How does densification versus urban sprawl affect air pollution?

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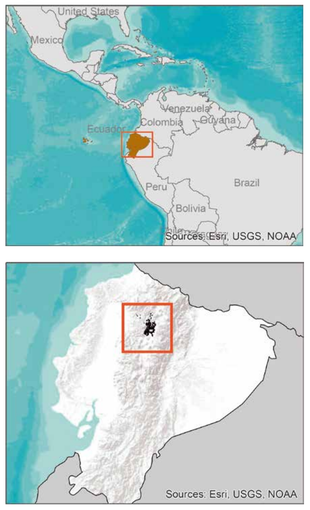
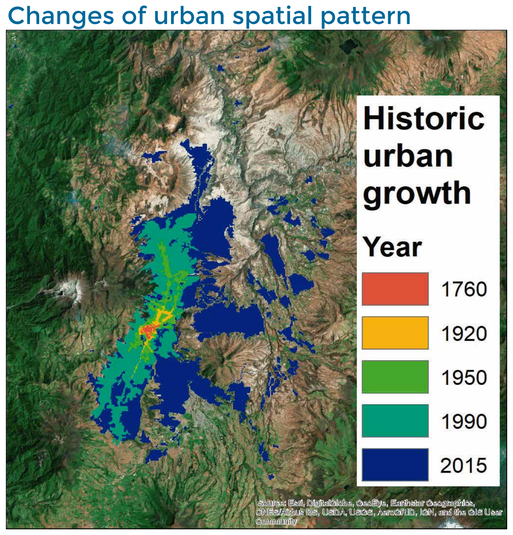
AARHUS UNIVERSITY

context

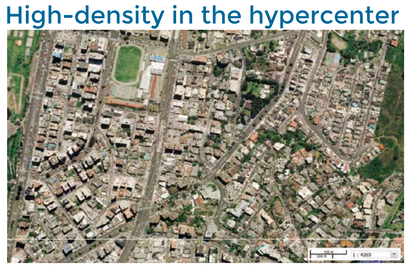
Quito



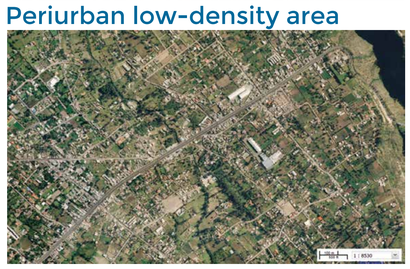
Changes of urban spatial pattern



High-density in the hypercenter



Periurban low-density area



Hypercenter, higher buildings are being constructed

Vehicles and especially diesel busses are the main source of air pollution

Quito is in a region with complex topography that restricts urban growth along valleys and river canyons
Currently there are about 2 million inhabitants

method

By 2050 the population is estimated to be more than 3,000,000 inhabitants

Scenario 1

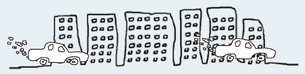
Urban sprawl to valleys with low buildings and polpulation density over large areas

Densification of built-up area, high-rise buildings and high density of population

Scenario 2

Effect on air pollution?

... when the main emission source is vehicles, and the traffic is affected by the spatial urban pattern



Two extreme scenarios:

Scenario 1
Urban Sprawl
(business as usual)

Scenario 2
Urban Densification

Urban growth

Mapping of urban land use and population density

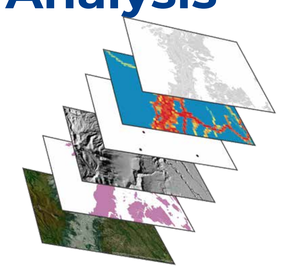
Scenario 1
Urban sprawl
LUCIA (CA based model)

Scenario 2
Urban densification
GIS modelling

Traffic Modelling

Spatial Analysis

What are the spatial relations between air pollution and urban features (streets, blocks, etc.)?

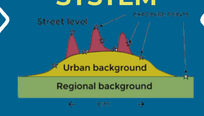


Air pollution

Mapping of air pollution
Scenario 1 & Scenario 2
Air pollutants emissions

Meteo-rology condi-tions

THOR-AirPAS SYSTEM



Regional back-ground air pollu-tion

Maps of air pollution concentration

Spatial modelling of urban growth and its influence on air pollution: Evaluation of vertical versus horizontal growth of the city of Quito
Supervisors: Matthias Ketzel, Gregor Levin

Sources
Location maps: ESRI, USGS, NOAA. Historic Urban Growth map: Municipality of Quito, Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Aerial photographs: Ministery of Agriculture and Farming of Ecuador. City photograph: author. Bus photograph: Mario Egas / El Telégrafo digital edition July 27, 2016.

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