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UArctic - Graduate Seminar on Climate Change and Resilience in the North

# Drivers for green infrastructure mainstreaming in northern land development: An evolutionary governance perspective

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# OUTLINE


I Background

II Research objective

III Methodology

IV Findings

V Discussion

# Climate Change

- Exacerbates vulnerability in northern communities (1, 2).
- Resilience through adaptation is a necessity!
- Ecosystems enhance system redundancy, provide greater flexibility, and can act alongside grey infrastructure (3, 4)

Image courtesy: TomTookIt

# Building Resilience: Green Infrastructure

- Natural, semi-natural, or constructed living system that contributes ecosystem services to humans (5).
- Examples: naturalization, conservation areas, low-impact design.
- Provides ecosystem services help enhance resilience and reduce vulnerability (6).

Image courtesy: TomTookIt

# Relationship to Resilience? Ecosystem Services

- Flood mitigation
- Water purification
- Erosion control
- Stormwater management
- Heat reduction
- Air pollution interception
- Habitat and biodiversity
- Recreation
- Passive enjoyment
- Aesthetic

Image courtesy: Nicklas Baran

# Research Gaps

- We know that different green infrastructure solutions provide different ecosystem services (7).

- Gaps in understanding:
    - How stakeholder ecosystem service values shape green infrastructure implementation.
    - Enabling and constraining factors to implementation in northern communities.


Image courtesy: Nicklas Baran

# Research Objectives

- To elucidate the underlying factors influencing green infrastructure uptake in urban planning and development of northern communities.

Image courtesy: Nicklas Baran

# Case Studies

| Case Study/Factor | City of Edmonton, Alberta | City of Winnipeg, Manitoba |
| --- | --- | --- |
| 2021 population (change since 2016; 8) | 1,010,899 (+8.3%) | 749,607 (+6.3%) |
| Average annual temperature (1981-2010; 9) | 4.2 °C | 3.0 °C |
| Biogeography | River city; aspen parkland; flat and gently rolling/flat terrain; now cultivated for agriculture | River city; tallgrass prairie; extremely flat terrain; now cultivated for agriculture |
| Land Development Context | Rapid suburban development 2008-2015 catalyzed by oil boom. | Slow suburban development. |

# Methods

- 16 key informant interviews
  - Nine from Edmonton; seven from Winnipeg.
  - Six municipal officials; six land developers; four consultants

- Document review of relevant policy.

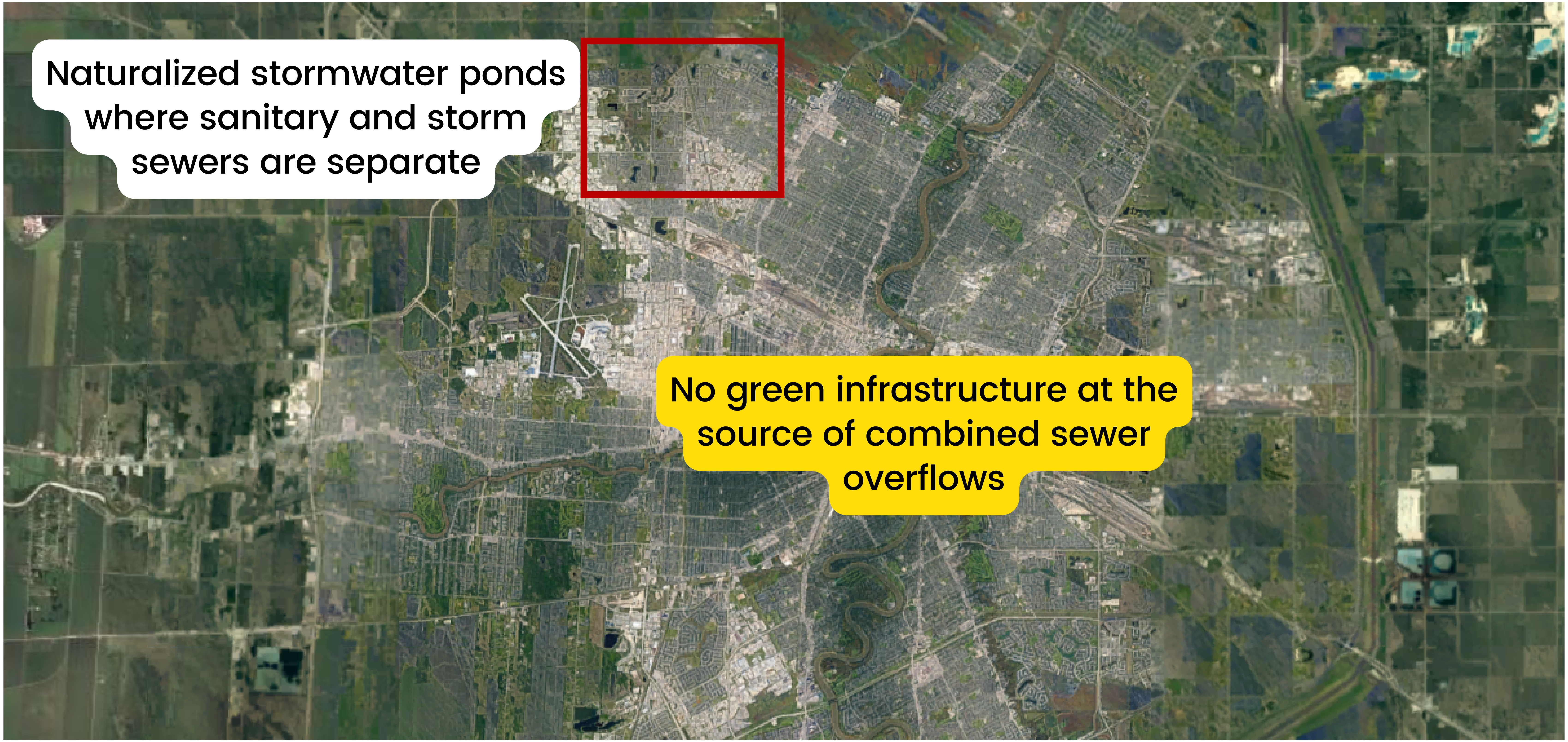
- Document analysis of municipal plan.

# Extent of Green Infrastructure Implementation

- Both cities have made naturalized stormwater ponds standard practice, upland naturalization also occurring.
- Edmonton has explored non-conventional approaches like bioswales and rain gardens with limited success.
- Focus is largely on greenfield development instead of infill.

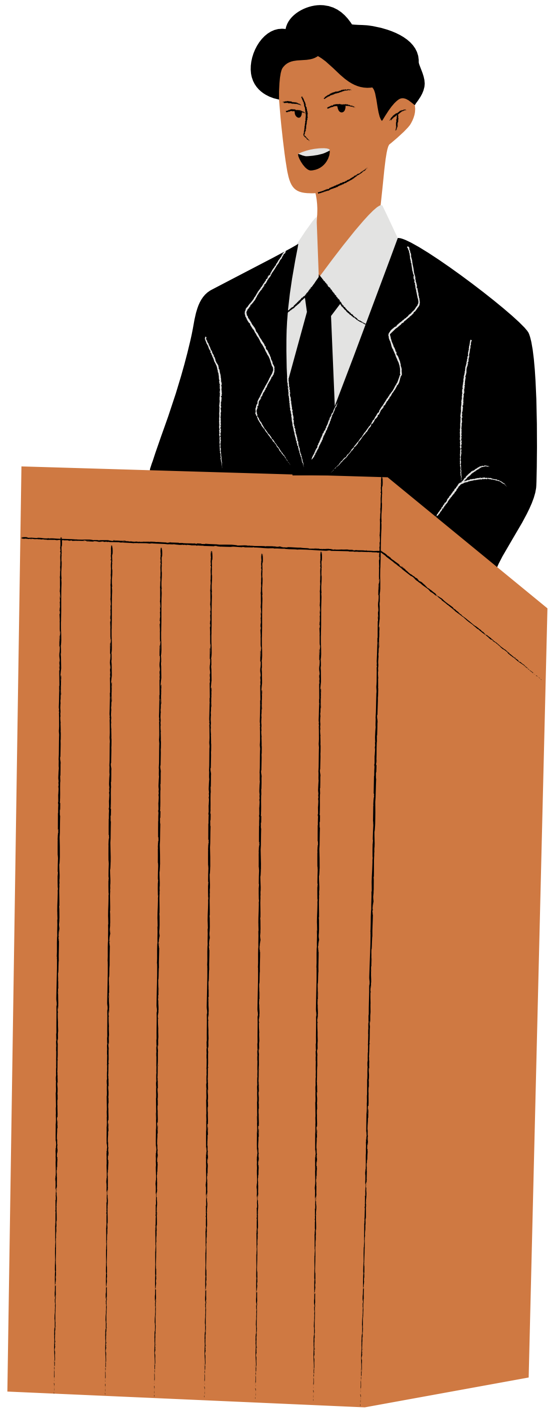
Image courtesy: Nicklas Baran

# Combined Sewer Overflows in Winnipeg



# Drivers for Implementation

- Political ideology.
  - Climate adaptation is a priority in Edmonton, not Winnipeg.
- Location-specific events.
  - Eutrophication of Lake Winnipeg.
- Stakeholder motivations.



# Constraining & Enabling Factors - Institutional

- Reluctance to accept new, untested, and non-engineering approaches.
- In Winnipeg, municipal administration and rigid regulations are the primary barrier.
- Policy-induced ecosystem service tradeoffs.

Image courtesy: City of Edmonton

# Constraining & Enabling Factors – Financial

- Additional cost for developers.
- Incentives for developers: amenity bonus.
- Certain approaches require less maintenance.
- Still, the municipality struggles with maintenance in cost and capacity.

# Constraining & Enabling Factors - Physical

- Climate - a major barrier to rain gardens, bioswales, and green roofs.
- Soil - clay is impermeable, can do more harm than good.
- Ecological - invasive species, ecosystem disservices.
- Built area - inadequate space for implementation in mature areas.

Image courtesy: Nicklas Baran

# Evolutionary Governance Theory (10)

- Explores the evolution of governance.

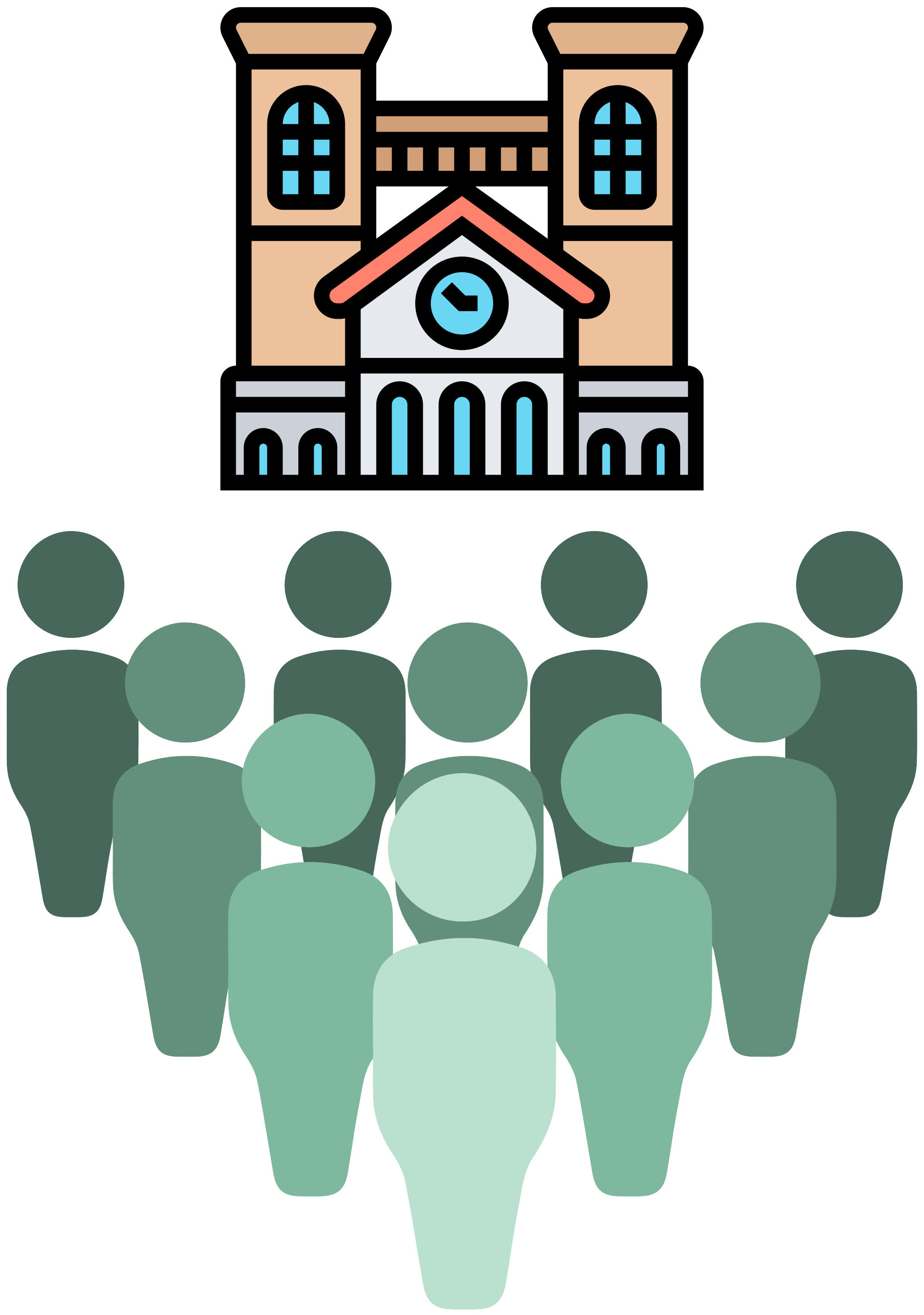


## Elements

- Agents
- Institutions
- Power
- Knowledge

# Agents & Institutions

- Agents: municipal administration & council, land development industry, consultants.
- Institutions: plans, policies, regulations, informal convention.
- Green infrastructure implementation requires flexible institutions for context-specificity (11)



# Power/Knowledge

- Power and knowledge are inseparable.
- Municipal power can dictate development through institutions.
- Yet developers have power to influence institutions.
- This is informed by knowledge.

# Path Dependencies

- Historical legacies of suburban sprawl.
- Engineering-oriented policies.
- Takes political will from multiple avenues to shift governance paths.

# Evolving Governance: Champions

- In Winnipeg, developers championed green infrastructure while municipal officials were hesitant.

- In Edmonton, City Administration is championing green infrastructure while developers are hesitant.

Image courtesy: Nicklas Baran

# Key Implications

- Municipalities have power to lead or prevent green infrastructure mainstreaming.

- Developer insight is important.

- Future improvements are required.

Image courtesy: Nicklas Baran

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