FRACTAL SPATIAL ANALYSIS, A COMPLEMENTARY TOOL TO LCA IN INDUSTRIAL ECOLOGY AND CIRCULAR ECONOMY PLANNING: THE MONTREAL CASE STUDY
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PRESENTATION

• Theoretical Framework

• The Fractal Dimension and Lacunarity

• Territorial Sample

• Urban functions

• Results

• Complex Geometry and Industrial Ecology

• Conclusions
Theoretical framework

Sustainability is a emerging property of complex systems.
- Ehrenfield, 2009

Complexity Science tools combined with classic Industrial Ecology tools and the social Sciences can help to attain a more sustainable future.
- Gerard et Al.

Fractal Dimension and Lacunarity

Fractal Dimension: The box Counting Method

Lacunarity: The box Sliding Method:

Source: http://hypertextbook.com

Source: Wikimedia
Territorial samples

Villeray-Saint-Michel-Parc-Extension

- Area: 16.5 km²
- Density: 8624.7 pop./km²
- Average household size: 2.2 person

Rivière-des-Prairies-Pointe-aux-Trembles

- Area: 42.3 km²
- Density: 2517.4 pop./km²
- Average household size: 2.5 person

http://ville.montreal.qc.ca/pls/portal/docs/page/plan_urbanisme_fr/media/images/public/carte_arr.gif
The urban functions

Classifications:
Institutional  Residential
Commercial   Industrial

Zoning map of Villeray-Parc-Extension

Commercial  Commercial  Institutional
Results: Fractal dimension of urban functions

Fractal Dimension of Urban Functions

ZONING TYPE

- Commercial-Institutional
- Commercial-Residential
- Industrial-Commercial
- Industrial
- Institutional
- Commercial
- Residential

FRACTAL DIMENSION VALUE

- Rivière des Prairies
- Villeray-Parc-Extension
Results: The relevance of Lacunarity

Industrial and commercial Urban function

Villeray-Parc-Extension

Rivière-Des-Prairies
Complex Geometry, LCA and Industrial Ecology

From urban zoning to Urban ecosystem management

Urban Function ➢ Fractal and Lacunarity Analysis

Spatial Data
➢ Urban Function Density
➢ Urban Function Distribution

GIS + Consumer LCA

Fractal and Lacunarity Analysis

Spatial Data
➢ Impact/Resource Density
➢ Impact/Resource Distribution

Source:
NORLCA, REYKJAVIK 03.10.2014
Conclusions:

• Fractal dimension and Lacunarity can characterize the socio-economic system spatial organization.

• Combined with LCA, the methodology could be used to characterize the urban ecosystem quality.

• The toolset could provide comparative analysis that can be used to either optimize the ecological landscape or to select the best suitable ecological niche for respective economic activities.