Session 3.3

Wall-E: Promoting innovation, new technologies and future visions on the role of urban forests and trees to address climate change.

Moderator: Stephen Livesley
Beyond Education and Engagement

How the Oak Bay Coolkit program empowers climate champions in greening private and public land

Presented by

Stephen R.J. Sheppard (PhD), CALP, UBC, Canada
Chris Hyde-Lay, District of Oak Bay, Canada
Elisa Kwun, CALP, UBC, Canada
Sara Barron (PhD), Urban Forestry Program, UBC, Canada
How do we scale-up community action on Urban Forestry & the Climate Emergency?
- collective action at hyper-local scales
- ‘cool tools’ & positive engagement processes

Why the urban forestry angle?
- urban forests as an easy entry point
- meeting canopy targets on private land
- resilience - cooling communities etc.
1. Introduce Oak Bay

2. The Oak Bay Coolkit and mobilization program

3. Results so far: champions, Climate Action Plans & trees on the ground

4. Scaling-up and replicability
District of Oak Bay
Vancouver Island, British Columbia, Canada

- Population: 18,000
- Primarily residential
- Canopy cover: 33%, target 40% by 2045
- Rare ecosystems & strong volunteer programs on ecological restoration
- Significant vulnerabilities in low-canopy neighbourhoods to heat, drought, wind, flooding/sea level rise etc.
- Leading policies: zoning canopy targets, electrical gardening equipment, engagement

LIKE MANY NORTH AMERICAN SUBURBS
2 Oak Bay Coolkit program

Goals:

- Empowering local climate champions
- Mobilizing neighbourhood action to climate-proof the community (adaptation & mitigation)
- Making climate action & stewardship visible on private & public land

Council support/funding for 3 year program
Oak Bay Coolkit

Fun ‘Do-It-Yourself’ visual learning tool
- engaging citizens on climate change & urban forestry on their block
- applying 7 years of Coolkit research
- ‘one-stop-shop’ resource, customized to Oak Bay

5-step process
“The most inspiring activity was going outside and measuring trees. We got to know about our community” (Coolkit workshop participant in Vancouver)
Visioning solutions

- Tree planting
- Active transportation
- Heat pumps
- Home energy retrofits
- Rain-gardens
- De-paving ‘car habitat’
- Rewilding parklets, etc.

“wonderful example of activity at extremely local level....empowering... really tangible...“
Teacher, Vancouver School Board
Climate Action Plans group brainstorming

Discuss/pick 3 key actions as priorities for your neighbourhood or group
3 Coolkit Program Results
Years 1-2

Geographic spread

- 10 neighbourhood groups + individual projects
- reaching 10-12% of Oak Bay blocks

Broad representation

- network of 40+ trained Coolkit champions
- including ‘The Choir’ & neighbours, family members etc.

Creatively engaging others & building capacity

- Block parties
- ‘Ice Cream Socials’
- Block Watch meeting
- Strata council meetings
- ‘InTreeging’ proposal
- Walkability audits…..
- Emergency Response volunteers
- Community-led Facebook site
- Official celebration event with Champion Awards
Harling Point neighbourhood
Climate Action Planning
Overview of Climate Action Plans

- 10+ climate action plans / project designs:
  - physical and behavioural solutions
  - Adaptation and Mitigation - tree-planting, meadow-scapes, traffic calming, white roofs, local food etc.
  - aligned with Oak Bay Council’s “Big Moves”

- Some CAPs require joint resident/District action on public & private land:
  - street bump-outs, de-paving parking lot, landscape/tree stewardship etc.

- Collaborative outcomes to date:
  - 60 Coolkit trees planted on private & public land
  - strata council plan for cool roofs
  - Oak Bay tree-list for citizens
  - monthly Coolkit meetings/presentations
  - to make climate projects visible neighbourhood signage
4 Scaling-up and replicability for community climate & urban forest action

- Scaling-up neighbourhood action is doable & crucial to meeting targets (eg. private trees)

- Tips for organizers:
  - Tools & processes applicable across N. America & beyond, but customize to your community
  - Make it visual, fun, simple, positive!
  - Trees & pollinators a good entry-point but will need broader/deeper actions (aligned with municipal policies)

- Needs:
  - Train-the-trainer programs for practitioners & community organizers (eg. micro-certificates)
  - Sustained, funded, collaborative programs with designated backbone organization (eg. municipality, contracted NGO, community trust)
Thank you!

- Stephen R.J. Sheppard, CALP, UBC
- Chris Hyde-Lay, District of Oak Bay
- Elisa Kwun, CALP, UBC, Canada
- Sara Barron, Urban Forestry Program, UBC

Collaborative for Advanced Landscape Planning
https://calp.forestry.ubc.ca/

https://connect.oakbay.ca/coolkit
No easy shortcuts to a ‘green future’: lessons from imagining 2050s desired urban futures in six cities

Presented by
Dr. Mariana Dias Baptista
Co-authors: Olivia Bina, Andy Inch, Mafalda Pereira, Roberto Falanga
Principal Investigator: Tom Wild
Agenda

Overview
Nature Futures Workshops
Methodology
Results & Discussions
Next Steps
Overview

• **Conexus – H2020 EU Project**
• Latin American and European partners
• **Aim:** to strengthen international cooperation on nature-based solutions (NBS) and ecosystem restoration.
• **Urban Life-Labs*** in 7 cities.

*collaboration and partnerships with local communities of learning to support the development of NBS pilot projects.
Nature-based Solutions

• The United Nation Environmental Assembly (UNEA-5) resolution formally adopted the definition of NbS as ‘actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits.’
Nature Futures Workshops
Desired Futures

• ‘Cities are creating futures without challenging the deep inequities’ (Inayatullah 2011, p. 656), partly linked to persistent imaginaries of cities as machines.

• A gap in terms of **positive future visions** that are needed in many cities (McPhearson et al. 2016; more generally, see: Bai et al. 2016), and more specifically in exploring urban related imaginaries and pathways that foreground nature and plural perspectives of urban HNRs (Elmqvist et al. 2013; Mansur et al. 2022).

• There are calls for **alternative visions beyond** ‘merely purchasing the used futures of other cities’ (Inayatullah 2011, p.654), enabled through a (re)discovery of desire and utopian imaginaries (Bina et al. 2020; Pötz 2019).

Bina, O., Baptista, M.D., Pereira, M. M, et al. (Under review) Exploring desired urban futures: the transformative potential of a nature-based approach. Futures
Objectives

The Workshops were an opportunity to think about a nature-based future in the cities of Conexus, through a more creative way.

Explore wishes, hopes and possibilities around the idea of nature-based futures for cities in the year 2050.

Engage a variety of perspectives and plurality of voices in discovering desired futures for nature (and life) in cities;
Why 2050?

Because the scale and scope of the transformation we are considering is the kind of long-term change that requires a generation, as it includes social values and attitudes.
Who?

NbS-Community:

• A variety of leaders, experts and agents of change involved directly and indirectly in the future of nature (and life).
• Local government, academics, NGOs, and activists.
Expected to co-create:

- Elements of a desired future for nature (and life) in cities in 2050
- Elements of pathways to get there, which will include NbS.
METHODOLOGY

The Three Horizons
Three Horizons approach (Sharpe et al., 2016): understanding the current world and creating representations of desired future states.

**Horizon 1 - The Present Futures:**
- Where participants discuss the current trends that determine the "business as usual" of our cities;

**Horizon 3 - The Futures We Want:**
- where participants set out their visions;

**Horizon 2 - Possible Ways Forward:**
- actions and interventions capable of operating transformation paths from H1 to H3.

Source: https://leadersquest.org/three-horizons-introduction/
More info: https://youtu.be/p90ZTg0svmM
Pre-workshop Survey

• Three basic questions which will prepare participants for the Horizon 1.
  • **Question 1**: Share 3 key problematic/concerning trends for the area of your city.
  • **Question 2**: Share 3 drivers of change that you think are the most relevant for exploring the present and future of your city.
  • **Question 3**: Share 3 seeds of change that you think are the most promising for shaping the future of your city.

• Initial creative exercise for the Horizon 3: Postcards from the future

Results & Discussion
"Today I notice that we have a greener and more colourful environment thanks to the tree planting and the permanent flowering of plants." Bogota

"The result of this change of trajectory in my opinion were the new social and environmental collectives that grew throughout the city, the change from public policy and planning and the spaces of co-creation and construction that were given to have citizen participation in decision making." Bogota

"There are no more cars in the city centre and the public transports are super-efficient with a very affordable fare. It is also possible to get around on the numerous bike paths, some passing through the green corridors of the city, which simultaneously allow the inhabitants to spend more quality time in natural spaces." Lisbon

"We have developed a more local and organic food production chain, with agroforestry spaces scattered around the city, producing healthy, poison-free food in backyards and public gardens." Sao Paulo

"People are also more involved in local decision-making, with opportunities to really shape how public services work. The time for all of this has been made possible by the introduction of a universal basic income (UBI)." Lisbon

“(...) in this projection, in which there is a less predatory relationship [with nature], with respect to the environment we inhabit, this is also transferred to the bonds and relationships established among us. (...) it seems to me, the notion of care, and indeed, we realize that what surrounds us perishes, if we do not sustain a concrete care.” Buenos Aires

awareness-raising and education to [consumption] renunciation, understood as degrowth (...) no longer seen as negative” raising “the awareness that the race for progress is no longer sustainable”. Turin
### What needs changing
(Pathways to the future)

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<tr>
<td>- Renaturation of rivers</td>
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<td>- Giving rights to nature</td>
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<td>- Offer more inclusive forms of environmental education and awareness raising</td>
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<td>- Changing people’s habits and ways of living to overcome the climate and biodiversity crisis</td>
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<td>- Implement radical and potentially transformative public policy initiatives (e.g., universal basic income, participatory budget)</td>
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<td>- Training for city planners and technical staff</td>
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<td>- Strategic distribution of vegetation in the city, based on diagnosis, planning and incentives</td>
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<tr>
<td>- Promoting urban food initiatives and local production</td>
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<td>- Diverse and inclusive decision-making participation</td>
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<td>- Creating local decision-making instances</td>
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<tr>
<td>- Political and economic incentives (public and private) for community-led environmental initiatives</td>
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</table>

### Governance, Policy & Planning

- Public green spaces

### Education, Awareness & Cultural Change

- Alternative models

### Collaboration, Community & Agency

- Urban Food system
Discussions

• We cannot create greener futures without considering the broader contexts in which we imagine they will function.

• Exercising our collective imagination about desired futures allows us to step back, shape alternatives to the present, and identify detailed pathways towards them.

• Imagining and reimage positive visions of fairer and more just requires some optimism (Sardar 2013).

• Limited opportunities to step back from dealing with immediate or urgent problems

• Exercising our capacity to co-imagine desired futures can help us strengthen our NBS communities and broader ‘nature-based thinking’ within it.

Next steps
Official futures

Desired futures

-Visions
-Scales of change
-Actors
-Action
-Challenges and threats

•What are the differences and similarities?

•Are the actions we could imagine enough to bridge the gaps between the world we feel we are heading towards and where we would really like to be?
References


Thank you

Mariana Dias Baptista | The University of Sheffield
Research Associate

marianadbaptista@gmail.com

My LinkedIn profile
2nd World Forum on Urban Forests
2023
Presented by
Chloe Treger
Co-lead TreesAI Pilots
Dark Matter Labs

Trees as Infrastructure
Driving investment in urban NbS - interim learnings from our case study in Glasgow, UK
- CONTEXT

TREESAI APPROACH

LEARNINGS

NEXT STEPS
Organisations are facing climate-related risks affecting their financial operations. These risks include various transition (e.g. new PRA regulation on disclosing risks) and physical risks (e.g. heavy rainfall causing repeated surface water flooding.) Typically, the mitigation of climate risk is managed using financial hedging products (such as insurance solutions) or grey infrastructure. But the ongoing climate volatility will lead to escalating costs, carbon-intensive adaptation investments and ultimately uninsurability.

Public and Private Organisations will need to adapt.

Part of a risk mitigation strategy is investments in Nature-based Solutions (NbS) that help to mitigate climate risks, reducing and preventing exposure.
The Challenge

1. Desirability
   Confidence in NbS
   a. Locational information - lack of data and modelling of locationally calibrated NbS
   b. Lack of long-term benefits valuation and infrastructure
   c. Lack of data-sharing protocols & proprietary modelling

2. Feasibility
   Delivery
   a. Lack of space
   b. Small scale of projects
   c. Small market/ Limited number of contractors
   d. Unfamiliarity with capex and opex (maintenance) costs
   e. High levels of tree death

3. Viability
   Collaboration
   a. Inter-organisational challenges (e.g. siloed departments)
   b. Misalignment of bureaucratic processes
   c. Complex ownership requiring collaborative delivery
   d. Lack of standards
A cloud-based open source platform which aims to revalue nature from a liability to an asset to drive investment into our collective resilience.

1. Scenario impact models for informed decision-making
2. Civic Engagement & match-making for delivery of just portfolios
3. Developing new funding structures for collective investment
Glasgow Pilot

Aim: To fund a portfolio of Nature-based Solutions projects in Glasgow and the Clyde Valley.

1. Desirability
   Embedding open source scenario modelling into flood-risk models to calculate risk reduction (partnership with IBM/STFC)

2. Feasibility
   Portfolio-based strategy with multiple projects and developers, with pre-agreed maintenance schedules.

3. Viability
   Bringing in blended finance to support the planting and growing of urban nature-based solutions
Location Based Scoring: Where to locate NBS to maximise benefits?

Street Trees can reduce peak summer temperature between 1-5 °C through evapotranspiration.

Tree Canopy allows only 10-30% of solar radiation to reach area below canopy.

Energy: Carefully positioned trees can reduce a home’s energy cost by 25%.
Desirability: Impact Functions

- Bounding box
- Assets
- OSM data
- Shapefile OR raster
- Frequency plots
- Assets + hazard
- CLIMA DA data
- Impact functions OR cost per asset
- Hazard cost
- Asset report
- In blue are custom user inputs
Feasibility: Community-based portfolios

Engaging Urban Forest Communities: A Database of tools and best practice

- Feasibility and scalability in practice
- Tools and models for community engagement
- Best practices for urban forest management

Additional features:

1. Impact Measurement
2. Attract Blended Investment
3. Outcomes and Outcomes
4. Monitoring
5. Maintaining & Caring
6. Mapping
7. Citizens
8. Council
Viability: Pilot Partnership

Non-binding Memorandum of Understanding (MOU) for Ecosystem Services - DRAFT

This Memorandum of Understanding (MOU) sets forth the terms and conditions for a partnership to develop a collaborative framework for multilateral ecosystem services agreements among the undersigned parties. This MOU aims to promote collaboration and mutual benefits in the sustainable management and utilization of ecosystem services.

PARTIES
[List of participating parties involved in the MOU, legal names / legal entity, addresses, relevant contact information.]

- FloodRE
- COF
- GCC
- Scottish Water
- SEPA
- National
- Scottish Flood Forum
- TreesAI
Our initial blog, which laid out our concept of an open source model to support municipalities in transitioning toward resilient urban forest management practices, and our strategy document, which provides more detail.

Our interim learning report provides an analysis of how we can overcome existing structural challenges to reach investment readiness for the long-term stewardship of Nature-based Solutions in cities.

DRAFT: TreesAI Glasgow Pilot Learning report

Quick Links

Overview

TreesAI provides a series of tools to help establish nature as a critical and investable part of urban infrastructure. Over the past two years, we’ve been building the TreesAI Pilot in Glasgow, Scotland.

Glasgow faced a series of interconnected social, environmental, and economic challenges. The city is eager to explore a series of nature-based solutions, but is looking to overhaul NBS financing, shifting from sporadic cash injections towards a robust funding model.

By connecting green investors to existing or potential projects, helping the city to better map and measure the impact of the projects, and encouraging citizens to participate in the co-creation of a more inclusive Glasgow, we’re helping the city to meet its ambitious green infrastructure goals.

The report largely focuses on lessons and learnings from our work so far. So if you want to go into the details of our experience in Glasgow, click here.

We’re entering conversations with cities across the world. While every municipality...
LBS
Location-based Scoring
Where to locate NBS as a climate adaptation strategy and to maximise benefits to the city?

- Cooling effect
- Flood Alleviation
- Improved air quality
- Improved noise pollution
- many more

Energy

Tree Canopy
ALLOWS ONLY 10-30% OF SOLAR RADIATION TO REACH AREA BELOW CANOPY

Street Trees
CAN REDUCE PEAK SUMMER TEMPERATURE BETWEEN 1-5°C THROUGH EVAPOTRANSPIRATION

CAREFULLY POSITIONED TREES CAN REDUCE A HOME'S ENERGY COST BY 25%
Location criteria helps prioritise projects to mitigate targeted risks through weighting formulas.

Location-based scoring developed using the IVAVIA framework (Resin, 2018) and the IPCC’s Fifth Assessment Report.

Spatial indicators of climate-related risks of a given landscape.
Impact Chain | Data Management | Score Calculation | Overlay with GUS | Data Visualization
---|---|---|---|---
Qualitative Risk Assessment | Data collection and geoprocessing | LBS Model (data normalization, weighting of indicators and aggregation) | Risk score map is compared to GUS impact assessments of the current canopy structure | Maps, sankey diagrams, and charts
Climate Risk is understood as the result from the interaction of vulnerability, exposure, and hazard.
Risk = Exposure + Hazard + Vulnerability
(coping capacities & sensitivity)
LBS - Data Management

Data collection and geoprocessing

- **E01**: Population Density
- **H0 1**: Avg. Summer Temperature
- **H0 3**: PM10
- **VS01**: Preschool population
- **VS02**: Elderly Population
- **VC01**: Parks

---

**TreesAI**
LBS - Score Calculation

LBS for Heat Risk

LBS Mode 1
(normalization, weighting, aggregation)
Indicate areas in the city where there is a high risk of heat stress and low cooling effect from trees to support in the decision-making of planting new trees for heat stress alleviation.
IBM Research

TreesAI
Impact Work Package

Katharina Reusch
<table>
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<tbody>
<tr>
<td><strong>Open Street Map (OSM) Data Extraction</strong></td>
</tr>
<tr>
<td>➔ show for any bounding box the buildings, landuse, natural land and road network</td>
</tr>
<tr>
<td>➔ For TreesAI use case: show trees per bounding box</td>
</tr>
</tbody>
</table>

| **Flood Data** |
| ➔ showcasing different flood data availability |
| ➔ CLIMADA global dataset |
| ➔ SEPA: Scottish Environment Flood Maps |
| ➔ GUS: TreesAI Project Floodmaps |

| **TreesAI Cost Calculations** |
| ➔ estimating costs based on literature for flood damage at different depths |

| **Fragility Impact Function** |
| ➔ calculating building fragility probabilities for 4 fragility categories for Glasgow area |

| **OSM – Flood Overlay** |
| ➔ overlay of flood data (raster or shapefile) with OSM data |

| **Other Impact Assessments** |
| ➔ How to scale impact assessments globally |
Overall Impact Workflow
as created for TreesAI project but available for any area as multiple workflows in GeoDN (soon)
Open Street Map Data Extraction
Open Street Map Data Extraction - Glasgow

- OSM Python API allows to pull categories such as buildings, landuse, natural land, highways, road etc
  https://wiki.openstreetmap.org/wiki/Map_features
- For example for buildings, they are put into categories such as houses, commercial, religious buildings
  https://wiki.openstreetmap.org/wiki/Key:building
- Run for Glasgow City, see image
OSM Workflow also has trees itself – total 84k in Glasgow
Available Flood Datasets for Glasgow

Note: With shapefiles of the actual flood extents, it is easier to pick out buildings actually affected by a flood. For Rasterfiles of for example 1km resolution, all assets in that area are listed and they are probably not all affected in the same way. Additionally rasterfiles average over a region and usually have much lower flood depths in meters than shapefiles with actual flood extents and depths.

SEPA Flood extent and depth (10m)

CLIMADA River Flood Climate Scenario (5km)

TreesAI Project GUS model (10m)
• Trying out Climada Library
https://wcr.ethz.ch/research/climada.html
- Flood Hazards available for various climate scenarios

```
{res_arcsec: ['150'],
 climate_scenario: ['rcp26', 'rcp85', 'historical', 'rcp60'],
 spatial_coverage: ['country']}
```

- For Glasgow example, downloaded climate scenario rcp85 => This high-emissions scenario is frequently referred to as "business as usual" if society does not make changes.

- RCP85 for year 2030 to 2050: 2050

- RCP26 (global temp rise below 2 degrees) for year 2030 to
GUS model Glasgow

GUS = Growth Urban Scenario
https://lucidmindsai.medium.com/green-urban-scenarios-298d75b100b4

Flood extent and depths
SEPA Flood Map

Flood Extents for Glasgow

Zoom in
OSM with Flood Overlay
How to?

- The flood hazard is then converted into a dataframe with a location and flood depth

- This is then overlayed with the polygons from OpenStreetMap
GUS model Glasgow

Overlay flood extents with affected buildings

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GUS model Glasgow

Frequency of buildings affected by floods and the relevant depth

Note: This is only a subregion of Glasgow where GUS model ran, this does not represent all Glasgow buildings.

Note: There are multiple school buildings, but probably one school itself affected. It depends how OpenStreetMaps maps buildings.
Using Climada Data

All of Glasgow covered

Overlay flood raster all data and show breakdown of affected assets and areas based on flood depth (in meters).

Flood Data:
```python
flood_hazard = client.get_hazard(
    hazard_type="river_flood",
    properties={
        "country_name": "United Kingdom",
        "climate_scenario": "rcp85",
        "year_range": "2030_2050",
    },
    source='ISIMIP',
)(ISIMIP, https://data.isimip.org/)
```

Number of assets affected

Assets affected by floods Glasgow

- building
- highway
- landuse
- natural
Fragility Impact Function
Re-categorise of Glasgow

- For IBM Impact example all buildings were re-categorized into 15 different building types, each having its own fragility function based on building type.

![Diagram showing building types](image-url)

Figure 4. Schematic representation of using minimum building archetypes portfolio to model a community.

- F1: One-story single-family residential building on a crawl space foundation.
- F2: One-story multi-family residential building on a slab-on-grade foundation.
- F3: Two-story single-family residential building on a crawl space foundation.
- F4: Two-story multi-family residential building on a slab-on-grade foundation.
- F5: Small grocery store/gas station with a convenience store.
- F6: Multi-unit retail building (strip mall).
- F7: Small multi-unit commercial building.
- F8: Super retail center.
- F9: Industrial building.
- F10: One-story school.
- F11: Two-story school.
- F12: Hospital/Clinic.
- F13: Community center (place of worship).
- F14: Office building.
- F15: Warehouse (small/large box).
Flood impact function.
flood_depth: water surface elevation in meters.
first_floor_elevation: the building's first floor elevation in meters.
name: the name of the function.

Damage state goes from DS0 to DS4.

- DS0: Insignificant damage to components below first-floor elevation. Water enters crawlspace/basement and touches foundation (crawlspace or slab on grade). Damage to components within the crawlspace/basement including base insulation and stored inventory. Minor damage to garage interiors including drywall, cabinets, electrical outlets, wall insulation (Garage is below the first-flood elevation (FFE)). No sewer backup into the living area.

- DS1: Water touches floor joists up to minor water entering the building. Damage to carpets, pads, baseboards, flooring. Damage to the external AC unit (if the AC unit is not elevated) and the attached ductworks (if ductworks are in the crawlspace). Complete damage to the garage interior (if the garage is below FFE). No drywall damages with the potential of some mold on the subfloor above the crawlspace. Could have a minor sewer backup and/or minor mold issue.

- DS2: Partial damage to drywalls along with damage to electrical components (base-outlets), water heater, and furnace. Complete damage to major equipment, appliances, and furniture on the first floor. Damage to the lower bathroom and kitchen cabinets. Doors and windows may need replacement. Could have a major sewer backup and major mold issues.

- DS3: Damage to the non-structural components and interiors within the whole building including (but not limited to) drywall damage to upper stories for multi-story buildings. [e.g., attic, second story, etc.]. Electrical switches and mid-outlets are destroyed. Damage to bathroom/kitchen upper cabinets, lighting fixtures on walls are destroyed with potential damage to ceiling lighting fixtures. Studs reusable; some may be damaged. Major sewer backup will happen along with major mold issues. Equipment, appliances, and furniture on the upper floors are also damaged (e.g., attic, second floor, etc.).

- DS4: Significant structural damage present (e.g., studs, trusses, joists, etc.). Non-structural components and interiors are destroyed including all drywall, appliances, cabinets, furniture, etc. Damage to rooftop units/components including roof insulation, sheathing, and electro-mechanical systems (rooftop AC units, electrical systems, cable railing, sound system, etc.). Foundation could be floated off. The building must be demolished or potentially replaced.
Fragility Impact Calculation

Used: OSM Buildings Glasgow
Flood: SEPA Flood model
(due to more and higher flood values than GUS output which only had a max flood depth of 12cm when overlayed with buildings)

DS1: Water touches floor joists up to minor water entering the building.
DS2: Partial damage to drywalls along with damage to electrical components
DS3: Damage to the non-structural components and interiors within the whole building
DS4: Significant structural damage present (e.g., studs, trusses, joists)

Illustration for one building – flood depth 0.3m
Illustration for one building flood depth 1.2m
Glasgow City Region Impact Map

- based on forecasted CLIMADA river flood depth (in meters) for 2030-2050
- Impact function calculated on the 15 building types specified before
- 4 different damage categories based on first floor levels and estimated impact for those
- Left is an example of Damage State 1 (DS1) probability for each building in Glasgow
TreesAI Building
Cost Calculations
Table 4.17 Weighted annual average damage calculations: residential property with no protection (where <0.1m = all sector residential damage figures at 0.05m – Appendix 4.1).

<table>
<thead>
<tr>
<th>Flood frequency</th>
<th>Distribution of flood depths (m)</th>
<th>Damage ($)</th>
<th>Weighted damage ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years</td>
<td>&lt;0.1</td>
<td>87</td>
<td>10,973</td>
</tr>
<tr>
<td></td>
<td>0.1-0.3</td>
<td>7</td>
<td>23,250</td>
</tr>
<tr>
<td></td>
<td>0.3-0.6</td>
<td>11</td>
<td>27,667</td>
</tr>
<tr>
<td></td>
<td>0.6-1.2</td>
<td>1</td>
<td>50,207</td>
</tr>
<tr>
<td></td>
<td>&gt;1.2</td>
<td>0</td>
<td>32,153</td>
</tr>
<tr>
<td>Total weighted damage</td>
<td></td>
<td></td>
<td>13,087</td>
</tr>
<tr>
<td>10 years</td>
<td>&lt;0.1</td>
<td>60</td>
<td>12,763</td>
</tr>
<tr>
<td></td>
<td>0.1-0.3</td>
<td>31</td>
<td>26,075</td>
</tr>
<tr>
<td></td>
<td>0.3-0.6</td>
<td>10</td>
<td>50,762</td>
</tr>
<tr>
<td></td>
<td>0.6-1.2</td>
<td>6</td>
<td>33,108</td>
</tr>
<tr>
<td></td>
<td>&gt;1.2</td>
<td>2</td>
<td>54,855</td>
</tr>
<tr>
<td>Total weighted damage</td>
<td></td>
<td></td>
<td>20,292</td>
</tr>
<tr>
<td>25 years</td>
<td>&lt;0.1</td>
<td>45</td>
<td>12,763</td>
</tr>
<tr>
<td></td>
<td>0.1-0.3</td>
<td>24</td>
<td>26,075</td>
</tr>
<tr>
<td></td>
<td>0.3-0.6</td>
<td>22</td>
<td>50,762</td>
</tr>
<tr>
<td></td>
<td>0.6-1.2</td>
<td>6</td>
<td>33,108</td>
</tr>
<tr>
<td></td>
<td>&gt;1.2</td>
<td>4</td>
<td>54,855</td>
</tr>
<tr>
<td>Total weighted damage</td>
<td></td>
<td></td>
<td>22,186</td>
</tr>
<tr>
<td>50 years</td>
<td>&lt;0.1</td>
<td>32</td>
<td>14,502</td>
</tr>
<tr>
<td></td>
<td>0.1-0.3</td>
<td>20</td>
<td>28,858</td>
</tr>
<tr>
<td></td>
<td>0.3-0.6</td>
<td>24</td>
<td>53,687</td>
</tr>
<tr>
<td></td>
<td>0.6-1.2</td>
<td>4</td>
<td>78,628</td>
</tr>
<tr>
<td></td>
<td>&gt;1.2</td>
<td>3</td>
<td>13,200</td>
</tr>
<tr>
<td>Total weighted damage</td>
<td></td>
<td></td>
<td>27,751</td>
</tr>
<tr>
<td>100 years</td>
<td>&lt;0.1</td>
<td>22</td>
<td>14,502</td>
</tr>
<tr>
<td></td>
<td>0.1-0.3</td>
<td>16</td>
<td>28,858</td>
</tr>
<tr>
<td></td>
<td>0.3-0.6</td>
<td>20</td>
<td>53,687</td>
</tr>
<tr>
<td></td>
<td>0.6-1.2</td>
<td>10</td>
<td>78,628</td>
</tr>
<tr>
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<td>12</td>
<td>13,200</td>
</tr>
<tr>
<td>Total weighted damage</td>
<td></td>
<td></td>
<td>22,186</td>
</tr>
</tbody>
</table>
Based on the costs, we can calculate the total cost per flood depth for Glasgow:

- **SEPA Flood Maps**
- More than 13,000 buildings affected
- Costs of 308 million in damages

**Total number of buildings affected**
13126

**Total cost of damage based to all buildings**
308,387,246

Show the number of buildings affected per flood depth

- **292M**
- **16M**
- **192k**
3.3. Jeff Carroll

Corning a Unicorn: Forging An Urban Wood Marketplace At Scale

Presented by
Jeff Carroll CEO
Urban Wood Economy
Industry Problem
Is there enough material?

46 million tons from Cities

- Assuming a mortality rate of 2%, annual urban woody biomass loss in the U.S. = @ 46 million tons of fresh-weight merchantable wood OR 7.2 billion board feet of lumber OR 16 million cords of firewood.

- The potential value from urban wood waste ranges between $89-$786 million annually depending upon the product (e.g., wood chips, lumber, biochar).

What if…
we could extract wealth from the urban wood waste stream, capture the carbon, and create jobs… sustainably?
Business Model, Impact & Opportunity
Urban wood sources

Wood from buildings being deconstructed

Wood from trees which fall in the city

Grow supply chain

Reduce waste

Grow supply chain

InCREASE market value of wood materials

Low Value/Low Volume: Biomass, Chips, Mulch, Topsoil, Biochar

Workforce development

High Value/Low Volume: Lumber

Broker materials

Consumer Sales
IMPACT: Reduced Waste & Increased Value of Materials

Urban and Community wood falls into two categories:
- High value / Low volume
- Low value / High volume

Both require a supply chain for economic success:
- High value material = value-add milling and processing.
- Low value material = lesser value alternative product.

Both generate revenue, create jobs, and capture carbon.
IMPACT: Employment for the Marginalized

- Revenue from an urban waste creates jobs
- National (U.S.) unemployment may be low but urban community rates above 20%.
- An urban wood economy creates access to the larger wood industry.
OPPORTUNITY: Large Untapped Market

- High volume users want eco-friendly wood
- Demand for U&C wood grows as climate concerns grow
- Build a robust supply chain
Memphis

The land of the Delta Blues has a lot to be optimistic about.

1) Launch first biomass campus/zero-waste facility
2) Assets in place e.g. real estate, equipment, improvements, and funding
3) Moving material to the site
4) Currently hiring staff
5) Establishing “Good Neighbor” practices
Pittsburgh has on-going workforce development programs to provide employment pathways for individuals returning from incarceration.

1) Current contracts for deconstruction - a job generator
2) Funding acquired for mill shop operation and market development
3) Planning underway for a biomass campus
4) Early commitment to fund the development of a biomass campus
San Diego

UWE is looking to partner with state and federal agencies to provide feasibility studies and pre-development work in several CA cities.

TBD
Partners
Thank you

Jeff Carroll | Urban Wood Economy
Capturing Carbon and Creating Jobs

info@uweconomy.org
2nd World Forum on Urban Forests
2023
Growing to Its Potential

The Value of Urban Nature for Communities, Investors, and the Climate

October 18, 2023
Agenda

Urban Nature: An Overlooked Investment Opportunity

Quantifying the Value of Urban Nature

Developing Innovative Financing Solutions
Urban nature has the potential to deliver global net benefits exceeding $3T per year and cumulative net benefits of $59T between 2023 and 2050.

Source: RMI Analysis
To unlock those benefits, we need to invest $135 billion in new projects per year through 2030.

Average Annual Initial Cost (2023-2030): $135B

Source: RMI Analysis
This represents an overall benefit-cost ratio of 9-to-1.

As a comparison:
Investing in Resilience in Low- and Middle-Income Countries

Economic Benefits: $4.2 Trillion
Benefit-to-Cost Ratio: 4 to 1
We need to invest an additional $100 billion annually to fill the gap.

1% of projected 2030 city spending on infrastructure

Funding Gap:
$103 Billion/Year

How much investment do we need (average 2023-2030)?
$135 Billion/Year

How much investment do we currently have annually?
$32 Billion/Year

<0.3% of total city spending on infrastructure

Source: RMI Analysis
Agenda

- **Quantifying the Value of Urban Nature**
- Developing Innovative Financing Solutions
Nature’s many benefits add up for economic value.

Total Annual Value of Benefits of Urban Nature

Source: RMI Analysis
We analyzed three opportunities for urban nature to save energy and carbon.

- Reducing mechanical cooling loads and building energy use
- Avoiding the embodied carbon of grey stormwater infrastructure
- Encouraging more walking, biking, and public transit instead of driving
Less mechanical cooling can lower building energy use, peak demand, and energy bills.

1. Lowering building **energy use** by over 1%
   
   *Energy savings alone pays back the cost of planting trees in 11 years*

2. Decreasing buildings’ **peak demand** by 1%-3% (Over 100 MW)
   
   *Enough to save over $150 million in new power generation costs*

3. Reducing household **energy bills** by 12%
Green stormwater infrastructure slashes embodied carbon and costs.

Using nature to manage stormwater in Ahmedabad’s eastern expansion zone — projected costs and embodied carbon under three scenarios, 2050

Costs

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Construction</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey</td>
<td>349</td>
<td>18</td>
</tr>
<tr>
<td>Low-impact grey</td>
<td>332</td>
<td>176</td>
</tr>
<tr>
<td>Green</td>
<td>158</td>
<td>27</td>
</tr>
</tbody>
</table>

Embodied carbon

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Embodied carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey</td>
<td>53</td>
</tr>
<tr>
<td>Low-impact grey</td>
<td>31</td>
</tr>
<tr>
<td>Green</td>
<td>7</td>
</tr>
</tbody>
</table>

Grey scenario includes concrete-lined lakes. Low-impact grey scenario includes lakes lined with rock and wire mesh. Green scenario includes preserved natural lakes. All scenarios assume maintaining 15% green cover in the eastern expansion zone. Maintenance emissions are minimal in comparison to construction. This excludes rehabilitation (material replacement) emissions.

Source: RMI
Street trees support a shift away from driving to walking, biking, and transit.

Modeled added street trees in Curitiba – annual reduction of VKT and emissions, 2035-2050, relative to a business-as-usual scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>Vehicle kilometers traveled (Millions km)</th>
<th>Emissions (Thousand mt CO₂e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2035</td>
<td>15</td>
<td>1.1</td>
</tr>
<tr>
<td>2040</td>
<td>15</td>
<td>0.9</td>
</tr>
<tr>
<td>2045</td>
<td>16</td>
<td>0.6</td>
</tr>
<tr>
<td>2050</td>
<td>16</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Source: RMI Analysis
Urban nature can also be a critical tool for equity.

- Cooling for all
- Protecting flood-prone communities
- Enhancing comfort and safety for sustainable mobility

We will need to break historical investment patterns to address inequity in urban nature.
Agenda

- Quantifying the Value of Urban Nature
- Developing Innovative Financing Solutions
Innovative financing solutions can drive investment in urban nature.

- Launching the “Nature for Cool Cities Challenge”
- Creating a multidimensional, beyond-carbon credit system
- Aggregating urban nature projects
- Including trees in utilities’ asset and rate base valuation
Multi-dimensional credits that go beyond carbon can unlock revenue for cities.
For more information, contact:

Julia Meisel
Manager, Urban Transformation
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2nd World Forum on Urban Forests

2023
Data-Driven Decisions with Smart Tree Inventories

Presented by
Josh Behounek
Davey Resource Group
Right Decision, at the Right Time, on the Right Tree

Technology won’t replace arborists but arborists who use technology will replace arborist who do not.
Step 1: We capture cm-accurate point cloud and automatically identify each tree.
Step 2: Create a 4D Digital Tree Twin of each tree
Step 3: We analyze each tree and identify outliers

- on ecological benefits
- on economic value
- safety factor
- species
- metrics
- Leaf Area Index
- vitality
- changes over time
- cohort analysis

Digital Tree Twin
Step 4: Arborists assess outliers

Remotely ~ 20%

In field ~ 10%
Smart Tree Inventory Program

Year 1
- Initiate smart tree inventory
- Perform outlier advanced assessments
- Install TreeKeeper

Year 2
- Implement information via TreeKeeper 9

Year 3
- Re-scan smart tree inventory
- Perform outlier advanced assessments
- Perform change analysis
- Update TreeKeeper
- Perform outlier advanced assessments

Year 4
- Implement information via TreeKeeper 9
- Perform change analysis
- Update TreeKeeper

Year 5
- Re-scan smart tree inventory
- Perform outlier advanced assessments
- Update TreeKeeper

Cohort: 16” Ash Trees ± 2”

Leaf Area Index

Tree 1

68.3%
95.5%
99.7%

Tree 2
Corridor clearance

Human Thermal Comfort
- Objective
- Repeatable
- Efficient
- Precise
Thank you

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CEUs
Session 3.3: Wall-E: Promoting innovation, new technologies and future visions on the role of urban forests and trees to address climate change
PP-23-3571