Los efectos de la agriculturización del humedal pampeano sobre la eutrofización de sus lagunas

The effects of the Pampas wetlands agriculturization on shallow lakes eutrophication

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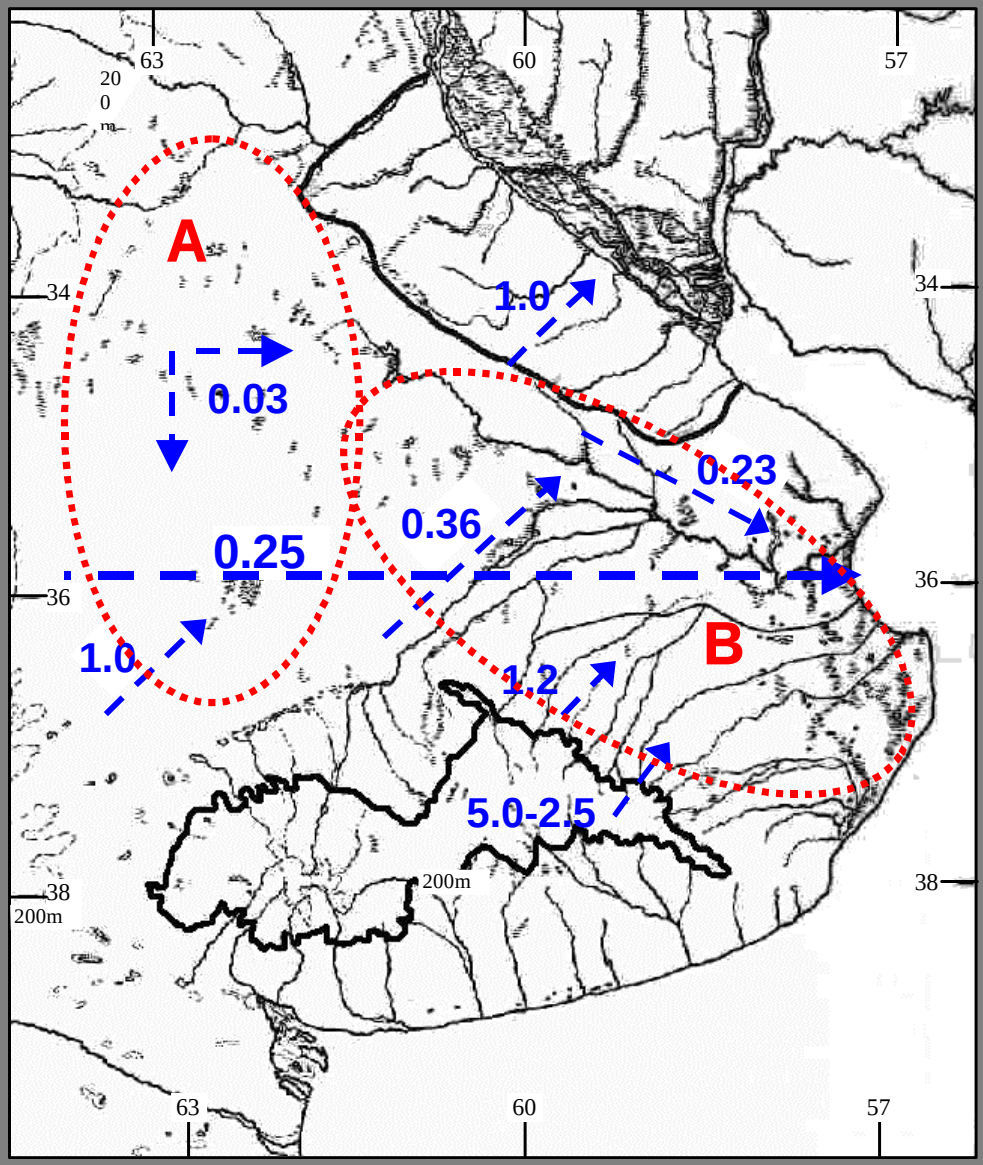


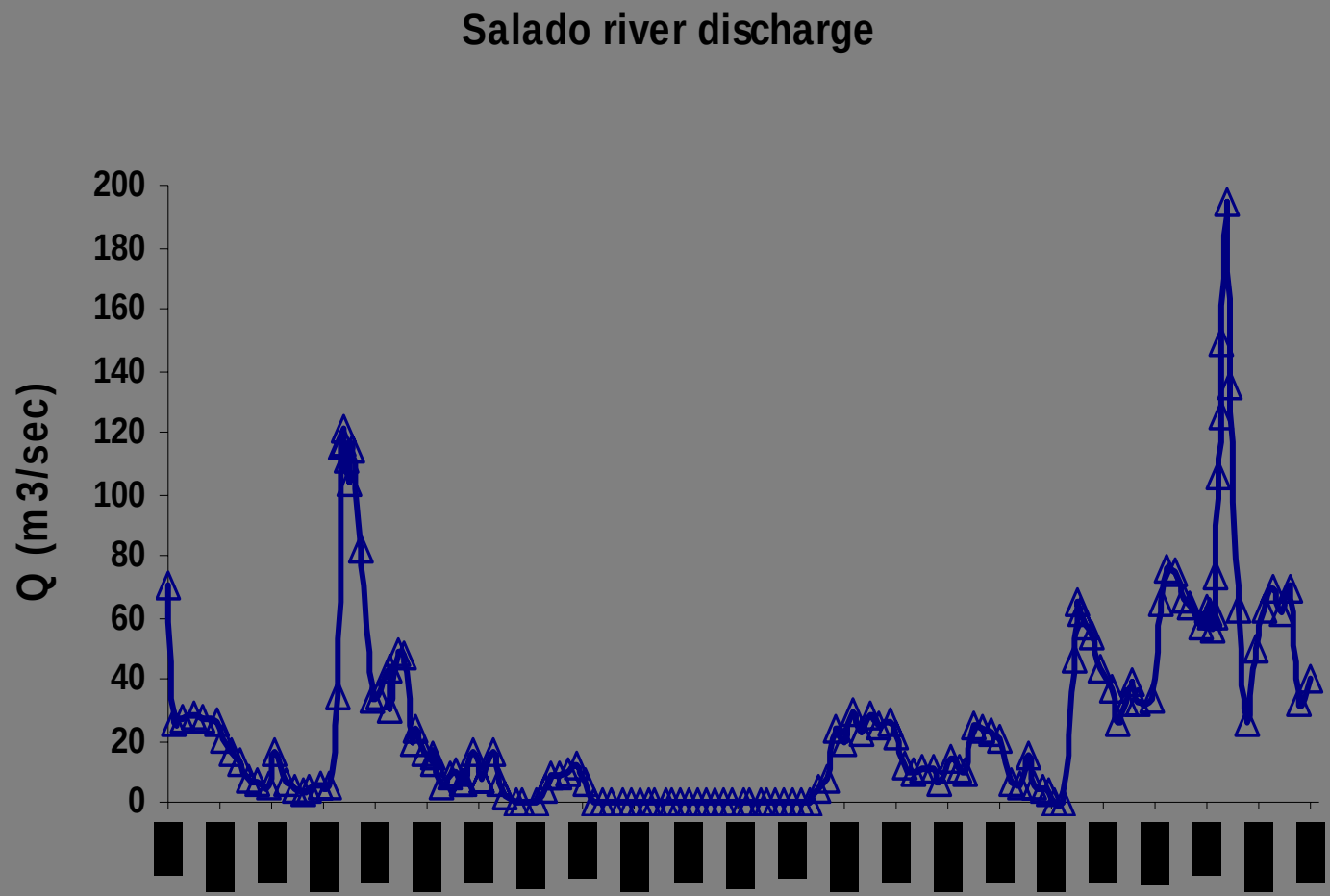
the Pampas

- Central
- Flooding

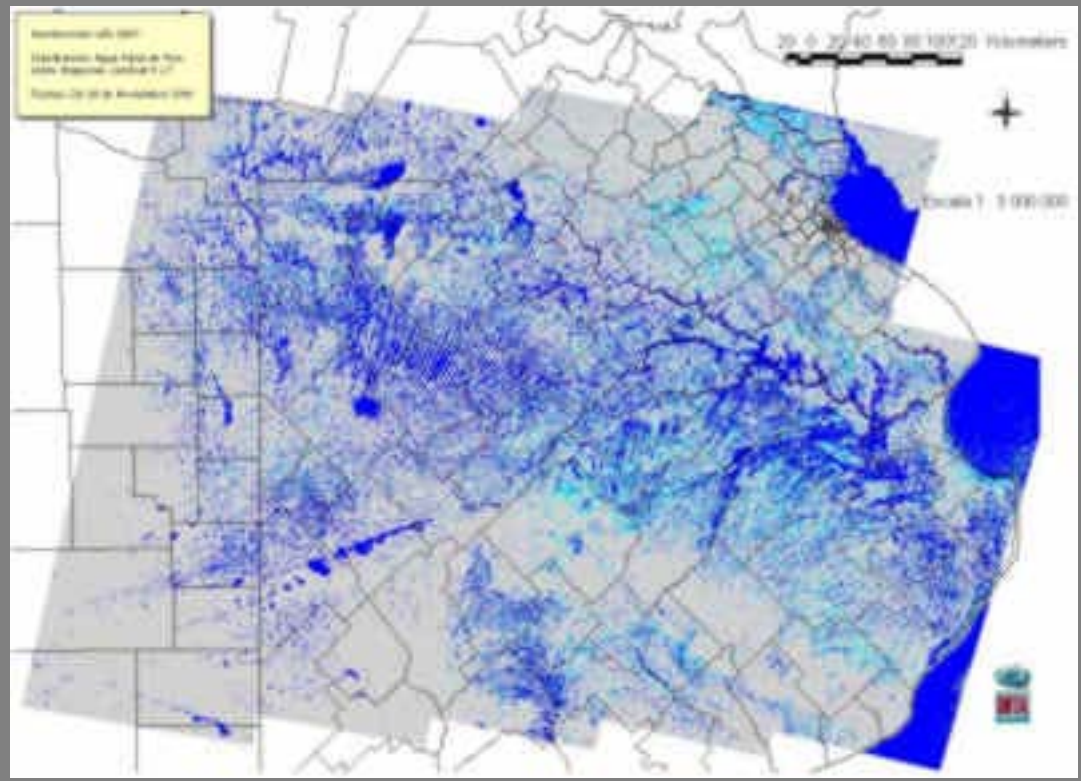
factors that determine the main characteristics of the pampean wetlands

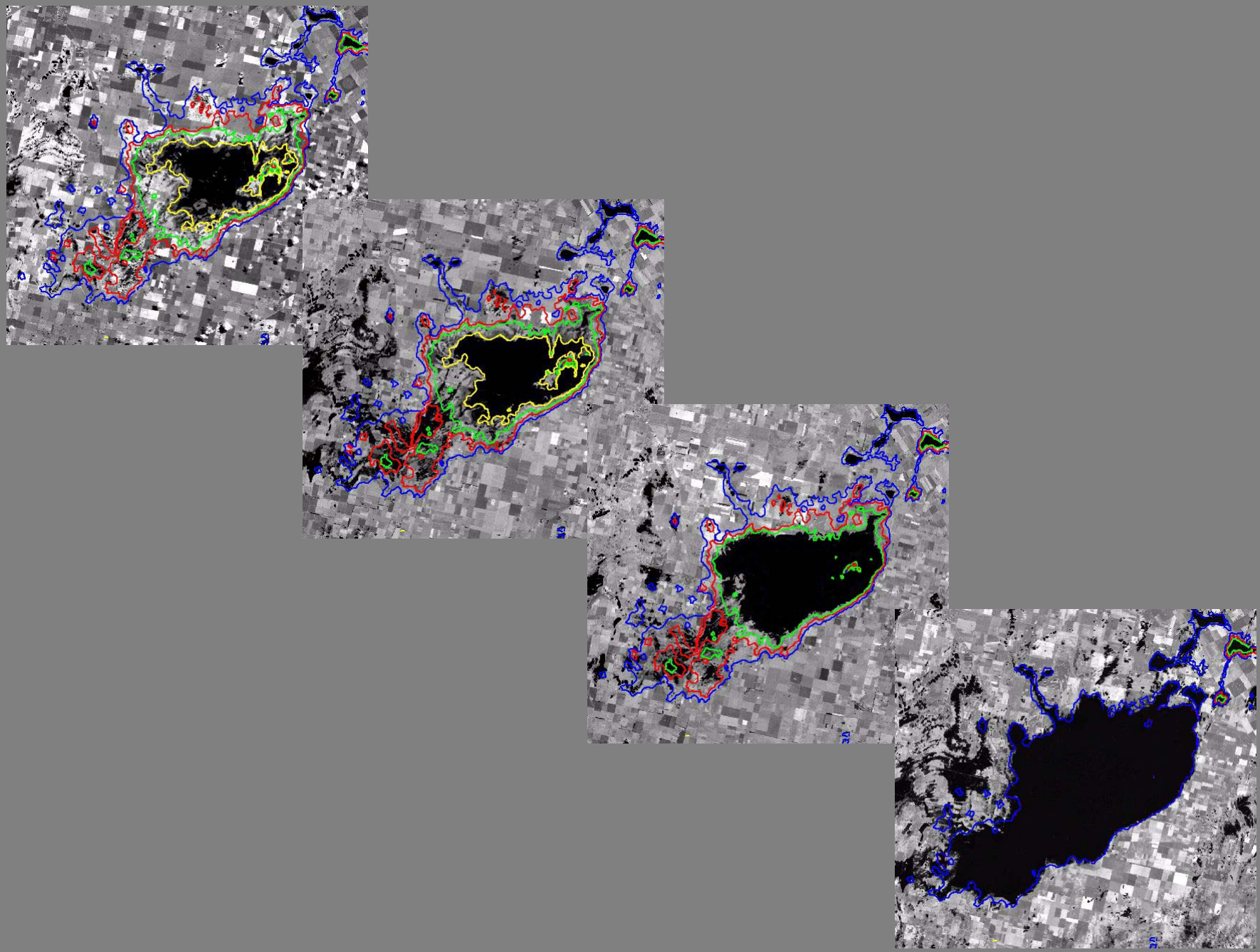
- **geomorphology of the plains**
- **climate**
- **climate variability**
  - **long-term variability**
  - **short-term variability**
  - **seasonal variability**

short-term climate variability in the plains



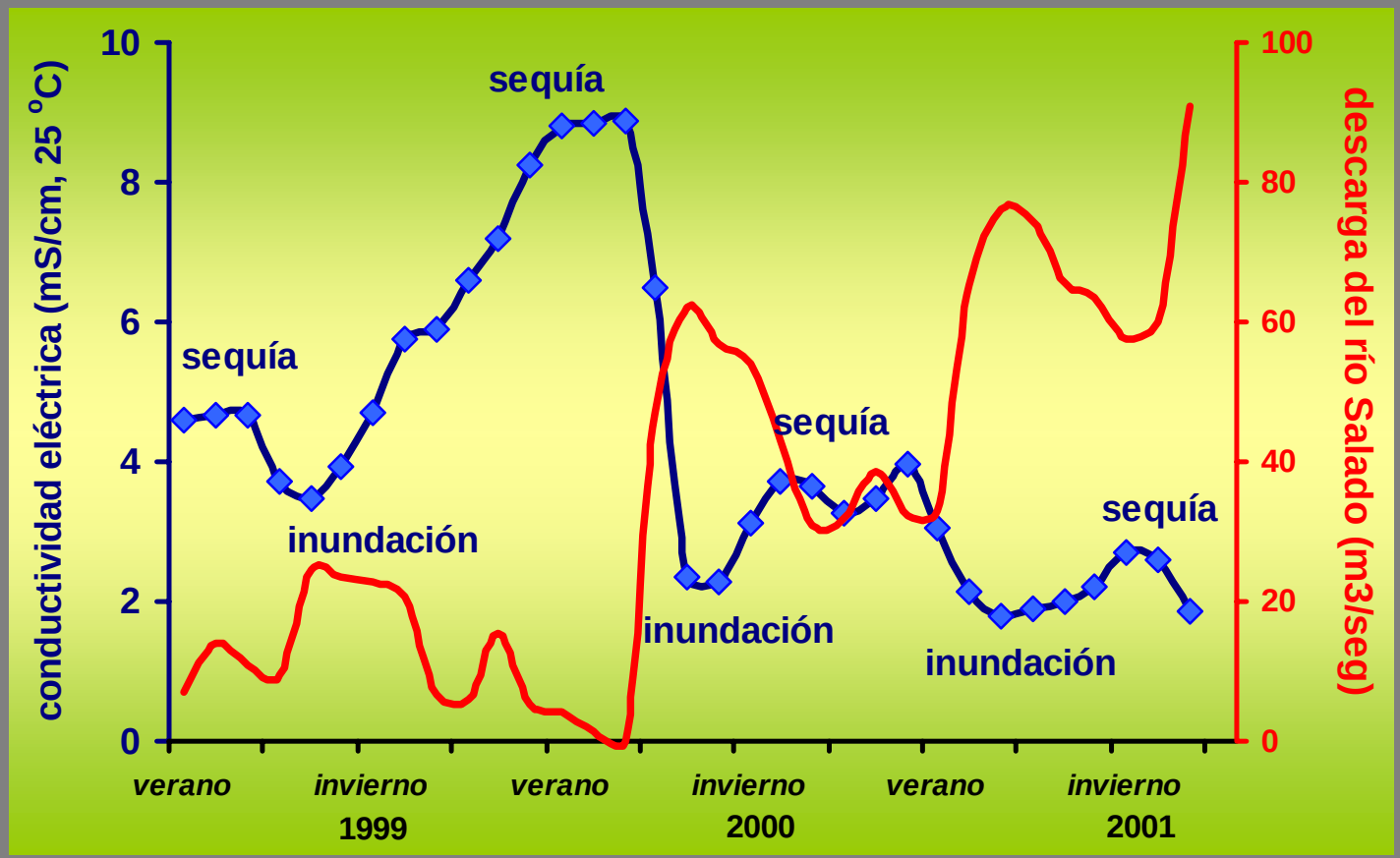
noviembre 2001





ciclo sequía – inundación característico del humedal pampeano

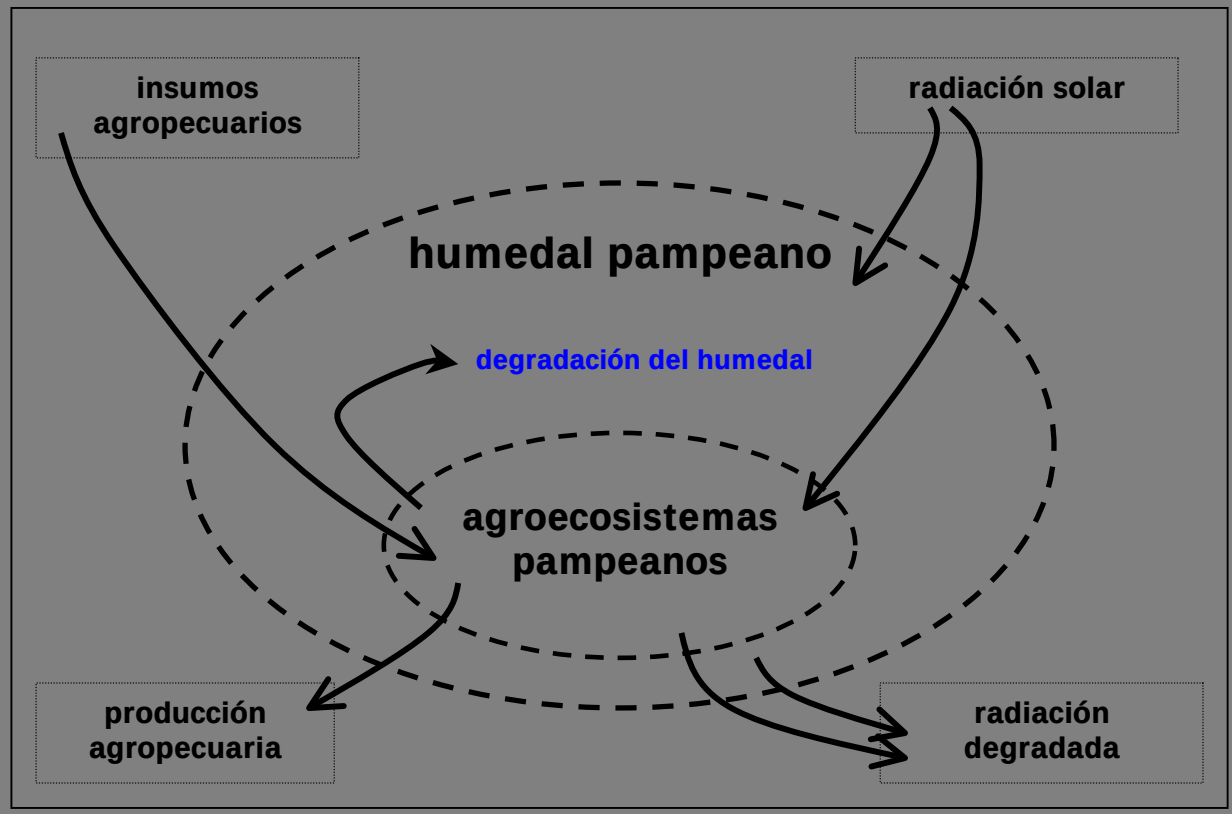
“ inundación” en la sequía y “sequía” en la inundación



seasonal variability in very shallow lake salinity is included

Rosso and Rennella, unpublished data

“agriculturización” e inevitable degradación del humedal pampeano



$$d_i S = [\sum^i (\mu_i^{I} - \mu_i^{II})\, d_e n_i^{I} + \sum^i \sum^r (A_i^{I}\, d\xi_r^{I} + A_i^{II}\, d\xi_r^{II})] \;/\; T_0 \geq 0$$

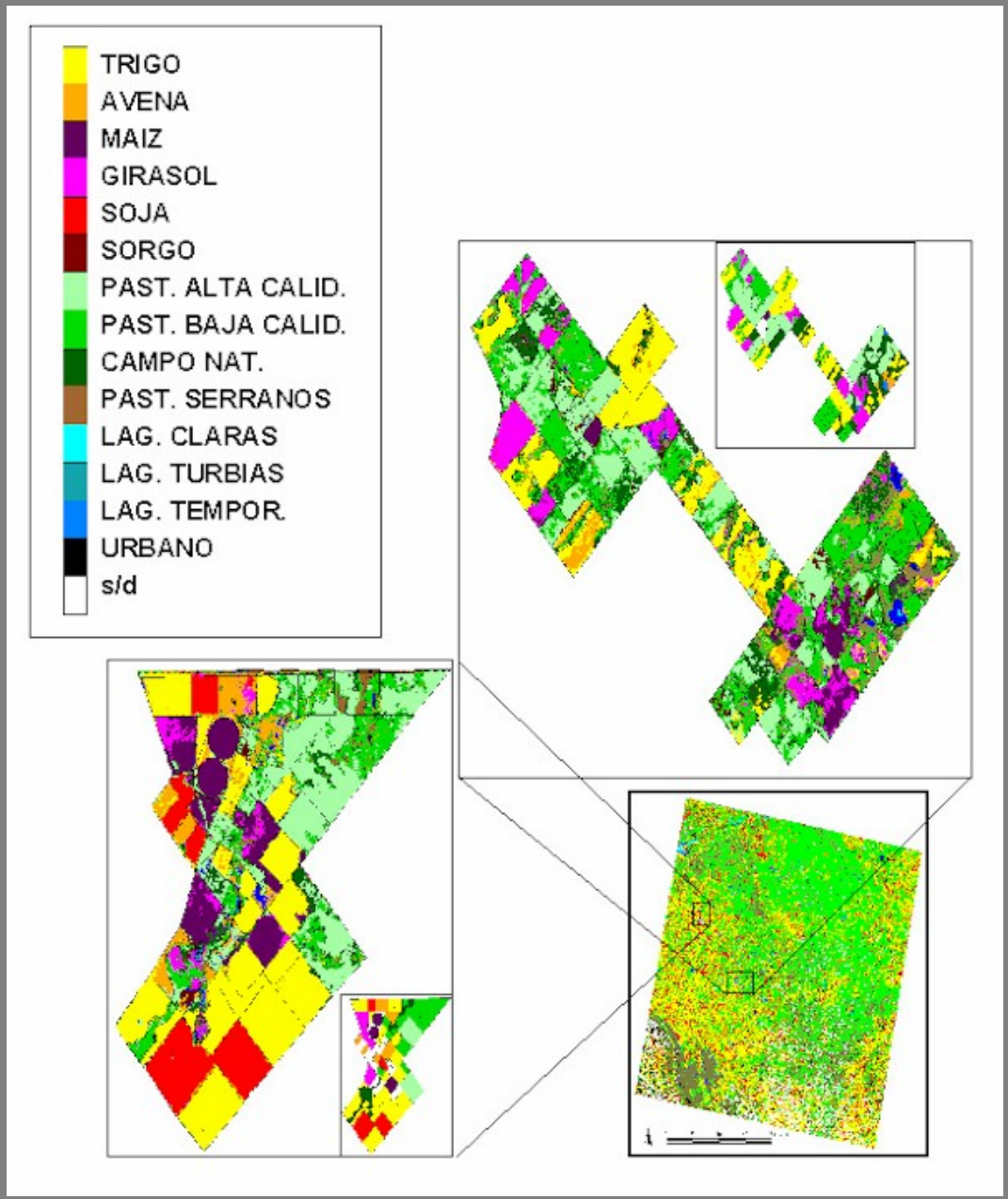
primordial grasslands

an hypothetical landscape for primordial pampean wetlands

current grasslands (1)

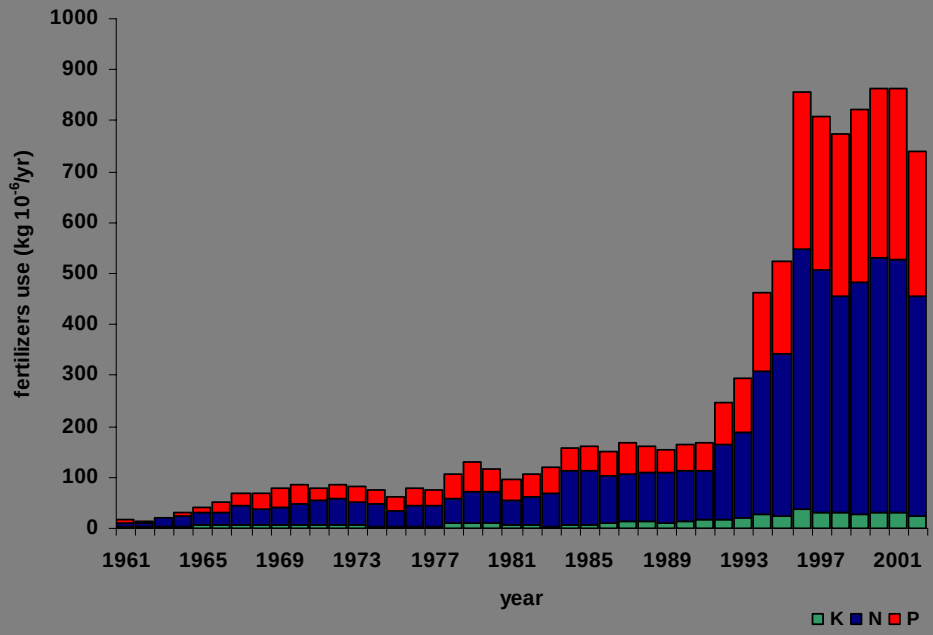
fotos: INTA

current grasslands (2)



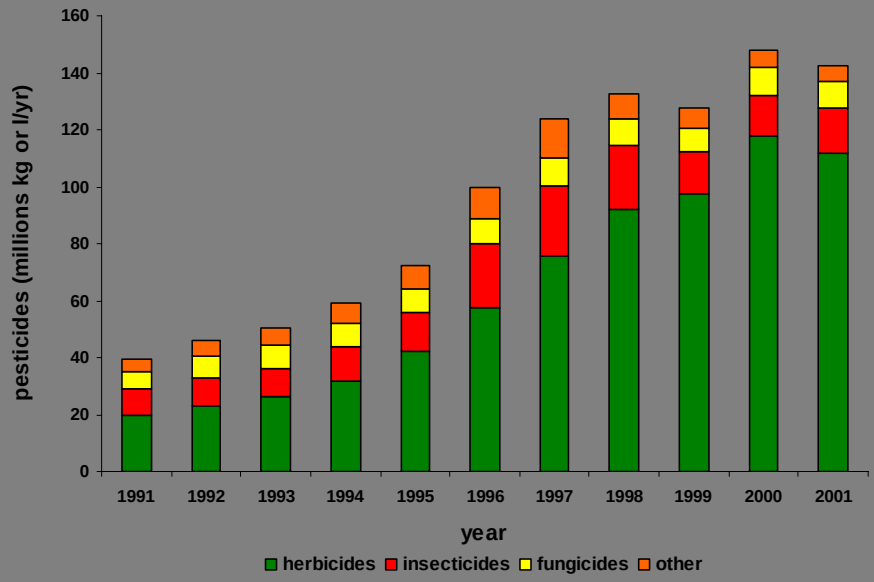
from Guerschman et al., 2001

“more agriculturization”



fertilizers use

pesticides use

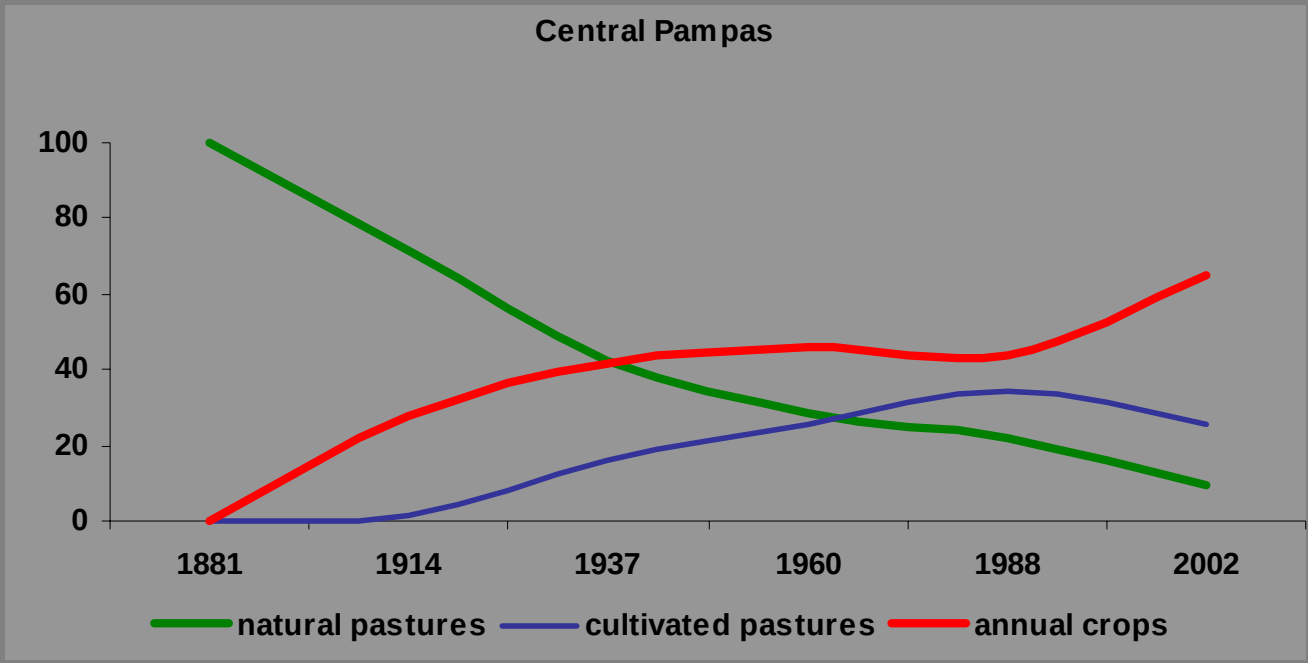


environmental efforts on the pampean wetlands

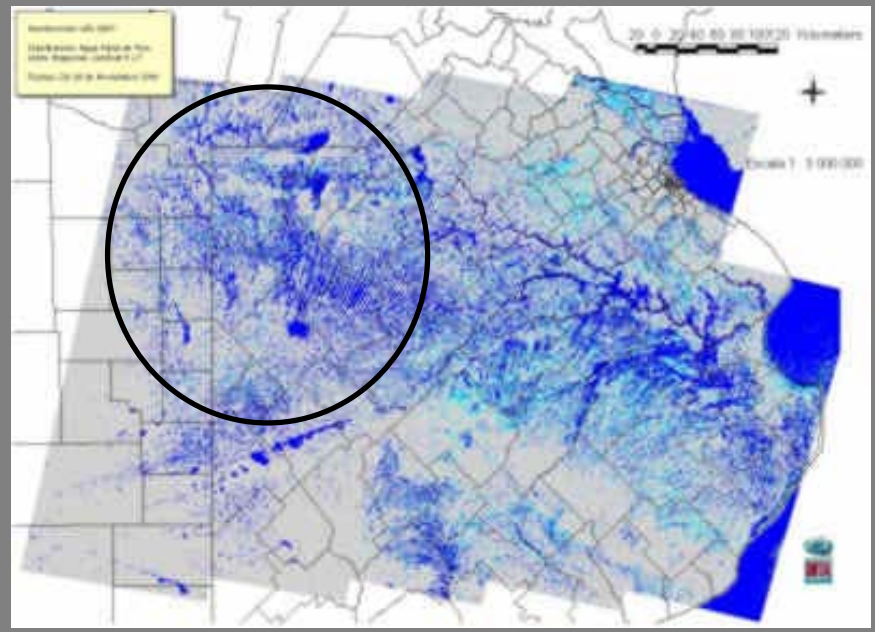
- dredging, canalization and damming of water bodies
- changes in land use patterns
- increased land erosion
- agriculture (pastures, implanted pastures, annual crops, extensive livestock growing, animal feed-lots)
- unregulated urbanization with deficient or without sewage treatment works
- unregulated land-fill usually with toxic substances

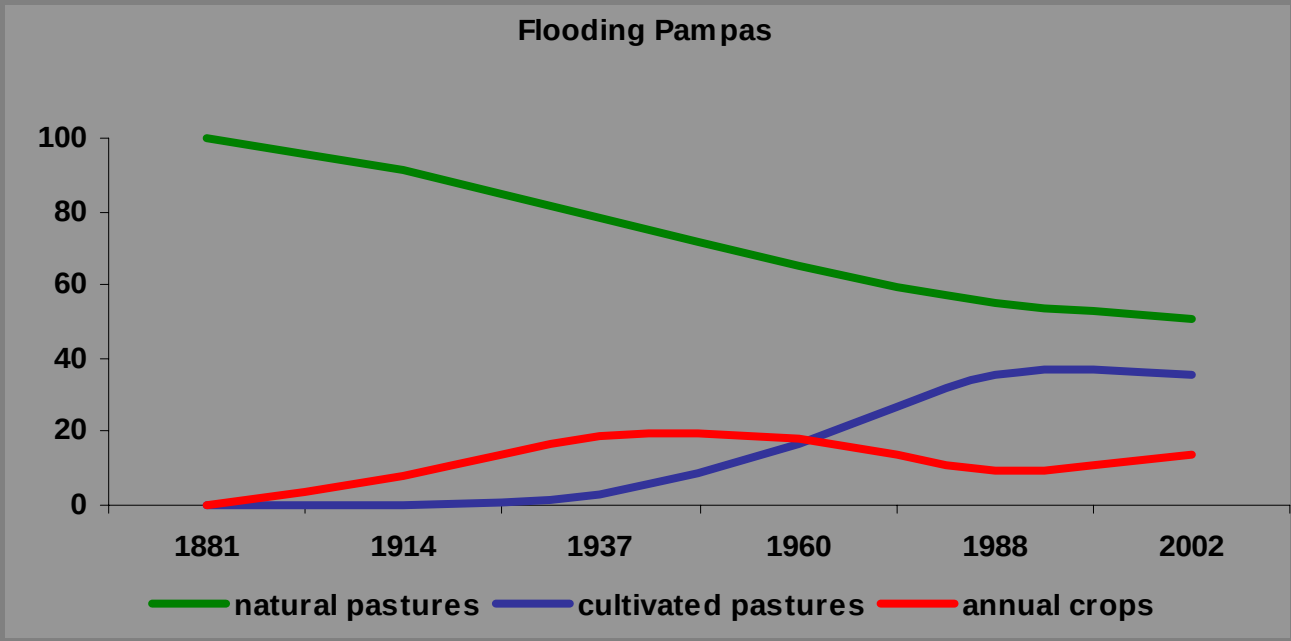
environmental effects in the pampean wetlands

- changes in natural hydrological patterns
- changed morphology of water bodies
- increased inorganic sedimentation
- increased levels of non-oxidized organic matter and its metabolites
- nutrient enrichment (mainly P and N)
- contamination of surface waters and groundwater with toxic substances commonly used in modern agriculture (herbicides, insecticides, and other agro-toxic substances)
- contamination of surface waters and groundwater (?) with highly toxic substances used in industry
- huge changes in vegetal and animal biodiversity and abundance for both terrestrial and aquatic ecosystems

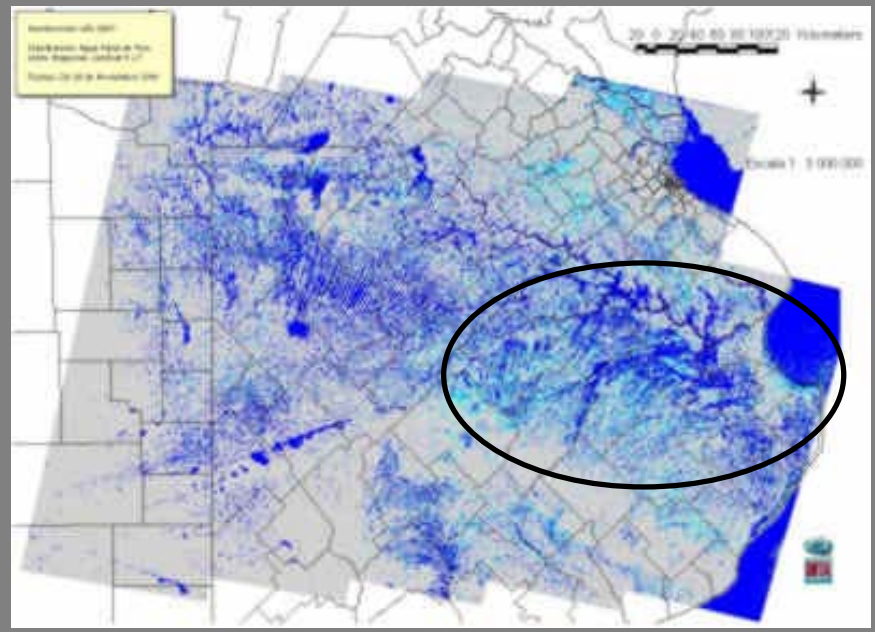


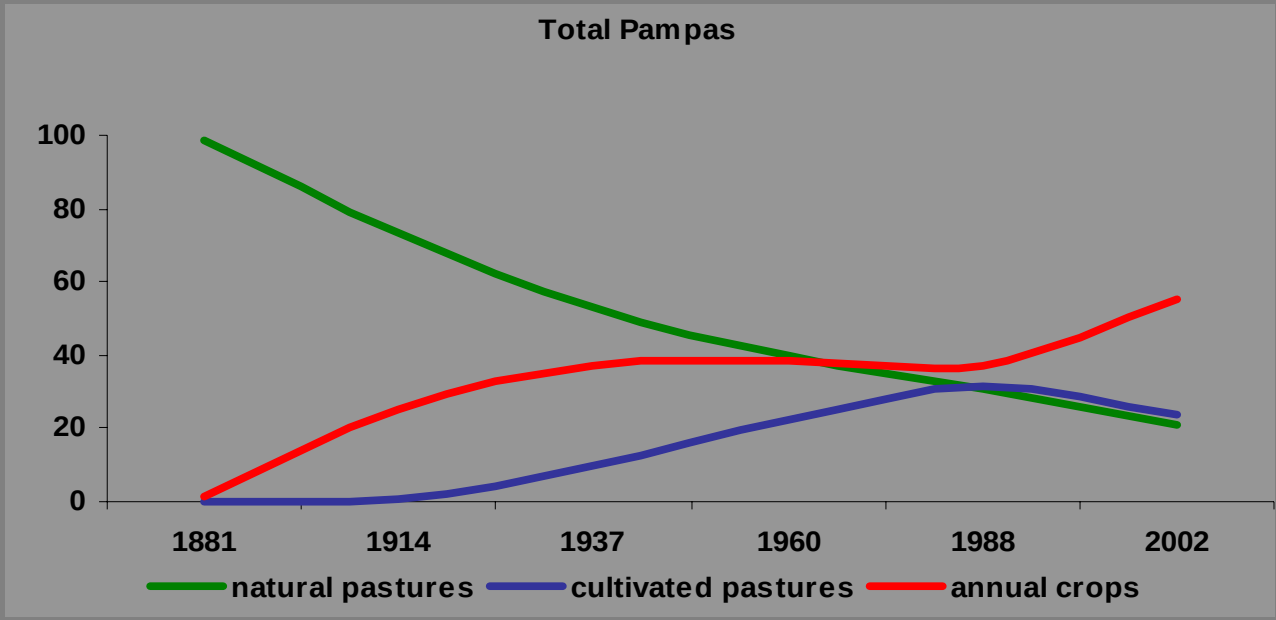
modified from Viglizzo et al., 2001

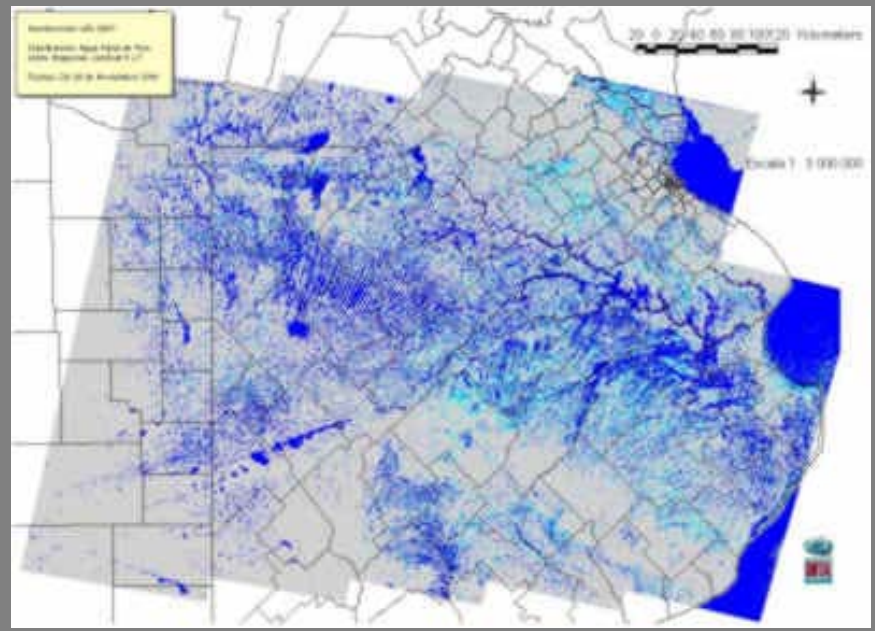


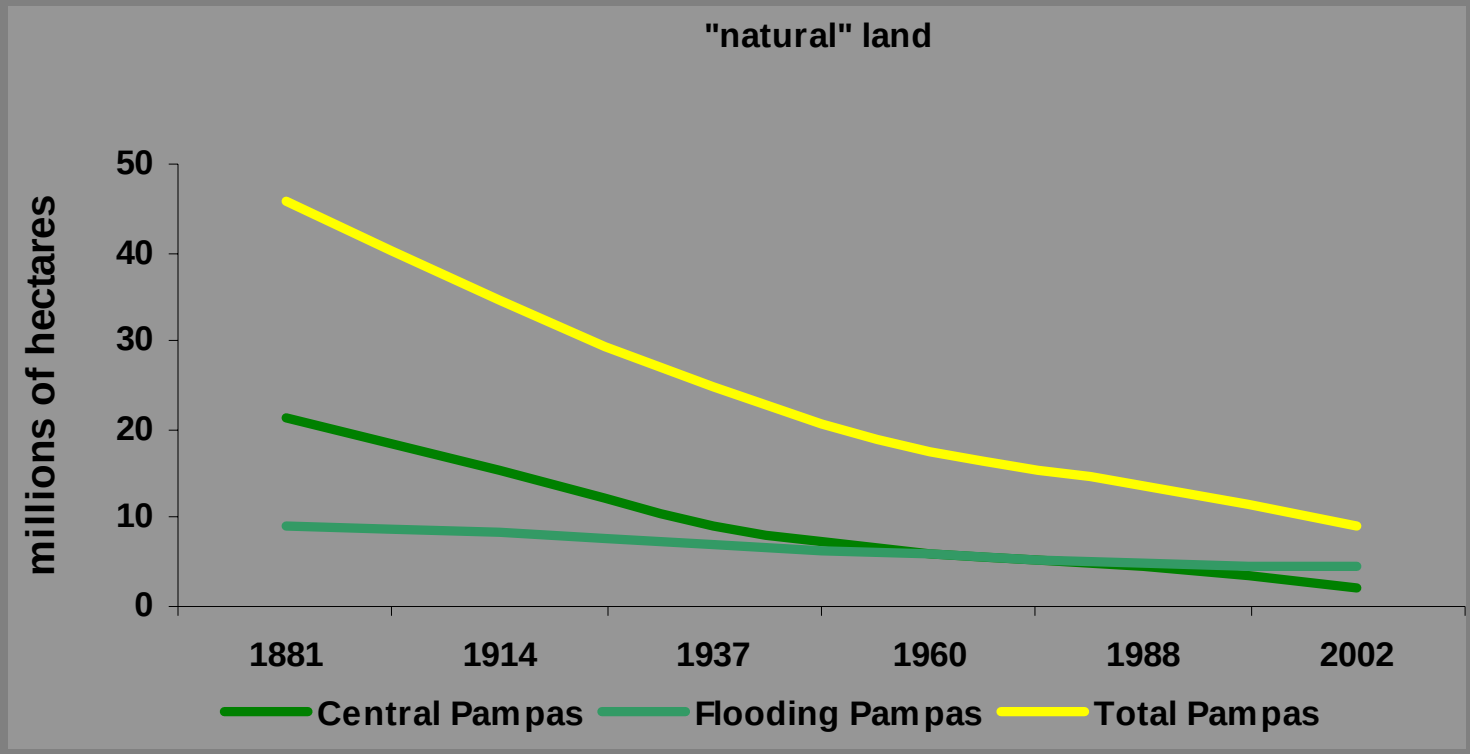


modified from Viglizzo et al., 2001

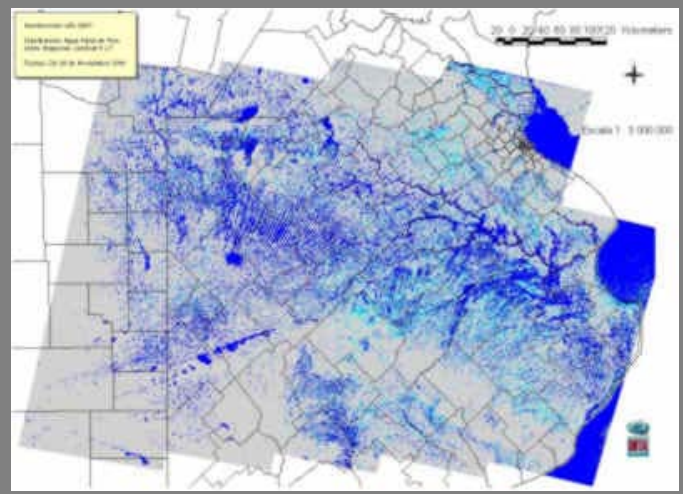



Total Pampas
100
80
60
40
20
0
1881
1914
1937
1960
1988
2002
natural pastures
cultivated pastures
annual crops

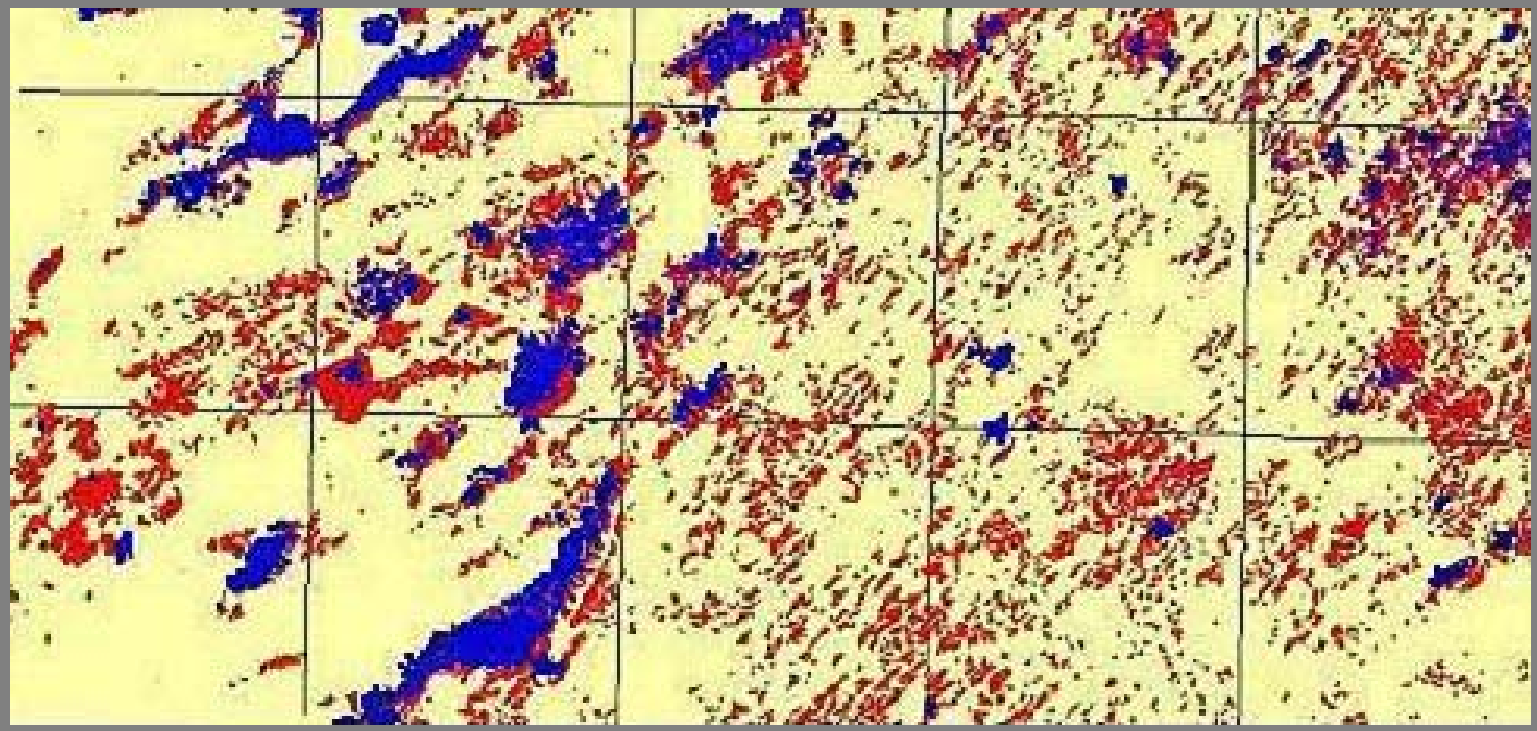




modified from Viglizzo et al., 2001

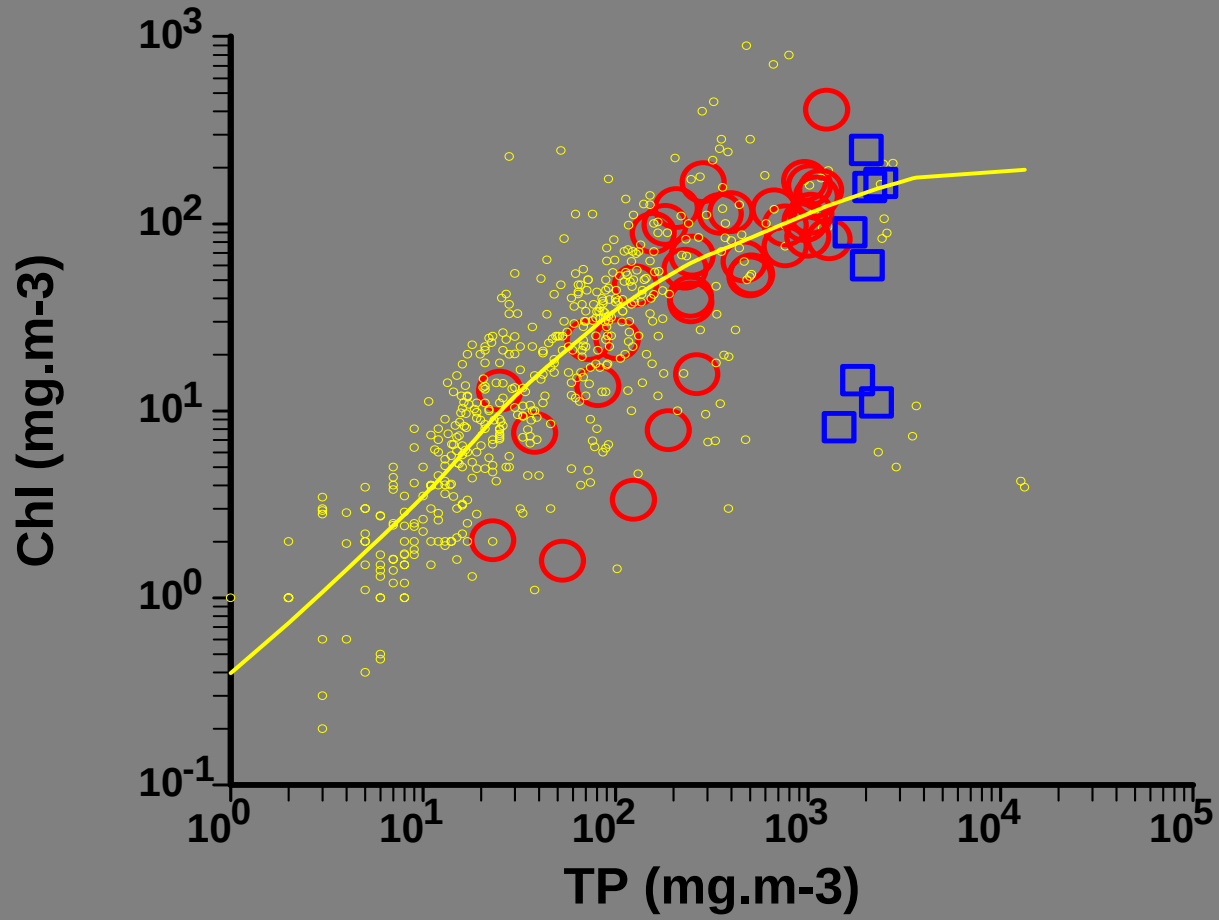


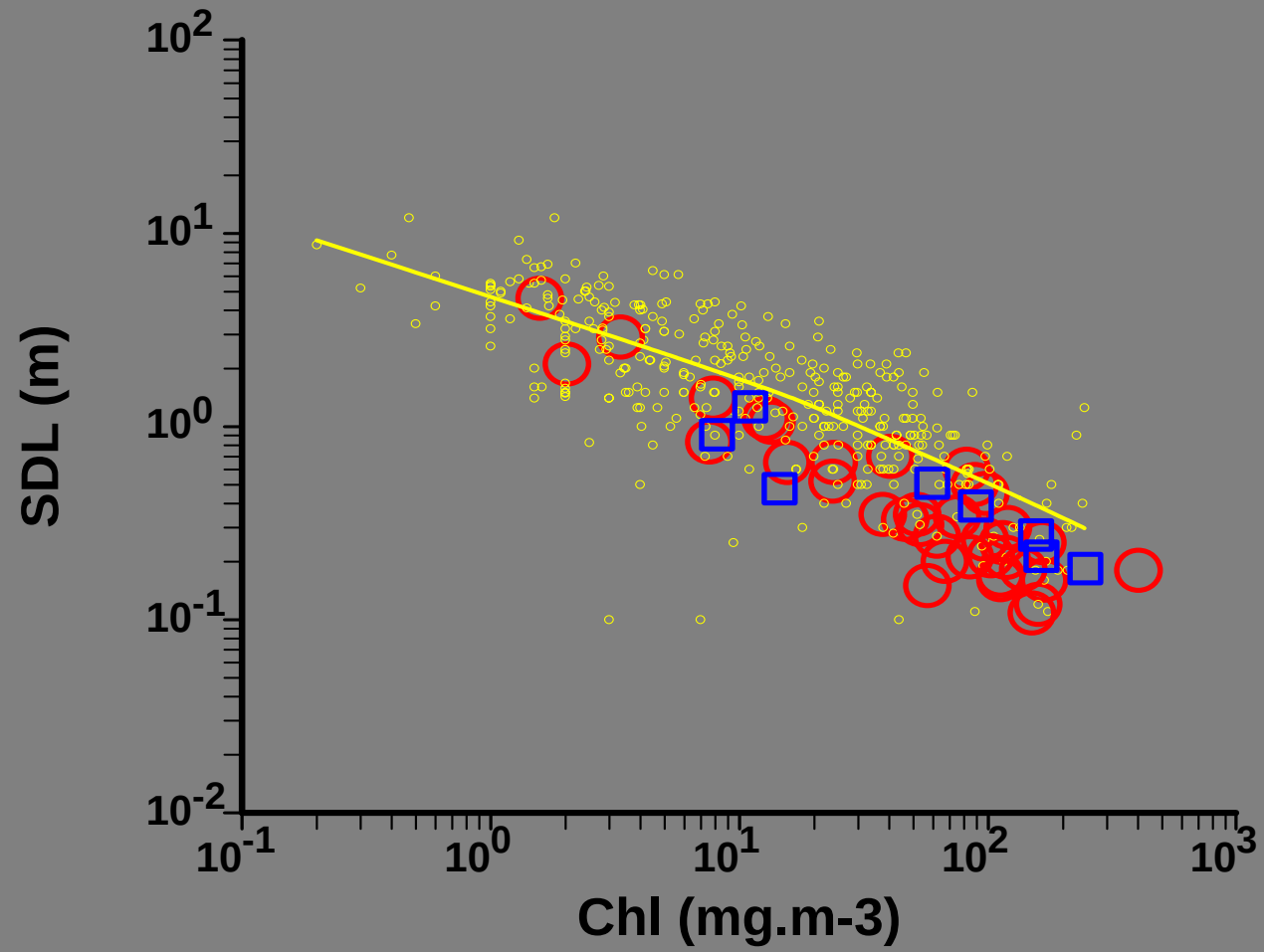
los lagos someros (lagunas):



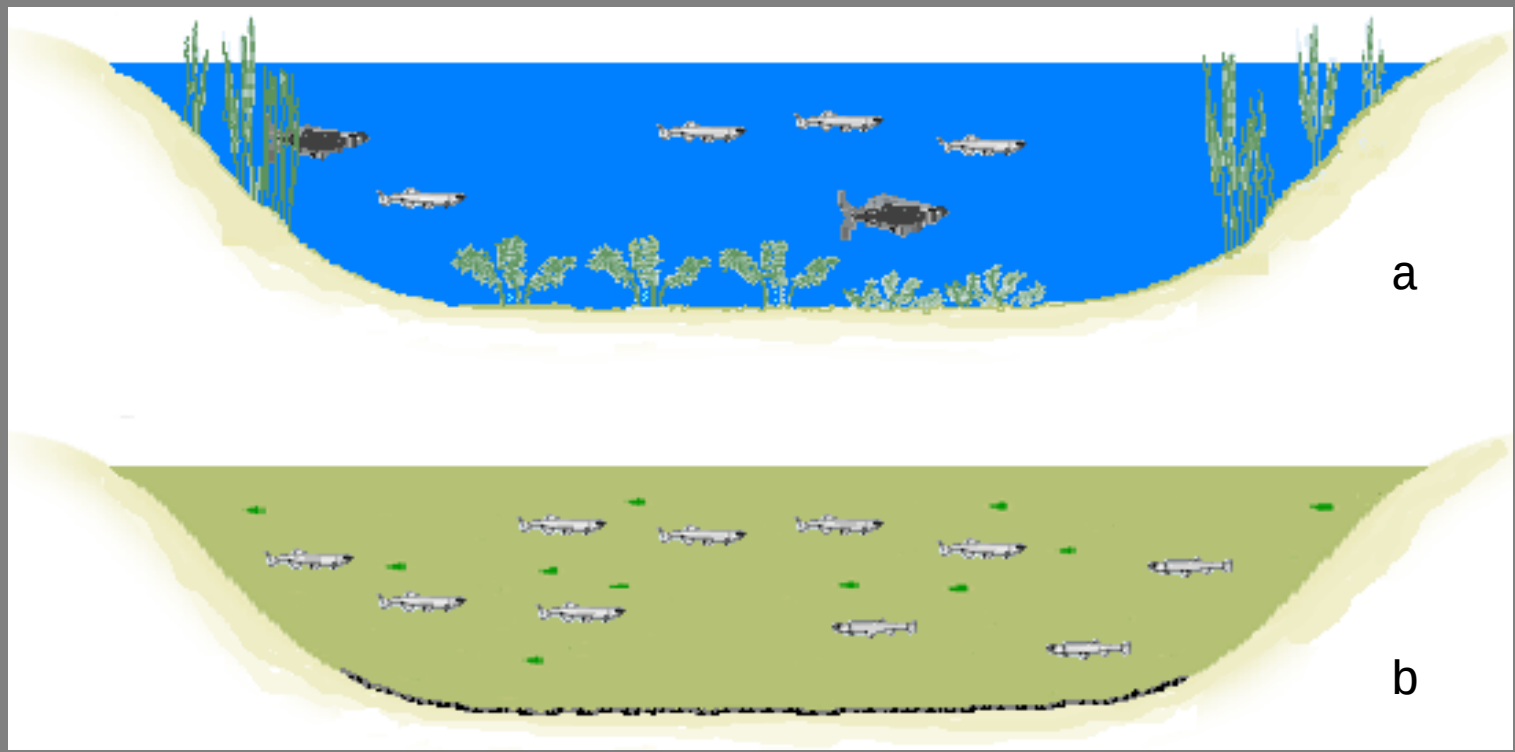
componente central

del humedal pampeano

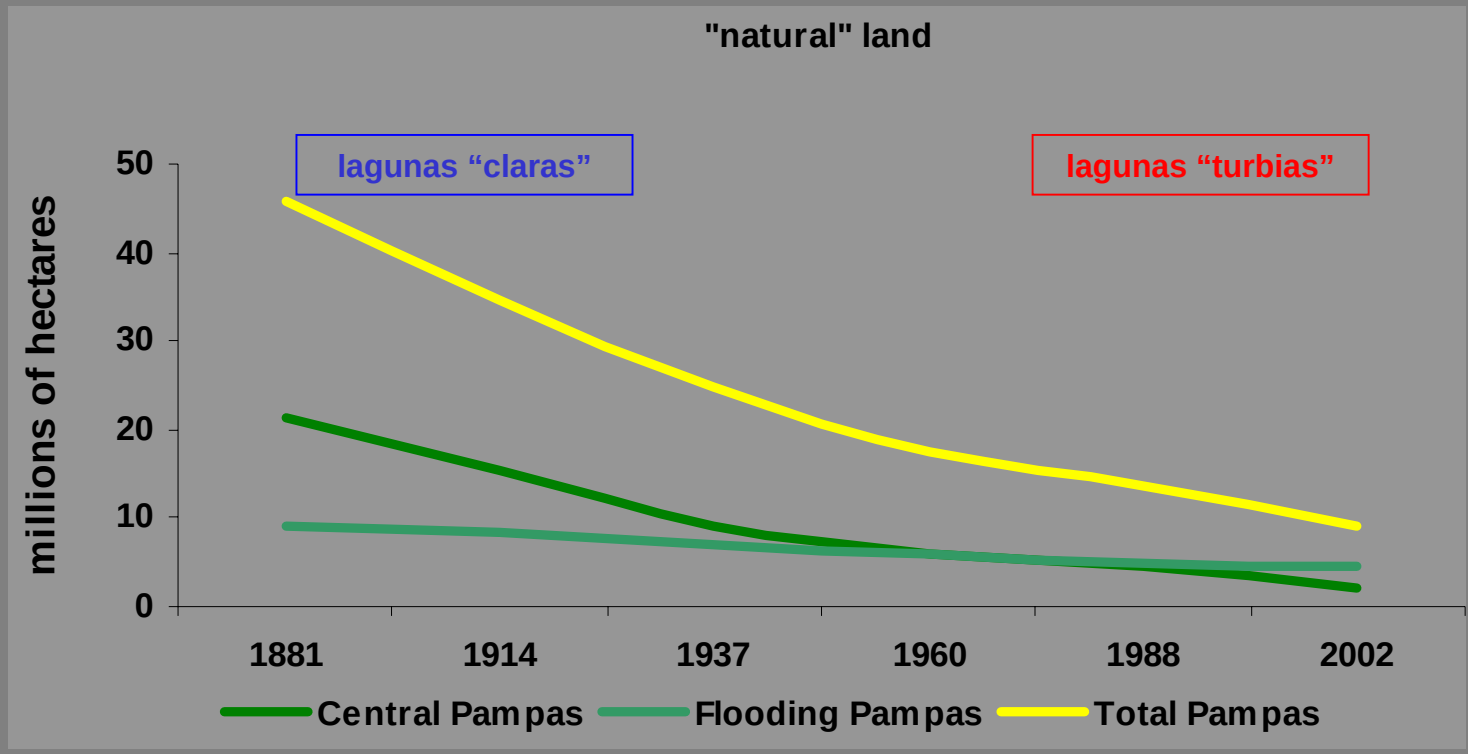

Chl (mg.m-3)
10^3
10^2
10^1
10^0
10^-1
10^0
10^1
10^2
10^3
10^4
10^5
TP (mg.m-3)

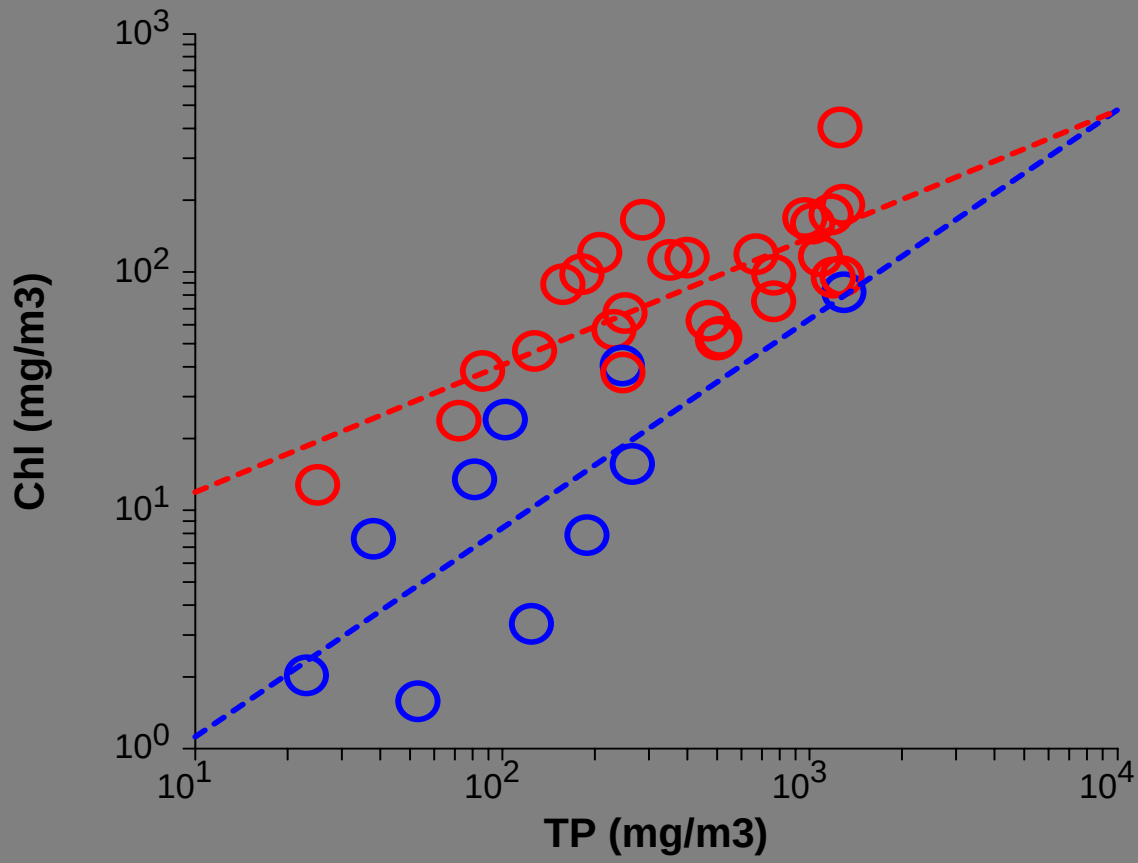

SDL (m)
10^2
10^1
10^0
10^-1
10^-2
10^-1
10^0
10^1
10^2
10^3
Chl (mg.m-3)

“claras” y “turbias”



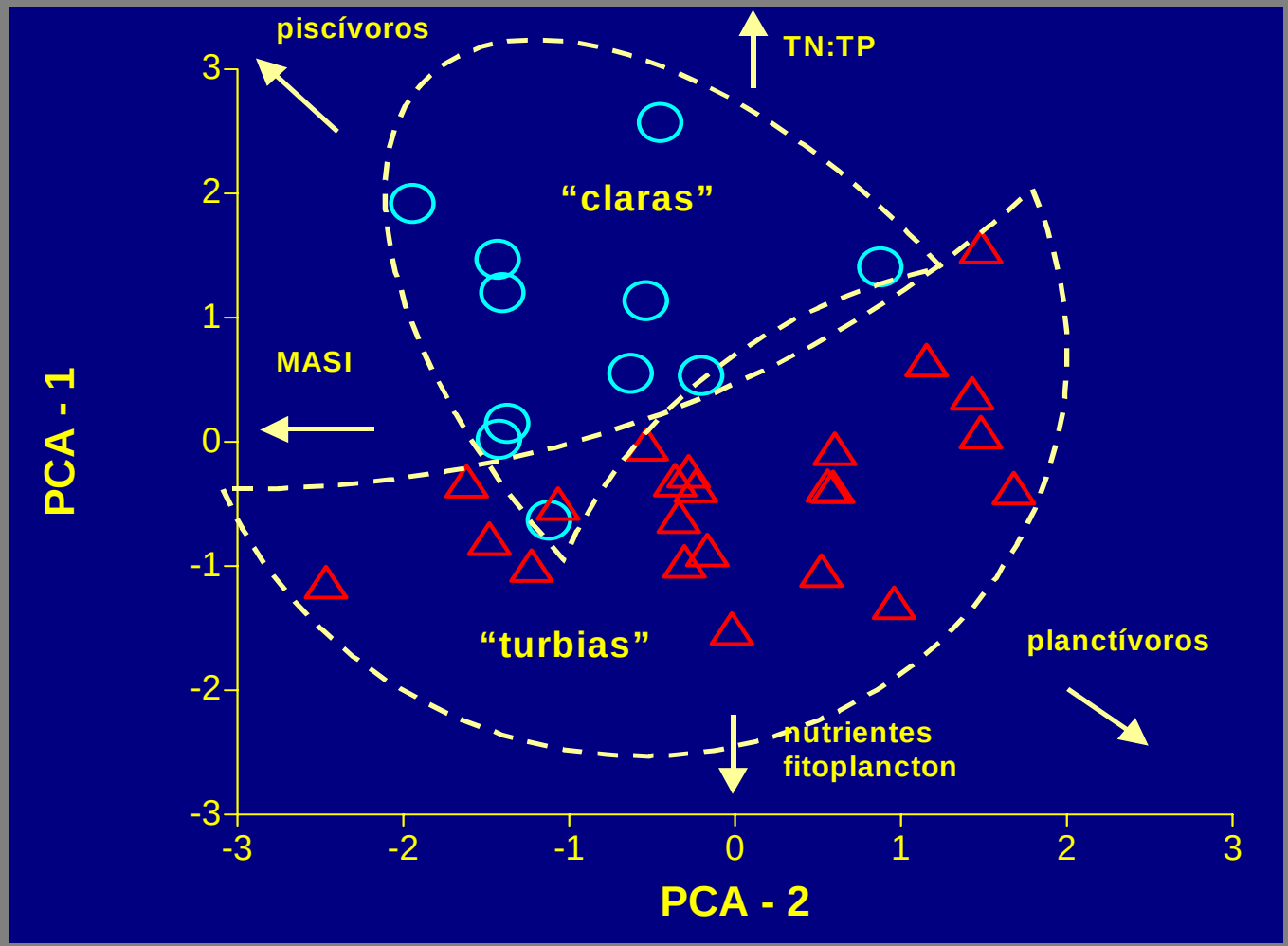
lagunas “claras” y “turbias” como indicadores de la intensidad de acción antrópica sobre el humedal pampeano



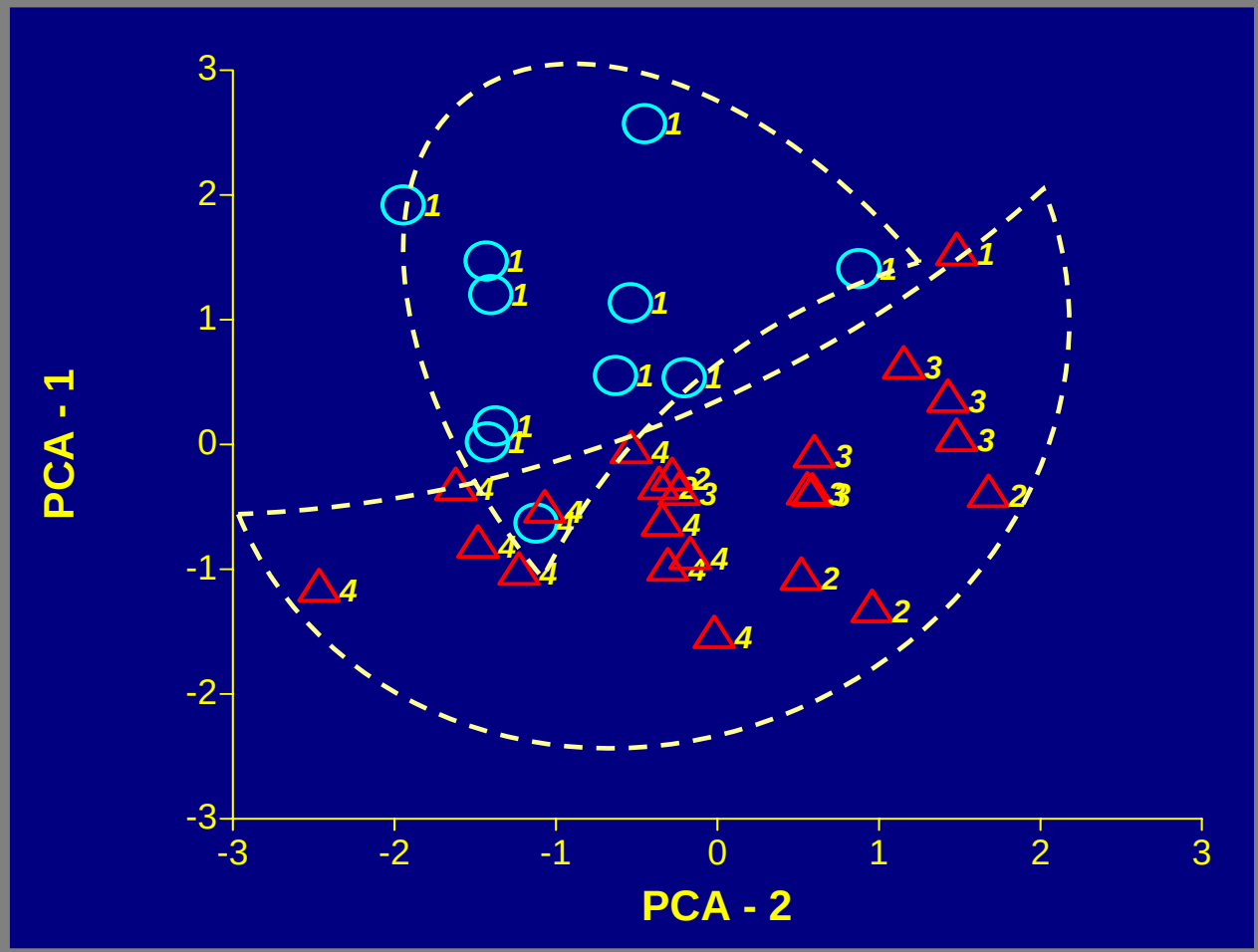


37 lagunas pampeanas, “turbias” (O) y “claras” (O)

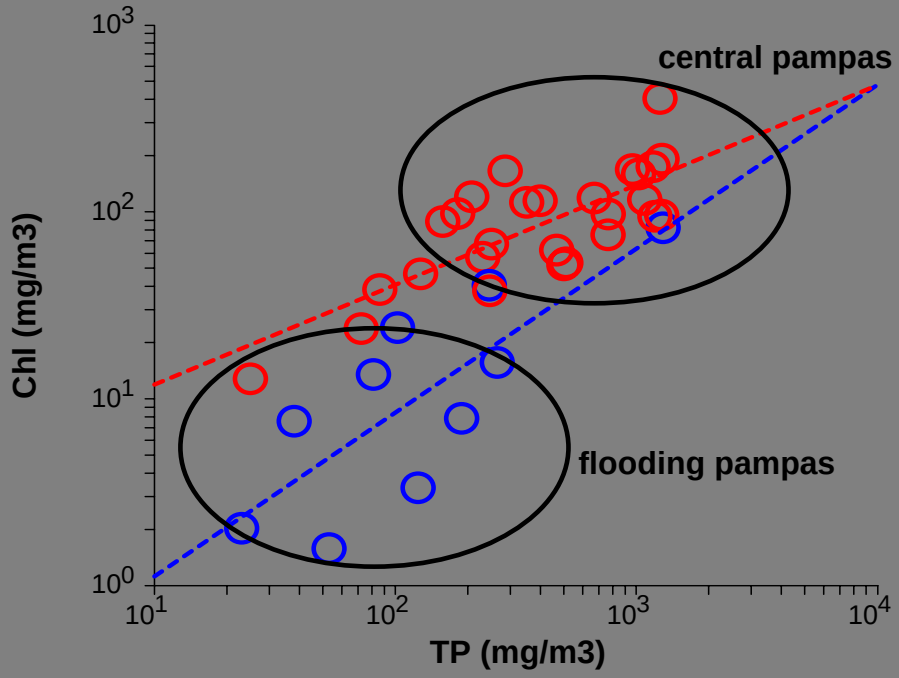
“claras” y “turbias”

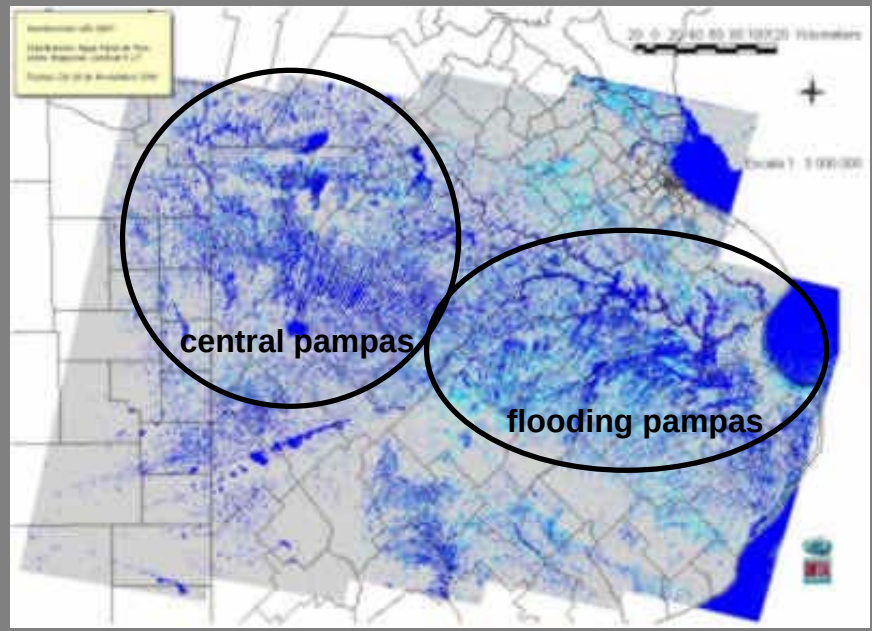


“claras” y “turbias”



“claras” y “turbias”

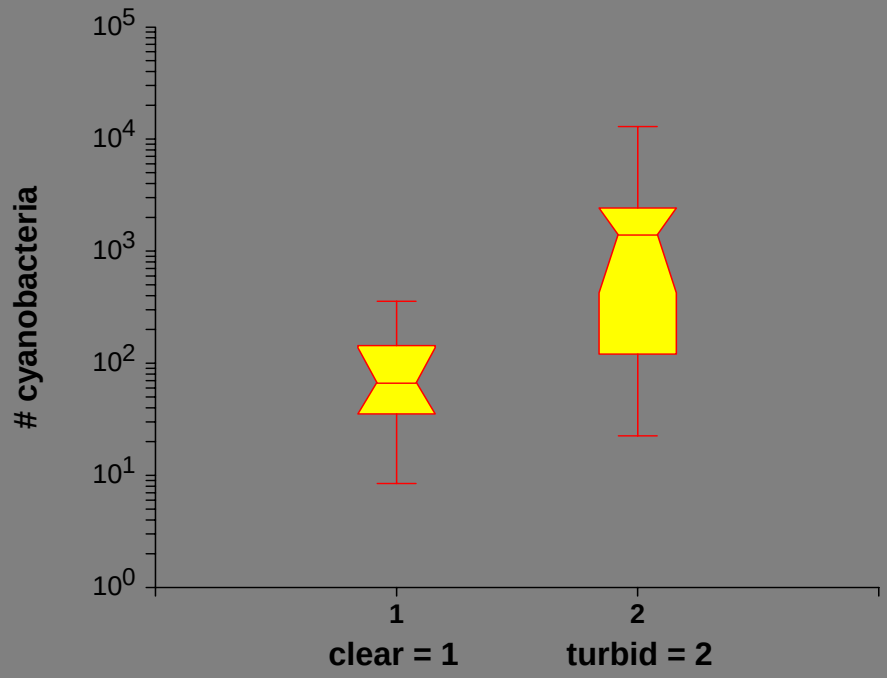


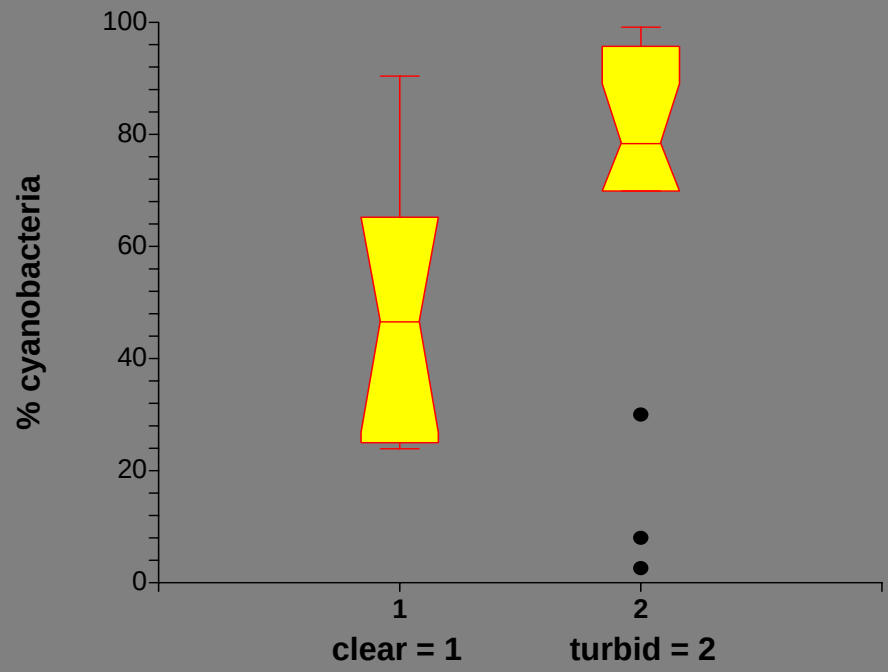


for pampean terrestrial ecosystems, dramatic changes in weighted biodiversity have been widely documented for vegetal and animal communities, therefore, only some changes in the biota of the aquatic component of the pampean wetlands will be presented here:

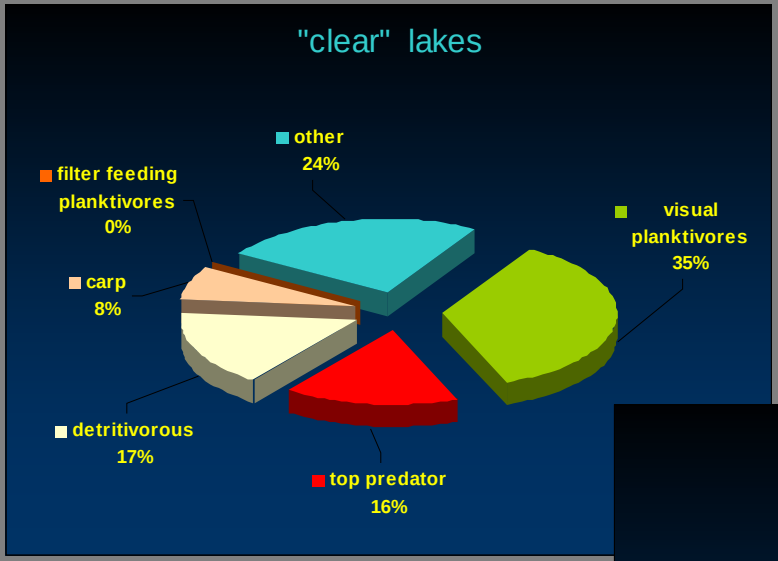
lake phytoplankton

“clear” and “turbid” lakes

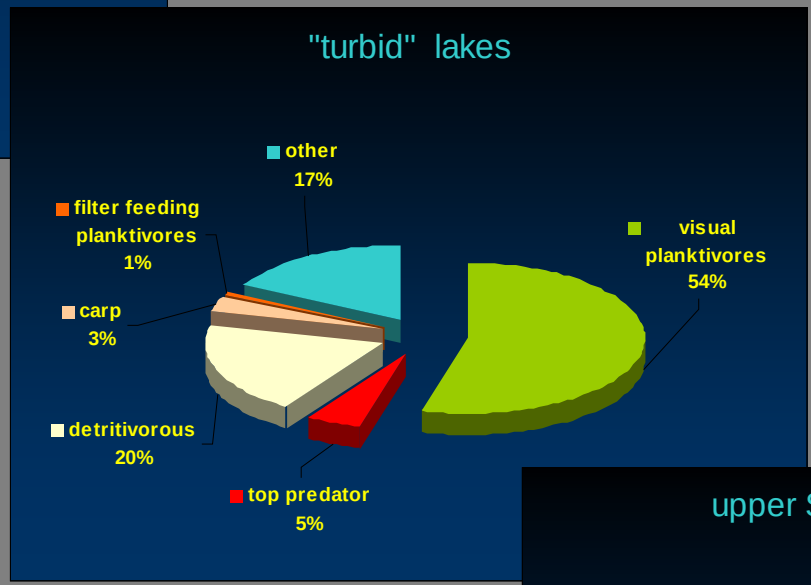




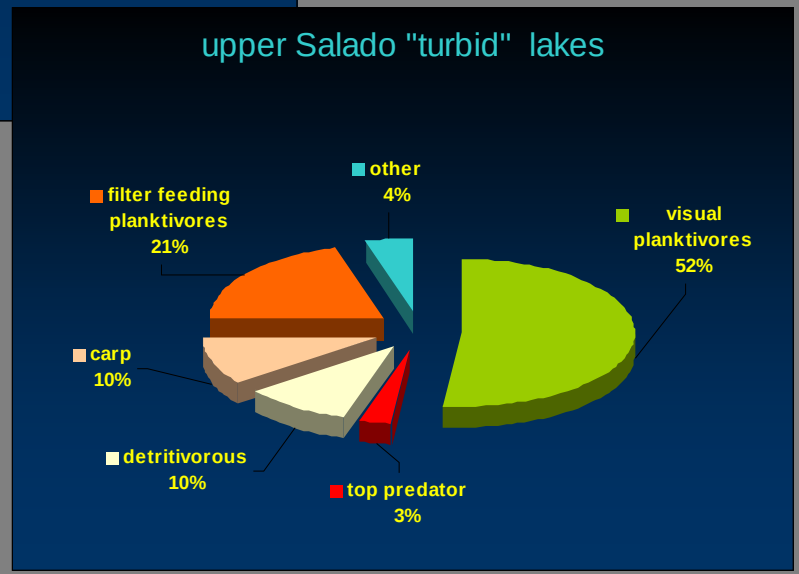
lake fish changes
from “clear” to “turbid” very shallow pampean lakes



water transparency = 1.50 m



water transparency = 0.38 m



water transparency = 0.23 m

from primordial wetlands to agricultural land

past

- natural grasslands
- natural drainages

- "clear" lakes
- macrophyte dominated
- usually with oxic, P unsaturated sediments
- balanced vegetal and animal communities
- relatively low levels of organic matter, more oxidative environments
- nutrient levels according to drainages on highly productive soils

present

- agriculture, human settlements and highly modified grasslands
- drainages medium to highly modified

- "turbid" lakes
- phytoplankton dominated
- hypoxic and anoxic, P saturated sediments
- simplified vegetal and animal communities
- high levels of organic matter, reductive environments
- very high nutrient levels due to agriculture and urbanization
- extended fish and avian mortalities
- human health hazards

muito obrigado!