

# Chemical accumulation and records of past environmental change: Insights from the east coast of South Africa

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# Wetlands in Drylands

## Climatic drivers:

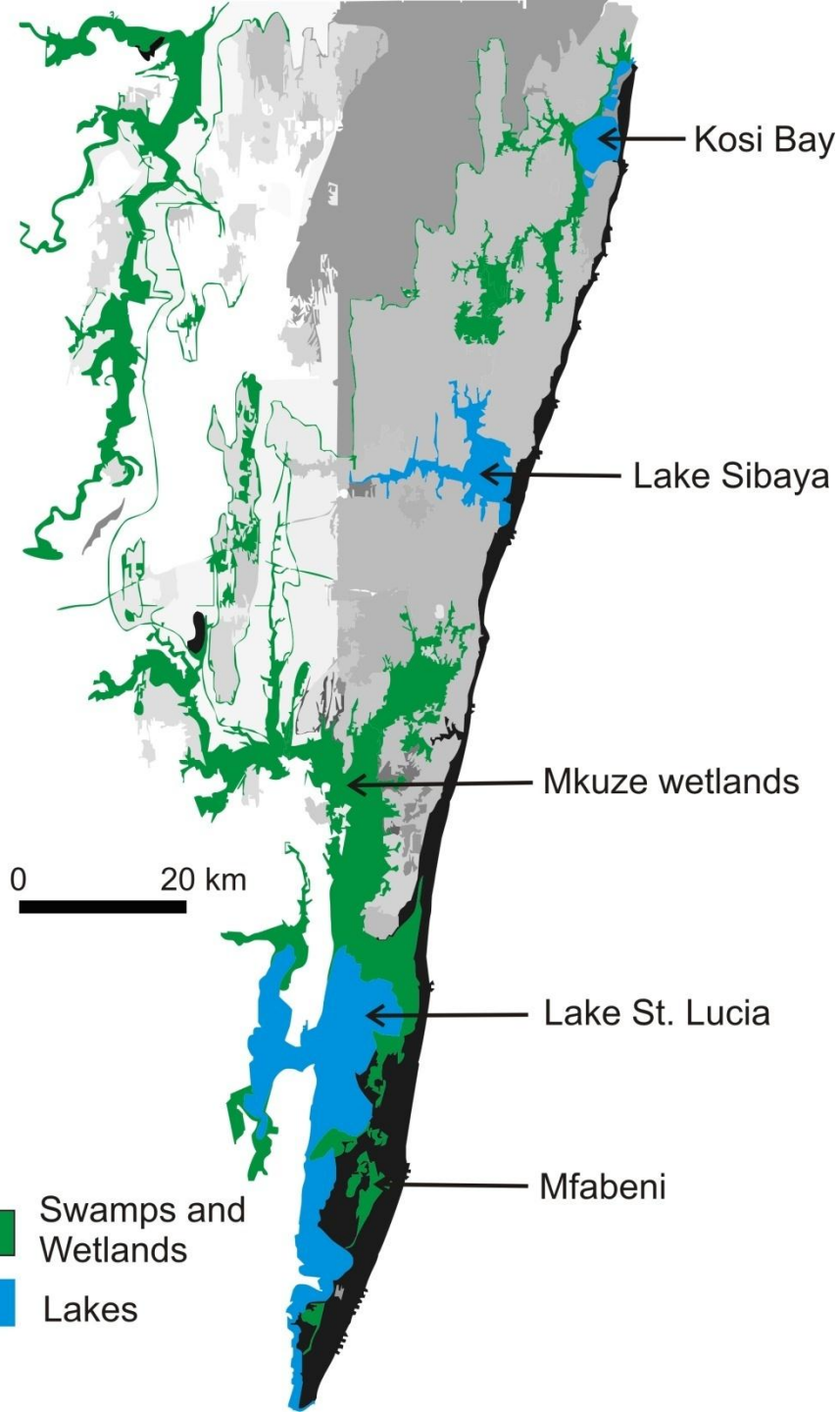
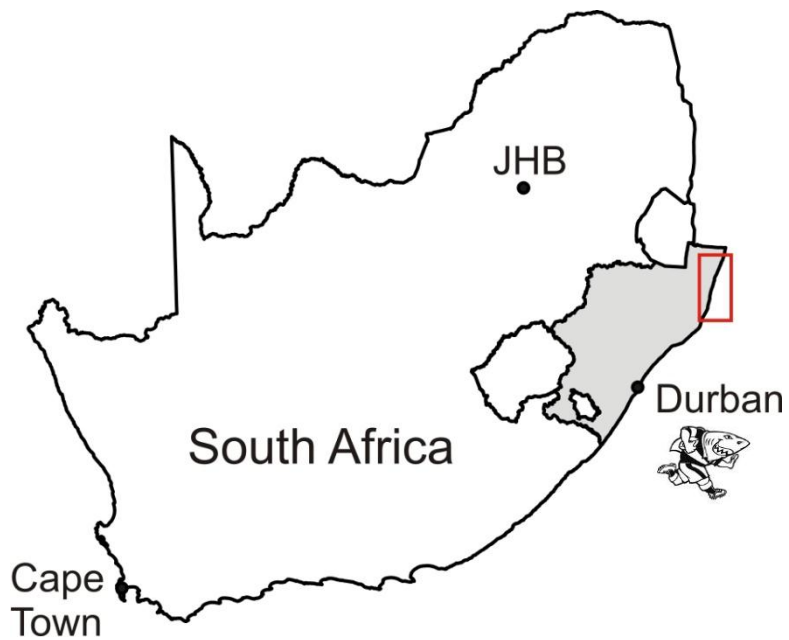
- Wetlands are most widespread in relatively humid, warm tropical and temperate regions of the world.
- Perennial features remaining saturated throughout the year.

## In Southern Africa:

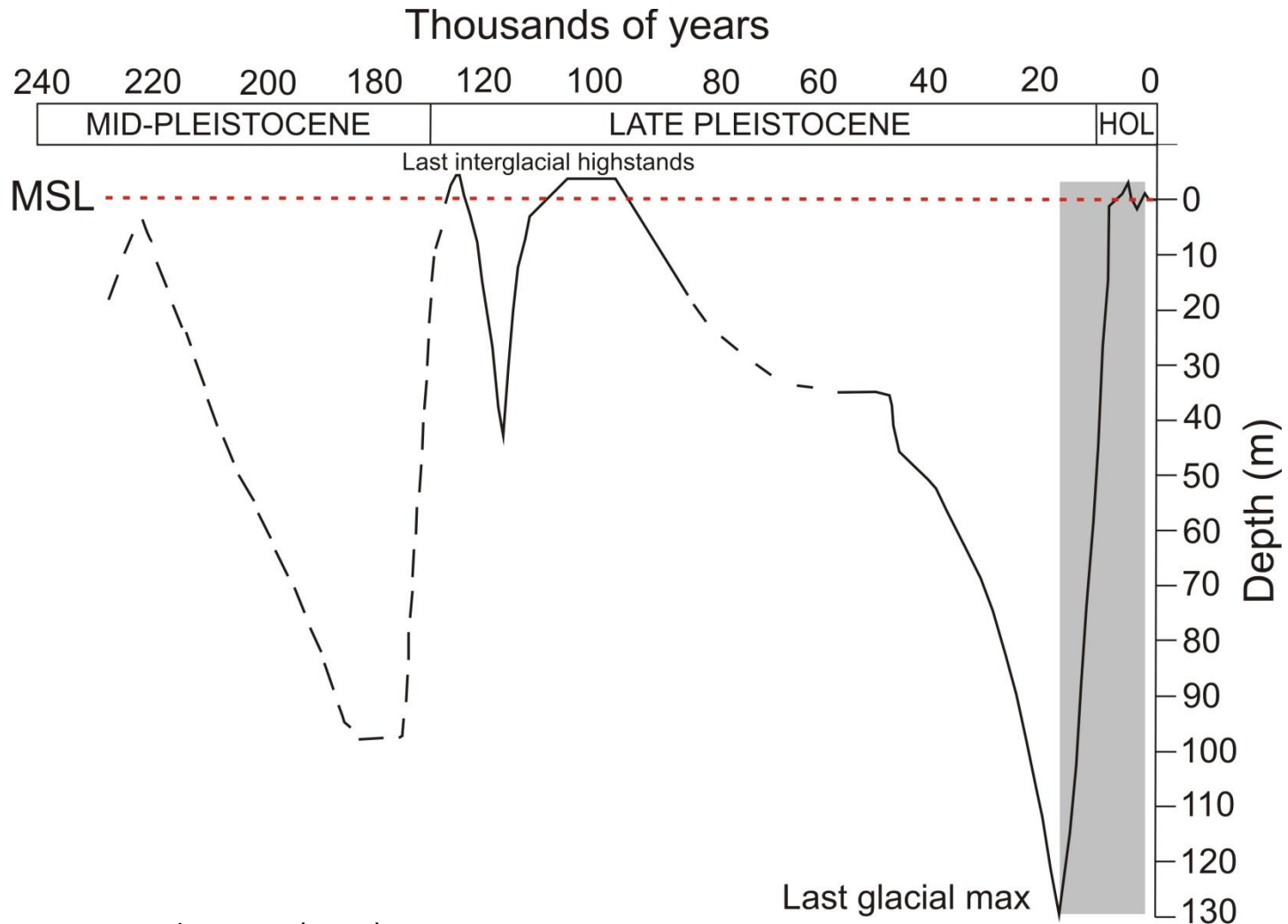
- High evapotranspiration rates – net water deficit.
- Seasonal or variable rainfall.
- Rivers are the primary hydrological input.



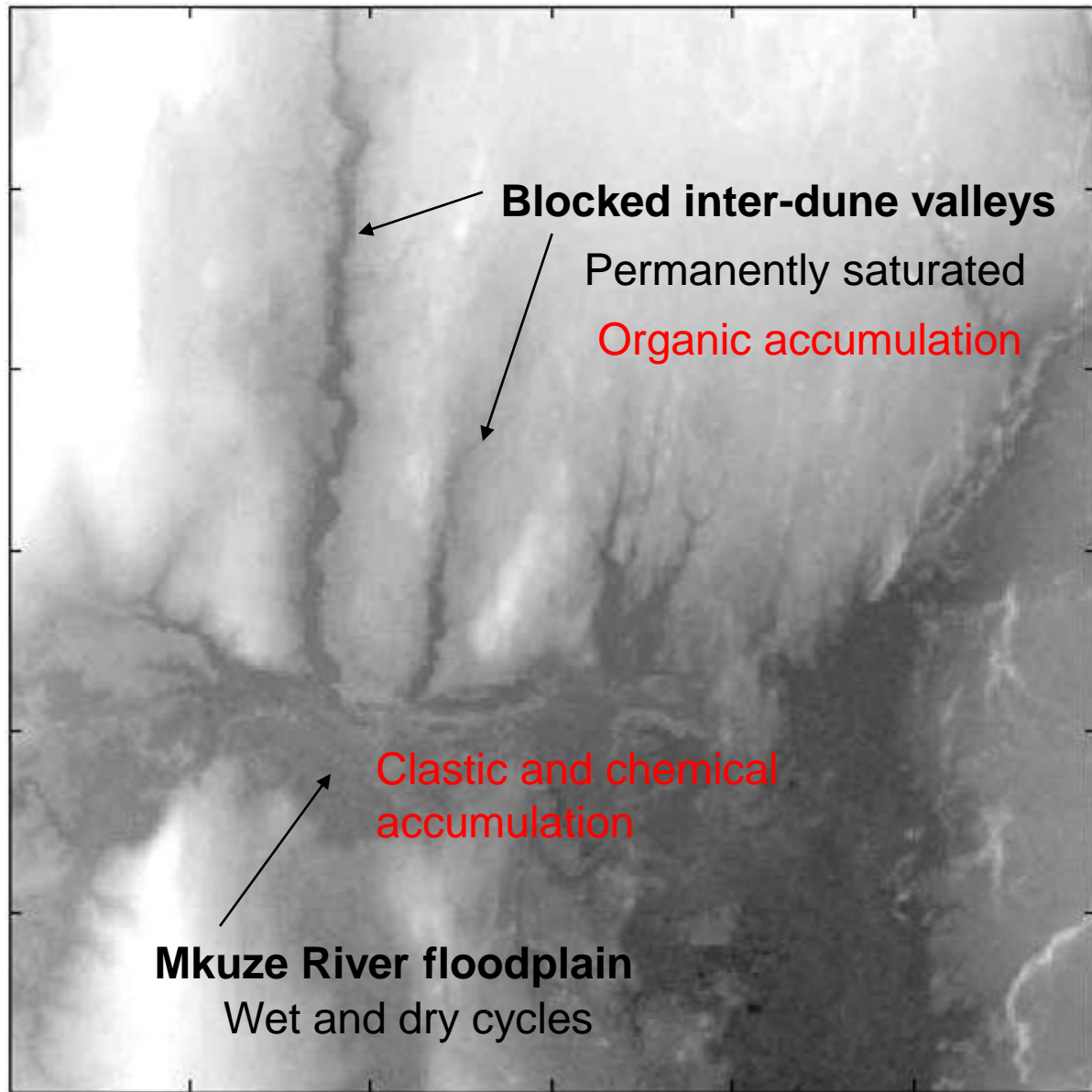
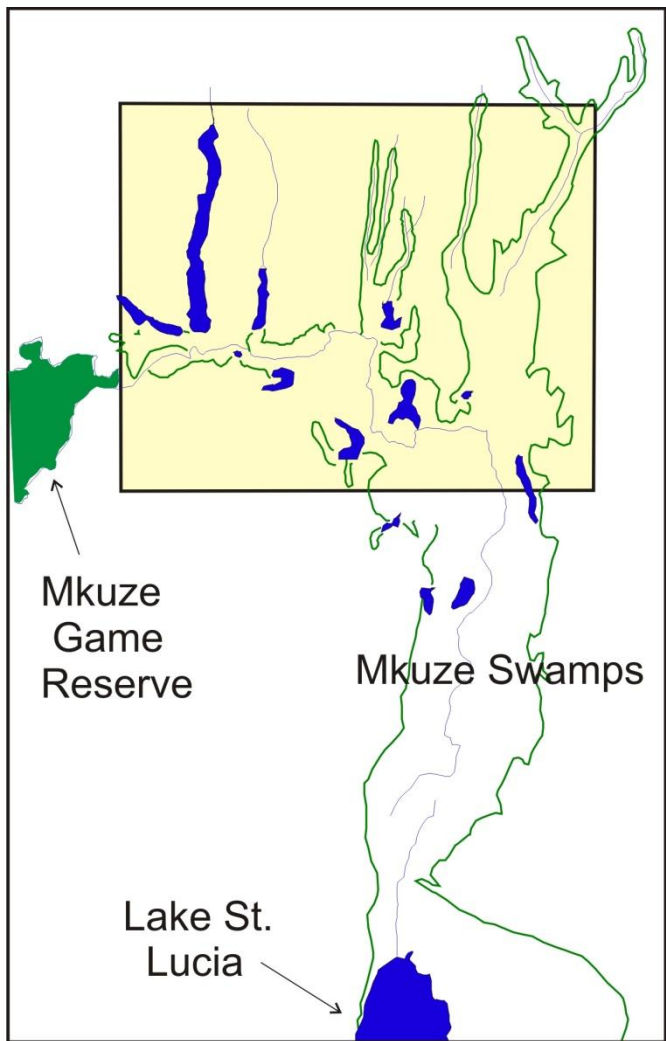
Floodplain wetlands



# Past changes in sea-level



After Ramsay and Cooper (2002)





Lake Sibaya



Mkuze 2011



Sibaya 2011



Mkuze 2011



Mkuze 2011

# Chemical transformations

- Research into mechanisms have focused on N and P.
- SA wetlands tend to accumulate large quantities of chemicals.
- Si, Ca, Mg, Na, Cl – potential to modify wetland systems.





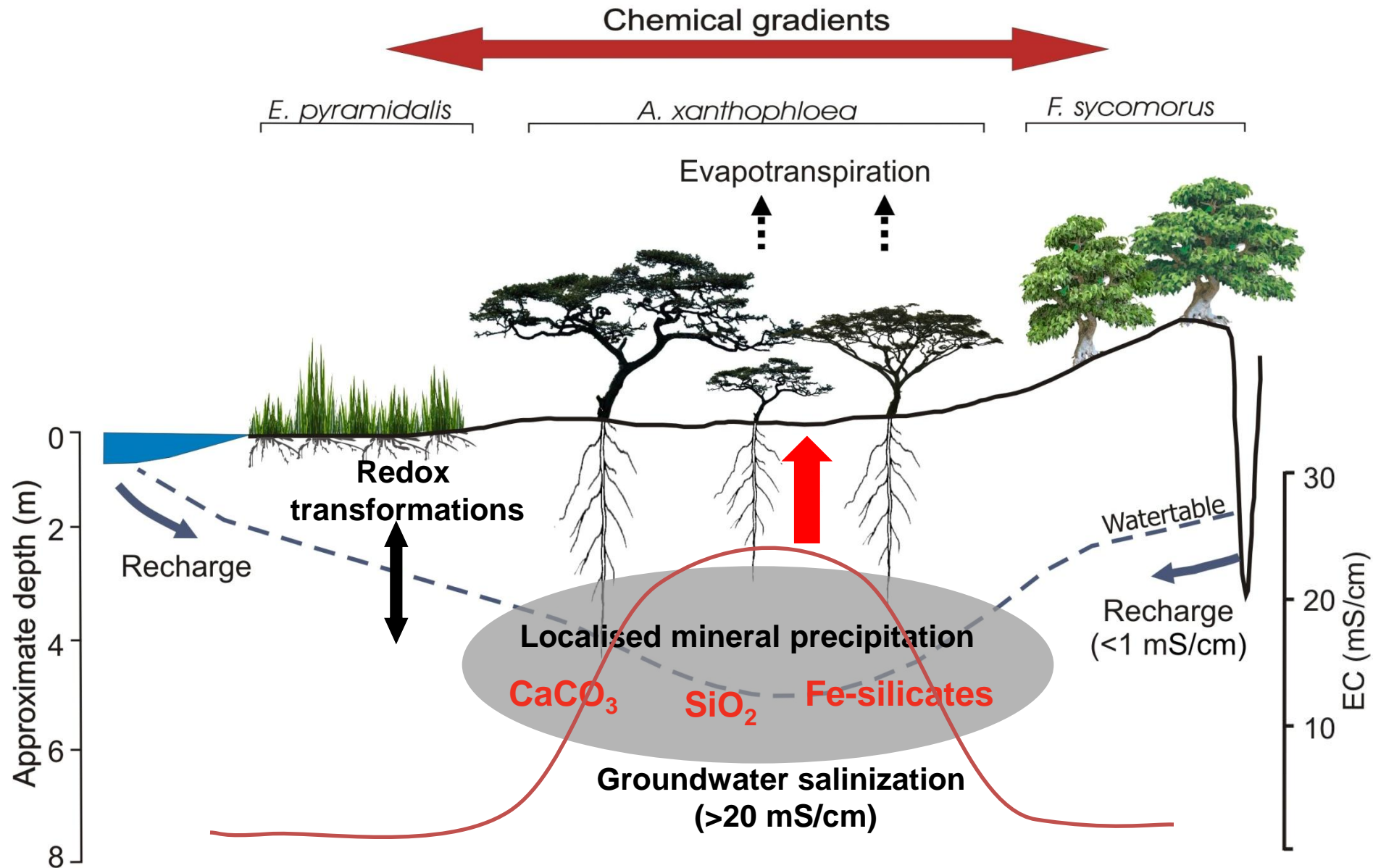
# Chemical accumulation on the Mkuze floodplain

Long-term sink for solutes

Solute	% mass retained
Si	80
K	70
Ca	50
Mg	20
Na	20

Total mass retained = 30 t/yr

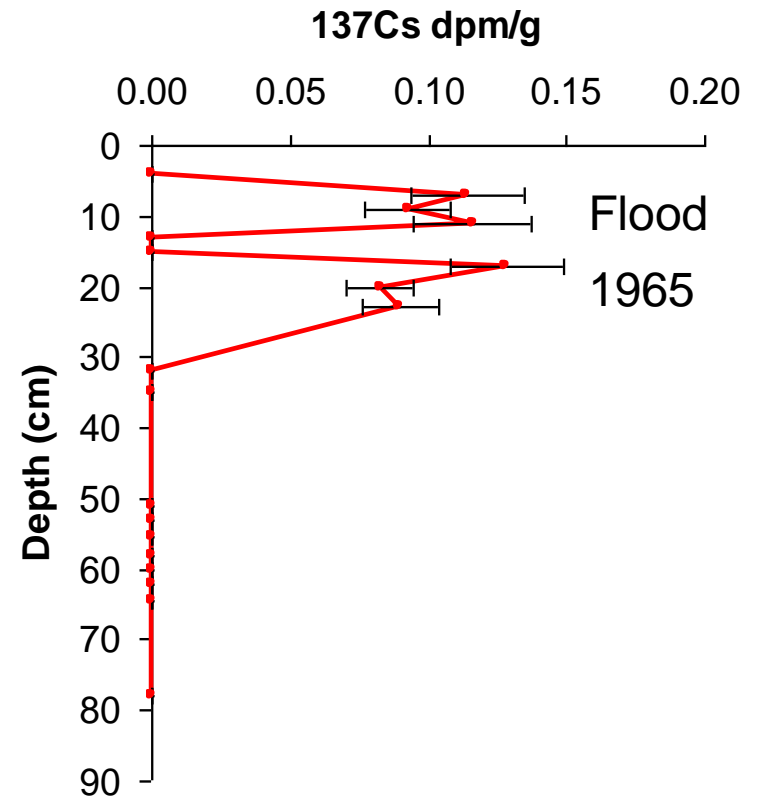
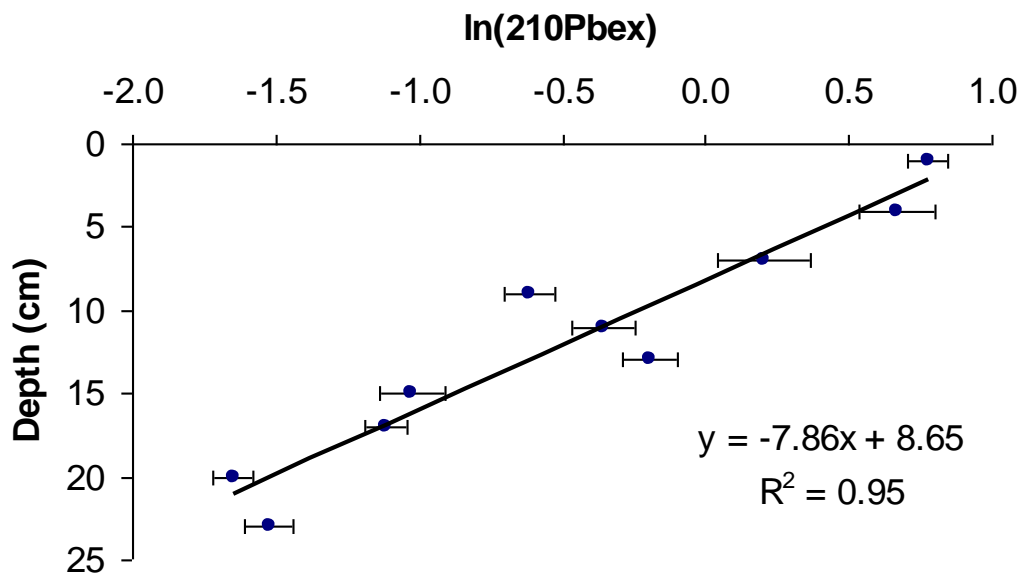
# Chemical Interactions and Feedbacks



# Accumulation rates: Use of radioisotopes

$^{210}\text{Pb}$

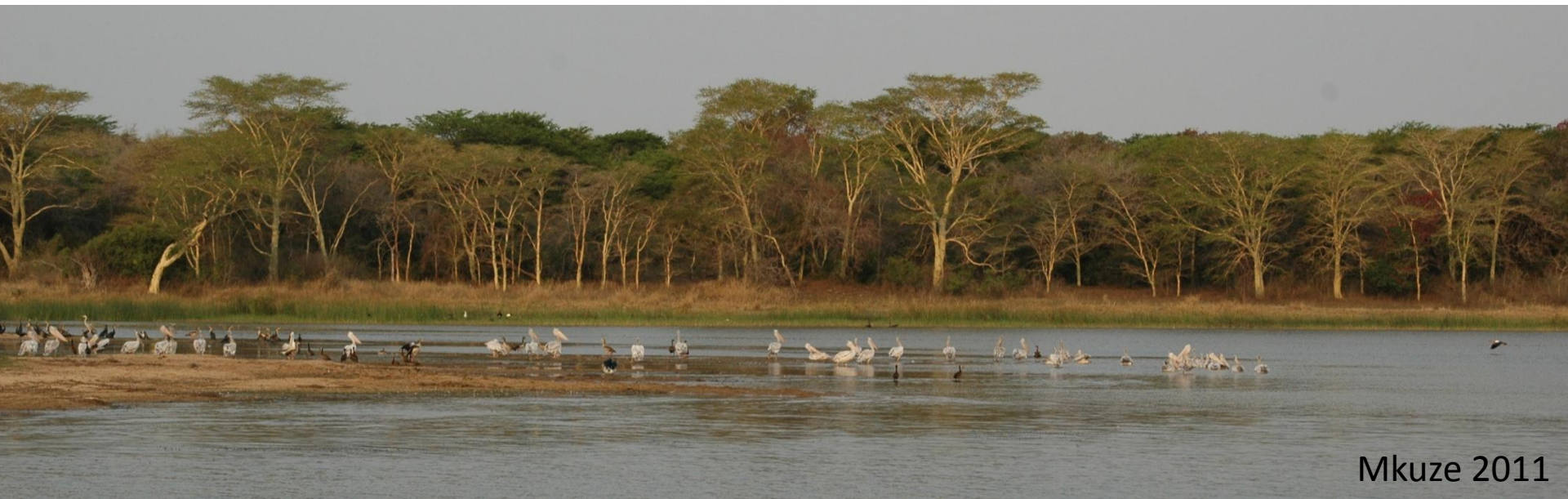
$^{137}\text{Cs}$



Rate = 2.5 – 5 mm/yr

# Landscape heterogeneity

- Sedimentation maintains a heterogeneous suite of habitats.
- Chemical accumulation plays an important ecological role:
  - Vegetation distribution based on chemical gradients
  - Modifies sediment EC and pH
  - Water quality



# Nylsvlei floodplain, South Africa



**Tree-covered islands**

# Organic Accumulation: Palaeoenvironmental Archives

- Archives of past vegetation and climate and changes.
- Lack of regional high-quality long-term records.
- Great potential for decoding the climate dynamics in southern Africa.



Longest record recovered  
from the S-E coast of Africa:  
>45 000  $^{14}\text{C}$  years

Millennial scale changes

Drivers of climatic change

## High-resolution, multi-proxy analysis:

- $^{14}\text{C}$  and  $^{137}\text{Cs}$ ,  $^{210}\text{Pb}$  dating
- Pollen, charcoal record
- Geochemical fingerprinting
- $^{12}/^{13}\text{C}$  and  $^{14}/^{15}\text{N}$
- OSL

A close-up photograph of a hippopotamus in a body of water. The hippo's mouth is wide open, showing its large, yellowish, conical teeth and the pinkish-red interior of its mouth. The hippo's head is partially submerged, and its dark, wrinkled skin is visible. In the background, another hippopotamus is swimming in the water. The scene is lit with natural light, possibly from the sun being low in the sky, creating a warm glow on the hippo's face.

Thank you