Post War Recovery Planning with Integrated Natural Systems

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LVF

Introduction

The war in Ukraine has brought an enormous human toll: Thousands of civilians have been killed, millions have been forced to flee overseas, and it has destroyed homes, schools, and hospitals.

However, beyond the immediate, visceral impacts, the conflict has created vast environmental destruction that will necessitate many years to restore.

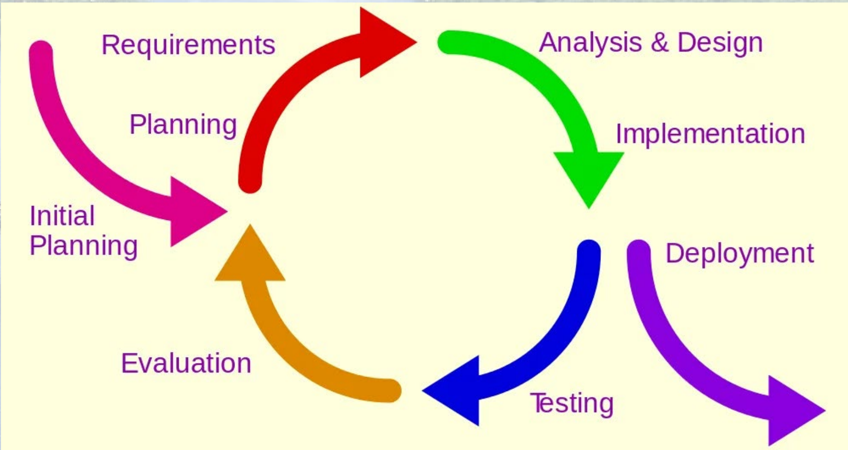
As part of the eventual reconstruction effort, Ukraine is positioning itself to incorporate nature based solutions (NBS) in the rebuilding process.

Introduction

Nature Based Solution (NBS) Design offers a process for incorporating multiple components (hydrology, geology, ecology, human systems) in the development of environmental restoration projects.

The incorporation of each component over the course of a project necessitates iteration, or the reexamination of the project as a whole, to determine if the project definition and formal design concept are still capable of delivering maximum benefit in balance.

Iteration allows a project to be scrutinized at multiple levels, from the site extent project definition to the specific form/function of the project.



This presentation will focus on the Urban Environment.

NBS Design Process

Facilitating a process of NBS design for clients necessitates a clearly laid out process and key tools that can facilitate iterative design.

The process definition can help clients ask important questions about the extent and function of a site as well as the process for incorporating data and design decisions along a timeline.

With every site being unique but with common core characteristics to the process, we can help avoid a single design fits all strategy.

While process definition can inform an approach, we have identified key areas of technical methods which necessitate the development of tools to enable the process to achieve design excellence.

Planning Tools - GUI, models and exploratory tools to be used on the front end of studies to rapidly explore many options. Support conceptual/schematic design activities to allow preliminary costing of preferred alternatives.

Biology/Ecology – What is the current state and direction of the ecosystem? In what way do we want to influence the ecosystem? How significant is the feedback from biology and ecology to the other tiers (i.e. H&H, Geomorphology, and WQ)?

Water Quality – Which factors and processes influence WQ? To what degree? Which processes can be influenced?

Geomorphology – Which forms are present in the system? How dynamic or these forms?

H&H – What scales and/or locations control H&H? What are approximate costs for earthwork and infrastructure? What are O&M costs?

Hydraulics & Hydrology

Select models that can be used at fine resolution scales to large regional scales.

HEC-RAS – Hydrodynamic model that allows the user to perform one-dimensional steady flow, one and two-dimensional unsteady flow calculations, sediment transport/mobile bed computations, and water temperature/water quality modeling.

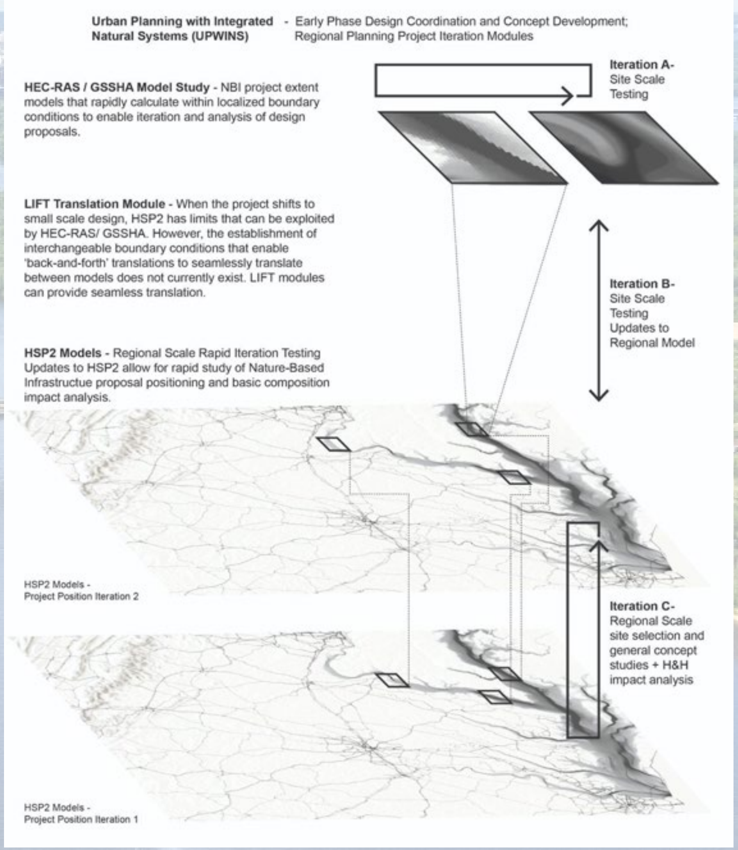
GSSHA – A two-dimensional, physically based watershed model that simulates surface water and groundwater hydrology, erosion and sediment transport.

CEQUAL-W2 – A water quality and hydrodynamic model in 2D (longitudinal-vertical) for rivers, estuaries, lakes, reservoirs, and river basin systems. W2 models basic eutrophication processes such as temperature-nutrient-algae-dissolved oxygen-organic matter and sediment relationships.

HSP2 – A watershed model that is a port of the well-established Hydrological Simulation Program - FORTRAN (HSPF), re-coded with modern scientific Python and data formats. HSPF is a process-based watershed model for quantifying runoff and addressing water quality impairments associated with combined point and nonpoint sources.

SWAT – A small watershed to river basin-scale model used to simulate the quality and quantity of surface and ground water and predict the environmental impact of land use, land management practices, and climate change. SWAT is widely used in assessing soil erosion prevention and control, non-point source pollution control and regional management in watersheds.

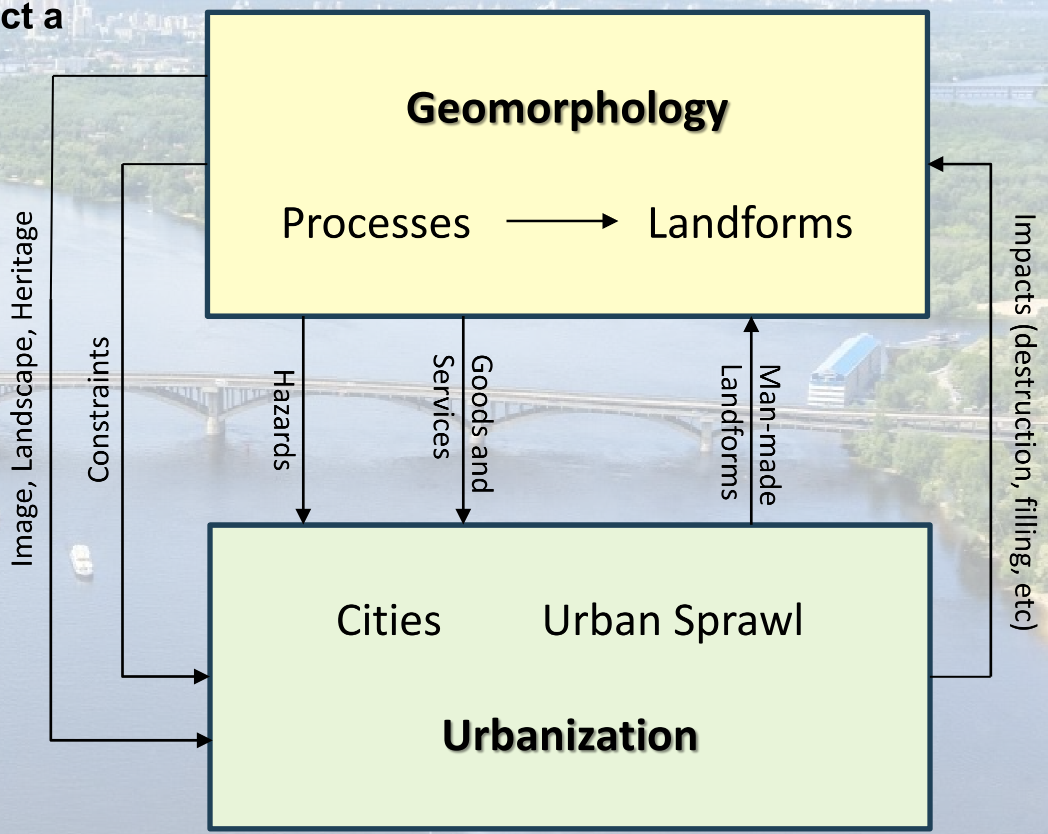
Multi-Scale – Spatial and Temporal



Geomorphology

Urban geomorphology is the study of how anthropogenic changes (Urbanization) affect a natural terrain.

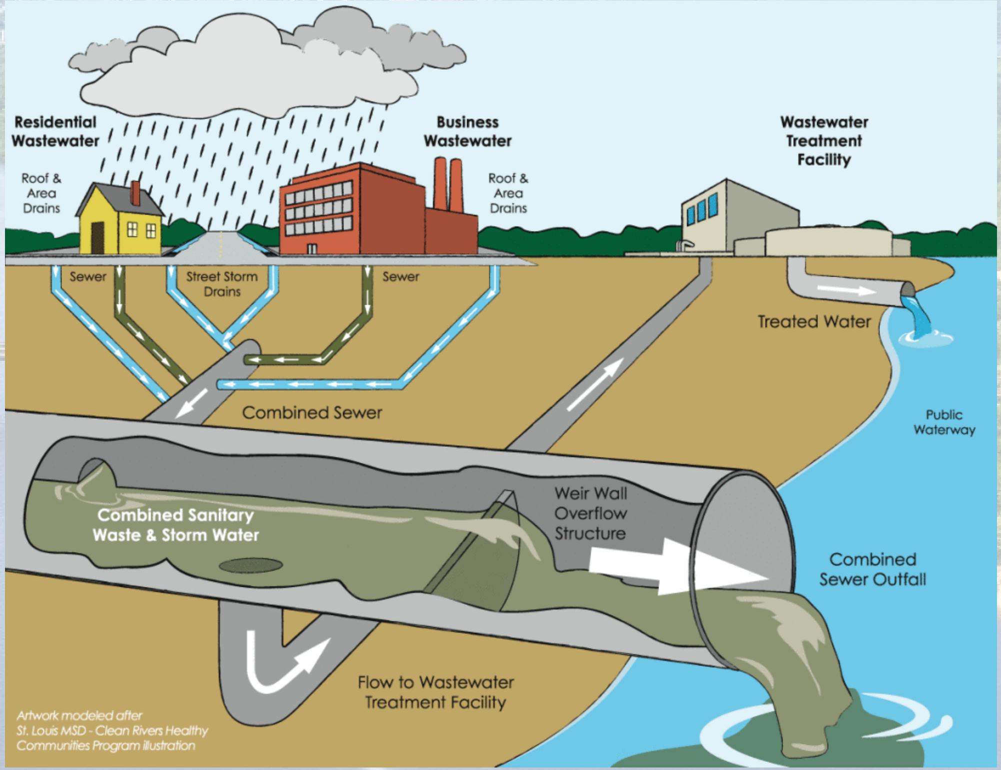
- Land Subsidence
- River Channelization
- Urban Erosion and Sedimentation
- Land Reclamation
- Cut and Fill Landscapes
- Urban Heat Island Effect
- Urban River Restoration
- Mining and Quarrying Impacts
- Coastal Urbanization
- Urban Slope Stability



Water Quality

The effects of urban development on water quality tend to be more variable than hydrological or geomorphological effects, depending on:

- Urban land use (residential versus commercial/industrial)
- Presence of water treatment plants
- Illegal discharge connections
- Effluent or combined sewer overflows
- Landfills
- Failing septic systems
- Extent of stormwater drainage



Biology/Ecology

Urban Ecosystems are considered an ecosystem functional group within a larger land-use biome.

They are structurally complex ecosystems with highly heterogeneous and dynamic spatial structure that is created and maintained by humans.

They include cities, smaller settlements and industrial areas, that are made up of diverse patch types (e.g. buildings, paved surfaces, transport infrastructure, parks and gardens, refuse areas).

Wetlands

Bioswales

Green Roofs

Rain Gardens

Permeable Pavements

Manage the Water on Site!

Community Exposure

Who and What is most at risk?
What are the risks?
When are the risks?
Where are the risks?

How might you reduce Exposure?

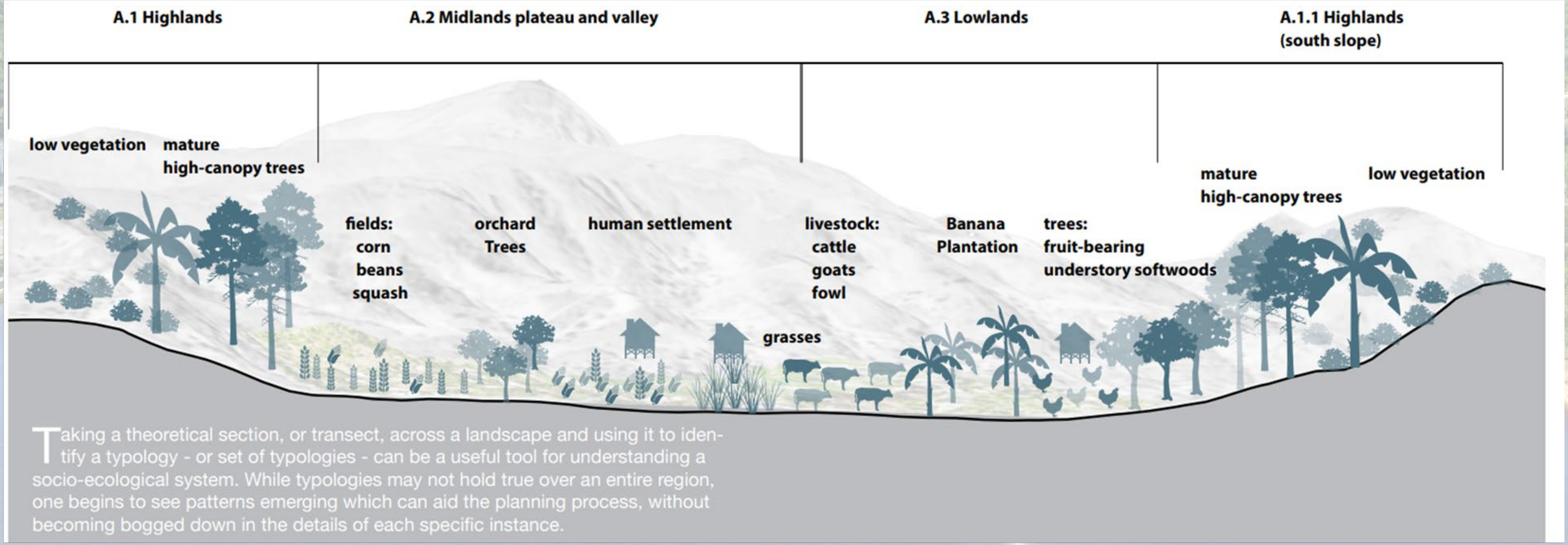
- Flooding
- Heat
- Contamination
- etc.

Understand the Context

Typologies

Not every single location can be addressed. So…
Think typologically

Looking for Patterns useful to Planning over larger Regions.



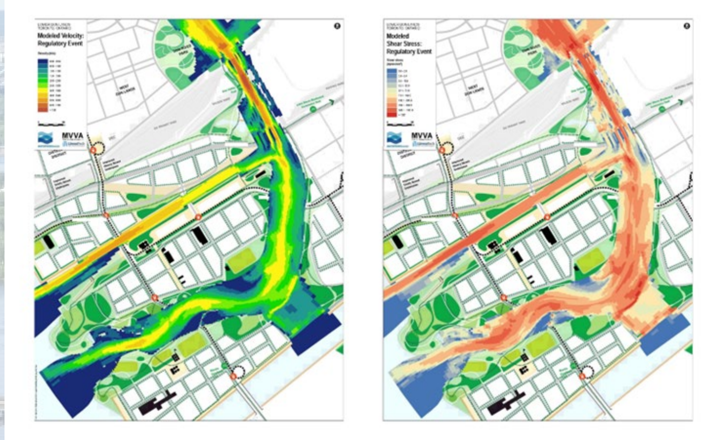
Source: Dave Hampton / Build Health International
https://resilientcoasts.org/#AnalyzeProjectSites

Actioning: Identify Projects, Involve People in the Solutions

- Hold Workshops
- Group Sectors/Disciplines by Local Expertise and Interests
- Allow for Cross Pollination of Ideas
- Evaluate Risk-Opportunities
- Evaluate Vulnerabilities-Strength/Capacity

Climate Ready Dorchester, Massachusetts. Source: https://www.scapestudio.com/projects/climate-ready-dorchester/

Problems to Opportunities



- Pivot quickly from Problems to Opportunities
- Empower Local Actors, Culturally relevant Approaches
- Blend Outside Expertise with Local Expertise

Accepted Technologies Blended with Local Technologies

dlo rigol: 'bioswale'

Teknik / teknoloji

- reyabilitasyon dlo / dlo rigol
- kaptaj
- filtraj (chimi, natirèl)

Sispann èrodasyon ravin ak woche ak kouveti vegetal

koleksyon lapli pou lakay (sitèn)

Try to draw from both 'accepted practice' and local technologies

Scale: toggle between household, community, and landscape.

From a workshop in Fond-des-Blancs, Haiti

Adaptive Management

Adaptive management is a **structured**, **iterative process** of robust decision making in the face of **uncertainty**, with an aim to reducing uncertainty over time via system monitoring.

In this way, decision making simultaneously **meets one or more resource management objectives** and, either passively or actively, accrues information needed to **improve future management**.

Adaptive management is a tool which should be used not only to **change a system**, but also to **learn about the system**. Because adaptive management is based on a learning process, it **improves long-run management outcomes**.

The **challenge** in using the adaptive management approach lies in finding the **correct balance** between gaining knowledge to **improve management in the future** and achieving the **best short-term outcome** based on current knowledge.

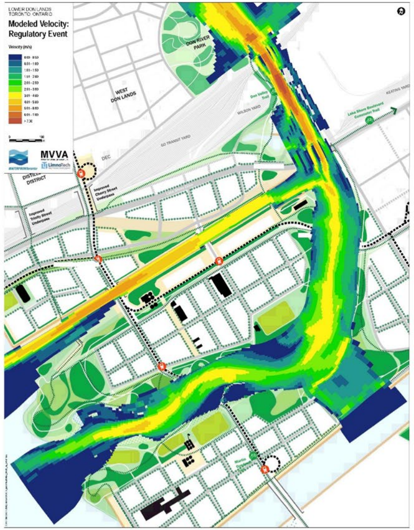
Project Examples

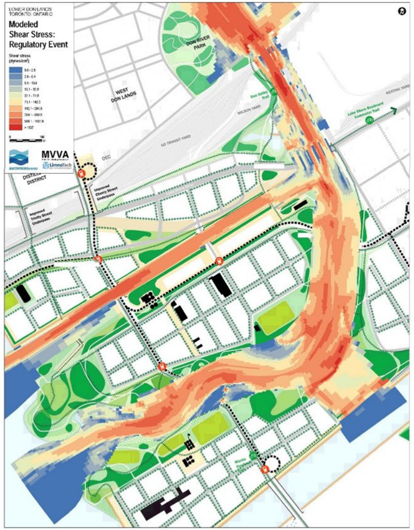
Toronto Don Lands Project – Toronto Canada

The Toronto Don Lands project combined design of a new mouth for the Don River, engineering control structures, detailed hydraulic and hydrodynamic flood modeling, permitting, and urban design/landscape architecture

https://www.waterfrontoronto.ca/

Toronto Don Lands Project – Toronto Canada





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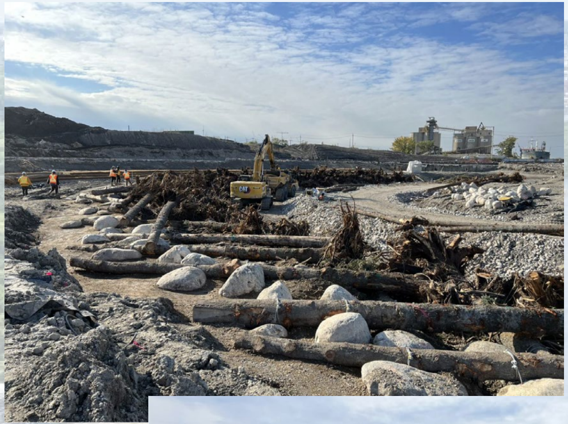

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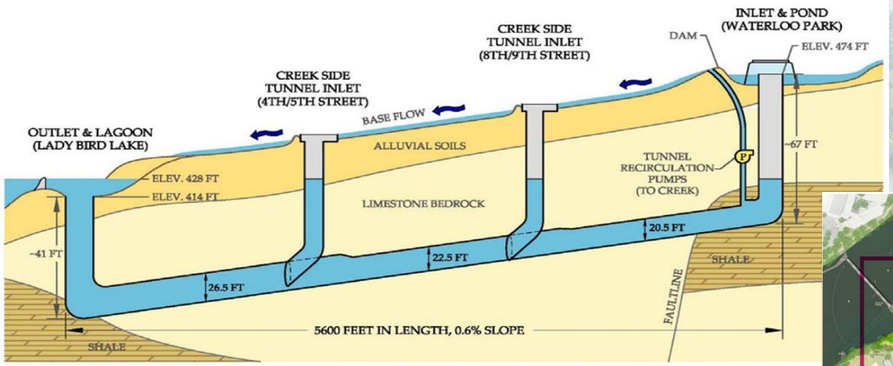
Waller Creek – Austin, TX



The Austin Waller Creek project combines heavy engineering, hydrologic, hydraulic and water quality modeling, and urban design/landscape architecture

Austin Waller Creek

Construction is Commencing!

https://waterloogreenway.org/overview/

Tulsa Gathering Place Project – Tulsa, OK

Tulsa Gathering Place project included landside terraforming, hydrologic and hydraulic modeling, permitting, and urban design/landscape architecture

https://www.gatheringplace.org/

Harold Simmons Park, Trinity River Project – Dallas, TX

- Flood management
- Sediment management
- Corps permitting and levee management
- River Channel modification / stream geomorphology
- Ecological design of wetlands and river edge margins, grasslands
- Park and trail planning

https://trinityparkconservancy.org/the-park/

Questions

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