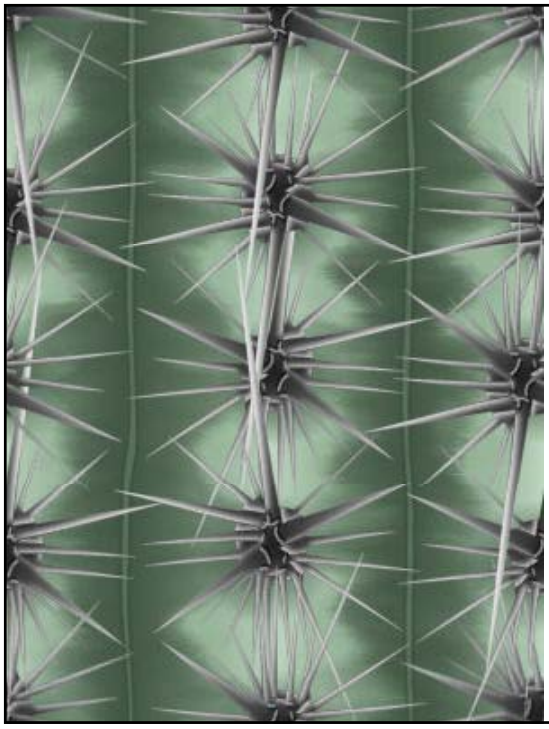
daniel williams faia, apa
dwa-design: architecture, urban and regional design

in·fra·struc·ture (nfr-strkchr)
n.
1. An underlying base or foundation especially for an organization or system.
2. The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons.

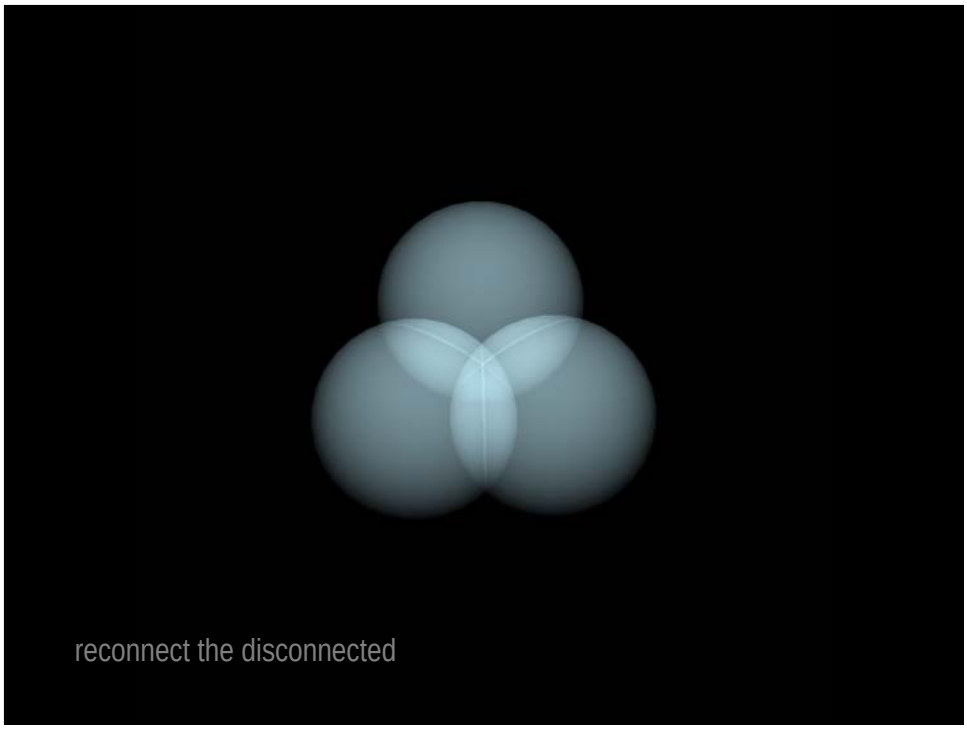
"Sustainability is the [emerging] doctrine that economic growth and development must take place, and be maintained over time, within the limits set by ecology in the broadest sense -- by the interrelations of human beings and their works, and the biosphere...It follows that **environmental protection and economic development are complementary** rather than antagonistic processes."

William D. Ruckelshaus
Scientific American
September 1989

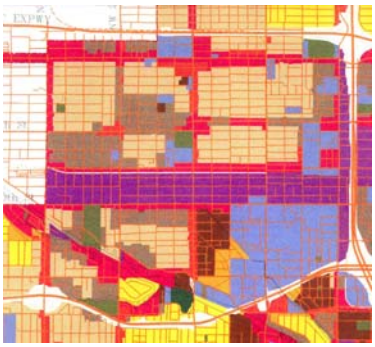
How we doing? What is sustainability?

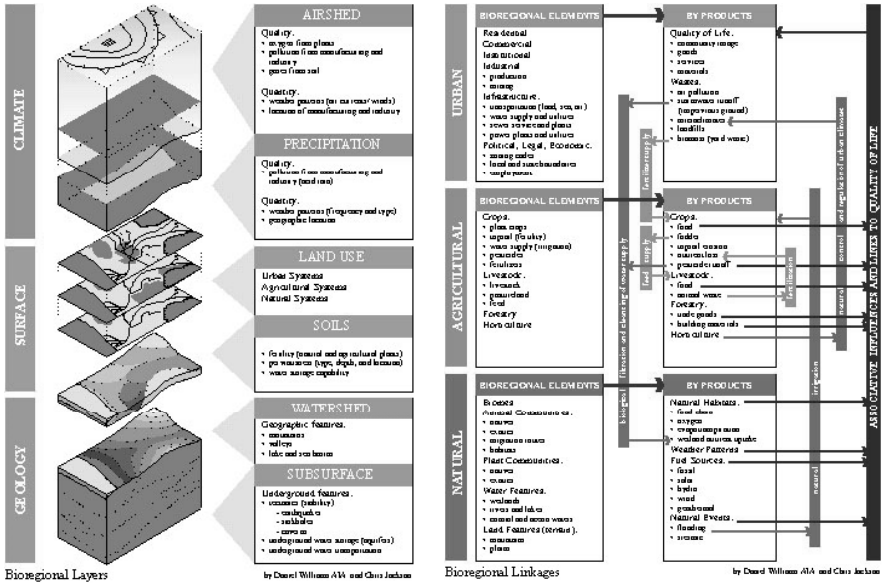


…the ecological model

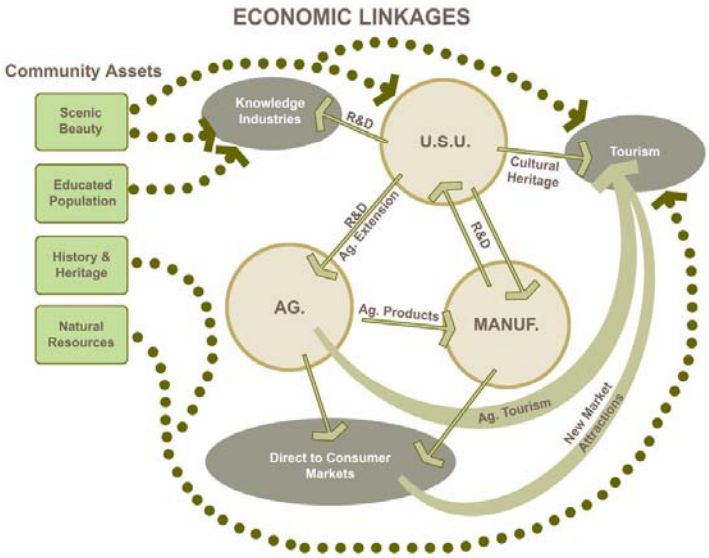


designing sustainable urbanism and regionalism starts with the **analysis of the regional renewable energies and resources** then changes the urban and regional patterns to incorporate them.

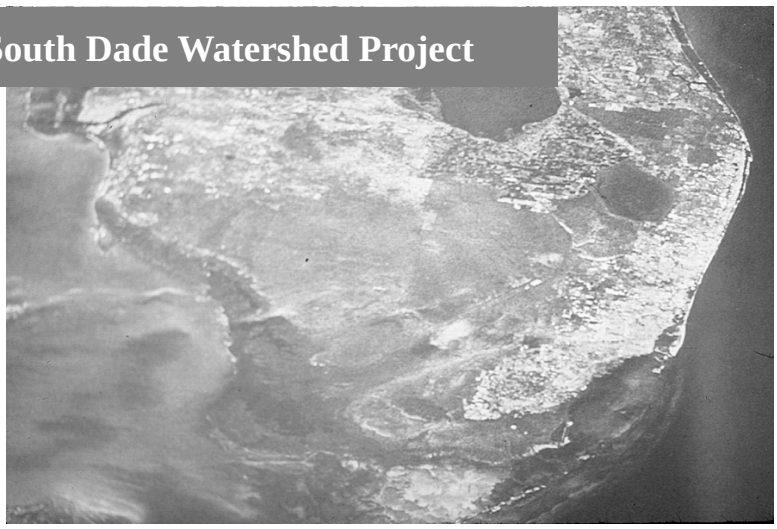




reconnect the linkages – water, waste, food, jobs……

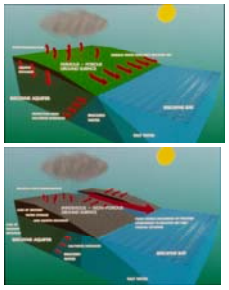


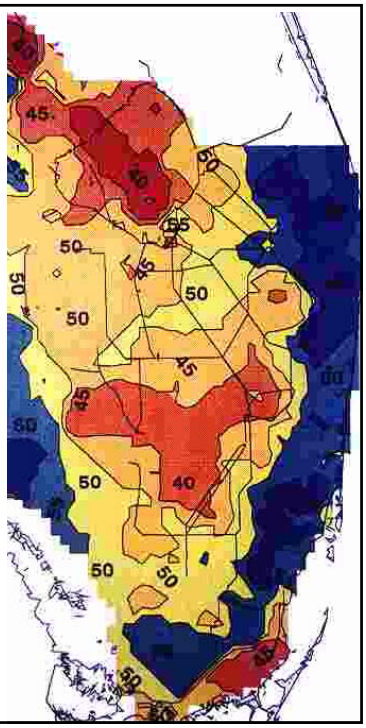
The South Dade Watershed Project



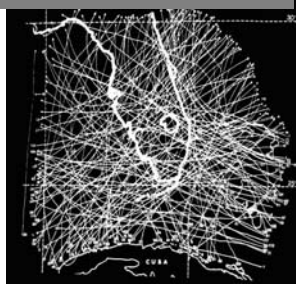
Rainfall and consequently recharge is spatially located.

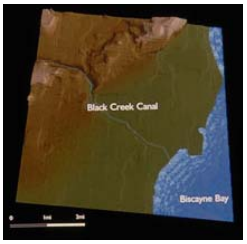
If the surface areas with the greatest rainfall are made impervious (urban), the recharge must come from outside the area of its use. what is the carrying capacity?

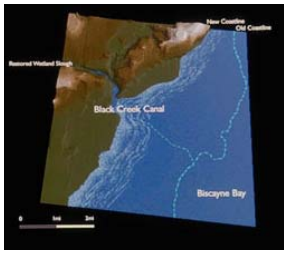


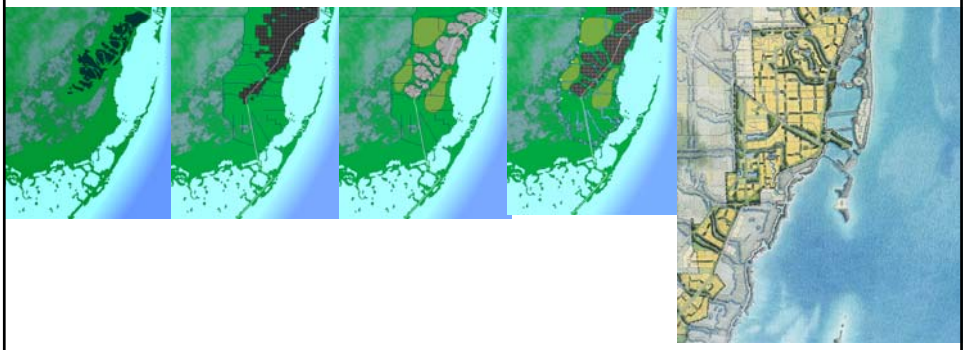


hurricanes / water / climate change / sprawl



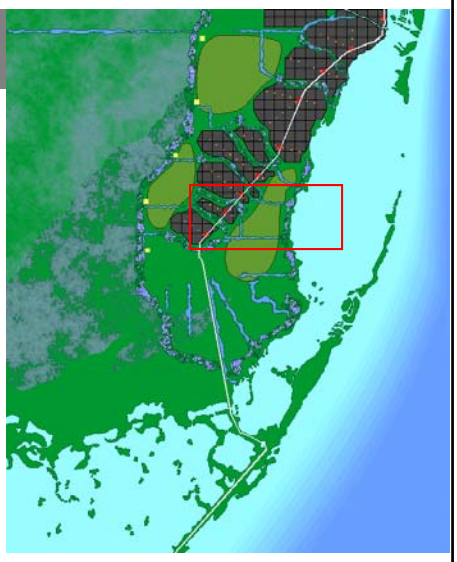






regional infrastructure ……...design factors

- establish water supply and land use criteria - “carrying capacity”
- develop transit and water storage as a development strategy
- create regional water recharge areas
- protect / preserve agriculture
- preserve / protect / re-establish ecological system integrity



create / connect to a regional vision

establish water supply and land use criteria - carrying capacity

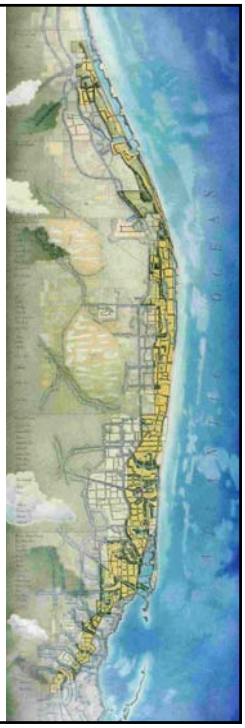
protect / preserve agriculture - develop transit

additional 700,000 by 2025

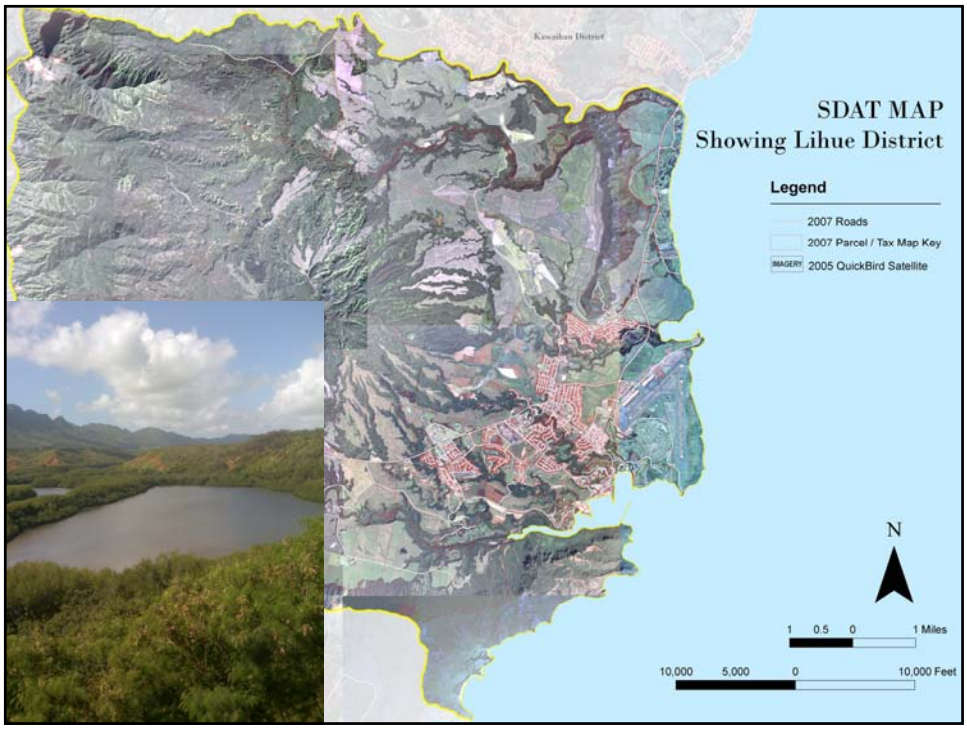
preserve / protect / re-establish ecological system integrity

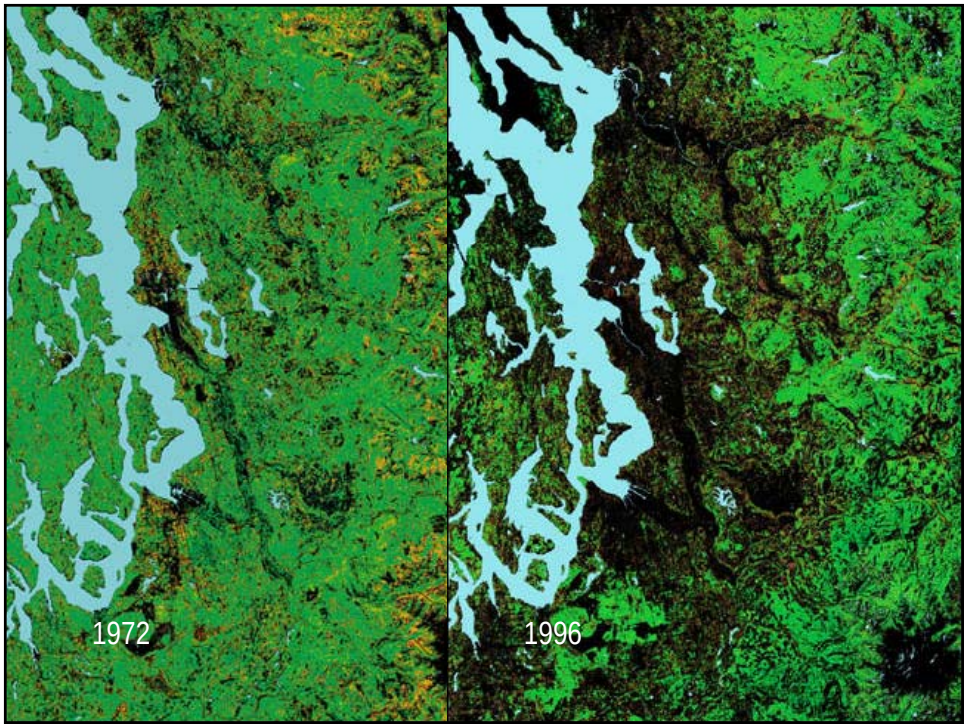
The economic, environmental and social choice is clear - The Eastward Ho: Alternative Development Vision SAVES

→ 67,725 acres of developable land
→ 13,887 acres of fragile environmental lands
→ 52,856 acres of prime farmland
→ $62,000,000 in state road costs
→ 108 lane miles of state roads
→ $1,540,000 billion in local road costs
→ 4,221 lane-miles of local roads
→ $157,000,000 in water capital costs
→ $135,600,000 in sewer capital costs
→ an average of $ 24,250,000 per year in public sector service costs



Study, understand and apply the historic processes, patterns and knowledge to patterns for the future.





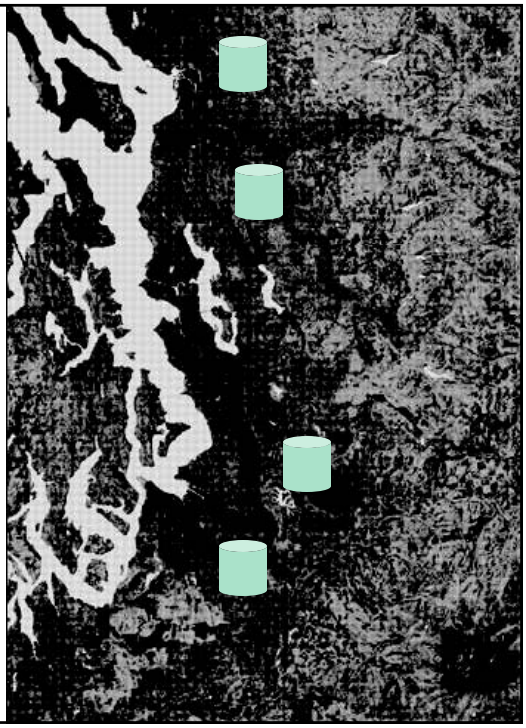
infrastructure for people and salmon

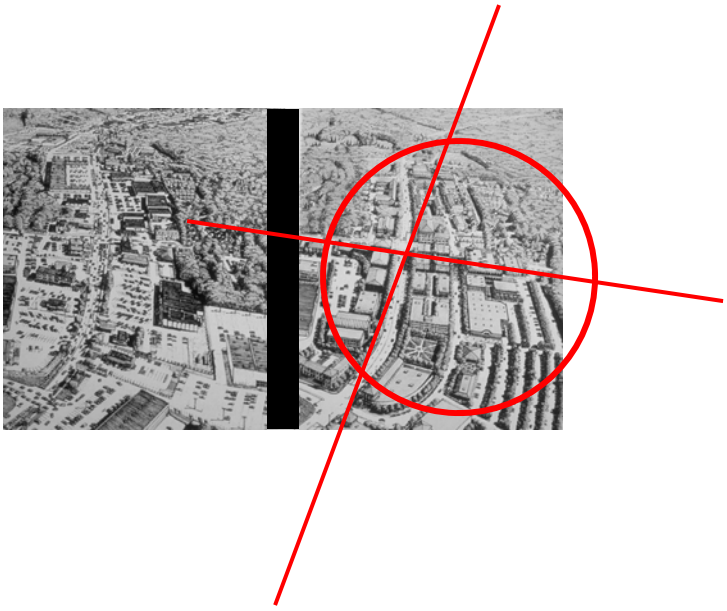
….with the given precipitation, what volume and what locations should water be stored under:

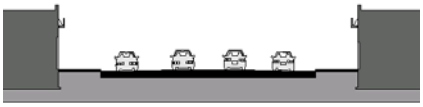
1) present conditions

2) drought

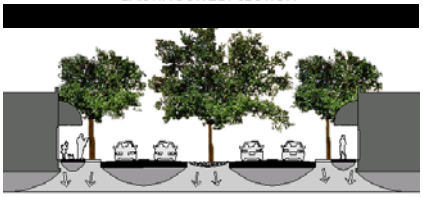
3) flood



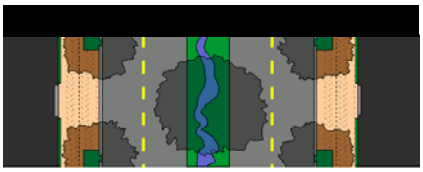




EXISTING STREET SECTION



PROPOSED STREET SECTION



PLAN VIEW

flooding and recharge = property value + amenities

local and regional next steps...

- **design and plan our region as a blue/green infrastructure**… a proactive response to climate-change challenges, assuring smart growth, sustainable and livable communities.
- **help lead** - the creation of post-disaster plans for regions and communities “in harms way” - turn adversity into opportunity
- **help lead** - the re-connection with biological climatic systems - **biourbanism** - in design and planning work…localize
- **help lead** - educate public officials on systems solutions and advocate comprehensive master plans and incorporate these plans into their political platforms.

GREEN INFRASTRUCTURE FOR CLIMATE BENEFIT

Green Futures Research and Design Lab

March 3, 2010

Nancy D. Rottle, ASLA, Associate Professor
Director, Green Futures Lab
Department of Landscape Architecture
University of Washington
Seattle, Washington

What is Urban Green Infrastructure?

- Green Spaces: "the entirety of urban green spaces" that "performs a multitude of vital environmental services in cities." (*Girling and Kellett 2005*)
- Sustainable infrastructure: "high performance infrastructure" *(New York City 2005)* - Utilities that use natural forms and processes such as detaining and filtering stormwater in vegetated swales and reducing impervious surfaces to increase infiltration
- Green Infrastructure "…considered to comprise of all natural, semi-natural and artificial networks of multi-functional ecological systems within, around and between urban areas, at all spatial scales" *(Tzoulas et al., 2007).*

Community and Open Space

Low-Impact Mobility

Habitat

Water

Five Waters:

- source
- stormwater
- graywater
- black water
- aquatic environments

Energy, Food & Climate (Metabolism)

5 Overlapping Green Infrastructure Systems:

community & open space

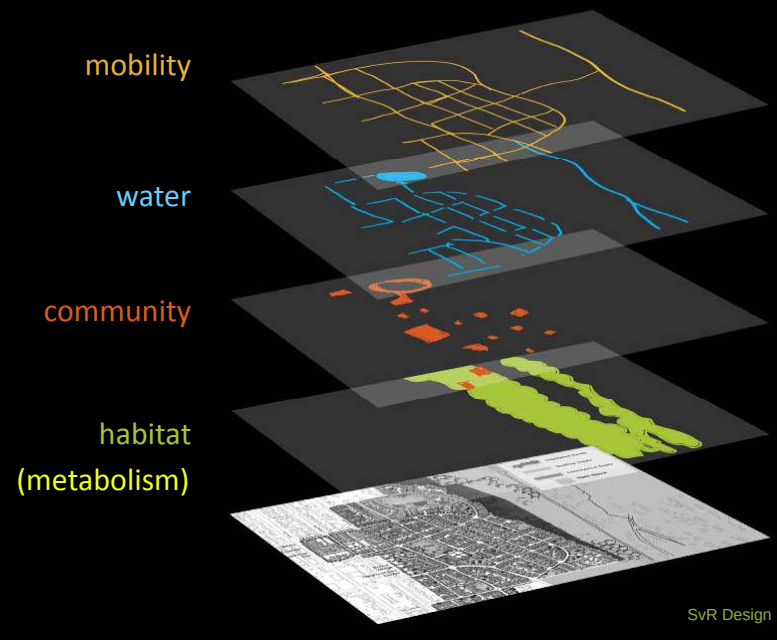
habitat

water

mobility (active transport)

energy & materials (metabolism)

Green Infrastructure System Layers



SvR Design

Overlapping layers of Urban Green Infrastructure address multiple values simultaneously.

community & open space • habitat • water • mobility • metabolism

High Point Housing Development

SvR Design

Where traditional infrastructure addresses a single system with a singular function, green infrastructure typically provides ecological services that serve multiple functions.

Green Futures Research & Design Lab
UW College of Architecture & Urban Planning

The UW Green Futures Lab (GFL) develops innovative approaches to the **ecological planning** and **design of public space** through interdisciplinary research, design and education. Faculty and students advance solutions related to **urban green infrastructure** – streets, trails, parks, open spaces, drainages and shorelines – **systems that together comprise interconnected networks of the public realm**. Such multi-functional networks support successful dense urban settlement, providing facilities that may help to **protect climate, preserve biodiversity, foster equitable health and improve quality of life**. The GFL works with communities to envision their sustainable futures, exploring solutions that incorporate **low-impact development strategies, community space, habitat restoration, low-carbon energy** and **pedestrian** and **bicycle mobility**.

GOALS

- To explore questions of **policy development** and **potential solutions** for urban green infrastructure,
- To test the environmental and civic effects of **innovative approaches**, and
- To disseminate innovations that foster vibrant, livable cities and regenerate **ecologically-healthy** metropolitan regions.

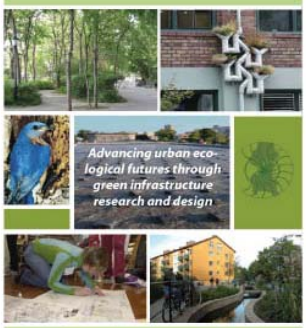
STRATEGIES

- Research consolidates existing knowledge and tests best management practices for green urban infrastructure.
- Active design engagement with local communities informs research and advances innovative design practices.
- Research and design activities of the lab create interdisciplinary connections between scholars, institutions, and Pacific Northwest communities.
- Publications, public lectures and an "information commons" provide public education for academic and citizen communities.

Green Futures Research and Design Lab at UW

Innovative approaches to the ecological planning and design of public space, focusing on urban green infrastructure.

Green Futures
Research & Design
Lab



Landscape Architecture Department
College of Architecture & Urban Planning
University of Washington

Green Futures Lab

Addresses Research, Planning, Design and Public Process for Green Infrastructure

Project Examples:

community & open space

Open Space Seattle 2100 – Documentation and Dissemination
Open Space Financing and Housing Affordability – white paper
Lake Forest Park Green Legacy Process

water

Green Streets Design Studies
Waterfront Stormwater Solutions

mobility (active transport)

Downtown Seattle Pedestrian Use Study; Consultant to Gehl Architects
Data Collection for Seattle Pedestrian Master Plan

habitat

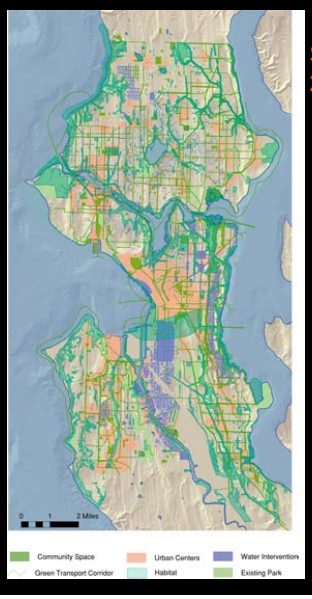
King County - Seattle Biodiversity Action Plan (in conversation)

energy & materials (metabolism)

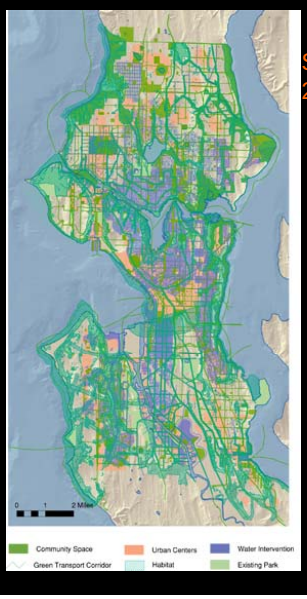
GIS Study on Seattle Community Gardens
Seattle Green Roof Studies

Open Space Seattle 2100

Visions for Seattle's Green Infrastructure



Seattle 2025



Seattle 2100

Open Space Seattle 2100- Resources

- Full report from the Green Futures Charrette:

Envisioning Seattle's Green Future

- Executive Summary and CD
- Green Futures Toolkit
- All on Website:

www.open2100.org

What are our Climate Change Challenges?

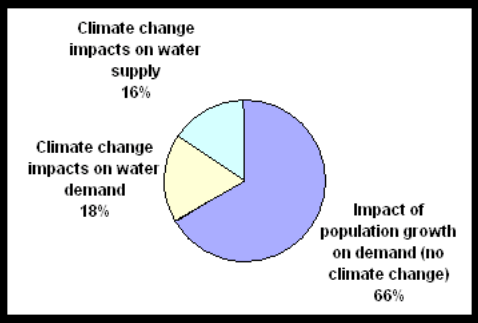
PNW Predicted Climate Change Impacts*

- 2 - 4 degrees (F) warmer by 2050
  - hotter summers with “heat island”
  - more soil evaporation
  - one-third less snowpack for water supply
  - higher water demand
  - problematic water temperatures for salmon
  - Stress on urban forests, species adapted to native forests
  - Reduced biodiversity
- Stronger winter storms
  - flooding, stream erosion
- Rising sea levels
  - over 4’ by 2100, highest impact scenario

* (UW Climate Impacts Group 2005)

Water Supply

- Water supply Impacts 2040 for Bull Run Watershed, Portland (per Climate Impacts Group)



How do we simultaneously mitigate and prepare for adaptation to climate change?

Protecting climate through green infrastructure

- **Community Space:** Supports livable compact urban form
  - **compactnes**s of settlement, for support of public transit
  - enables people to drive less, reduce carbon emissions
  - access to **amenities**, open space and contact with natural world
- **Low-Impact Mobility** - Pedestrian environments and Cycling networks:
  - reduced carbon emissions
- **Urban Greening:**
  - Urban forests and organics in soil sequester carbon
  - Urban greening (forests, building roofs and walls) cool overall temperatures and shade buildings (reduced energy consumption)
- **Water Conservation and Natural Drainage:**
  - Can reduce energy usage to pump water
- **Metabolism:**
  - Local food production and consumption, reducing fossil fuels in transportation and food production
  - Low-impact energy generation (micro hydro, geothermal, heat from burning urban forest waste)

Adapting/Minimizing impacts of climate change: Building Resilience

- **Community Space:**
  - Urban Livability; Post Peak-Oil Social Resilience
- **Low-Impact Mobility:**
  - Movement redundancy, reduced air pollution, health
- **Urban Greening:**
  - Mitigate heat island effects, for human well-being and survival of cool-temperature species (e.g. salmon): forests, streets, parks, roofs, walls, shorelines
  - Connected, diverse vegetative habitat for species resilience to habitat changes, exotics and pests
- **Water:**
  - Stormwater infiltration and retention features to cope with increased precipitation and storm intensity, reduce pollution stresses to aquatic environments
  - Water harvest and re-use to assure adequate water supply for domestic, industrial and agricultural needs
  - More robust aquatic habitats, resistant to stresses and change
  - Use sea level rise to improve aquatic habitat
- **Metabolism (Energy and Materials)**
  - Additional energy supply / redundancy to cope with increased demand (esp. summer when hydro flows are low)
  - Local food source resiliency

Green Infrastructure: Simultaneously Mitigating and Adapting to Climate Change

	Mitigate	Adapt
Community Space		
Urban Amenities support Compact Form	x	x
Urban Green Space " "	x	x
Low-Impact Mobility		
Pedestrian Environments (supported by transit)	x	x
Bicycling for All	x	x
Water		
Water Supply: Harvest and Re-use	[x]	x
Stormwater Treatment - Natural Drainage	x	x
Coastal and Riparian Environments	x	x
Habitat		
Urban Forests, Connected habitats	x	x
Riparian Restoration	x	x
Energy and Materials (Metabolism)		
Community Gardens	x	x
Small-scale Energy	x	x
Recycled Materials	x	

Documented Green Infrastructure Benefits

- Univ. of Manchester study (Gill *et al 2006*):
  - Adding 10% tree cover in urban areas could maintain surface temps at or below 1990 levels, versus potential 1.7C rise by 2080, or 5+C rise with 10% green loss (low emissions scenario in town centers)
  - Greening all roofs maintain temperatures below 1990 for all scenarios and land cover types, 7.6 C less than if roof are not greened in town centers (high emissions scenario)
  - Increasing tree cover and adding green roofs would reduce projected higher stormwater runoff

Protecting Climate

Compact Urban Form

Density

+

Amenity

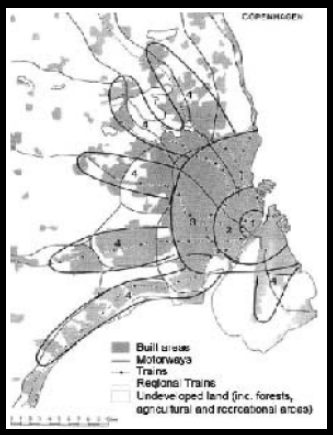
=

Sustainability

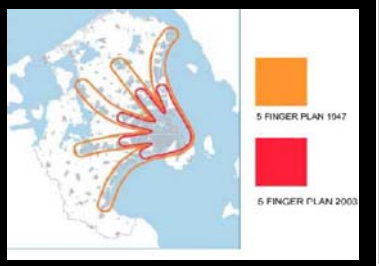
Protecting Climate

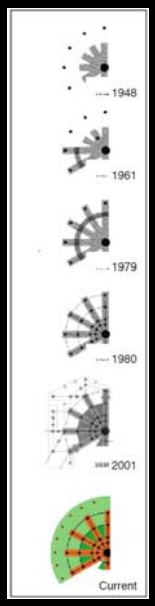
Community Space: Access to Public Space and Nature

Copenhagen



"The public should have easy access to infrastructural facilities such as commuter train lines and motorways, as well as they should be able to enjoy and live close to nature."
-Copenhagen Capacity





Protecting Climate

Community Space: Access to Urban Amenities

Copenhagen

Portland

Protecting Climate

Low Impact Mobility

Copenhagen

Seattle?

Protecting Climate

Urban Forests and Soil Sequester Carbon

- One 12” tree = 17 lbs/yr = 63 miles (passenger car)

  5000 miles/yr = (79) 12” trees

- One 30” tree = 92 lbs = 337 miles (passenger car)

  5000 miles/yr = (15) 30” trees

Protecting Climate

Urban Greening - Forests, Roofs, Walls

Musée du Quai Branly, Paris

Protecting Climate

Lowering Energy Consumption through Urban Greening

OR

Protecting Climate

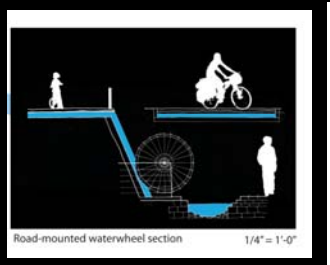
Local Food Production and Access

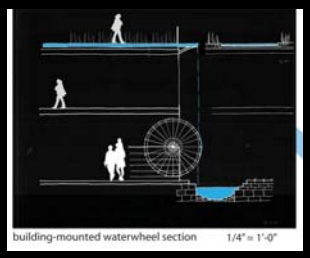
High Point Market Gardeners

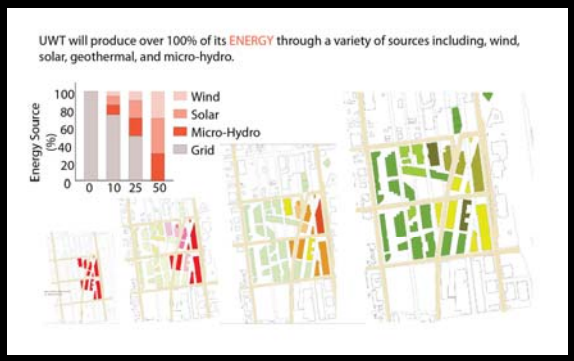
Seattle P-Patch

Protecting Climate

Local Energy Generation







Minimizing Impacts, Building Resilience

Urban Greening

Minimizing Impacts, Building Resilience

Resilient, Connected Urban Forests

Minimizing Impacts, Building Resilience

Water Harvest and Re-use

Minimizing Impacts, Building Resilience

Natural Drainage approaches – cleaning and detaining at the source

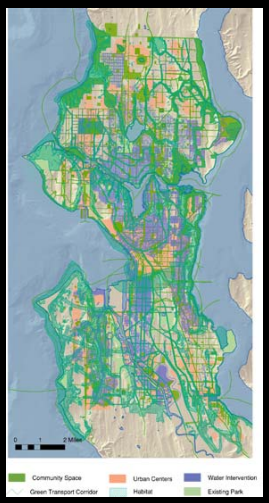
OR

How do we get there?

Visioning is a first step – Then follow with municipal investment

…Creative thinking about the future requires tension –the tension of holding both the real and the possible in our awareness at the same time.
- Milenko Matanovic, Pomegranate Center

Seattle 2025



Seattle 2100

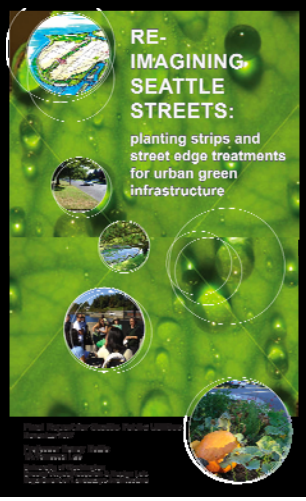
How do we get there?
Vision + Municipal investment

Lake Forest Park - 100 year Green Legacy Plan

How do we get there?
Small Interventions, spread widely.

Green Street Studio Explorations for Seattle Public Utilities

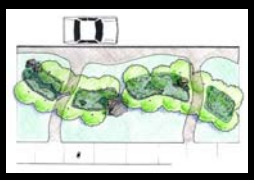
Parking Strip Designs



How do we get there?

Small Interventions, spread widely.

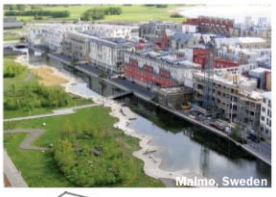
Street Edges and
Parking Strips as Green
Infrastructure

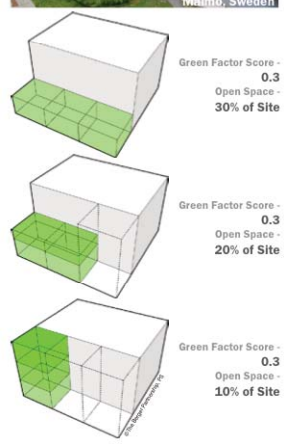


Justin Martin

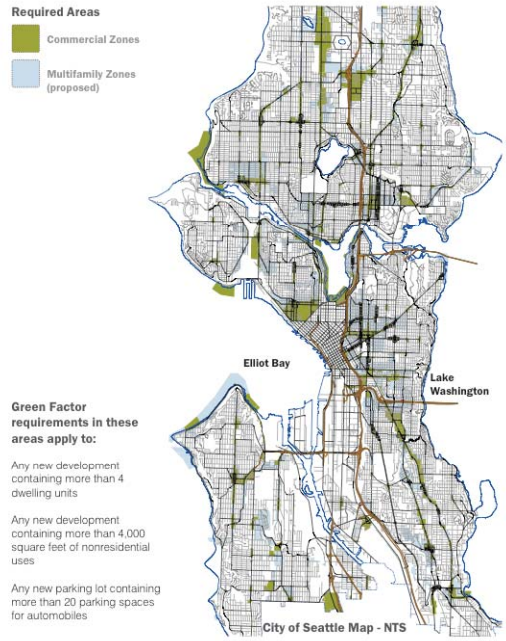
Eric Berg and Justin Martin

How do we get there?
New approaches to building codes and municipal practices.





Conceptual Green Factor Square Footage Diagram



Green Factor requirements in these areas apply to:

Any new development containing more than 4 dwelling units

Any new development containing more than 4,000 square feet of nonresidential uses

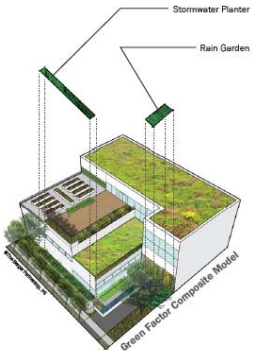
Any new parking lot containing more than 20 parking spaces for automobiles

The Berger Partnership

Element: Bioretention Facilities

The Berger Partnership PS Landscape Architecture 5

Bioretention facilities are the third category of landscaped areas defined by Green Factor. Their initial factor of 1.0 is the highest of any category and can be combined with planting factors and bonuses, for combined factors of over 1.8. These high factors reflect the functional benefits of stormwater cleansing and volume reduction, habitat creation, aesthetic improvement, and education opportunities that come with the construction of well designed bioretention areas.



Rain Gardens and Swales

Rain gardens and bioswales are typically vegetated depressions located on grade. Their main functional value is the retention and infiltration of stormwater. Acting as a filter for runoff from permeable surfaces, they reduce pollutants which enter storm systems. Often simple in design and construction, they create a high level of function for a low cost. Larger space on grade, with properly draining soils are required for the construction of these features. When calculating Green Factor values, only calculate the surface area of the rain garden.

Graphic Legend
- Impervious Surface
- Infiltration Zone
- Amended Soil
- Existing Subgrade
- Optional Gravel
- Overflow Drain
- Overflow Drain Inlet

A3

Element- Bioswale or Rain Garden

Functional Benefits

Increased infiltration
Reduced runoff
Improved runoff quality
Pollution reduction
Public education

Environmental Considerations

Factor - 1.0

Stormwater Planters

Stormwater planters are containers designed to capture and either retain or infiltrate stormwater based on their design. The amount and frequency of water captured depends on storm events, so they should be populated with a variety of plants adapted to both wet and dry conditions. Visually they can be striking landscape features providing a high functional value. While more expensive than bioswales, stormwater planters provide many benefits and are appropriate for areas with space constraints or on structure.

Graphic Legend
- Rainwater Source
- Splash Block
- Amended Soil
- Filter Fabric
- Gravel
- Perf. pipe along planter bottom
- Overflow Drain
- Plantings
- Pipe to stormwater system
- Planter wall w/ waterproofing
- Pedestrian area

A3

Element- Stormwater Planter

Functional Benefits

Reduced runoff
Improved runoff quality

Environmental Considerations

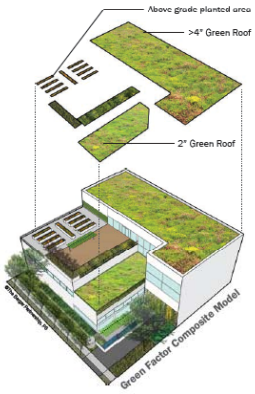
Embodied energy and carbon in concrete

Factor - 1.0

Element: Green Roofs

The Berger Partnership PS Landscape Architecture 8

Green Roofs offer a dramatic functional improvement over conventional roofs. They provide habitat for insects and birds, improve stormwater quality while reducing runoff quantity, and they reduce the heat island effect. Their use in building design can count toward LEED® certification, reduce heating and cooling costs, and almost double the lifespan of the roof. They are becoming more common and can be useful in educating the public about the benefits of green building practices.



2" to 4" of growth medium

Thin profile green roofs have the advantage of reduced structural load on a building, while offering many of the benefits of a thicker profile roof. Even thin profile roofs can capture and retain 60% of the precipitation that falls on them.
Green Factor defines green roofs as any planting which is on top of a structure at least one floor above the level of the at grade entrance. Green roofs with less than a 2" soil profile will be categorized as landscaping areas with less than 24" of soil.

Graphic Legend
- Sedum Mat
- >2" Growth Medium
- Filter Fabric
- Drainage Layer
- Waterproofing Layer
- Roof

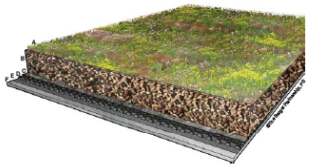
C1

Element - 2-4" Green Roof
Functional Benefits
Reduction of runoff
Reduction of heat island
Habitat creation
Improved insulation

Environmental Considerations
Petroleum products
Requires irrigation

Note - Green Roof can extend roof lifespan to 50-100 Years
Factor - 0.4

1.0 / 0.4 GF



Over 4" of growth medium

Green roofs with a thicker soil profile can support a wider range of plants than a roof with a 2" profile. The increased plant diversity can create a wider range of possible habitats for native insects and birds. Heating and cooling benefits are increased due to increased insulation, and the stormwater are improved. While a wide variety of roof systems are available, proper design, installation and maintenance are crucial to a successful project.

Graphic Legend
- Plant Material
- >4" Growth Medium
- Filter Fabric
- Drainage Layer
- Waterproofing Layer
- Roof

C2

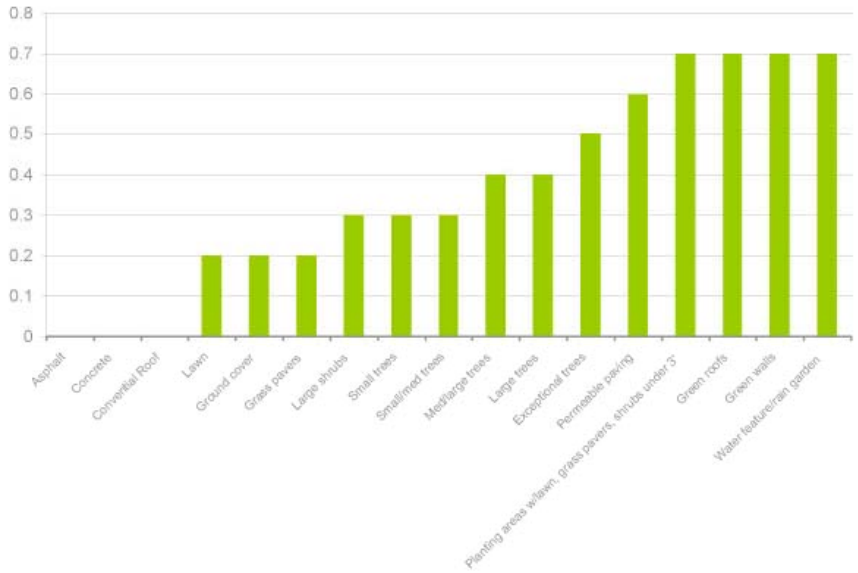
Element - >4" Green Roof
Functional Benefits
Further runoff reduction
Reduction of heat island
More diverse habitat
Improved insulation

Environmental Considerations
Petroleum products
Requires irrigation

Note - Green Roof can extend roof lifespan to 50-100 Years
Factor - 0.7

1.0 / 0.4 GF

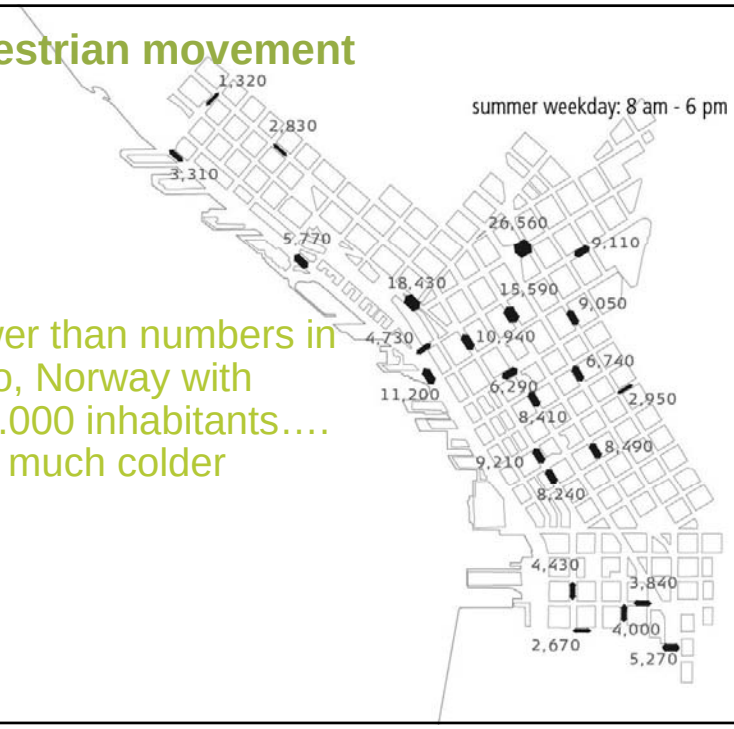
SEATTLE/*green factor*



How do we get there?
Prioritize Transit, and Pedestrian and Bicycle Environments

Research on Seattle's Pedestrian Environment with Gehl Architects, Copenhagen

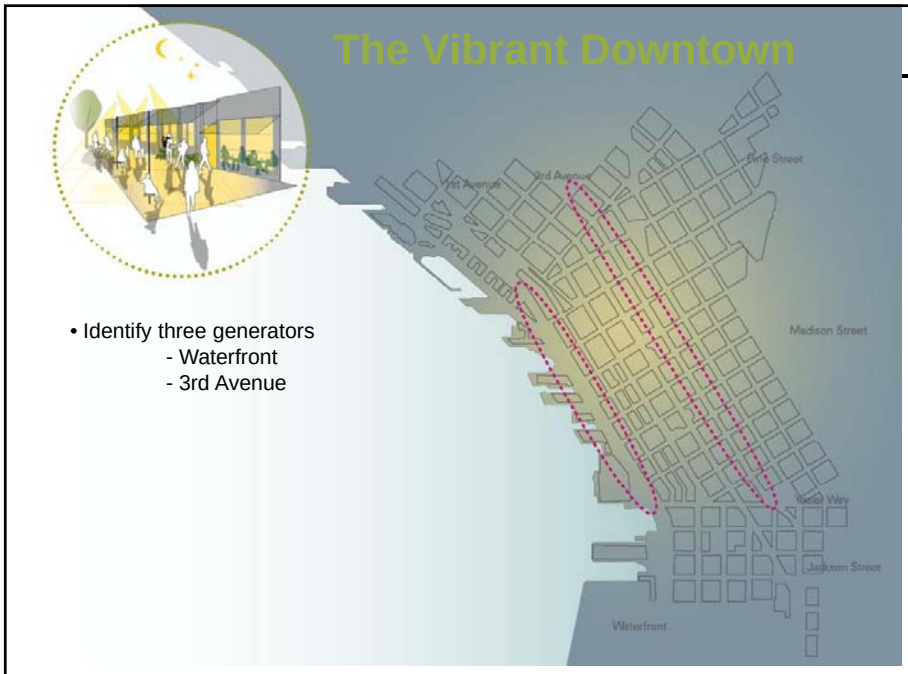
Pedestrian movement



Lower than numbers in Oslo, Norway with 850.000 inhabitants…. and much colder

The Sustainable Downtown

- Upgrade waterfront - waterfront city
- East-west streets as green connectors
- "Alleys as green lungs"



How do we get there?
Incorporate a Multiple Value Approach

e.g. projects that simultaneously achieve:

Urban Livability
Complete Streets
Biodiversity
Water Quality
Energy Conservation

Green Infrastructure Asset Management Pilot Process:

Coordinate capital improvement projects (CIP) around green infrastructure, using triple bottom line metrics

social
environmental
economic

Integrate Asset Management Team for Green Infrastructure ▶ Identify CIP Projects for Inter-disciplinary/ Green Infrastructure Approach ▶ Implement demonstration projects - 5% of CIP budget per year

How do we get there? Prototype Design and Research

Waterfront Stormwater Solutions for Puget Sound

Waitaingi Park, Wellington, NZ

New Zealand Example: City stormwater is filtered and re-used for irrigation in a new park on Wellington's urban waterfront.

Documented reduction in heavy metals, nitrogen, and suspended solids below water quality guideline levels. (Wellington City Council 2007)

How will your city use its green infrastructure for climate benefit and adaptation?

Nancy Rottle
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