

Reclaiming Nature's Metropolis

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URBS IN HORTO. It is the Latin phrase inscribed across the city seal of Chicago, Illinois. A quick search online yields an English translation and thus the impression that Chicago is a city in a garden. Furthermore, immediately above this banner lies the iconographic and idyllic representation of an unsettled Chicago—a Chicago where Native Americans, Americans, and Europeans alike came together at a small portage connecting the Mississippi River and Lake Michigan. There, they traded in the bounty of the surrounding hinterland and their respective civilizations. And while it is easy to imagine how at the turn of the century, Chicago may have still resembled the ecologically diverse backdrop on which it was built, little remains of that backdrop today. In Nature's Metropolis, William Cronan offers a revised history of how Chicago developed through an economic lens and presents in abundantly well-documented fashion how its development and expansion nearly always occurred at the expense of its surrounding natural resources. Cronan furthers this notion in the documentary Chicago, City of the Century:

"What made Chicago so special was that the web of railroads that were being projected west dumped everything into its lap. It became the funnel that delivered an entire ecosystem, the entire Western landscape into the waiting markets of the eastern seaboard of the United States and of Europe."

But it wasn't just far away markets coupled with a network to serve them that created the kind of industry that would make Chicago the fastest growing city of the 19th century. Its businessmen were a rare breed—greedy, direct, and notoriously brutal to their laborers. To their credit, however, they were equally ingenious in pioneering technology that either increased production cycles exponentially or obliterated the seasonal production cycle altogether. In 1831, Cyrus Hall McCormick developed a mechanized reaper that would not only replace the century-old scythe, but revolutionize the family farm itself. In doing so, McCormick turned Chicago

into the "Great Reaper City" of the world. Not to be outdone by McCormick's accomplishment, Philip Armour then turned Chicago's pork packing industry into the largest ever informally bestowing upon Chicago the nickname, "Porkopolis". In very short order, Chicago's industrial elite along with a hungry and willing proletariat turned America's great frontier city into nature's greatest butcher. Cronan, again gives us perspective:

"Go to the Chicago Board of Trade today and you will see [as one would have for the past 150 years] one of the most extraordinary monuments to world capitalism that you can see anywhere on earth. It's an amazing scene. What'll be happening down on that floor are people buying and selling commodities and products from ecosystems and economies all over the world, setting prices that determine the future for people all over the world, and yet you look at it and you don't have a clue, all the elements that are coming together there. It is where the world connects in the modern age and it is where that connection is rendered invisible in the modern age."

Cronan's observation has only become even more evident in recent years with online brokerage houses providing yet another router in the already cloudy network between man and the commodities on which he is so heavily dependent. If it isn't immediately palpable the kind of murky logic this condition might produce, consider for a moment all the factors necessary in order for a highly intelligent civilization such as ours to feed its crops oil and its cars crops.

It is no surprise then that a city with the architectural tradition and the engineering prowess of Chicago might still remain one step removed from a sustainability movement that owes as much to the Jane Jacobs and Rachel Carsons of the world as it does to the William McDonoughs and Michael Braungarts. Its evolution as nature's metropolis is difficult to overcome. This isn't to say, however, that it hasn't come a long way in the last 20 years. Great progress has been made. Yet, Chicago's efforts to become "the greenest city in America" have largely taken on the face of the movement's left-brained protagonists. Green roofs are a hot sell and contractors, developers, and architects alike are quick to cite their sustainability credentials while equally quick to abandon those ideals when they compromise either the big idea or the bottom line. Of course, there is nothing wrong with turning green tech into big business. In fact, it should be lauded and/or made example of when done to great success. But it is a one-sided response to the problem of our day and often that response requires no behavioral change and comes at the expense of, or with neglect for, the human element in the equation—an element that Chicago has continually rendered invisible throughout its nearly 200 year history.

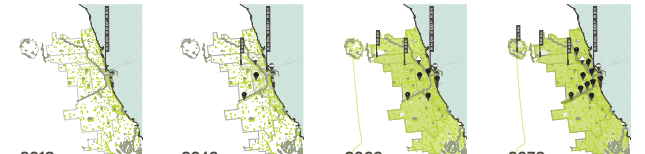
That human element, as diverse as it is, and as connected as it is to both the ecology of place and the economy of our day is precisely what Reclaiming Nature's Metropolis: A Living Building Language seeks to discover and visualize.

"If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos."
—Edward O. Wilson, In Rosemarie Jarski, Words From The Wise (2007), 269



Imagine the possibilities if there were no automobiles. If you've never lived in a city with decent public transit, you're probably wondering how you're going to get to work every day. But if you have, your imagination is more likely running wild with the possibilities. What would my street look like? Could my kids play in it? Could I play in it? There would be no more searches for parking! There's no shortage of ideas mainly because there's no shortage of opportunity.

Our nation and its cities are literally defined by their roads. It wasn't always like this, however. Chicago witnessed its marshes slowly defined by walking paths, then transformed into equestrian paths, paved to hold the weight of a new automobile, and then paved 12 times over to hold the weight of an entire army of automobiles. Unfortunately, we have been either blind or ambivalent to this creep and its negative externalities. That is, until now. Faced with congestion, poor air quality, and the near complete occupation by this mechanical army on a plane humans have depended on for food and nourishment for hundreds of thousands of years, we seek change.



2013 Existing parks and a homogeneous street grid leave little room for a small, disconnected habitat to mature.

2046 The highway system is phased out and external travel both to and from the city is 100% facilitated by the 2046 transit system. Highways have been transformed into habitat corridors that provide critical connections between wildlife and plantlife in the urban core and surrounding villages.

2066 With a more robust system of transit-oriented development, the streets are removed and planted throughout established neighborhoods. The "greening" industry will yield new jobs and revolutions in road recycling technology. The greened streets provide habitat for birds, small mammals, improve public health, and provide public spaces while reducing the urban heat island effect.

2076 After the street phase-out is complete, riparian corridors will be created by providing buffers of at least 2000-ft along major waterways.

Riparian corridor benefits:
1) protect water quality by naturally filtering pollutants;
2) provide habitat for mammals and corridors for vertebrate species;
3) increase property values for anyone nearby;
4) sequester carbon and improve air quality.

SYNANTHROPIC BIODIVERSITY [Site] taking it to the streets

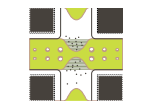
As automobiles are supplanted by public transit, several patterns begin to emerge as streets become corridors for habitat and human activity. Avenues transform into gathering places, they are consumed by habitat, important for wildlife and ecosystem services (stormwater retention, reduced heat island, etc.). They also become a new breed of commons—a locus of commercial activity and exchange that brings the city to life in a way previously unimaginable. At right are just a few of the endless possible manifestations of this new language.



Prairie This heavily wooded intersection with tall grasses is optimal grazing space for prey animals. It is also an optimal area for insects and small woodland mammals.



Rehabilitation The intersection is bisected by bioswales that serve to break the scale and pace of the street. The idyllic nature of the land lends itself to morning walks or evening strolls. It is also a great place to interact with wildlife.



Underground Transit Entry The streetway above the underground rail system is slightly elevated for minimal ground disruption.



Exchange Market The scale of individual markets maintains diversity and competition in the city. Both buyers and sellers can set up shop in these exchanges.



Third Place The intersection is used to fulfill the necessity of a "third place"—places where the community can meet in a sunny space free of commercial pressures and anxiety.

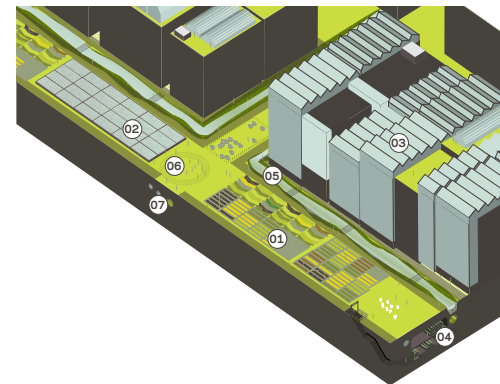


Edge Bioswales Water collection and edge runoff is handled by bioswales. The street edge slows down the pedestrian traffic thus creating a more residential neighborhood.

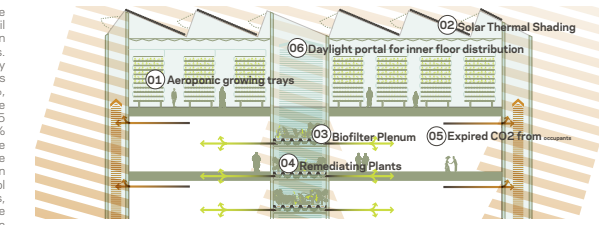


Marshland The intersection not only reintroduces centuries-old prairie into the city but it also collects excess rain water which promotes insect and amphibian breeding. At night, the sounds are akin to a place on the bayou or what Chicago's first settlers might have experienced.

ANATOMY OF AN INTERSECTION [Site] endless opportunity



Urban rooftops are converted into productive agricultural greenhouses. Rather than soil planting, an aeroponic system with rotation trays is used to produce herbaceous plants. This system requires less nutrients and only a fog of water. In a controlled biosphere, this method can reduce water usage by 98%, fertilizer usage by 60%, and pesticide usage by 100%, while maximizing crop yields by 45 to 75%. Research has also found an 80% increase in dry weight biomass per square meter using aeroponics, which means more organic waste for biomass and biodegestion systems. If pests become a problem, control predators such as praying mantis, lady bugs, green lacewings, and pirate bugs can be introduced into the space to balance the populations. Additionally, plants that are off of CO₂ which humans expel at a rate of ~2lbs a day. Cleansed exhaust air from below floors is pushed into the greenhouse to bolster plant growth. The greenhouse will also become a place of meditation and repose for the occupants seeking to break from their daily tasks.



NASA has tested common household plants in closed-loop biosphere projects to identify those that purify. These studies have found that many plants can break down complex organics used in our products and reduce 'sick building syndrome.'

GROWING PLATEAUX [Health] a different kind of green roof

- Deep-Root Garden:** The street provides an optimum depth for carrots, root plants, and potatoes.
- Rice Field:** A slightly elevated surface contains a wet pond for rice production.
- Aeroponic Greenhouses** produce most of the community's greens, herbs and tomatoes. A rotating aeroponic system increases the speed of production and decreases the amount of nutrients required.
- Nutrient Networks** are the storage houses and transportation channels for perishable goods in and out of the city. Biomass from agricultural fields travel on the line.
- Bioswales** handle runoff from hardscapes and unused water.
- Community:** Recipes are shared and cultural farming traditions are passed on where groups intersect.
- Existing Infrastructure** is utilized for carbon & nitrogen travel to the biodegesters.

A 'philia' is one of four ancient greek words for 'love' and the root word for the term coined by E.O. Wilson as 'biophilia'. It is a common descriptor for the kind of attraction that individuals have toward certain habitats, activities, and objects in their natural surroundings. Agrophilia is a complement to these two memes. It seeks to reestablish the seasonal rhythm with local foods and human taste and to educate on the closed loop process of grow-make-eat. Although many people will not be able to sustain themselves entirely on the crops they produce via urban agriculture, at the very least, they will be educated at an early age in how to make informed choices. Witnessing a plant grow from seed, multiply in scale by using water, soil, and sunlight, keeping it pest free, seeing it fill their table with fresh produce, and witnessing its decomposition (vermi or active) will lead to more responsible use of resources and more mindful consumption of food.

PLANT THE STREETS [Site] nutrient exchange

AGROPHILIA [Health] food love

To this effect, we have chosen Chicago's "Loop" as the seed community for where we will demonstrate the power of the Living Building Challenge and the new urban vernacular that has emerged. Why the Loop? The answer is two-fold. First, it is Chicago's oldest and most dense neighborhood thereby providing a multitude of scenarios in which a Living Building Language can emerge. Second, the world's population is trending towards dwelling in urban centers yet with the exception of their density, many of these urban centers have yet to embrace a truly holistic view of sustainability. We wanted desperately to know what a more right-brained understanding of sustainability might look like in an urban center historically formed and radically consumed by the titans of industry. In response, we found extraordinary opportunity to witness an even more extraordinary juxtaposition—one where urban jungle meets jungle, community equity meets private capital, and an individual's right to nature and freedom of expression is as visible to the casual observer as his or her neighbor's right to economic efficiency and uniformity. In short, it is a city in which forest-meister lives adjacent to banker and where some of the most basic human needs are rendered unto us in a way that is as bound to cause conflict as it is a beautiful mess.

So what does this look like and how does it behave? We imagine the Chicago of the future is at its core, a passive urban framework responding first and foremost to the innate regional and environmental qualities that define its place while simultaneously embracing the individual values of its people. More specifically, it is a passive solar architecture on the south with a flare for individual expression on the north. If we place this firmly within a political context (and not incidentally to show that it is both left of center and right of center in its pedigree), it is solidarity on the south, individual expression on the north; solidarity on the outside, individual expression on the inside. This is to say that every building and occupant has the responsibility of maximizing its solar gain on the southern façade while maintaining the freedom to do as they please on the northern façade—regardless of architectural aesthetic. That this urban framework participates whole-heartedly in the active collection of solar energy is ancillary to its primary mission.

Secondly, this is a Chicago whose landscape architecture is the new architecture. We have before us the opportunity to transform the people-laden car parks that have become our cities into a new kind of urban typology. Primary thoroughfares remain primary but for an expansive network of subterranean public and utilitarian transportation types. The rest of our

avenues are reclaimed in a multitude of ways. Beginning at the lake, natural habitat exchange and riparian corridors spreads like fingers into and through the city. Parks, gathering grounds, markets, and public art are found in densely populated areas. As density and building heights decline, agriculture and bio-digesters fill what was once a concrete network clogged with metal and grime. In this transformation arrives a new kind of way-finding system as well—one based on both building and habitat—and one that devours the disconnect between figure and ground.

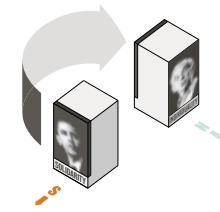
Lastly, our Chicago is a case study in adaptive re-use unburdened by ambition, formal limitations, or capital. This is not a city designed by starchitects or consistently over budget. This is a city reclaimed and designed by its people for its people without pretention and without master plan. It is a modern day architecture without architects where builders, untrained and uncorrupt, adapt and re-use the architecture, infrastructure, and industrial output of today, so that tomorrow we might finally be rich with the culture of our people rather than the culture of our consumption.

In a way, it is as though we have combined the adaptive ingenuity of Dharavi and its million-strong community of recyclers with the passive solar qualities of a Mesa Verde and injected it with the cultural diversity and engineering genius of nowhere else but Chicago itself. Why is this so important? Because what forms when these three elements are combined is a kind of new urban vernacular impervious to changes in fashion, education, politics, or economy. Together, it is so visually and philosophically distinct, not to mention compelling, that we cannot help but call it: A Living Building Language.



"Language is a process of free creation; its laws and principles are fixed, but the manner in which the principles of generation are used is free and infinitely varied. Even the interpretation and use of words involves a process of free creation."
—Noam Chomsky

Sustained movements embrace universally held values independent of party affiliation. It is human nature to want to define one's self while simultaneously situating one's self within a larger coalition. Architectural language becomes representative of this coalition of autonomy.



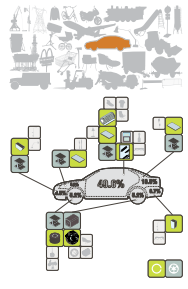
Recent experience suggests that significant improvement in material recovery (or, significant waste reductions) can be achieved rapidly and efficiently.

In 1989, a California law requiring that cities divert 50% of municipal waste from landfills has led to increased recycling and a number of ambitious programs for municipal composting and/or biodigestion. Legislation establishing e-waste takeback and recycling programs has diverted the majority of electronic waste from landfills. New building standards, unveiled in 2010, require construction waste reductions of at least 50%. And seemingly unrelated legislation regulating greenhouse gas emissions has had the effect of further boosting alternative approaches, like biodigestion, that benefit from an inherently low-emission or low-energy approach.

Policies like these compel waste to bear its true cost, promoting reuse, recycling, and informal systems of trade and bartering.



When public protest forced Chicago's Gustavus Swift (1839–1903) and his meat-packing empire to drastically reduce the amount of pollutants dumped into the river and surrounding communities, Swift sought innovative approaches to turning items previously considered "waste" into new products and ultimately profit. This practice was so successful that Swift once bragged he could use "everything but the squeal." Parallels between Swift, his "disassembly lines," and Chicago's rich tradition of roughneck perseverance and ingenuity are not lost here. As cars are gradually phased out of contemporary culture, there is ample opportunity for the birth of another kind of automotive industry—one that would turn Henry Ford over in his grave.

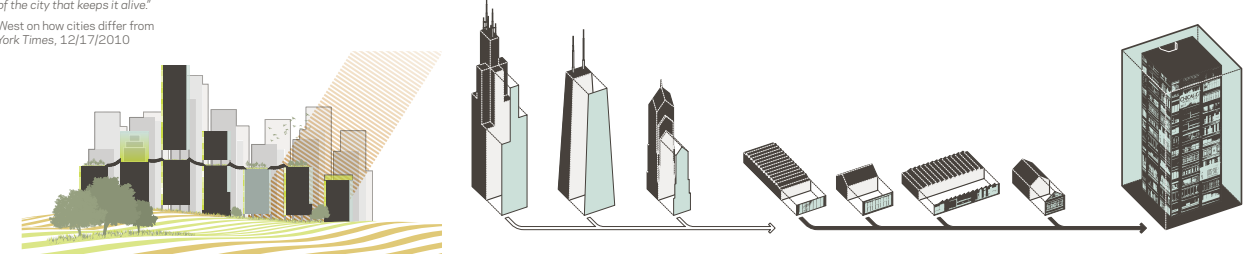


DEMOCRACY [Equity]
design as a neutral framework

"Think about how powerless a mayor is. They can't tell people where to live or what to do or who to talk to. Cities can't really be managed, and that's what keeps them so vibrant. They're just these insane masses of people, bumping into each other and maybe sharing an idea or two. It's the freedom of the city that keeps it alive."

—Physicist Geoffrey West on how cities differ from corporations. *New York Times*, 12/17/2010

Citizens enjoy planted avenues,



RIGHTS TO NATURE [Equity]
new city in a garden

2076 BASELINE

Baseline energy demand was established using data from the Chicago Climate Action Plan.

cta

Transit + Reduced Heat Island Effect
Urban greening cools the city and reduces air conditioning loads; transit improves efficiency of travel and switches its load from oil to electricity.

Building Retrofits + Energy Efficiency

The recent renovation of the Empire State Building achieved an energy reduction of nearly 40%; this figure is assumed for the retrofits proposed here. These retrofits are enabled by strict energy codes, generous incentives, and market mechanisms that appropriately price materials and energy.

Shift to Thermal Heat Sources

Rather than use high-grade energy (electricity or natural gas) for water heating and space heating and cooling (which require a change in temperature of +100 degrees F), we shift these needs to low-grade renewable sources—largely ground source heat, pumps, and rooftop solar thermal.

Harvest Waste for Fuel

Biodigesters capture urban waste (sewage, municipal organic waste, and green waste from the newly greened city) and transform them into methane-laden biogas, which is burned for heat and power. Agricultural wastes from within the city and beyond are cleanly combusted for heat and power.

Capture the Sun

Distributed generation with high-efficiency photovoltaic panels meets a large portion of electricity needs, particularly air conditioning, which tends to coincide with peak solar output. Distributed production smooths out natural variations in renewable energy making the system more resilient.

Harvest the Wind

The Windy City's proposed 2200 MW wind farm provides electricity for remaining electric needs. Pairing solar and wind increases reliability; storage / reserve is provided with pumped water, compressed air, and hydrogen at multiple scales, rather than batteries.

Behavioral Change / Shift in Values

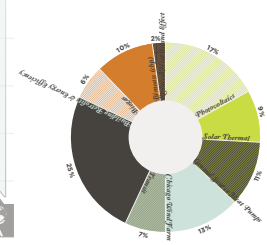
Aided by transparency, unprecedented access to information, and a revitalized public realm, citizens are empowered to make decisions that will build a sustainable future from the bottom up.

Our approach to energy is three-fold:

- 1) Reduce demand and improve efficiency. We propose a language of passive solar and efficiency retrofits—glass façades to the south and individual interventions to the north which cut building energy use by an average of 40%.
- 2) Match energy supply with end-use needs. A large majority of energy needs are for heating and cooling. These are best provided through thermal sources—sunlight, biofuels, and the warmth of the earth.
- 3) Meet all needs with 100% renewable energy. Photovoltaic panels cover the city's southern façades; 2200 MW of wind power is generated off its shores; and its municipal and agricultural wastes are harvested for their energy before returning to the earth as compost.

As Amory Lovins argued in his seminal *Soft Energy Paths*, this approach to energy also enhances democracy and equity. As most end-use needs are distributed, small-scale, and require low-grade energy that can be supplied through simple, durable strategies such as passive solar, solar thermal, geothermal, and biodigesters, such technology has a democratizing effect. It is accessible, flexible, adaptable to place, and manageable by individuals and neighborhoods.

However, even these technical strategies, as aggressive as they may be are not enough to get us to "net zero"—something more of us is required. That something is behavioral modification. Aided by transparency, unprecedented access to information, and a revitalized public realm, citizens are empowered to make decisions that will build a more sustainable future. These are the actions—grassroots, bottom-up, messy, and democratic—that will be truly transformative and will get Chicago to net zero and beyond.



BREAKING BAD [Energy]
toward net positive energy production

WIND FARM + ENERGY PROFILE [Energy]
the windy city; 100% renewable energy

STRATEGIES IN PASSIVE + ACTIVE SOLAR ADAPTATION
an architectural language, combined strategies for organic hvac + solar retrofitting