CHALLENGES AND OPPORTUNITIES:

THE ESTUARINE DELTA UNIT OF RIO DE LA PLATA AND PARANA RIVER.

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ISU

COMPLEXITY OF DELTAS AND ESTUARINE SYSTEMS

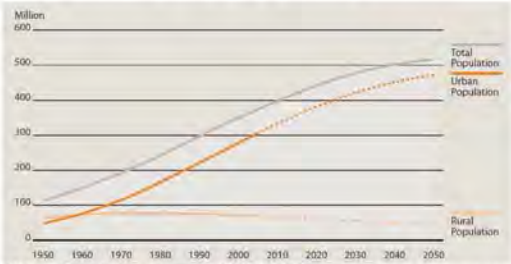
CLIMATE CHANGES
global and local trends

URBAN DEVELOPMENT & INFRASTRUCTURES
demographic growth,
socio economic dimension

NATURAL ENVIRONMENT
regional and local dynamics

POLITICAL, SOCIAL, ECONOMICAL & TECHNOLOGICAL FRAMEWORKS

SOUTH AMERICAN SCENARIO



Urban Population Growth 1950-2050 Source: Urban-age, LSE.

Social Inequality Source: Urban-age, LSE.

GREAT BIODIVERSITY & NATURAL RESOURCES

Urban Population Growth:
150 % **increase** by 2050
+
75% of population living in **coastal areas**
+
High Social Inequality
+
Climate Changes
=

HIGH VULNERABILITY

PARANA DELTA AND RIO DE LA PLATA ESTUARINE SYSTEM

Parana River: 3rd major river of the American Continent (after Mississippi and Amazon). Lenght:2.570 Km.; Flow: 17.000 m3/s.

Rio de la Plata: widest estuary in the world (up to 230 Km).
La Plata Basin: 2nd major basin of South America (3.1mill Km2).

STRUCTURE OF THE PRESENTATION

I **ECOLOGICAL FUNCTIONS**

II **NATURAL ENVIRONMENT, URBAN PATTERNS & SOCIO ECONOMIC DIMENSION**

III **CLIMATE CHANGE**
Future trends, impacts & vulnerabilities.

STRATEGYC MEASURES
Adaptation and governance.

PART I

ECOLOGICAL FUNCTIONS

ECOLOGICAL FUNCTIONS

Dynamic sedimentary geologic-hydrologic unit influenced by the same natural and urban forces.

ECOLOGICAL FUNCTIONS: **DELTA - WETLAND - ESTUARY**

***SOURCE OF WATER**

***GROUNDWATER REPLENISHMENT**
(Underground Aquifers: Guarani, Puelches, Pampeano, Parana...)

*** BIODIVERSITY**
(Wetlands conver 1% of the earth´s surface and hold 40% of the species)

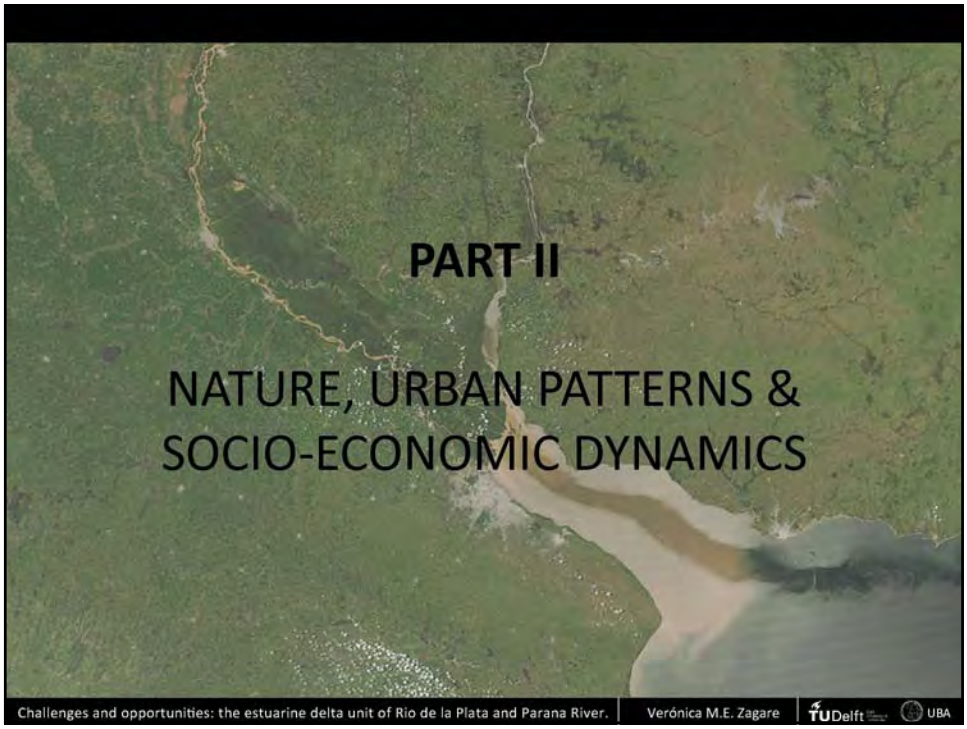
*** NUTRIENT RETENTION + WATER, AIR & SOIL PURIFICATION**

*** FLOOD CONTROL**

*** SHORELINE STABILIZATION**
(Protection of storm surges, South-Eastern winds, waves and other events)

*** ENERGY: POWER STATIONS**
(Ilha Solteira and Jupia -BR-, Itaipu -BR-PY-, Yaciretá -AR-PY)

*** FOCUS OF CONSERVATION ACTIONS**


PART II
NATURE, URBAN PATTERNS &
SOCIO-ECONOMIC DYNAMICS
Challenges and opportunities: the estuarine delta unit of Rio de la Plata and Parana River.
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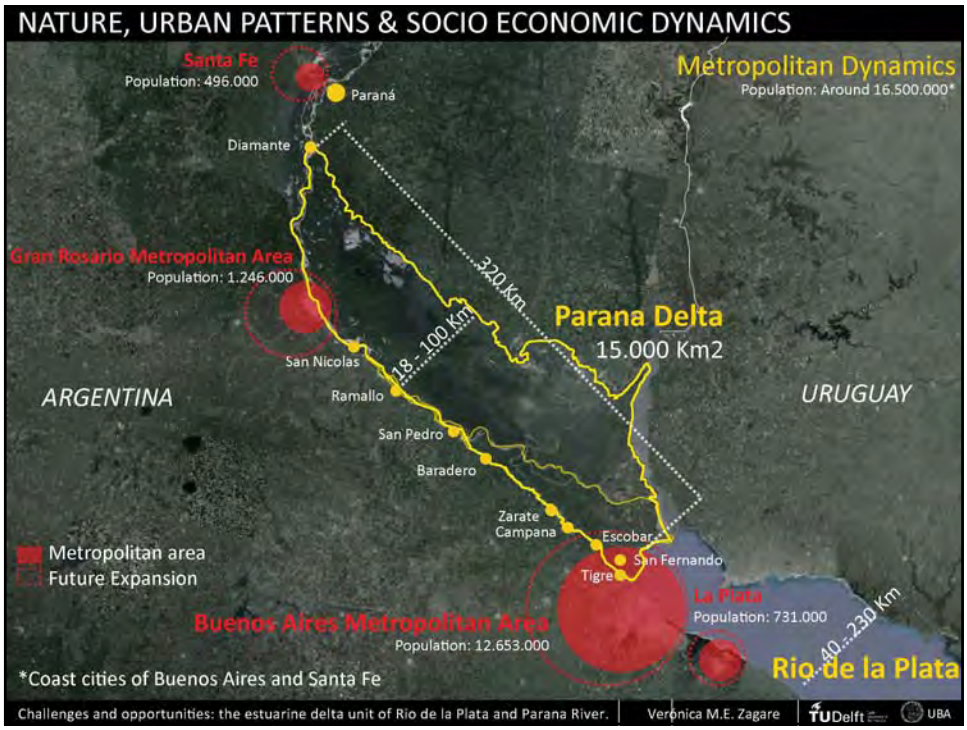
NATURE, URBAN PATTERNS & SOCIO ECONOMIC DYNAMICS
Santa Fe
Population: 496.000
Paraná
Diamante
Metropolitan Dynamics
Population: Around 16.500.000*
Gran Rosario Metropolitan Area
Population: 1.246.000
320 Km
18 - 100 Km
Parana Delta
15.000 Km2
San Nicolas
Ramallo
ARGENTINA
URUGUAY
San Pedro
Baradero
Zarate
Campana
Escobar
San Fernando
Tigre
Metropolitan area
Future Expansion
La Plata
Population: 731.000
Buenos Aires Metropolitan Area
Population: 12.653.000
40...230 Km
Rio de la Plata
*Coast cities of Buenos Aires and Santa Fe
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NATURE, URBAN PATTERNS & SOCIO ECONOMIC DYNAMICS

NATURE, URBAN PATTERNS & SOCIO ECONOMIC DYNAMICS

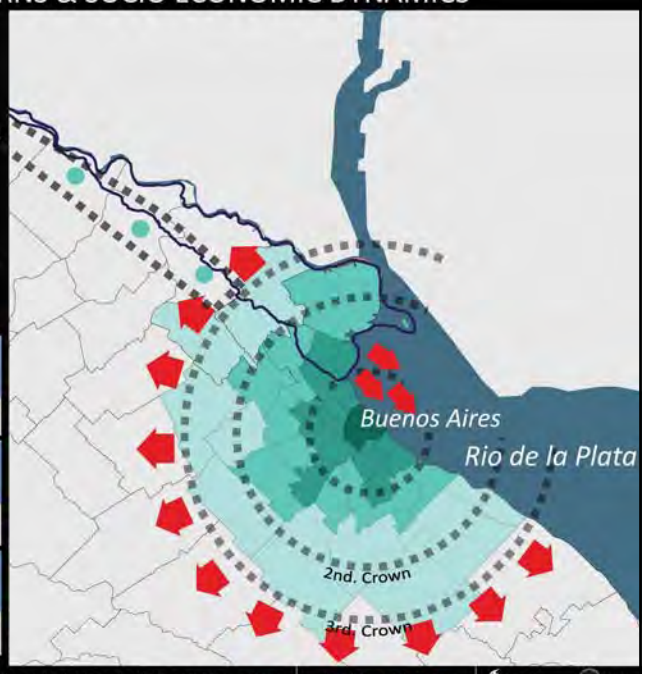
The **Delta Front** will reach the coast of Buenos Aires City in 110 years.

NATURE, URBAN PATTERNS & SOCIO ECONOMIC DYNAMICS

BAMA
35% of urban population
53% of GDP
less of 0.15% of the territory.

City of Buenos Aires
stabilized its population.

BAMA tripled its population in the last 20 years.



PRODUCTION AND RESIDENTIAL SPACES

URBAN GROWTH

↓ ↓

PRODUCTION SPACES | **RESIDENTIAL SPACES**

↓ ↓

ECONOMIC ACTIVITIES | **SOCIO-ECONOMIC SITUATION**

↓ ↓

URBAN PATTERNS

PRODUCTION SPACES
DELTA ISLANDS
Challenges and opportunities: the estuarine delta unit of Rio de la Plata and Parana River.
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PRODUCTION SPACES
CONTINENTAL AREAS
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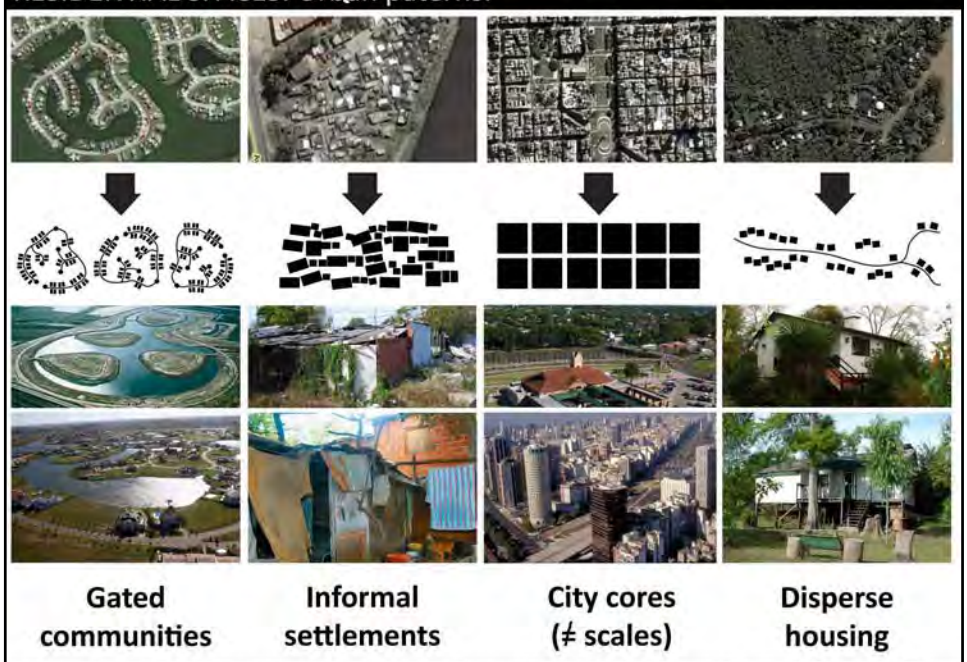
PRODUCTION SPACES

RESIDENTIAL SPACES: Urban paterns.



RESIDENTIAL SPACES: Urban paterns.
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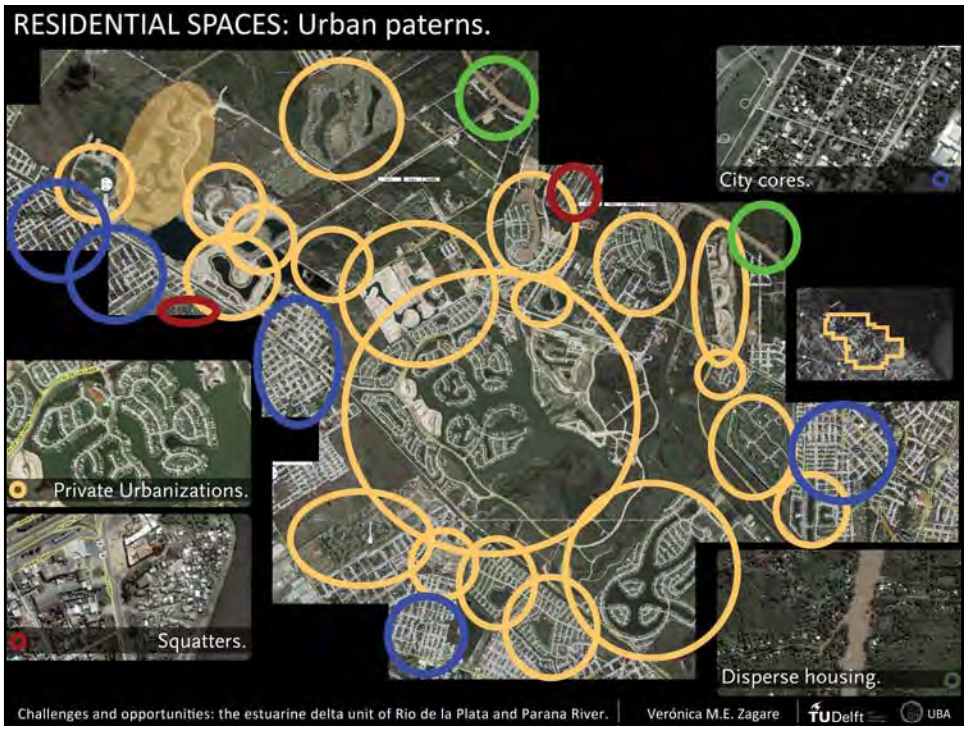
RESIDENTIAL SPACES: Urban paterns.
City cores.
Private Urbanizations.
Squatters.
Disperse housing.
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PART III
CLIMATE CHANGE
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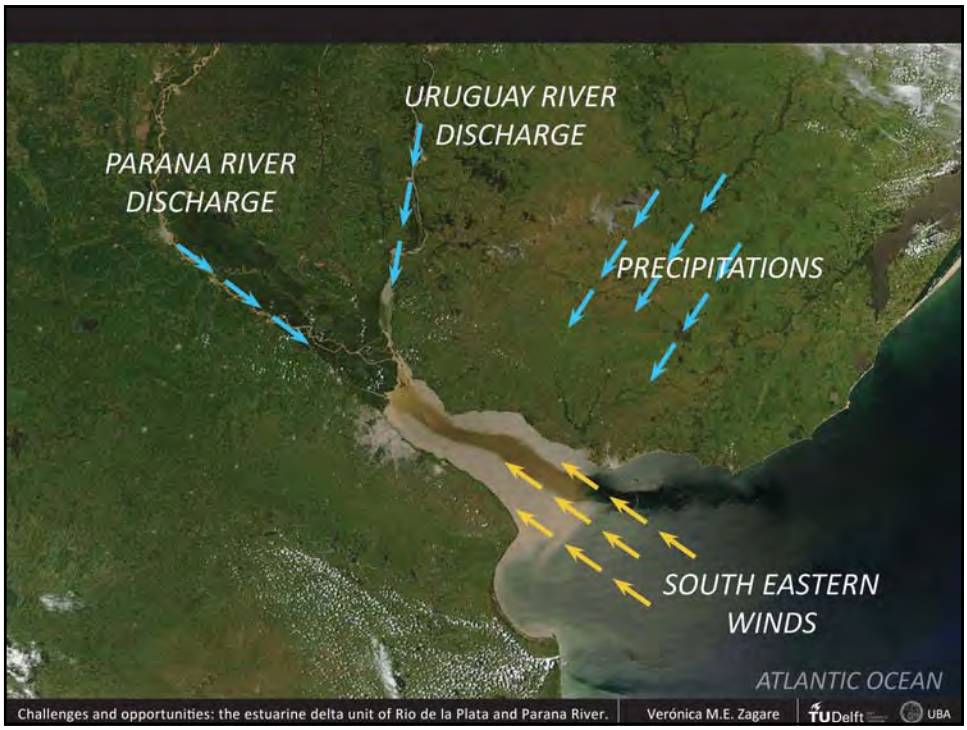
URUGUAY RIVER DISCHARGE
PARANA RIVER DISCHARGE
PRECIPITATIONS
SOUTH EASTERN WINDS
ATLANTIC OCEAN
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CLIMATE TRENDS: TEMPERATURE AND PRECIPITATIONS

TEMPERATURE RISE

from 0.4°C to 1.8°C by 2020

from 1.0°C to 7.5°C by 2050

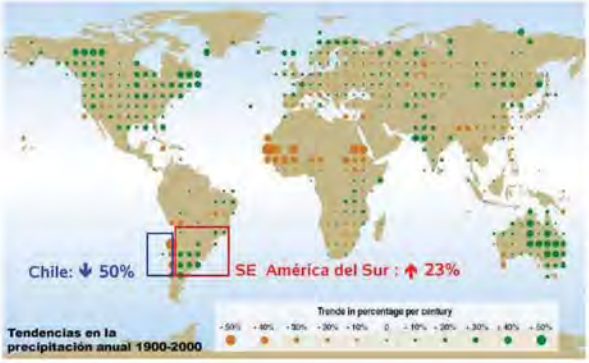
(South West South America)

↑ Glacier retreat (affects water availability and hydropower generation).

↑ Evaporation rates.

Source: IPCC

PRECIPITATIONS INCREASE (Mesoscale Conductive Systems)



River discharges:
rise of 1% in precipitation
=
rise of 2% in river flow

1951-1970 → 1980-1999

↑ 16% (La Plata Basin)

↑ 32% in river streamflow

FLOODS

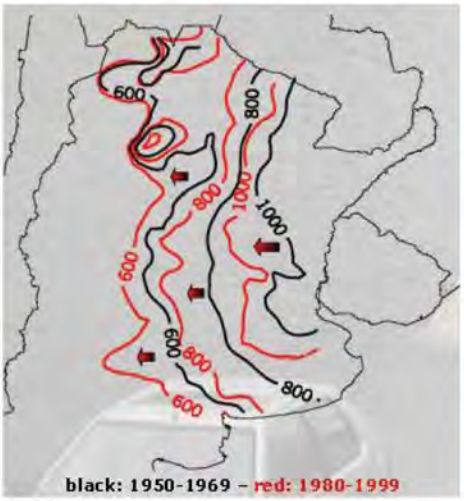
Source: Berbery et al., 2006

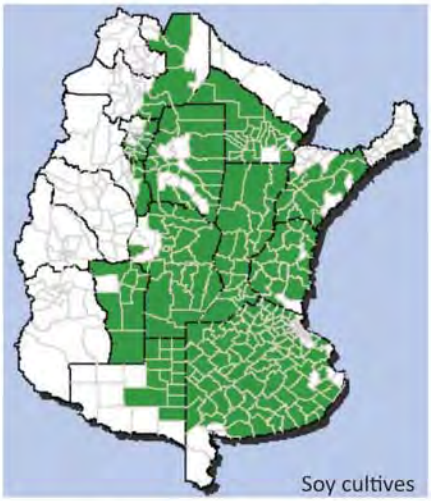
CLIMATE TRENDS: TEMPERATURE AND PRECIPITATIONS

ISOHYETS DISPLACEMENT

Movement towards West (up to 200 Km.)

Increase of agricultural surface in around 100.000 Km2.

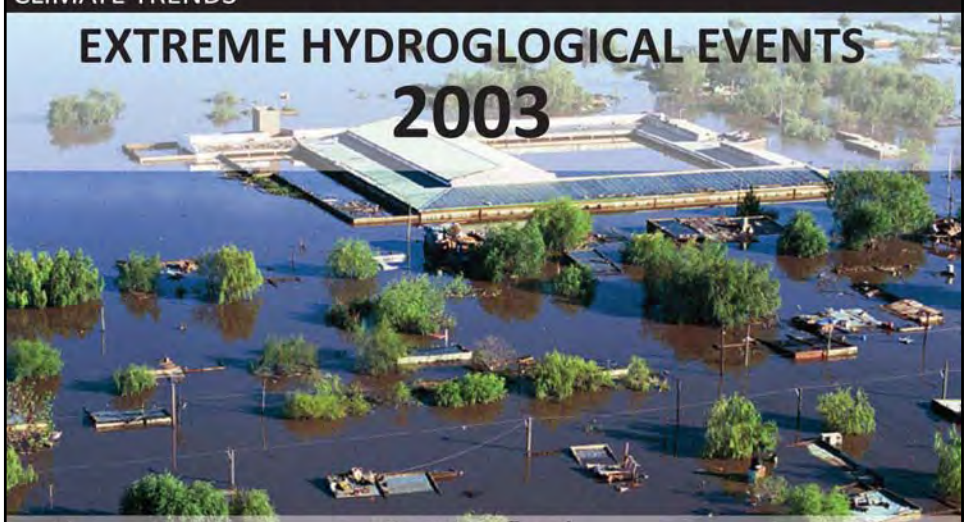




EXTREME HYDROGLOGICAL EVENTS
1983

Lost of Parana Delta´s buffer condition.
40.000 Km2 of flooded lands.
Cause: related to El Niño
Repeated in 1998

EXTREME HYDROGLOGICAL EVENTS
2003



Santa Fe flood.
Hundreds of evacuated people and millionaire loss
Cause: precipitation increase + water level rise
+ lack of planning

CLIMATE TRENDS: EXTREME HYDROLOGICAL EVENTS

Apart from precipitations and river discharges, the system is affected by:

***EL NIÑO SOUTHERN OSCILLATION (ENSO)**

Temperature change in surface waters and air surface pressure.

It affects during El Niño warming phase and during neutral phases.

Not always followed by precipitations.

***SUDESTADAS (South-Eastern winds)**

Winds from the Atlantic Ocean increase water level, producing floods.

IMPACTS AND VULNERABILITIES

a) QUANTITY AND QUALITY OF WATER

WATER QUALITY is affected by:

Climate Change
Agricultural intensive practices
Urban consumption and waste
Deforestation
fluvial navigation

Urban demand:

Underground water (aquifers)
Superficial water (Rivers)

Over-exploitation causes salinization.

Lack of exploitation causes an increase of underground water level producing deterioration of structures and septic tanks overflowing.

IMPACTS AND VULNERABILITIES

b) AGRICULTURE & STOCKBREEDING

AGRICULTURE is affected by CC: by precipitations and the displacement of isohyets (change in agricultural borders)-.

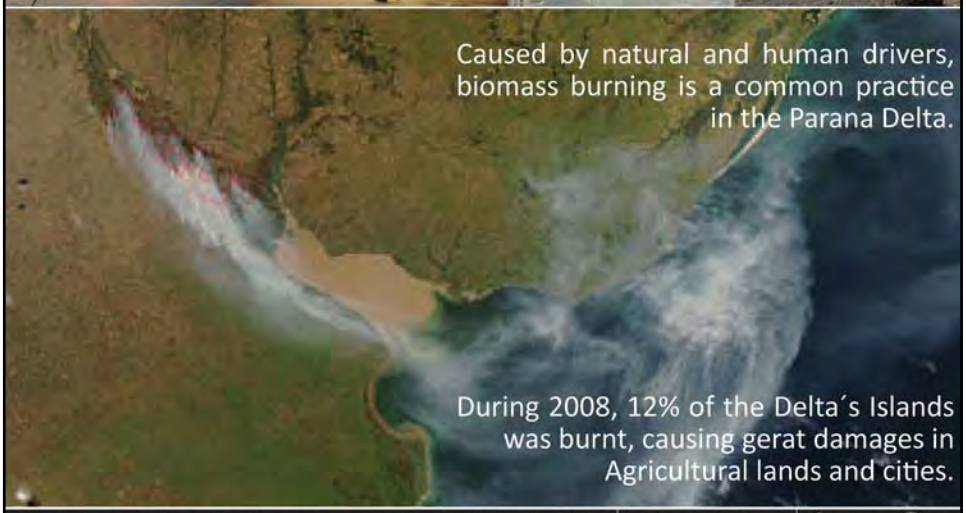
It affects natural environment: by the use of pesticides and agrochemicals, lost of crops diversity (important of soy cultives, which uses glisfosat and cause soil degradation and water pollution).

STOCKBREEDING is affected by CC: by floods and eventual droughts.

It affects natural environment: if the amount of cattle is not controlled. It increased 475% from 2003 to 2008. The excess of cattle faeces produces soil and water pollution.

IMPACTS AND VULNERABILITIES

c) BIOMASS BURNING



IMPACTS AND VULNERABILITIES

c) BIOMASS BURNING

POSITIVE EFFECTS

*Cleaning of the land from rodents and grass.
*Stimulation of the development of new vegetable species.
*Liberation of seeds for new germi nations.
*Nutrient recycle.

NEGATIVE EFFECTS

*Change in **surface albedo**.
*Loss of **animal and vegetable biodiversity**.
*Changes in **vegetable structure**.
*Exposition of rhizomes and roots.
***Carbon liberation and greenhouse gasses emission**.
***Uncontrolled fires:** burnt of great surfaces and generation of smoke and fumes causing traffic accidents and health problems.

IMPACTS AND VULNERABILITIES

d) LAND USES CHANGES: DEFORESTATION & URBAN EFFECTS

DEFORESTATION AND LAND USE CHANGES → **AGRICULTURE AND URBAN DEVELOPMENT**

AGRICULTURE

*Changes from vegetation into crop or pasture for agricultural uses:

Modification of surface albedo, roughness, air circulation, precipitations and temperature

URBAN DEVELOPMENT

*Urban Heat Island effect (UHI) increasing temperature.
*Loss of green surfaces and decrease of wind speeds.
*Generation of pollutants and heat sources.

IMPACTS AND VULNERABILITIES

d) LAND USES CHANGES: DEFORESTATION & URBAN EFFECTS

PRIVATE DEVELOPMENTS

INFORMAL SETTLEMENTS

IMPACTS AND VULNERABILITIES

e) COASTS AND HYDROLOGICAL EROSION

EROSION: wash away of soil by the action of water, which carries sediments and contaminants.

CAUSES: NATURAL PROCESSES + ECONOMIC ACTIVITIES

**Stockbreeding.*
**Agriculture.*
**Ships (fluvial navigation).*

EFFECTS:
*Changes in sedimentation rates
*Loss of capacity to regulate the hydrologic regime.
*Floods.

IMPACTS AND VULNERABILITIES

f) ENERGY AND FLUVIAL NAVIGATION

ENERGY

*Shortage of water can cause problems in hydro power generation

*Problems in higher parts of the river impact on the river mouth, the Delta and the coasts of the Rio de la Plata.

FLUVIAL NAVIGATION

*The increase in fluvial navigation produces growing effects for national economy.

*Need for a balance to reduce erosion and changes in biodiversity.

*Need for planning *(Parana-Paraguay hydroway + Orinoco + Amazon + Rio de la Plata + Atlantic Ocean)*.

STRATEGIC MEASURES

ADAPTATION TO CC, SUSTAINABLE DEVELOPMENT AND GOVERNANCE

STRATEGICAL LOCATION OF THE ESTUARINE UNIT OF PARANA DELTA AND RIO DE LA PLATA.

Adapt to Climate Change and Demographic Dynamics

↓

SUSTAINABILITY + GOVERNANCE + BOTTOM-UP MEASURES

=

Regional vision beyond jurisdictional division.

Regional planning: need for a structural vision.

How are the programs/plans going to be achieved?

Who is going to implement them?

How are the citizens/NGOs going to participate in the process?

SOME ADAPTATION MEASURES... .

Environmental Quality

*Conservation of the wetland and its ecological functions.

*Analysis of the area (GIS) to find strengths ans vulnerabilities.

*Control of the activities developed (types, intensity, pollutants).

Safety

*Construction of infrastructures.

*Management of flooding risks.

*Canals and infrastructure maintenance.

Life Quality

*Urbanization of informal settlements.

*Regulation of private developments.

*Construction of infrastructures (water, sewage, electricity and gas systems).

*Development of land uses plans.

Coordination of actors

*Regional and local governmental and nongovernmental institutions.

*Regulation of the role of involved actors.

ADAPTATION AS A CHALLENGE AND OPPORTUNITY...

Cooperation and participation of multiple governmental and nongovernmental actors to guarantee governance.

CONTEXT

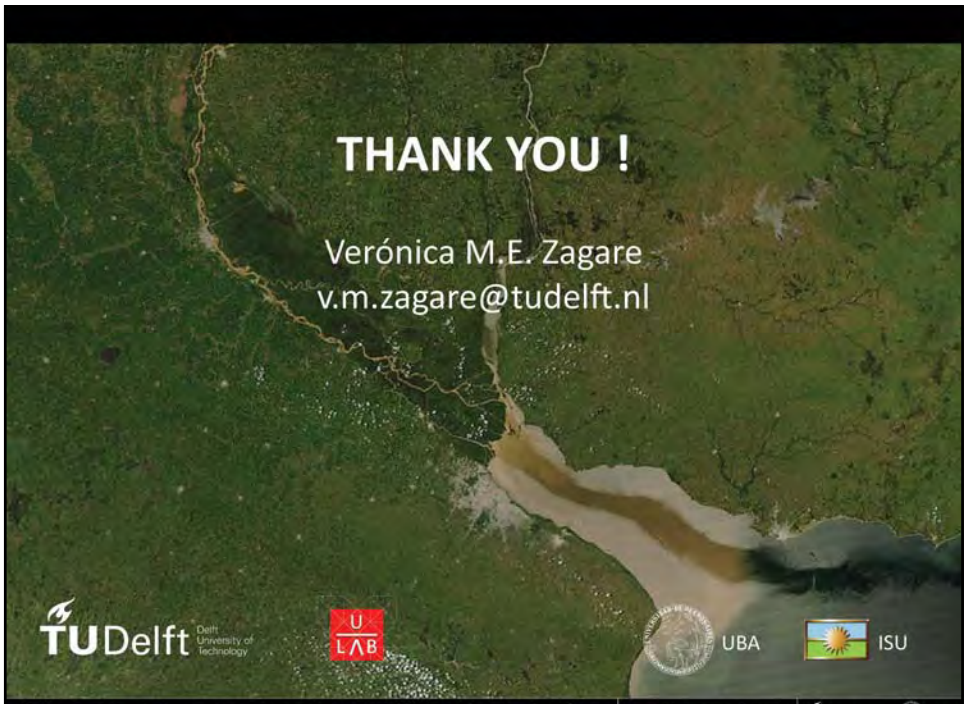
*Lack of regional and metropolitan conscience

*Politic and administrative fragmentation of the space

*Polarisation of resources.

*Economic crisis and instability.

*Uncertainty of climate drivers and trends.

*Political intention?

Far from being an obstacle, it is a challenge and an opportunity that needs to be undertaken.