Reflexive Urbanization

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"In the last century, capital [and power] have become more important than land."
John Kenneth Galbraith, *The New Industrial State*, 1967.

Nineteen-sixty-seven was a year of landmarks. It was the year that marked the end of General Motors' two year long Futurama exhibition that attracted over 29 million people at the New York World's Fair. For the largest employer in the US, 1967 also saw the introduction of three new models including the Cadillac Eldorado, the Chevrolet Camaro and the Pontiac Firebird. While GM celebrated the production of its one millionth U.S. made car that same year, it also faced a major labor backlash outside its headquarters in Detroit, amidst a year of civil rights rioting across the country in cities like Newark, Plainfield, Cleveland, Cambridge, Buffalo and Milwaukee. 1967 was also the year that the Outer Space Treaty banned the use of nuclear weapons in space while underground nuclear testing blindly continued in Nevada's Yucca Flat. 1967 was the year that the Vietnam War reached its midway mark, just before San Francisco's 1968 Summer of Love. It was also the year of Apollo 4, the first unmanned flight in earth's orbit while TWA flight 128 became the 12th worst crash in the history of the US plunging into a forest two miles before reaching the runway at Greater Cincinnati Airport.

More importantly, 1967 was the year that a small staff of five at the Milwaukee Journal, after successfully campaigning to stiffen the law against water pollution in Wisconsin and the Great Lakes, was awarded the Pulitzer Prize for Public Service. The award was a notable advance in the national effort for the conservation of natural resources against the dangerous trends of downstream contamination from Wisconsin's mainstay industries of papermaking, brewing, cheesemaking and vegetable canning. Those efforts in "The Genuine American City" catalyzed the approval of the Clean Water Act three years later by John F. Kennedy, boldly assuring that all lakes and rivers nationwide would be rendered safe by eventually eliminating all wastewater discharges to the nation's waters by 1985. While its statute has fallen short of its ambitious goal to end all pollution, the Clean Water Act did succeed in ending a dark industrial age when Americans could not swim in major rivers like the Mississippi, the Potomac and the Hudson, an age epitomized by incidents in the Great Lakes like the fires on the oily surface of Cleveland's Cuyahoga River, the declaration of Lake Erie as a dead zone, the over-fertilization of Lake Ontario from sewage and detergent discharges and the mercury contaminations that closed fisheries on Lake Superior, Lake Michigan and Lake Huron.

Nineteen-sixty-seven therefore represents a tipping point in the history of industrialization in America as a period that has "left a legacy of industrial production and pollutants on the contemporary landscape"[1] where, according to a National Report on Brownfields Redevelopment in 2006 titled *Recycling America's Land,* more than 400,000 sites with real or perceived environmental hazards dot the American landscape today. As the 20th century recently came to a close, a decisive transformation in industrial process, manufacturing technologies and environmental attitudes has occurred in fields of practice ranging from business and economics to real estate and land development. Heightened by the pressures of globalization, this post-industrial shift has spawned a generation of practitioners ranging from Julie Bargmann to James Corner - that have been focusing on the

transformation of brownfields and the remediation of urban ecologies to jumpstart the post-industrial economy of the 21st century.

Two main practices of intervention characterize the project of post-industrial remediation. On the one hand, there are practitioners of site-level remediation that rely on measures of spatial beautification or surface concealment, who employ property plans and spatial renderings aimed at visualizing the immediate or short term benefits of design. The other, more informative practice lies with regional-scale materials management strategies determined by logistical, environmental, social and financial parameters, usually associated with a distribution of sites in varying sizes. Best viewed from the air, these sites often involve design strategies that integrate regional transportation infrastructures and watershed-based ecosystems. Due to their higher degrees of complexity, these strategies must rely on incremental and subtle transformation over relatively long periods of time.[2]

This paper explores the potential effectiveness of this broader understanding of the processes of urbanization[3] and the bio-physical factors that pre-condition them in North America. Tracing a timeline through the patterns of land transformation over the past century, this paper puts into question the decisive transitional period of Western industrial society defined through conventional dictums such as Post-Enlightenment, Post-Fordism, Post-Modernism or Post-Industrialism and instead, argues for a *reflexive* understanding of urbanization[4], a term that suggests a retroactive view of urban patterns. To accomplish this, a panoramic lens is employed here to open a retrospective investigation of shifts over the past 100 years evidenced by the presence of industrial sites in the Great Lakes, and ends with a projective outlook on current practice seen through emerging streams of development in North America. The underlying question raised here is how can a different, more contemporary understanding of the post-industrial landscape in North America structure the development of a new economic and ecological order for the 21st century?[5]

Failures & Accidents

The reconsideration of the post-industrial project begins by tracing the origins and the events that fueled the current body of work emerging over the past two decades. Ironically the result of accident and failure rather than by design or by planning, there are two sites in the Great Lakes that decisively illustrate the legacy of 20th century industry with two decisively different outcomes: the first involves a chemical dumpsite in Niagara Falls, New York and the second involves an industrial dumpsite in Toronto, Ontario.

The Love Canal

In 1978, during the construction of the Lasalle Expressway in southeastern Niagara Falls, over 20,000 tons of toxic waste was discovered in what is now recognized as America's most notorious dumpsite. The 16 acre site - a one-mile long, fifteen foot wide and ten feet deep trench that was originally built by William T. Love as a hydroelectric and transportation project between the upper and lower Niagara Rivers - was used as a chemical dump for more than 10 years between 1942 and 1953 by the Hooker Electrochemical Company[6] and formerly as a weapons dump for the United States Army. Prior to its industrial use, the canal was bucolically used as a local swimming hole during the summer and as a skating rink during the winter. Once filled and capped, the site was then reluctantly sold to the City of Niagara for a dollar, and with the baby-boom pressure after Word War II, the municipality built a school and a 100-home neighborhood. From the mid 1950s through the 1970s, a record number of illnesses were reported as a result of chemical exposure, including rashes, burns, miscarriages and birth defects and cancer.[7] Eckardt C. Beck, a former EPA administrator, recalls the explosive nature of the Love Canal incident in the Spring of 1978, after a period of record rainfall:

> *Corroding waste-disposal drums could be seen breaking up through the grounds of backyards. Trees and gardens were turning black and dying. One entire swimming pool had been had been popped up from its foundation, afloat now on a small sea of chemicals. Puddles of noxious substances were pointed out to me by the residents. Some of these puddles were in their yards, some were in their basements, [and] others yet were on the school grounds. Everywhere the air had a faint, choking smell. Children returned from play with burns on their hands and faces.*[8]

That same year, the school was closed, pregnant women and children were evacuated, and home-grown vegetables were banned. The state purchased and leveled 239 homes near

the canal. Eventually, everyone in the Love Canal area was evacuated and relocated with money advanced by the state and federal governments. [9]

Infamously known as Love Canal, it was the first contaminated site to gain national and international attention due to the scale and magnitude of its consequences, a recognition that was ironically instigated by the unsolicited research of Lois Marie Gibbs, a proactive mother who formed the Love Canal Homeowners Association in the mid 1970s after discovering the location of the dumpsite below her son's elementary school. From this toxic tragedy, the Love Canal spawned the development of what would become one of the most important legislative programs in the United States, the 1980 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), that aimed at reversing the dangerous trend of chemical dumping, groundwater contamination and air pollution.[10] Known as Superfund, the federal program was worth over 30 billion USD since its inception, and was given birth by the U.S. Environmental Protection Agency to essentially clean up a list of 98 national priority sites. With the growing number of sites and concerns over groundwater quality in the country, the program has grown to staggering proportions dealing with more than 1300 sites throughout the country. With its emphasis on the legislative attribution of blame and responsibility during the past twenty years however, the Superfund Program failed to gain traction on the actual remediation and clean up of sites. Despite its heroic intentions, the Superfund's "polluter-pays and one-size-fits-all" policy essentially failed due to exorbitant funds used in endless litigation and generic remediation technologies applied to depressed local economies and site-specific ecologies.[11] Today, after a 200-million dollar lawsuit, the evacuation of over 200 families and 50 million dollars in site remediation, the only evidence of Love Canal's past is a demolished community, a vacant street and a fenced-in site.

The Leslie Street Spit

While the Love Canal incident remarkably catalyzed the era of post-industrial remediation in the United States, another lesser known dumpsite some 300 kilometers across Lake Ontario from Niagara Falls, tells the story of an entirely different yet equally informative story. Projecting southward from the shorelines of Downtown Toronto, the dumpsite is a linear headland constructed with waste materials, mostly concrete and rubble from urban operation such as the excavation of urban sites, the construction of subway tunnels, the demolition of buildings form the city centre and the dredging of the Toronto Harbour in the 1960s, 70s and 80s. Generically dubbed the Leslie Street Spit, the headland was initiated by the Toronto Port Authority as a shoreline disposal program in proximity to the downtown area that would simultaneously function as a coastal barrier for the city's inner harbor. The silty clay substrate of the city's pre-existing geology proved an ideal base material for the construction of the headland. During the forty year period that spanned the development of the downtown area, the headland slowly grew into what is now a five kilometer long peninsula (Fig. 1).[12]

From a regime of protracted neglect resulting from the failure of the shipping boom, emergent vegetation and wildlife accidentally colonized the peninsular landmass in the 1980s and 1990s. With the intervention of the Toronto and Region Conservation Authority in the late 1990s, the headland was preserved as one of the most unique constructed wildernesses in North America.[13] According to Michael Hough, the notable urban ecologist and landscape architect, proactive conservation of the Leslie Street Spit has made it "one of the most significant wildlife habitats in the Great Lakes region in an environment where industrial growth has destroyed many of the habitats bird require, and has rendered others toxic."[14] As a dualized infrastructure, the headland now functions as a an active dumping ground during regular business hours, an ecological recreation area during off-hours for the more than 3 million inhabitants of the Greater Toronto Area while continuously operating as a coastal protection barrier for nearby island communities and. A by-product of the logistics of city building, the headland model provides evidence of a critical correlation between the mechanics of urban construction (i.e. excavation, demolition, dredging, transportation, logistics, and development) and the manufacturing of contemporary land use where post-industrial sites can serve as productive, multi-functional landscapes that hold urban economies in a synthetic equilibrium.[15]

Fig. 1. Manufactured Site: the crenelated headland of the Leslie Street Spit that projects 5 kilometers southward from the shoreline of Lake Ontario, near Downtown Toronto. Looking north, landfilling operations still remain active on the eastern half of the headland while the western half is used for recreational and ecological park use. The configuration of the headland emulates other geologically-formed spits in the Great Lakes such as the Point Pelee or Rondeau Point in Lake Erie (Photo: Pierre Bélanger).

Shifts & Patterns

Though the historical and ecological contexts of the Love Canal and the Leslie Street Spit widely differ, they present a unique and compelling case for understanding of a logistical reciprocity between different patterns of land transformation, especially when considering shifts in economy and industry. From a geo-economic perspective, four common denominators best substantiate this logistical bond between industrialization and land transformation:[16] a) waste: there is a process built-in to the production and distribution of materials that generates waste at the urban scale; b) ecology: there exists a bio-physical infrastructure at the scale of the watershed that pre-conditions location of industry and methods of production (i.e. hydrological patterns, soils, and bio-mass); c) globalization: there exists economic forces that exercise significant impact on the type and location of industry; d) multiplier effect: the magnitude of industrial operations considerably impacts a region over time (job spin-offs, supply chains and distribution networks).[17] Either through dumping, disposal, landfilling or storage of materials, these denominators show that the case of active lakeshore-reconstruction in the Great Lakes that has been well underway for the past two hundred years provides considerable evidence of a hidden, invisible infrastructure that historically supports patterns of urbanization, and bears the capacity of generating them in the future. These "factors of invisibility" therefore demand a critical re-consideration of the post-industrial landscape in the Great Lakes especially given that, according to the U.S. Environmental Protection Agency, has one of the highest concentration of contaminated urban sites and waters in North America; second only the State of California.

The Rust Belt

What is often marginalized in the discourse on post-industrialization is that the legacy of contaminated sites[18] in the Great Lakes Region are the residual effects of a specific context that hinges on geography, economy and politics in a region historically known as the Rust Belt. That region spans Wisconsin and Illinois to Pennsylvania and Upper New York State. During and after the two World Wars, the region underwent a considerable rate of growth from weapons production to automotive manufacturing primarily as a result of the abundance of iron ore, coal and fresh water in proximity of the commercial nerve centre of the Northeastern Seaboard. Several decades later, this rate of transformation was ironically reversed: the U.S. steel industry for example fell from 509,000 workers in 1973 to 240,000 in 1983, where one of the basic manufacturing industries fell by more than half in just ten years. The aftermath of the militarization and industrialization of this region was aptly surmised by Joel Garreau, an award-winning journalist for the Washington Post, in his 1981 book, *The Nine Nations of North America*:

> *"Tough is what defines North America's nation of northeastern gritty cities in a multitude of ways. Gary, South Bend. Detroit. Flint. Toledo. Cleveland. Akron. Canton. Youngstown. Wheeling. Milwaukee. Sudbury. London. Hamilton. Buffalo. Syracuse. Schenectady. Pittsburgh. Bethlehem. Harrisburg. Wilkes Barre. Wilmington. Camden. Trenton. Newark. […] The litany of names brings clear associations even to the most insulated residents of other regions. These names mean one thing: heavy work with heavy machines. Hard work for those with jobs; hard times with those without. […] When columnists speak of managing decline, this is the region they mean. When they speak of the seminal battles of trade unionism, they place their markers here. When they write of the disappearing Democratic city political juggernauts, not for nothing do they call them machines, for this is where they hummed, then rusted."*[19]

Fig. 2. Post-Industrial Landscape: once the largest processor of steel and iron in Canada and one of the most heavily polluted inland ports in North America, the 2150 hectare embayment of the Hamilton arbour is now the site of a major remediation action plan under pressure of its rapidly diversifying economy to clean its polluted waters and contaminated sediments using new discharge management systems and sedimentation decontamination technologies (Photo: Pierre Bélanger).

Heightened by the global mobility of corporations, the de-industrialization of the Rust Belt resulted by and large from international trade deregulation policies such as GATT in 1946 (General Agreement on Tariff and Trade) and the NAFTA in 1994 (North American Free Trade Agreement) that opened international borders southward to Mexico and westward to Asia where labor and raw materials are cheaper and environmental laws less stringent. As a result of global outsourcing,[20] plant relocations led to industrial de-corporation, land un-development, population un-employment and de-urbanization. Abroad, globalization created surrogate sites: for example, Bangkok has replaced Detroit, Shanghai replaced Cleveland, Taipei replaced Toledo, and Mexico City replaced Milwaukee.[21]

This economic fallout further precipitated the population vacuums of inner cities in the Rust Belt from the 1950s onward, largely leaving them victims of decaying infrastructure, contaminated land and heavy tax burdens (Fig. 2.). An industrial vacuum and corporate exodus that was the subject of Michael Moore's award-winning documentary "Roger and Me" in 1989, that provided a stinging indictment of the General Motors Corporation and CEO Roger Smith, for closing down all the assembly plants in Flint, Michigan leaving over 40,000 people jobless and the entire city virtually bankrupt in the 1980s. Today, the most active areas of the city are ironically two landfills that flank the city of Flint on the north and south ends, where the generic landscape of General Motors plants and lots now lies, largely vacant and abandoned on the overgrown banks of the Flint River.

The Cutover

Though relatively recent, the decline in population of inner cities and the regional spread of new immigrant populations is not entirely new.[22] Nor is the phenomenon of regional de-industrialization unique to the question of economic and ecological recovery in the 21st century. For example, prior to the mechanical industrialization of cities in the Rust Belt, a significant shift took place following the clear-cut logging and slash fires in the virgin forest regions of the Mid-Western United States and central Canada in the late 19th century. From Northern Michigan to Southwestern Ontario, rampant clear-cutting began with the hardwoods (like the oaks, maples and birches) in the mid 1890s and spread to the softwoods (like the white pines and spruces) by 1910 into the 1920s. Historically recognized as the *Great Lakes Cutover*, over 65% of the 40 million northern acres of choice timber in Michigan, Wisconsin and Minnesota (as well as some areas of Ohio and Upstate New York) were stripped bare and shipped to modern commercial centers such as Philadelphia, New York and Washington. While the decimation of the forests resulted in a westward expansion and colonization of the western frontier in the late 19th century, an emerging group of conservationists, planners and industrialists were intent on developing strategies for the economic recovery of these decimated areas, preoccupied with re-utilization of the land that was by now rendered useless from a logging perspective. From an agricultural perspective however, the cutover region appeared as a land of fervent potential and one the most notable proponents of land reclamation was Benton Mackaye. Renowned forester and harbinger of the conservation movement in the United States in the early 20th century who later founded the Appalachian Mountain Trail, Mackaye drew up reclamation plans for the Department of Labor and the Forest Service in the first two decades of the 20th century.[23] Hand-in-glove with the efforts of conservationist and reformist, P.S. Lovejoy, Mackaye borrowed from the prototypes of woodland settlements published by the Canadian Commission on Conservation sketching out reforestation diagrams at the

regional scale. Laced with re-zoning strategies and dotted with re-colonization patterns, Mackaye's strategies completely re-conceived the landscape of the failed agricultural experiments of the Northern Wisconsin region, and several other cutover regions in the Northwest United States.[24] The small army of re-builders at the beginning of the century was unilaterally intent on the development of a renewable economy of conservation areas, selective logging zones and village settlements that would upset conventional paradigms of Promethean development:

> *"these are the principles of the highest use of land; of the free soil basis of homesteading, efficient reclamation and State aid to self help; of community cooperation as against Robinson Crusoe independence; of forestry as against timber mining; of permanent employment for the lumberjack; and of the forest community as against the hobo logging camp."*[25]

Coupled, the ecological objectives of Mackaye and the economic imperatives of Lovejoy would lay the groundwork for revolutionary developments in the field of land planning and sustained land production. Shifts that later crystallized in the work of Richard T. Ely, a German-trained reformist and economist from the University of Wisconsin who would go on to develop a new field of effective land utilization arguing for a more consolidated understanding of the Cutover Region. Disfavoring the uncoordinated efforts of the greedy land hustler or the uninformed reckless farmer, Ely's vision for more synthetic strategies later took shape in 1940 in *Land Economics*, a radical book that spawned the development of a discipline that aimed at the establishment of a new order and strong stability to the Cutover Region.[26] "From a distance of several decades, it is difficult to realize that the cutover crisis is essentially one of agriculture. Farmers are largely absent from this land today, having been replaced by a crop of trees which, to the untutored eye, looks more like a primeval forest. Yet a thread of continuity runs through the cutover story, whether the crop was corn, cattle or pine."[27]

For one of for the first times in the history of North America, collective farsighted reclamation of land supplants the nearsighted individuated efforts of private land tenure. In this lofty publication, Ely sets out the ground work for instituting a new and contemporary approach to the development of land based on existing site conditions, *regional co-operation* and state legislation that, at its base, uniquely hinged on the empirical understanding of bio-physical resources especially that of groundwater at the watershed level where,

> *"percolating water found in the interstices between soil and rock particles constitutes a vast resource of water. It is estimated that if [groundwater in the United States] were brought to the surface it would form a lake from 500 to 1000 feet deep. As early as 1927 it was reported that the water level had fallen 48 feet in five years in Indiana, and some of the cities had to shift to surface water for their needs. It is claimed that the drain upon subsurface water in the Great Lakes Region was an important element in reducing the seepage into the lakes and streams and consequently an important factor in lowering the level of the Great Lakes. The rights to underground water are even more complicated than the rights to surface water because the supply is invisible and the volume and direction of flow are usually unknown."*[28]

In remarkable opposition to European forms of urbanization, Ely was drawing up the blueprint of an entirely new economic structure, mapping out land reclamation strategies based on pre-existing stock of environmental conditions particularly centered on the value, significance and magnitude of water-based resources. To accomplish this in the Cutover Region, Ely es sentially promoted the *de-zoning* of the land - rather than the settling of it - taking it out of so-called productive use and re-allocating land uses that were directly generated from soil types, micro-climates and water resources. Founder of the American Economic Association and bullish proponent of labor organizations and public control of resources, Ely's vision was a revolutionary development that can be considered one of the most significant innovations in land utilization since the square mile grid that was grafted onto the American landscape more than a century earlier by Lewis & Clark, famed surveyors at the turn of the 19th century.

No coincidence was it that a Prairie School architect would unveil almost simultaneously, an intricately detailed scale model, twelve by twelve foot in size, representing a hypothetical four square mile community proposal in the early 1940s. Aptly titled BroadAcre City, the proposal was largely an antithesis to the European concept of the city, towards conceiving a Midwestern structure that uniquely incorpo rated water as primary infracture amidst an

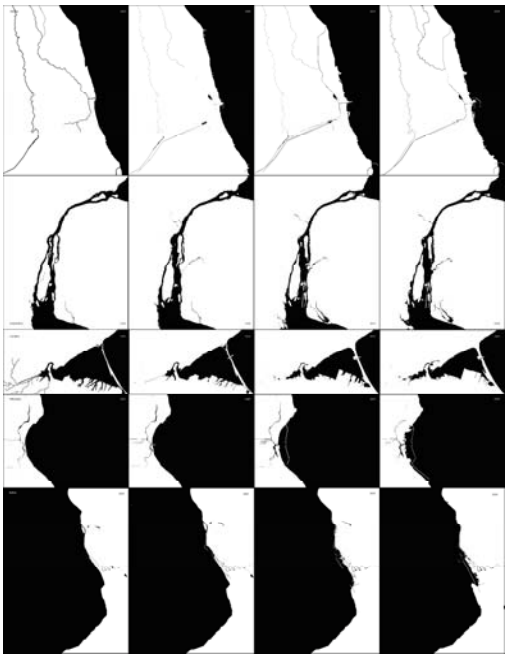

Fig. 3. Landscape Urbanization: 200-year chronological transformation of shorelines in Great Lakes cities as a result of inland harbour development, rail transportation, industrial port activity, maritime shipping and lakeshore expressways. From top to bottom: Chicago, Detroit-Windsor, Hamilton, Milwaukee and Buffalo (Diagram: Pierre Bélanger).

expansive flat land of agriculture, housing and industry. Almost two decades later, in stark resemblance to the policies of Richard T. Ely, a young architect by the name of Frank Lloyd Wright would distill the essence of the land settlement challenge in the Mid-West in his 1958 manifesto *Living City* in which he proclaimed: "We should have a system of economics that is structure…that is organic tools. We do not [currently] have it."[29] A statement that echoed a 1951 luncheon address to the Henry George School Commerce and Industry in Chicago, when Wright proclaimed: "We are all hanging by our eyebrows from skyhooks economically, just as we are architecturally. Henry George showed us the only organic solution of the land problem."[30]

From the forty million northern acres in Michigan, Wisconsin, and Minnesota that had been stripped of choice timber by 1900 to the more than 50,000 brownfield sites in the Great Lakes Region today, the historical re-structuring of land in the Great Lakes Region is therefore nothing new. As landscape projects, the operations proposed by Benton Mackaye, Richard Ely, Frank Lloyd Wright, Kenneth Galbraith, Lois Gibbs and Michael Hough each argue against the lop-sidedness of modern industrialization for a new equilibrium that harnesses and replenishes, rather than exploits, available resources and materials. At their base, these operations each seek to establish new synergies and reciprocities between the forces of urbanization (trade, production, transportation, housing, waste) and ecological systems (water, soil, climate, bio-mass, wildlife). As strategies, they offer a way to address the recent evaporation of manufacturing plants, the fields of abandoned lands, the legacy of contaminated sites and the overall depletion of fresh water resources in the Great Lakes. As visions, they point the way towards understanding how the hollowing out of inner cities and the onslaught of global outsourcing can redefine how we conventionally perceive the structure of the city; in favor of a more *reflexive* understanding of the urban landscape that incorporates forces exercised at the scale of the urban, the regional, the continental, and the global (Fig. 3). Seen as a retroactive and reciprocal process, how then can the relationship between urban economies and bio-physical systems inform the restructuring of post-industrial landscape?[31]

Streams & Synergies

Paramount to the revision of the post-industrial project is the dismantling of the New World's inheritance of the Old World concept of the city. That effort ironically starts with a French geographer implanted to the United States by the Twentieth Century Fund in the 1950s. Coining the term *megalopolis*, Jean Gottman answered the call to explain the logic of a rapidly spreading horizontal pattern of urbanization of the Northeastern coastal region. Demanding a radical reconsideration of the European notion of the city as the locust of urban activity, Gottman's baedeker-like tome called for an alternative, more decisively North American pattern where,

> *"We must abandon the idea of the city as a tightly settled and organized unit in which people, activities, and riches are crowded into a very small area clearly separated from its non urban surroundings. Every city in this region spreads out far and wide around its original nucleus; it grows amidst an irregularly colloidal mixture of rural and suburban landscapes; it melts on broad fronts with other mixtures, of somewhat similar though different texture, belonging to the suburban neighborhoods of other cities."*[32]

So it is of no coincidence that the cover of Gottman's magnum opus bears a diagram where the continuous topography of continental divides essentially prefigures as the primary spine that holds the world together. Gottman's megalopolis project was later picked up and applied as a theory of urban growth in Constantine Doxiadis' study of the Detroit area as the heart of a Great Lakes Megalopolis during the late 1960s for the Detroit Edison company[33]. And although Doixiadis failed to predict the pattern of de-industrialization of Detroit and other Rust Belt Cities that was already underway, his findings confirm the prevalence of a distinctive pattern of low rise urbanization in North America that would essentially persist in the decades to come thanks to the rise of individual purchasing power, individual mobility and individual housing. In retrospect, Doxiadis and Gottman's work can be seen as the genealogy of a late century regionalism that correlated patterns of urban growth and geography in the Great Lakes and the Mid-Atlantic.

More recently, this post-industrial regionalism has informed and re-adapted by the legislative work of the Toronto Waterfront Regeneration Trust in what is referred to as the Toronto Bioregion. In the early 1990s, David Crombie, now President of the Canadian Urban Institute, drew up a seven volume report laying out a remarkably straightforward framework. In clear resemblance to the work of Benton Mackaye, Crombie proposed a landscape system for cities within the Lake Ontario watershed by simply delineating major bio-physical zones for non-development other urban areas for re-development. Rather than control growth, the system privileged the pre-emptive and pro-active conservation of bio-physical features like the Oak Ridges Moraine and the Niagara Escarpment – as an *infrastructure* - while ensuring that "the waterfront be clean, green, useable, diverse, open, accessible, connected, affordable, and attractive."[34]

Today, this post-industrial regionalism has also been re-adapted at the urban scale in the political work of Jay Williams a thirty five year old mayor who, despite the odds of being elected because of age and race, became the mayor of Youngstown, Ohio in 2005. The former steel town lost more than half of its 170,000 residents in the past twenty years from countless plant shutdowns like Republic Steel and Youngstown Sheet & Tube Company. Rather than growing its way back to prosperity, Youngstown has recently implemented a strategy of protracted shrinkage. Echoing Ely's approach to land economics, Williams' strategy is novel in that it calls for an overall downsizing of the city by razing derelict buildings, by cutting off infrastructure (like power and sewage) to fully abandoned tracts of land and re-zoning vacant lots into pocket parks where back taxes are exchanged for land stewardship. Youngstown's decommissioning strategy suggests a general process of urban *un-development* and land *de-incorporation* to reduce the tax burden on citizens and maintenance burden on public works department. "So instead of capturing its industrial past, Youngstown hopes to capitalize on its high vacancy rates and underused public spaces to become a culturally rich bedroom community serving Cleveland and Pittsburg both of which are 70 miles away."[35]

The revisionist quest for a more contemporary understanding of urban land patterns in North America in the wake of 20th century industrialization clearly demonstrates how to begin closing the gap between economic development and ecological imperatives by factoring in the uncompromising scale of the continental landscape, a factor that privileges by necessity low-rise urban development and horizontal spread. Whereas in the past century, industry destroyed the environment in service of the economy, today, the environment *is* the economy. Youngtown's case is a microcosm of subtle and incremental shifts rendered visible at the scale of the in the Great Lakes Region, clearly evident by the emergence of three cumulative streams of development that warrant critical and more elaborate consideration: urban ecologies, bio-industries and waste economies.

Fig. 4. The Great Lakes Areas of Concern (AOCs): jointly designated by the US-Canada Great Lakes

Water Quality Agreement (Annex 2 of the 1987 Protocol), these areas are defined as "severely degraded geographic areas that fail to meet the general or specific objectives of the agreement where such failures has cause or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." The U.S. and Canadian governments have identified 43 of such areas; 26 in U.S. waters, 17 in Canadian waters and 5 are shared between U.S. and Canada on connecting river systems (Diagram: Pierre Bélanger).

Urban Ecologies

The first stream of development is the renewed focus on urban ecologies, the bio-physical system that has experienced a considerable revival over the pas decade due to several developments in the environmental sciences. Over the past two decades for example, the emergence of the field of landscape ecology[36] has enlightened our understanding of the long terms effects of industrialization on biological systems that range from lake eutrophication and sediment contamination to the depletion of fish populations and water reserves. These effects can now be better understood both at the macro- and micro-scale, radically altering the perception of heavy industry in the watershed region of the Great Lakes from an economic generator to an environmental polluter. Together with late-century visualization technologies (from satellite photography, ground penetrating radar to deepwater sonar imaging), the slow yet large scale accumulated effects of near water industries and upstream urban activities are today not only better understood, but have literally come back to the surface over the past generation such as in the case of the Love Canal in Niagara Falls, New York.

As a result of this growing environmental *transparency*, stricter regulatory controls and increasing pressure for urban land, the redevelopment of the more than 400,000 brownfields in North America has gained significant traction over the past decade with the creation of the US EPA's Brownfields Economic Redevelopment Initiative in 1993 and Canada's National Roundtable on the Environment and the Economy in 1994. According to Environment Canada and the US Environmental Protection Agency, brownfields represent more than $2 trillion worth of property within the U.S. and Canada that is devalued due to the presence of environmental hazards. Furthermore, the total cost of restoring these sites to productive reuse is estimated to be in excess of $650 billion.

At the centre of this environmental renaissance is a massive remediation program in the Great Lakes Region spearheaded by the International Joint Commission.[37] As a *co-operative agency*, the mandate of the International Joint Commission is to advise on the use and quality of boundary waters in Canada and the United States - through the development of a series of Remedial Action Plans for 43 sites listed as high-priority Areas of Concern in the Great Lakes Region (Fig. 4). A program that bears considerable impact on the re-shaping of contemporary design practices that must necessarily operate within parameters established at the watershed level that affects everything from deepwater temperature zones to underground aquifers to upstream riparian areas.[38] One of the most pressing challenges in the redevelopment of brownfield sites on the shoreline of the Great Lakes is *sediment decontamination*. Recognized as the largest major source of contaminants in Great Lakes rivers and harbors entering the food chain, polluted sediment created by decades of industrial and municipal discharges severely limit remediation and redevelopment efforts by virtue of its scale, magnitude and complexity.

With the growing rate of urbanization of the Great Lakes region, the rapid depletion of freshwater supplies estimated between 6 to 9 times the rate of replenishment according to the World Water Federation, and the more than 24 billion gallons of municipal sewage dumped by combined sewer overflow systems according to the Sierra Legal Defence Fund, attention to the design of urban ecologies suddenly is taking on critical and pressing relevance.[39] As the world's largest reserve of fresh water second to the Polar Ice Cap in the Arctic, the design of urban ecologies in the Great Lakes watershed - once the bane of Northeastern industrialization - stands to become an influential prototype as one of the 106 fresh watersheds of the world, where over 60% to 75% of the population will live by the year 2025.

Bio-Industries

The second stream of development is the emergence of bio-industries. With a population count of over 30 million people, the Great Lakes Region is now producing, under pressure of its past decline, a set of new industries currently emerging from tighter environmental controls. Lying within a day's drive or an hour flight, the region is home to 50 percent of the

combined Canada - U.S. population, representing 75 percent of the two countries' combined purchasing power. Popularly known as the green industry, the emergence of bio-industries can be viewed as the expansion and the improvement of previously untapped forms of land-based development spawned by micro-level technologies such as nanotechnology and bio-engineering, and by macro-level strategies such as agro-forestry or waste farming unilaterally focused on closing the material loop or harvesting renewable energy.

Different from the conventional, mono-functional industries of cash crops and animal feed lots that rely on heavy inputs of imported energy and large economies of scale, the bio-industry is premised on more diverse, lighter and more opportunistic forms of development; renewable energy sources (from alternatives to conventional energy inputs such as oil, gas and coal), technological innovations (new manufacturing techniques or cultivation systems) and labor flexibilities (seasonally mobile labor force). According to Paul Hawken, author of *The Ecology of Commerce: A Declaration of Sustainability who* recognized early on the importance of this shift in the early 1990s,

> *"business is on the verge of a transformation, a change brought on by social and biological forces that can no longer be ignored or put aside, a change so thorough and sweeping that in the decades to come business will be unrecognizable when compared to the commercial institutions of today."* [40]

With the replenishment of regional water resources in the past decade, the Rust Belt region is shifting to a more diverse economic base where some of the most fastest growing industries now include viticulture (wine & grape industry), silviculture (timber and dimensional lumber industry) and floriculture (greenhouse and nursery industry) to name a few. So competitive has it become to conventional heavy industry, the bio-industries are in fact exploding. Floriculture for example is currently outpacing all other major commodity sectors in sales growth according to the U.S. Dept. of Agriculture Economic Research Service since the early 1990s.[41]

Well into a decade of burgeoning expansion, growth rates in the bio-industry has oscillated between 5% and 10%, with retail expenditures topping 50 billion dollars a year for seemingly banal products like cut flowers, cultivated greens, potted flowering plants, bedding plants, sod, ground covers, nursery crops, bulbs, cut Christmas trees, and every other nursery or greenhouse product imaginable. Since the past decade, these new forms of industrial production[42] are rapidly taking root in the Great Lakes and evidenced by three types of bio-industries: green house start-ups in the Niagara Region that doubled between 2000 and 2005,[43] the construction of America's first indoor composting facility on the site of a former tire manufacturing facility in the Hamilton Harbour in 2005 and the construction of the Northeast's first bio-fuel plant on the site of a former brewery in Fulton, New York in 2006.

As neo-industrialism, the bio-industry is further distinguished from conventional industrialism in what it takes, what it makes and what it wastes. Conventional forms of industry are typically linear, fixed and self-depleting as opposed to being networked, flexible and renewable.[44] Surprisingly, these developments echo a radical observation that ironically came from the very same inventor of the assembly line, almost a century ago, when Henry Ford proclaimed that:

> *"The fuel of the future is going to come from fruit like that sumach out by the road, or from apples, weeds, sawdust – almost anything. There is fuel in every vegetable matter than can be fermented. There's enough alcohol on one's year yield of an acre of potatoes to drive the machinery necessary to cultivate the field for a hundred years."*[45]

The stream of bio-industrial development point towards a greater shift over the past century, from economies that are based on the import of non-renewable hydrocarbons (oil, coal, natural gas), to economies based on the regional cultivation of renewable carbohydrates (soils, vegetal materials and other bio-mass), while harnessing the competitive forces of global outsourcing, automated manufacturing and just-in-time delivery.

Waste Economies

The third stream of development is the management of waste materials generated by urban and industrial processes. Over the past decade, an unprecedented re-organization of the municipal solid waste industry has taken place in the Great Lakes Region as a result of the closure of the world's largest landfill, Fresh Kills Landfill in New York City, and from the tightening of environmental controls by the

U.S. Environmental Protection Agency. While the number of landfills has actually decreased throughout the United States and Canada, the rate of landfilling has dramatically increased during the past 10 years, resulting in the creation of mega size landfills whose operations are essentially aimed at achieving greater economies of scale. At the centre of this extraordinary transformation is the State of Michigan, the third largest importer of trash in the U.S. (next to Pennsylvania and Virginia) and home to the largest waste disposal sites in the Great Lakes region. Heightened by cross-border movements of solid waste between Canada and the United States, the shier magnitude of the operations is staggering, "receiving approximately a 40-ton truck and trailer every three minutes."[46]

The contemporary challenge of mass-landfilling in Michigan – the international magnet for municipal solid waste in the Great Lakes - effectively signals a tipping point in the handling of garbage in big cities. Unilateral solutions to garbage collection and disposal born from mid 20th century industrialized forms of planning and engineering can no longer deal with the magnitude and the complexity of urban waste streams. A challenge magnified by the reality that commercial waste streams from the North American construction and demolition industry represent twice as much as the municipal sector (400 versus 235 million tons), a figure dwarfed by waste streams in the mining industry that represent five to ten times more every year (2-3 billion tons). So, notwithstanding the environmental consequences, energy inputs and geopolitical costs of landfilling, how then can the industrialization of waste management be transformed into a new economic sector?

Quantifying and mapping the life cycle of industrial process (material inputs, energy requirements, emissions, discharges) and the waste streams of urbanization (surface run-off, sewer outflows) is the first leap required of industry for the effective transformation of waste economies. For example, the invention of steel was the invention of slag, the invention of petroleum was the invention of plastic, the invention of cement was the invention of sulfuric gas, the invention of sewage was the invention of sludge. These observations form the basis of the emerging field of *industrial ecology*, a discipline that involves the transactions and exchanges of chemical waste products between different industrial operations in industrial parks or urban districts, according to existing transportation networks.[47]

Fig. 5. Global Watersheds: the 106 primary freshwater basins of the world. The United Nations reports that 60 to 75% of the world's population will be living downstream in watershed deltas and estuaries by 2025 (Diagram: Pierre Bélanger, adapted from the Word Water Federation).

Closing the material loop is the second leap required of industry in the waste economy. Multilateral strategies that include *diversion, separation, recycling and composting*, are proving effective as durable alternatives to conventional systems of waste management. One of the most recent examples of the potential effectiveness of strategically integrated programs at the urban scale is a new, state-of-the-art composting facility on the site of a former tire manufacturing plant, contaminated with polychlorinated biphenyls (PCBs) and petro-hydrocarbons (PHCs) in the Hamilton-Harbor. Built by a world-class public-private partnership between the City of Hamilton's Waste Division, Maple Reinders Constructors (a Canadian design-build company) and the Christiaens Group (a Dutch composting and mushroom technology expert), the 40-acre facility can process at full capacity up to 90,000 tons of compost every year, enough for a city of almost 1 million people. As the first and largest indoor facility of its kind in North America, the operative costs at this central composting facility (CCF) are remarkably 25% to 35% lower than landfilling costs, simultaneously offsetting the cost of site bio-remediation such as in-situ deep molasses injection. As a result, the former urban landfill that was once the most active industrial site in the region is ironically being squeezed out of the market, straddling bankruptcy as diversion strategies literally bring waste back into the economic loop.[48]

Essentially, the strategy of *diversion* is but one example of reciprocal mechanisms inherent to an operational and logistical understanding of materials management in urban areas. Back at the Central Composting Facility in the Hamilton Harbor, there are plans to expand the facility with sorting recyclable materials that, on a per-ton basis, could generate 10 times more jobs than landfilling. At the continental scale, the statistical effect of recycling is staggering: "if all of the 25.5 million tons of durable goods now discarded into America's landfills each year were reclaimed through reuse, it is estimated that more than 100,000 new jobs could be created in this industry alone."[49] A fact echoed by the Northeast Recycling Council, where "recycling provides the bedrock for large, robust manufacturing industries in the United States that use reusable materials. It provides manufacturing industries with raw materials that are less expensive than virgin sources,"[50] a long-term economic advantage that translates into value for consumers who ultimately spend less on products and packaging:

> *"For example, in the area of paper manufacturing, new mills making paper for corrugated boxes, newsprint, commercial tissue products and folding cartons have lower capital and operating costs than new mills using virgin wood. This is why U.S. pulp paper manufacturers have voluntarily built or expanded more than 45 recycled paper mills in the 1990's and are projected to spend more than $10 billion on such facilities by the end of the decade. A substantial acceleration in the rate of use of recovered paper by U.S. paper manufacturers began around 1985, coinciding with the expansion of business and community recycling collection programs and increases in landfill disposal fees in the Northeast and West Coast. Recycling has long been the lower-cost manufacturing option for aluminum smelters, and is essential to the scrap-fired steel mini-mills that are part of the rebirth of a globally competitive U.S. steel industry."* [51]

This is where the multiplier effect of the recycling industry eclipses the landfilling industry through employment spin-offs and technological innovation. Where bio-remediation alone cannot solve the challenge of brownfield redevelopment, the incendiary effect of new integrated regional economies offers a significant model for the reuse of land where remediation costs are offset by the overall returns from productive land re-development.[52]

With the more than 250 million tons of municipal solid waste generated each year and the 400,000 brownfields currently idling across North America, the evidence suggests that the unilateral dependence on landfilling can be counteracted through new, previously unforeseen economic and ecological synergies that exist between public regulatory agencies and private turn key enterprises…where it matters the most: at the source, in urban areas.

The effectiveness of diversion also operates at a broader scale in regional materials program. Waste diversion programs like the Comprehensive Nutrient Management Plan (strategy for the land application of animal waste from feedlots as fertilizer on farm fields, in order to minimize water quality and public health impacts) developed in the mid 1990s and the USACE's Beneficial Material Reuse Management Program (sediment decontamination coupled with material management programs) provide an untapped strategy towards achieving greater economies of scale in the remediation of contaminated underwater lakebeds and upland sites. With the more than 70 million tons of sediment dredged from the ports of Great Lakes Cities over the past 30 years, the potential for diversion of excavated materials from the mouths of rivers towards inactive or abandoned industrial sites seems limitless.[53]

Compounded, these programs also prove the effectiveness of how landscape-based strategies can potentially solve two challenges all at once. A dualized approach to land redevelopment can re-structure the wasteland of landfills and contaminated sites across America, while avoiding the historical restoration of bucolic land uses such as parks or parking lots (like Monte Testaccio in Rome, Buttes de Chaumont in France and Flushing Meadows in New York) towards serving a larger purpose of urban economic regeneration. Shit in other words, the waste of the 21st century is the new food.[54]

Conclusion: Landscape as Infrastructure

As contemporary streams of development, the recovery of urban ecologies, the growth of bio-industries and the emergence of waste economies elucidate how the post-industrial landscape can be re-organized as a contemporary infrastructure. These streams flow across a widening field of intervention where design - as an integrative discipline concerned with the operative, logistical and spatial aspects of urbanization - can engage existing programs and

processes, at large geographic scales. The engineering of basic elements such as topography, hydrology and bio-mass expressed through process diagrams and logistical schedules suddenly hold significant agency in the translation of invisible yet fundamental processes that support urban development. What is most compelling about this operational optic is that it avoids the trap of post-industrial landscape remediation by acknowledging the latent reciprocity between biological processes, industrial operations and urban land uses with the need to synthesize conditions that may have previously seemed unconnected or even opposing. But let's make no mistake; the effects of future transformation will be rather slow and subtle, requiring the active and sustained engagement of long term, opportunistic partnerships that bridge the private and public sectors.

Sequencing of land transformations over time, synergies between land uses and reciprocities between different agencies, can therefore amplify and accelerate these strategies, placing emphasis on performative effects rather than their end results. The *synthesis* of urban operations – coupled with the reflexive mechanisms that underlie them - can therefore lead towards the development of a co-operative landscape practice for the present and future reclamation of post-industrial landscapes in the Great Lakes Region.[55]

From the case of the 40 million acres of abandoned stump fields of the 19th century Cutover to the remediation 20,000 tons of toxic chemicals buried in the Love Canal site of the 20th century to the management of the 6 quadrillion liters of fresh water in the Great Lakes, a reconsideration of the banal infrastructures of urban operation is pressing. Greater attention and integration of streams of development in waste, water, transport and energy streams of development in may in fact elucidate some of the more fundamental processes that underlie the contemporary urban landscape today. Seen over time, these processes may appear as incredibly subtle or fleetingly ephemeral, but will in fact prove as an extremely stable and robust infrastructure for the 21st century economy of the New World.

Endnotes

[1] See Kirkwood, Niall. *Manufactured Sites: Rethinking the Post-Industrial Landscape* Spon Press: London, 2001. back cover.

[2] See Corner, James. "Not Unlike Life Itself: Landscape Strategy Now" in *Harvard Design Magazine 21* (Fall/Winter 2004). p 32-34.

[3] Urbanization is explicitly used here to designate the process an propensity to increase, stabilize or reduce the occupational carrying capacity and productivity of land.

[4] Reflexive designates an asymmetrical process of folding or bending back onto itself; or a process that is carried out or produced in reaction, resistance or return to an existing condition. See Beck, Ulrich, Anthony Giddens & Scott Lash. *Reflexive Modernization: Politics, Modernization and Aesthetics in the Modern Social Order* Polity Press: Cambridge, 1994).

[5] The discourse on the post-industrial landscape remains incomplete until discussing the work of John Kenneth Galbraith - originally from small rural agricultural community in Southern Ontario - in his revolutionary bestseller *The New Industrial State* at the end of the 1960s, in which he charted six of the most noticeable cumulative aspects of modern mass industry: the world renowned economist John Kenneth Galbraith laid out in his revolutionary bestseller The New Industrial State at the end of the 1960s, six of the most noticeable effects of modern mass industry: 1) scale, increased time span of production evidenced by the deployment of large production processes, large labor demands and large energy inputs; 2) heavy equipment, increased technological investments evidenced by the development of large, horizontal production plants, warehouses and industrial parks; 3) capital, increased financial investments evidenced by the development of large banks and insurance companies, 4) labor division, increased specialization of job tasks evidenced by large assembly lines and large trade unions; 5) incorporation, hyper-organization of complex production systems evidenced by the development of large, corporate structures and large legal bodies; and 6) planning, necessity for total planning at all levels of the production process evidenced by large, hierarchical bureaucracies, commercial divisions and production protocols.

[6] Chemicals found at the Love Canal such as dioxin-tainted trichlorophenols are by-products of caustic soda production, a major base chemical manufacturing commodity in the commercial production of chlorine for the petroleum refining, pulp and paper, water treatment and aluminum industries. Like soda ash and sulfuric acid, it is one of the workhorses of the chemical industry and there is scarcely a single chemical in the world that does not require one or more of these three basic agents for its production.

[7] Between 1974 and 1978, defects occurred in 56 percent of births at Love Canal.

[8] Beck, Eckardt C.. "The Love Canal Tragedy" in *EPA Journal* (January 1979). www.epa.gov/history/topics/lovecanal/01.htm

[9] U.S. President Jimmy Carter declared Love Canal a federal disaster zone in 1978.

[10] Environmental legislation in the United States emerged at a time of heightened environmental awareness around the world with incidents such as Ridderkerk toxic dumpsite in The Netherlands (1981), the Tar Ponds in Sydney, Canada (1982), the Times Beach dioxin spraying incident in Missouri (1983), the DOW chemical spill in Bhopal, India (1984) and the nuclear reactor accident in Chernobyl, Ukraine (1986).

[11] The National Center for Policy Analysis provides a stinging indictment of the CERCLA program in "Superfund: A History of Failure" *Brief Analysis No. 198* (21 March 1996).

[12] Lakeside land reclamation using industrial materials bears environmental risks such as chemical leaching, heavy metal contamination, increased turbidity, increased biological oxygen demand and fish habitat depletion.

[13] See Toronto and Region Conservation Authority. *Tommy Thompson Park - Public Urban Wilderness: Habitat Creation & enhancement Projects, 1995 -2000* TRCA: Toronto, 2000.

[14] Hough, Michael. *Cities and Natural Process*, Second Edition Routledge: New York, 2004. p 139.

[15] Synthetic is critically employed here as the result of a process of combining and composing different elements to form a whole or a complex of parts. See Bélanger, Pierre. "Synthetic Surfaces" in Waldheim, Charles (ed.), *The Landscape Urbanism Reader* Princeton Architectural Press: New York, 2006. p 239-265.

[16] Geo-economics involves the research, planning and development of land and industry to build strong economies and improve quality of life. The field of research was pioneered between the 1950s and 80s by McKinley Conway, an aeronautical engineer from the Southern United States who founded the International Development Research Council and the World Development Federation in the 1980s. See Conway, McKinley. "Geo-Economics: The Emerging Science" *IDRC Research Report No. 1* (May 1983).

[17] These 4 industrial factors were adapted from McKinley Conway's book *Industrial Park Growth* (Conway Publications: Atlanta, 1979) provides a quantitative analysis of the emergence and expansion of industrial parks that bloomed across America after World War II.

[18] According to the U.S. Environmental Protection Agency and Environment Canada, there are approximately 50,000 brownfields in the Great Lakes region with real or perceived levels of contamination that pose obstacles to redevelopment.

[19] Garreau, Joel. "The Foundry" in *The Nine Nations of North America* Houghton Mifflin Company: Boston, 1981. p 49-97.

[20] On the effects of global outsourcing, see Thomas L. Friedman *The World Is Flat: a Brief History of the Twenty-first Century* Farrar, Straus and Giroux: New York, 2005.

[21] See Jones, Roland. "As Detroit falters, Asian makers pick up speed" Toyota likely to surpsass GM as world's top carmaker; China lurks in wings" *MSNBC Business News* (9 May 2006). www.msnbc.msn.com/id/10532121/.

[22] Post-industrial manufacturing centres like Flint, Sudbury and Youngstown that grew from and singularly relied on one or two industries should be distinguished from larger more diverse centres of economic activity like Toronto and Chicago that provide access to social services like medical health care, education and mass transit.

[23] Benton Mackaye's role in the history of the conservation movement and impacts on land planning is thoroughly chronicled by Paul Sutter in "A Retreat from Profit: Colonization, the Appalachian Trail, and the social roots of Benton MacKaye's wilderness advocacy". *Journal of Environmental History* (October 1999).

[24] These strategies resemble 18th century colonization programs like the "Come to Detroit" campaign employed in the 1750s, when the Governor General of New France provided incentives such as a spade, axe, sow, plough, seed stock, wagon and a cow to attract newcomers to the swamplands in Michigan and rendered from rampant uncoordinated deforestation. See "This Date in Michigan History: May 24, 749". www.michiganhistorymagazine.com/date/may03/05_24_1749.html

[25] Mackaye, Benton. "Colonization of Timberlands – Synopsis" (1917), *U.S. Forest Service* (Dartmouth College Library, The Papers of Benton Mackaye) Box 181, Folder 31. p 3.

[26] Different from land planning or real estate development, land economics is a hybrid scientific discipline crossbred from the fields of economics and agriculture that relies on a regional perspective for the effective re-organization and use of land over long periods of time taking into account natural endowment of resources.

[27] Kates, James. *Planning a Wilderness: Regenerating the Great Lakes Cutover Region* University of Minnesota Press: Minneapolis, 2001. p 16.

[28] Ely, Richard T. & George S. Wehrwein. *Land Economics* The MacMillan Company: New York, 1940. p 382-383.

[29] Wright, Frank Lloyd. *The Living City* Horizon Press, New York, 1958. p 162.

[30] *Ibid*, p 162.

[31] This question exposes the lack of correlation between the economy and the environment in the branded canons of urban growth in America such as New Urbanism, Smart Growth and Community Planning. See Florida, Richard. "The New Megalopolis: Our focus on cities is wrong. Growth and innovation construct new urban corridors" *Newsweek International (*July 3-10, 2006) and "Defining the Supercity" in Conway, McKinley. *The Great Cities of the Future The Futurist Magazine* (June-July 1999).

[32] Gottman, Jean. *Megalopolis: The urbanized Northeastern seaboard of the United States* Twentieth Century Fund: New York, 1957.

[33] See Doxiadis, C. A. *Emergence and Growth of an Urban Region: The Developing Urban Detroit Area - A Study directed by and carried out by Doxiadis Associates with the participation of Wayne State University and the Detroit Edison Company* The Detroit Edison Company: Detroit, 1967-1970.

[34] Crombie, David. *Watershed: Interim Report* Royal Commission on the Future of the Waterfront: Toronto, 1990. p 4. Crombie's seven volume opus is summarized in *Regeneration: On the Great Toronto Bio-Region* Royal Commission on the Future of the Waterfront: Toronto, 1994.

[35] Lanks, Belinda. "Creative Shrinkage" *New York Times* (10 December 2006). For more information on Williams' award winning strategy, see "Accepting that Youngstown is a smaller city" and "Defining Youngstown's image in the new regional economy" in *Youngstown 2010: The Vision*, www.youngstown2010.com.

[36] See "The Emergence of Landscape Ecology" in Forman, Richard T.T. & Michel Godron (eds.) *Landscape Ecology* John Wiley & Sons: New York, 1986). p 3-31.

[37] The International Commission is an independent binational organization established by the 1909 Boundary Waters Treaty to strategically control the amount of water that could be diverted from the Niagara Falls and to prevent further diversion of waters from the Great Lakes Basin.

[38] The conservation and transformation of urban ecologies relies on a sound scientific understanding of topography and vegetal systems while acknowledging the fundamental importance of water – quantitatively and qualitatively - as the underlying superstructure at the regional watershed scale. The tectonic value of landforms and bio-economic characteristics of vegetal systems are best expressed in the writings

of Clemens Steenbergen, a landscape architect from the Technical University of Delft who was one of the first to establish an underlying relationship between topography and urbanism that: "While modern architecture experimented in the middle of the past century with disconnecting topography and form, the landscape became a neutral tableau, reduced to its monumental aspects. The plan was projected onto this as an autonomous intervention....Today, we find ourselves in an era where we can try to expose once again the landscape origins of the city [...] through a reformulation of its topography by reorganizing the urban fragments in the context of landscape." See Arriola, Andreu and Bernard Huet (eds.). *Modern Park Design: Recent Trends* Uitgeverij Thoth: Bussum, The Netherlands, 1994.

[39] Urban surface run-off and combined sewer overflows represent the most important pressures on infrastructure systems and water quality in the Great Lakes today. Downstream impacts are evidenced by the closures of beaches, unsightly algae and poor fish habitat. See "U.S., Canadian cities fowling the Great Lakes with raw sewage – Report Card reveal Great Lakes cities not making the grade" *Sierra Legal Defence Fund* (29 November, 2006), www.sierralegal.org/m_archive3/pr_06_11_29.html

[40] Hawken, Paul. *The Ecology of Commerce: A Declaration of Sustainability* HarperCollins Publishers: New York ,1993. p 3.

[41] See "Floriculture Worldwide: Trade And Consumption Patterns", *Agricultural Economics Research Institute* The Netherlands. www.agrsci.unibo.it/wchr/wc1/degroot.html

[42] The development of industries that are based on renewable resource inputs for raw materials has its precedents. Dating back to the turn of the century, before the advent of alcohol prohibition and well before the supremacy of Southern U.S. oil barons, vegetal sources of fuel such as hemp, soy or corn were widely publicized by Henry T. Ford and Rudolf Diesel. See "Biodiesel in the United States: A Brief History" in Pahl, Greg. *Biodiesel: Growing a New Energy Economy* Chelsea Green: 2005.

[43] Like grapes, plums, peaches and other tender fruits, greenhouse production is located in general area of the Niagara Fruit Belt due to its fertile sandy soils and warm temperate climate. According to Ontario Flower Growers Incorporated; "There are more than 250 commercial greenhouses in the Niagara region and 126 hectares (310 acres) protected under glass or plastic. The industry employs about 3,000 people in the Niagara region, generating approximately $250 million in annual sales with agri-tourism that also provides a substantial economic source for the Niagara Region", www.ontarioflowers.com/potted_plants/location.htm).

[44] Just like the Bessemer process was the first inexpensive industrial process developed for the mass-production of steel from molten pig iron in the 1940s, the composting process - an emerging bio-technology that decomposes organic materials from oxygen depletion and thermal convection - will revolutionize the industry of the mass-recycling of organic waste in the 21st century.

[45] Henry Ford, as quoted in the *Christian Science Monitor* during a trip to Sudbury (Ontario), reported in the *New York Times* "Ford predicts fuel from vegetation" (19 September 1925).

[46] See Bélanger, Pierre. "Airspace: The Operational Ecologies & Geo-Politics of Landfilling in Michigan" in Knechtel, John (ed.). *Trash* MIT Press: New York, 2006. p 139.

[47] See Lerup, Lars. *Toxic Ecology: The Struggle between Nature and Culture in the Suburban* Eighth Megacities Lecture, 2005.

[48] The Taro East Landfill that services the Greater Hamilton Area is owned by Philip Services Corporation (PSC), a waste management giant ragging under a one-billion dollar debt load from environmental lawsuits. See Marley, Michael. "Philip, subsidiaries pursue bankruptcy cover in Canada" *American Metal Market* (23 September 2003).

[49] See "The Five Most Dangerous Myths About Recycling" by Brenda Platt, The Institute for Local Self-Reliance (Washington, D.C.), www.grn.com/library/5myths.htm

[50] Marian Chertow (Director, Yale Center for Industrial Ecology), "The Economics of Recycling", Keynote, *By-Products Beneficial Use Summit*, Philadelphia PA (November 29-30, 2005).

[51] American Forest & Paper Association, *1994 Statistics; Paper, Paperboard and Wood Pulp,* pp. 52-53 and *Paper, Paperboard, Pulp Capacity and Fiber Consumption, 35th Annual Survey*, p. 12, 24 (American Forest & Paper Association: Washington DC, 1994).

[52] Critical to this transformation is the hegemony of speed in modern industrial production. From mining to agriculture to construction, the acceleration of industrial processes has essentially underpinned Modernity in the twentieth century. That underlying hegemony is currently being usurped by the combined paradigms of pace, synergy and synchronization that privilege co-operations and inter-relationships. For a related discussion on the relevance of synergy, see Haken Hermann .The Science of Structure: Synergetics Van Nostrand Reinhold Company, New York: 1981. The concept of synergies was equally popularized in the 1970s by Buckminster Fuller in two important volumes Synergetics I, II in collaboration with E.J. Applewhite (Macmillan Publishing Co.: New York, 1975 & 1979).

[53] See Voros, Andrew S. (Executive Director of the New Jersey/New York Clean Ocean Shore Trust). "Dredged Materials in Abandoned Mine Reclamation; Applications for the Great Lakes Region" keynote paper presented at the Water Environment Federation Conference (2005).

[54] Kevin Lynch is one of the first urbanists to explicitly articulate the relationship between waste, ecology and urbanism in *Wasting Away: An Exploration of Waste & Urban Ecology* Sierra Club Books: San Francisco, 1991).

[55] Co-operation is an aggregated process embedded in the functional mechanics of city-building that foregrounds the potential reciprocity between the five basic infrastructures of urban areas including water management, waste recycling, transportation logistics, food production and energy generation to achieve greater economies and ecologies of scale.