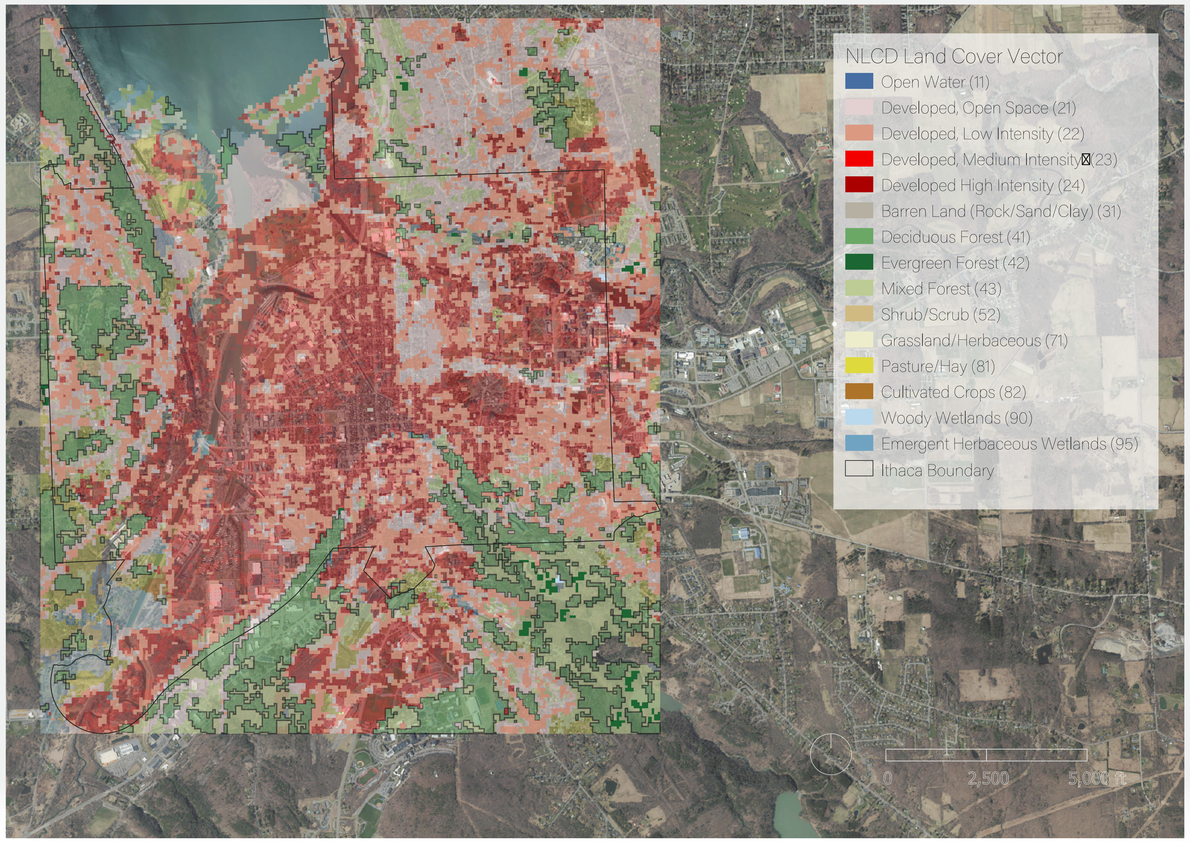
A Landscape Approach To Carbon

Considering carbon sequestration inventories as an initial step in design research



Abstract

The poster visualizes a landscape scale inventory of carbon sequestration, as an initial step in the design research process. Ongoing work in design research makes a case for the value of and need for design research, and compares design research to conventional research models (Vanucchi). Highlighted in this work are approaches to climate change-based risk to demonstrate the value of exploratory research that makes uncertainty central to the research design (Vanucchii) . The map utilizes a land use inventory method for carbon measurement, taken as a means to consider and achieve local carbon neutrality. The methodology follows The Philipstown Inventory 2020. The report is one of the first in New York State to use real local data to measure the full life-cycle carbon emission impacts of the goods and services and to estimate the work of natural resources to remove and store carbon from the atmosphere (Angell, 13). The maps, in their initial stages, are intended as a tool for community leaders, the public, and academics to come together and engage in topics focused around carbon sequestration and climate change.

Ithaca Land Use Inventory

Key	Land Use Category	Total Acres in Tompkins County	% Of Tompkins County Land Cover	Carbon Multiplier (g/C02e/m²/yr)	C-sequestered estimate (Mto2e/year)
23	Developed, Medium Intensity	970.70	24.95%	1	3928298.757
22	Developed, Low Intensity	810.54	20.83%	1	3280157.049
21	Developed open space	517.69	13.30%	93.1	195044816.3
24	Developed High Intensity	487.81	12.54%	0	0
11	Open water	360.09	9.25%	2.4	3497314.136
41	Deciduous Forest	315.13	8.10%	696.7	888504761.3
81	Pasture/Hay	128.17	3.29%	93.1	4829105816
42	Evergreen Forest	121.22	3.12%	696.7	341760714.8
90	Woody Wetlands	79.96	2.05%	696.7	225442888.6
95	Emergent Wetlands	31.98	0.82%	143	18509142.31
52	Shrub/Scrub	29.18	0.75%	1	118106.698
71	Grassland/Herbaceous	23.78	0.61%	295.5	28432492.11
31	Barren Land (Rock/Sand/Clay)	8.69	0.22%	0	0
82	Cultivated Crop	6.25	0.16%	44	1112868.436

TABLE 7. LAND COVER IN Ithaca NY, BY LAND USE CATEGORY, AND ANNUAL CARBON SEQUESTRATION ESTIMATES (2016).

Photographs: Land Use

Glossary of Key Terms ,

Landscape Scale

Carbon-dioxide equivalent:
This report often refers to carbon-dioxide equivalent (CO2e) values,
And particularly metric tons of this unit, noted as MTCO2e. In greenhouse gas emissions inventories,
The primary gasses are mostly quantified by the number of metric tons contributed to the atmosphere.
Meanwhile, each gas warms the atmosphere to a varying degree. In order to express this cumulative
Contribution from a mixture of greenhouse gases, each gas is reported by its relative warming in
Relation to carbon dioxide, allowing for a single "carbon-dioxide equivalent" value.

Carbon negative
: A situation where carbon removals are greater than carbon emissions.

Carbon sequestration:
Removal of CO2 from the atmosphere. This most often happens through
Photosynthesis in plants and through ocean processes, such as metabolic processes of aquatic life. Also
Known as carbon sinking. Also referred to as carbon removal.

Carbon storage:
Carbon that is held in a pool other than the atmosphere, such as living plant biomass,
Soil carbon, or long-lived wood products. Disturbance of ecosystems with stored carbon can lead to
Significant CO2 emissions. Also known as a carbon stock or pool.

Consumption-based accounting:
A greenhouse-gas emissions-accounting methodology that
Calculates emissions at the point of consumption, attributing all the emissions that occurred in the
Course of production and distribution to the final consumers of goods and services. Consumption-based
Accounting is a nascent methodology that shows promise for including considerations for our global
Flows of goods and services in traditional GHG inventories.

Direct emissions:
Greenhouse gas emissions that occur within the geographic boundary for a Community inventory.

Downstream emissions:
Emissions that occur after the use phase in the life cycle of a product,
Material or energy source. Downstream emissions are primarily associated with disposal, such as
Landfilling or incineration of solid waste.

Greenhouse gas:
A greenhouse gas (GHG) acts to warm the Earth's surface by preventing heat from being radiated to space. Human activities since the industrial revolution have greatly increased
Concentrations of several of these gases. Carbon dioxide (CO2) is the most significant, though methane
(CH4) and nitrous oxide (N2O) as well as HFCs are also important contributors to warming.

Indirect emissions:
Greenhouse gas emissions that occur outside of the geographic boundary.

Net-zero emissions: A situation where emissions are balanced by greenhouse gas removals. Also known as carbon neutral.

Production-based accounting: a greenhouse-gas emissions-accounting methodology that prioritizes calculating emissions-generating activities within the geographic boundary of a particular jurisdiction. The jurisdictional boundary is limited to the location where goods and services are produced. This methodology is more standardized in global practice, notably through the US Community and Global Protocols for GHG Emissions Inventories.

Scopes Framework: GHG accounting protocols divide emissions into three categories, called scopes. Scope 1 includes all direct emissions, such as fuels burned in buildings or vehicles within the community. Scope 2 is for emissions from electricity use. Scope 3 is for all other indirect emissions. Typical scope 3 emissions in a community inventory include emissions from solid waste sent to landfills outside the community, community use of air travel, and emissions to produce materials, goods and services used in the community.

Upstream emissions: Greenhouse gas emissions that occur before the use phase in the life cycle of a product, material or energy source. Upstream emissions can include those from extraction of raw materials, processing and manufacturing, and transportation along each step of the supply chain.

Re-considering Land Use Geometries

Further areas of design research might consider the spatial pattern of land use geometries, and how planning at this scale may improve both carbon sequestration metrics as well as landscape ecologies. Further design research may consider the geometries of land use patterns, along side parcel boundaries, land values maintenance regimes and ownership structures.

Open Water

Developed Medium Intensity

Deciduous Forest

Shrub/scrub

Pasture/Hay

Developed Open Space

Developed High Intensity

Evergreen Forest

Grassland/herbaceous

Woody Wetlands

Developed low intensity

Barren Land/Rock

Mixed Forest

Cultivated Crops

Emergent herbaceous Wetlands

Considering Designed Response: New Land Use Categories and Predetermined Geometries

The below visual considers how sequestration multipliers on developed land uses might increase, providing plant palettes which could break up impervious surfaces. Further design research may consider unique strategies for each land use. In particular considering how the integration of both time and scale integrate may inform response..

"Annually, the city gets about the same amount of rain as it has over the last few decades, but it comes in deluges, instead of steady, moderate downfalls, said Dr. Bassuk, the Cornell professor. And there is more time in between rain events, making drought more likely. When rain comes hard and fast, it often runs off without being absorbed by the soil, said Mark Fisher, the former vice president of horticulture at the Brooklyn Botanic Garden. Erosion is another issue.",-Nina Bassuk

Bioswales integrate ecological functions with architectural and aesthetic values. This particular plant palette, incorporates vegetation which considers the zonal shifts, increases in temperature as well as changes in rainfall frequency and amount. A combination of woody and herbaceous plants chosen for their structure, color, ecological function and bloom time, works to envelop the space with a variety of color and texture.

References

1. Angell, Jason. Ecological Project, SINK, STORE,REDUCE, OFFSET An Innovative GHG Inventory and Its Implications for Achieving Local Carbon Neutrality.
2. Vanucchi, Jamie. CELA Annual Meeting. March 2019. Sacramento, CA. Council of Educators in Landscape Architecture, Positioning Design Research for an Uncertain Future.
3. Collins, Lisa M. "Sultry Nights and Magnolia Trees: New York City Is Now Subtropical." New York Times, 24 July 2020.

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