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Resilient
Cities and Landscapes

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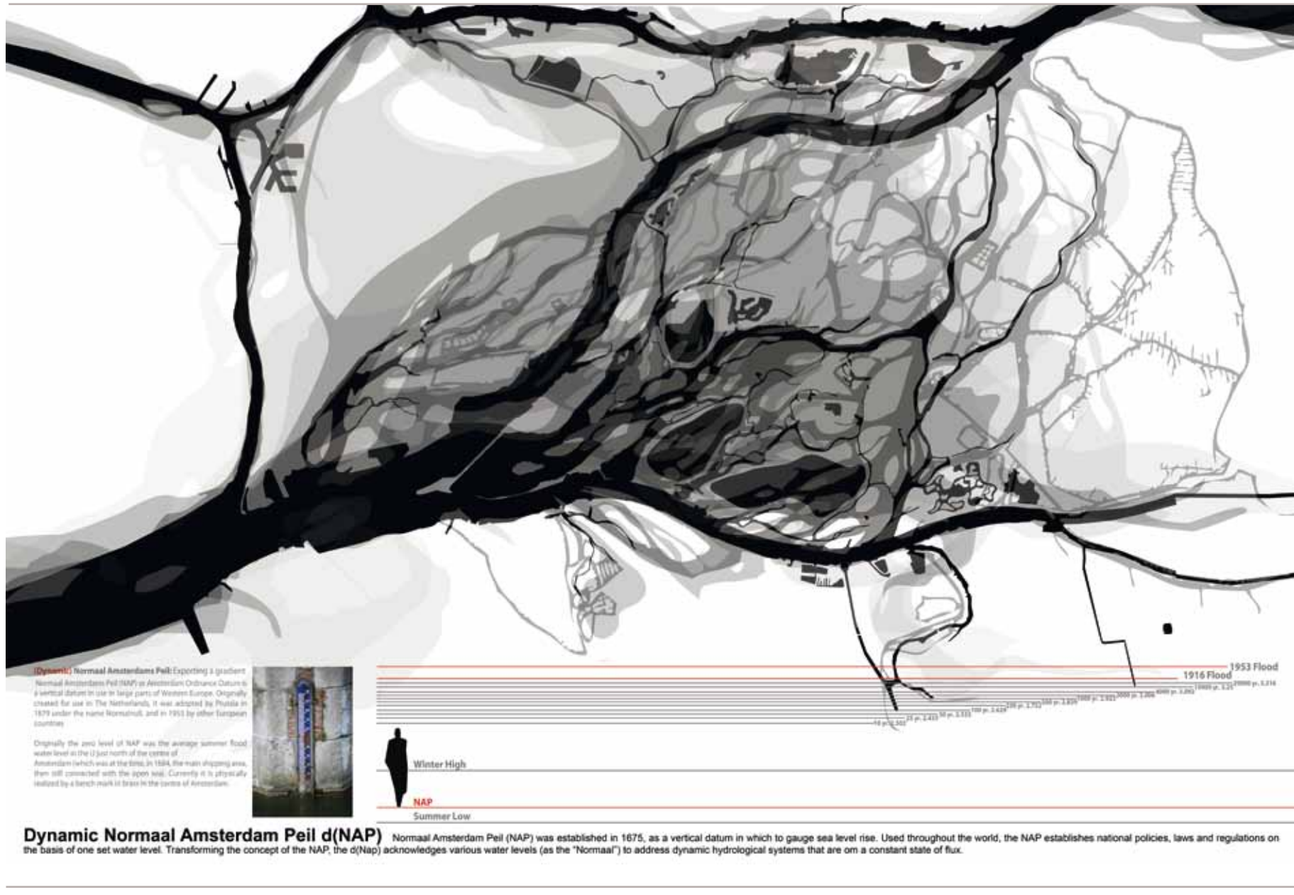
RESILIENCE

Designing the New Sustainability

Design for resilience needs an evidence-based approach that contributes to adaptive and ecologically-responsive design in the face of complexity, uncertainty and vulnerability. Put simply: What does a resilient world look like, how does it behave and how do we design for resilience?

Long-term sustainability necessitates an inherent and essential capacity for resilience – the ability to recover from disturbance, to accommodate change, and to function in a state of health. In this sense, sustainability typically means the dynamic balance between social-cultural, economic and ecological domains of human behavior necessary for humankind's long-term surviving and thriving. As such, long-term sustainability sits squarely in the domain of human intention and activity – and thus – design; it should not be confused with the ultimately impossible realm of managing "the environment" as an object separate from human action. Instead, the challenge of sustainability is very much one for design, and specifically, design for resilience.

A growing response to the increasing prevalence of major storm events has been the development of political rhetoric around the need for long-term sustainability, and in particular, its prerequisite of resilience in the face of vulnerability. As an emerging policy concept, resilience refers generally to the ability of an ecosystem to withstand and absorb change to prevailing environmental conditions; in an empirical sense, resilience is the amount of change or disruption an ecosystem can absorb and, following these change events, return to a recognizable steady state in which the system retains most of its structures,



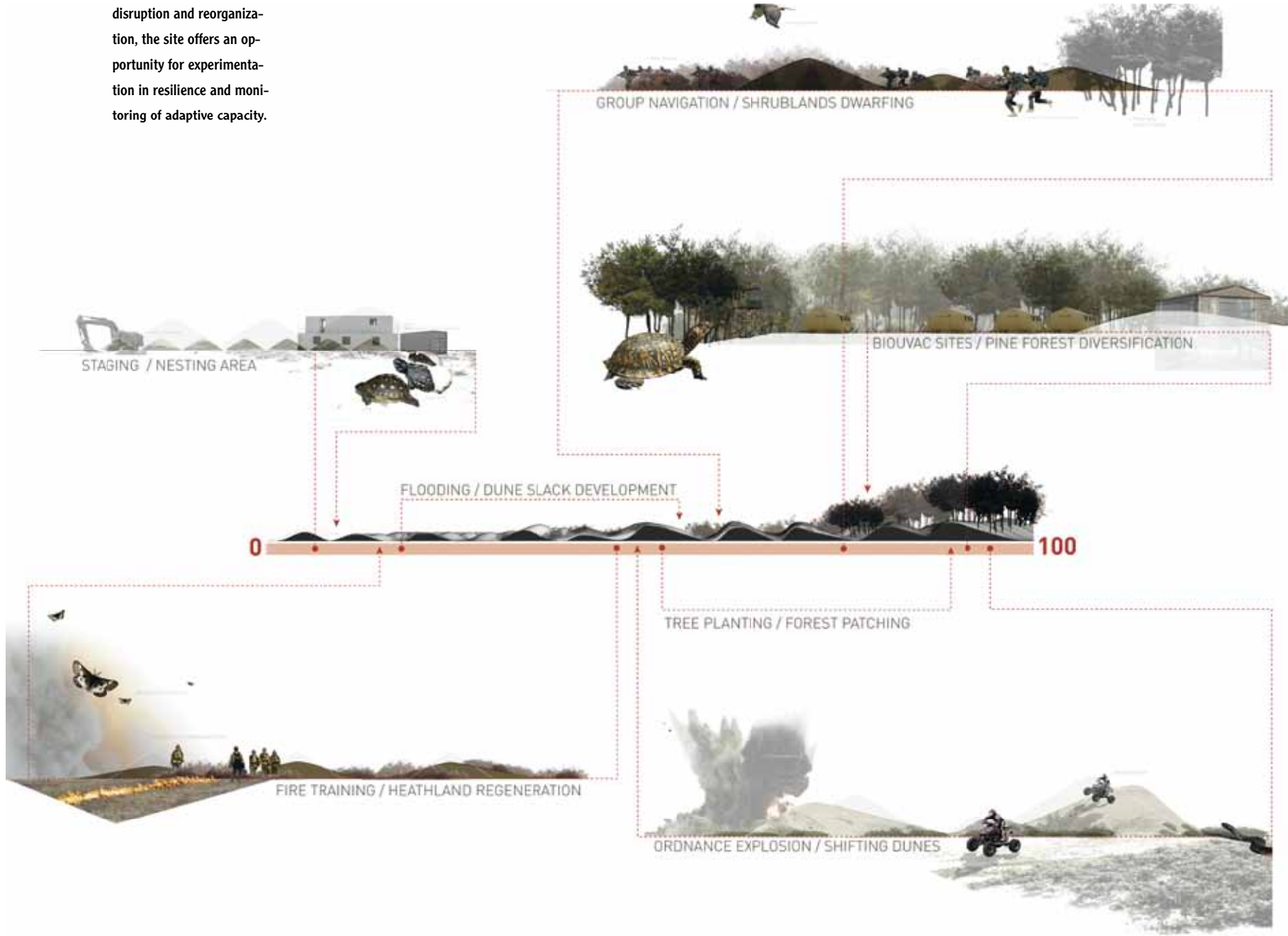
For the design studio "Depoldering Dordrecht" at the Harvard Graduate School of Design, Kimberly Garza and Sarah Thomas proposed a speculative dynamic measure of sea level for the Netherlands delta region as part of a climate-change adaptation project.

functions and feedbacks. In both contexts, resilience is a well-established concept in complex ecological systems research, with a history in resource management, governance and strategic planning. Yet despite more than two decades of this research, the development of policy strategies and design applications related to resilience is relatively recent. While there was a significant political call for (implied) resilience planning following New York's Superstorm Sandy in 2011 and the ice storm of 2013 in Toronto and the North-Eastern US, there is still a widespread lack of coordinated governance, established benchmarks, implemented policy applications, tangible design strategies, and few (if any) empirical measures of success related to climate change adaptation. There has been too little critical analysis and reflection on the need to understand, unpack and cultivate resilience beyond the rhetoric and to develop specific tactics for design. Design for resilience would benefit from an evidence-based approach that contributes to adaptive and ecologically responsive design in the face of complexity, uncertainty and vulnerability. Put simply: What does a resilient world look like, how does it behave and how do we design for resilience?

The emergence of resilience rhetoric is tied not only to the emerging reality of climate change but to an important and growing synergy between research and policy responses in the fields of ecology, landscape and urbanism – a synergy that is powerfully influenced by several remarkable and coincidental shifts at the turn of the millennium. Most notable is the global shift in urbanism in which our contemporary patterns of settlement are tending towards large-scale urbanization. The last century has been characterized by mass-migration to ever-larger urban regions, resulting in the rise of the "mega-city" and its attendant forms of suburbia, exurbia and associated phenomena of the modern metropolitan landscape. According to the World Health Organization, the percentage of people living in cities is expected to increase from less than 40 percent in 1990 to 70 percent in 2050, and the United Nations projects that in 2030 there will be 5 billion urbanites with three-quarters of them in the world's poorest countries. By contrast, in 1950, only New York and London had over 8 million residents, yet today there are more than 20 megalopoli, with the majority in Asia. Indeed, for most of the world's population, the city is fast becoming the singular landscape experience.

In North America and the United States in particular, this shift in urbanism has come (paradoxically) with a widespread decline in the quality and performance of the physical infrastructure of the city. The roads, bridges, tunnels and sewers that were built in the early part of the last century to service major urban centers are now aging (and crumbling), while both the political will and the public funds to rebuild outdated but essential public infrastructure are disappearing. What's more significant is that as these infrastructures continue to decay, they are increasingly vulnerable to catastrophic failure in the face of more frequent and severe storm events, which compounds the cost of their loss and the extent of impact.

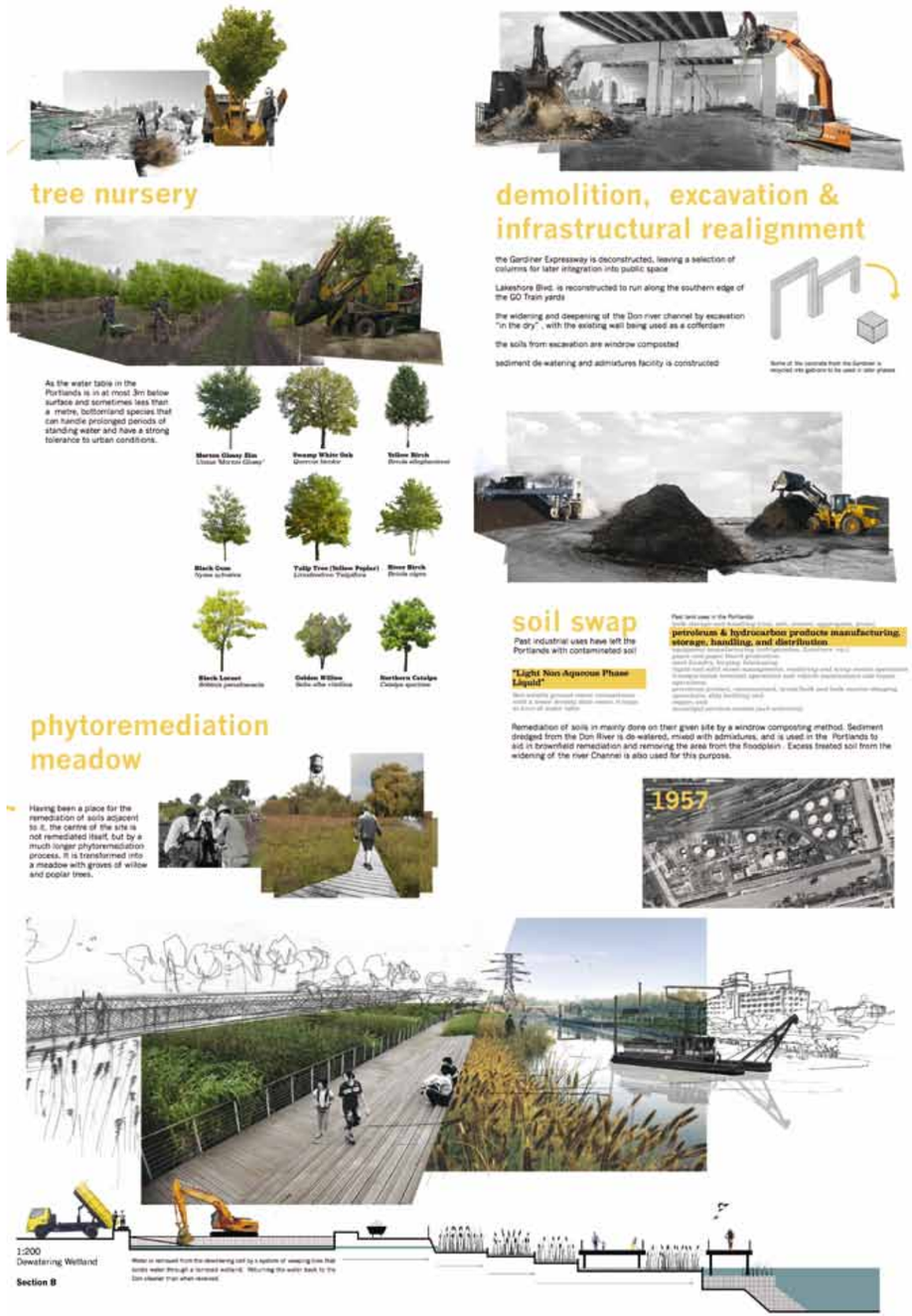
Speculative Resilience 1 – Non-Linear Habitat Management: Gena Wirth's drawing proposes multiple possible habitat scenarios in a non-linear management strategy for a still-active military training site. Characterized by episodic disruption and reorganization, the site offers an opportunity for experimentation in resilience and monitoring of adaptive capacity.



The emergence of a new paradigm in ecology represents another significant and concomitant shift with a change in urbanism and the reality of climate change. In the last 25 years, the field of ecology has moved from a concern with stability, certainty, predictability and order in favor of more contemporary understandings of dynamic systemic change and the related phenomena of uncertainty, adaptability and resilience. Increasingly, these concepts in ecological theory and complex systems thinking are found useful as frameworks for decision-making generally and, with empirical evidence, for landscape design in particular. This offers a powerful new disciplinary and practical space, equally informed by ecological knowledge as an applied science and as a construct for managing change, and within the context of sustainability, planning for and with change, as a conceptual model of design.

With this new ecological paradigm has come another important shift in creating the synergy necessary for resilience-thinking: the renaissance of landscape as both discipline and praxis throughout the last 15 years and its (re)integration with planning and architecture in both academic and applied professional domains. Landscape scholars, such as (e.g.) Beth Meyer, James Corner, Julia Czerniak and Charles Waldheim (among others) have identified the rise of urban post-industrial landscapes coupled with a focus on indeterminacy and ecological processes as catalysts for the reemergence of landscape theory and praxis. Understood today as an interdisciplinary field linking art, design and the material science of ecology, landscape scholarship and application now includes a renewed professional field of practice in the space of the city – a phenomenon clearly represented in the design projects featured in *Topos,* for example.

These shifts in our collective understanding of urbanism, landscape and ecology have created a powerful synergy for new planning and design approaches to the contemporary metropolitan region. This synergy has been an important catalyst for the emergence of resilience rhetoric, but there is much work to be done to move towards evidence-based implementation of strategies, plans and designs for resilience. The scale and impact of North American mega-storms such as Hurricane Katrina in 2005 and Superstorm Sandy in 2011 have been effective policy triggers – and design provocation – for a new breed of disaster preparedness planning in general and flood management plans in particular. Conventional policy and planning approaches to natural disasters have long been rooted in the language of resistance and control, referencing coastal defense strategies such as fortification, armoring, and shoring up using brute-force engineering responses designed to do battle with natural forces (demonstrated, e.g. ,in the work of Anuradha Mathur and Dilip da Cunha). By contrast, emerging approaches reference the language of resilience and adaptive management, and are associated with elasticity and flexibility, using hybrid engineering of constructed and ecological materials that adapt to dynamic conditions and natural forces (e.g., in the work of James Corner Field Operations, and Chris Reed/ Stoss, see p. 60). For example, work by Chris Reed

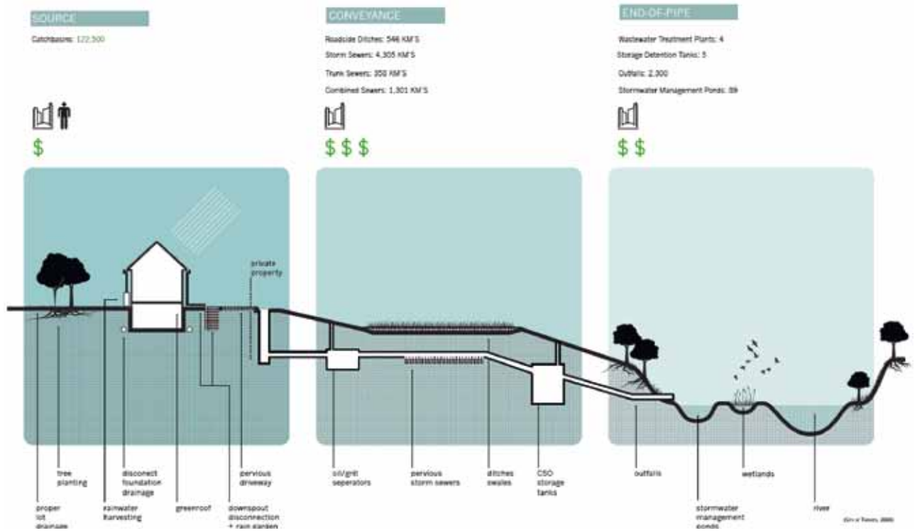


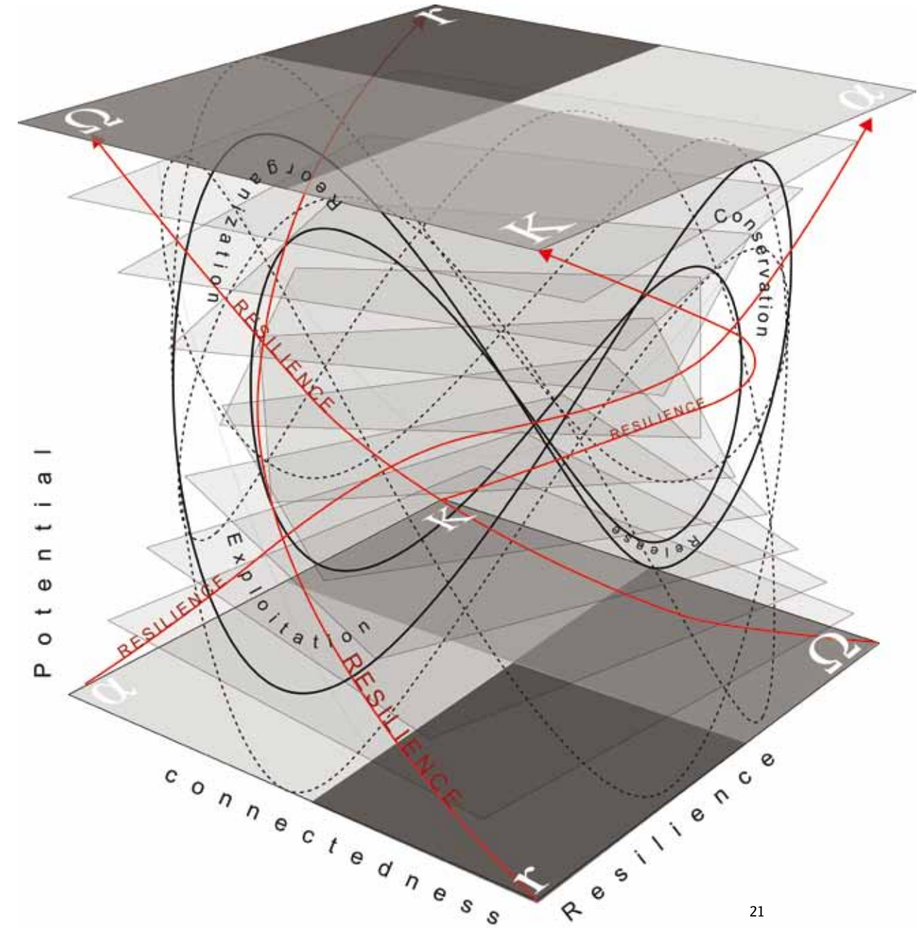
Speculative Resilience 2 – Remediation for Resilience in the Toronto Portlands: Contaminated sediments in the Don River estuary are improved through on-site dewatering and soil-washing operations as part of phased transformation of the post-industrial site. Derelict lands are re-purposed over time for productivity through ecological infrastructures of phyto-remediation, soil improvement and tree nursery operations, while site zoning accommodates seasonal flooding.

and Stoss emphasizes urban ecological flows rather than fixed conditions as a tactic for resilience: the Trinity Riverfront water gardens are designed along a moisture gradient from wet to dry, and the City Decks on Lake Michigan accommodate cyclic fluctuations between high and low water.

Recent coastal management policies and flood-management plans following the major storm events abound in this language of resilience. The New Orleans *Water Management Strategy,* Louisiana's *Coastal Management Plan,* New York's *Rebuild by Design* programme (see *Topos* 87) and Toronto's *Wet Weather Flow Master Plan* are examples notable as responses to catalytic storm events and climate change, yet remain for the most part speculative, untested and unimplemented, relying on a general language of resilience that is conceptual rather than experiential, contextual or scientifically-derived.

Resilience has origins across at least four disciplines of research and application: psychology, disaster relief and military defense, engineering, and ecology. A scan of resilience policies (see resilient-cities.iclei.org) reveals that the concept is widely and generally defined with reference to several of the origin fields, and universally focuses on the psychological trait of being flexible and adaptable, e.g., having the capacity to deal with stress; the ability to "bounce back" to a known normal condition following periods of stress; to maintain well-being under stress; and to be adaptable when faced with change or challenges. However, the use of resilience in this generalized context begs important operational questions of how much change is tolerable, which state of "normal" is desirable and achievable, and under what conditions is it possible to return to a known "normal" state. In policies that hinge on these broadly defined, psycho-social aspects of resilience, there is little or no explicit recognition that adaptation and flexibility may in fact result in transformation – and thus, require the transformative capacity that is ultimately necessary at some scale in the face of radical, large-scale and sudden systemic change. Using sea level as an example, if we accept that waters naturally rise and fall within a range of seasonal norms, we might be better off to embrace a gradient of acceptable "normal" conditions rather than a single static – and ultimately, brittle state that is unsustainable. A more critical and robust systems-oriented exploration of resilience is necessary, e.g., as being developed by Brian Walker, Carl Folke and others at the trans-disciplinary Stockholm Resilience Centre. This more nuanced emerging discourse of resilience is essential to confront the difficult but essential question of how much can a person, a community, or an ecosystem change before it becomes something unrecognizable and functions as an altogether different entity. Current policies risk the potential power of resilience by emphasizing a misguided focus on "bouncing back" to a normal state that is ultimately impossible to sustain. But if resilience is to be a useful concept in informing design strategies, it must ultimately instruct how to change safely – to adapt, with transformative capacity – rather than to resist change by relying on the illusion of a perpetual normal. This is the challenge ahead for a new culture of sustainability and its associated practice of design for resilience.





Top: Projecting Resilience: Toronto's Wet Weather Flow Master Plan is a 25-year city-wide plan to reduce, hold and slow storm water runoff on a watershed basis, using a hierarchy of design and policy solutions from point-source to conveyance to end-of-pipe solutions. The plan is projected in sections, to visualize and communicate the tangible effects of overland flow and to identify planning, management, and design strategies for improved resilience to storm events.
Bottom: Resilience as a function of ecosystem processes: Holling's (1992) dynamic model of ecosystem development represents cyclic but discontinuous periodic change (manifest as disturbance) as a normal attribute of living systems. Such disturbances provide opportunities for creative renewal and adaptation of living structures and functions, and they are essential to the development of resilience – and with it, transformative capacity.